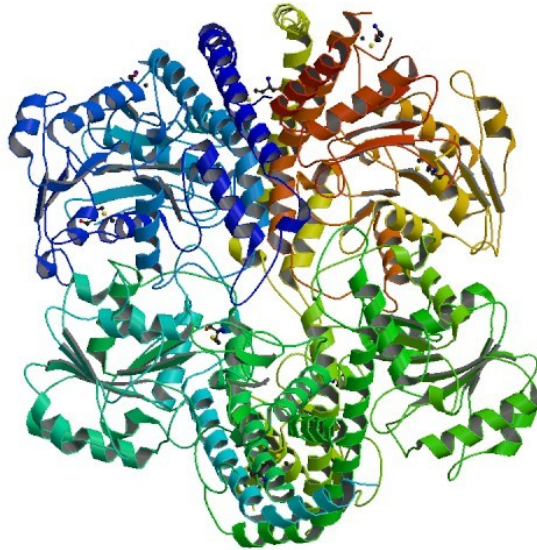


# Eric Pitman Summer Workshop in Computational Science

## Introduction to Proteins



Amanda Ruby

# What is a protein?

## **The molecules that “do”**

- Present in every organism
- Perform almost every molecular function
- Are also building blocks in the structures of cells

# Central Dogma

## DNA

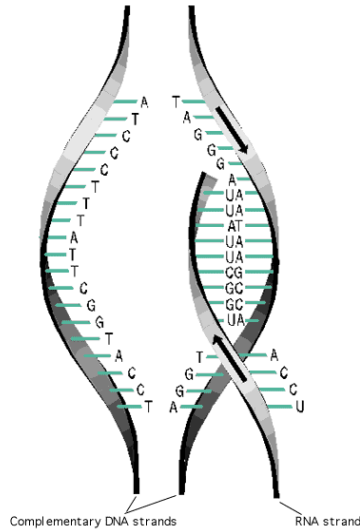


Transcription

## mRNA

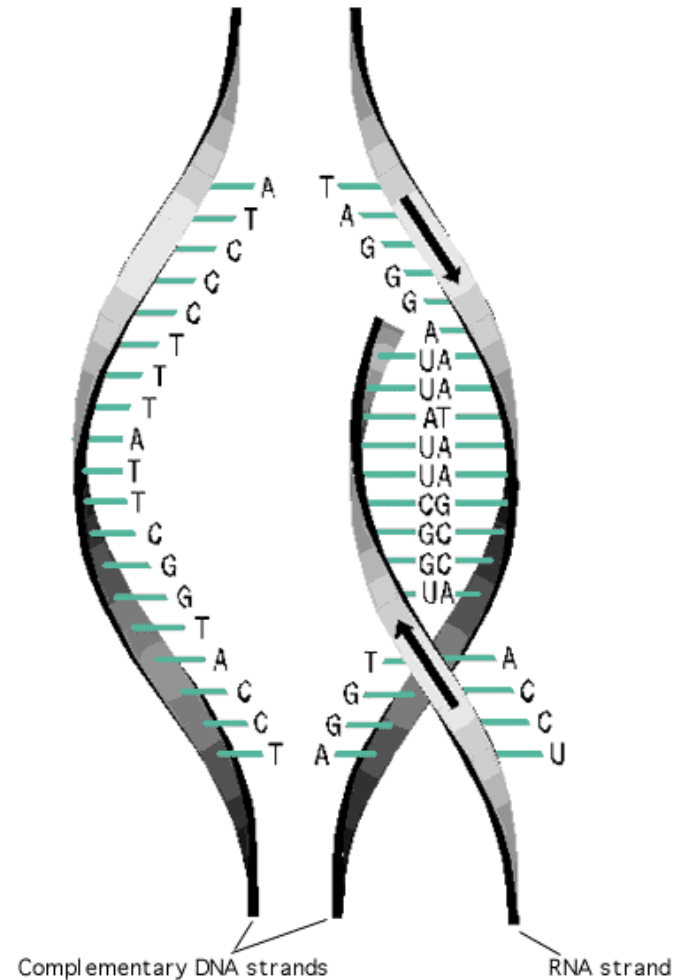
Translation

## Protein

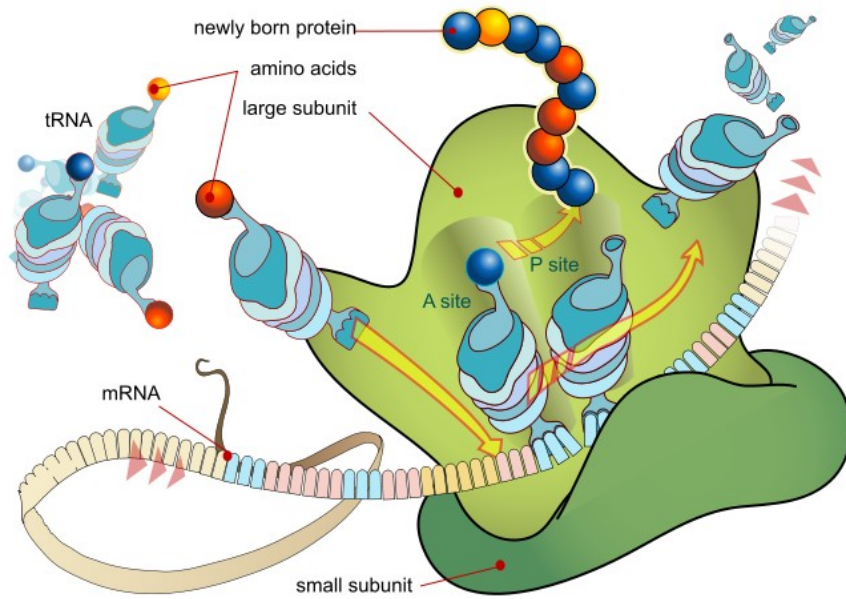


# Transcription

- The double helix of DNA is “unzipped”
- Enzymes come in and synthesize a strand of **mRNA**, using the DNA as a template (RNA is a string of nucleotides with slight chemical differences from DNA)



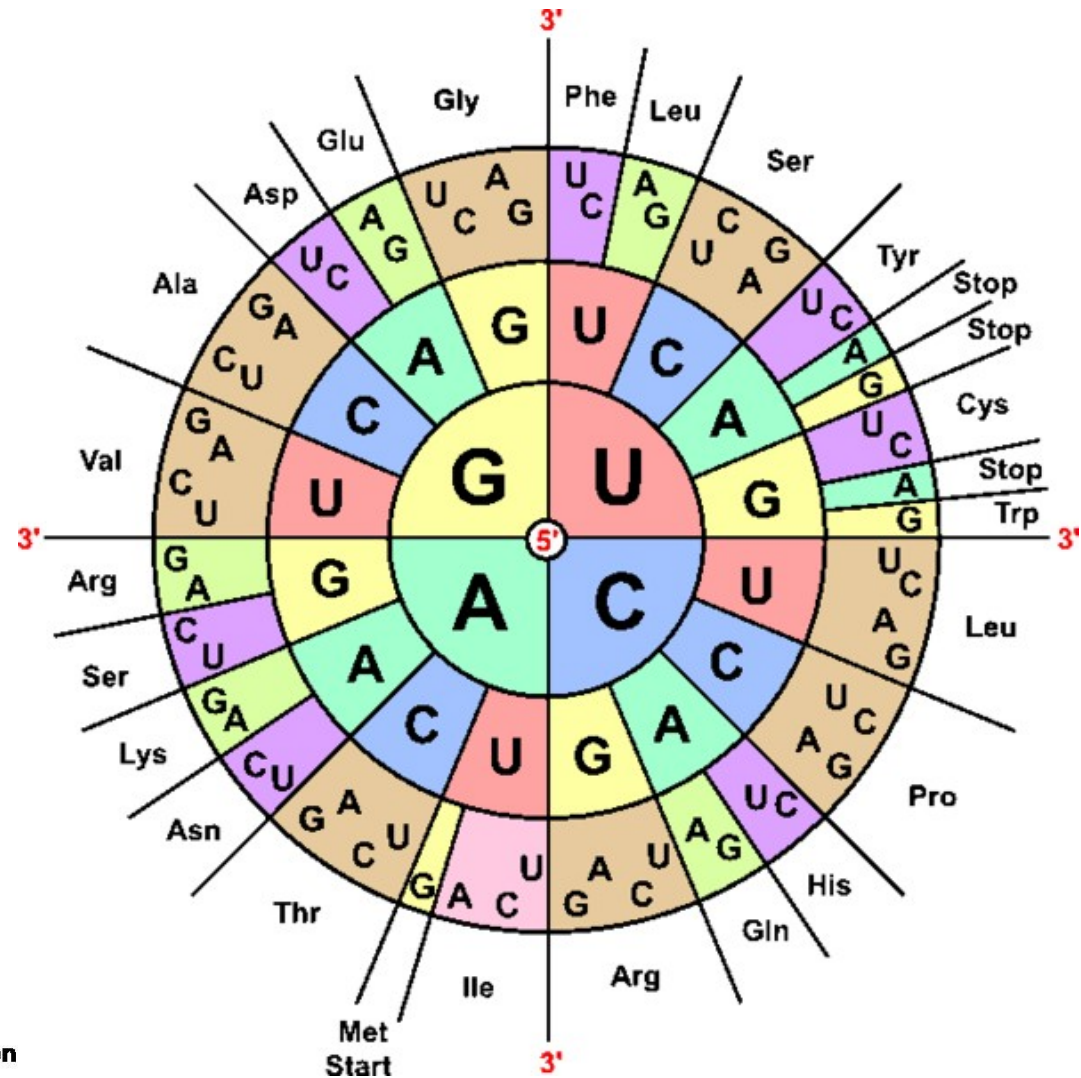
# Translation



- mRNA is used as a template
- Ribosomes and other molecules construct a protein

# Codons

- mRNA is translated in “chunks” of three, called **codons**
- The starting nucleotide is determined using bioinformatics to find the **reading frame**
- The genetic code is **degenerate**



5' AUG CAA CCC GAC UCC AGC 3'

3' UAC GUU GGG CUG AGG UAG 5'

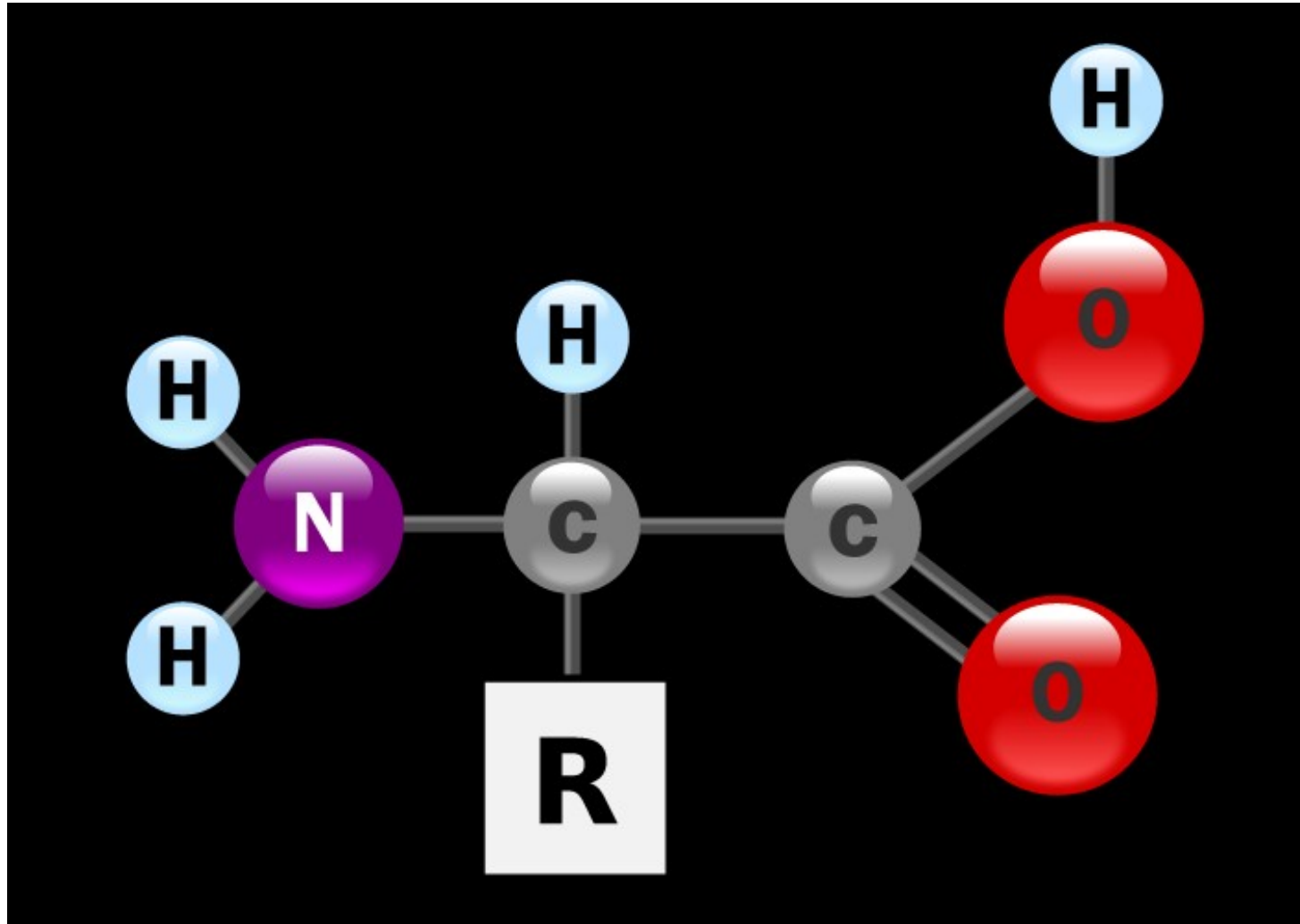
Met-Gln-Pro-Asp-Phe-Ser

← Codon

← AntiCodon

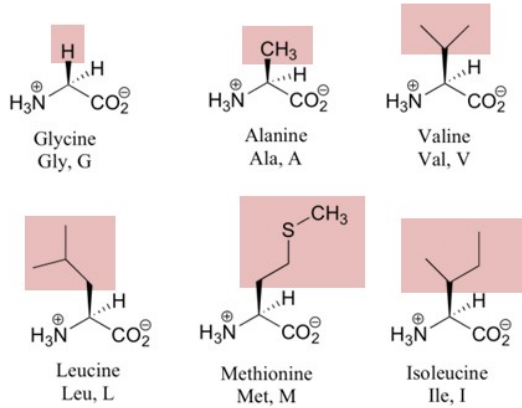
← Amino Acids

# An Amino Acid

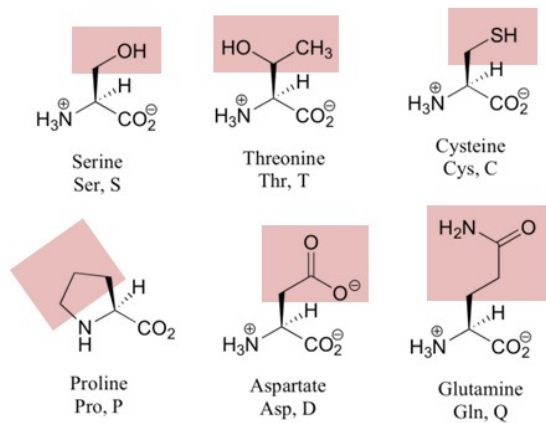


# The Amino Acids

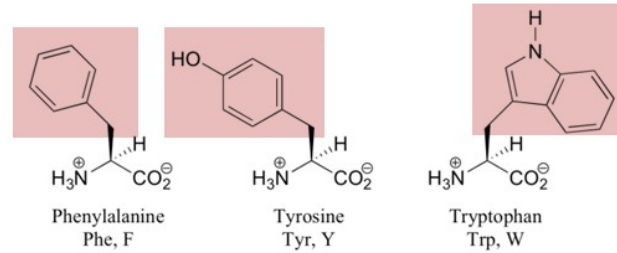
## Nonpolar, aliphatic side groups



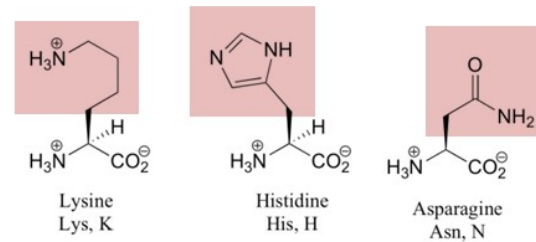
## Polar, uncharged side groups



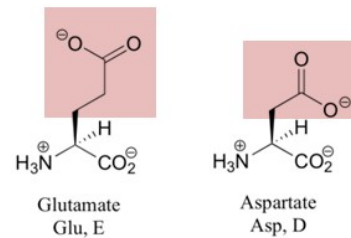
## Aromatic side groups



## Positively charged side groups



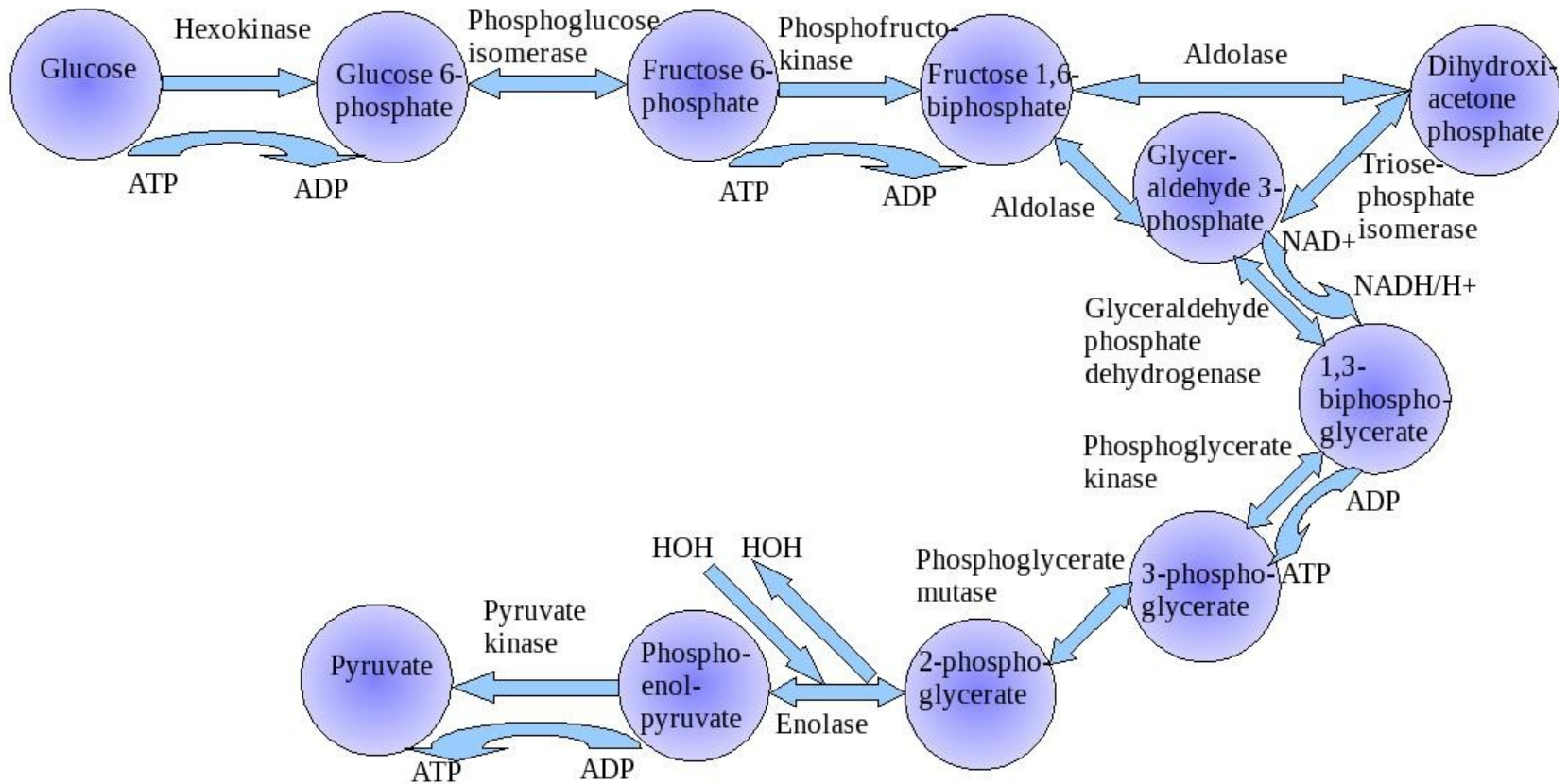
## Negatively charged side groups



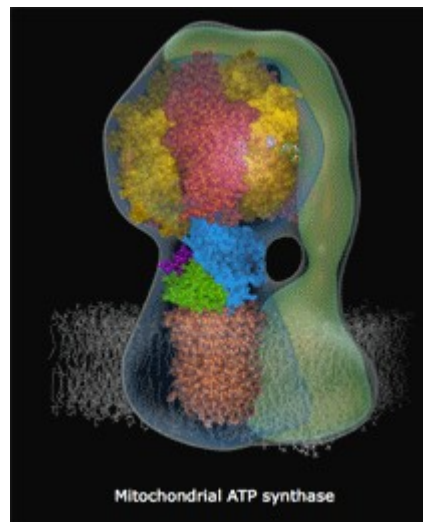
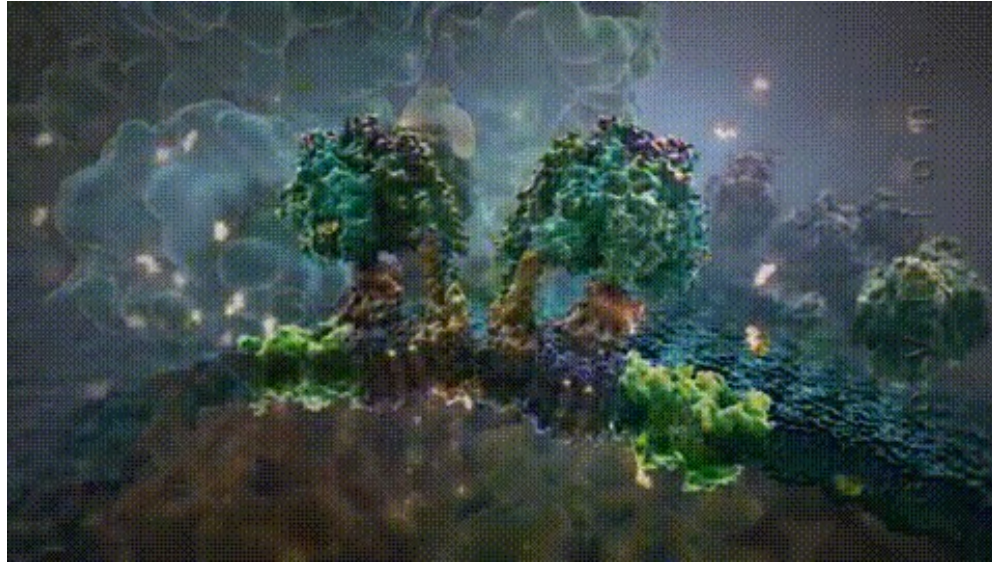


**What Do Proteins Do?**

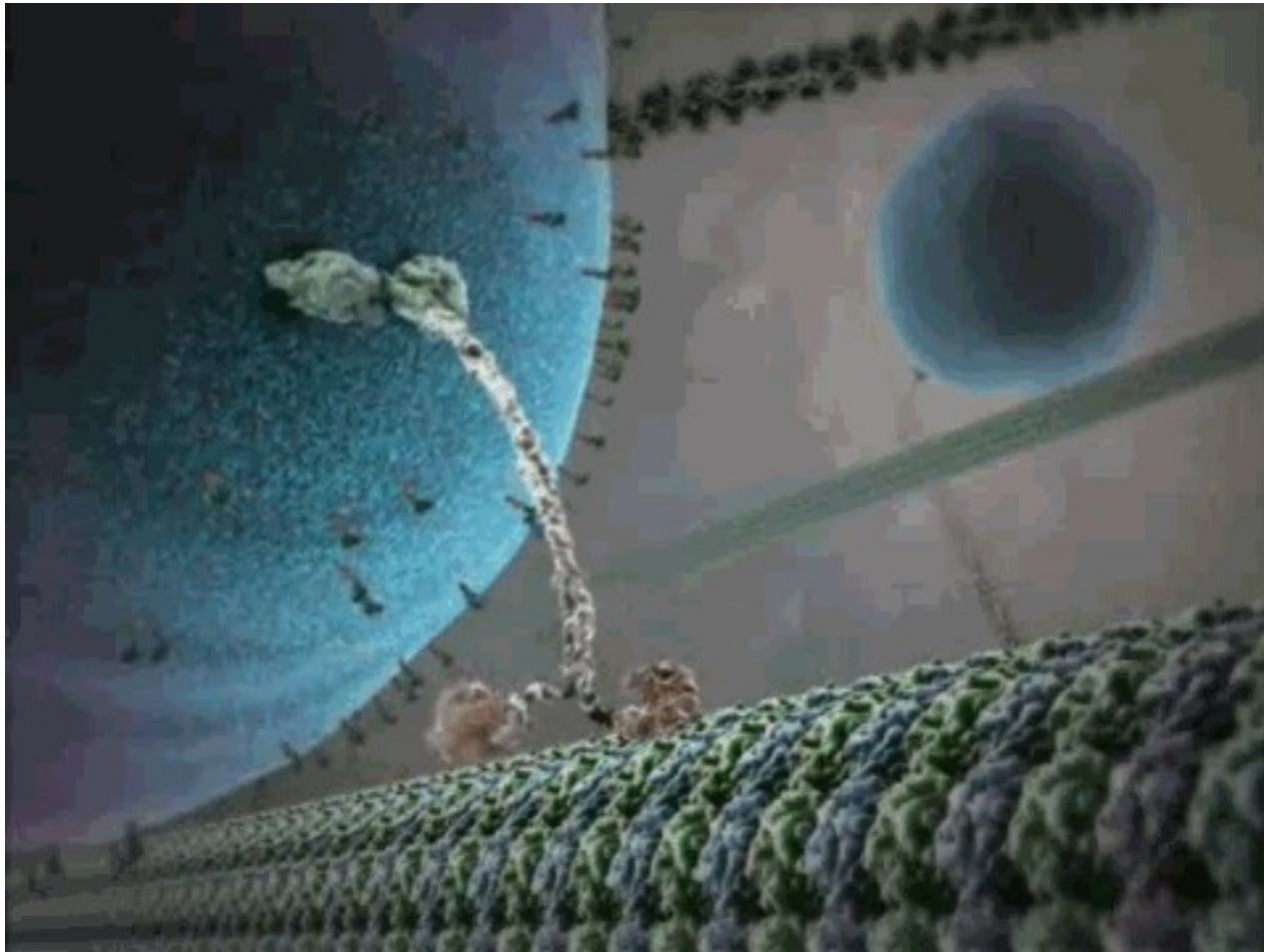
# Glycolysis



# ATP Synthase



# Kinesin



# Picture Credits

- DNA, slide 3:  
[http://www.ucdavis.edu/one/local\\_resources/images/stories/kind/dna\\_sculpture.jpg](http://www.ucdavis.edu/one/local_resources/images/stories/kind/dna_sculpture.jpg)
- RNA, slide 3: [http://biology.unm.edu/ccouncil/Biology\\_124/Images/transcription.gif](http://biology.unm.edu/ccouncil/Biology_124/Images/transcription.gif)
- Protein, slide 3:  
[http://www.miketyka.com/wp-content/uploads/2012/05/DSC\\_6499\\_sm-655x1024.jpg](http://www.miketyka.com/wp-content/uploads/2012/05/DSC_6499_sm-655x1024.jpg)
- Translation, slide 5:  
[http://upload.wikimedia.org/wikipedia/commons/thumb/b/b1/Ribosome\\_mRNA\\_translation\\_en.](http://upload.wikimedia.org/wikipedia/commons/thumb/b/b1/Ribosome_mRNA_translation_en.)
- Codons, slide 6: <http://biochemhelp.com/images/codon-anticodon.jpg>
- Translation chart, slide 6:  
[http://upload.wikimedia.org/wikipedia/commons/thumb/3/31/Codons\\_aminoacids\\_table.png/59](http://upload.wikimedia.org/wikipedia/commons/thumb/3/31/Codons_aminoacids_table.png/59)
- Amino acid, slide 7:  
<http://upload.wikimedia.org/wikipedia/commons/c/ce/AminoAcidball.svg>
- Amino acids, slide 8:  
<http://amit1b.files.wordpress.com/2012/09/20-amino-acids1.png>
- Glycolysis, slide 10:  
<http://upload.wikimedia.org/wikipedia/commons/e/e1/Glycolysis.jpg>

# Picture Credits

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**RNA, slide 3:** [http://biology.unm.edu/ccouncil/Biology\\_124/Images/transcription.gif](http://biology.unm.edu/ccouncil/Biology_124/Images/transcription.gif)

**Protein, slide 3:** [http://www.miketyka.com/wp-content/uploads/2012/05/DSC\\_6499\\_sm-655x1024.jpg](http://www.miketyka.com/wp-content/uploads/2012/05/DSC_6499_sm-655x1024.jpg)

**Translation, slide 5:**

[http://upload.wikimedia.org/wikipedia/commons/thumb/b/b1/Ribosome\\_mRNA\\_translation\\_en.svg/651px-Ribosome\\_mRNA\\_translation\\_en.svg.png](http://upload.wikimedia.org/wikipedia/commons/thumb/b/b1/Ribosome_mRNA_translation_en.svg/651px-Ribosome_mRNA_translation_en.svg.png)

**Codons, slide 6:** <http://biochemhelp.com/images/codon-anticodon.jpg>

**Translation chart, slide 6:**

[http://upload.wikimedia.org/wikipedia/commons/thumb/3/31/Codons\\_aminoacids\\_table.png/596px-Codons\\_aminoacids\\_table.png](http://upload.wikimedia.org/wikipedia/commons/thumb/3/31/Codons_aminoacids_table.png/596px-Codons_aminoacids_table.png)

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**Amino acids, slide 8:** <http://amit1b.files.wordpress.com/2012/09/20-amino-acids1.png>

**Glycolysis, slide 10:**

<http://upload.wikimedia.org/wikipedia/commons/e/e1/Glycolysis.jpg>