Week 2 Handout

A. Patterning Molecules
   1. TRANSCRIPTION FACTORS
      • Sequence specific DNA binding proteins
      • Activators - turn gene expression on
      • Repressors - turn gene expression off \( \rightarrow \) has priority - always wins over activators
      • What are the conditions for gene expression?

      • Experiment: Fused regulatory region of Dpp to coding region of lacZ gene
                    (makes Beta-Galactosidase turns cells blue) \( \rightarrow \) expressed lacZ gene in same
                    pattern as Dpp (dorsal epidermis) = blue skin
                    \( \rightarrow \) What does this show?

   2. SECRETED SIGNALING MOLECULES
      • How do cells communicate via secreted signaling molecules?

   3. MORPHOGENS
      • What two criteria are needed in order for a molecule to be a morphogen?
        Give an example.

B. Dorsal-Ventral Axis Establishment in Flies (Drosophila)

   What is a maternal gene? Give an example.

   What is a Zygotic gene? Give an example.
Fill in the germ layers of the drosophila embryo as discussed in class and what they give rise to.

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Fill in the appropriate genes/molecules that help establish the D-V axis in flies and their functions.

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What genes are activated at **NO** levels of Dorsal (Dorsal-Ectoderm)?

What genes are activated at **MEDIUM** levels of Dorsal (Lateral-Neuroectoderm)?

What genes are activated at **HIGH** levels of Dorsal (Ventral-Mesoderm)?
How does the dorsal gradient ensure Rho is expressed only in the lateral region of the embryo?

Describe what happens in the following mutants.
  • Sna- =
  • Twi- =
  • Mutating the binding site for Sna in the Rho gene =
  • Mutating the binding site for Sna in ALL the neuroectodermal genes =

C. Dorsal-Ventral Axis Establishment in Frogs (*Xenopus*)

Fill in the germ layers of the vertebrate embryo and what they give rise to.
Describe how the D-V axis is formed in the frog embryo.

1. The mother establishes the ________and _________hemispheres in the unfertilized egg.
2. The is egg is fertilized and the sperm entry point determines the _________ pole
3. Cortical rotation occurs and _____________________→ ___________________________ when moved towards opposite end (dorsal pole)
4. _______(TF) activates expression of mesoderm inducing factors (MF) in vegetal hemisphere & inhibit response to MFs in those same cells
   → ___________________________ - MFs will diffuse and only have an effect on neighbors
5. Beta-Catenin (TF) is a morphogen with higher levels _________and low levels________________. It helps subdivide the _____________into the different tissue domains (Spemann organizer, heart/muscle, blood).
6. Spemann organizer is established at the _________end of the mesoderm. It gives rise to the _____________(transient rigid “backbone” that acts as a source of neural signals→ secreted into dorsal animal hemisphere)
7. _______________(Sog in flies) activates ____________development by repressing _____________(Dpp in flies), which activates ________________development.