Differential Gene Expression in Cells w/ Identical DNA:

- Post-Transcriptional Control:
  - once an mRNA is made, a series of events must occur if the final product is going to affect the cell
  - each of these events offers an opportunity to regulate gene expression
  - the 3 major control points @ this stage are as follows
    - splicing mRNAs in various ways
    - altering the rate @ which translation is initiated
    - modifying the life span of mRNAs & proteins after translation has occurred
- Alternative Splicing of mRNAs: diff. combinations of exons are incorporated into the final mature RNA
  - spliceosome can include or exclude diff. types of exons
  - results in diff. proteins in diff. cell types
- How Translation is Controlled:
  - many miRNAs (micro RNAs) interfere directly w/ translation
  - in other cases, mechanisms that do not involve miRNAs are responsible for controlling the timing or rate of translation
  - for example: regulatory proteins may bind to mRNAs or ribosomes to regulate translation
  - in addition, in response to viral infection, the translation can be slowed or stopped by phosphorylation of a certain ribosomal protein
- Post-Translational Control:
  - mechanisms for post-translational regulation allow the cell to respond to new conditions rapidly by activating or inactivating existing proteins
  - regulatory mechanisms occurring late in the flow of info from DNA to RNA to protein involve a trade-off between speed & resource use
- We end up w/ the same DNA in all of our cells b/c of DNA replication (mitosis)
- in order for cells to divide, the DNA in the "mother" cell must be faithfully replicated in order to ensure both "daughter" cells have a full complement of chromosomes

- DNA Replication:
  - during replication the 2 parental strands separate
  - the bases are paired in the parental duplex either A-T or G-C
  - each parental strand serves as a template for the synthesis of a new daughter strand
- Proteins involved in DNA Replication:
  - topoisomerase II: relieves the stress of unwinding
  - helicase: enzyme that unwinds the DNA duplex
  - DNA polymerase: extends an RNA primer
  - single-stranded binding proteins: stabilize single strands of DNA