

Morphogen Concept

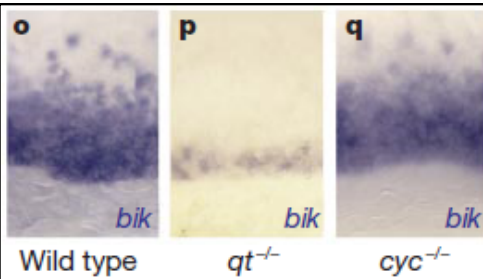
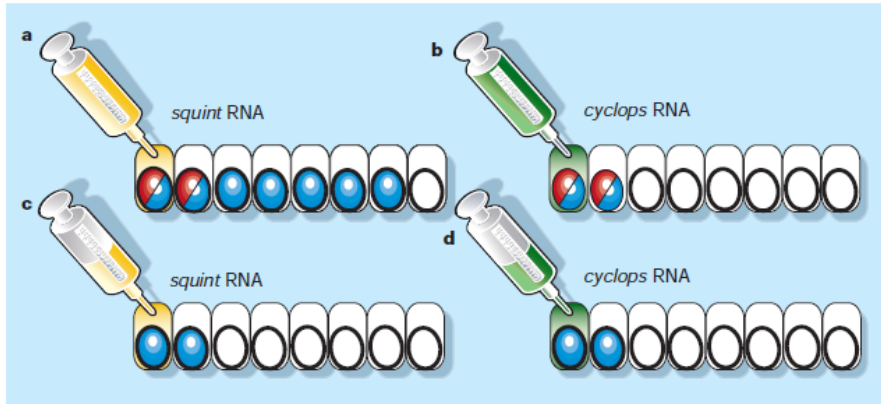
- Secreted by an organizing center (one group of cells)
- Spreads to non-adjacent cells
- Affects cells directly (not through relays)
- Concentration dependent: different effects at different distances from the organizing center

This has been a controversial concept.

Alternative to Morphogen

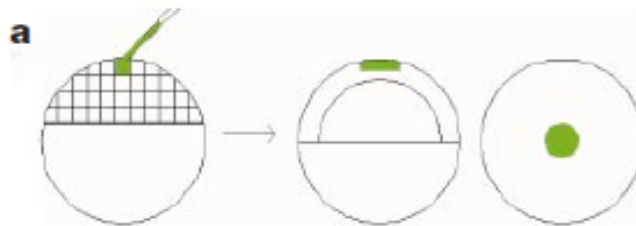
- Relay: a signal is received by one cell, which emits a signal to its neighbors, and so on.
- Could be the same signal as the organizing center, or a different signal emitted by neighboring cells.

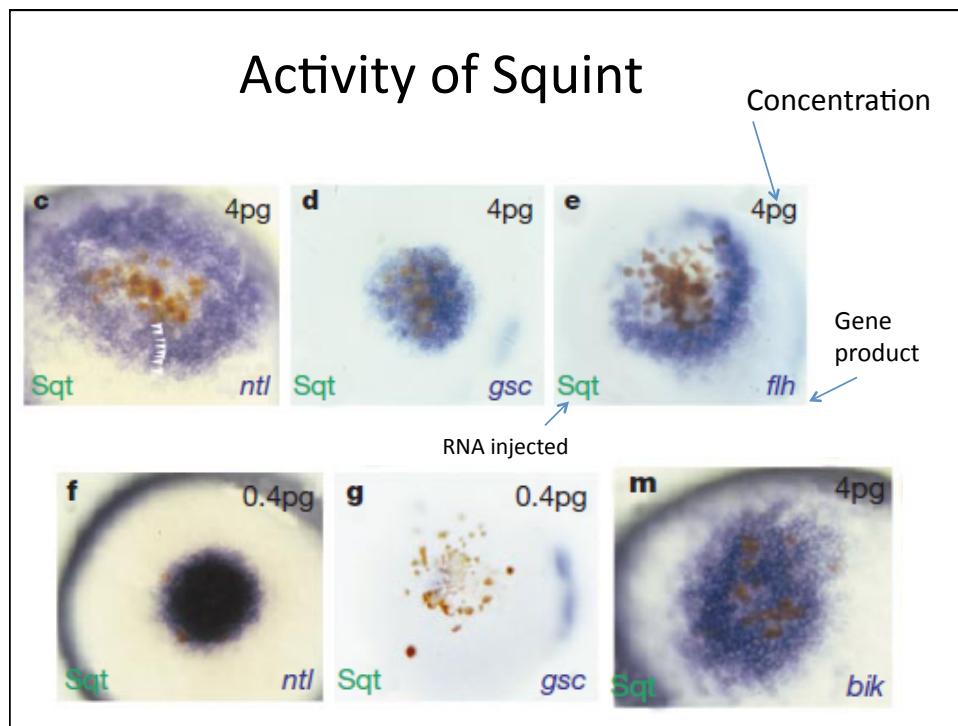
Different Activity of Squint and Cyclops



Ordinary pattern of expression (blastoderm margin)

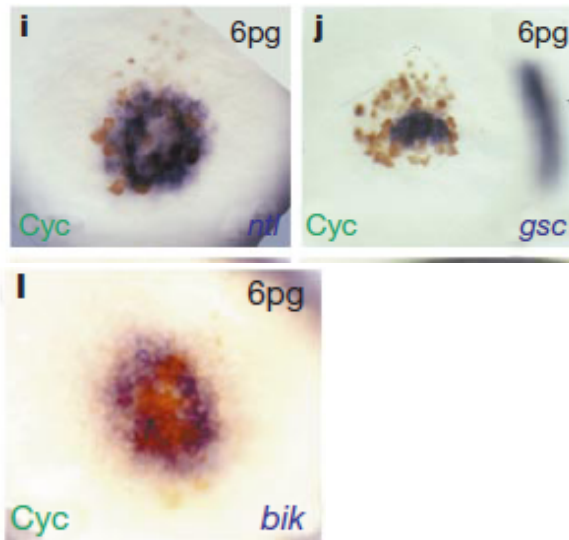
Researchers tested squint and cyclops in a different part of the embryo.





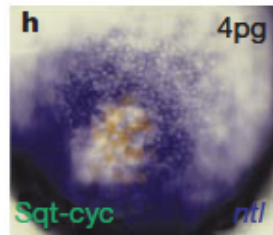
- Squint induces gene expression in a wide radius (6-8 cells)
- GSC requires high concentrations of squint, close to origin.
- Other products (*ntl*, *flh*, *bik*) are expressed at lower concentrations/farther from origin.
- Consistent with morphogen hypothesis or relay hypothesis.

Activity of Cyclops

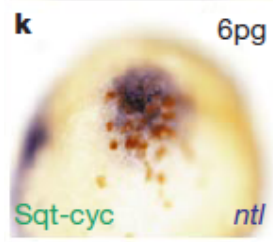


- Only induces expression in a narrow radius
- Not consistent with morphogen or relay hypothesis.

Chimaera Experiments:

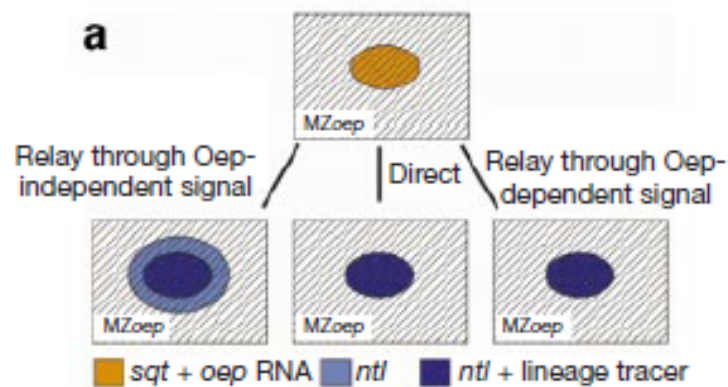


Prodomain of cyclops, domain of squint:
Result: acts like squint.




Prodomain of squint, domain of cyclops:
Result: acts like cyclops

How is the Squint signal carried?



n 4pg

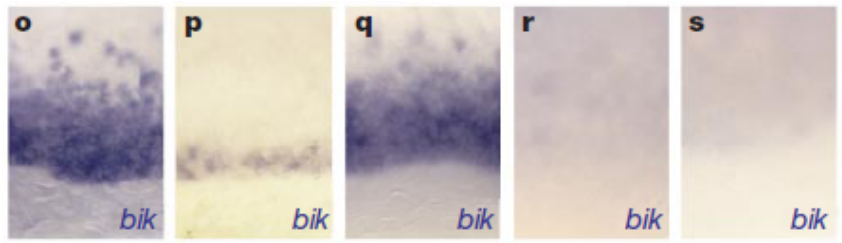


Oep: a receptor needed to respond to Nodal signals (Cyclops or Squint)

MZ: no oep from mother or zygote.

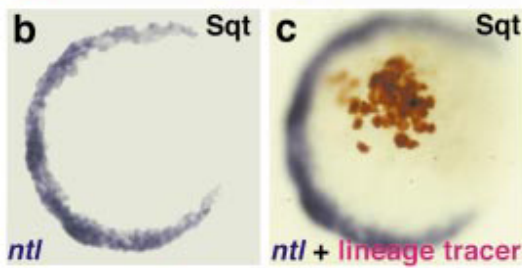
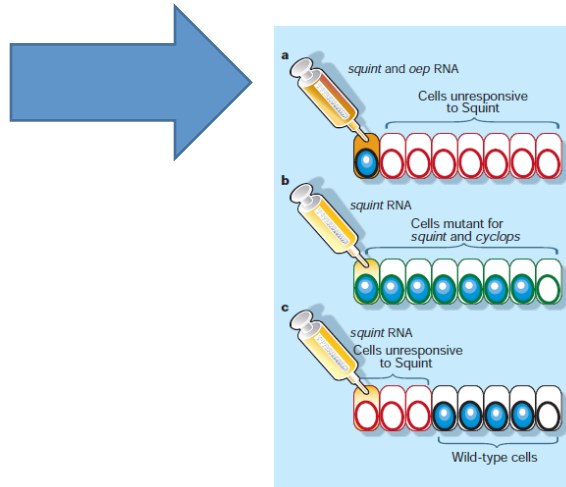
If no Oep:
Squint does not induce activity

Activity in the Blastoderm Margin

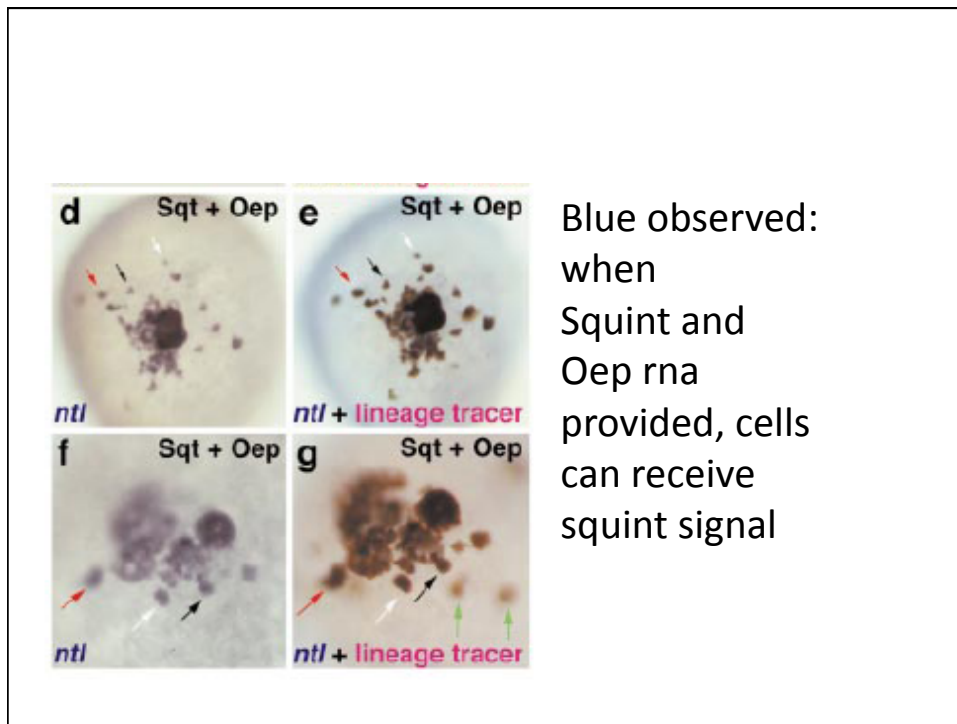


o Wild type p $qt^{-/-}$ q $cyc^{-/-}$ r $cyc^{-/-};sqt^{-/-}$ s MZoep

Figure 2

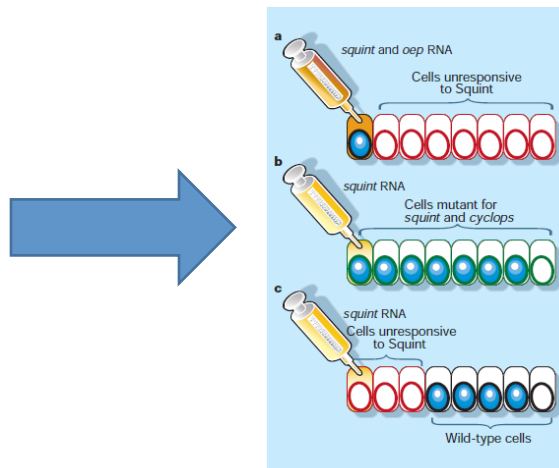


No blue: No reception of squint signal

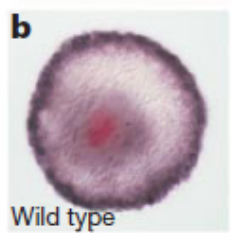


- Conclusion: Oep receptor involved in squint activity.
- But: is it to receive squint signal, or is it to relay squint?

Figure 3



Wild Type Activity



Red: Squint rna

Blue: ntl expression



Result: ntl expressed at a distance From source of squint

Squint/Cyclops Mutant Activity

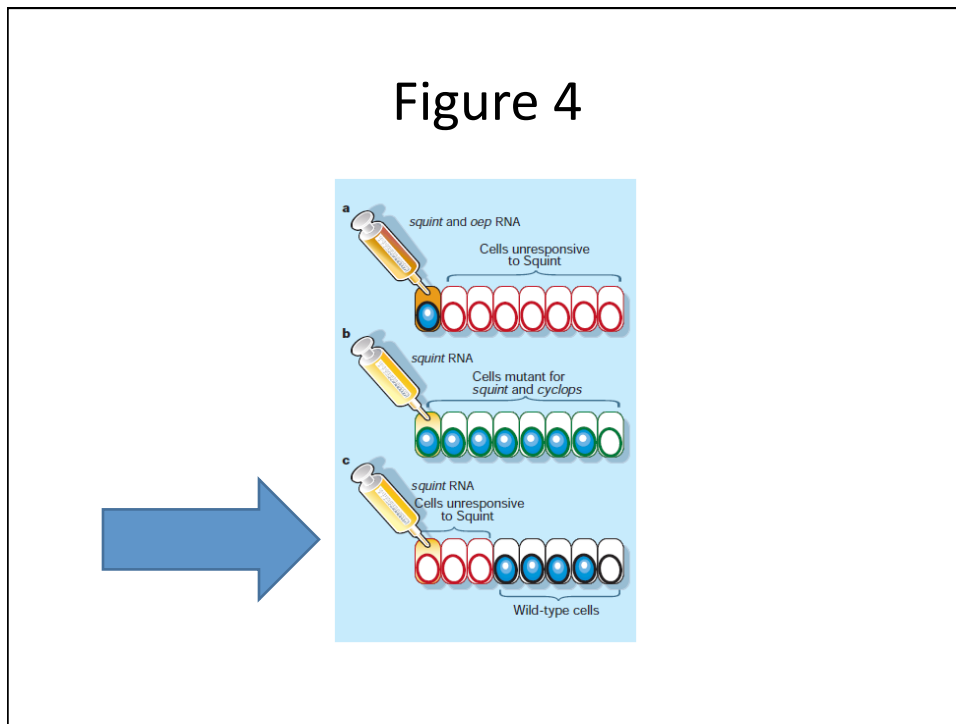
Result: *ntl* expressed at
a distance
From source of *squint*



Conclusion:

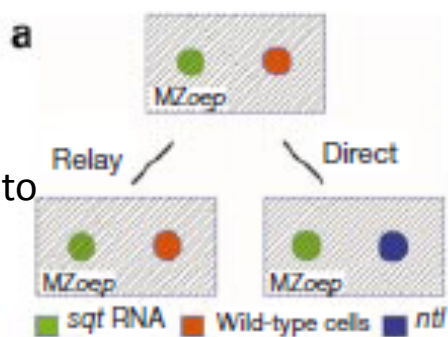
- No difference!
- Therefore: *squint* signaling not caused by a relay of a Nodal gene product.

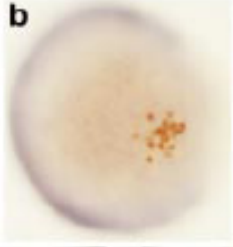
Figure 4



Experimental Design

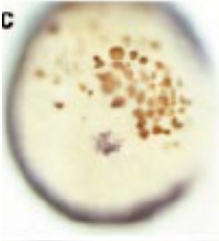
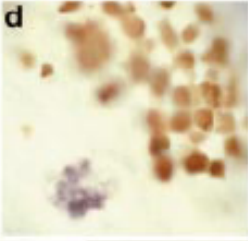
- Embryo is MZoop (can't respond to Squint)
- Squint RNA injected into Mzoep cell.
- Later, wild type cells Added at a distance from Squint producing cells.



b  Control: no squint. Brown represents wild type cells. No ntl (blue)

Experimental: Brown represents Mzoep cells producing squint.

Blue: wild type cells Producing ntl.

c  **d** 

Conclusions:

- Squint has a wide radius of effect.
- Requires oep receptor in affected cells: not a non-squint relay.
- Does not require ability to produce squint in affected cells: not a squint relay.
- Does not require that the cells have once been near the origin of squint.
- Evidence indicates squint is a morphogen.