SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

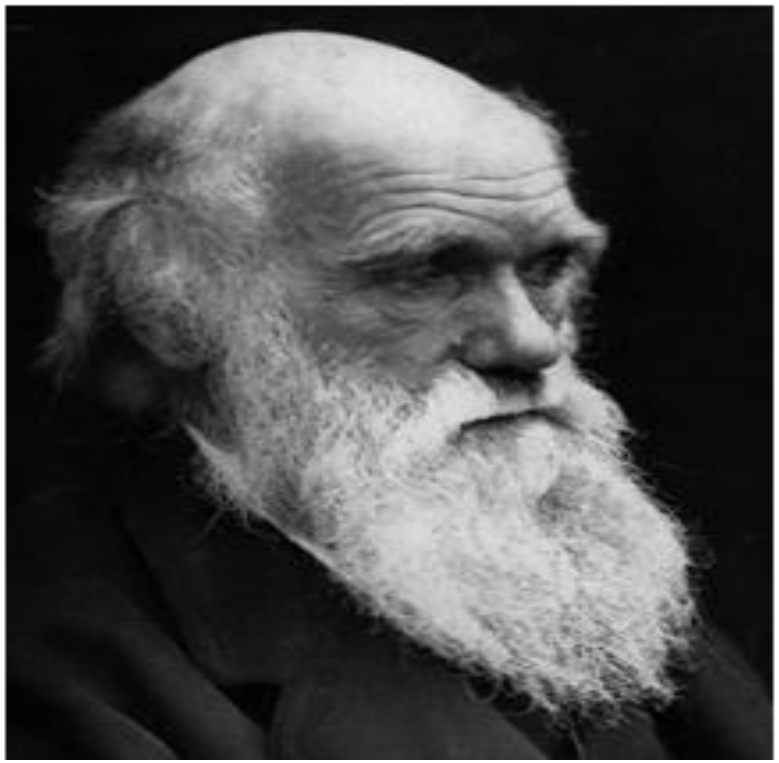
19GET277 / Biology For Engineers

IV YEAR / VII SEMESTER

UNIT-III: GENETICS AND IMMUNE SYSTEM

EVOLUTION: THEORIES OF EVOLUTION

Charles Darwin



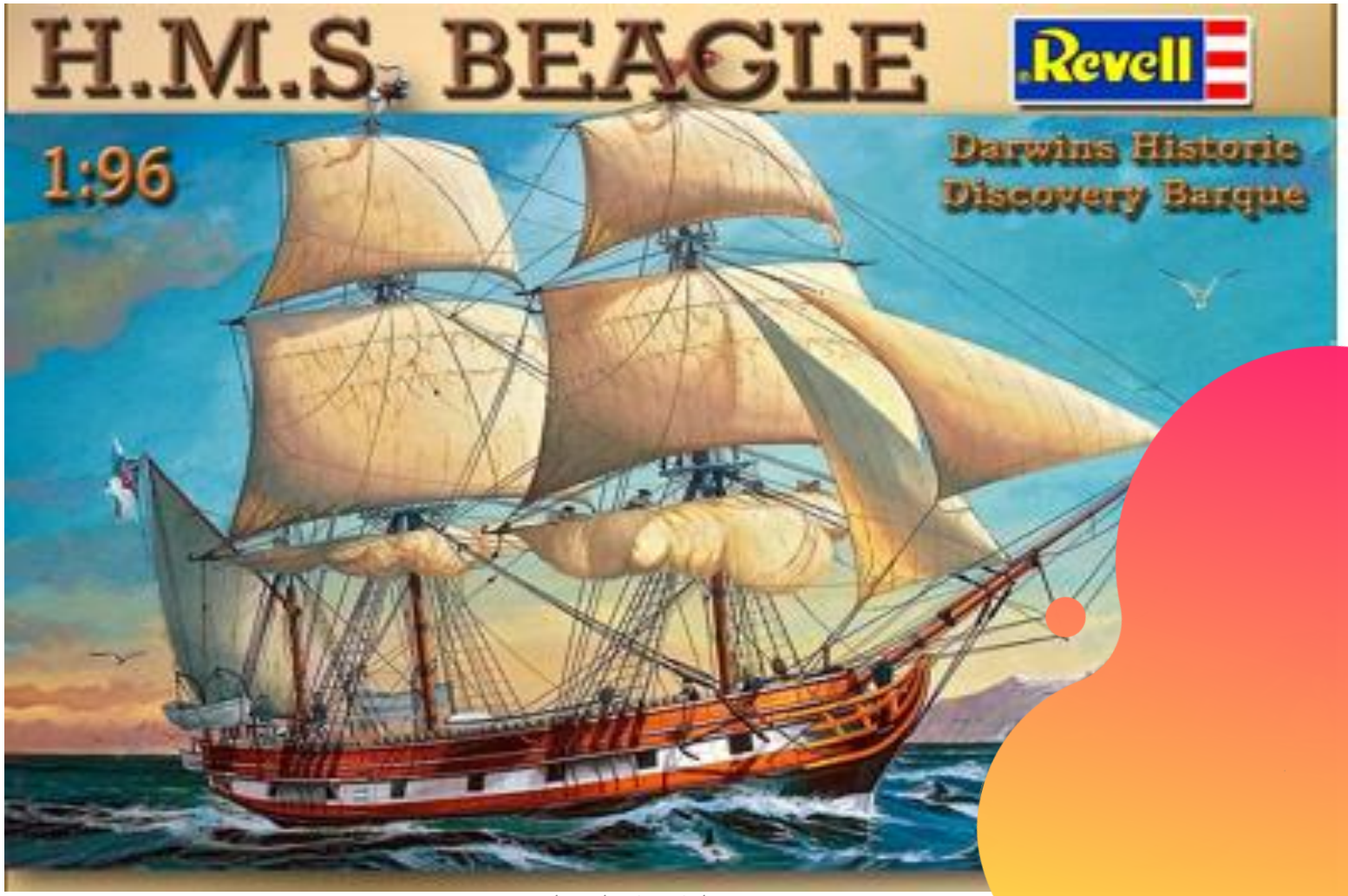
Darwin's Theory of Evolution

- **Evolution**, or change over time, is the process by which modern organisms have descended from ancient organisms.

- A scientific **theory** is a well-supported testable explanation of phenomena that have occurred in the natural world.

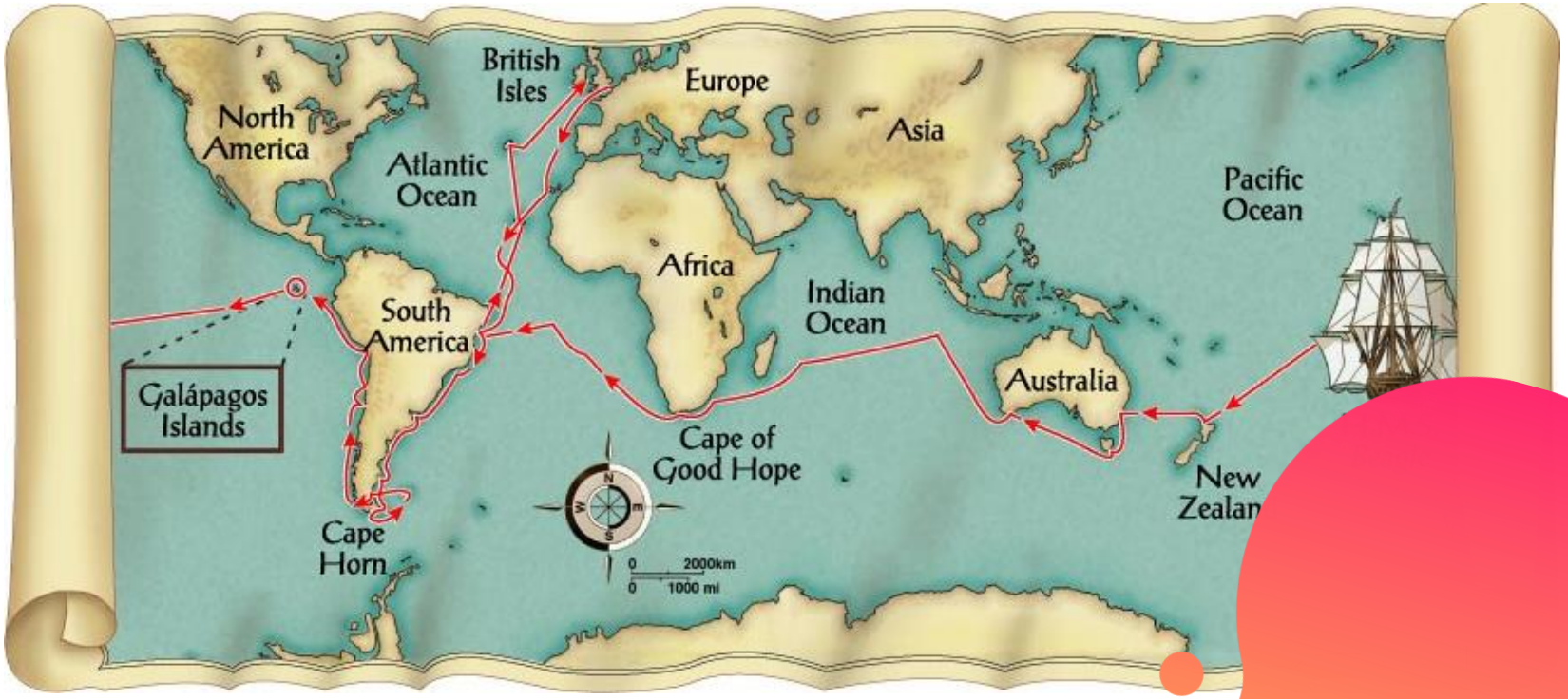
How do you think Darwin came up with his theory?

oyage of the Beagle



oyage of Beagle

- **Dates:** February 12th, 1831
- **Captain:** Charles Darwin
- **Ship**: H.M.S. Beagle
- **Destination:** Voyage around the world.
- **Findings:** evidence to propose a revolutionary hypothesis about h
  life changes over time


British Isles
Europe
North America
Asia
Atlantic Ocean
Pacific Ocean
Africa
Indian Ocean
South America
Galápagos Islands
Australia
Cape of Good Hope
New Zealan
Cape Horn
0 2000km
0 1000 mi

Patterns of Diversity

- Darwin visited Argentina and Australia which had similar grassland ecosystems.
  - those grasslands were inhabited by very different animals.
  - neither Argentina nor Australia was home to the sorts of animals that lived in European grasslands.

Patterns of Diversity

- Darwin posed challenging questions.
  - Why were there no rabbits in Australia, despite the presence of habitats that seemed perfect for them?
  - Why were there no kangaroos in England?

..ving Organisms and Fossils

- Darwin collected the preserved remains of ancient organisms, called **fossils**.

- Some of those fossils resembled organisms that were still alive today.

..ving Organisms and Fossils

- Others looked completely unlike any creature he had ever seen.

- As Darwin studied fossils, new questions arose.
  - Why had so many of these species disappea
  - How were they related to living species?

Fossils

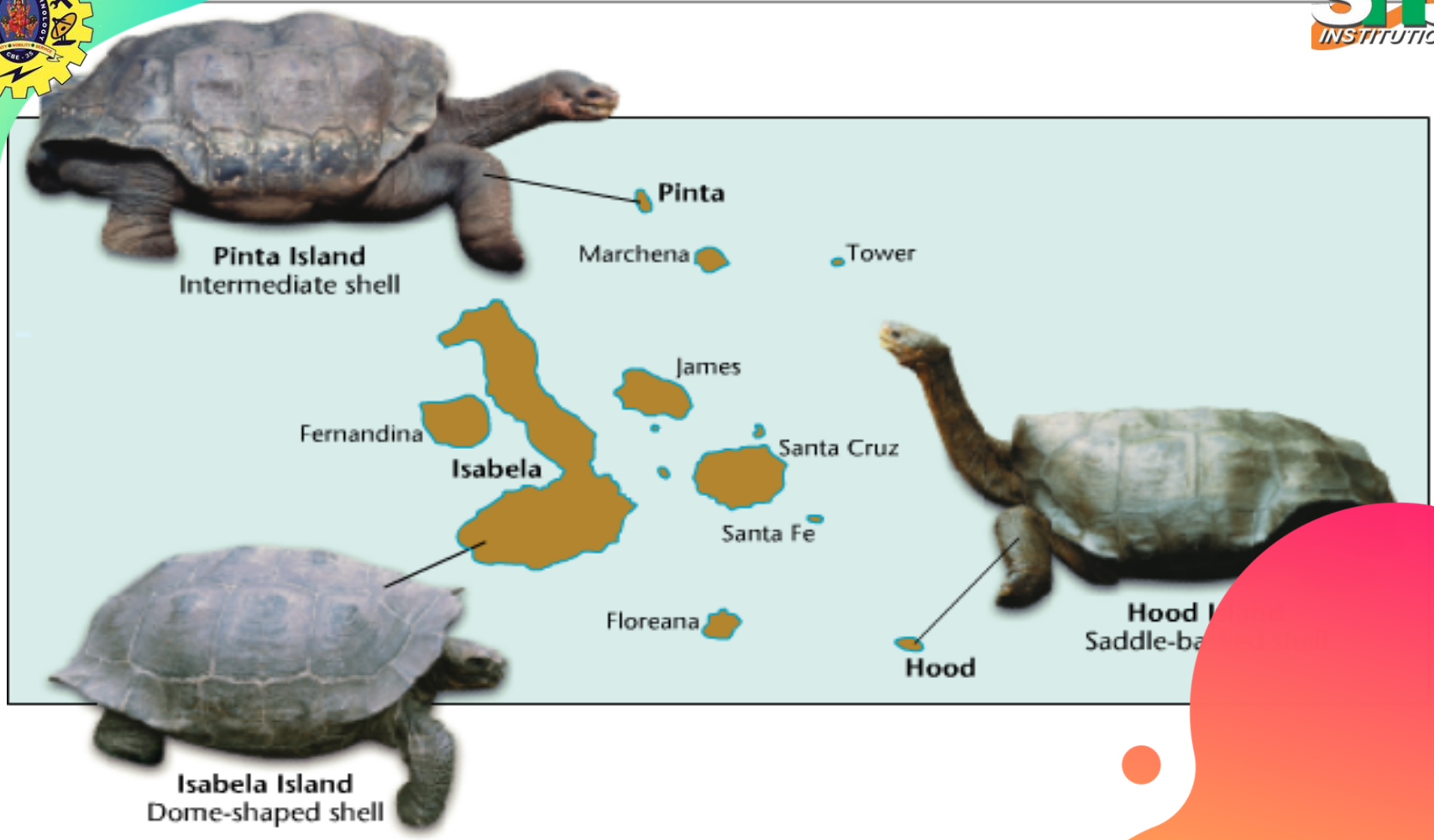
The Galapagos Island

- The smallest, lowest islands were hot, dry, and nearly barren-Hood Island-sparse vegetation

- The higher islands had greater rainfall and a different assortment of plants and animals-Isabela- Island had rich vegetation.

The Galapagos Island

- Darwin was fascinated in particular by the land tortoises and marine iguanas in the Galápagos.
- Giant tortoises varied in predictable ways from one island to another.
- The shape of a tortoise's shell could be used to identify which island a particular tortoise inhabited.



Variation Among Tortoises Darwin observed that the characteristics of many a
among the different Galápagos Islands. Among the tortoises, the shape of the shell corresponds t
ortoise (right) has a long neck and a shell that is curved and open around the neck and legs, allo
egetation on Hood Island. The tortoise from Isabela Island (lower left) has a dome-shaped shell
sland is more abundant and closer to the ground. The tortoise from Pinta Island has a shell that i

nimals found in the Galapagos

- Land Tortoises
- Darwin Finches
- Blue-Footed Booby
- Marine Iguanas

Animals

The Journey Home

- Darwin Observed that characteristics of many plants and animals vary greatly among the islands

- **Hypothesis:** Separate species may have arose from an original ancestor

Ideas that shaped Darwin's Thinking

- **James Hutton:**
- 1795 Theory of Geological change
  - Forces change earth's surface shape
  - Changes are slow
  - Earth much older than thousands of years

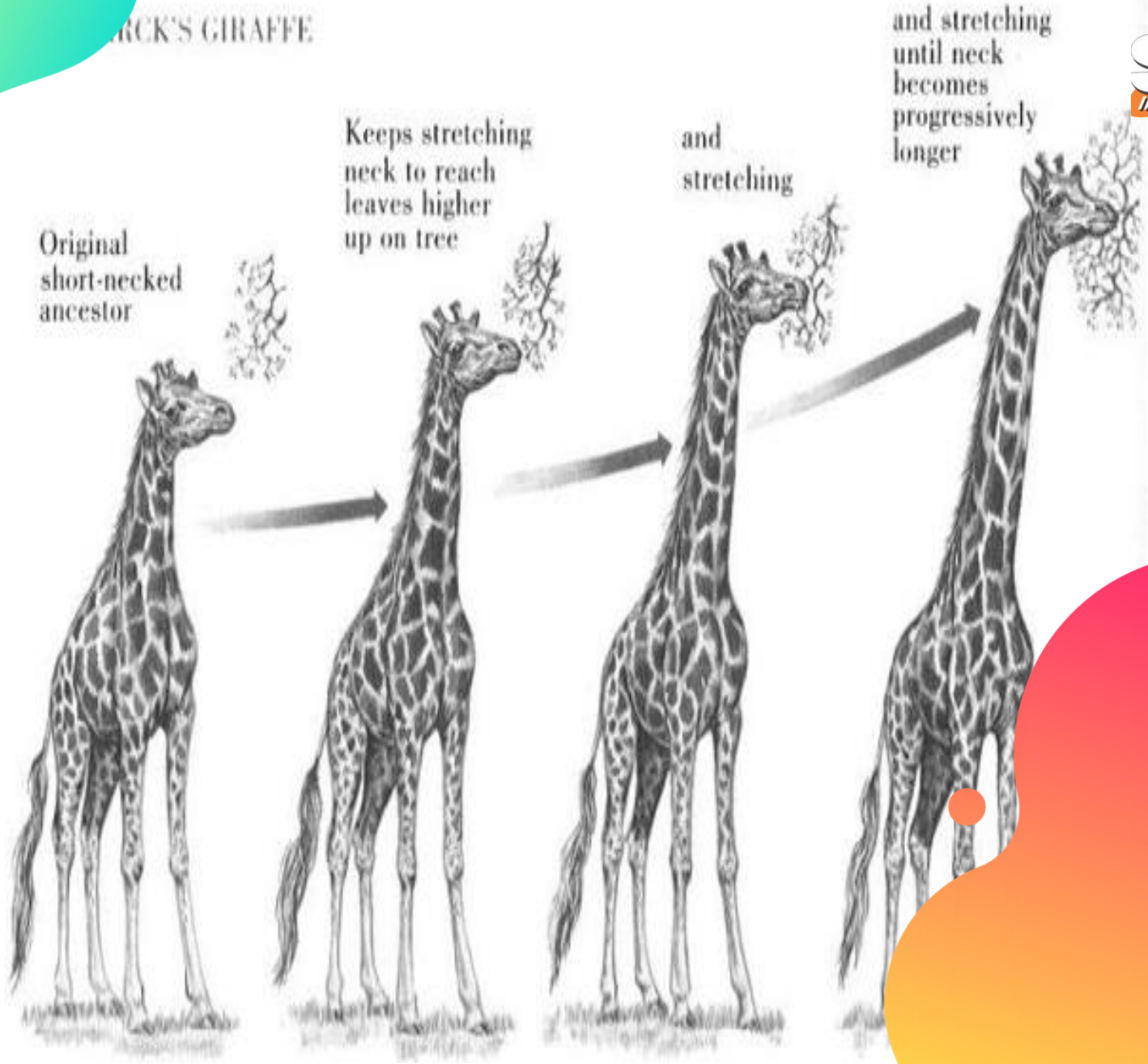
Ideas that Shaped Darwin's Thinking

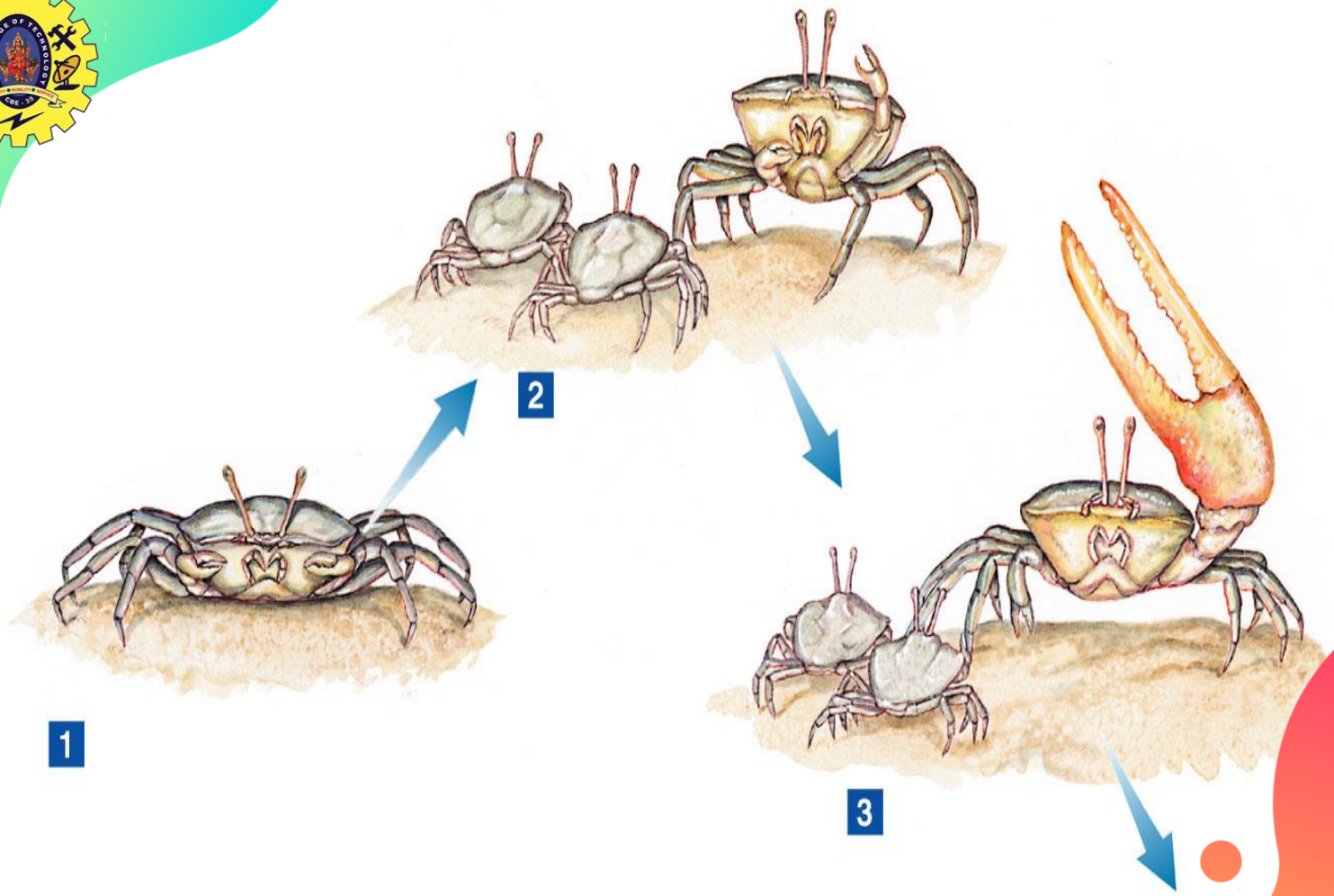
- **Charles Lyell**
  - Book: *Principles of Geography*
  - Geographical features can be built up or torn down
  - Darwin thought if earth changed over time, what about life?

Lamarck

Lamarck's Theory of Evolution

- Tendency toward Perfection(Giraffe necks)
- Use and Disuse (bird's using forearms)
- Inheritance of Acquired Traits


RCK'S GIRAFFE
Original short-necked ancestor
Keeps stretching neck to reach leaves higher up on tree
and stretching
and stretching until neck becomes progressively longer


1
2
3

Population Growth

- **Thomas Malthus**-19th century English economist
- If population grew (more Babies born than die)
  - Insufficient living space
  - Food runs out
  - Darwin applied this theory to animals

Publication of Orgin of Species

- Russel Wallace wrote an essay summarizing evolutionary change from his field work in Malaysia

- Gave Darwin the drive to publish his findings

Natural Selection & Artificial Selection

- **Natural variation**--differences among individuals of a species
- **Artificial selection**- nature provides the variation among different organisms, and humans select those variations they find useful.

Evolution by Natural Selection

- **The Struggle for Existence**-members of each species have to compete for food, shelter, other life necessities

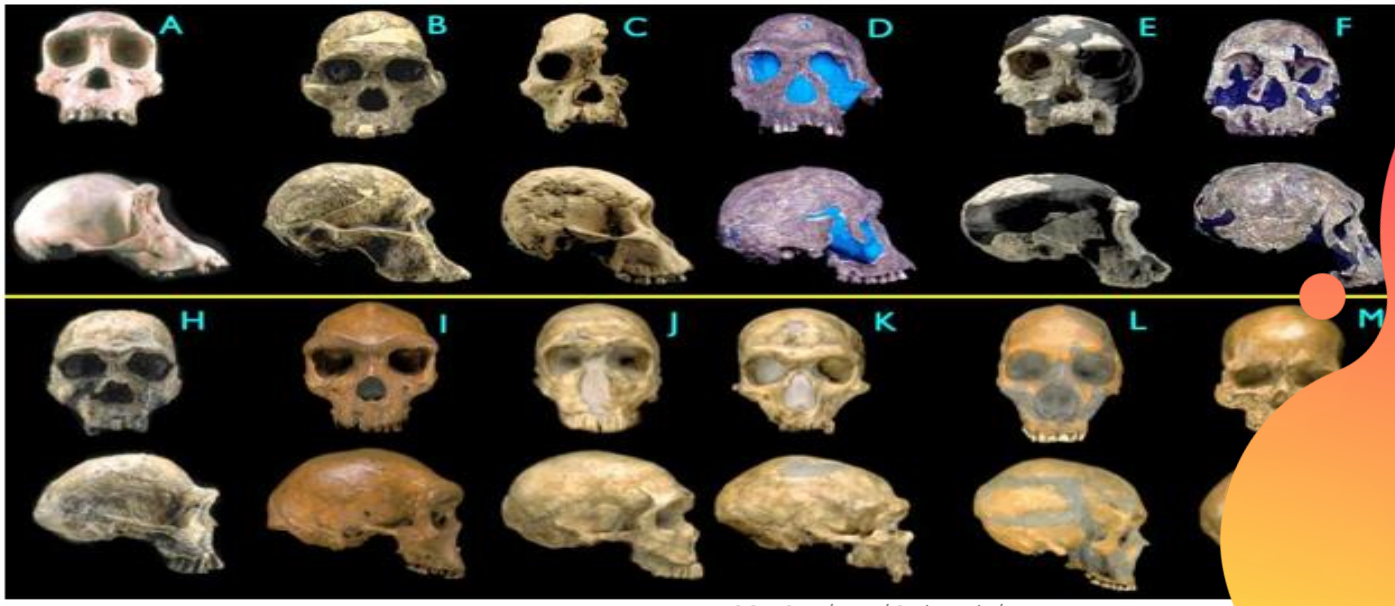
- **Survival of the Fittest**-Some individuals better suited for the environment

Natural Selection

- Over time, natural selection results in changes in inherited characteristics of a population. These changes increase a species fitness in its environment

Descent

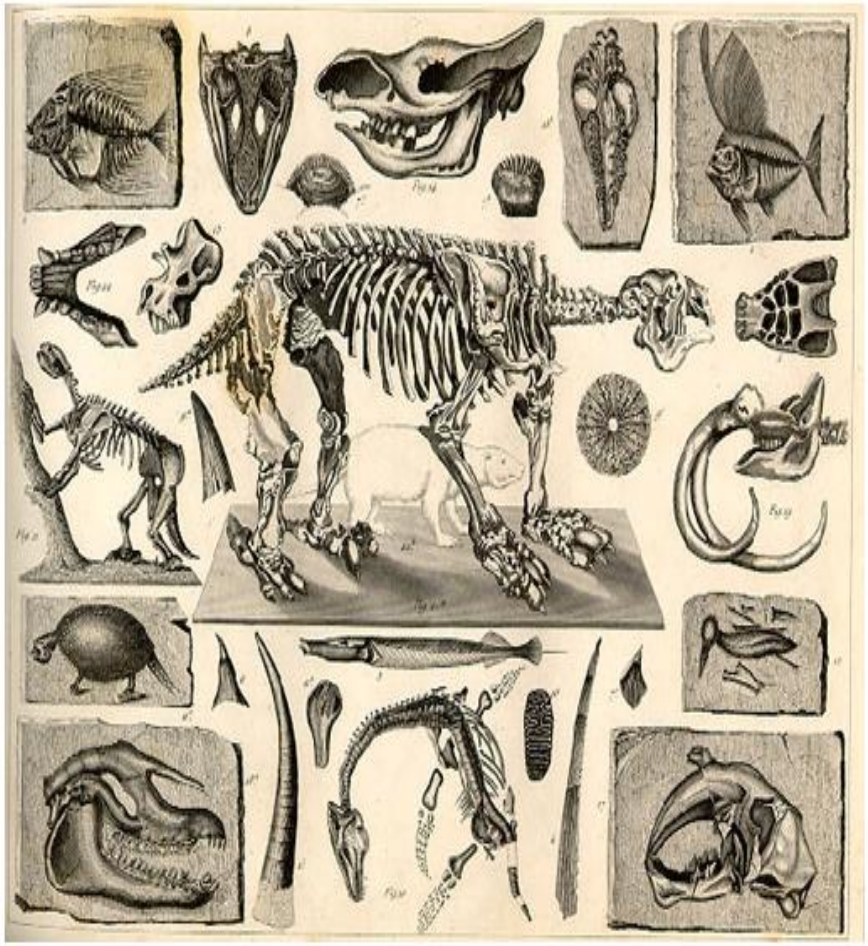
- **Descent with Modification**-Each living organism has descended, with changes from other species over time
- **Common Descent**- were derived from common ancestors



Evidence of Evolution

- **The Fossil Record**
- **Geographic Distribution of Living Things**
- **Homologous Body Structures**
- **Similarities in Early Development**

Evidence for Evolution



- **The Fossil Record**-Layer show change
- Geographic Distribution of Living Things
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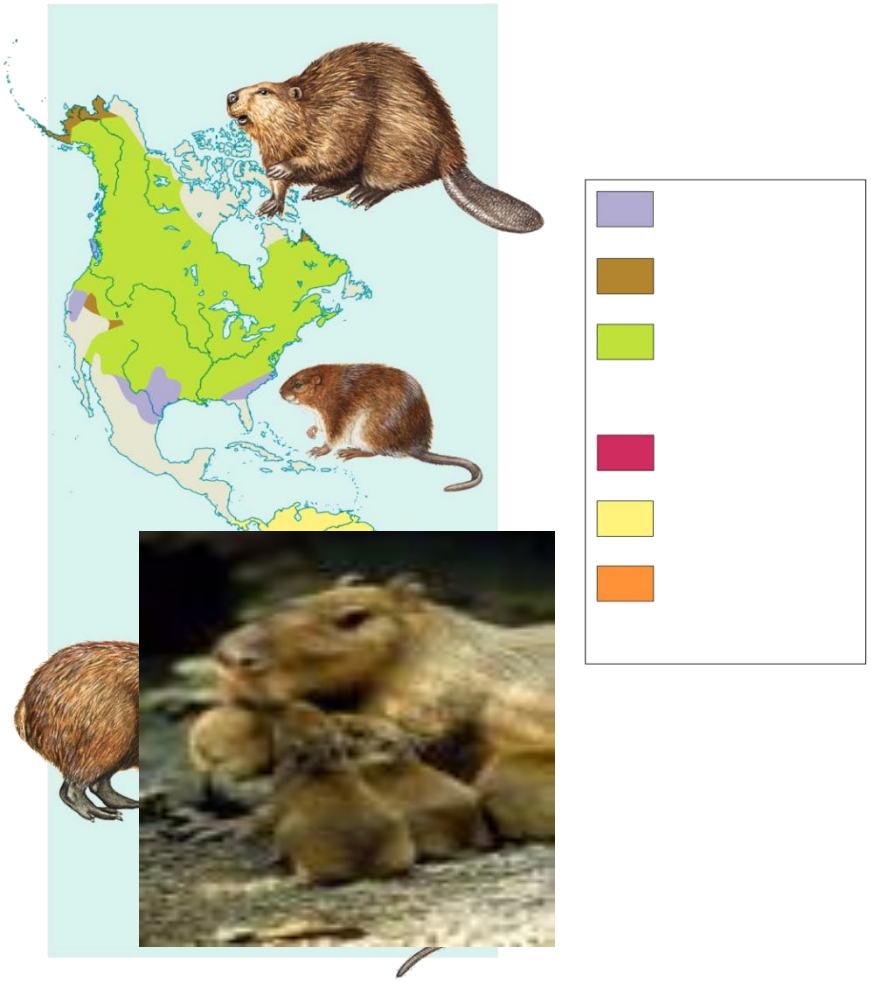
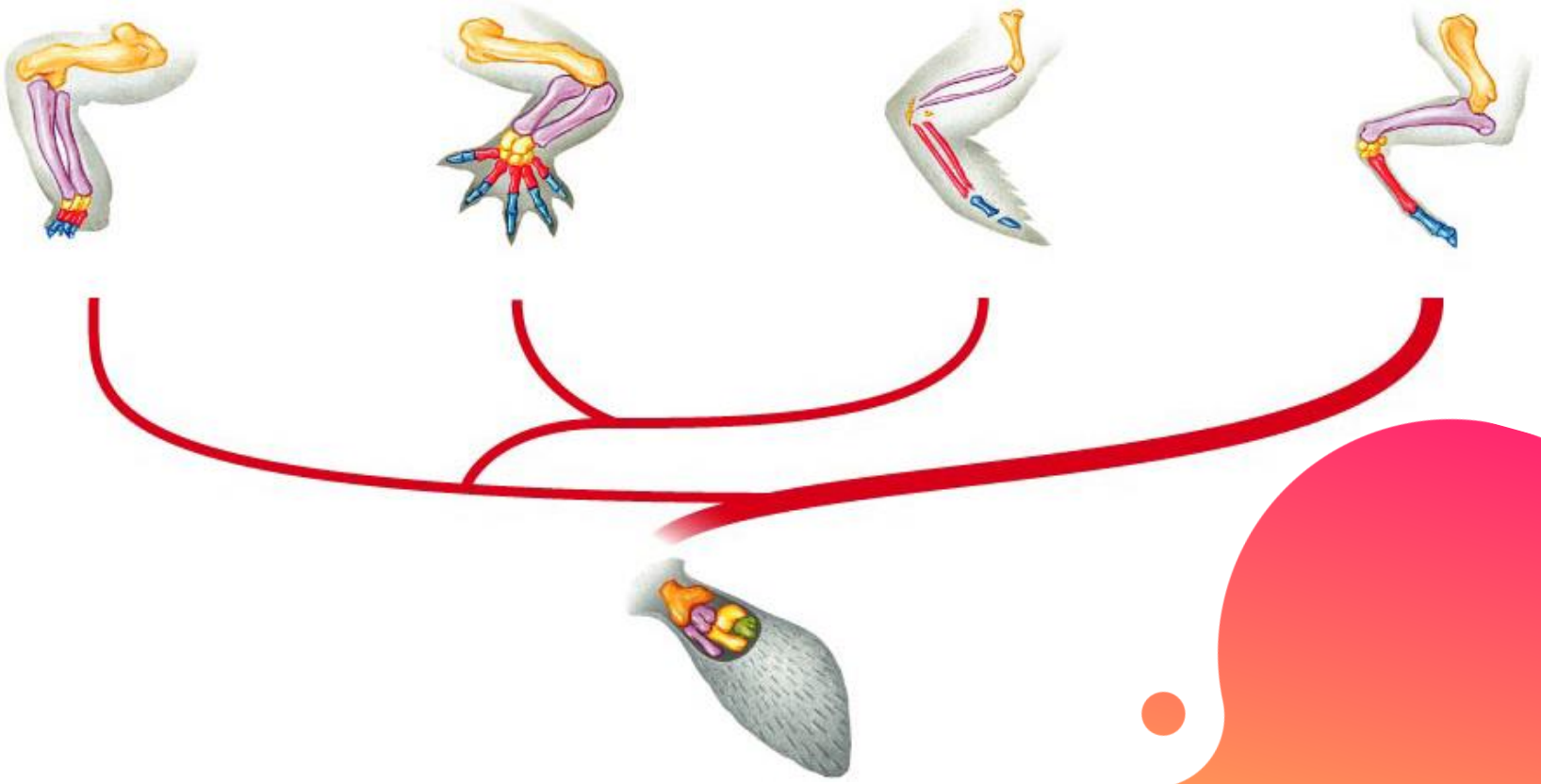
Evidence of Evolution



- The Fossil Record
- **Geographic Distribution of Living Things-**similar environments hav similar types of organisms
- Homologous Structures
- Similariti Develop

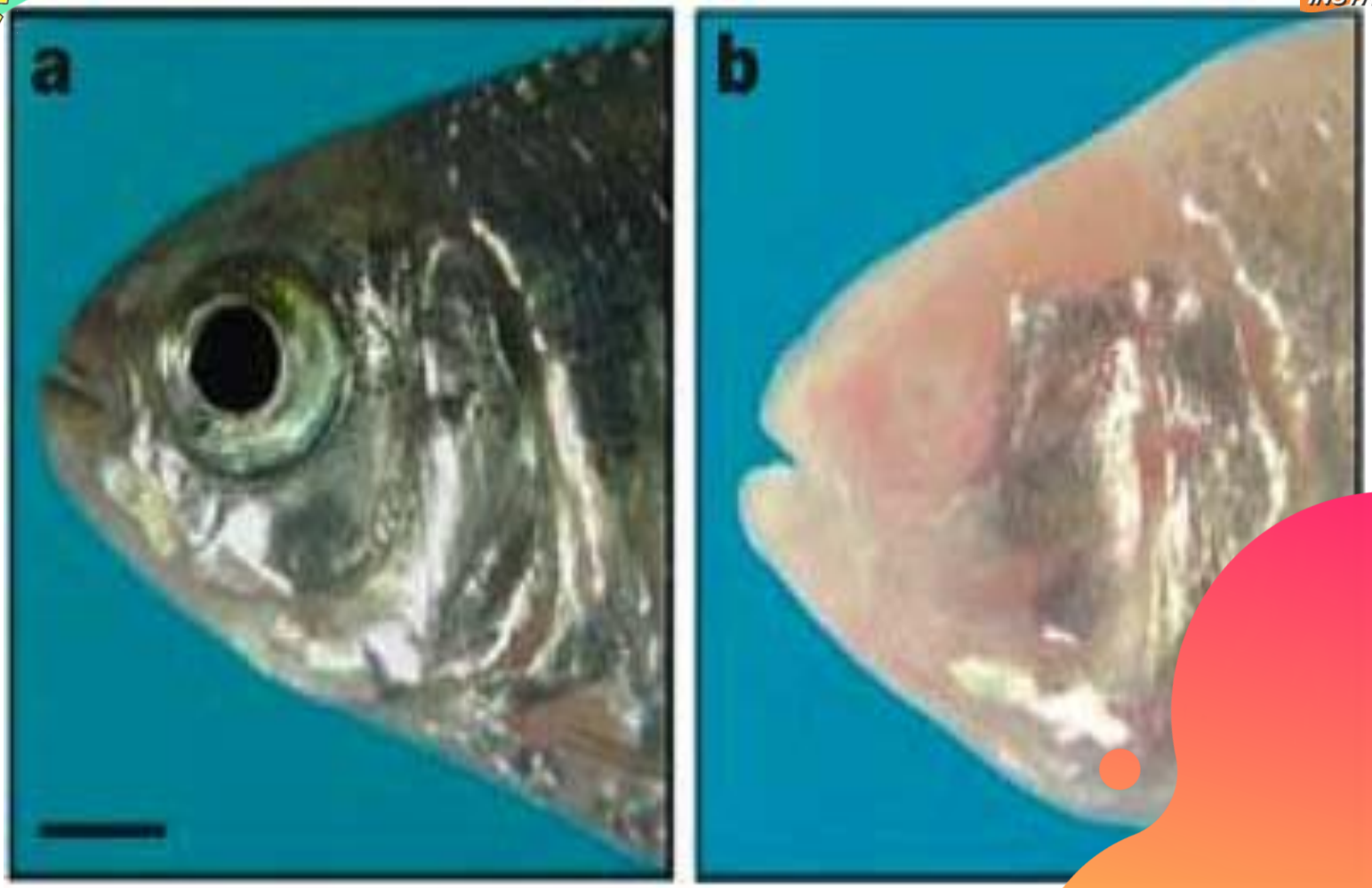
Homologous Structures

- **Homologous Structures**-structures that have different mature forms in different organisms, but develop from the same embryonic tissue



Evidence for Evolution

- **Vestigial organs**-organs that serve no useful function in an organism
- i.e.) appendix, miniature legs, arms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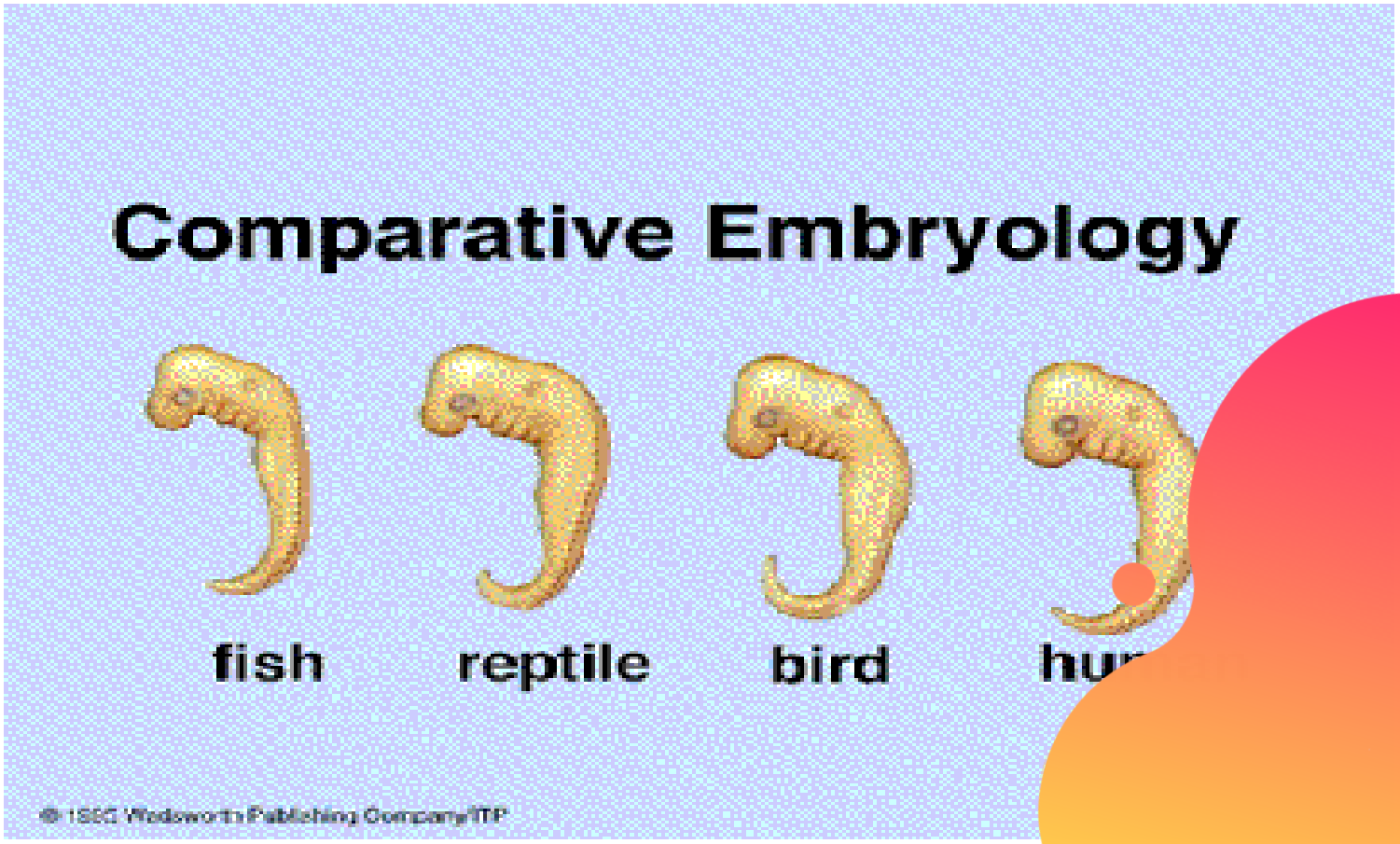
Similarities in Early Development



Summary of Darwin's Theory

- Individuals in nature differ from one another
- Organisms in nature produce more offspring than can survive, and many of those who do not survive do not reproduce.

Summary of Darwin's Theory

- Because more organisms are produce than can survive, each species must struggle for resources

- Each organism is unique, each has advantages and disadvantages in the struggle for existence

Summary (cont.)

- Individuals best suited for the environment survive and reproduce most successful
- Species change over time

Summary (cont.)

- Species alive today descended with modification from species that lived in the past
- All organisms on earth are united into a single family tree of life by common descent

Mesonychid

Ambulocetus

Rodhocetus

Basilosaurus