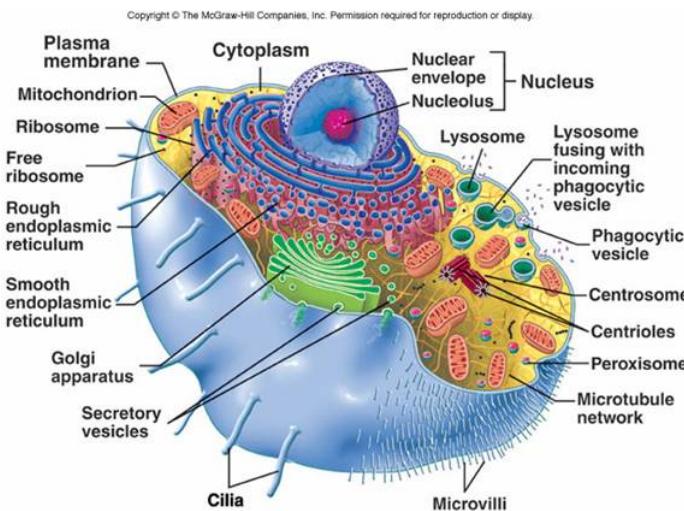


# 1 Central Dogma of Biology

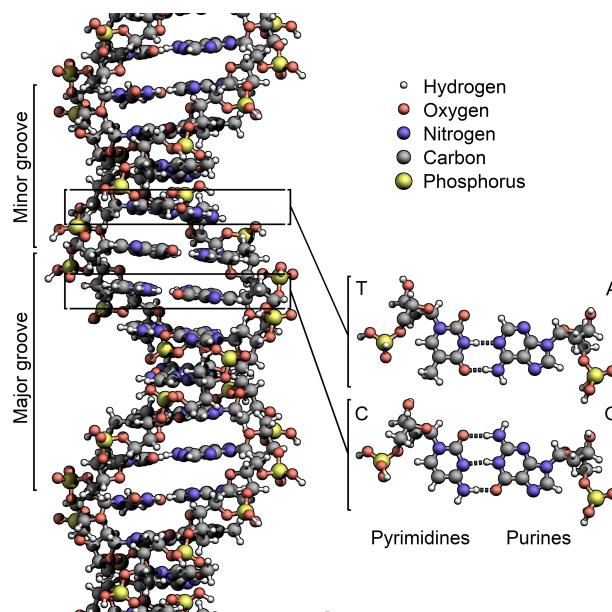
## 1 Definition (The Cell)



## 5 Definition (Amino Acids)

Ala	Arg	Asn	Asp	Cys	Glu	Gln	Gly	His	Ile
A	R	N	D	C	E	Q	G	H	I
Leu	Lys	Met	Phe	Pro	Ser	Thr	Trp	Tyr	Val
L	K	M	F	P	S	T	W	Y	V

## 6 Definition (DNA Molecule)



## 2 Definition (The Cell)

- single cell organisms
- multi cell organisms

## 3 Definition (The Cell)

- prokaryotes
- eukaryotes

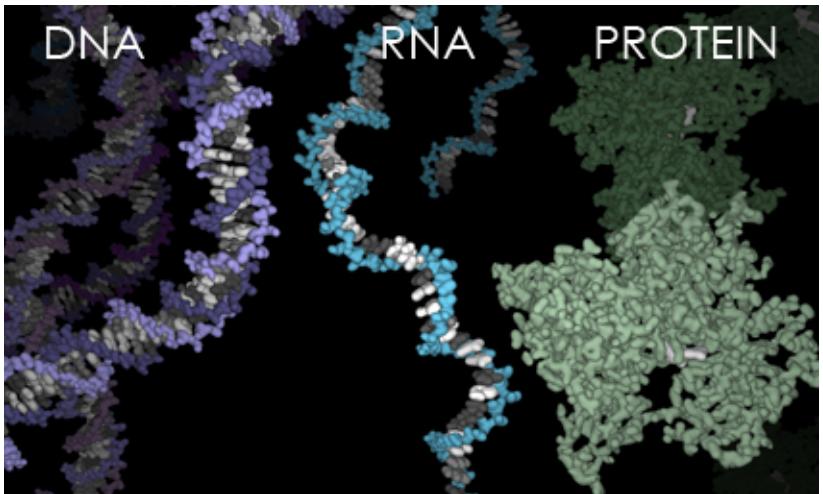
## 4 Definition (Nucleic Acids)

- DNA: A T G C
- RNA: A U G C

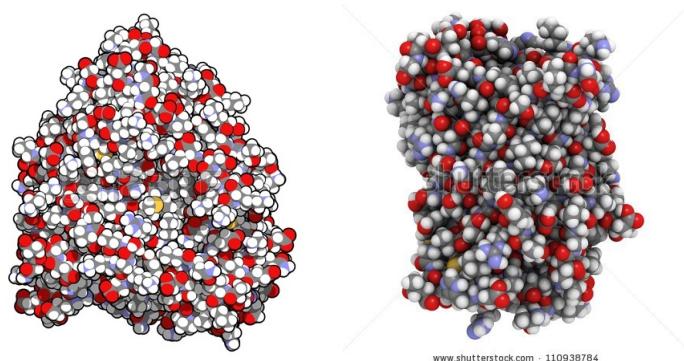
7 Definition (tRNA Molecule)



9 Definition (DNA vs RNA vs Protein Molecule)



8 Definition (Protein Molecules)



1 Lesson (Molecules of Life)

Discuss how the four types of molecules, DNA, mRNA, tRNA and proteins are:

(a) similar.

(b) different.

2 Lesson (Genetic Code)

How can the 20 different amino acids of protein sequences be coded using only the four different nucleic acids of DNA?

## 10 Definition (Genetic Code)

Genetic Code				
First Position	Second Position			
	C	A	G	
T	TTT Phe TTC Phe TTA Leu TTG Leu	TCT Ser TCC Ser TCA Ser TCG Ser	TAT Tyr TAC Tyr TAA Stop TAG Stop	TGT Cys TGC Cys TGA Stop TGG Trp
C	CTT Leu CTC Leu CTA Leu CTG Leu	CCT Pro CCC Pro CCA Pro CCG Pro	CAT His CAC His CAA Gln CAG Gln	CGT Arg CGC Arg CGA Arg CGG Arg
A	ATT Ile ATC Ile ATA Ile ATG Met	ACT Thr ACC Thr ACA Thr ACG Thr	AAT Asn AAC Asn AAA Lys AAG Lys	AGT Ser AGC Ser AGA Arg AGG Arg
G	GTT Val GTC Val GTA Val GTG Val	GCT Ala GCC Ala GCA Ala GCG Ala	GAT Asp GAC Asp GAA Glu GAG Glu	GGT Gly GGC Gly GGA Gly GGG Gly

## 11 Definition (Genes)

Genes are segments of DNA that are transcribed and translated into a protein sequence. Splicing may be required.

- codon: group of three nucleic acids that code for a single amino acid.
- introns: portions of a gene that are removed before translation.
- exons: portions of a gene that are spliced before translation.

## 3 Lesson (cDNA)

What is cDNA?

## 4 Lesson (DNA Transcription and Translation)

The following cDNA sequence contains the beginning of the gene that codes for the human insulin protein.

TGCCTGTCTCCCAGATCACT  
GTCCTTCTGCCATGGCCCTG  
TGGATGCGCTCCTGGCCC

(a) Determine the sequence of cDNA that codes for the first nine letters of the insulin protein sequence.

*Solution:*

(b) Determine the sequence of mRNA that codes for the first nine letters of the insulin protein sequence.

*Solution:*

(c) Determine the first nine letters of the insulin protein sequence.

*Solution:*

(d) Use the Uniprot database to check your answer to part (c) by looking up the protein sequence for the human insulin protein.

*Solution:*

## 5 Lesson (Transcription and Translation)

Use the link below to look at an animation of the transcription and translation of DNA and discuss what you see.

<http://www.dnalc.org/resources/3d/central-dogma.html>

Because it takes three letters of a DNA sequence to translate to a single letter of a protein sequence, where we start the translation in the DNA sequence has a big effect on the resulting protein sequence. In other words, we have to choose the correct **reading frame** before we attempt to translate a DNA sequence into a protein sequence. Reading frames which start with the start codon ATG are called **open reading frames**.

## 6 Lesson (Jemboss (Translation))

Install the free bioinformatics software package **Jemboss** and use it to check your answers to Lesson 4 part (c). Use the commands

NUCLEIC, TRANSLATION, transeq

7 Lesson (Jemboss (Open Reading Frames))

(a) Determine three of the six possible translations of the following segment of DNA.

T A T A G G G A C T C A

(b) Check your answer with Jemboss. Use the commands NUCLEIC, TRANSLATION, sixpack

*Solution:*

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