Control in Eukaryotic Genomes: That's us!

Ch. 19

What makes us different?

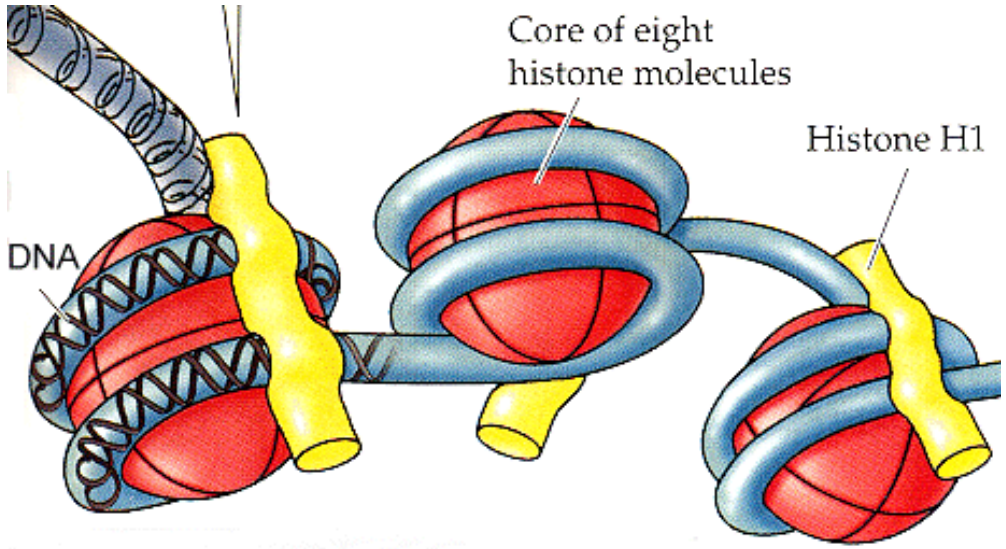
- We have a lot more DNA
  - 35,000 genes
- a lot of that doesn't code for anything
- Cell specialization means not all cells have the same DNA
- All that DNA requires major organization
- How would you deal with all that DNA?

How much DNA is that?

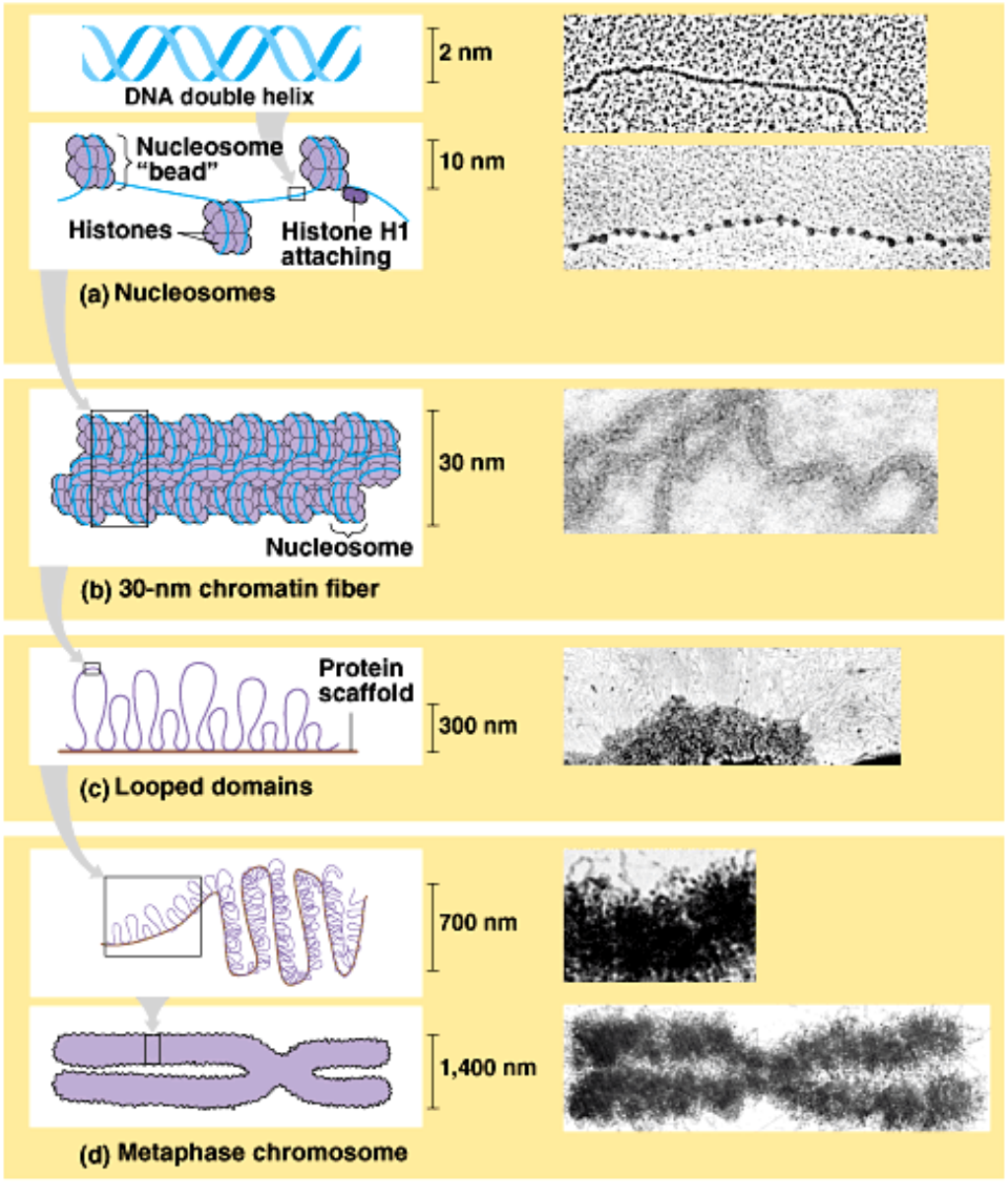
- If extended, each DNA molecule would be about 6 cm long, thousands of times longer than the cell
- Each human chromosome averages about 2 x 10^8 nucleotide pairs
- This chromosome and 45 other human chromosomes fit into the nucleus
- How is this done?

Histones: the first level of packing

- Their positively charged amino acids bind tightly to negatively charged DNA.
- Makes chromatin look like beads on a string
  - Beads called **nucleosomes**, where DNA winds around a core of histone proteins.



Chromatin: the DNA suitcase

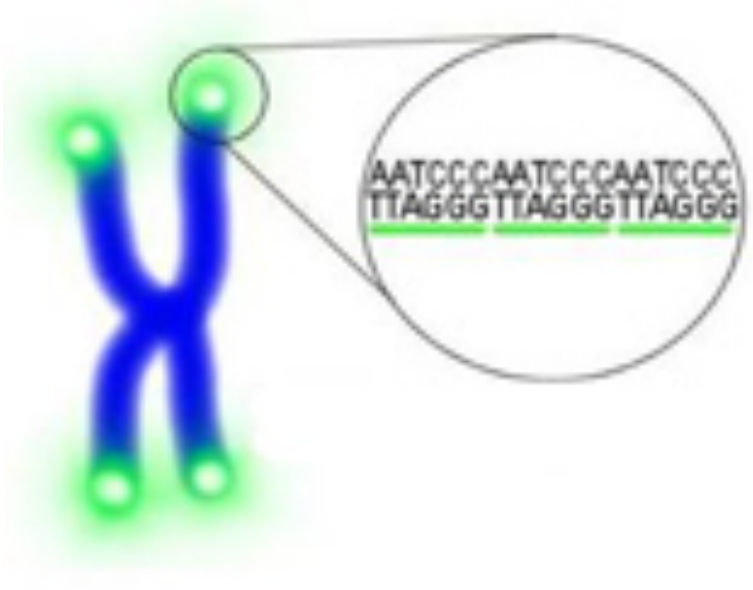


Getting down to the DNA level

- In eukaryotes, most of the DNA (about 97% in humans) does *not* code for protein or RNA.
  - Some are regulatory sequences
- Some is **repetitive DNA,** present in many copies
  - 10-15% is satellite DNA where base pairs are repeated up to hundreds of thousands of times in a row
  - This can cause mental retardation, like repeats of CGG
  - The longer the repeat, the worse the conditions
  - Some is helpful…..

Telomeres and Centromeres

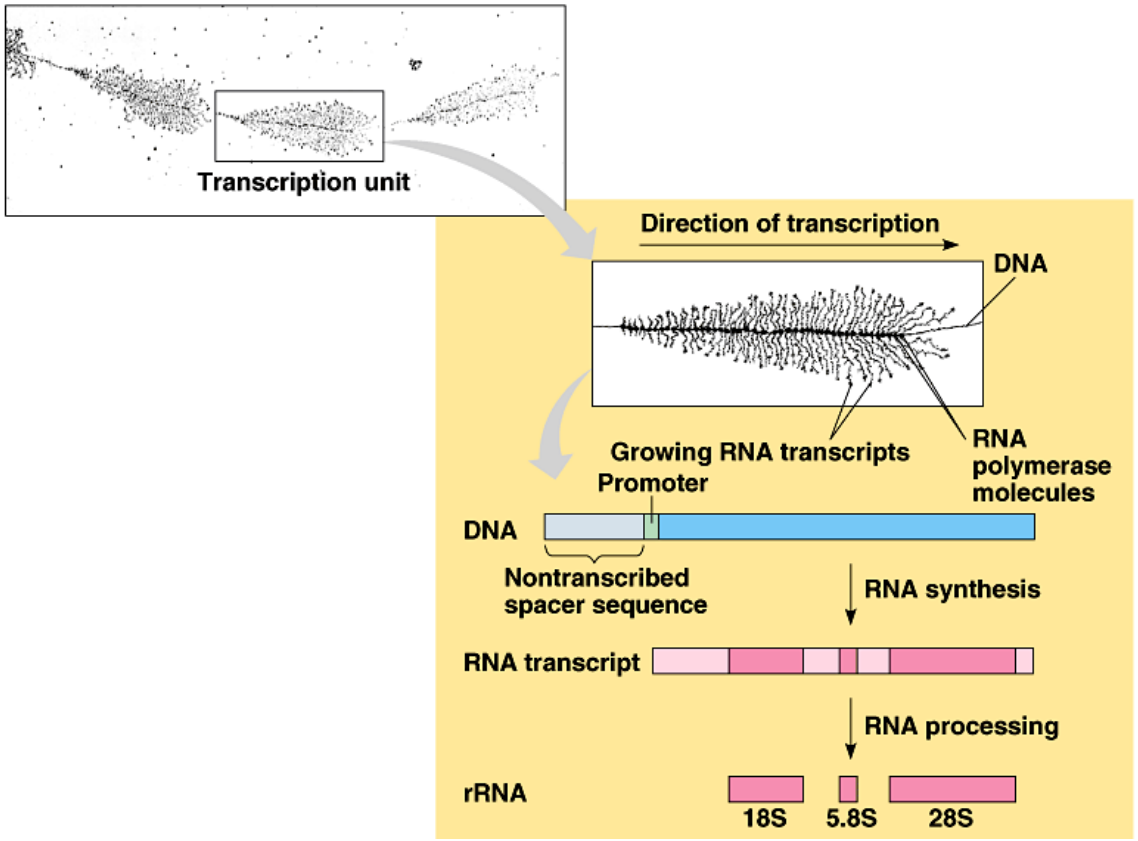
- The DNA at the centromeres separates sister chromatids during cell division



- The telomeres protect genes from being lost by protecting the ends of chromosomes from degradation

Multi-gene families that code

- For example, the three largest rRNA molecules are encoded in a single transcription unit that is repeated thousands of times



- Each antibodies consists of four polypeptide chains, each with a constant region and a variable region, giving each a unique function
  - As a immune cell differentiates, one of several hundred possible variable segments is connected to the constant section by deleting the intervening DNA.

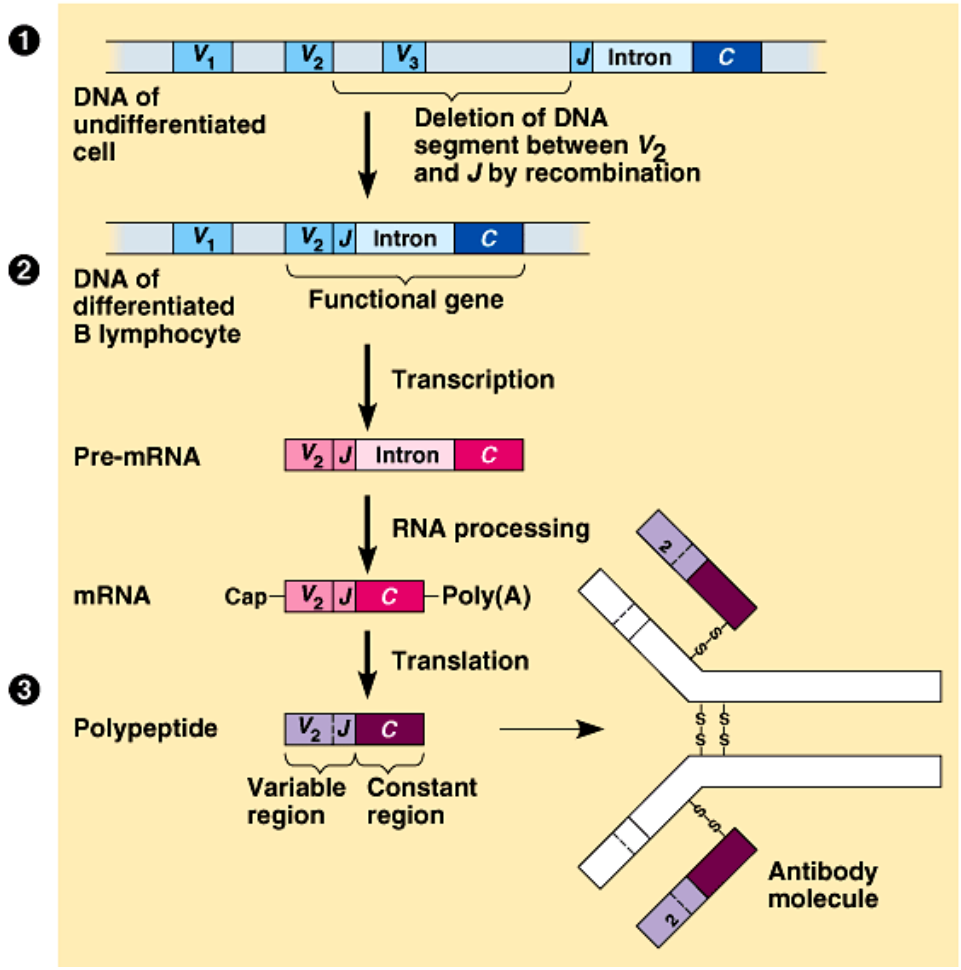
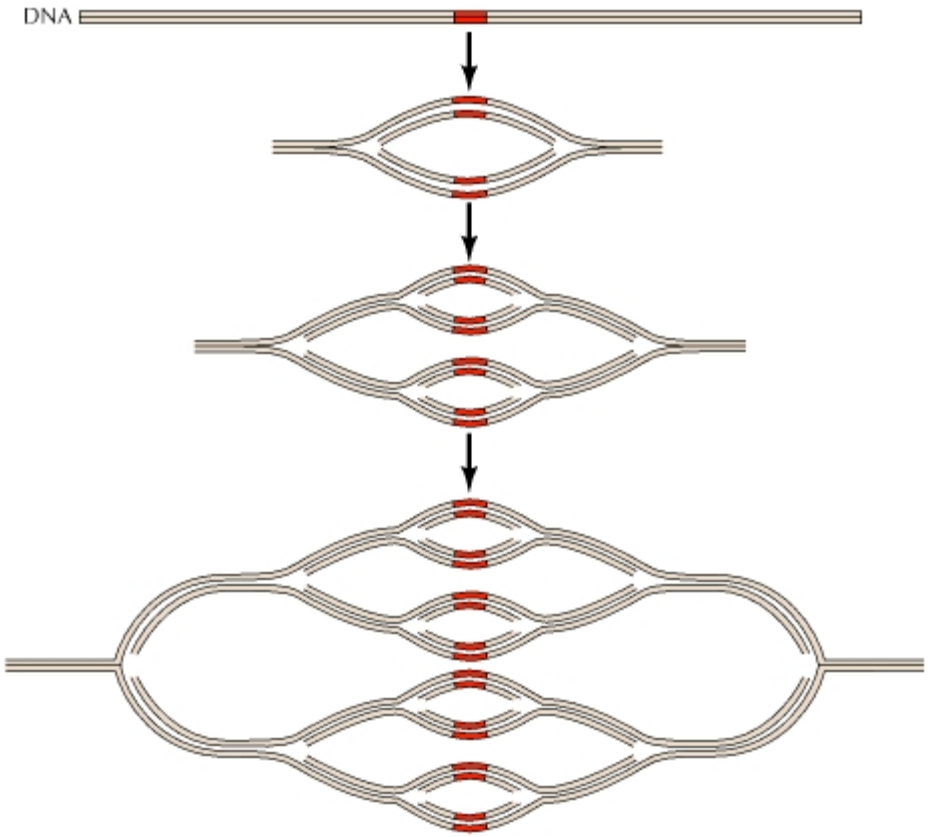


Fig. 19.6

Gene amplification



- Happens during development with ribosomes
  Why do you think this is?

Where's the regulation?

- Now it's your turn!