

The following material will appear on the upcoming exam. Use this preview to familiarize yourself with the material, and guide you in studying. Be sure to look up the definitions of any words you do not know. You are free to discuss this material or ask questions about it.

Use a #2 pencil to fill in the information on your NCS answer sheet.

- 1) Enter your **last name** and **first name** as indicated and darken the corresponding circles
- 2) Enter your **CWID** in the spaces indicated for “Student ID” and darken the corresponding circles.
- 3) Enter **1913** in the spaces indicated for “**Course number**” and darken the corresponding circles.
- 4) Enter the **form** of the exam (**001** or **002**) in the spaces indicated for “**SEC**” and darken the corresponding circles
- 5) Write your **O-Key Account Username** above the words “Last Name”.

Amish people in the U.S. are all descendants of 200 Swiss and Germans who migrated out of Europe in the mid-18<sup>th</sup> century and settled in the New World. There are about 250,000 Amish in the U.S. today, mostly living in rural Pennsylvania and Ohio. Amish rarely marry outside their community. A genetic disorder known as Ellis-van Creveld (**EVC**) Syndrome, occurs at a much higher rate among the Amish than anywhere else. Symptoms of this syndrome include deformed bones, dwarfism, heart disease and extra toes and fingers (polydactyly). EVC Syndrome has been traced to a mutation in the *EVC* gene, the normal function of which involves coding for a protein that allows to cell-to-cell signaling during development.

Equal numbers of male and females are affected by Ellis-van Creveld (EVC) Syndrome, which often “skips” a generation (*i.e.* It will be seen in grandparents and their grandchildren only.)

A mutation in this middle segment of the *EVC* gene is:

Original gene: **GGG AAA TTT GGG** → Mutant gene: **GGG AAA ATT GGG**,

The *EVC* gene is located on a chromosome with over a thousand other genes.

After meiosis, each of the resulting cells of an organism contains 15 chromosomes.

The Kingdom of Chillandia was ruled by King Olaf, who was married to Queen Hilda. Olaf and Hilda had one son, Prince Erik. Olaf’s brother, Prince Ubba, was unmarried. King Olaf died tragically in battle and, by royal tradition, Hilda became Ubba’s wife. They soon had a daughter, Princess Greta. Years later a scandal erupted: A young man named Leif arrived in the kingdom, claiming to be Ubba’s illegitimate son and heir to the throne. Even though Leif says he does not know who his mother is, the Royal Biologist claims to already have enough evidence to solve this case! Key phenotypic traits of royalty were as follows:

Person	Sex	Colorblindness [X-linked recessive]	Blood Type	Earlobe Type (autosomal) [Free = dominant; Attached = recessive]	Notes
<i>Adults</i>					
Olaf	Male	Color Blind	A	Free	married to Hilda
Hilda	Female	Normal Vision	B	Free	married to Olaf
Ubba	Male	Normal Vision	AB	Attached	Hilda’s second husband; Olaf’s brother
<i>Offspring</i>					
Erik	Male	Color blind	O	Attached	child of Olaf & Hilda
Greta	Female	Normal Vision	A	Free	child of Ubba & Hilda
Leif	Male	Color Blind	O	Free	of unknown origin

According to the U.S. Census Bureau, the U.S. population in the 2010 census was ~ **308** million people. The birth rate (**b**) was **0.014** person/person/year and the death rate (**d**) was **0.009** person/person/year.

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The following single-stranded DNA, **AGAGTTCCA**, from the middle of a bacterial gene was mutated.

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The pancreas is used by the body to process food. As it does this, the pancreas secretes hormones (such as insulin) that are involved in glucose metabolism, as well as various digestive proteins. These proteins include **trypsin** – which breaks down other proteins; **steapsin** – which breaks down fats; and **amylopsin** – which breaks down complex carbohydrates (such as starches). The failure of the pancreas to secrete enough of the insulin hormone can lead to Type-1 insulin-dependent diabetes, which is an inability of the body to produce insulin.

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A molecular biologist estimates that a segment of the amylopsin gene contains **600 base-pairs** of DNA and 300 of these **bases** are adenine (A).

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The Endosymbiotic Theory has been used to explain the origin of both chloroplasts and mitochondria.

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After reaching its carrying capacity(K), competition for food increased in a population of fish in a lake causing many fish to die from starvation.

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A very intense and destructive fire occurred in an African savanna and killed 80% of the individuals in a population of zebras.

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You are ill with a bacterial infection, and your doctor has prescribed a round of antibiotics for you to take. Some antibiotics can pass through human cells and affect DNA replication in mitochondria, but not in the nucleus.

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The figure on your right represents a type of molecule **produced and secreted** by B-cells.

