Chapter 16 – Origin of New Species

1. General Information

The Earth, and the life on it, is constantly changing, even today
Evolution – the biological process that ties all species together
Population – all the members of a certain species
Organisms don't evolve. Populations do. Organisms can't adapt. Populations adapt over time

2. Charles Darwin's Theory of Evolution

Origin of Species by Means of Natural Selection –Darwin's book on evolution
Went to the Galapagos on a science mission on the **Beagle**
The Galapagos Islands – a chain of volcanic islands that never were once part of the mainland
Located about 950km west of Ecuador, all life on it had to swim, fly, or float over on veggie rafts
The islands houses 2 mammals, 7 reptiles, and 20 species of birds
Finches – there are 13 different types of finches on the Galapagos
Darwin theorized that they all evolved from a single species
The major difference among the finches were their beaks, which dictated their diets
Niche – a way of life, or profession of an organism
When the finches first arrived, each filled a niche that had little competition, then adapted to it
Darwin did not immediately derive his theory of natural selection at the Galapagos
Artificial Selection – the creation of new breeds of organisms by selective breeding
Natural Selection – the creation of new breeds of organisms by survival of the fittest
Darwin used the idea of artificial selection to explain evolution through natural selection
His theory was supported by other scientists' experiments with birds, mice, moths, and bacteria
Since genetic information was unavailable during Darwin's lifetime, he had trouble defending his theory
He had trouble defending how the traits were passed on from generation to generation
Later, genetics study shows that variations are caused by mutations and genetic recombination
Assumptions that natural selection makes:
There are far too many organisms than can survive
There are not enough resources to satisfy every organism
There will always be a struggle to survive
Those with favorable traits will survive
Those with favorable traits will pass the trait to their offspring

3. Genetics, Gene Frequencies, Population Genetics, and Speciation

Population Genetics – the study of allele frequencies within a population
Gene Pool – all of the genes of a population of organisms
Allele Frequency – how often a gene occurs. Can be determined experimentally and mathematically
Equilibrium Gene Pool – a well adapted population that has a gene pool that doesn't change much
Factors that can change a gene pool/frequency
Mutation – the introduction of a new gene
Migration – movement of organisms into or out of the population
If a group of organisms are either added or removed, gene frequency changes
Gene Flow – the movement of genes into and out of a population by migration
Genetic Drift – random changes in alleles. Can have great effects on small populations
Selection – natural or artificial selection will determine which organisms will pass on their genes
Nonrandom mating – certain individuals like to make with certain other individuals
Does not change gene frequency, but the proportion of individuals that are homozygous
Inbreeding – breeding in the same family that produces homozygous recessive offspring
The Hardy Weinberg Principle – the mathematical relationship of gene frequencies
Consider a gene pool with 40% W alleles, and 60% R alleles

	R – 60/100, or .6	W – 40/100, or .4
R – 60/100, or .6	RR - .6*.6 = .36. 36%	RW - .4*.6 = .24. 24%
W – 40/100, or .4	RW - .4*.6 = .24. 24%	WW - .4*.4 = .16. 16%

Hence, we get 36% RR, 16% WW, and 48* RW
Microevolution – the changes that occur within a populations and species
Macroevolution – evolution above the species level, including micro-evolutionary data and fossil records
Studies evolutionary trends, mass extinctions, and changes that result in new organisms
Speciation – evolution of a new species

Generally occurs when part of a population gets isolated and starts inbreeding
Occurs slowly through nature, but technology can speed it up
By subjecting flies to a certain pesticide, scientists created a new breed of resistant flies
Speciation occurs often in isolated small populations where allele frequencies are changed easily
Geographical isolation can cause new species, as they start breeding with each other
Two sides of the Grand Canyon contains two different species of squirrels
Ecological isolation, the needing of different habitats by different animals, can cause new species
Behavior isolation, or differences in mating calls and preferences, can cause new species
Seasonal isolation, or different mating times, can cause new species
Mechanical isolation, or physical characteristics that prevent two species from interbreeding, inhibit the creation of new species
If the sperm and egg are too different, the fertilized zygote often will not develop

4. Questions about Evolution

Why do some species remain unchanged for long periods, and then suddenly die?
Why do some species just arise in a very short period of time?
Punctuated Equilibria – long stable periods followed by short, rapid bursts in the rate of evolution
Are our fossil records incomplete or did evolution “jump” at certain points in history?
How does the theory of Creation fit into the story, if at all?