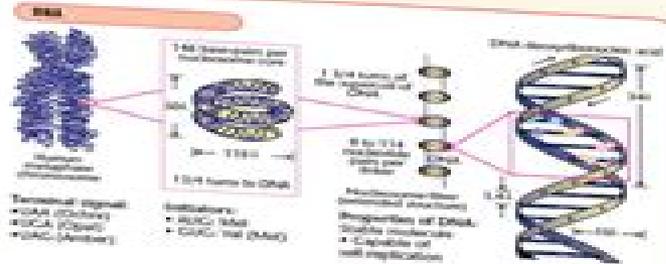


# College Genetics

## GENETIC BASICS

- Genetics is concerned with heredity and variation
- all living things are products of both nature and nurture; the heredity unit (gene) provides an organism with its nature (that is, biological potential and limitations), while environment provides nurture components
- Interaction of nature and nurture provides organisms with distinct anatomical, physiological, biochemical, and behavioral characteristics
- Genes reside in a long molecule called deoxyribonucleic acid (DNA); along with histones, DNA forms nucleosomes that organize into structures with distinctive staining properties called chromosomes found in cell's nucleus
- Carry (C) lines used to express activity of radioactive substance
  - 1 Ci = 1000 mCi =  $3.7 \times 10^{10}$  disintegrations/second
  - 1 becquerel = 1 disintegration/second =  $2.7 \times 10^{-11}$  mCi
  - 1 mCi =  $3.7 \times 10^7$  becquerels



## GENETIC CODE

First Letter	Second Letter					
	G	C	A	G	C	A
G	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG
	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG
	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG	GUU GUC GUA GUG
A	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG
	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG
	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG	AUU AUC AUA AUG
C	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG
	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG
	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG	CUU CUC CUA CUG

## UNITS OF MASS

- Molecular weight (mw) is measured in daltons; 1 dalton = mass of hydrogen molecule =  $1.67 \times 10^{-24}$  g
- Average molecular weight of 1 nucleotide pair = 66 daltons
- DNA units = kilobase (kb) =  $1 \times 10^3$  bases
- 1.9 kb DNA = coding capacity for 333 amino acids = 37,000 dalton proteins
- 10,000 dalton proteins = 275 base pair (bp) DNA
- 30,000 dalton proteins = 1.35 kilobase (kb) DNA
- MW of a double-stranded DNA molecule = number of base pairs × (660-dalton/ base pair)
- Mass of a double-stranded DNA molecule =  $2 \times$  (grams of DNA)/(MW dalton)

## NUCLEIC ACID DATA

- 1 μg of 1000 bp DNA = 1.52 pmol =  $9.1 \times 10^{11}$  molecules
- 1 μg of 66132 DNA (4941 bp) = 0.33 pmol =  $2.1 \times 10^{11}$  molecules
- 1 mg of λ DNA (48502 bp) = 0.85 pmol =  $5.8 \times 10^{11}$  molecules
- 1 pmol of 1000 bp DNA = 0.66 μg
- 1 pmol of 66132 DNA (4941 bp) = 2.88 μg
- 1 pmol of λ DNA (48502 bp) = 32.00 μg

**Notes:** There are  $3 \times 10^9$  bp in human genome = 33% of human genome is repetitive DNA sequence; 40% is unique human chromosome number (diploid) is 46 (23 pairs)

## ISOTOPE DATA

Isotope	Particle emitted	Half-life
<sup>14</sup> C	β	5.73 years
<sup>32</sup> P	β	14.3 days
<sup>35</sup> S	γ	87 days
<sup>32</sup> P	β	14.3 days
<sup>3</sup> H	β	12.5 years

## ORGANISM

Earth	Cell
Continent	Cell nucleus
State	Chromosomes
City	Chromosomal DNA
Address	Gene segment

## MEASURING DISTANCE

- Genetic distances are expressed in either kb, mb, or cM (centimorgan)
- 1 cM equals one megabase (Mb) of DNA
- 1 cM that is 1 cM apart shows 1% recombination
- Lengths:
  - 1 angstrom (Å) = diameter of H nucleus = 0.3 nm
  - 1 micrometer (μm) = 10 Å =  $10^{-5}$  mm
  - 1 micron/ micrometer (mm) =  $10^{-3}$  mm
  - 1 mm = 1000 μm

## POPULATION GENETICS (HARDY-WEINBERG LAW)

- The population is infinitely large and mates at random
- No selection is operative; therefore, there is no differential mortality nor differential reproduction
- The population is closed; no immigration or emigration
- 50% matings from one allele state to another; evolution is neutral so chance is only factor operative in gametogenesis

**Equilibrium Diploids:**  
Frequencies of dominant allele A and recessive allele a among 100 and sperm are p and q ( $p + q = 1$ )

# Genetics Study Guide College

**Kathleen Armour**



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