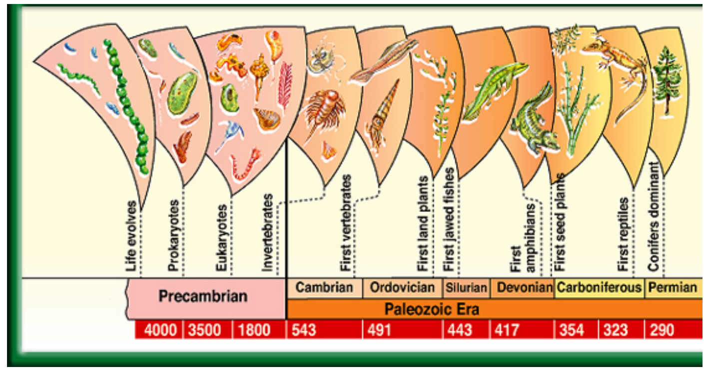

Adv. Biology: Evolution Study Guide

Section 14.2 (Pages 9 – 15)

- Spontaneous generation – the idea that life arises from non-life (nowhere).
- Francesco Redi and his experiment – An Italian scientist that tested the idea of spontaneous generation and disproved it. He put meat in jars, and one had maggots growing, which was uncovered, while the covered one did not.

One of the first recorded investigations of spontaneous generation came in 1668. Francesco Redi, an Italian scientist, tested the idea that flies arose spontaneously from rotting meat. He hypothesized that flies—not meat—produced other flies. In his experiment, illustrated using present-day equipment in **Figure 14.11,** Redi observed that maggots, the larvae of flies, appeared only in flasks that were open to flies. Closed flasks had no flies and no maggots. The results of his experiments failed to convince everyone, however. Although people were beginning to use the microscope during Redi's time and knew that organisms invisible to the naked eye could be found almost everywhere, some thought that these tiny organisms must arise spontaneously, even if flies did not.

failed to convince everyone, however. Although people were beginning to use the microscope during Redi's time and knew that organisms invisible to the naked eye could be found almost everywhere, some thought that these tiny organisms must arise spontaneously, even if flies did not.

Figure 14.11 Francesco Redi showed that flies and maggots did not arise spontaneously from rotting meat.
Infer *the purpose of the covered flask in Redi's experiment.*

- (Theory of) Biogenesis – states that only living organisms can produce other living organisms.
- Louis Pasteur and his experiment – He designed an experiment to show that biogenesis was true even for microorganisms.

The idea of spontaneous generation was not completely rejected until the mid-1800s. It was replaced by the **theory of biogenesis** (bi oh JEN uh sus), which states that only living organisms can produce other living organisms. Louis Pasteur designed an experiment to show that biogenesis was true even for microorganisms. Pasteur's experiment is illustrated in **Figure 14.12.** In one flask, only air was allowed to contact a sterile nutrient broth. Nutrient broth supports the growth of microorganisms. In another flask, both air and microorganisms were allowed to contact the broth. No microorganisms grew in the first container. They did, however, grow in the second container.

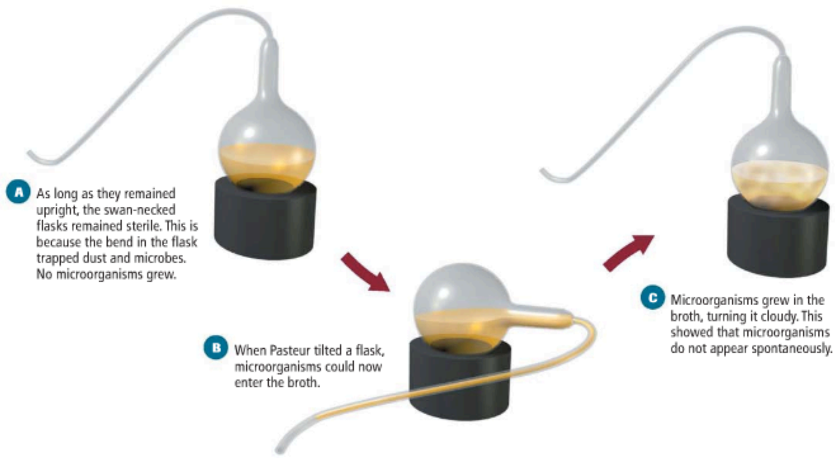

Figure 14.12 Pasteur's experiment showed that sterile broth remained free of microorganisms until exposed to air.

The idea of spontaneous generation was not completely rejected until the mid-1800s. It was replaced by the **theory of biogenesis**

- Primordial soup – an early hypothesis about the origin of life. Scientists Alexander Oparin and John Haldane suggested this hypothesis in the 1920s. They thought that if Earth's early atmosphere had a mix of certain gases, organic molecules could have been synthesized from simple reactions involving those gases in the early oceans. UV light from the Sun and electric discharge in lightning might have been the primary energy sources. They thought that these organic molecules would have eventually supplied the precursors to life.
- Stanley Miller and Harold Urey and their experiment. – Scientists who were the first to show that simple organic molecules could be made from inorganic compounds. (See Ch. 14 – Page 11)
- Evolution of cells: first cells to evolve – See Ch. 14 – Pages 13-14
- Endosymbiont theory – **according to this theory, the ancestors of eukaryotic cells lived in association with prokaryotic cells.** In some cases, prokaryotes even might have lived inside eukaryotes. Eventually the relationship between the cells became mutually beneficial, and the prokaryotic symbionts became organelles in eukaryotic cells. **This theory explains the origin of chloroplasts and mitochondria, as show in Figure 14.17 (See Ch. 14 – Page 14)**
-

<u>Section 14.1 (Pages 1-8)</u>

- Early earth– there was not a lot of free oxygen (See Ch.14 - Page 1)
  - Formation – was a molten body, and gravity pulled the densest elemets to the center of the plantet.
  - gases on the early earth – probably what is in volcanoes such as water vapor, carbon dioxide, sulfur dioxide, carbon monoxide, hydrogen sulfide, hydrogen cyanide, nitrogen, and hydrogen.
  - Weather – see above and below

    - atmosphere – because of its gravitational field, Earth is a planet that is able to maintain an atmosphere. The early atmosphere, unlike today's atmosphere had little or no free oxygen.
- Geologic time scale – is a record of Earth's History. All major geological and biological events in Earth's history can be identified within the geologic time scale. It is divided into two distinct segments – Precambrian time and Phanerozoic eon.. (See Ch.14 – Pages 5-8)
    - Eras – unit of geological time consisting of two or more periods that lasts hundreds of millions of years.
    - Major events – mass extinction (meteoroid strike), ice age, dinosaurs, etc.
    - animals that were present – from prokaryotes to humans
- Mass extinctions, meteorite strike – A mass extinction occurred at the end of Paleozoic and Mesozoic era (dinosaurs) – in the Mesozoic one, there is evidence in the K-T boundary of a meteoroid strike b/c of high levels of iridium, which is found in meteorites. (Ch. 14, Page 7)
- Pangea – Name of landmass, 225 million years ago (mya) when all of the continents were joined into one landmass.
    - plate tectonics – describes the movement of several large plates that make up the surface of the Earth. These plates, some of which contain continents, move atop a partially molten layer of rock underneath them.

<u>Section 15.1 (Pages 1-4)</u>

- Lamarck and Darwin's theories (See Notes Copy pg. 1)
    - Lamark – one of the 1st scientists to understand that change occurs over time. He states that changes are adaptations to the environment acquired in an organism's lifetime. He said that acquired changes are passed to offspring. Law of Use and Disuse – if body part is used, it got stronger; if not used, it deteriorated.
    - Darwin – evolution is the slow, gradual change in a pop. of organisms over tune. Natural Selection - Individuals who inherited characteristics most fit for their environment are likely to leave more offspring than less fit individuals. "Survival of the fittest." Artificial selection – proc. Of directed breeding to produce offspring w/ desired traits (selective breeding). (**Chapter 15, pgs. 1-4)**
- Steps in Natural Selection – (Chapter 15, Page 3)
    - Individuals in a pop. show differences, or variations.
    - Variations can be inherited, meaning they are passed from parent to offspring.
    - Organisms have more offspring than can survive on available resources.
    - Variations that increase reproductive success will have a greater chance of being passed on than those that do not increase reproductive success.

Section 14.1 (Pages 1-8) *Continued*

- Fossils and dating fossils – (Chapter 14, Pages 1-4) a fossils is any preserved evidence of an organism. There are 6 categories – trace fossil, molds and casts, replacement, petrified or permineralized, amber, original material. **Dating fossils**: relative dating – method used to determine the age of rocks by comparing them w/ those in other layers. This is based on the law of superposition – younger deposited on top of older layers. Radiometirc dating – used day of radioactive isotopes to measure age of rock. This requires the use of the half-life isotope = amount of time for half of original isotope to decay.

Section 15.3 (Pages 13-24)

- Peppered moths – (Chapter 15, Page 18)

Directional selection If an extreme version of a trait makes an organism more fit, **directional selection** might occur. This form of selection increases the expression of the extreme versions of a trait in a population. One example is the evolution of moths in industrial England. The peppered moth has two color forms, or morphs, as shown in **Figure 15.17.** Until the mid 1850s, nearly all peppered moths in England had light-colored bodies and wings. Beginning around 1850, however, dark moths began appearing. By the early 1900s, nearly all peppered moths were dark. Why? Industrial pollution favored the dark colored moths at the expense of the light-colored moths. The darker the moth, the more it matched the sooty background of its tree habitat, and the harder it was for predators to see. Thus, more dark moths survived, adding more genes for dark color to the population. This conclusion wa reinforced in the mid-1900s when the passage of air pollution laws led t the resurgence of light-colored moths. This phenomenon is called indus trial melanism.

Directional selection also can be seen in Galápagos finches. For three decades in the latter part of the twentieth century, Peter and Rosemary Grant studied populations of these finches. The Grants found that during drought years, food supplies dwindled and the birds had to eat the hard seeds they normally ignored. Birds with the largest beaks were more successful in cracking the tough seed coating than were birds with smaller beaks. As a result, over the duration of the drought, birds with larger beaks came to dominate the population. In rainy years, however, the directional trend was reversed, and the population's average beak size decreased.

Section 15.2 (Pages 5-12)

- Evidence of Evolution: **See Packet**
  - Homologous structures – anatomically similar structures inherited from a common ancestor. (Page 6)
  - Analogous structures – can be used for same purpose and similar ins structure, but not inherited from common ancestor. (Page 8)
  - vestigial structures – reduced forms of functional structures in other organisms. (Page 7)
  - embryology – the study of embryos, provided a glimpse into evolutionary relationships.

    - Biochemistry – molecules w/ a recent common ancestor should have more amino acid sequences in common. The more closely related the species are, greater number of sequences will be shared.
- **<u>Section 15.3 (Pages 13-24) *continued*</u>**
- Stabilizing, directional and disruptive selection (**Pages 17-19 and packet**)
    - Stabilizing selection – eliminate extreme expression when avg. expression leads to high fitness.
    - Directional selection – if an extreme version of a trait makes an organism more fit. Increases exp. Of extreme versions of a trait in a pop.
    - Disruptive selection – process that splits a pop into two groups, Removes indiv. w/ avg traits.
- Speciation – **See Page 21** - allopatric: barrier divides, sympatric: w/out physical barrier.
- Geographic isolation and reproductive isolation (prezygotic and postzygotic)
    - **See Pages 20 and 21** – Prezygotic – before fertilization, postzyogtic- after fertilization=infertile.
- Allopatric speciation and sympatric speciation – **Page 21 -** allopatric: barrier divides, sympatric: w/out physical barrier.
- Adaptive radiation - a type of speciation – diversication of a species into a number of different species, often over a relatively short time span. (pg 22)
    - divergent evolution – another name for adaptive radiation
    - convergent evolution – when unrelated species evolve similar traits even thought they live in different parts of the world. They have similar ecology and climate. (Pages 22 and 23)
- Coevolution – many species evolve in close relationship w/ other species. This relationship might be so close that the evolution of one species affects the evolution of other species. This is called coevolution (Page 22)
- Rate of speciation: (page 23)
    - gradualism – most scientists think that evolution occurs in small, gradual steps. A great deal of evidence favors this theory, but the fossil record contains instance of abrupt transitions.
    - punctuated equilibrium – attempts to explain abrupt transitions in the fossil record. According to this theory, rapid spurts of genetic change cause species to diverge quickly; these periods **punctuate** much longer periods when the species exhibit little change.
- **<u>Section 15.2 (Pages 5-12) *continued*</u>**
- Adaptations:
    - Mimicry – one species evolves to resembles another species, usually poisonous.
    - Camouflage – some species have evolved morphological adaptations that allow them to blend in with their environments.
    - Antibiotic resistance – (Page 11) – species of bacteria that originally were killed by penicillin and other antibiotics have developed drug resistance.

<u>Section 15.3 (Pages 13-24) *continued*</u>

- Genetic drift, gene pool, nonrandom mating, bottleneck, founder effect, gene flow – See Copied Notes
  - Genetic drift – any change in the allelic frequencies in a population that is due to change (pg. 15)
  - gene pool – there is tremendous variation within any gene pool. Ex. hundreds of breeds of dogs are dif. from each other but belong to same species. Sources of variation are mutations, genetic drift, and gene flow.
  - nonrandom mating – rarely is mating completely random in a pop. Usually, organisms mate w/ individuals close in proximity. This promotes inbreeding and could lead to change in allelic proportions favoring individual that are homozygous for part. traits. (page 16)
  - bottleneck effect – occurs when a pop. declines to a very low # and then rebounds. Could be nat. disaster like fire, earthquake, flood.
  - founder effect – occurs when a small sample of a pop. settles in a location separated from the rest of the pop. Alleles uncommon in original pop might be common in the new pop.
  - gene flow – movement of alleles into and out of a population. Happens b/c of migration of fertile individuals or gametes between populations.