

Preview material for Exam 3 Fall 2004

Students have found the following chart useful:

mRNA-Codon-to-Amino-Acid Decoder Chart									
1 st Letter		2 nd Letter						3 rd Letter	
U	C	A	G	U	C	A	G	U	C
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC		UCC		UAC		UGC		C
	UUA	Leucine	UCA		UAA	STOP	UGA	STOP	A
	UUG		UCG		UAG		UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC		CCC		CAC		CGC		C
	CUA		CCA		CAA	Glutamine	CGA		A
	CUG		CCG		CAG		CGG		G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC		ACC		AAC		AGC		C
	AUA		ACA		AAA	Lysine	AGA	A	
	AUG	Methionine; START	ACG		AAG		AGG	G	
G	GUU	Valine	GCU	Alanine	GAU	Aspartate	GGU	Glycine	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	Glutamate	GGA		A
	GUG		GCG		GAG		GGG		G

Many students have also found some of the following formulas useful:

$$r=b-d$$

$$G=rN$$

$$G = rN(K-N)/K$$

$$E = mC^2C = 2IIr$$

$$y = mx+b$$

Streptococcus pyogenes is a bacterium that produces enzymes and toxins that enable the bacterium to invade host tissues and spread within the host. Strains of *S. pyogenes* are capable of producing a variety of toxins and thus individuals infected with *S. pyogenes* exhibit one or more of a variety of illnesses ranging from a sore throat, inner ear infections, impetigo, scarlet fever, to endocarditis (inflammation of the heart lining). In the 19th century *S. pyogenes* infections were a major cause of illness, but the incidence (frequency) of invasive streptococcal disease declined during the early part of the 20th century. However, during the late 20th century, there was a worldwide increase in *S. pyogenes* infections. Along with this increase, new disease syndromes associated with *S. pyogenes*, such as large-scale tissue destruction and toxic shock-like syndromes, emerged. Because the infection spreads so rapidly through the muscle and associated tissues and the tissue damage is so extensive, surgical removal of damaged tissue is usually needed. Routinely (commonly) used antibiotics are not always effective in treating the infection. In the U.S., 15,000 cases occur annually, and 40% of them are fatal.

Peanut is a 7-month old Canada Goose. The egg he hatched from was found abandoned at Boomer Lake. During the time birds are in the egg, they cannot thermoregulate, so a very helpful female chicken brooded (sat on) the egg until it hatched. The fertilized egg cell (zygote) that Peanut developed from contained a total of 12 chromosomes. Prior to hatching, Peanut was kept warm by the body heat of the hen that brooded the egg. A few times a day the hen left the nest and went out to eat and drink, and Peanut's egg cooled.

Three babies were born during a power outage at a major medical facility. The parents only saw them briefly in dim light and during the confusion no ID bracelets were placed on the babies. After the lights came on, some quick blood type tests were done as well as a mandatory screening for PKU. Also, one baby was abandoned by its mother. PKU is an autosomal recessive disorder.

Parent	Blood Type	PKU
Couple 1		
Zack	B	No - heterozygous
Zelda	O	No - heterozygous
Couple 2		
Buster	O	Yes
Brenda	O	No - homozygous

Child	Blood Type	PKU
Baby W	O	NO - heterozygous
Baby X	B	YES
Baby Y	AB	NO - heterozygous

Pyrethrin is a toxin produced by an African perennial plant in the genus *Chrysanthemum*. It is a strong poison that keeps the sodium (Na⁺) channels open and thus makes an effective insecticide. Pyrethrin is absorbed across the body surface of the insect by simple diffusion.

Myasthenia gravis is a neurological disorder that is typically caused by the immune system attacking acetylcholine receptors, but other types have been documented. Congenital myasthenic syndrome or CMS can result from genetic abnormalities that result in abnormalities at neuromuscular synapses. While there are many forms of CMS, one form called "slow channel syndrome" is an **autosomal dominant** trait that affects one of the 4 proteins that make up the acetylcholine receptor. One of these proteins is called the E protein and the gene for this protein is found on chromosome 17.

[Ohno et al. \(1997\)](#) studied a patient with congenital myasthenic (slow channel) syndrome associated with malfunctioning acetylcholine receptors. They found a mutation in the gene for the "E" protein (a part of the receptor) that was caused by the conversion of an arginine codon to a stop codon at position 64.



Our first President, George Washington, contracted smallpox in his youth during an epidemic yet survived, the only evidence being facial scarring from pockmarks (conveniently omitted by later portrait painters). During a smallpox epidemic in Philadelphia during 1789, Washington stayed in the city and did not contract smallpox despite contact with many smallpox victims. Smallpox is now recognized as being caused by spread of the large poxvirus from person to person.

An exotic breed of goldfish has been introduced into Theta Pond by a zoology professor who studies population biology. This species of goldfish reproduces rapidly but is prey for many birds and is susceptible to diseases that cause mortality in the fish population. After the first 100 goldfish are released into the pond their population change can be summarized as follows:

End of year	# living goldfish
1	220
2	484
3	1065
4	1060
5	1066

In the summer following year # 5 a terrible drought hits Oklahoma, decreasing the level of the pond and raising salinity (salt concentration) in the pond. 70% of the goldfish soon die from the high salt concentration.

Another researcher is monitoring a deer mouse population in a 20-acre field. She made the following observations: At the end of the 2nd year there were 200 mice present in the field and she calculated growth rate (r) = 0.2 mouse/mouse/year.

George and Mimi usually plant 200 acres of their farm in corn. George knows he can buy seed for Big Yield, a strain of corn that is predicted to produce many more bushels of corn per acre than any strain they have planted before. He proposes that they buy enough Big Yield seed to plant all 500 acres of their farm with this high producing variety. Mimi heard a speaker from Corn U, the nearby agricultural college, report that a blight (an infectious disease caused by a fungus) from Poland has been found infecting corn in farms near theirs. She proposes that they plant Big Yield in 50 acres and three other corn varieties in three 50-acre plots of the 200 acres they usually plant in corn.