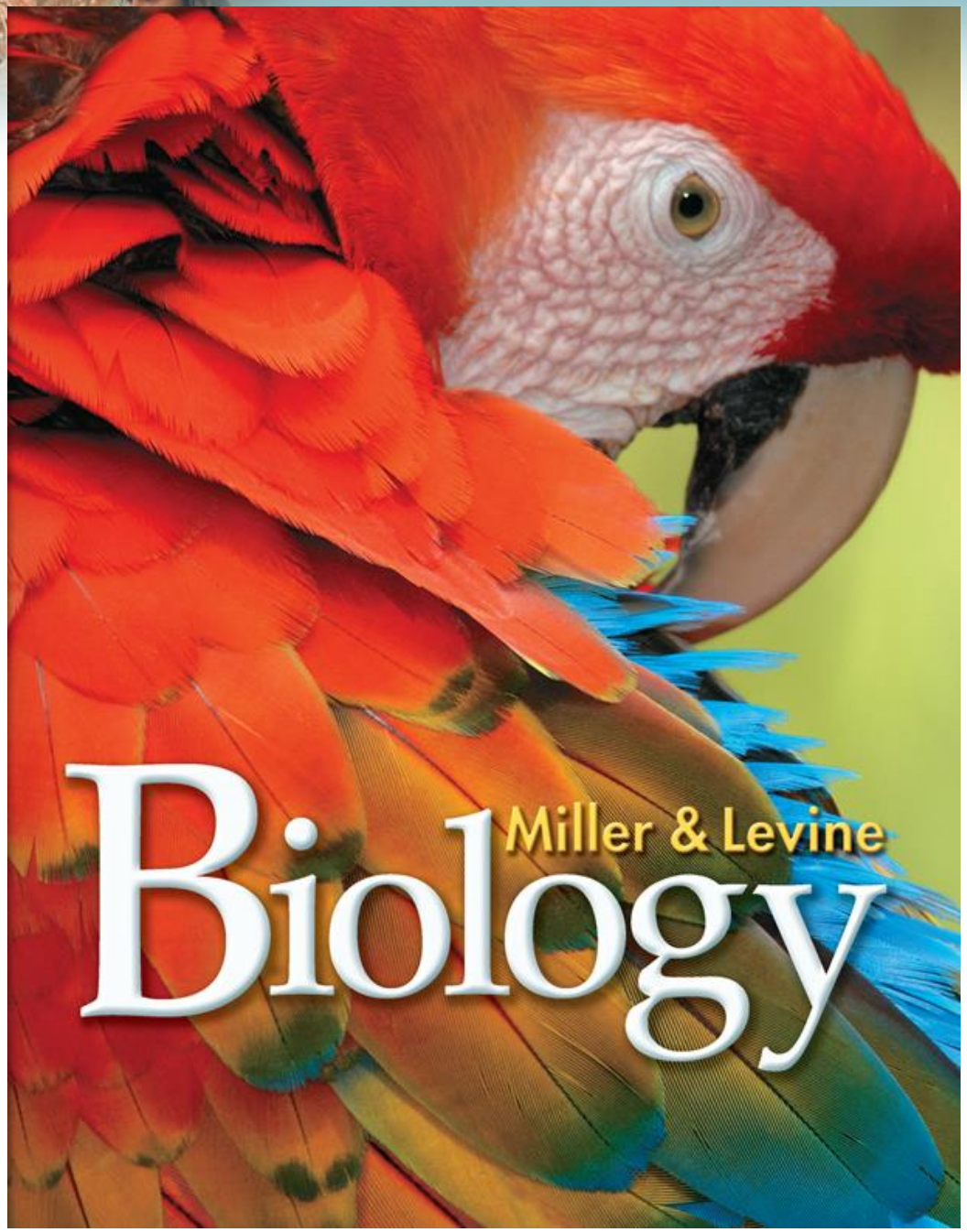


16.4 Evidence for Evolution

Biogeography

Biogeography - study of where organisms live, where they and ancestors lived.

Two significant patterns:

- closely related species separate in different climates.

- distantly related species develop similarities in comparable environments.

Closely Related but Different

biogeography of Galápagos species suggested populations on the islands evolved from mainland species.

variations among populations resulted in different, but closely related, island species.

example: giant tortoise shell shape

Distantly Related but Similar

similar habitats are home to species that are only distantly related.

Differences among those species provide evidence that they evolved from different ancestors.

similar selection pressures cause distantly-related species to develop similar adaptations.

example: rheas, ostriches, and emus inhabit similar grasslands in Europe, Australia, and Africa

The Age of Earth and Fossils

- Many recently discovered fossils form series that trace the evolution of modern species from extinct ancestors.

The Age of Earth

radioactivity now used to determine age of rocks and fossils.

example: carbon -14

scientists believe Earth is about 4.5 billion years old

Recent Fossil Finds

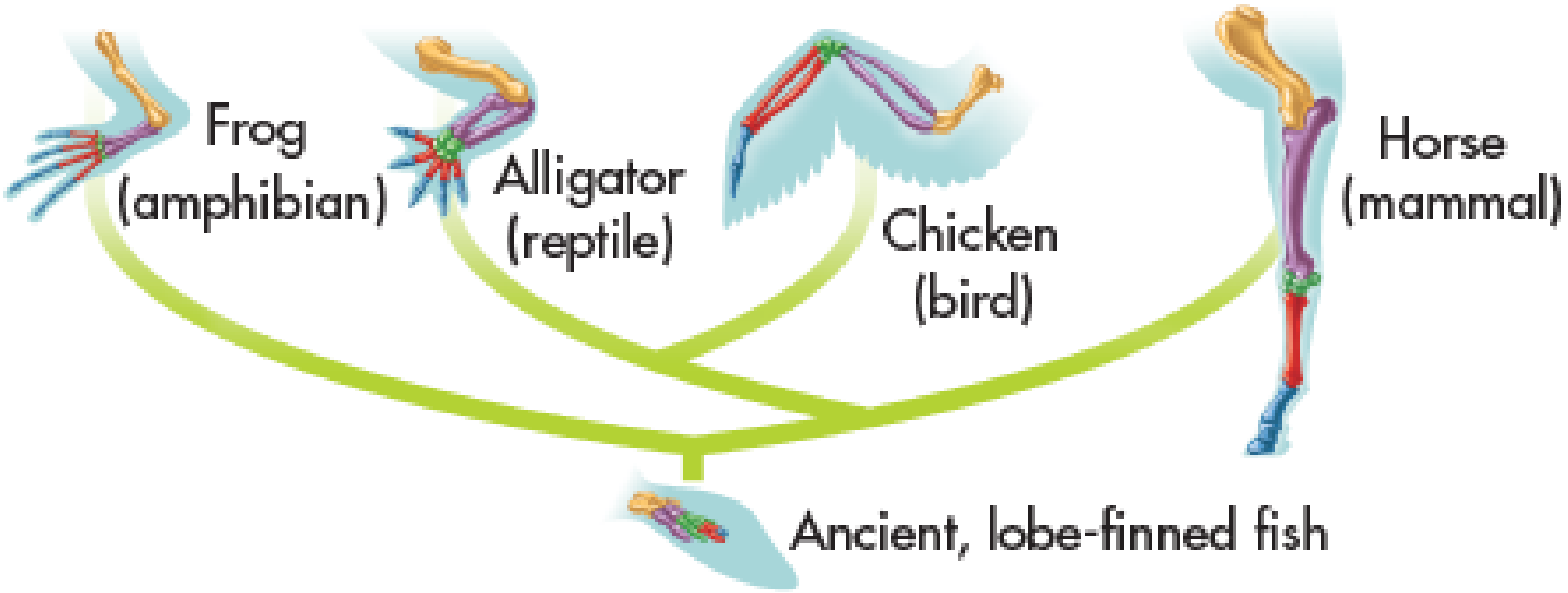
Since Darwin, fossils discovered that document intermediate stages in the evolution of species.

example: whales

however, fossil record is incomplete

Comparing Anatomy and Embryology

all vertebrate limbs have same basic bone structure.



Homologous Structures

Structures shared by related species and that are inherited from a common ancestor are called **homologous structures.**

Similarities and differences among homologous structures help determine how recently species shared a common ancestor.

Analogous Structures

Body parts that share a common function, but not structure, are called **analogous structures**.

Example: bee's wing and bird's wing

Vestigial Structures

Vestigial structures are inherited from ancestors, but have lost much or all of their original function.

example: whale pelvis, hind limb bones

Embryology

early developmental stages of many vertebrates look very similar.

Genetics and Molecular Biology

- At the molecular level, the universal genetic code and homologous molecules provide evidence of common descent.

Darwin didn't know about this!

Life's Common Genetic Code

All living cells use information coded in DNA and RNA to carry information from one generation to the next and to direct protein synthesis.

Animal	Sequence of Bases in Section of *Hoxc8*
Mouse	C A G A A A T G C C A C T T T T A T G G C C C T G T T T G T C T C C C C T G C T C
Baleen whale	C **C** G A A A T G C C **T** C T T T T A T G G C **G** C T G T T T G T C T C C C T G C **G** C
Chicken	**A** A **A** A A A T G C C **G** C T T T T A **C** **A** G C **T** C T G T T T G T C T C **T** C T G C T **A**

Homologous Molecules

Genes can be homologous

example: Hox genes help determine body's axis during development, and direct growth of limbs.

Homologous Molecules

Homologous proteins share structural and chemical similarities.

example: ***cytochrome c*** found in almost all living cells

Testing Natural Selection

- The Grants have documented natural selection in finch populations

They've shown that finches with different-size beaks have better or worse chances of surviving droughts.

- The Grants' work shows that variation within a species increases the likelihood of the species' adapting to and surviving environmental change.