Preview Material Exam 4 Fall 2008

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**" **(as marked on your test form) in the space above the boxes containing your O-Key Account Username**. Darken the **(N or S)** in the **last column of the name circles** depending on your test form. Enter the number **834** and **darken the corresponding circles** in the **first 3 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 = b-d or = $\frac{\text{\# of births - \# of deaths}}{N}$ **G = rN** **G = rN($\frac{K - N}{K}$)**

mRNA-Codon-to-Amino-Acid Decoder Chart

		2nd Letter							
1st 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

The rough skinned newt, an amphibian that lives in the western US, has few predators due to the potent toxin, tetrodotoxin or TTX, produced in its skin. TTX causes its toxic effect by blocking the Na^+ channel in the axon of the nerve. The toxin from one newt is potent enough to kill 12 humans. One of the few organisms that can eat the newt is the common garter snake. Although these snakes often eat the newt with no effect, sometimes the snake is poisoned. In one recent study, scientists compared the concentration of toxin in newts from 28 different areas to the level of resistance to TTX found in snakes from the same areas. In most cases, the snakes' level of resistance very closely matched the concentration of TTX in the newts. When resistance matches toxin concentrations, the toxin temporarily slows the snake down but isn't enough to kill it.
It appears that as the snakes evolve to become more resistant to TTX, the newts in the same region evolve to make more of the toxin.

In another study, the garter snakes from a specific region were found to be completely resistant to TTX. These snakes were found to have a single mutation in the gene that codes for the Na^+ channel protein. The mutation results in a new form of the Na^+ channel protein that has a serine in the spot that was phenylalanine. TTX does not bind to this new form of the protein.

A student is trying to develop a new research project studying algae and their use of photosynthesis. In order to perform his experiments, he must learn to grow the algae in a laboratory. In his first attempt, he follows a recipe published by another researcher to make a growth solution containing water and nutrients, but the algae grew very slowly. Next, he conducted an experiment to test his hypothesis that the original growth solution does not have rapid algae growth because not enough of either nitrogen or phosphorous was in the solution. In his experiment, he measured algae growth in the original growth solution, the original growth solution plus nitrogen, and the original growth solution plus phosphorous. Algae in the original growth solution grew slowly as did the treatment with nitrogen added. However, in the treatment that phosphorous had been added, the algae grew very rapidly.

Once the student had a growth solution that provided everything the algae needed to grow, he decided to put a very small number of algae in a large container so that all resources are available for many generations of growth. The student has his light system on a timer so that the lights turn on at 8:00 am in the morning and turn off at 10:00 pm at night. Following many days of growth, there is a great deal of algae in the jar. Each morning (8:00 am) and evening (7:00 pm) he measured the oxygen dissolved in the growth solution

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Bigfoot – The Final Adventures

For the Big Foot population that lives in Georgia, hair on their upper lip (mustache area) is a dominant autosomal trait, while a bare upper lip is a recessive autosomal trait. A hairy-lipped male and a hairy-lipped female have 8 offspring. Three of the offspring have bare lips and 5 have hairy lips.
A viral disease similar to chicken pox is common in juvenile Big Foot. Each individual usually only has symptoms of this disease once in their lifetime.
Unwittingly, a Big Foot ate some berries that contain a toxin that prevents the electron transport chain in the mitochondria from accepting electrons from NADH and $FADH_2$.

In the cichlid fish, *Cichlasoma citrinellum*, males and females both tend the young, which stay with the parents for 4-6 weeks. The young fish feed on the mucous secreted from the skin of their parents. Another cichlid fish, *Pseudocrenilabrus nicholsi*, is a mouthbrooder, which means that the females carry the young around for several weeks in their mouths and are solely responsible for their care.

A scientist, who was interested in cold tolerance of the arctic fox, placed a fox in a room held at -60°C. Although the fox easily survived and was uninjured, its metabolism was measured to be twice as high during the exposure to the cold compared to during warmer temperatures. Both male and female arctic foxes have short snouts, compact bodies, thick fur coats, and counter current blood vessel mechanisms.

In a park in Chicago there are squirrels and their fur color is affected by a single gene. The allele for brown fur is dominant over the allele for grey fur. When you started your study you observed that the numbers of brown squirrels and grey squirrels are equal. You calculated their birth (b) and death (d) rates and discover that for grey squirrels b = 1.1 squirrels/squirrel/year and d = 0.3 squirrels/squirrel/year. For brown squirrels b = 1.1 squirrels/squirrel/year and d = 0.1 squirrels/squirrel/year.

A farmer starts a field of corn from seeds. The seeds will germinate and develop into plants that will produce kernels to feed cows that in turn are eaten by humans. In order to increase the yield of the crop the farmer adds fertilizer to the soil (the fertilizer contains nitrogen and phosphorus) and sprays the plants with a bioaccumulating pesticide that kills insects that eat the corn kernels.

An elderly woman fell in her home and was not discovered for several days. Despite carefully watching her diet, the woman had gained much weight over the years, which may have cushioned the fall and prevented her from breaking any bones. However, it also prevented her from getting up, which resulted in her developing a severe sore on her side. When she was hospitalized she was suffering from dehydration, pneumonia, and systemic sepsis (i.e. a bacterial infection throughout her body) caused by *Staplycoccus aureus*. She was treated with a broad range of antibiotics for 4-6 weeks. Following the treatments and not eating for a few days, the woman began to have intestinal spasms, which the doctors treated with Clonidine. Another possible cause of her intestinal problem was "C Diff", a bacterium (*Clostridium difficile*), which is a normal inhabitant of human intestines, but could have taken over in her intestines causing diarrhea. C Diff is only a problem following long-term treatment with antibiotics. The woman's son was very concerned about her, as one might expect, and had many long conversations with the physicians caring for her, relying on his knowledge of basic biology to understand the ailments and treatments

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You were recently hired by an agribusiness firm to investigate how to increase the yields (number of tomatoes) of tomato plants. Your boss has some ideas and shows you the results of an experiment he did. In a greenhouse, he manipulated conditions and found that plants grown at 70° F with nitrogen added to the soil yielded an average of 40.2 tomatoes while plants grown at 80° without nitrogen added to the soil yielded an average of 31.1 tomatoes.

Later, while observing the tomato plants in the greenhouse, you notice that plants with larger leaves have produced more tomatoes. You do not have a way to change the leaf size.