Chromosomes, DNA replication, and the Cell Cycle

I. Chromosome Structure
   a. Each human cell contains more than 1 meter of DNA. Which must be folded into a very small space
   b. Eukaryotic chromosomes contain both DNA and protein, tightly packed together which is called chromatin.
      i. The proteins that DNA is wrapped around are called histones.
   c. Histones and DNA form a bead-like structure called a nucleosome.
   d. Nucleosomes are tightly packed into structures called chromosomes.
   e. Right before cell division each chromosome is replicated, which results in two identical “sister” chromatids. One chromatid goes to each of the two new cells.

II. DNA replication (duplicating DNA)
   a. DNA strands are complementary- that is each strand can be used to make the other strand.
   b. Starts by the DNA molecule unzipping and the hydrogen bonds between base pairs breaking. DNA helicase binds and stimulates unwinding.
   c. DNA single-stranded binding proteins stabilize the single strand structure.
   d. The sites on DNA where separation and replication occur are called replication forks.
   e. Replication takes place in both directions until each chromosomes is completely copied. In a 5’→ 3’ direction.
   f. There are two replicating strands the leading strand and the lagging strand. The leading strand moves in a forward motion. The lagging strand move in a backwards motion.
      i. The lagging strand is made up of Okazaki fragments which replicate short pieces of DNA at a time.
   g. DNA polymerase the principal enzyme in DNA rep. joins individual nucleotides to produce a DNA molecule, which is a polymer. DNA polymerase also proofreads each new DNA strand.
   h. Primase is an enzyme that helps start DNA replication in an Okazaki fragment.
   i. DNA ligase removes the gaps that are in place due mainly to the use of primase in the lagging strand.

III. The Cell Cycle
   a. Consists of 4 stages:
      i. G\textsubscript{1} phase: gap phase where cell increase in size, make new proteins and some organelles.
      ii. S phase: chromosome replication or synthesis
      iii. G\textsubscript{2} phase: gap phase where the cell makes all the organelles, and molecules needed
      iv. M phase: mitosis (body cell division)