BIOL 1114 **Exam #3 (Preview)** **April 12th, 2010**

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**" **in the space above the boxes containing your O-Key Account Username**. Darken the **(S)** in the **last column of the name circles**. Enter the number **1013** 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.

Use the following formulas and chart as needed.

r = birth rate(b) – death rate(d) $\quad r = \frac{\text{births} - \text{deaths}}{N} \quad G = rN \quad G = rN\left(\frac{K - N}{K}\right)$

mRNA-Codon-to-Amino-Acid Decoder Chart

1st Letter	2nd Letter: U		C		A		G		3rd 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	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	Arginine	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

Widow's peak is a trait expressed in individuals that have the dominant W allele. The w allele is recessive.

While SARS and avian influenza are emerging diseases with which the U.S. Public is most concerned, organizations such as the Pan American Health Organization (PAHO) provides information about, tracks, and identifies a range of other Acute Respiratory Diseases (ARS) that have the potential to become epidemics or pandemics. PAHO recommends testing for an ARS when a patient shows symptoms of high fever (in excess of 38 °C), coughing, and shortness of breath.

A PAHO investigator examines the DNA of a new strain of virus responsible for an ARS. Since it is a new strain, the current vaccine may not be effective. The bases in the DNA sequence that code for a part of the original virus to which the immune system responds is ...GGATGA....

There was a mix-up at the hospital in the town of Bedrock (and possibly other funny-business, assume no knowledge of parentage). After the kids grow up, they made the following table of genetic traits to help them figure out who belongs to whom.

Person	Sex	Color Blind	Ear Lobe Attached	Blood Type
Possible Parents				
Fred	M	Yes	Yes	A
Wilma	F	No	Yes	AB
Barney	M	Yes	Yes	O
Betty	F	No	No	B
Possible Children				
Bam Bam	M	Yes	No	AB
Pebbles	F	No	Yes	B
Inheritance Information		*Color blind is X-linked recessive*	*Unattached (No) is dominant*	*A and B are co-dominant*

A dam isolated a population of fish upstream and downstream of the dam. At the time of isolation nearly all the fish were completely silver. Occasionally a heritable mutation occurs in this species of fish that results in golden color. The water is clearer upstream of the dam as compared to downstream. To predators, the golden colored fish are more camouflaged than silver colored fish downstream.

Sickle-cell disease, an abnormality of the hemoglobin protein, is a common blood disease among African peoples. Sickle-cell disease causes red blood cells to become altered into a crescent sickle shape. Because it is less soluble than normal hemoglobin (hemoglobin A), sickle-cell hemoglobin (hemoglobin S) carries less of the oxygen required for aerobic cellular respiration. Those with sickle-cell disease usually do not survive beyond childhood.
In the 1950s, biologists realized that, in sub-Saharan Africa, the higher the incidence of malaria among the population, the higher the percentage of people carrying the sickle-cell allele. Malaria is caused by a single-celled parasite of the genus *Plasmodium*. It is most frequently transmitted to humans from the bite of blood-sucking *Anopheles* mosquitoes that are indigenous to central Africa. Malaria parasites penetrate red blood cells and feed upon their contents, leading to chronic illness and death. However, the malaria parasite is less able to infect a person having a single copy of the sickle-cell allele than a normal person. Single-celled microorganisms like *Plasmodium* (the malaria pathogen) are considered eukaryotes. The *Anopheles* mosquito that transmits malaria is most common in moist warm climates.

Africans with one sickle-cell allele:	25.0%
Africans with the sickle-cell disease:	0.75%
African-Americans with one sickle-cell allele:	9.0%
African-Americans with the sickle-cell disease:	0.25%

A molecular biologist characterized the amino acid sequences of hemoglobin A (normal) and hemoglobin S (sickle-cell hemoglobin), here are his results for the critical point in the protein:
Hemoglobin A = Leucine-Leucine-Threonine-Proline-Glutamate-Glutamate-Lysine
Hemoglobin S = Leucine-Leucine-Threonine-Proline-Valine-Glutamate-Lysine

The treatment of malaria with drugs has a long history. Chloroquine, a "second-generation" antimalarial drug, showed promise for many years. However, in recent times, malaria infecting many Africans is resistant to chloroquine. Many tropical medicine experts are seeking to develop a vaccine that would be effective against infection of humans by *Plasmodium.*

A cattle breeder in Slaughterville, OK is experiencing major losses because of a tick outbreak. He calls a veterinarian to help him. The veterinarian wants to know how many ticks are there in the farm, and how the tick population is growing. She isolates 1 m^2 of ground such that ticks cannot enter or leave the square. She first found 500 ticks inside the 1 m^2 enclosure. She continues to monitor (i.e., counts, keeps track of births, deaths) the 1 m^2 square monthly. The farm is 100,000 m^2 . In the next month the tick population inside the 1 m^2 enclosure experiences 100 births and 40 deaths. The population size in subsequent months is as follows: 628, 1010, 1829, 3756, 8984. In subsequent months, the 1 m^2 enclosure was teeming with ticks – she couldn't see even a tiny patch of bare ground! Continued monitoring yielded the following population sizes: 8984, 9781, 10234, 10009, 9963, 10120.

Dr. Hannibal Lecter is clever. After a murder, he uses the enzyme DNAase (it denatures all DNA) and wipes down the crime scene. Upon failing to detect any DNA, Agent Clarice Starling looks for RNA, and finds a lot of it. The RNA sequence she found was UGGCAUC

Rabbits typically have 35 pairs of chromosomes. The gene coding for melanin pigment proteins in the skin resides on the 12^{th} pair of homologous chromosomes. The condition called oculocutaneous albinism results when individuals have both alleles coding for non-functional melanin pigments. Such rabbits have no melanin pigmentation in the skin and fur, and are totally white.

The gene that codes for melanin proteins present in the eye is found on the X-chromosome. The allele that codes for the functional version of this protein is dominant over the non-functional version. Individuals who express only the non-functional version of the protein have no pigments in the iris and retina, and are almost blind in a condition called ocular albinism.