

Developmental Biology Lecture 17 (Week 10, Thursday) 10/30/2014

Robert Steven BIOL 3090

Important announcement: anyone who is caught using multiple clickers after today will not get anymore clicker points for the rest of the semester! This is considered academic dishonesty.

Slide 1)

(missing) Obtain specialized functions

(missing) Fully differentiated cells reach a terminal and stable state

Slide 2) Signals are instructive but not unlimited. As development progresses, more restrictions of what a cell can/cannot do occur.

(missing) Cells rarely divide after terminal differentiation; if they do, they pass on their differentiated state.

Fibroblasts are an exception to this!

Slide 3) First image of the epithelial cell is an intestinal cell. Notice the vast differences in structure- the red blood cell lacks a nucleus. This shows us just how specialized differentiated cells are for their function.

Slide 4) The less complex the organism, the fewer cell types they have. Why? Possibly linked to genome size or gene number but it is not clear. Some less complex organisms can have a larger genome because they have more genetic information. In plants, this is due to polyploidy, which increases the amount of genetic material they have, but does not mean they have more genes or make more proteins. In some organisms this is due to introns and exons, and any other non-coding regions they have- similar effect as polyploidy in that the amount of genetic information increases, but not the amount of genes or proteins expressed.

It is also possible for an organism with a small genome to express a substantially higher amount of genes compared to other organisms. This can result from alternative splicing.

Slide 5: Northern blot assay is kind of the old school method. Label and look for detection on a gel electrophoresis. Real-time PCR is for amplifying DNA. To detect RNA, you use reverse transcriptase to create DNA from RNA and then perform the test. Microarrays and RNA-seq are global tests. The microarray is shown to the right. Red dots indicate it is found in sample 1; green in sample 2; yellow indicates it is found in both.

Clicker!

A yellow dot on the microarray means the gene is

- A) Expressed only in sample 1
- B) Expressed at the same level in both samples
- C) Expressed only in sample 2
- D) Not expressed in either sample

Answer is **B!**

Slide 6)

(missing) Transcription; RNA processing and transport; translation
(incomplete) Regulators can activate or inhibit transcription

Slide 7)

(missing) Regulatory region specifies where and when the gene is expressed

Slide 8)

(incomplete) Specificity of activation: due to particular combination of gene regulatory proteins.

Enhancer can be up to thousands of nucleotides away- they don't have to be close.

Slide 9) It would be a good idea to know this pathway and terminology using the diagram.

(incomplete) MAPK activates transcription by phosphorylating a transcription factor.

Clicker Question!

Which properties of the TATA box allow for the start of transcription at this site?

- A) It binds ATP; the reaction requires energy
- B) It binds RNA polymerase
- C) Complementary base pairing between DNA strands is strong in this area
- D) Complementary base pairing between DNA strands is weak in this area

Answer is **D!** Hydrogen bonding is weaker between T and A base pairs than it is between C and G base pairs (there are 2 hydrogen bonds in TA and 3 in GC). So a GC rich area is tightly connected and a TA rich area is weaker. This means a TA region is easier to open up.

Slide 14)

(incomplete) Chromatin: The complex of DNA, histones, and other proteins that make up the chromosomes.

(incomplete) Heterochromatin: chromatin that is packaged into a structure that cannot be translated.

Euchromatin: not as tightly packaged; more active because it is more accessible.

Slide 15)

(missing) Accessible to transcription factors and other enzymes such as the nuclease DNAase 1.

Unwound= accessible

Slide 16)

(incomplete) Inactivation occurs through the formation of heterochromatin.

(missing) Involves xist gene

Extreme level of global gene regulation.