Developmental Biology
3090-01
Week 3, Thursday
9/11/14

Lecture 5) Development of the Drosophila Body Plan III and Lecture 6) Patterning the Vertebrate Body

As always, these notes are best used with the PDF slides posted to blackboard that correspond (I reference those when taking and typing notes!)

The exam will be one week from today on September 18th. It will cover material up through Tuesday's lecture. For studying, suggested to pay attention to lectures and lecture slides predominantly, and use the textbook to supplement studying. Exam 1 should be the hardest midterm eam.

Ci stands for cubitus interruptus (sorry there was no given spelling in class). We really need to know the hedgehog and wingless pathways.

When hedgehog is not present, smoothened is inhibited. This means that Ci is phosphorylated. No transcription occurs. When hedgehog is present, it binds patched. Patched prevents the inhibition of smoothened. Smoothened insures Ci is not phosphorylated so transcription occurs.

When wingless is not present, beta catenin is degraded and no transcription occurs. When wingless is present it binds frizzled. This leads to chain of events preventing the degradation of beta catenin, and transcription can occur.

(This is review from previous lecture and notes. Now continue with slide 17)

Slide 17: Shows a Wg and Hh signaling circuit. Wg and Hh feedback on each other. It is a positive feedback loop and a critical signaling circuit. The pictures show dendricles in a clear organized pattern (left) and unorganized in the prescence of a mutation to hedgehog (right).

Slide 18: Segments are different due to the expression of Hox genes, which give segments their identity.

Incomplete bullet: First evidence of genes that specify segment identity came from the observation of mutations that produced homeotic transformations.

One segment transformed into another is a homeotic mutation.

Homeobox: sequence of nucleotides indicate a homeodomain. DNA binding gives it transcription properties.

Missing bullet point: Considered one of the fundamental defining features of multicellular animals.

Slide 19: Hox genes have a specific layout in the genome.

Missing bullet point: Striking co-linearity between spatial and temporal gene expression patterns and their order on the chromosome ****

Know this point. It is very important. It means that more 3' genes are anterior expression and 5' ones are expressed posteriorly (spatial) and that 3' are expressed earlier in development whereas 5' are expressed later (temporal)

Slide 20: Bithorax mutation: haltere forms as a wing. Can mutate again and form a complete set of wings instead of halteres.

Can mutate structures that are supposed to be antennae into legs (see slide 21).

Slide 22: (Top left picture) Combination of all 3 determine identities.

Incomplete bullet: Conclusion- segment identities likely determined by variations in spatial and temporal expression patterns of hox genes combining.

Why they all called selector genes.

Slide 23: Homebox does not mean that a gene is a hox genes. There are other criteria to being a hox gene (and other genes can have homeoboxes). Hox genes are part of the hox cluster.

Missing bullet: We don't know the downstream targets of hox genes.

Clicker Question!

Drosophila genes are controlled by _____.

a) maternal genes
b) paternal genes
c) gap and pair rule genes
d) segmentation genes

Answer: c) gap and pair rule genes

This ends the continuation of notes from lecture five on Tuesday and begins Thursday's notes

Forward vs reverse genetics. Forward genetics are when the phenotype of a mutation is known (white eyes in drosophila) but not the gene that causes the

mutation. Genetic screenings can be performed to find out what this gene is. Reverse genetics are when the mutation and affected gene are known, but the affect on the phenotype is not known.

Slide 1: (starting with the slide Vertebrate Body Plan)

Extraembryonic structures- not found in drosophila (such as the placenta).

Slide 2: Vertebrates differ from one another, but also have similarities in the phylotypic stage.

Incomplete bullet: Phylotypic stage: Stage after gastrulation when embryos appear quite similar.

Modified differently after each stage.

Slide 3: Xenopus Laevis (African clawed frogs) were used for pregnancy tests at one time. They work well in genetics because they develop quickly. Their eggs are also hardy, which worked well for cutting and transplant experiments.

Know the order of development! (egg to adult, shown in the picture on this slide).

The frog takes 2-3 from the time of fertilization to hatch (Drosophila hatches in about 24 hours from fertilization).

Slide 5:

Missing bullet: Blastomeres: cells derived from cleavage division.

Slide 6: (This slide shows a video of cell division). The division becomes asynchronous after about 12 divisions.

Slide 7: The second major stage is gastrulation (Know this slide!!)

Incomplete bullets:

Involution: Cell movement involving a sheet of cells that enters into interior of embryo by rolling under itself.

Archenteron: Interior space that is precursor of the gut cavity.

(The blastoseal DOES NOT become the gut; this gets smaller and smaller until it vanishes)

Epiboly: Spreading of ectoderm to cover the embryo.