

BIOL 1114 Exam #3 (PREVIEW) April 14, 2014

Use a #2 pencil to fill in the information on your NCS answer sheet. Put your **O-Key Account Username** in the boxes indicated for **LAST NAME** and darken the appropriate circles. **Write your Name (Last, First)** and **“Star” or “NoStar”** in the space above the boxes containing your **O-Key Account Username**. Darken the **(S or N)** in the last column of the name circles. Enter the number **1413** and **darken the corresponding circles** in the **first 4 columns** of the **“Student ID.”** Failure to perform this correctly will incur a **-10pt handling fee**. Read all questions and answers *carefully* before choosing the **single BEST response** for each question. Feel free to ask the instructor for clarification.

mRNA-Codon-to-Amino-Acid Decoder Chart									
		2 nd Letter							
1 st Letter	U		C		A		G		3 rd Letter
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	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	AGA	A		
	AUG	Methionine; START	ACG		AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartate	GGU	Glycine	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	GGG	A		
	GUG		GCG		GAG	GGG	G		

important equations:	$r = b - d$	$G = r N$	$G = r N [(K - N) / K]$
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In 1986, a nuclear power plant in the town of Chernobyl, Ukraine malfunctioned and caused an explosion releasing lethal levels of radiation. The government ordered an immediate evacuation of all the power plant workers and citizens living in the town. They also named the center most 1,000 square miles the “zone of alienation.” Before the explosion, most of the area was agricultural fields, and the lack of forested habitat did not support large populations of wildlife. Humans often killed wild animals in order to protect their livestock. After the initial deaths of wildlife from the explosion, few individuals survived but were noticed to have increases in population sizes in the 1990’s which continue to grow even today. The wildlife still have high internal radiation levels in their bones and tissues, but remarkably these animals appear to be normal with few exceptions. There are growing populations of trees, small mammals like mice and rabbits and of larger mammals like beavers, deer, and wolves.

After the initial explosion, there were only 5 wolves that survived. After the explosion, the wolf population was closely monitored, and 22 wolves were counted in 1996 (10 years after explosion). The population was also found to have a birth rate of 3 births/wolf/year and a death rate of 0.1 deaths/wolf/year.

Barn swallows (*Hirundo rustica*) are one of the few animals that radiation affects visibly. They have a form of albinism where feathers around their beak are spotted with white patches instead of the normal shade of brown. If this condition were caused by a mutation in the gene responsible for controlling feather color, there would be two alleles: “A” for brown and “a” for albino. An individual can only have these albino patches if they are homozygous recessive.

Scientists have evidence suggesting the male birds with the albino patches are not selected by female birds for mating as often and therefore males with the albino patches have less fitness than male birds with the normal brown feathers. The barn swallow has a diploid (2n) number of 80 chromosomes. The gene for feather color has been sequenced and found to be 750 nucleotides in length. Birds with albino patches have a mutation at the 12th base in the DNA sequence in the feather color gene. The beginning of the mRNAs transcribed from brown and albino alleles are indicated below.

Bird with normal brown feathers	Bird with albino patches
AUGAGUGACUGGCUC...	AUGAGUGACUG <u>A</u> CUC...

P P P P P P P P P

Zeus, the king of the Greek gods dwelling on Mt. Olympus, was notorious for fathering children with many females (both goddesses and mortals). Three genetic traits of three of Zeus’ mates are listed below. Each mate on this list was the mother of at least one child listed below. Asclepius is the god of medicine and very clever. He tells Zeus that he can determine the 3 different mothers of the 4 children by blood type alone. He knows that Artemis and Apollo are siblings and Hercules and Persephone are children of the other mothers.

Being	Sex	Colorblindness (Color-blindness is X-linked recessive)	Blood Type (multiple alleles)	Polydactyly [6 fingers] is autosomal dominant; 5-fingers is recessive	Notes
ADULTS					
Zeus	male	normal vision	O	6 fingers	son of Cronus & Rhea king of the gods
Mates of Zeus					
Demeter	female	colorblind	A	5 fingers	
Alcmene	female	normal vision	B	5 fingers	
Leto	female	normal vision	AB	5 fingers	
CHILDREN					
Persephone	female	normal vision	A	6 fingers	
Artemis	female	normal vision	A	5 fingers	sister of Apollo
Apollo	male	colorblind	B	6 fingers	brother of Artemis
Hercules	male	colorblind	O	5 fingers	strongest mortal ever

Crayfish – also called crawfish, crawdads, freshwater lobsters, or mudbugs – are freshwater crustaceans resembling small lobsters, to which they are related. They breathe through feather-like gills. They are mostly found in freshwater and streams. Most crayfish cannot tolerate polluted water, although some species such as the invasive *Procambarus clarkii* are hardier. Crayfish feed on living and dead animals and plants. Crayfish are highly diverse in N. America, and species often differ considerably in color.

A common pollutant in freshwaters inhabited by crayfish is carbaryl, a potent neurotoxin to invertebrates that inhibits acetylcholinesterase. *Procambarus clarkii*, an invasive crayfish is relatively tolerant to carbaryl compared to native crayfish. The exoskeleton of *Procambarus clarkii* has a distinctive red color. Your little brother collects one of them from a nearby pond and brings it home in a green glass container (i.e. the glass allows only green wavelengths of light to pass through it).

The signal crayfish, *Pacifastacus leniusculus*, is distributed widely in the Pacific Northwest. Scientists discovered crayfish in Idaho, Oregon, and Washington that looked similar, yet decided to classify them as separate species.

The Payne County Health Department offers to all adults free-of-charge the **Tdap** vaccine; this is designed to protect the vaccinated person simultaneously against diphtheria, whooping cough and lock jaw.

Disease	Causative agent	Type of organism	Mode of transmission
diphtheria	<i>Corynebacterium diphtheria</i>	bacterium	Direct contact or cough droplets
whooping cough	<i>Bordetella pertussis</i>	bacterium	Direct contact or cough droplets
lock jaw	<i>Clostridium tetani</i>	bacterium	Wound infected by soil or manure

As children, your ancestors were likely exposed and even infected with diphtheria, which killed many of the children in their towns and villages. In the U.S., diphtheria killed 15,520 children in 1921; it was the third largest cause of death among children in England in the 1930’s. Much cellular damage caused by diphtheria is due to a toxin secreted by *Corynebacterium diphtheria*. This toxin causes a rapid inhibition of the joining of one amino acid to another. When *Clostridium tetani* infects a wound, it functions and multiplies anaerobically (i.e. without oxygen).