LECTURE 3

Dorsal-Ventral Patterning: Vertebrates

Early D-V Axis Establishment in Frogs

A. Initiation of D-V Polarity
   Maternally defined Animal-Vegetal polarity
   Sperm entry site defines ventral pole of embryo
   Cortical Rotation (transport of latent dorsalizing factor form vegetal pole)
   β-catenin transcription factor: graded D-V nuclear localization (remember fly Dorsal)
   Defines position of dorsal vegetal “Nieuwkoop center”
   Experimental manipulations:
     Cell transplantation
     RNA injection into blastomeres, injection of Dominant Negative receptor mutants
     Explant cultures ± Growth Factors
     (see Figure 5.1 and D/V Review)

B. Nieuwkoop Center: Vegetal Morphogens Pattern Marginal Zone
   Mesoderm axis formation: ventral posterior -> dorsal anterior
   Marginal zone forms as a band in animal cap adjacent to vegetal pole
   Subdivision of marginal zone (= mesoderm) into D-V territories:
     Dorsal territory (notochord) = Spemann Organizer
     Lateral region (heart and muscle)
     Ventral region (blood).
   D/V patterning molecules
     Siamois: transcription factor
     Activin/Veg-1: TGFβ related signals (in all vegetal cells, but activated dorsally ->
     activation of latent dorsalizing factors)
     VegT (expressed in all vegetal cells): “For-export-only” signaling
     ->TGFβ /Nodal-related mesoderm inducing signals?
     -I response to mesoderm inducing signals
     (see Figure 5.1 and D/V Review)

C. Marginal Zone (Mesoderm)
   Xsna, Xtwi, Xbrachyury: Transcription factors
   Ectopic Xbrachyury - ectopic mesoderm
   Zebrfish brachyury mutant - loss of mesoderm
   Mouse twist mutant -> failure to activate mesoderm genes
   Human twist mutations -> Saethre-Chotzen syndrome
   Mouse snail- mutant -> ectopic expression of ectodermal genes (normal
   mesodermal gene expression)
   Human FGF-R2 and FGF-R3 mutations -> Saethre-Chotzen syndrome
   (FGF signaling is also required in Drosophila for migration of mesodermal cells)
   Spemann Organizer: Source of neural "inducers" (Chordin = Sog, Noggin, Follistatin, DAN)
   Ventral mesoderm: epidermal inducer/neural inhibitor: BMP-4 = Dpp
   (see Figure 5.1 and D/V Review)