

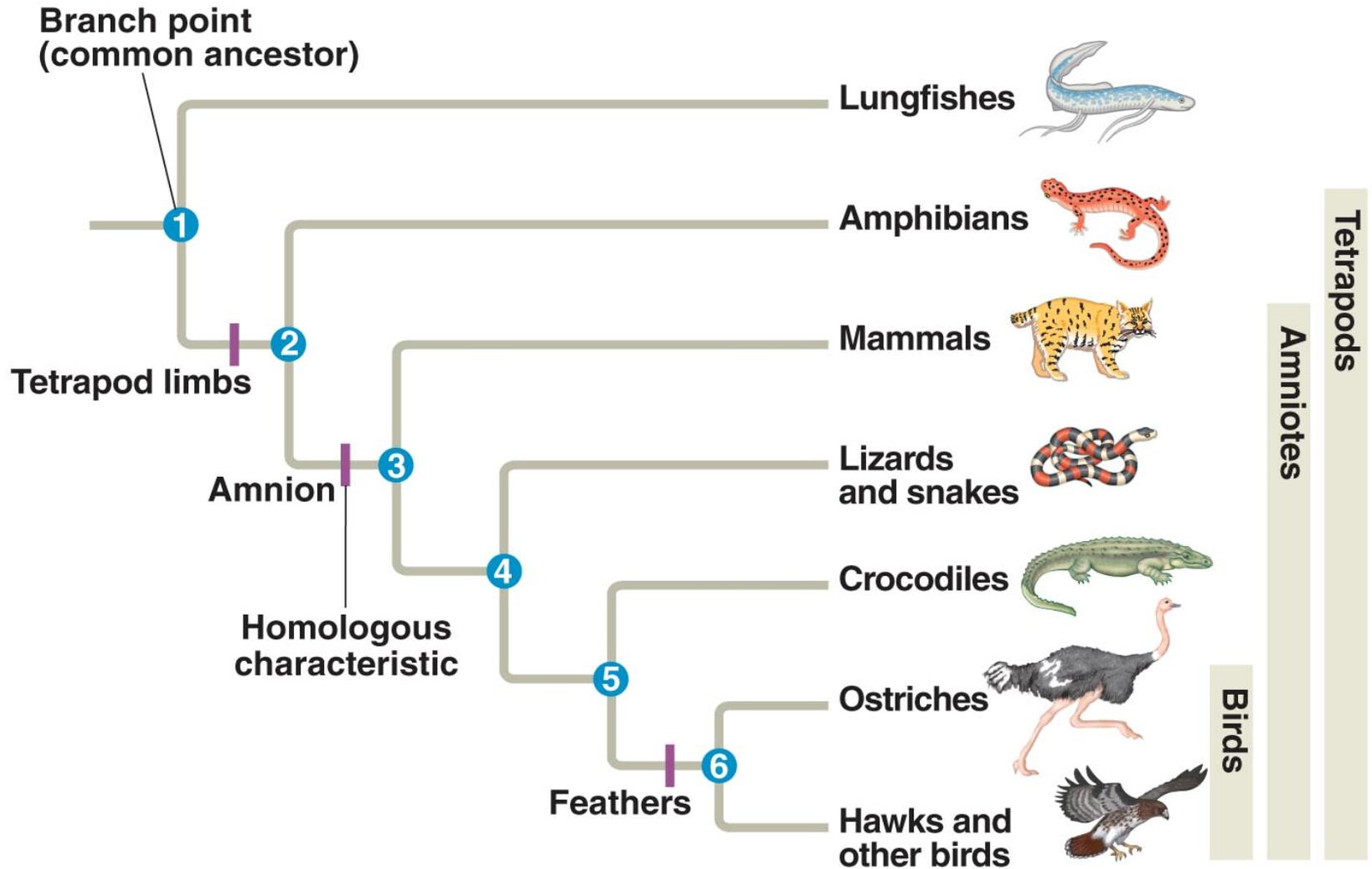
## 26) continuing previous lecture...

- **Vestigial** structures, the remnants of features that served important functions in the organism's ancestors, may not be just be morphological features like pharyngeal pouches or baleen whale's hind limbs
- There are many examples of homologies at the *molecular level* , namely genes inherited from a common ancestor and shared among organisms
- Some of those ancestral genes are not even expressed!

# 27) Homologies and the Tree of Life

- The Darwinian concept of an evolutionary tree of life can explain homologies
- Evolutionary trees are hypotheses about the relationships among different groups
- Evolutionary trees can be made using different types of data, for example, anatomical and DNA sequence data
- Fig. 22.19 illustrates the information provided in an evolutionary tree

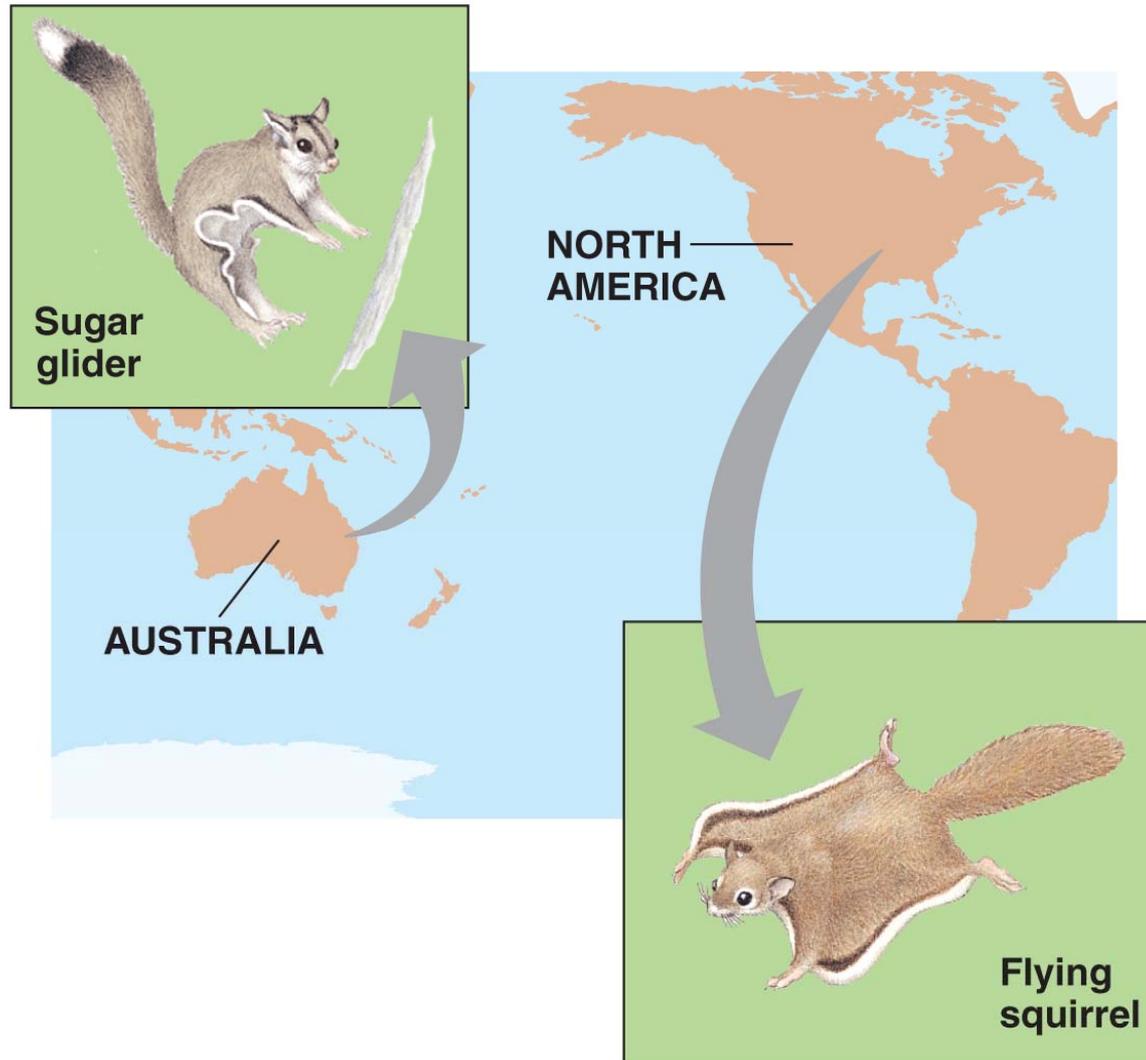
# 28) An evolutionary tree for tetrapods & the lungfishes based on homologies



## 29) Convergent evolution

- **Convergent evolution** is the evolution of similar, or **analogous**, features in distantly related groups
- Analogous traits arise when groups independently adapt to similar environments in similar ways
- Convergent evolution does not provide information about ancestry

30) The Sugar Glider (an Australian marsupial) and the Flying Squirrel (a N.A. placental) exhibit convergent evolution

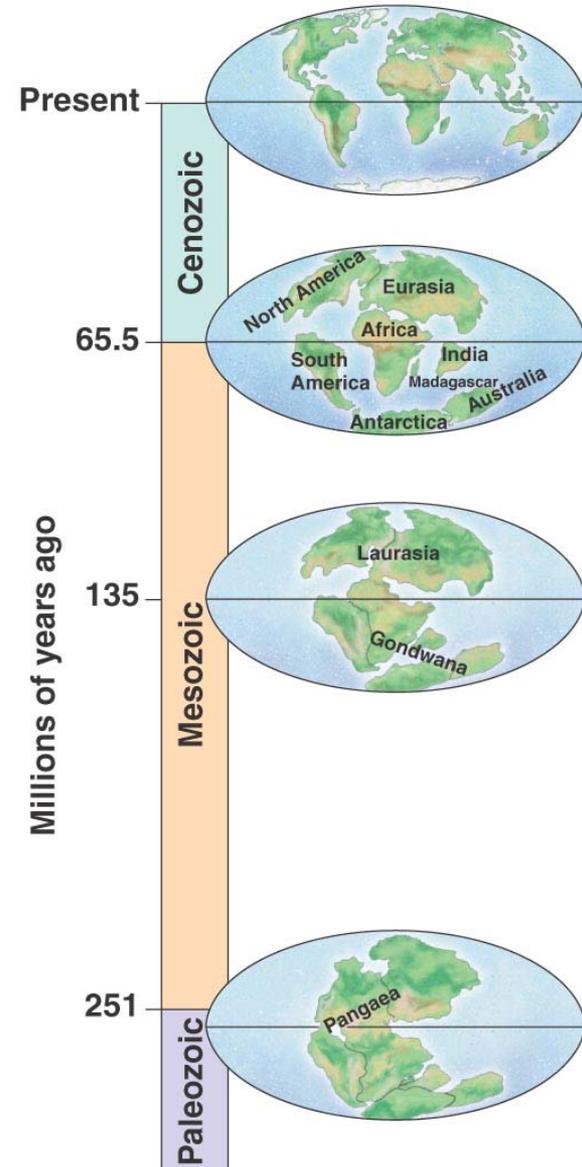


# 31) Biogeography

- Darwin's observations of **biogeography**, the geographic distribution of species, formed an important part of his theory of evolution
- Islands have many **endemic** species that are often closely related to species on the nearest mainland or island

# 32) Biogeography & Continental Drift

- Earth's continents were formerly united in a single large continent called **Pangaea**, but have since separated by **continental drift**
- An understanding of continent movement and modern distribution of species allows us to predict when and where different groups evolved



### 33) What Is *Theoretical* about the Darwinian View of Life?

- In science, a theory accounts for many observations and data, and attempts to explain and integrate a great variety of phenomena
- Darwin's theory of evolution by natural selection integrates diverse areas of biological study and stimulates many new research questions
- The theory has predictive value, and invites and suggests experiments that test the theory

34) Is it *informed* to dismiss Darwin's ideas as "just a theory"?

- In science, the word *theory* means something that accounts for many observations and explains & integrates a great variety of phenomena
- The colloquial use of the word *theory* comes close to what scientists mean by a *hypothesis*

## 35) More about the *theory of evolution*

- There is nothing “theoretical” about the evidence supporting evolution
- The research about evolution is ongoing and continues to support and refine Darwin’s original ideas
- No data have been found to refute the idea
- It is the single unifying explanation of the living world, and nothing makes much, if any, sense outside of this unifying theory

## 36) More about the *theory of evolution*

- The reason this unifying theory has become so widely accepted in the scientific world is that it has stood up to intense, thorough, continual observation and criticism
- The way to become rich & famous in science would be to show a fundamental error in the theory
- The built-in skepticism of science prevents these ideas from becoming dogma

37) Some aspects of the “evolution” of the theory of evolution:

- Darwin thought that evolution was a very slow process, but we know now that new species can form rapidly (a few 1000 years or less)
- We also know now that natural selection is not the only mechanism responsible for evolution (more about that later...)
- Today the study of evolution is livelier than ever