OUTLINE 20

I. The Concept of Evolution up to Darwin's Time

- **A. Greek Philosophy**
- **B. Christian Theology**
- **C. The Enlightenment**

II. Evolution Before Darwin

- **A. Lamarck**
- **B. State of knowledge at Darwin's time**

III. Darwin and the theory of Evolution By Natural Selection

- **A. Voyage of the Beagle**
- **B. Formulation of the theory**

IV. The Theory

- **A. Essential elements**
- **B. Contrast with views of the time**

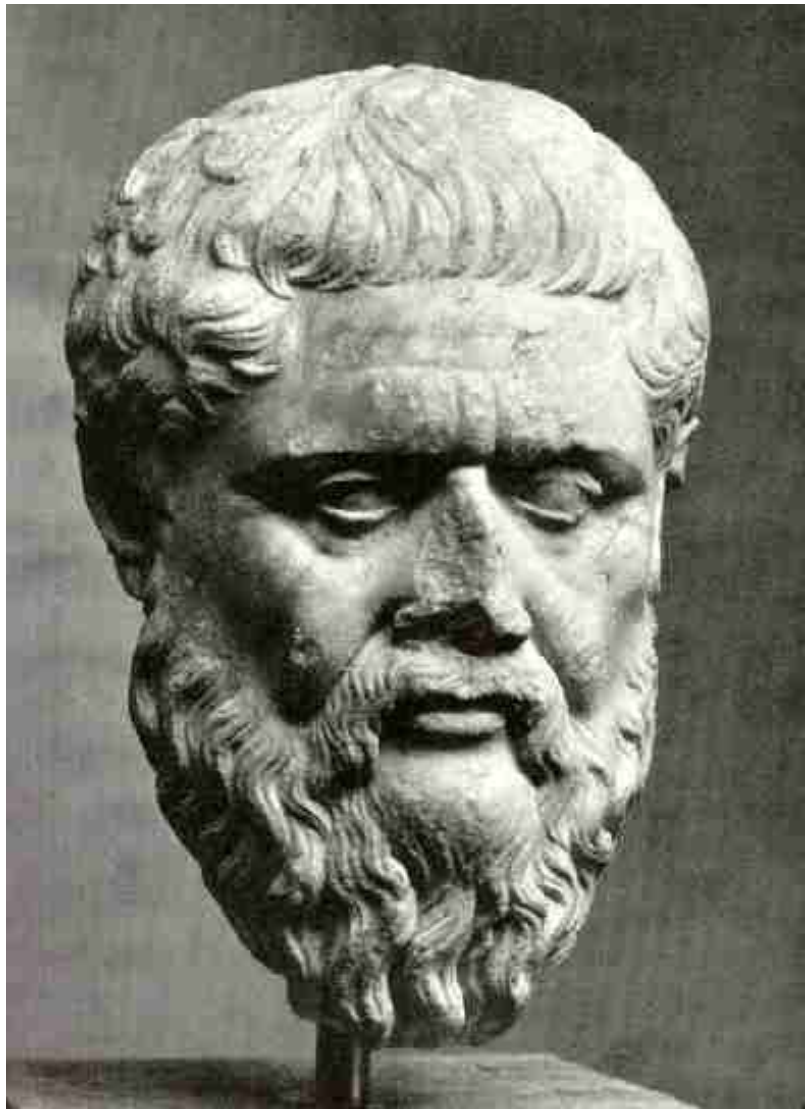
V. Darwin's Evidence

- **A. Artificial selection**
- **B. The fossil record**
- **C. Comparative anatomy**
- **D. Embryology**
- **E. Biogeography**

“Nothing in biology makes sense except in the light of evolution.”

- T. Dozhansky

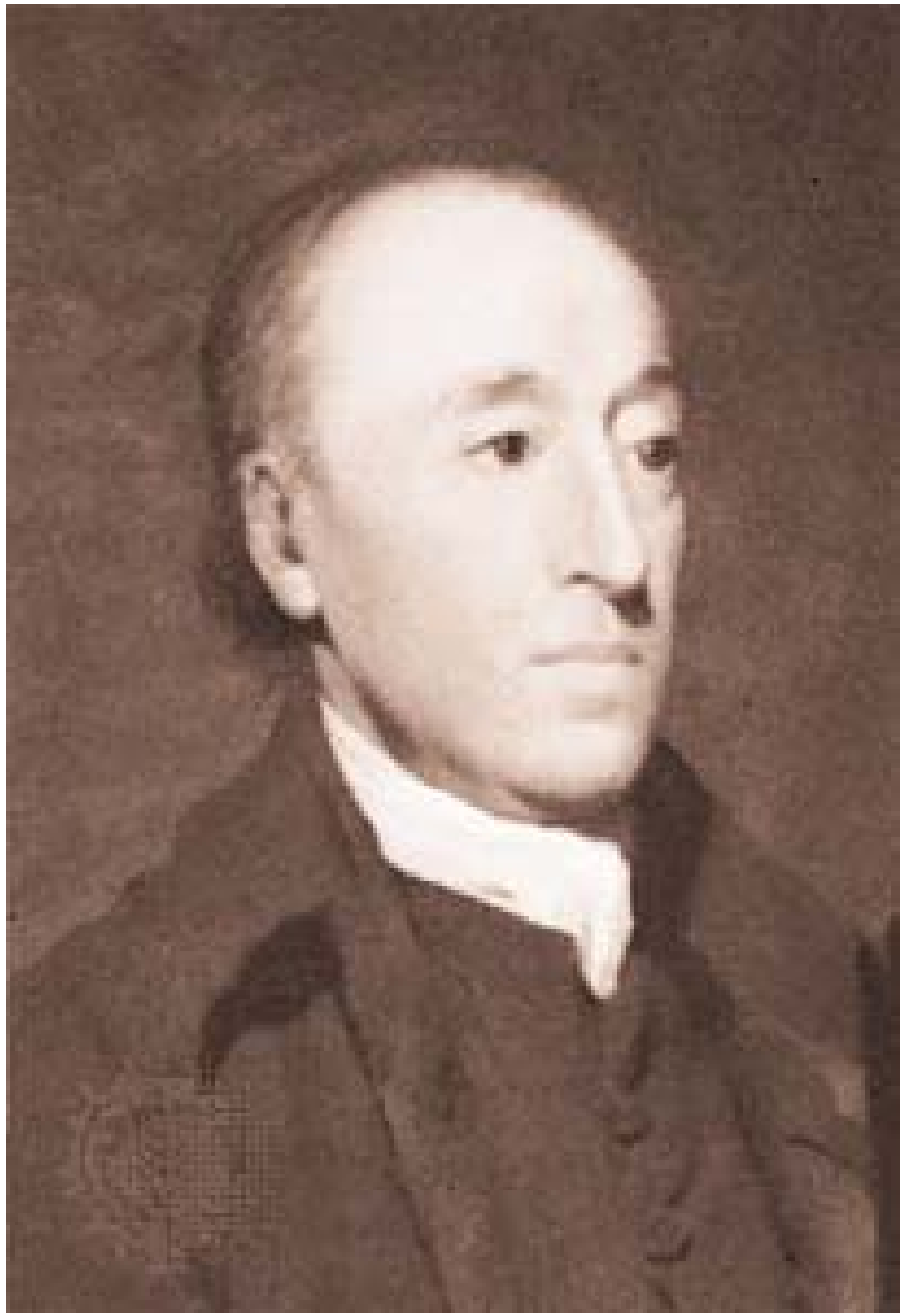
Greek Philosophy



Essentialism

James Hutton
1726 - 1797

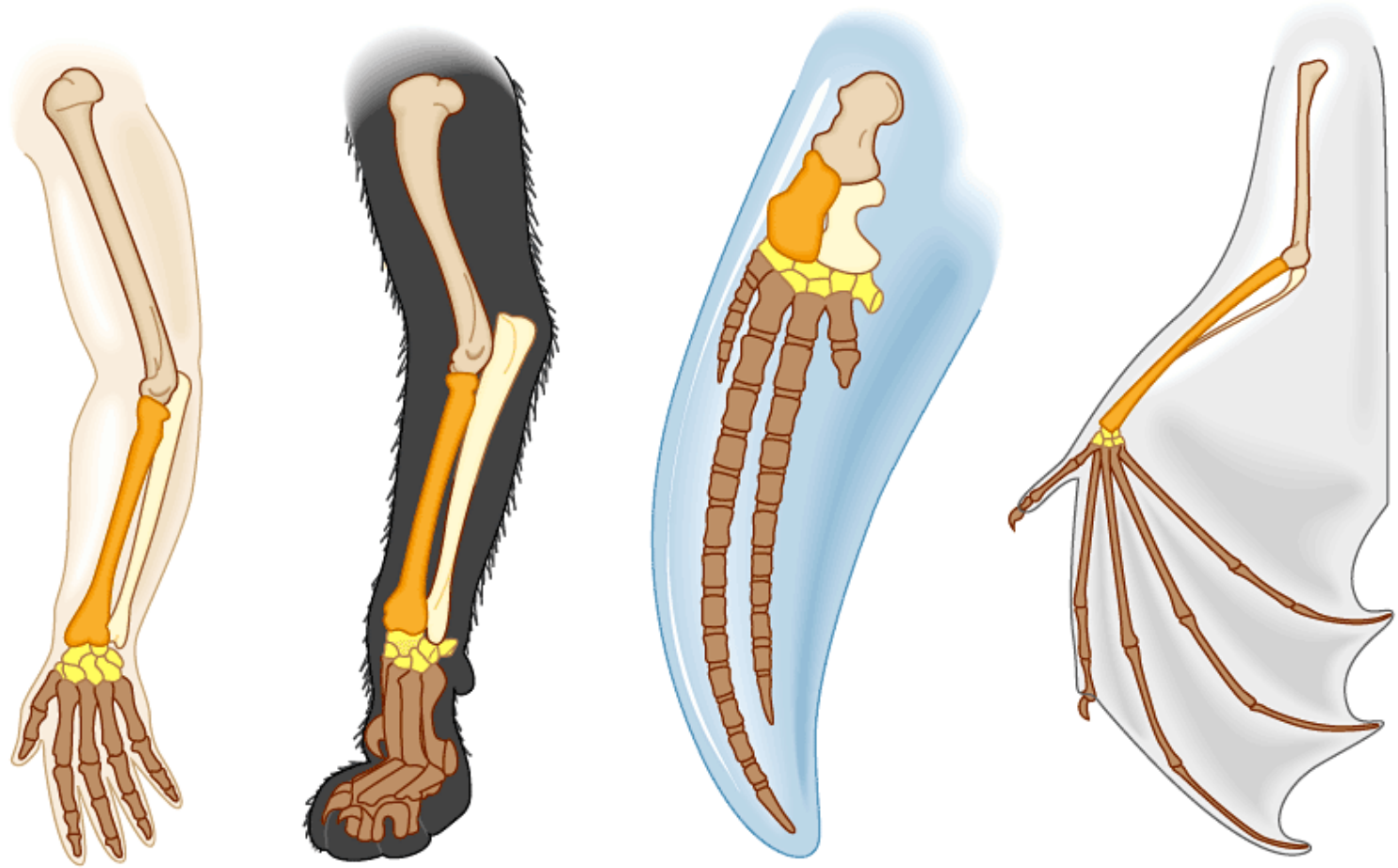
Gradualism Natural laws are invariant. Change results from the accumulation of slow continuous processes.



Charles Lyell
1797 - 1875

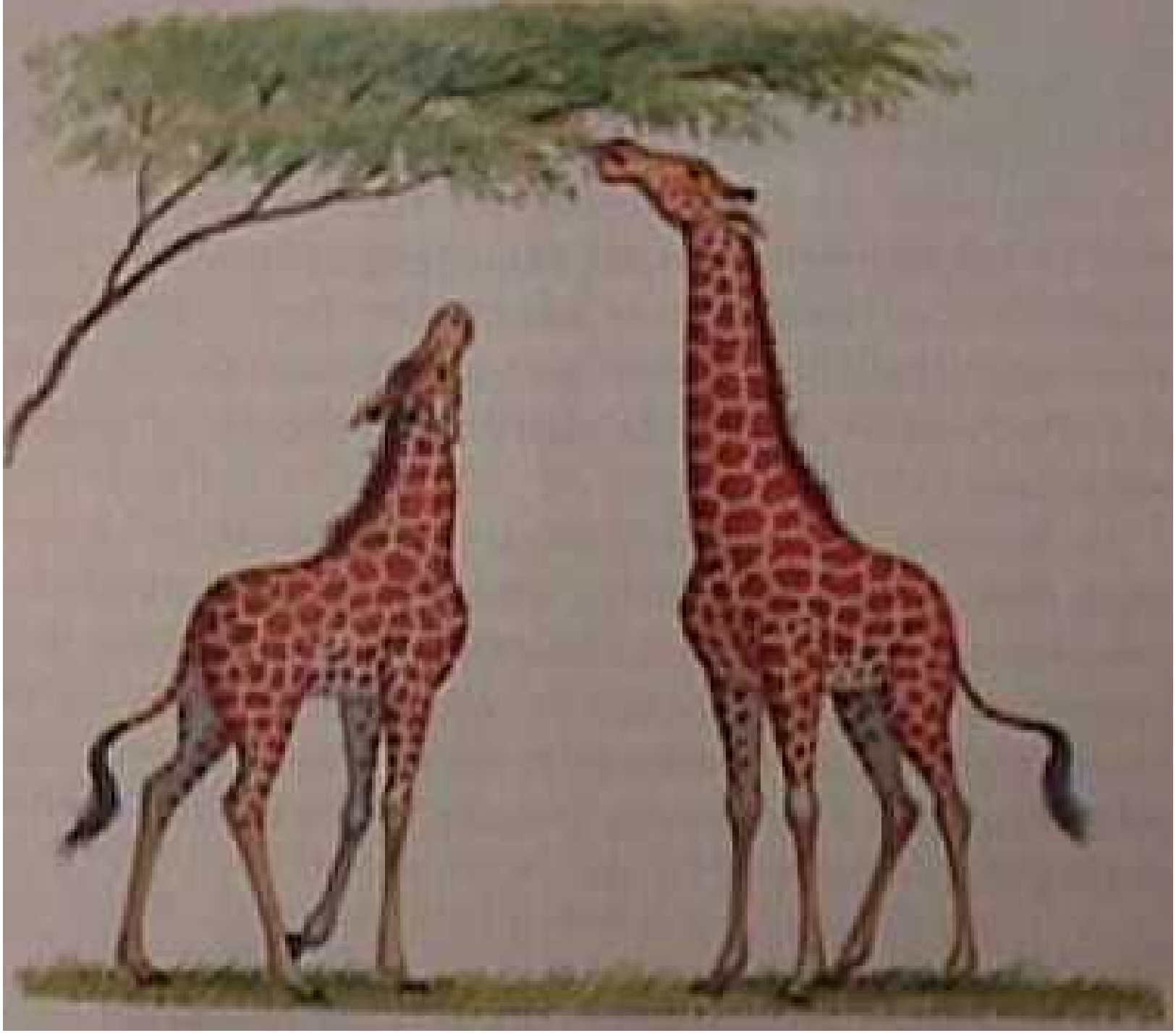
Uniformitarianism
the rate of geological activity on Earth is constant.

Similarity among the limb bones of organisms that use them for different purposes

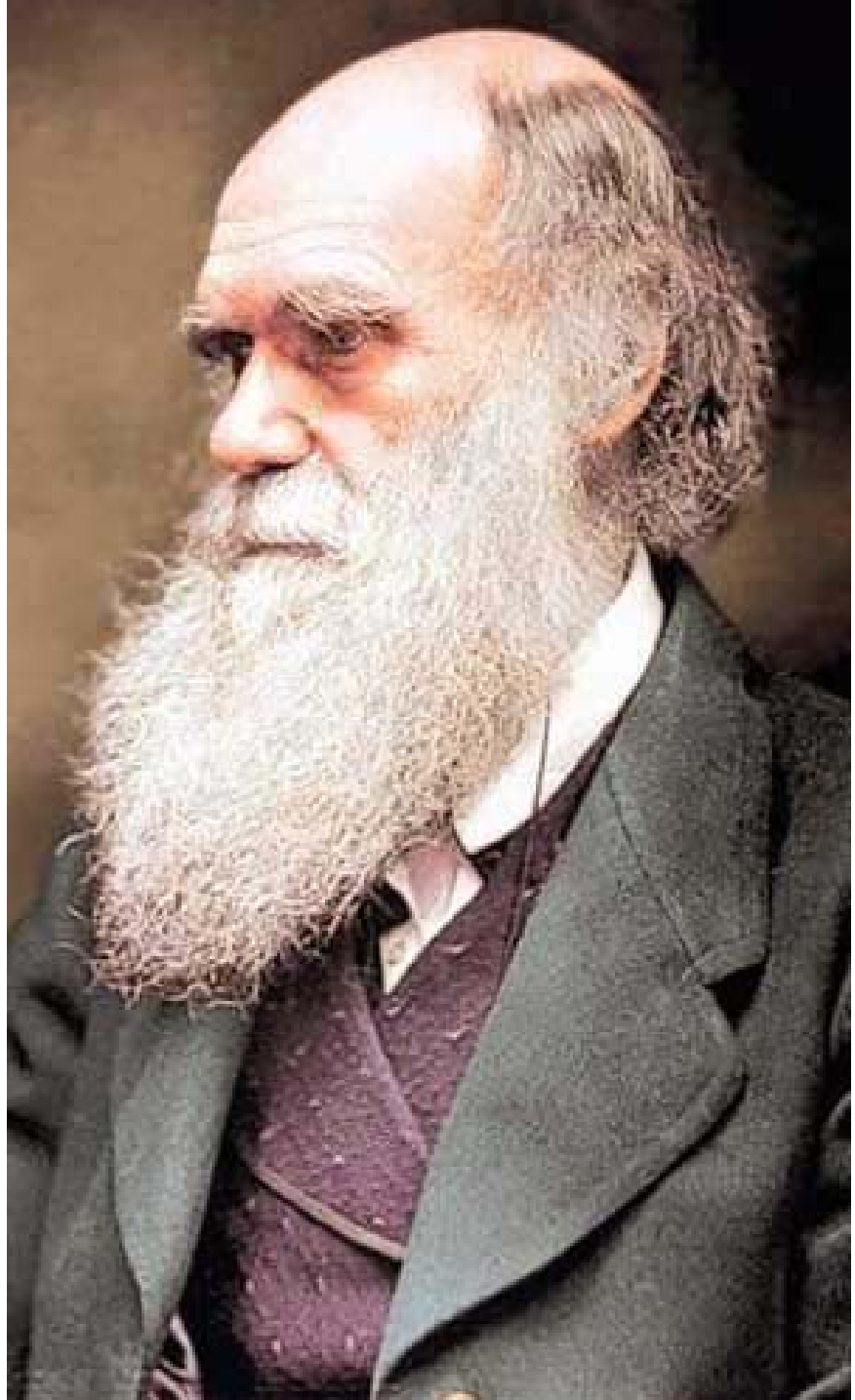


Jean-Baptiste de Lamarck
1744 - 1829

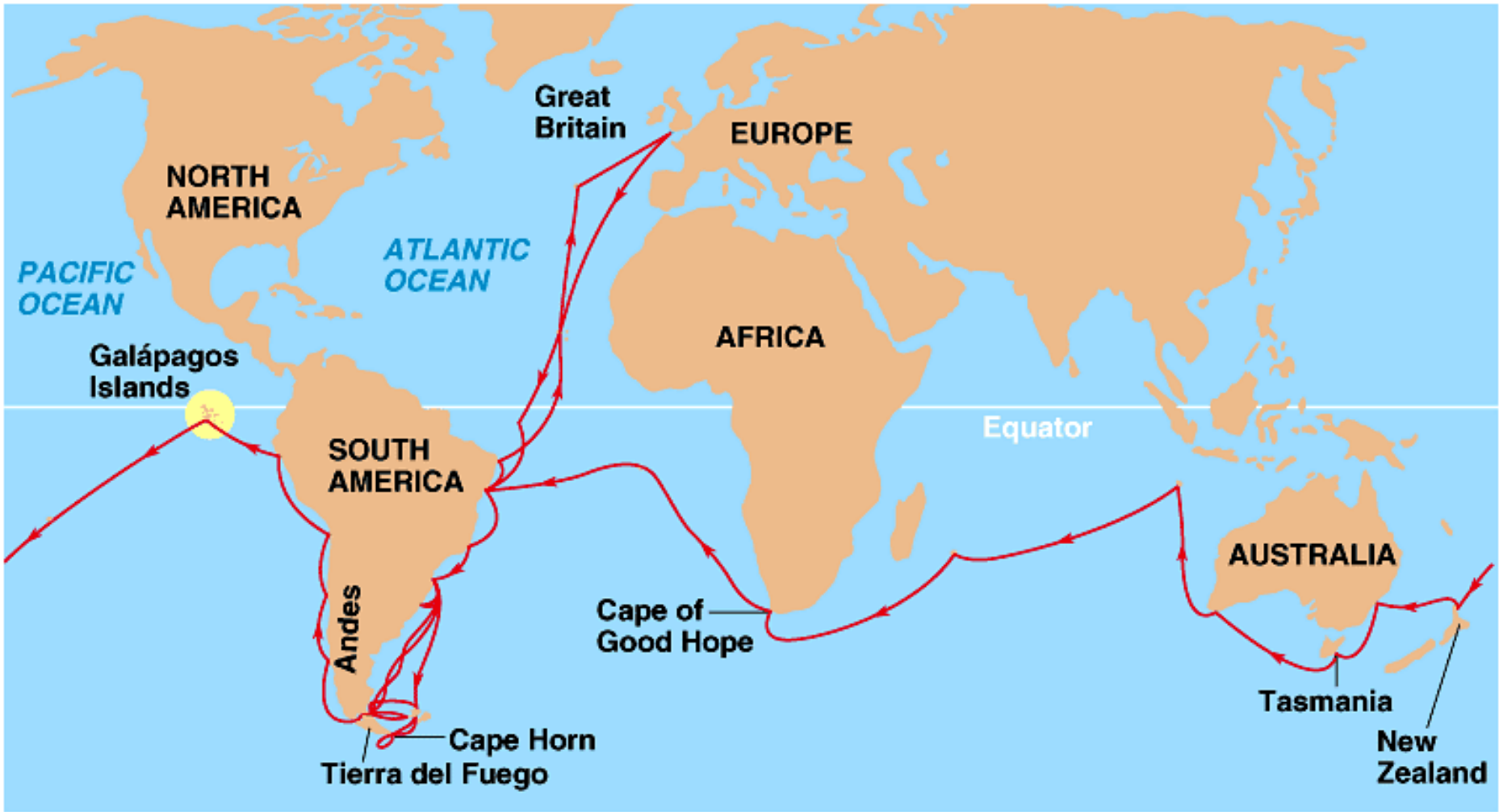
. . . *time* and *favorable conditions* are the two principal means which nature has employed in giving existence to all her productions. We know that for her time has no limit, and that consequently she always has it at her disposal.



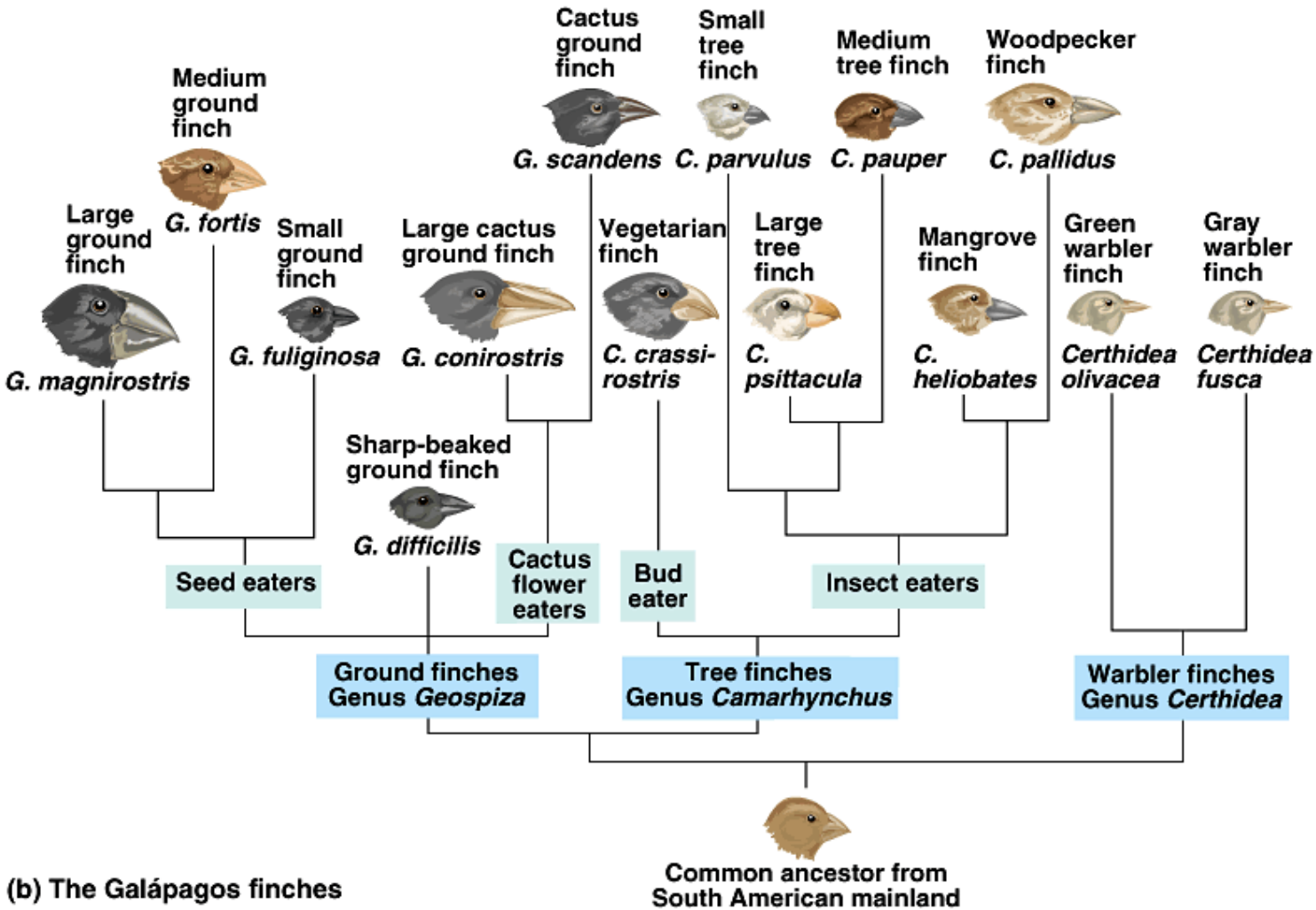
Charles Darwin
1809-1882



Voyage of the HMS Beagle



Finches of the Galapagos Islands

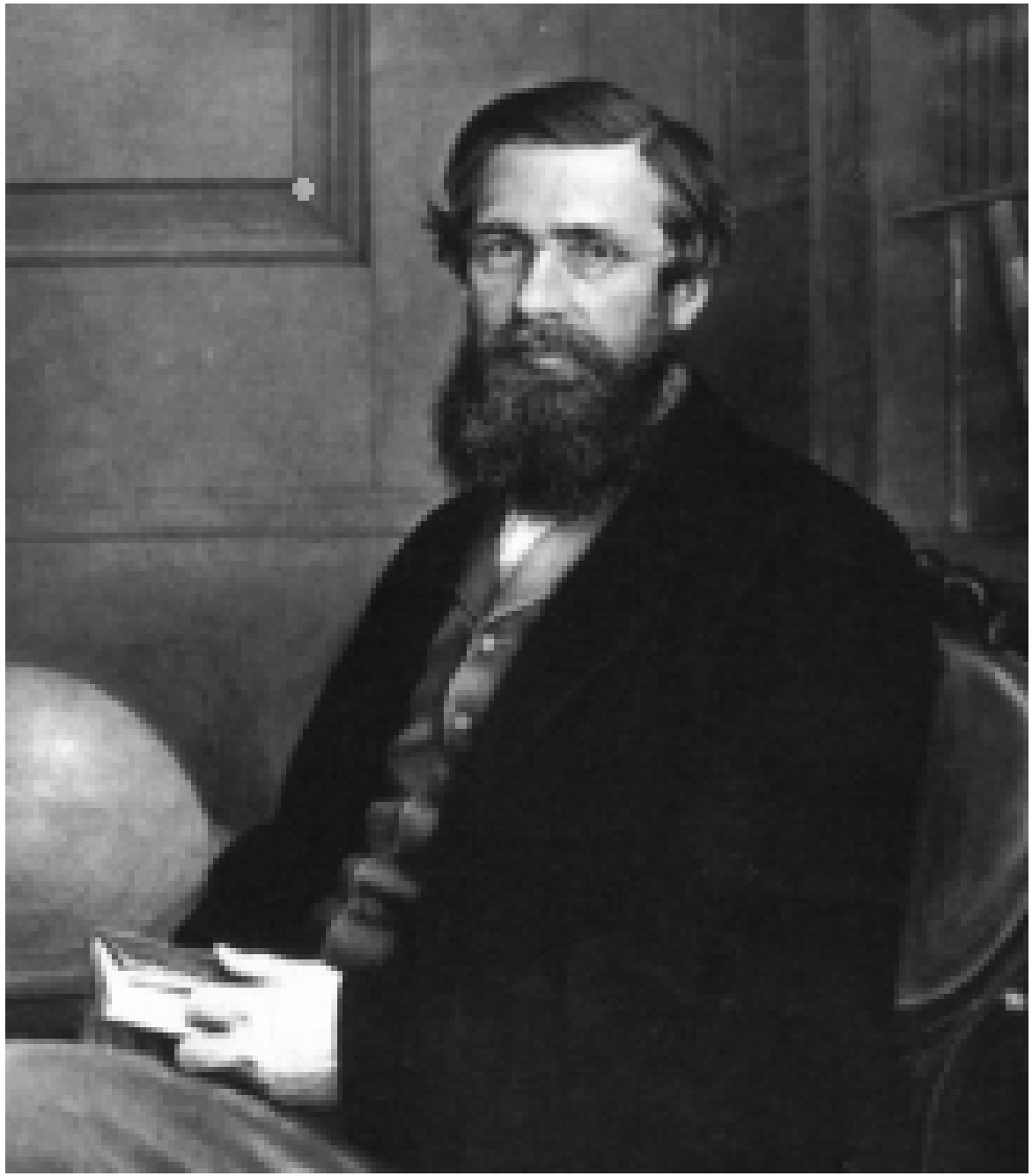


(b) The Galápagos finches

Thomas Malthus
1766 - 1834

Populations can increase faster than their resources

Alfred R. Wallace
1823 - 1913



ON

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.

By CHARLES DARWIN, M.A.,

FELLOW OF THE ROYAL, GEOLOGICAL, LINNÆAN, ETC., SOCIETIES;

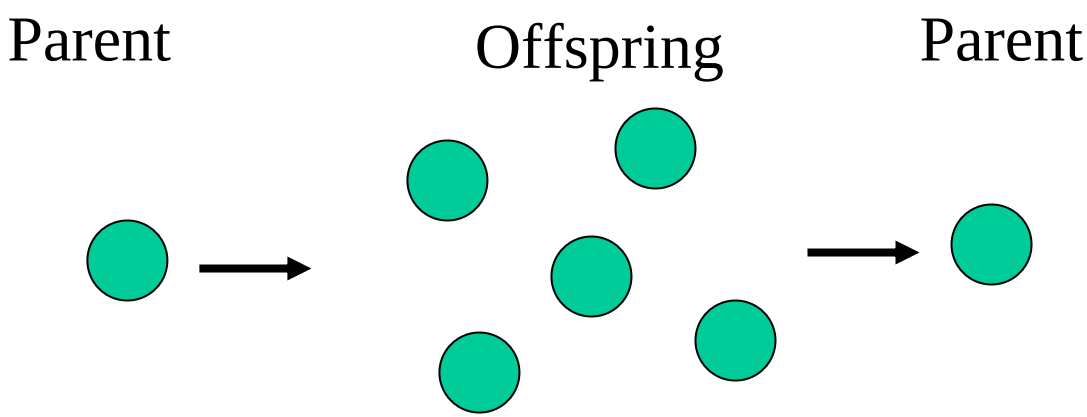
AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE ROUND THE WORLD.'

LONDON:

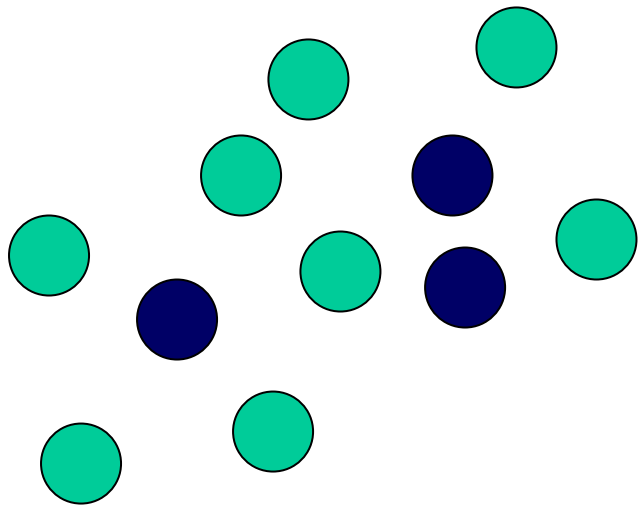
JOHN MURRAY, ALBEMARLE STREET.

1859.

More offspring are born than can survive to reproduce

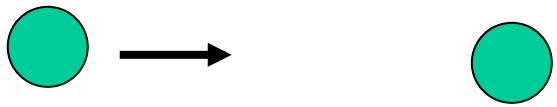


Individuals within a species vary



Traits are heritable

Parent Offspring

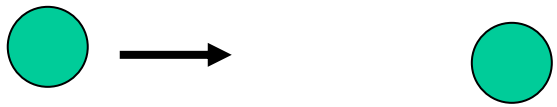


Parent Offspring

Individuals with some traits reproduce more than others

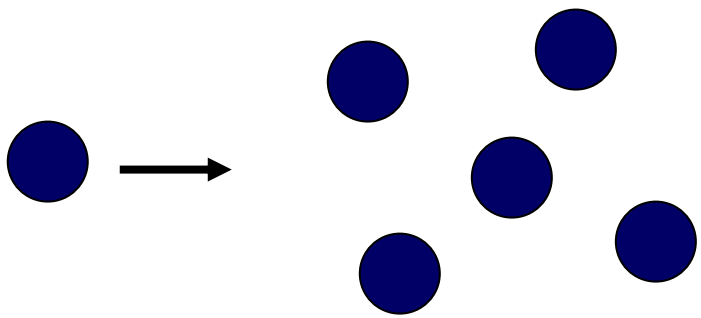
Parent

Offspring

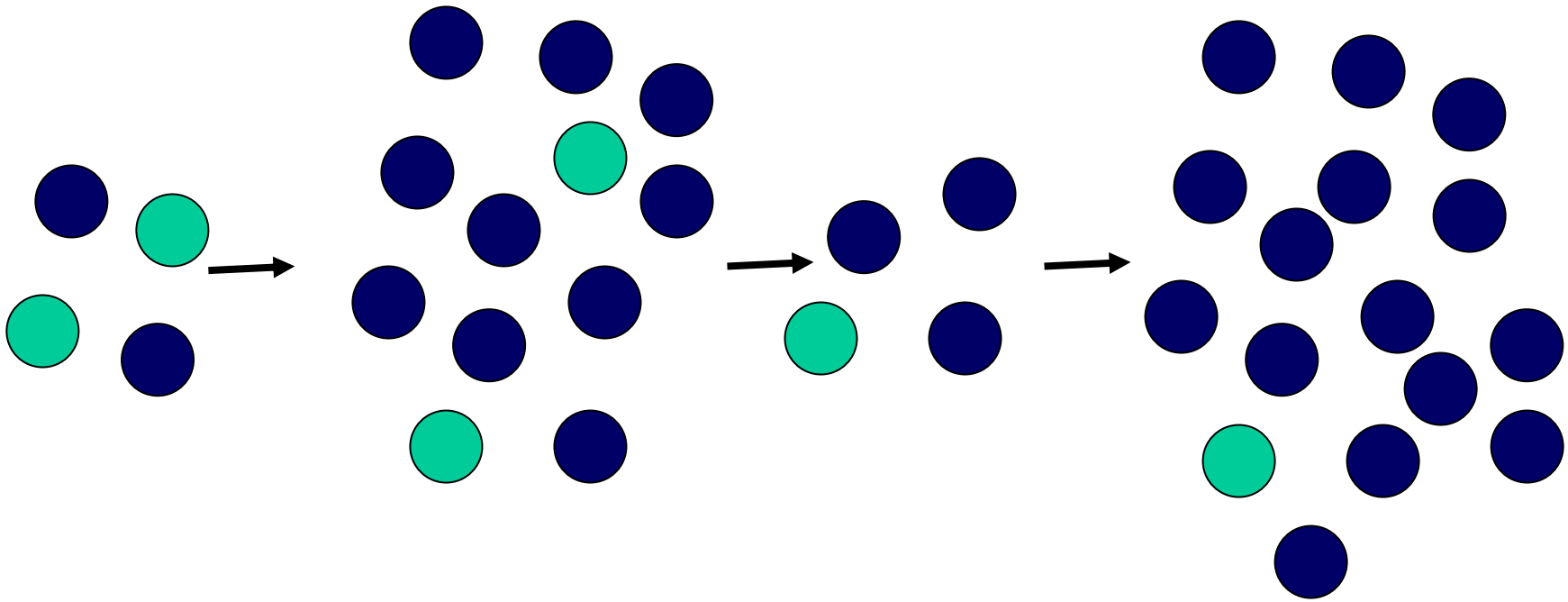


Parent

Offspring



Traits that enhance reproduction become more common each generation



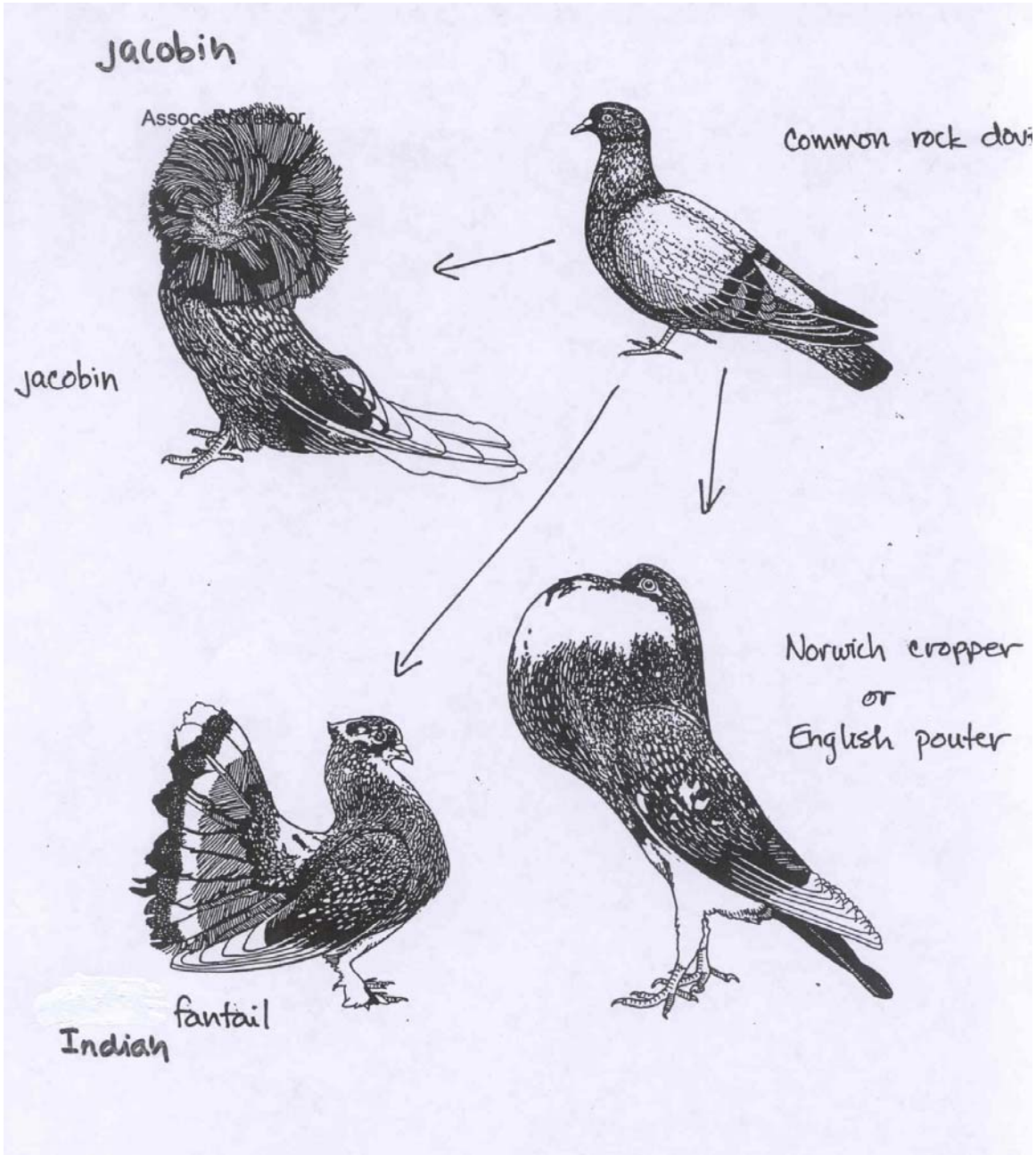
parents generation 1

offspring generation 1

parents generation 2

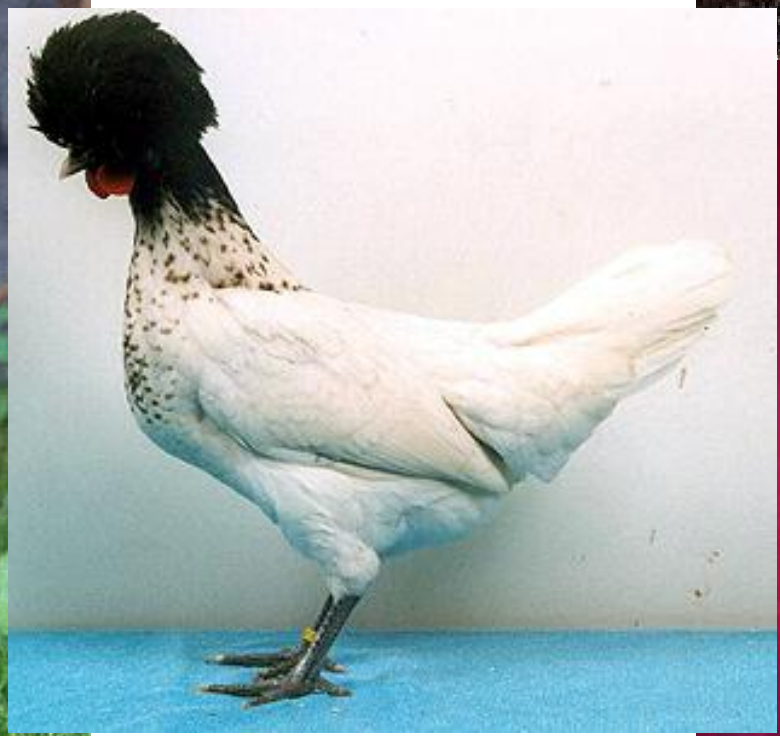
offspring generation 2

Artificial selection has produced different, true-breeding varieties of “fancy” pigeons from a single ancestral form





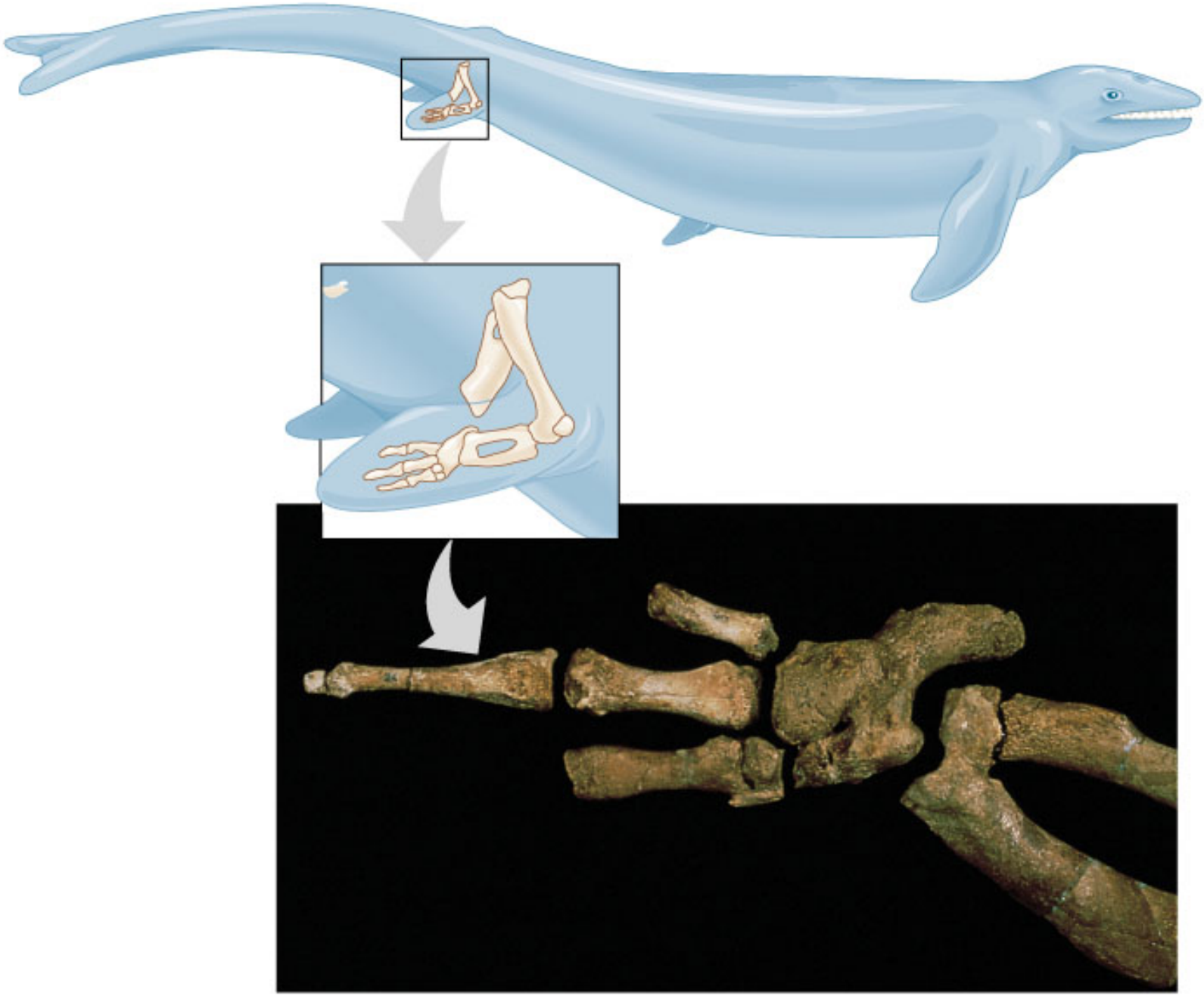


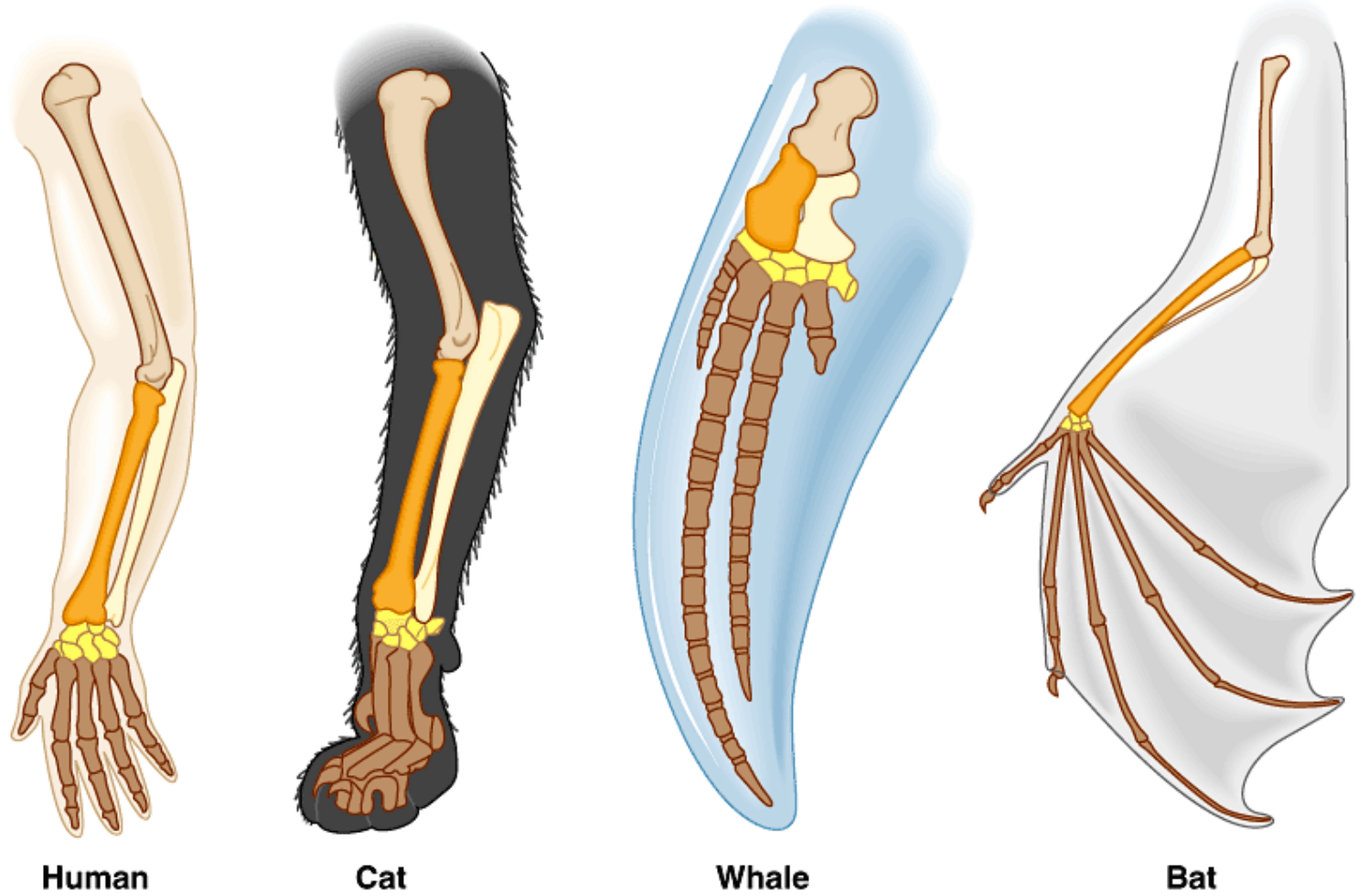

Fossils - preserved evidence of previously living things

Fig 22.17

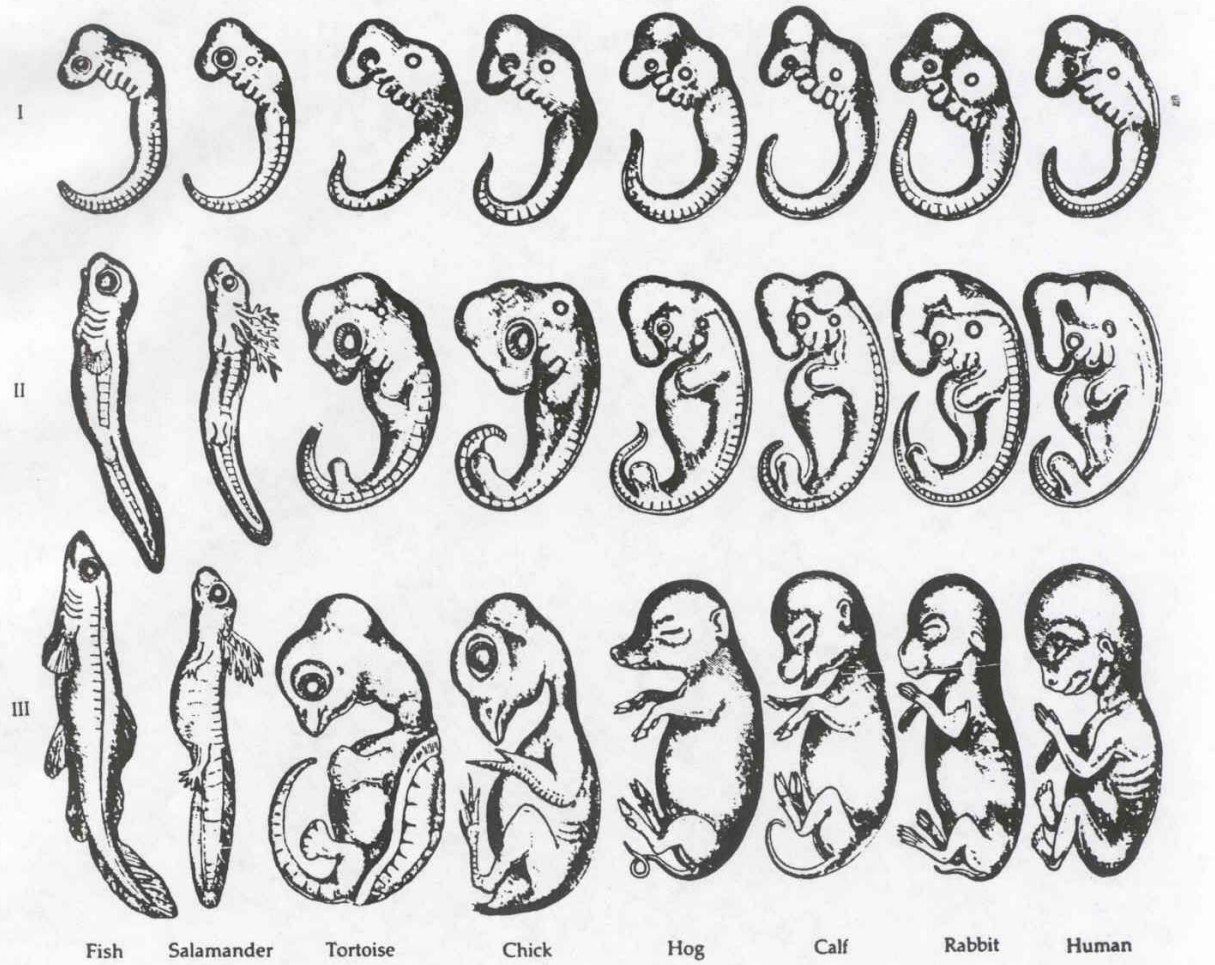
A fossil whale with hind legs



Homology - similarity caused by common ancestry



Evidence for evolution from comparative embryology



Early embryos of diverse groups share many features. As development proceeds, embryonic forms diverge and become more similar to adults of their own species (von Baer's law)

Table 22.1 Molecular Data and the Evolutionary Relationships of Vertebrates

Species	Number of Amino Acids That Differ from a Human Hemoglobin Polypeptide (Total Chain Length = 146 Amino Acids)
Human 	0
Rhesus monkey 	8
Mouse 	27
Chicken 	45
Frog 	67
Lamprey 	125