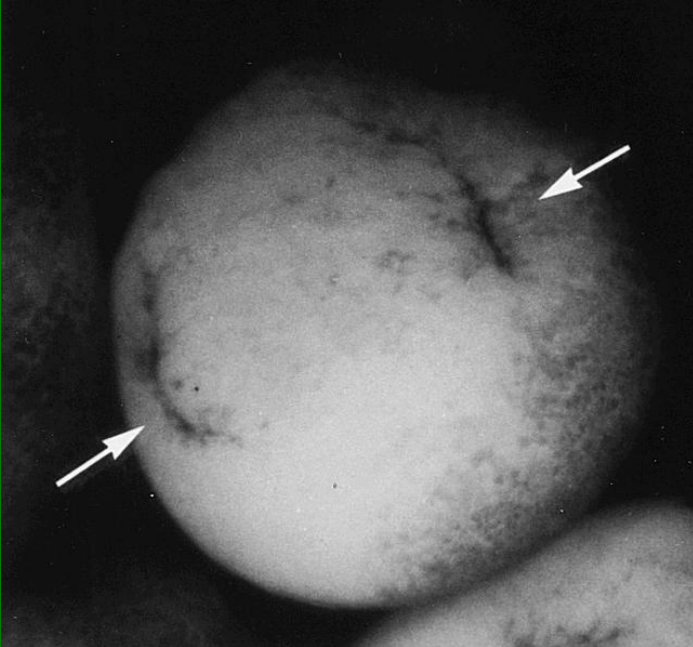


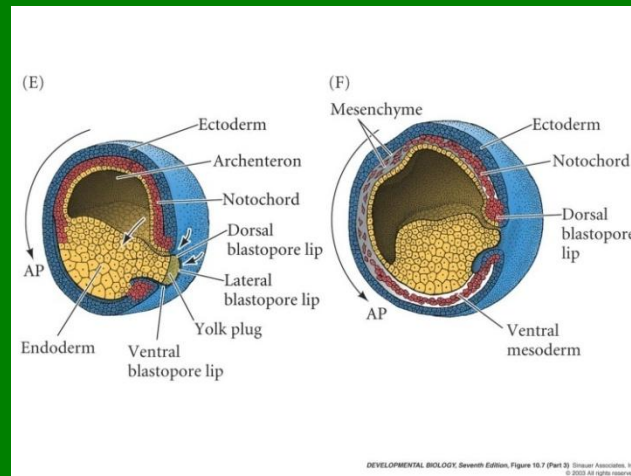
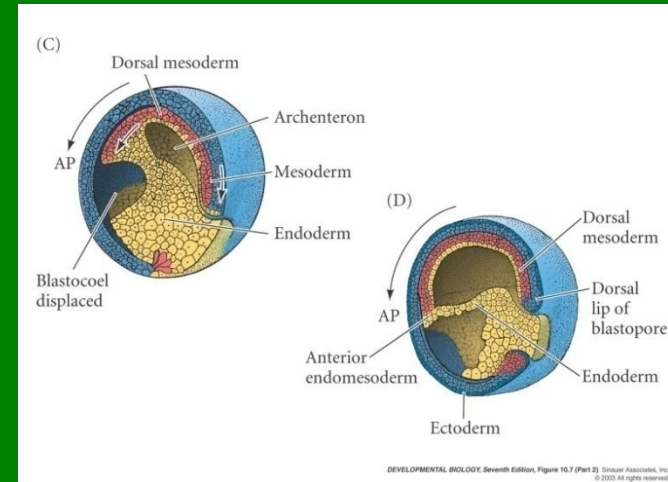
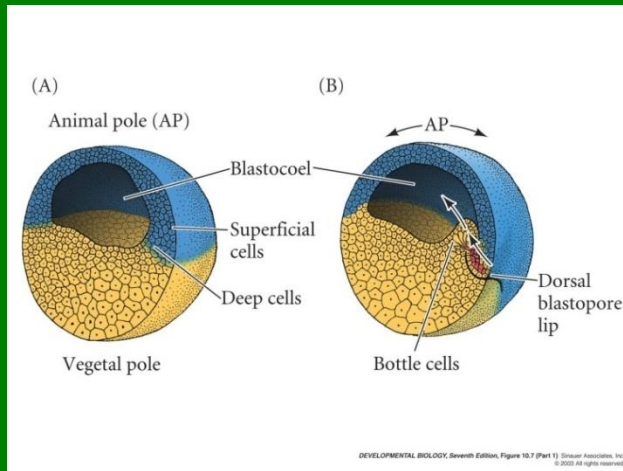
- Film gastrulation

Twins Produced by Rotation

- Move SEP up just before first cleavage
- Gravity displacement forms new axis

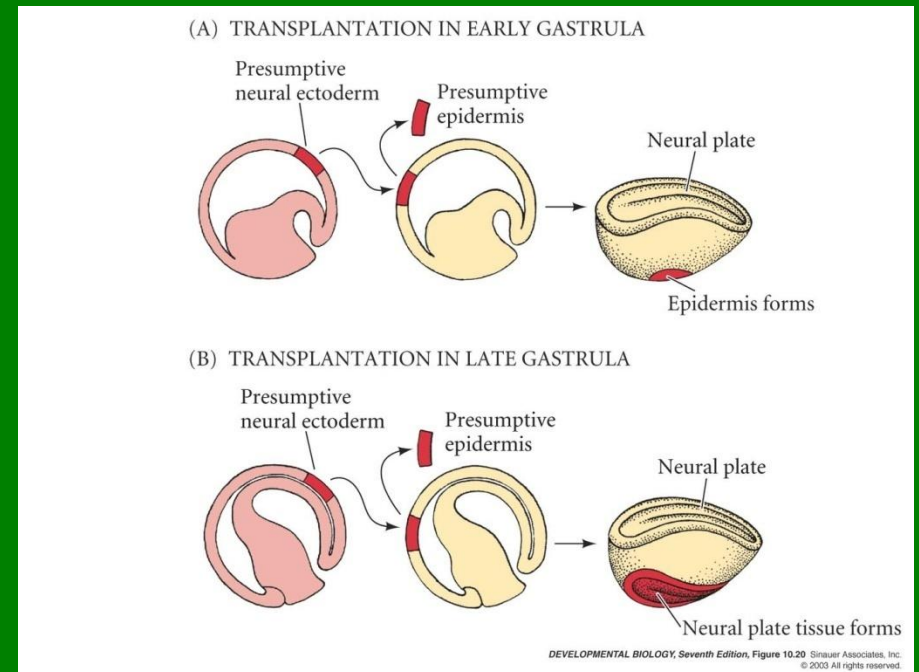


Gastrulation Begins with Formation of the Dorsal Blastopore Lip

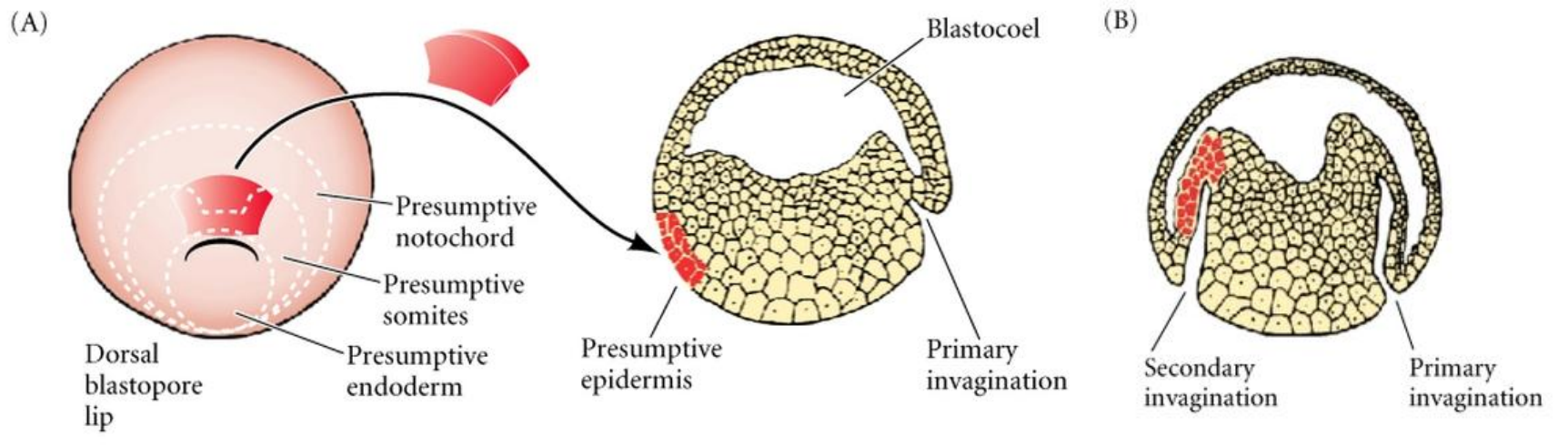


Spemann's Transplantation Experiments

- Pre-ectoderm cells of early gastrula are uncommitted
 - take on fate appropriate for position into which they are placed
- Cells of late gastrula are determined
 - maintain original fate regardless of position into which they are placed
- Exception: blastopore dorsal lip of early gastrula is already determined
- Film Spemann

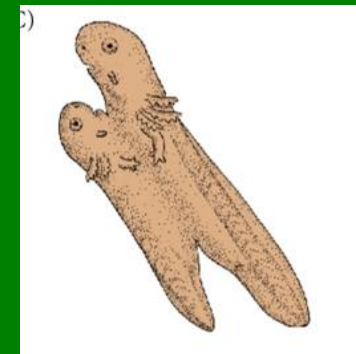
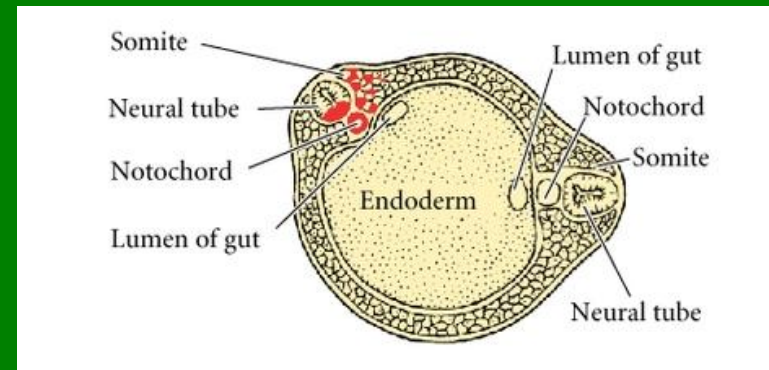


What Happens If Dorsal Lip Is Transplanted?



Experiments of Mangold and Spemann

- Dorsal lip cells and their derivatives (e.g. notochord) = “the organizer”
- Can induce host ventral tissue to change fate and form neural tube and dorsal mesodermal tissue (somites)
- Can establish a second dorsal-ventral axis



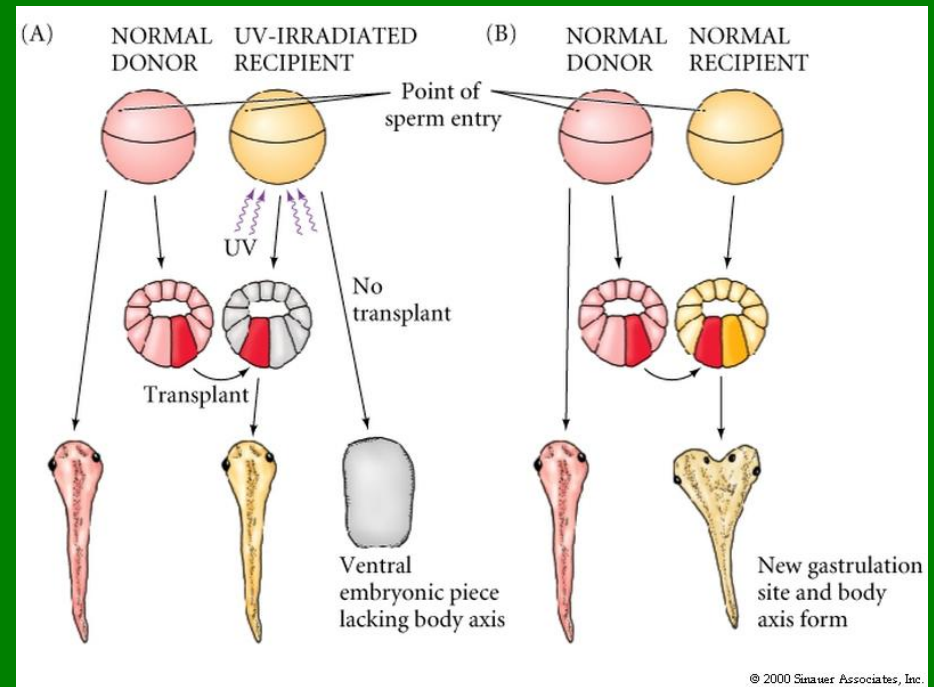
Primary Embryonic Induction

- The name given to this induction of the dorsal axis and the neural tube by dorsal-lip-derived cells
- But it is not the first induction
- Remember induction of mesoderm

Induction of the Mesoderm: Nieuwkoop Center

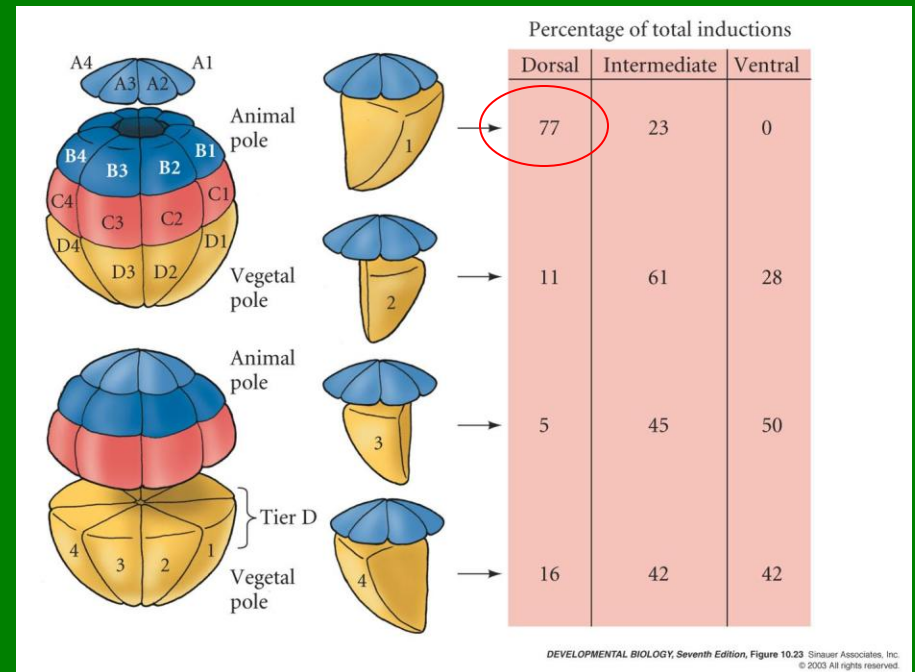
Which Cells Initiate Gastrulation?

- Vegetal cells opposite SEP initiate
 - Rescue UV irradiated
 - Twin normal recipient
- Property of 3 vegetal cells of 64-cell stage



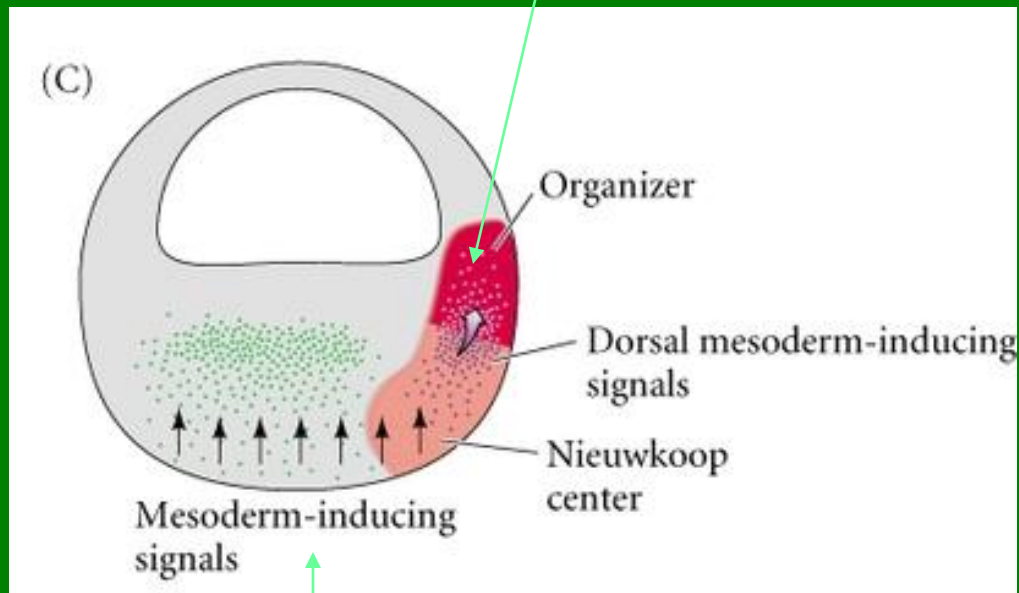
Nieuwkoop Center

- The type of induced mesoderm (dorsal or ventral) depends on the type of vegetal cells used
 - Blood, mesenchyme
Ventral
 - Muscle, kidney
Intermediate
 - Somites, notochord
Dorsal
- So the dorsal-most vegetal cells of blastula induce the organizer



Model of Mesoderm Induction

(depends on cortical rotation to free dorsalizing activity from vegetal pole)

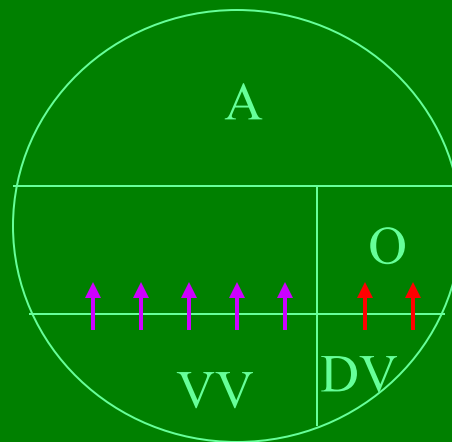


(not dependent on cortical rotation)

What are the molecules?

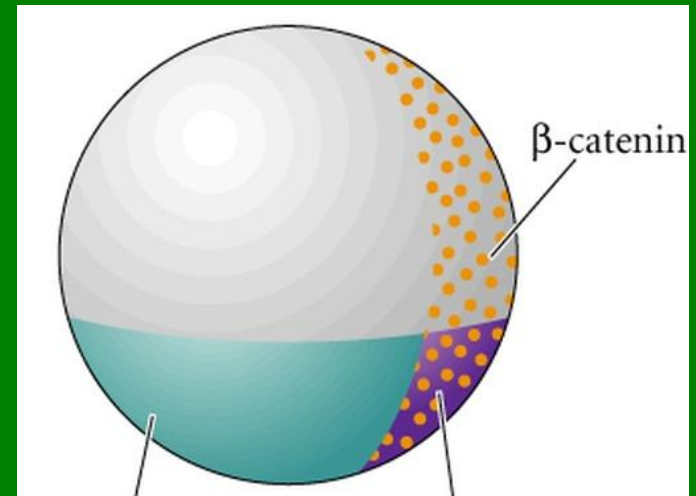
What are the Mesodermal Inducers?

- Activin-like molecules
- All vegetal cells can induce mesoderm
- Only dorsal cells can induce organizer of “primary” induction



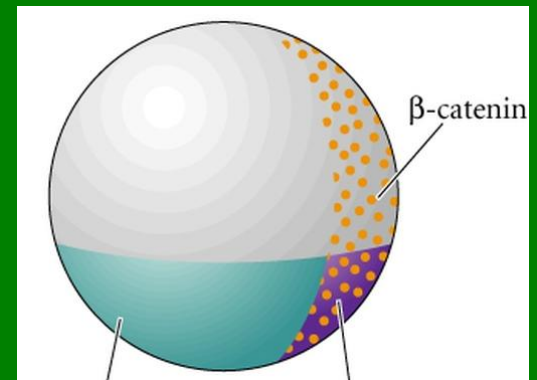
β -Catenin is Critical

- Accumulation in nuclei during early cleavages
- Experimental manipulations:
 - Depletion of β -catenin mRNA (injection of antisense RNA)
 - Injection of exogenous β -catenin into the ventral side



Experimental Results

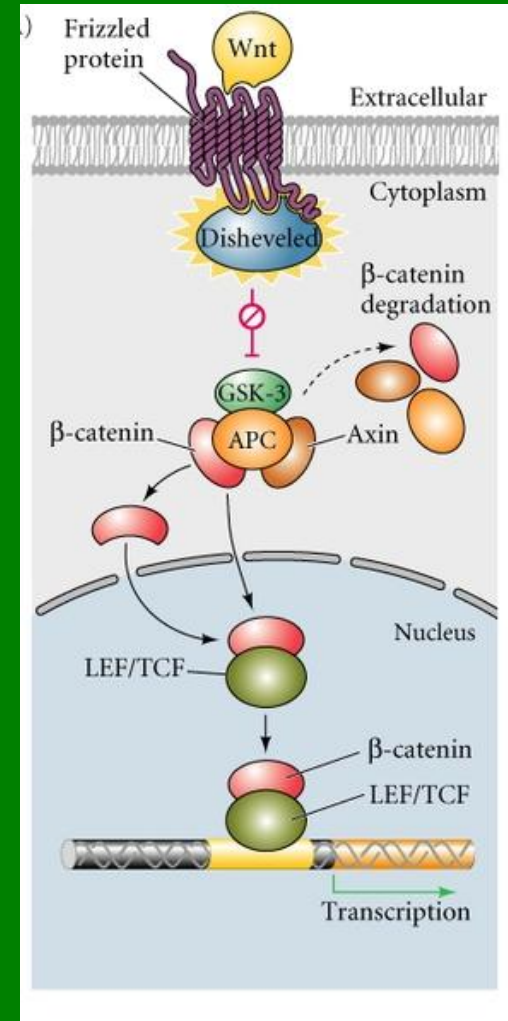
- Depletion of β -catenin mRNA:
 - Embryo lacks dorsal structures
- Injection of exogenous β -catenin into the ventral side:
 - Secondary D-V axis
- Depletion of GSK-3 in ventral side of embryo:
 - Secondary D-V axis



Remember GSK-3?

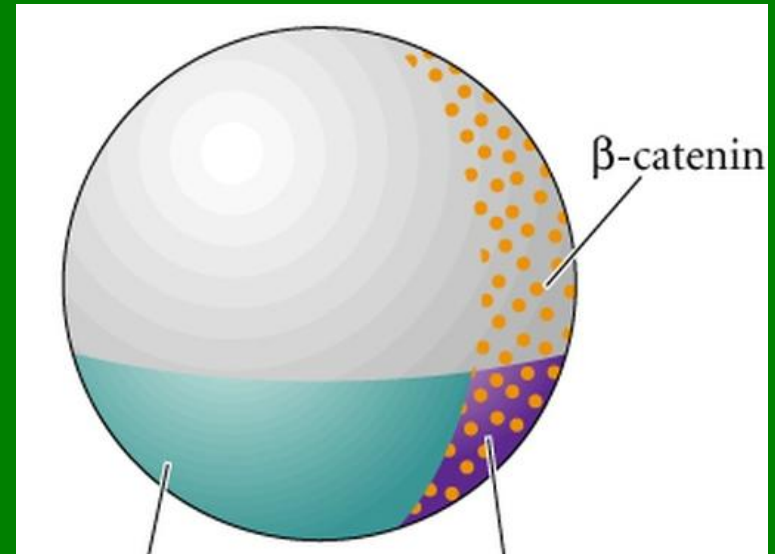
GSK-3 helps degrade β -catenin

Li^+ can inhibit GSK-3



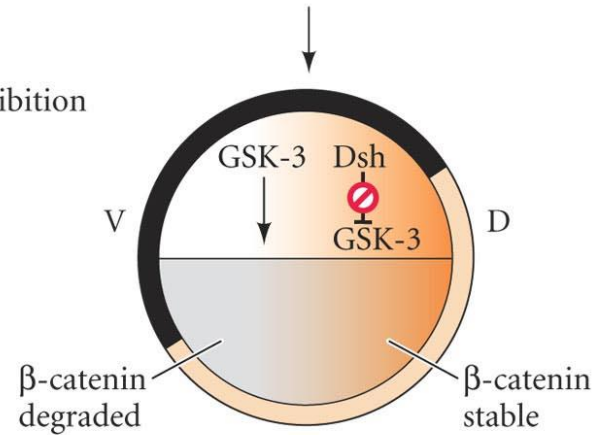
How is β -Catenin Localized?

- Maternal mRNA present throughout embryo
- Protein is made everywhere
- Degraded through GSK-3 action in ventral cells
- Why not degraded in pre-dorsal cells?

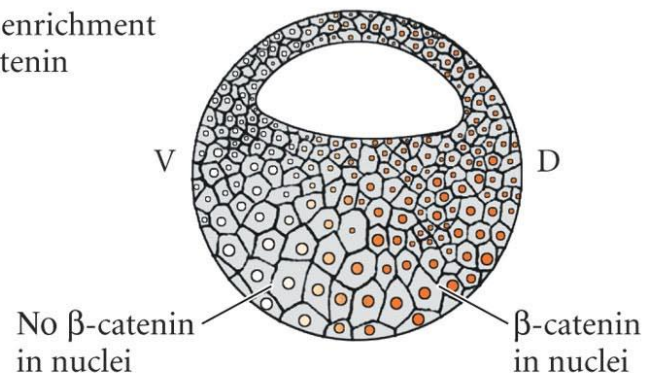


Model

(D) Dorsal inhibition of GSK-3

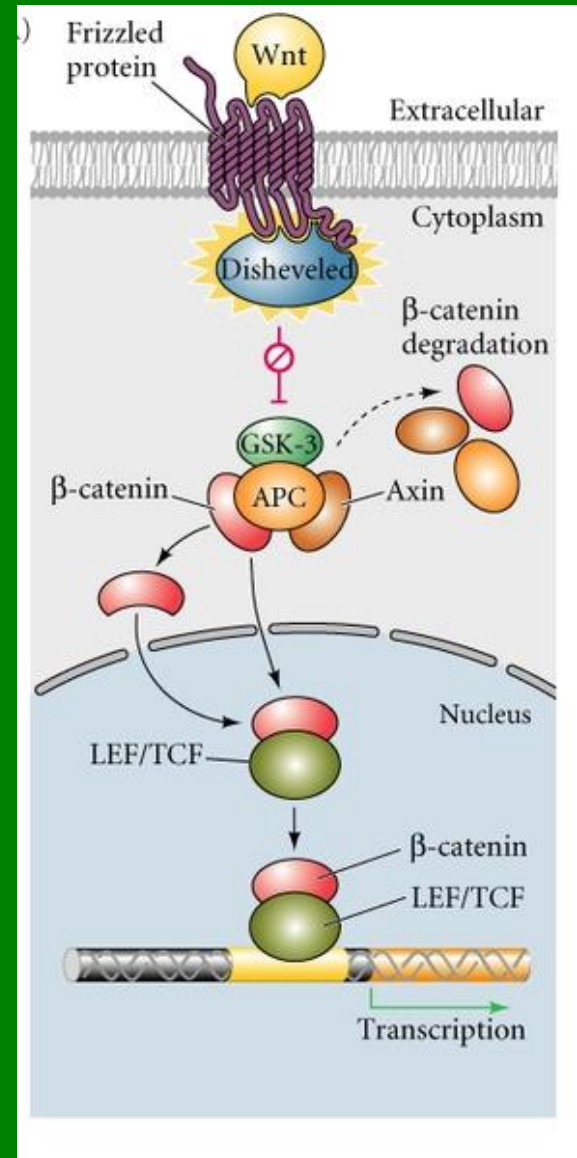


(E) Dorsal enrichment of β -catenin



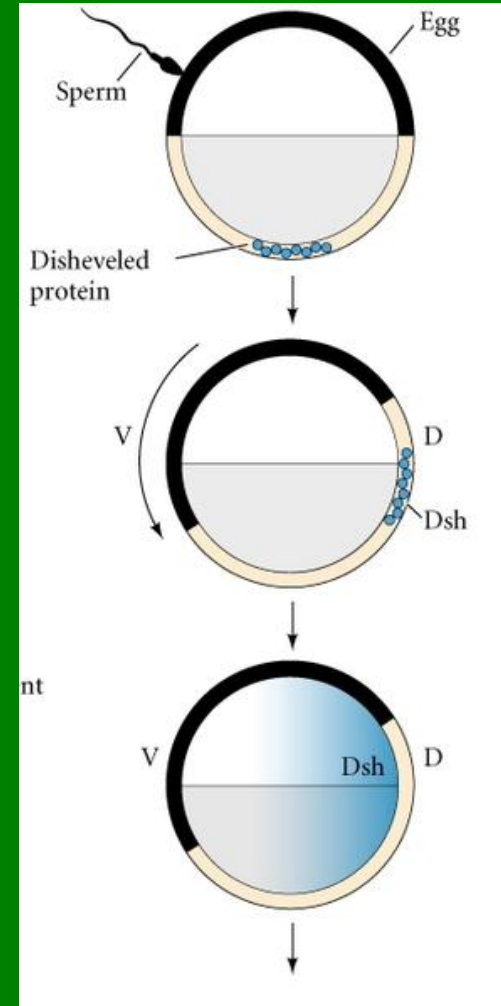
β -catenin

- Where is Disheveled?

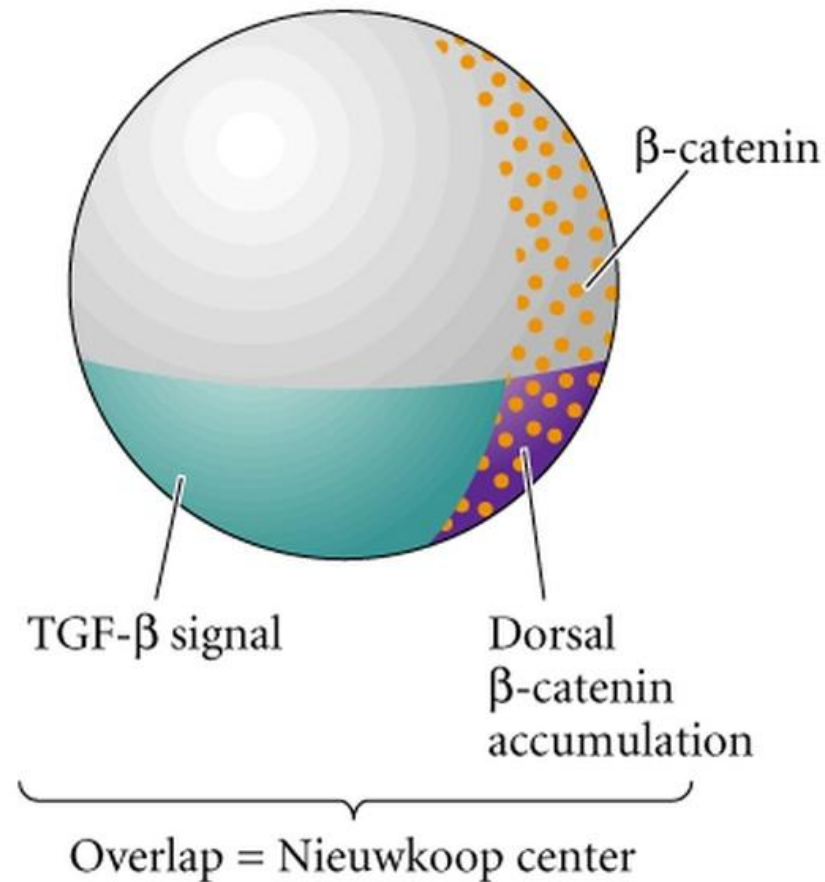


Where is Disheveled, the Negative Regulator?

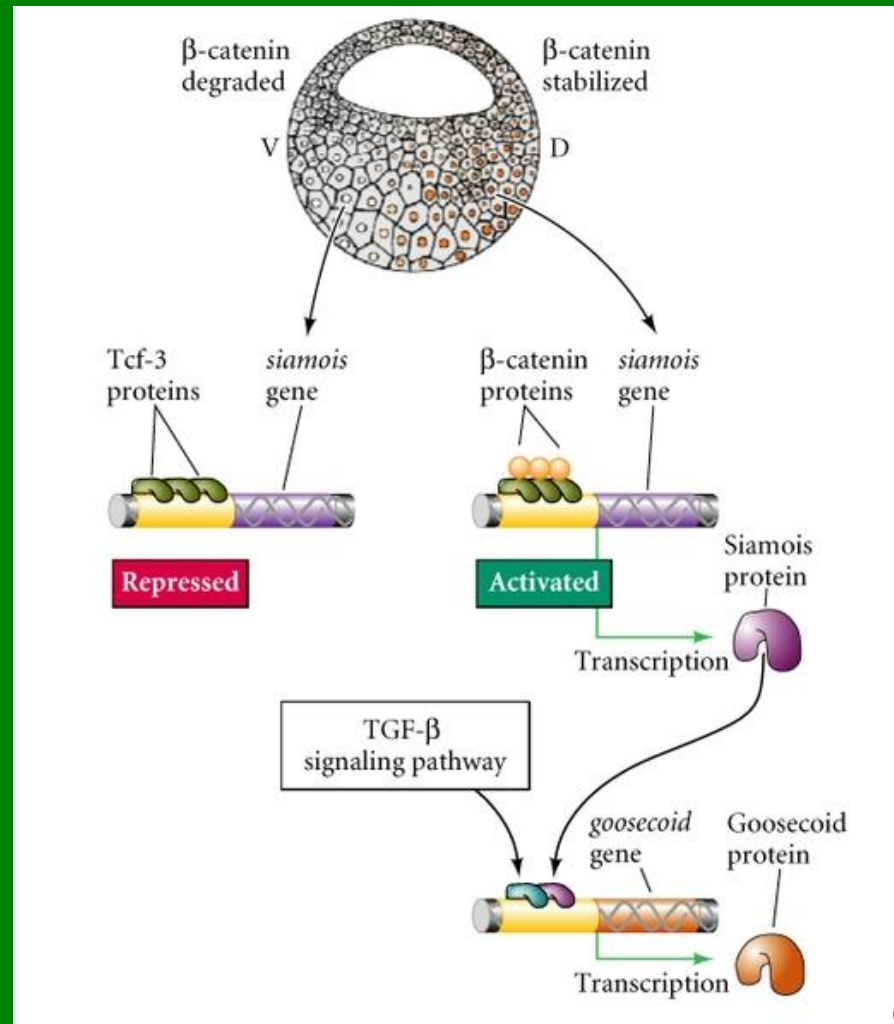
- Vegetal cortex of egg
- Upon fertilization it is translocated to dorsal side
 - As part of protein complexes moving along microtubule tracks
- Released from protein complexes in cortex



What Defines the Center?



β -Catenin Target Genes



Downstream

- β -catenin combines with Tcf3
- This transcription factor activates *siamois*
- *Siamois* activates
 - transcription factors like *goosecoid*
 - and paracrine factors
- Leads to organizer

Relationship of Nieuwkoop Center and Organizer

