Lecture of October 17, 2018
Chapter 4: Proof of Grand Central Dogma; DNA, RNA, Proteins

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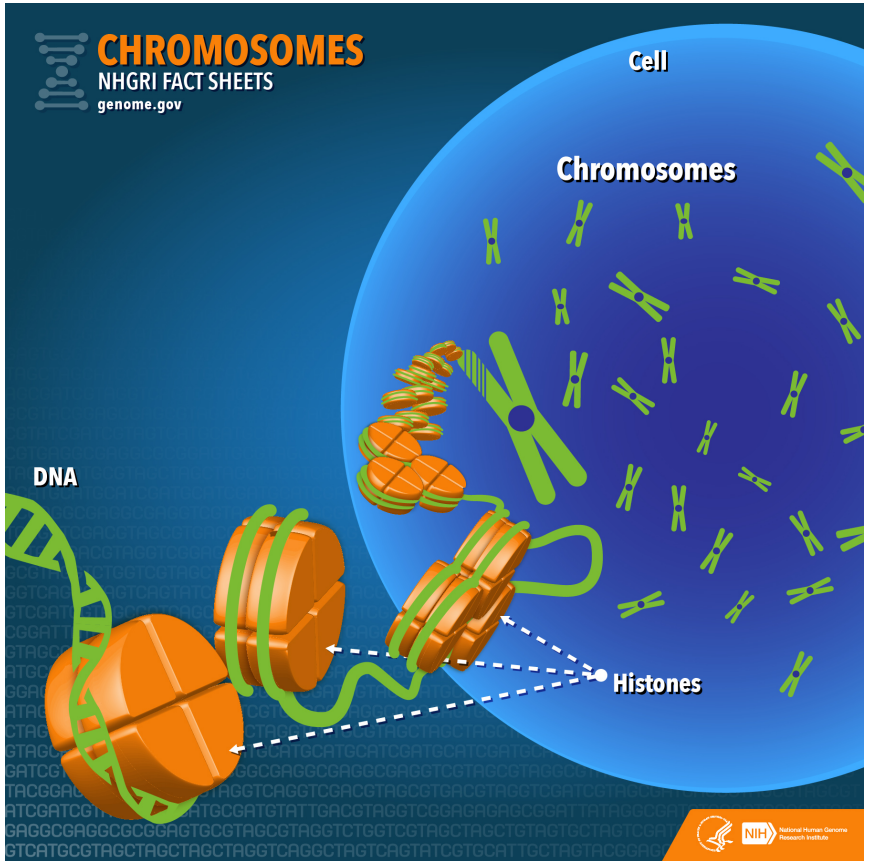
DNA and Chromosomes

SLIDE 2

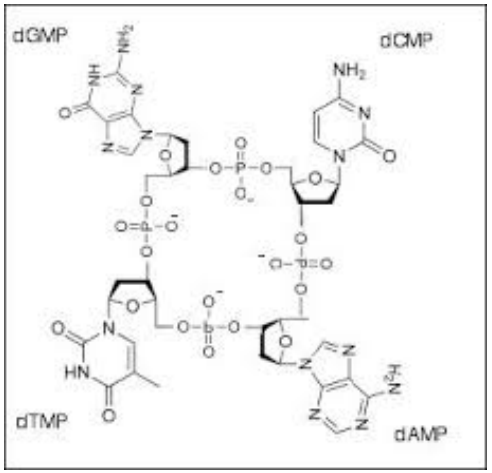
- In animal cells, DNA (code of life) is packed into multiple pairs of chromosomes.

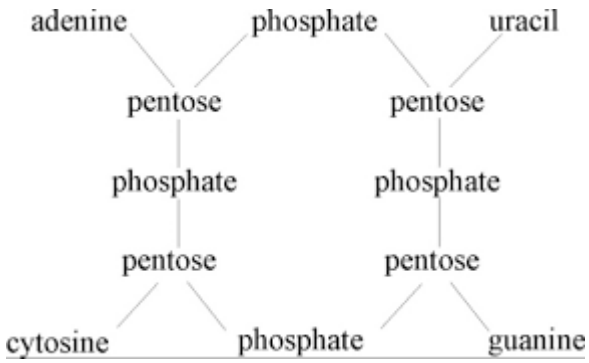


- A Chromosome is DNA molecule wrapped around proteins called histones.
- The human genome (genetic code) consists of 23 pairs of chromosomes packed into the nucleus of human cells

Section 4.3: Bacteriophages and Molecular Biology, Proof of Central Dogma

SLIDE 3





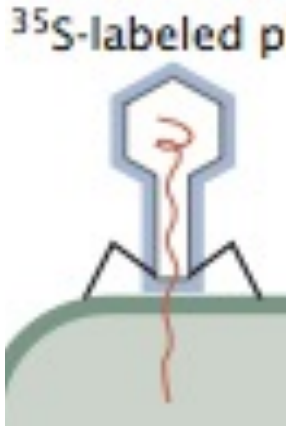
Tetranucleotide Hypothesis

- Proposed that DNA was made up of equal amount of A, G, C, T bases
- Code of life is written on the **proteins** part of **chromosomes**.

Section 4.3: Bacteriophages and Molecular Biology, Proof of Central Dogma

Proof that **code** of **life (genotype) encoded** in **DNA/RNA: Hershey-Chase experiment**

Phage Viruses multiply by inserting RNAs (their genetic materials) into a Bacteria, and using the bacteria's machineries to produce RNAs and proteins needed to replicate.



- Viruses are grown in media with **radioactive** phosphorous ^{32}P
- Only **RNAs** contain **Phosphorous**

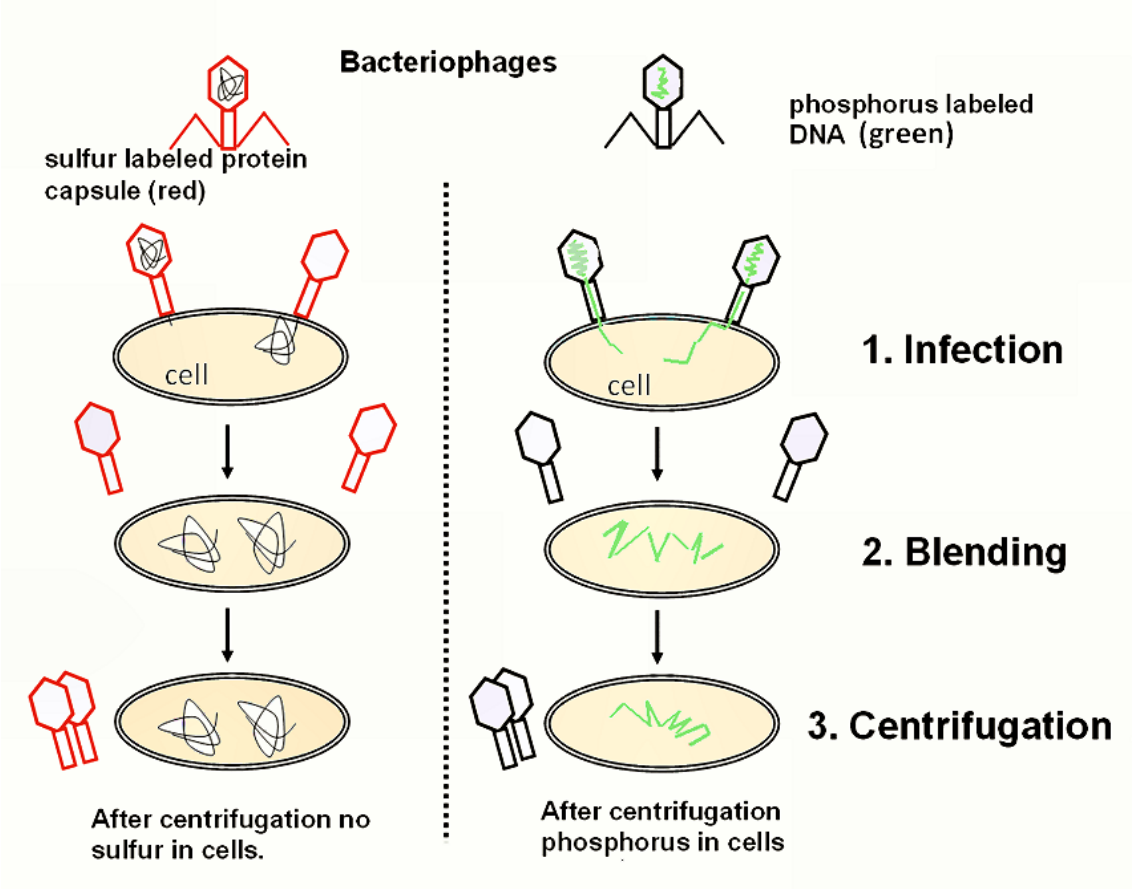
$$^{32}_{17}P \longrightarrow {}^{32}_{16}S + {}^{0}_{-1}e + \nu + 1.71\ \text{MeV}$$

- Viruses are grown in media with **radioactive sulfur** ^{35}S
- Only **proteins** contain Sulfur

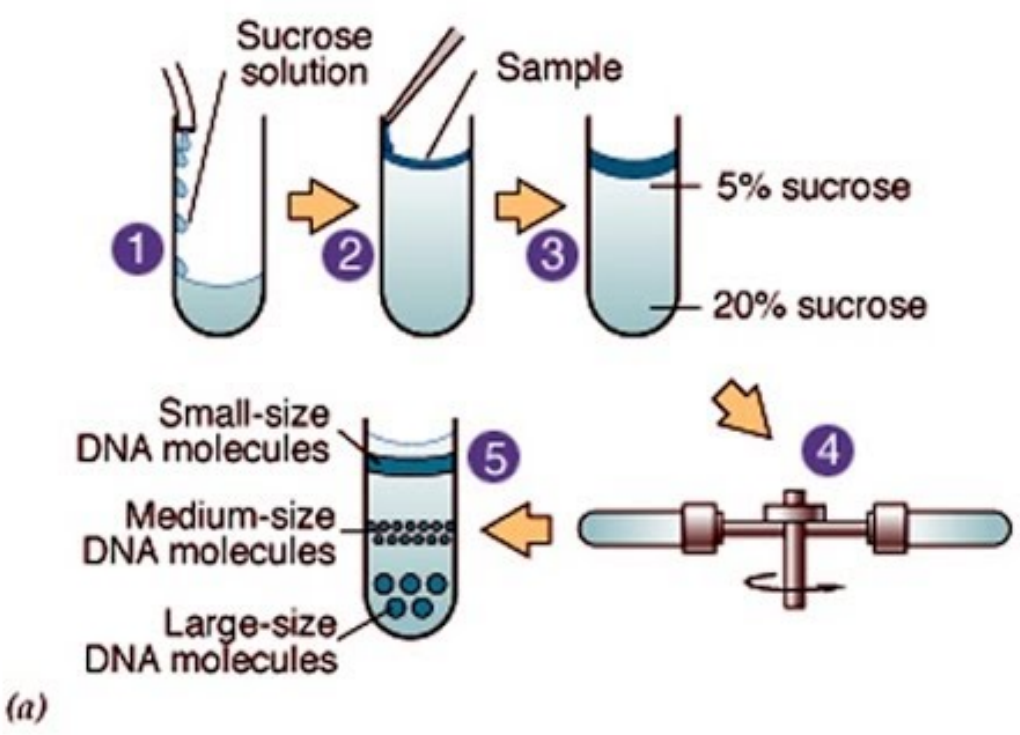
$$^{35}_{16}S \rightarrow {}^{0}_{-1}e + {}^{35}_{17}Cl + \bar{\nu}$$

Section 4.3: Bacteriophages and Molecular Biology, Proof of Central Dogma

Proof that **code** of **life (genotype) encoded** in **DNA/RNA: Hershey-Chase experiment**



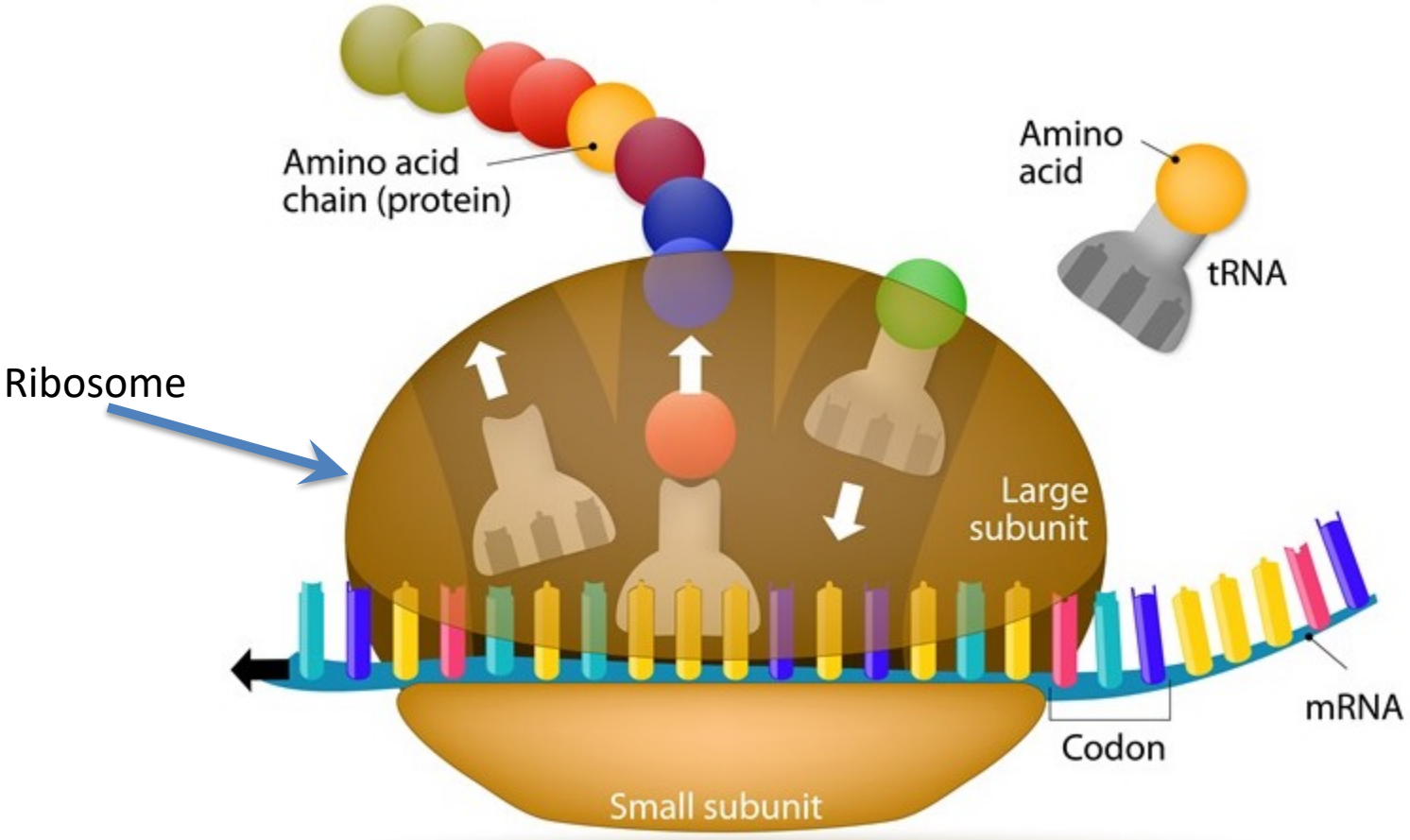
How do Centrifuges Work?



- A Centrifuge works by rotating at high speed, resulting in Large molecules moving to the bottom
- In the Hershey-Chase experiment, bacteria (E. Coli) are separated from virions (viruses) by centrifugation.

mRNA, Ribosomes, and Proteins

SLIDE 7



- A **codon** is a **sequence** of **three** DNA or RNA **nucleotides** (nt or bp) that corresponds with **one** specific **amino acid** or stop signal during protein synthesis.
- **One** mRNA has **average size** $\sim 1000\ nt$**,** which corresponds to an average protein size of $\sim 300\ amino\ acids\ (aa)$**.**

mRNA, Ribosomes, and Proteins

- Messenger RNA, aka mRNA are intermediate between proteins and DNA: **SLIDE 8**
- http://www.discoveryandinnovation.com/BIOL202/notes/lecture13.html

mRNA, Ribosomes, and Proteins

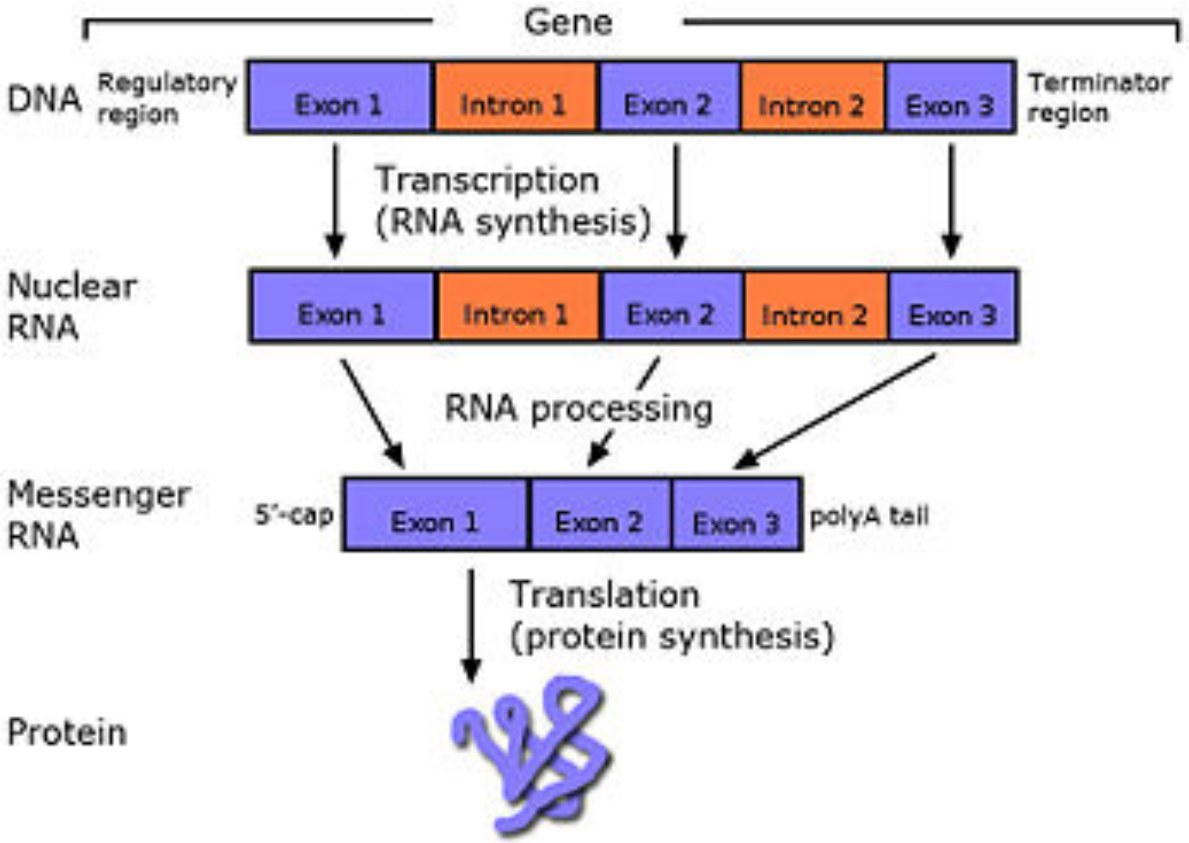
SLIDE 9

Experiment of Sydney Brenner, Francois Jacob, Mathew Meselson (1961)

- E. Coli grown in **heavy** (^{13}C, ^{15}N) radioactive environment, then infected with radioactive (^{32}P) Phage Viruses: all ribosomes; mRNA, and proteins are heavy. Viruses kill all bacteria.
- System transferred to **light** medium (^{13}C, ^{15}N, ^{31}P)
- In **light** medium, new light RNA and proteins are associated with viruses. **All ribosomes** are **heavy** – associated with dead **bacteria**.
- In the words or Francis Crick: “one gene, one ribosome, one protein”.

Introns and Exons

SLIDE 10



- As mentions a gene is a region of DNA associated with a protein (enzyme).
- Exons are coding regions of the gene, that are joined to form mRNA
- Introns are not coding regions that are spliced.

Spliced Introns

SLIDE 11

Figure 4.28: Experiment by Chambon to demonstrate the existence of introns. Unspliced DNA is hybridized to spliced mRNA. The loops correspond to regions of the DNA that have been removed in the mRNA. (Adapted from P. Chambon, *Sci. Am.* 244(5):60, 1981.)