

Chemical Biology 03

Oct 22, 2010

Finishing up on Central Dogma:

Germline vs. Somatic mutations

General Central Dogma/Genome Points

Gene Regulation

When do mutations get passed on to the next generation?

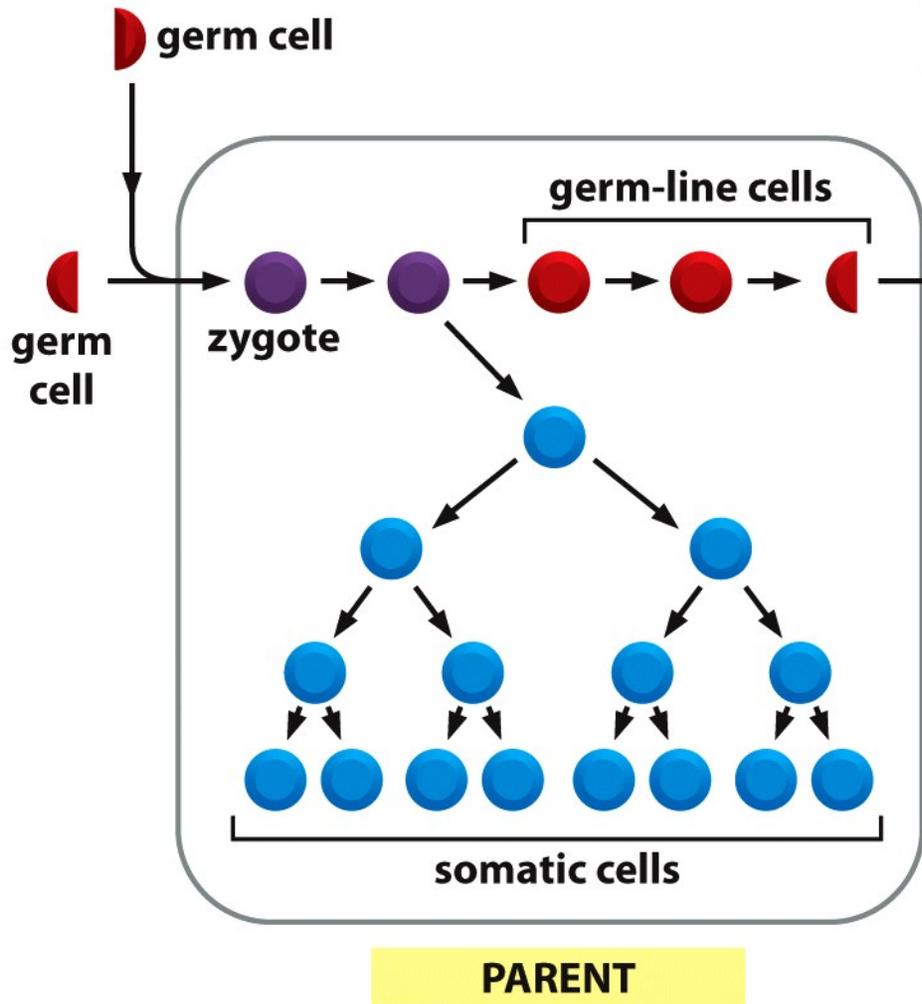


Figure 9-3 Essential Cell Biology 3/e (© Garland Science 2010)

When do mutations get passed on to the next generation?

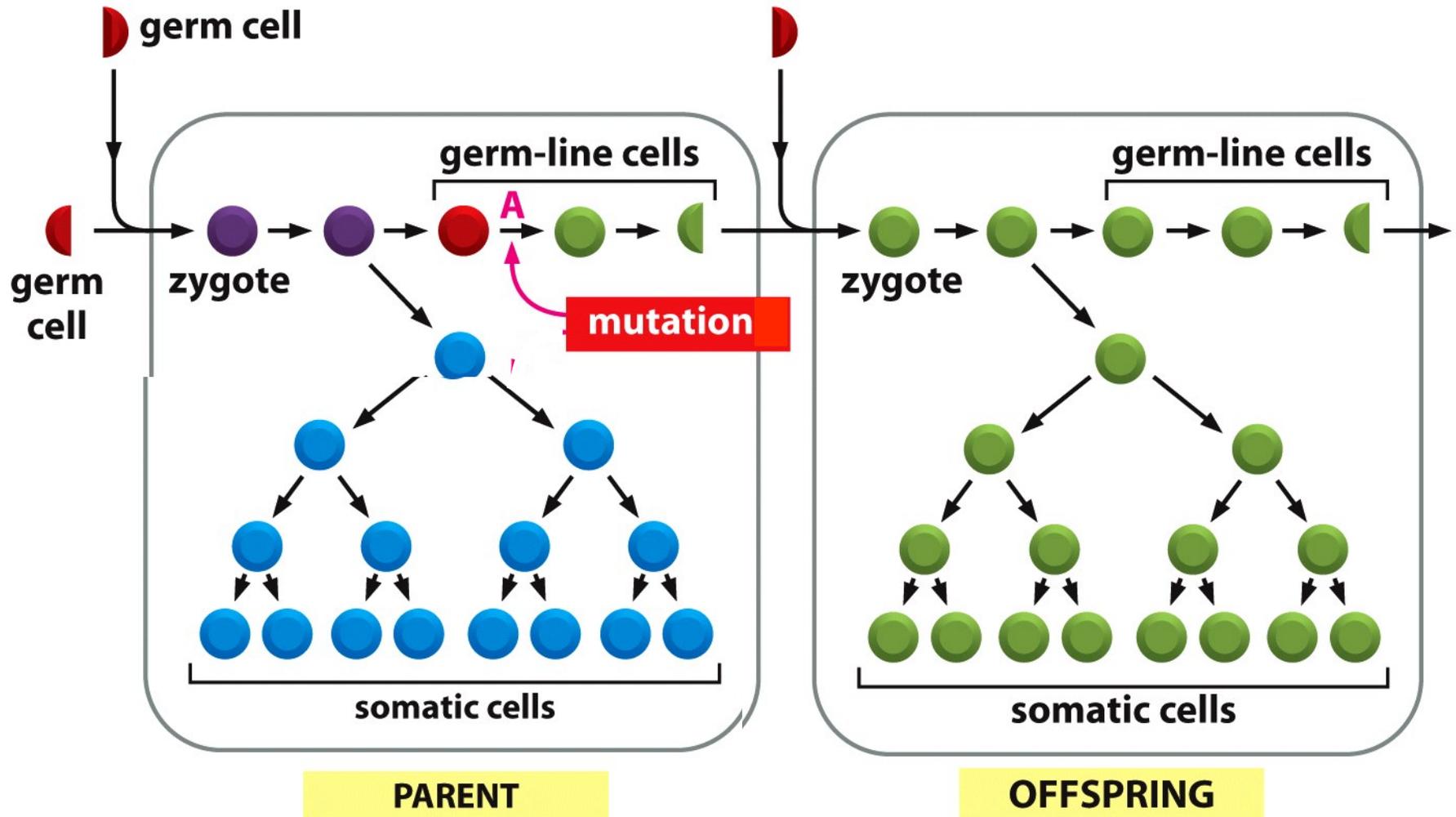


Figure 9-3 Essential Cell Biology 3/e (© Garland Science 2010)

When do mutations get passed on to the next generation?

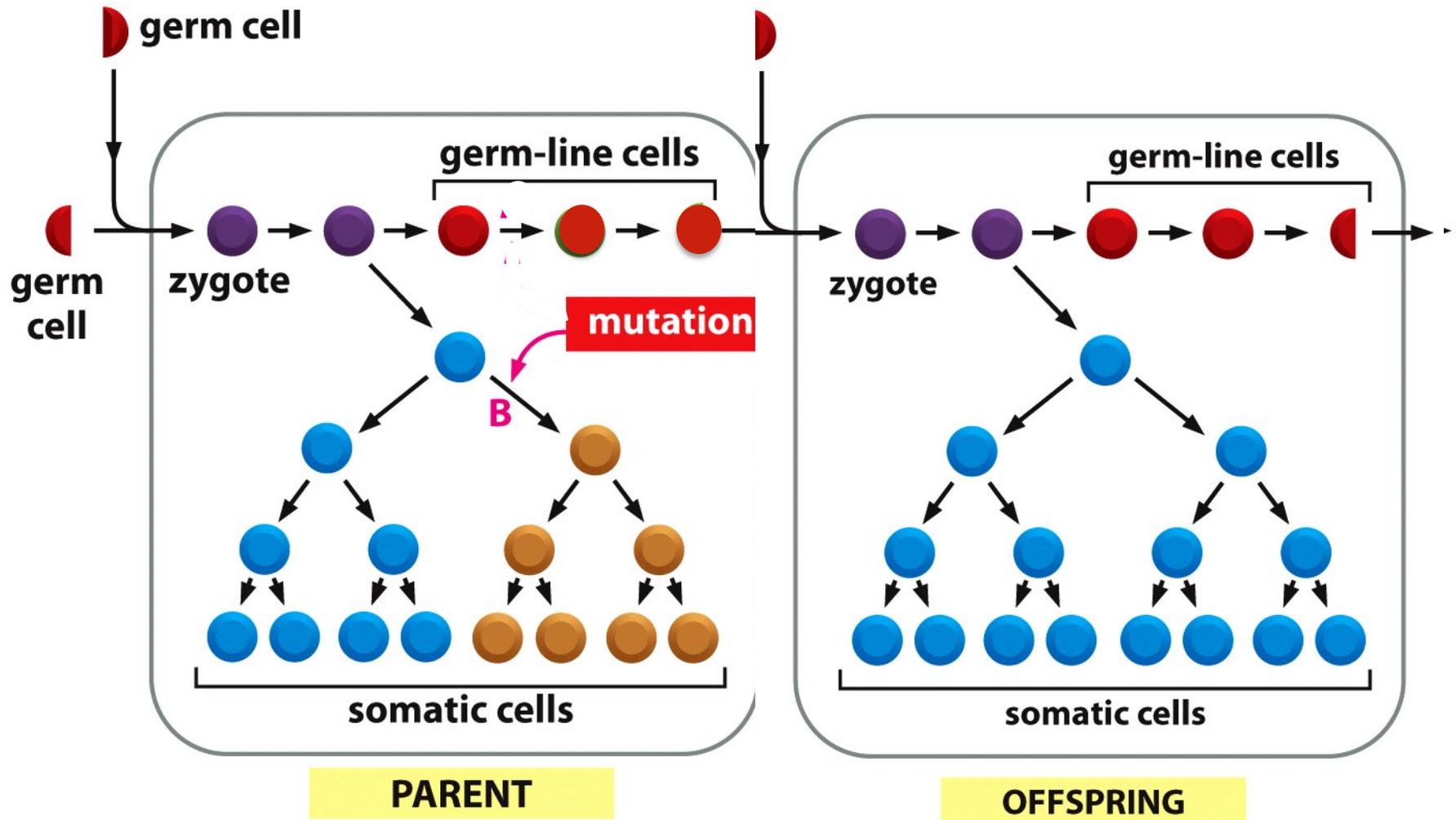


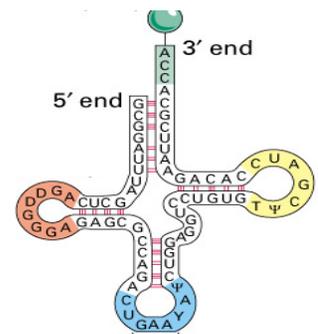
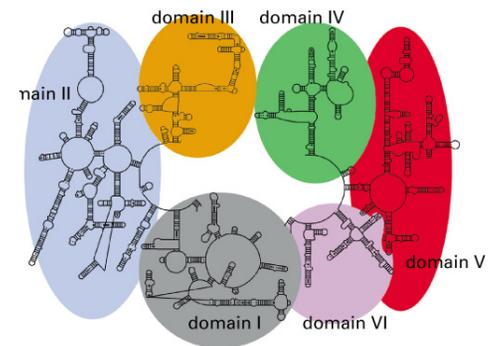
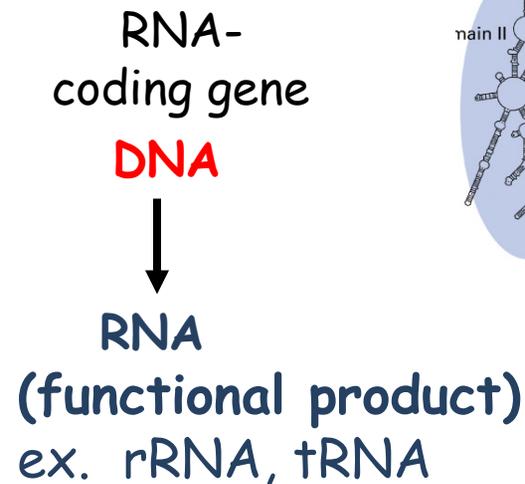
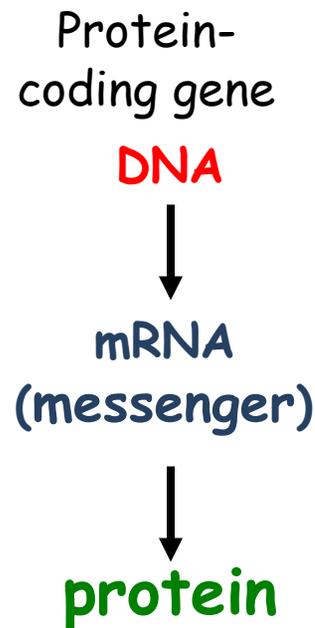
Figure 9-4 Essential Cell Biology 3/e (© Garland Science 2010)

Two final notes on Central Dogma

- 1) Not all RNA sequence is translated into protein sequence
- 2) Viruses exhibit some variations on DNA \rightarrow RNA
(but NOT on RNA \rightarrow protein)

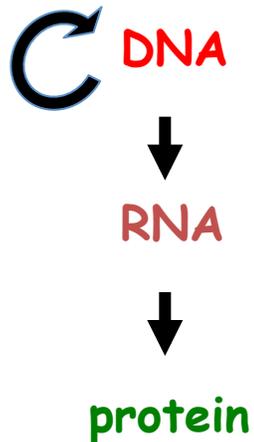
We have seen two different classes of RNA:

- 1) **mRNA** (messenger RNA) serves merely to carry information
= intermediate product of a gene
- 2) **RNA** with its own function: structural or catalytic
= final gene product
ex. Transfer RNA (tRNA) and ribosomal RNA (rRNA)

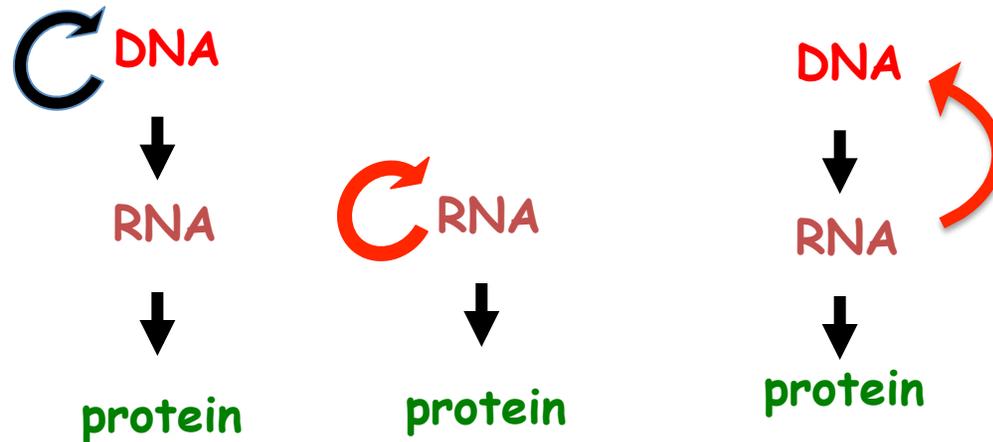


Central Dogma: Flow of information

all cellular organisms



Variations seen among Viruses

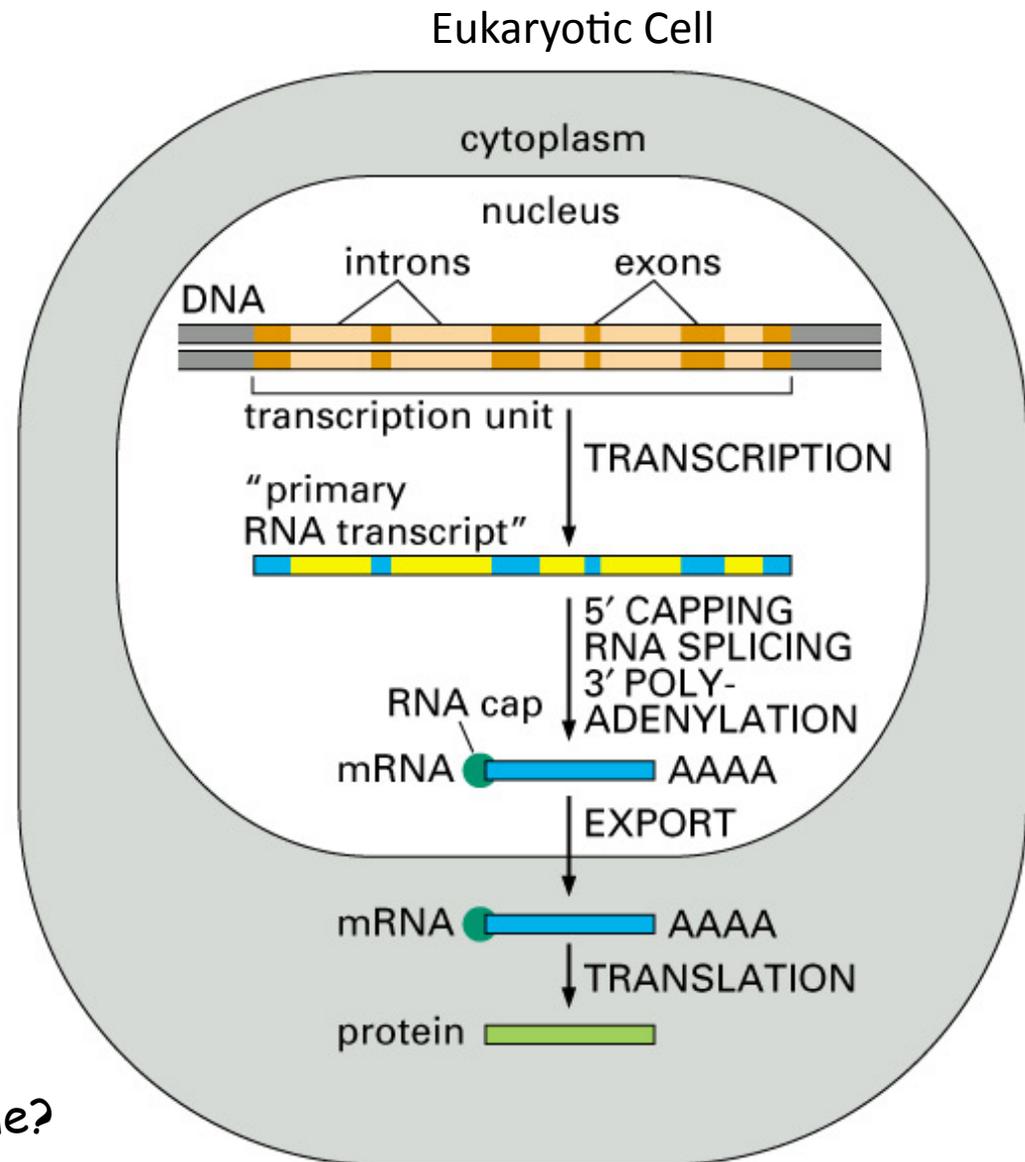


"gene"

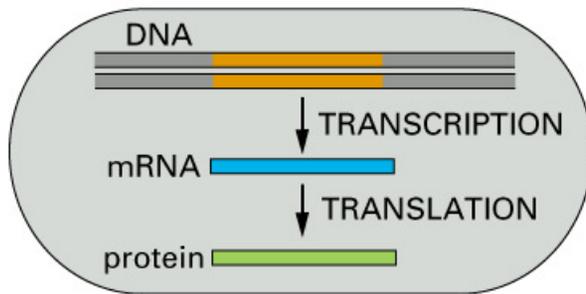
Segment of DNA that provides necessary information to encode a product
(includes sequences that Do not directly code for a.a.)

~25% of our genome is Transcribed into RNA
(only 1.5% of genome is coding)

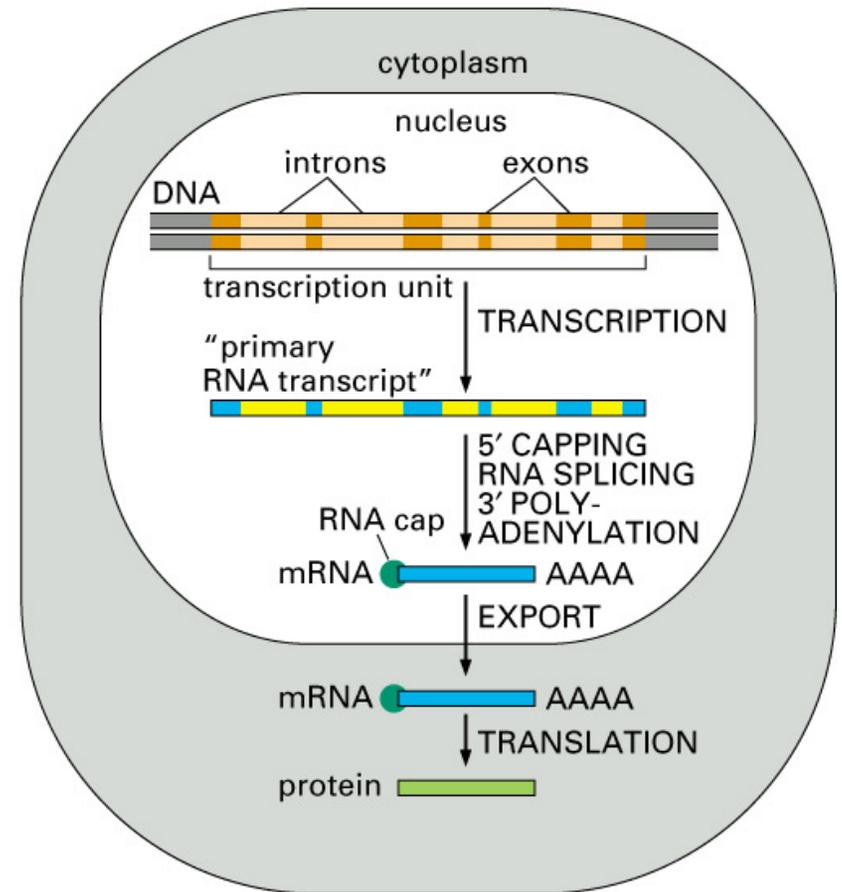
How many genes in human genome?
~25,000 (still figuring this out!)



(B) PROCARYOTES



(A) EUCARYOTES



Chemical Biology 03

Oct 22, 2010

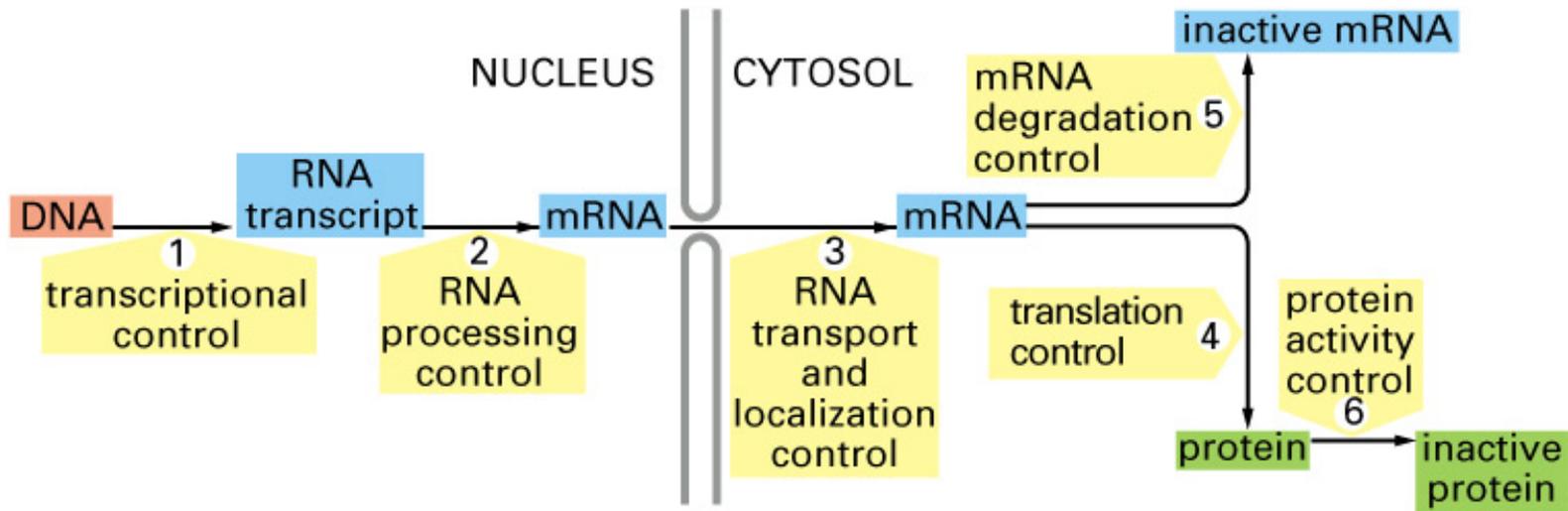
Finishing up on Central Dogma:

Germline vs. Somatic mutations

General Central Dogma/Genome Points

Gene Regulation

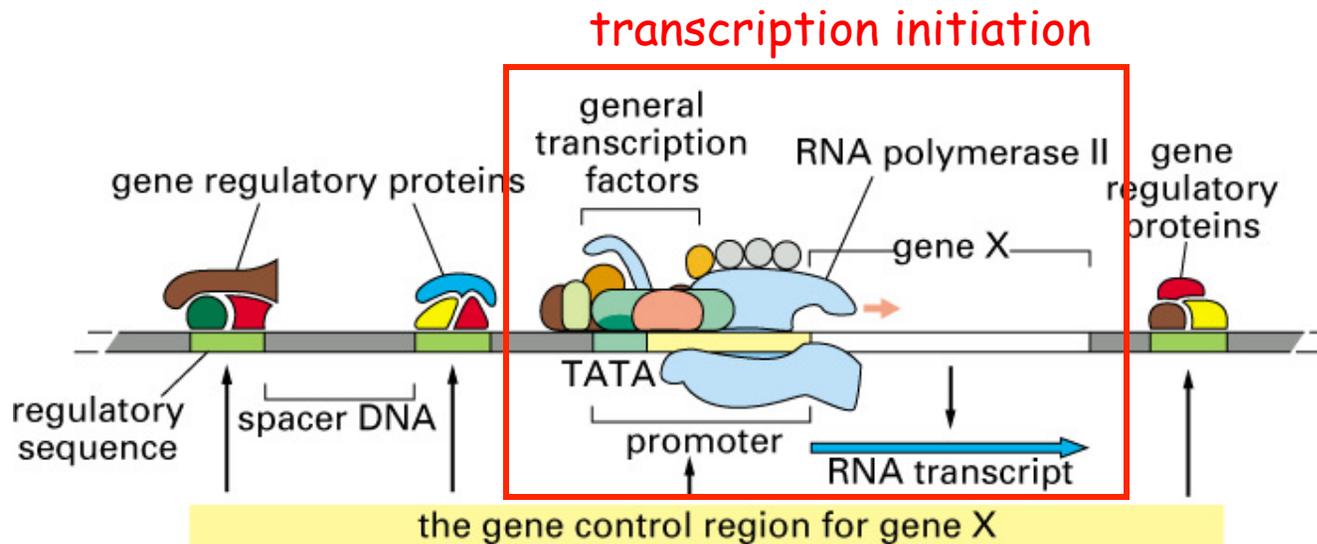
Gene Regulation: Every Step in Gene Expression is a potential target for Regulation



25,000 genes
present in all
human cells

subset of proteins
unique to a particular cell type
under a particular set of conditions

Transcriptional Regulation



Regulation is achieved by:

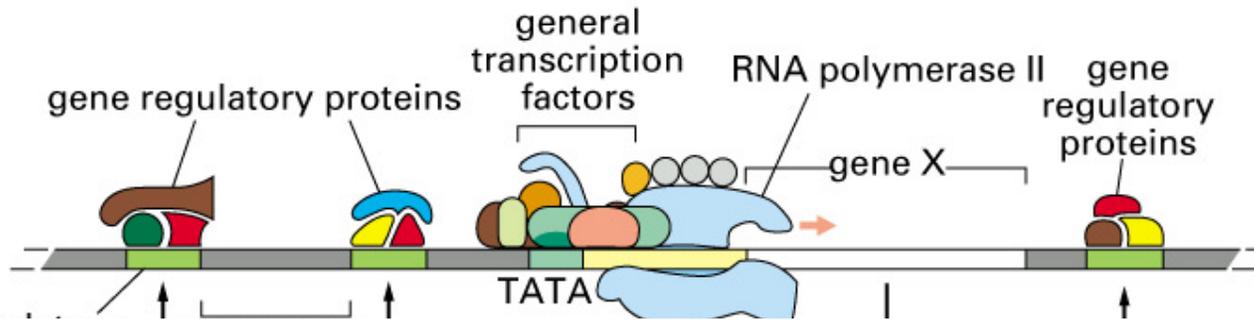
1) Regulatory DNA sequence

- next to promoter
- up to several 1000 base-pairs "upstream" (before) promoter
- sometimes even in introns or "downstream" of gene

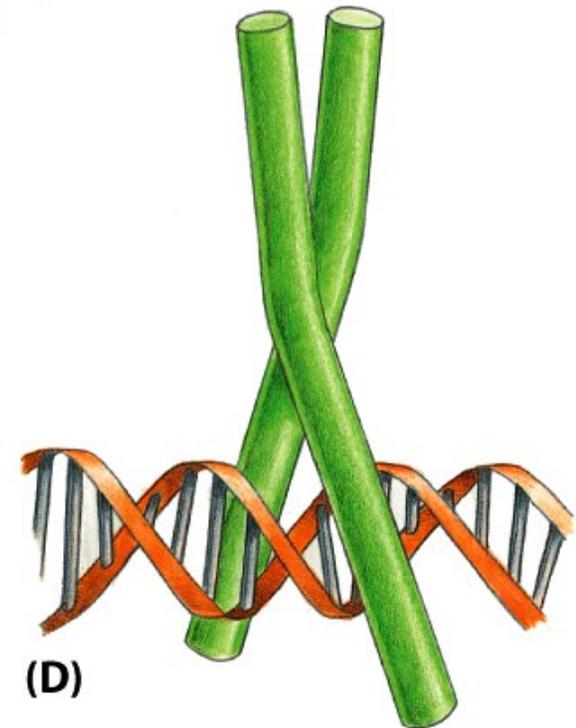
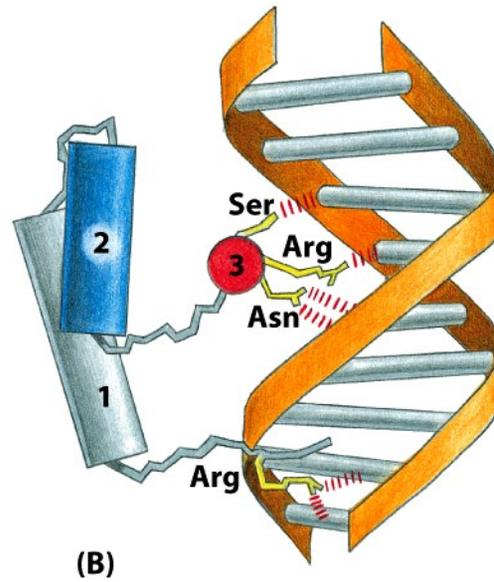
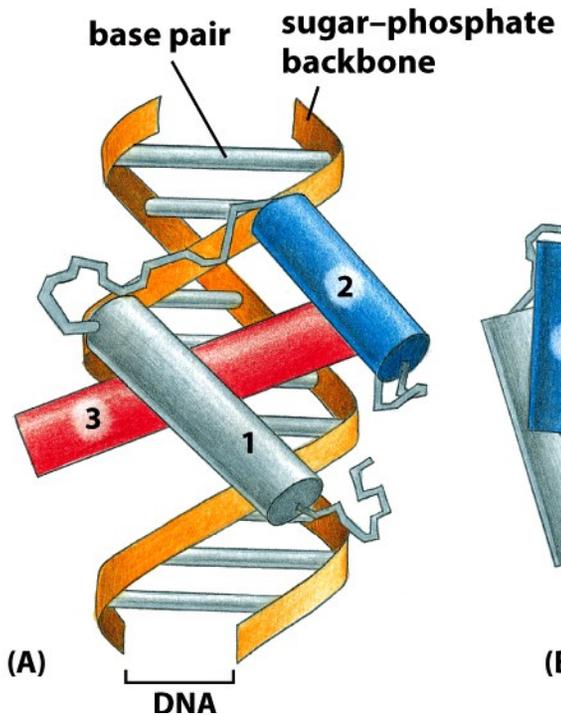
2) Regulatory Protein

- binds DNA double helix in a sequence-specific manner
- Some are Positive Regulators ("activators" and "enhancers")
- Some are Negative Regulators ("repressors" and "silencers")

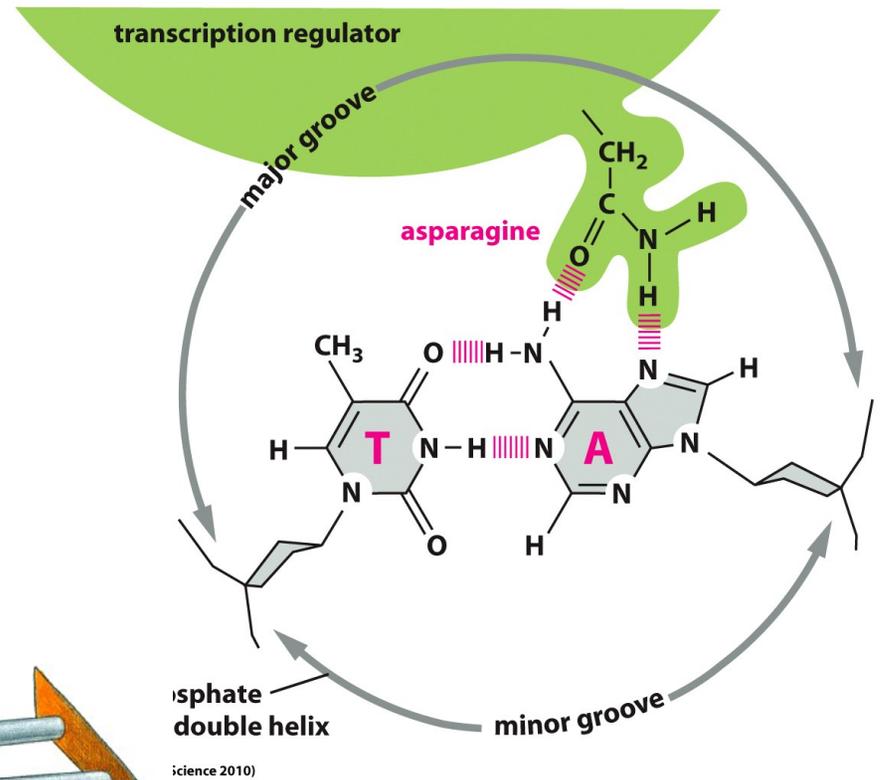
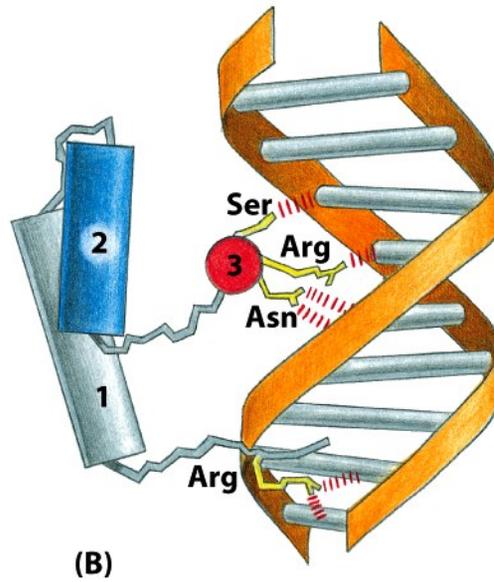
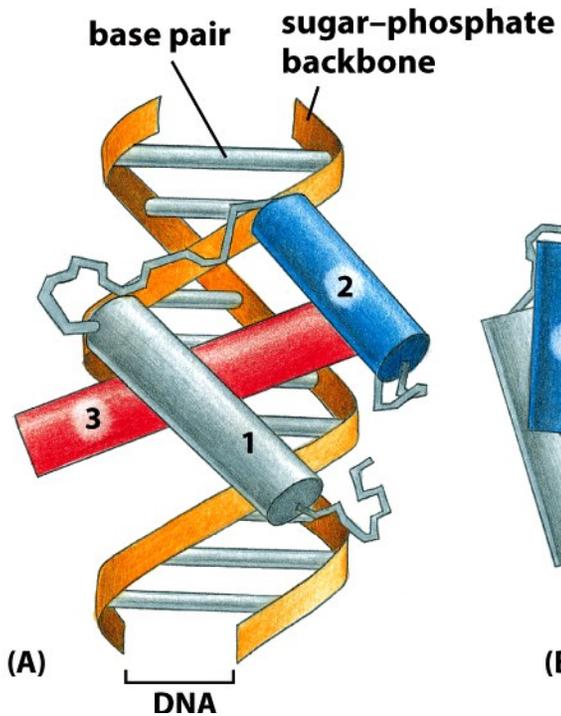
Transcriptional Regulation



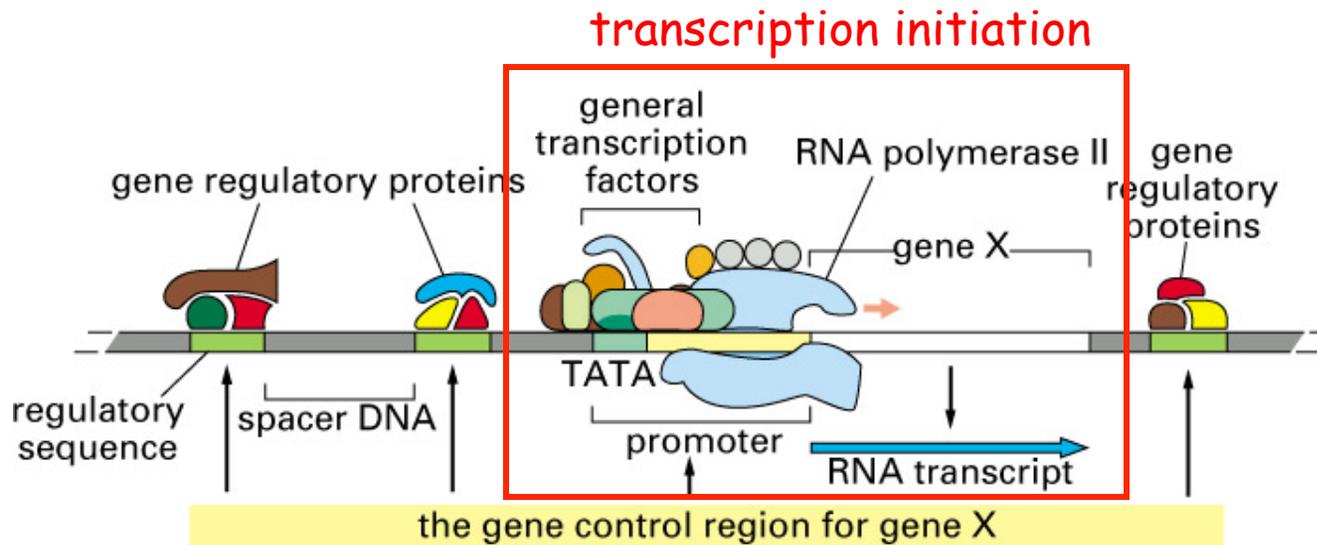
Examples of DNA-binding domains of Regulatory Proteins



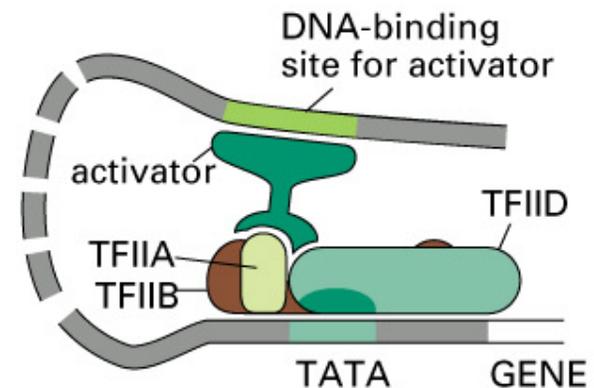
Regulatory Proteins bind Double-stranded DNA (like TATA binding Protein)



Transcriptional Regulation



How do proteins bound so far away influence transcription machinery?



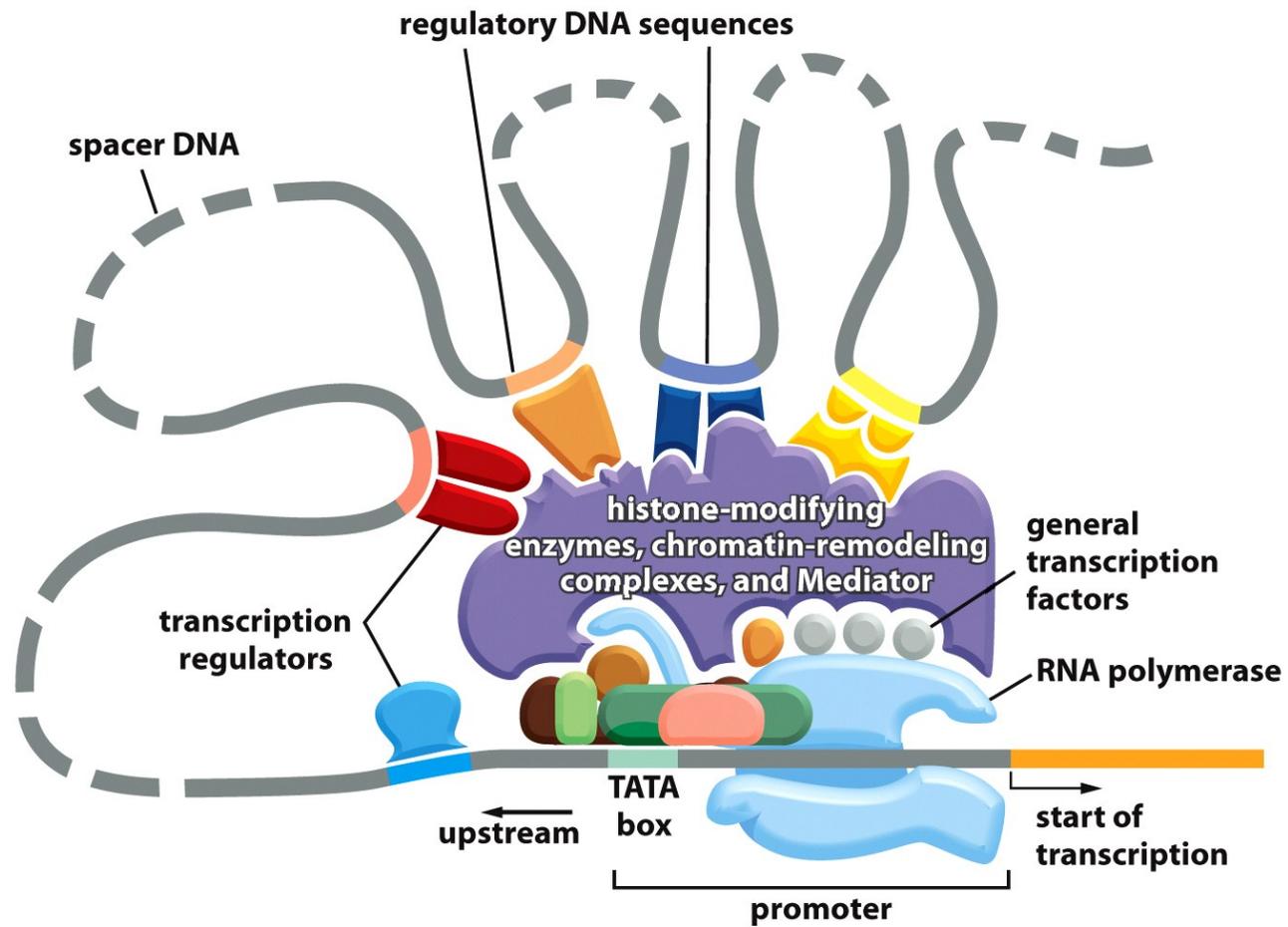
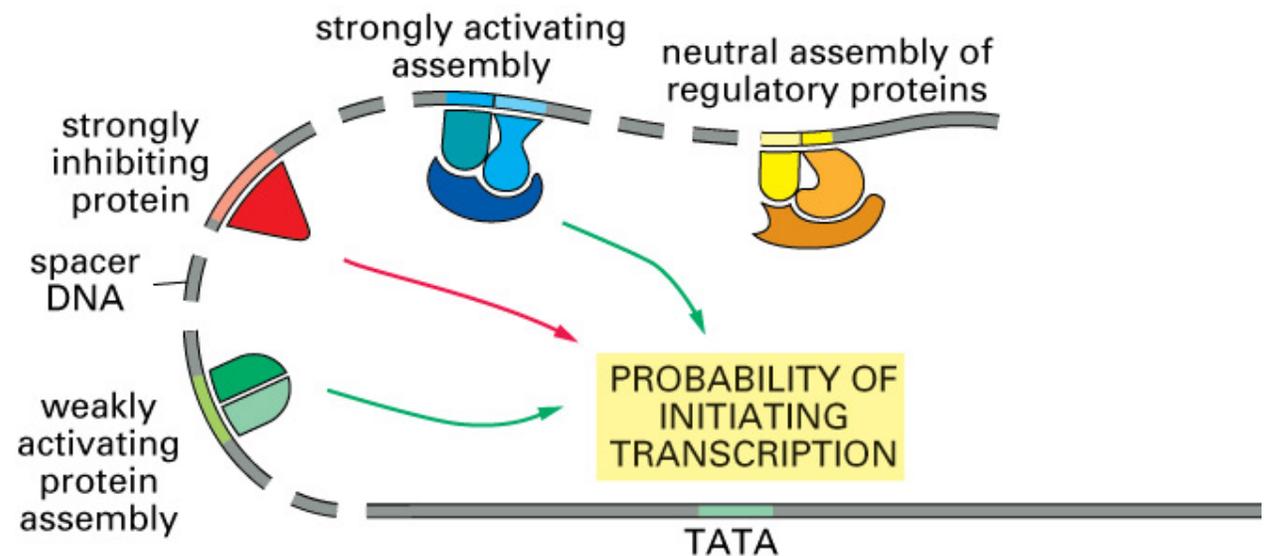


Figure 8-12 Essential Cell Biology 3/e (© Garland Science 2010)

Network of Regulatory Proteins

~ 2000 - 3000 genes in our genome = Transcriptional Regulatory Proteins

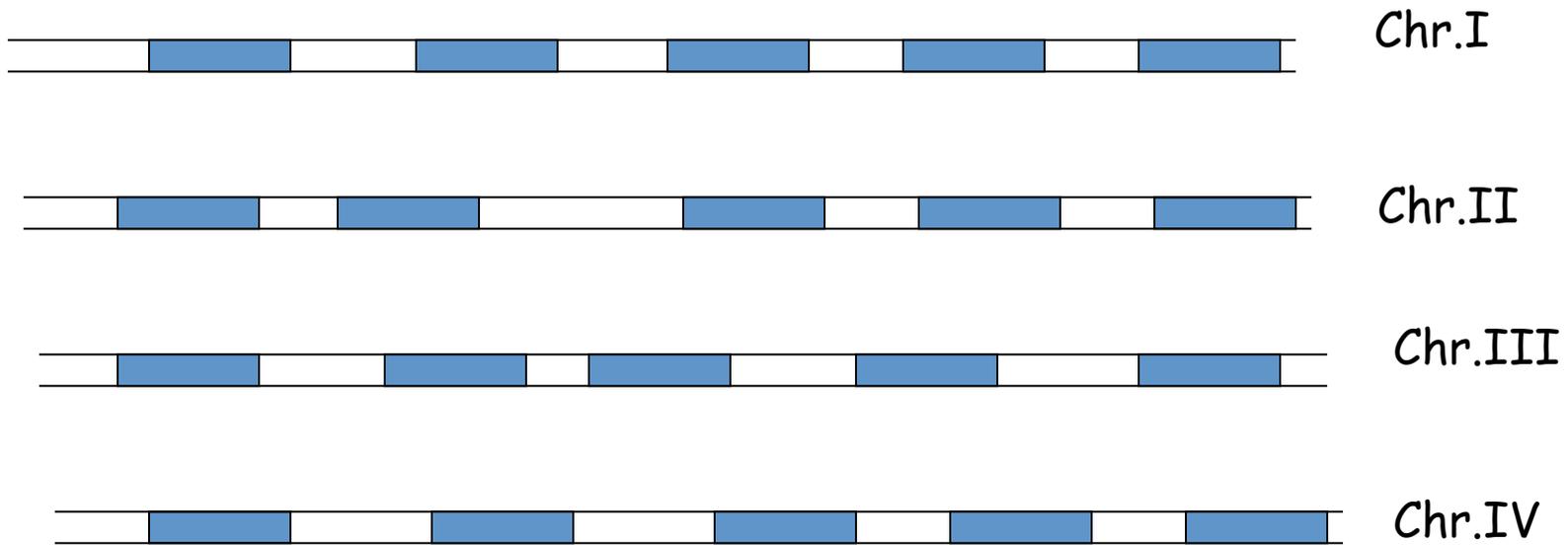
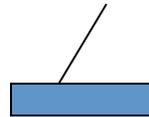
The transcriptional activity of any given gene is determined by abundance, activity, cooperation, competition of different Regulatory Proteins



The presence & activity of a regulatory protein is influenced by cell type and by extracellular environment

Recall that genes are scattered over many chromosomes

transcribed part of gene



Each gene acts independently: has its own TATA box and associated regulatory regions

