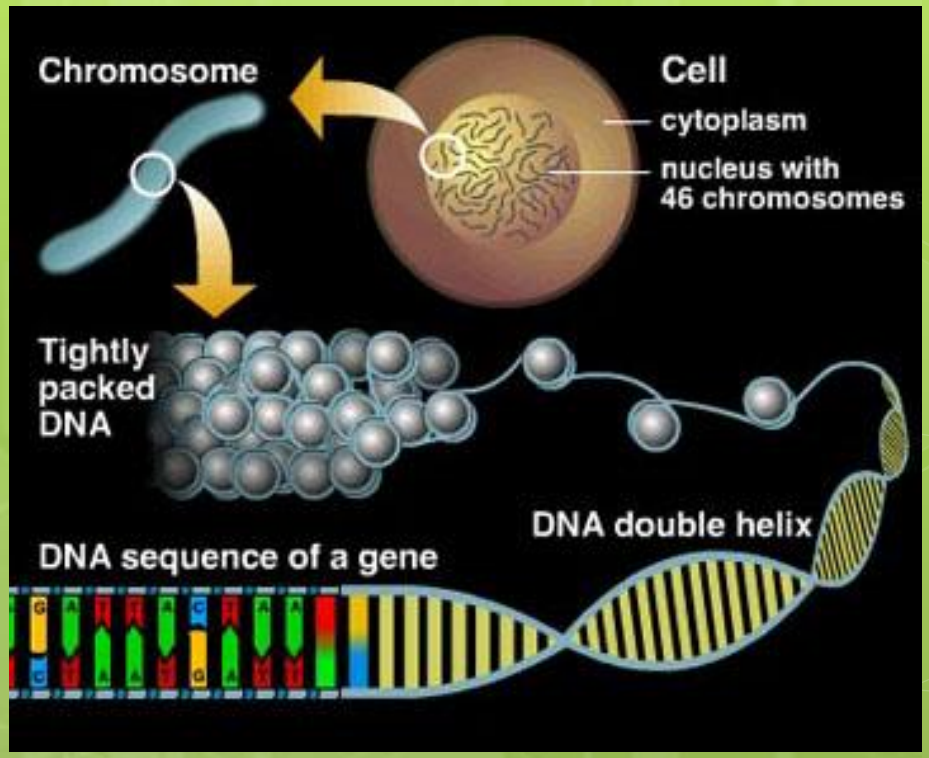
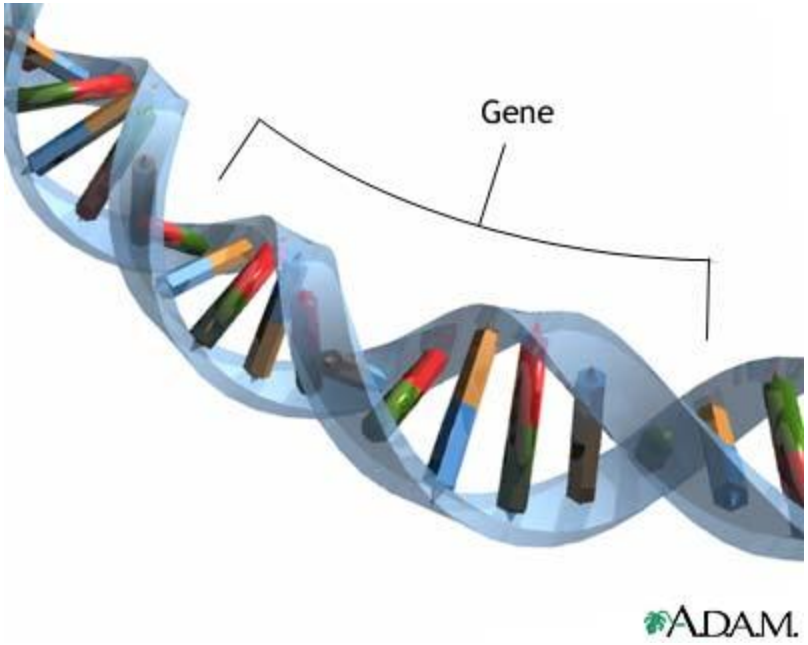
Regulating Gene Expression QQ

Determining when a gene is expressed *or not.*



Genes

- Definition:
  - a hereditary sequence of DNA, which occupies a specific location on a chromosome.
  - determines the organisms particular characteristic by directing the formation of the corresponding protein



Regulating Gene Expression in Eukaryotes…

- What is it?
  - Activating the expression of a particular piece of DNA only when needed

QQ#1: Why do we need to regulate gene expression?

- Why do we need it?
  - DNA is expensive and delicate
  - Transcription and translation take lots of energy…
    - be efficient! Only create proteins when needed!

How do we regulate gene expression…

1. Requiring 2 copies of a gene
   - Dominant genes: form of a gene that is expressed no matter what
   - Recessive genes: form of a gene that is only expressed when there are two copies of the same recessive gene

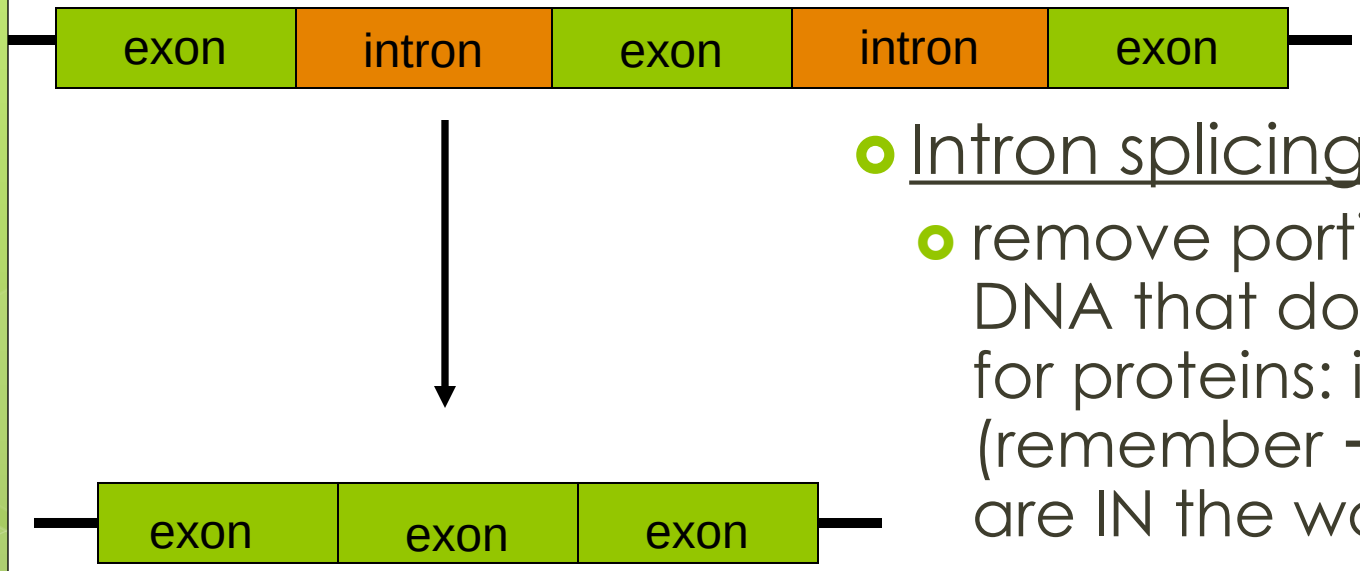
2. Transcribing only portions of the DNA that are needed
   - mRNA is created
   - Then mRNA is modified

Reminder:

- What happens in Transcription?
  - DNA → mRNA
- What happens in Translation?
  - mRNA → Protein (the gene has been expressed)
- But something else needs to happen to mRNA

Write this slide just like you see it: include pictures

mRNA Modification



- Intron splicing:
  - remove portions of DNA that do not code for proteins: introns (remember → introns are IN the way)
  - Exons are joined together

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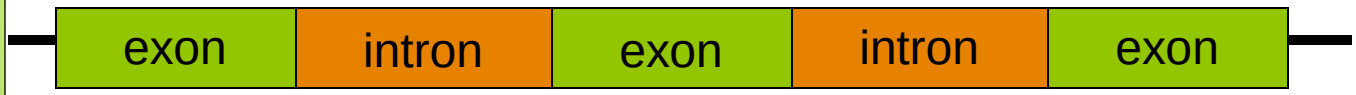
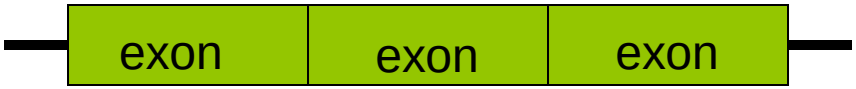
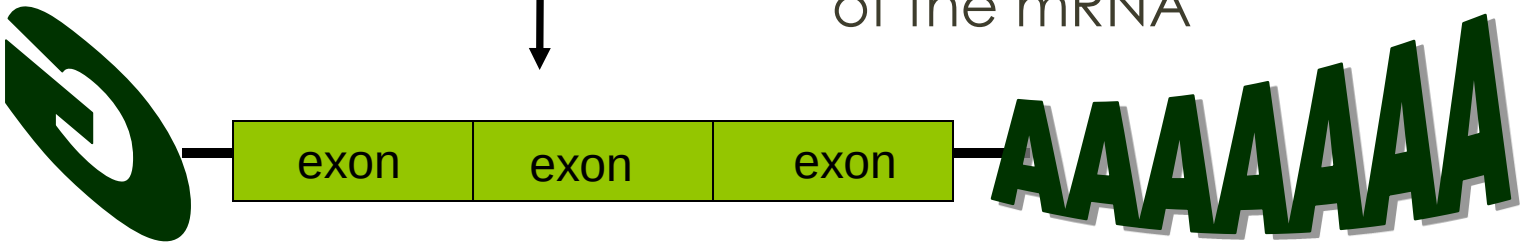
mRNA Modification





- G-cap:
  - a backwards guanine on the front of the mRNA
- Poly-A tail:
  - a chain of adenine nitrogen bases on the end of the mRNA



mRNA Modification terms…

- Why do we modify mRNA?
  - It's all for the regulation of gene expression…
    - Takes out unnecessary nucleotides
    - G-cap helps ribosome recognize mRNA
    - Poly-A tail: promotes export from the nucleus and translation, and protects the mRNA

- QQ#2: Summarize the three steps of modifying mRNA

Regulating Gene Expression in Prokaryotes (and some eukaryotes)...

- Operon: genes and regions of DNA that operate together for gene expression
- Some operons are always on, and always expressing genes but can be turned off.
- Some operons are always off, but can be turned on to express a gene.

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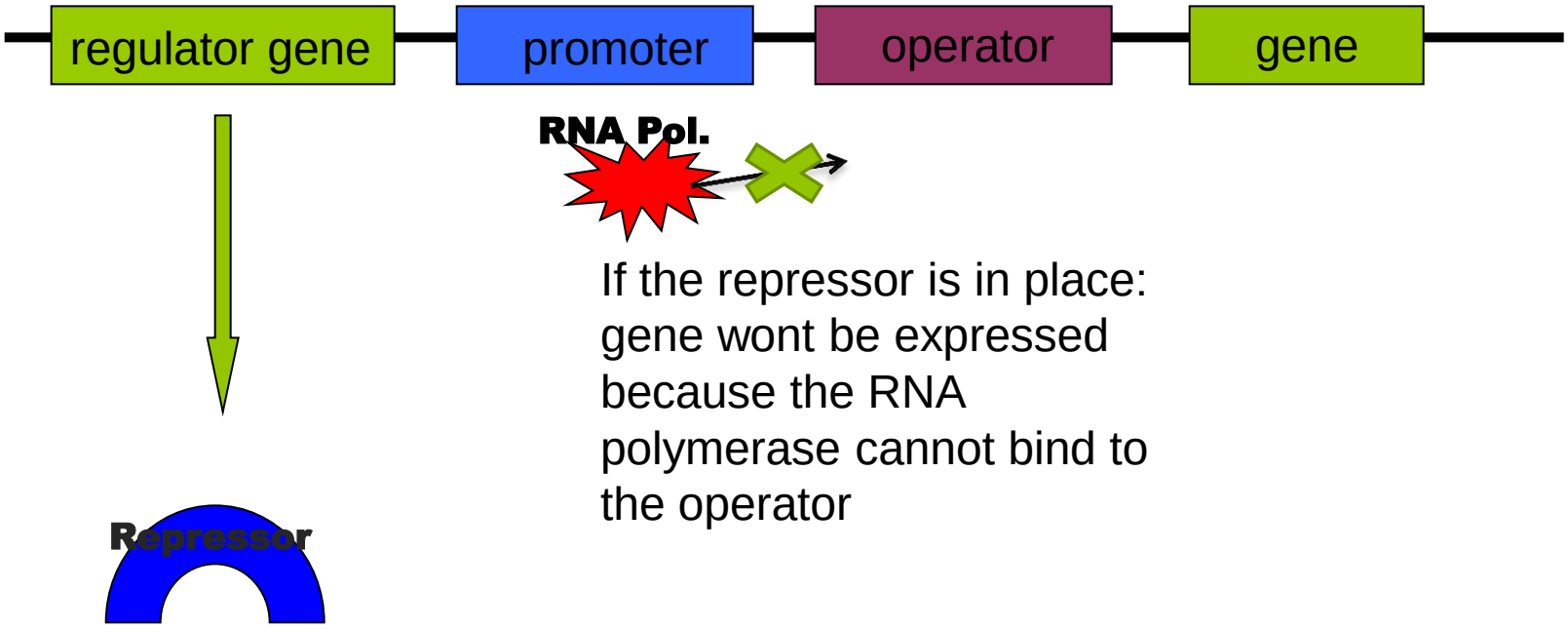
How it works….
If the gene IS NOT being expressed

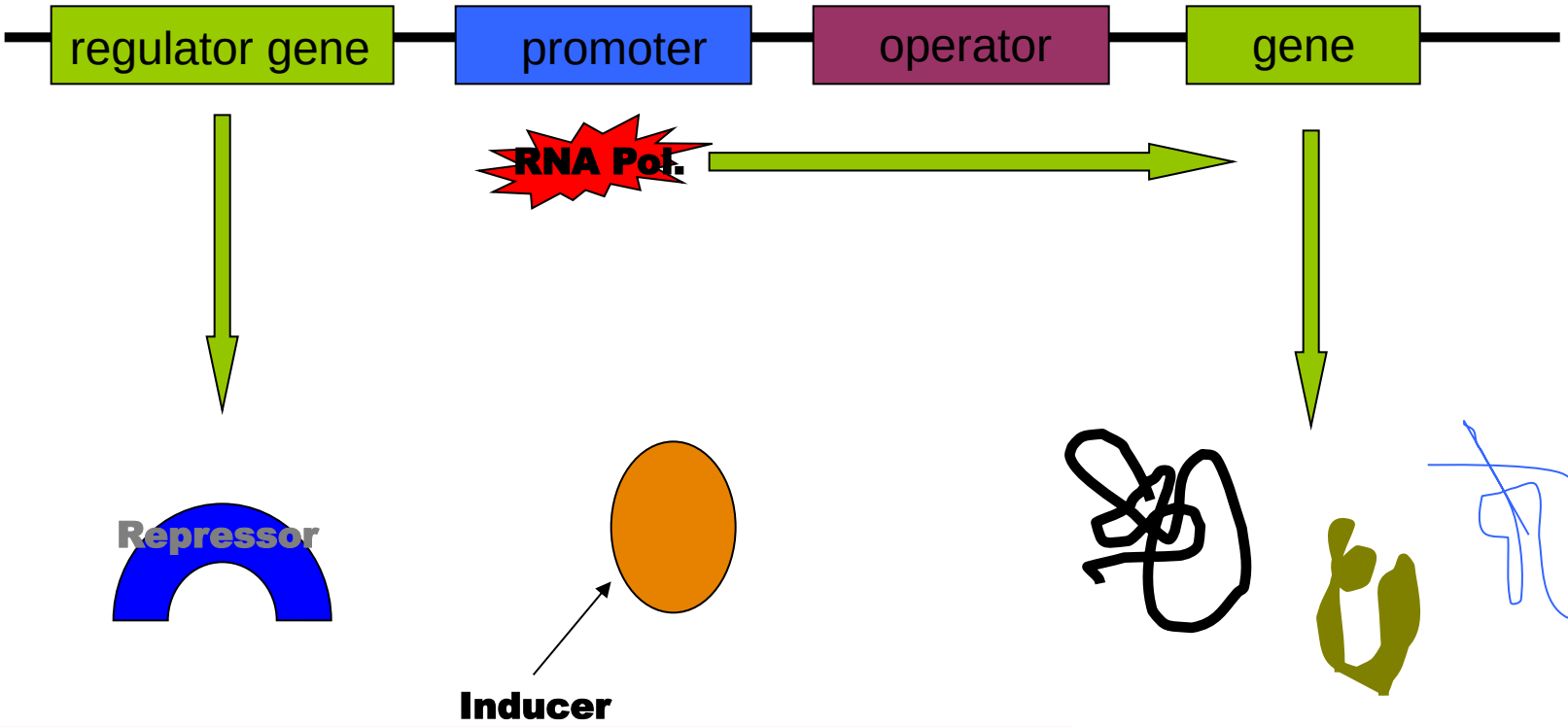


If the repressor is in place: gene wont be expressed because the RNA polymerase cannot bind to the operator

QQ#3: in one sentence explain when/why genes expression is off

Write this slide just like you see it: include pictures

How it works….
If the gene IS being expressed



QQ#4: in one sentence explain when/why genes expression is on

mRNA is made and translated: gene is expressed

Make sure you can define all of these

Operon terms…

- Operator Gene: regions on a chromosome which regulate transcription of gene clusters by providing a site for a repressor to bind to, thereby turning off the operon
- Promoter Gene: region on a chromosome next to the operator to which RNA polymerase binds at the beginning of transcription
- Repressor: a special protein that binds to the operator, preventing polymerase from attaching. This turns the operon off
- Regulatory Gene: a gene that codes for the creation of a repressor protein.
- Inducer: chemical substance that causes the production of proteins. Removes repressor
- RNA Polymerase: binds to the promoter sequence to transcribe mRNA

- For your summary:
- explain how these all interact to express genes using pictures and/or words

- Operator Gene
- Promoter Gene
- Repressor
- Regulatory Gene
- Inducer
- RNA Polymerase