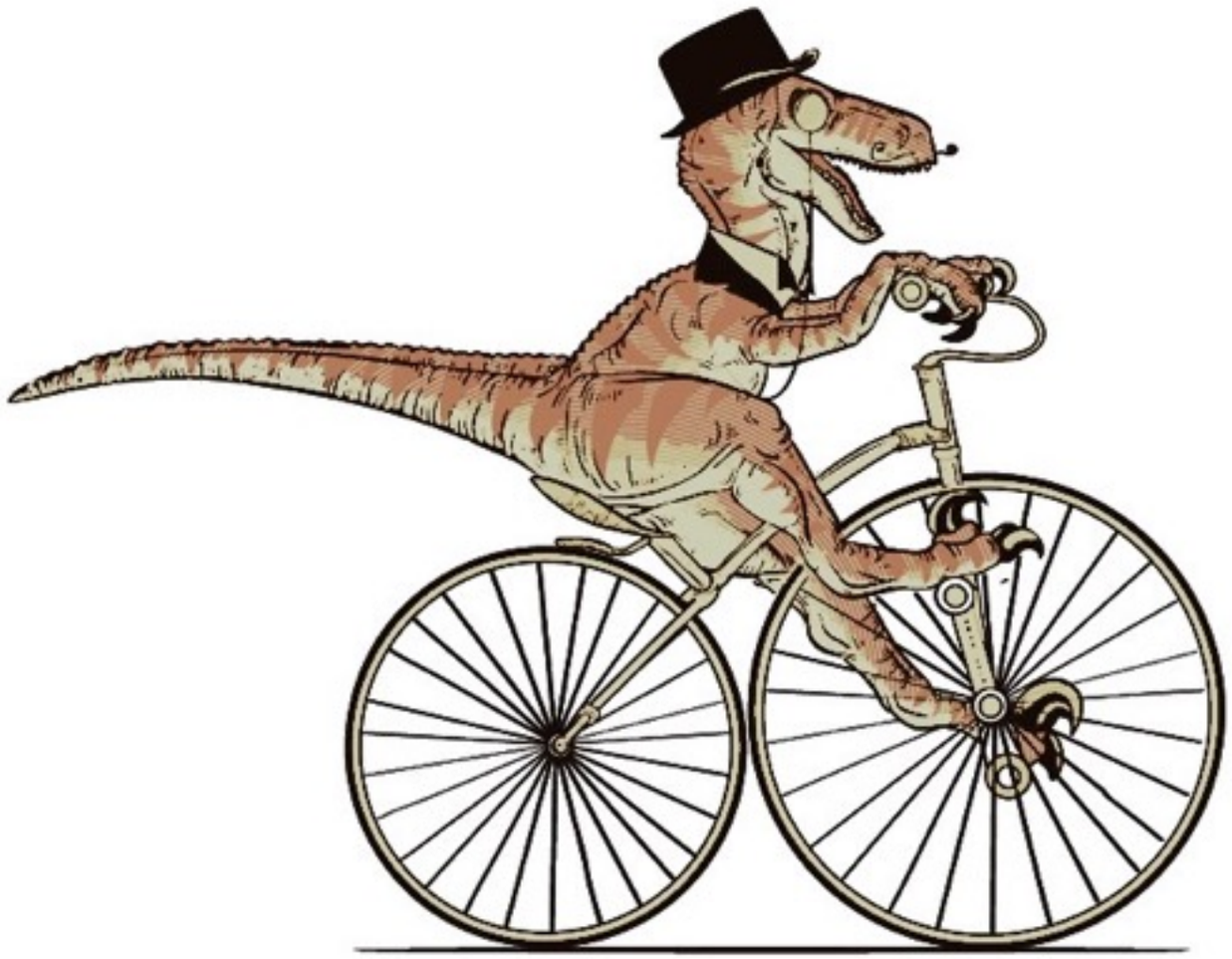
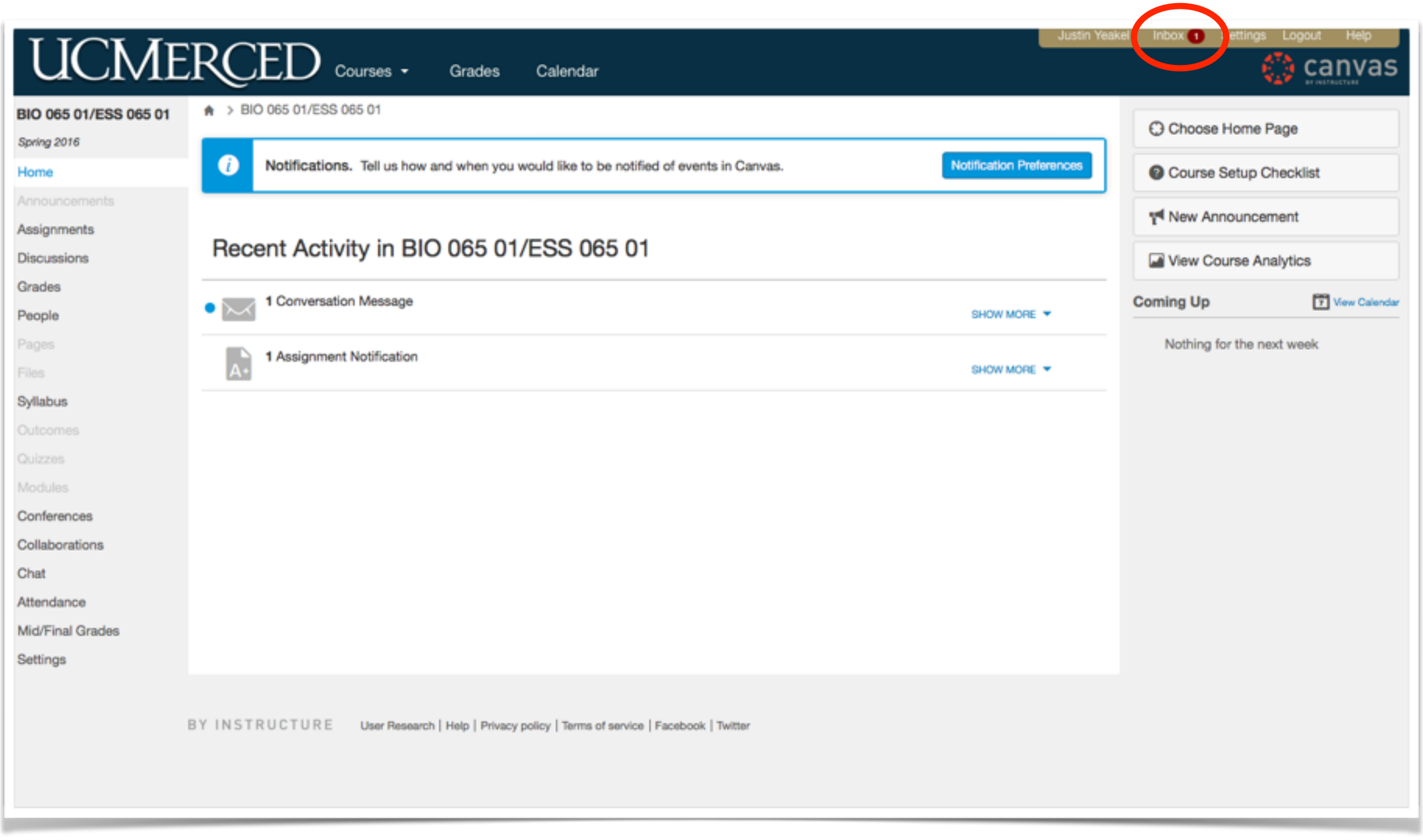
http://jdyeakel.github.io/teaching/dinos/



How to contact me



Important information:

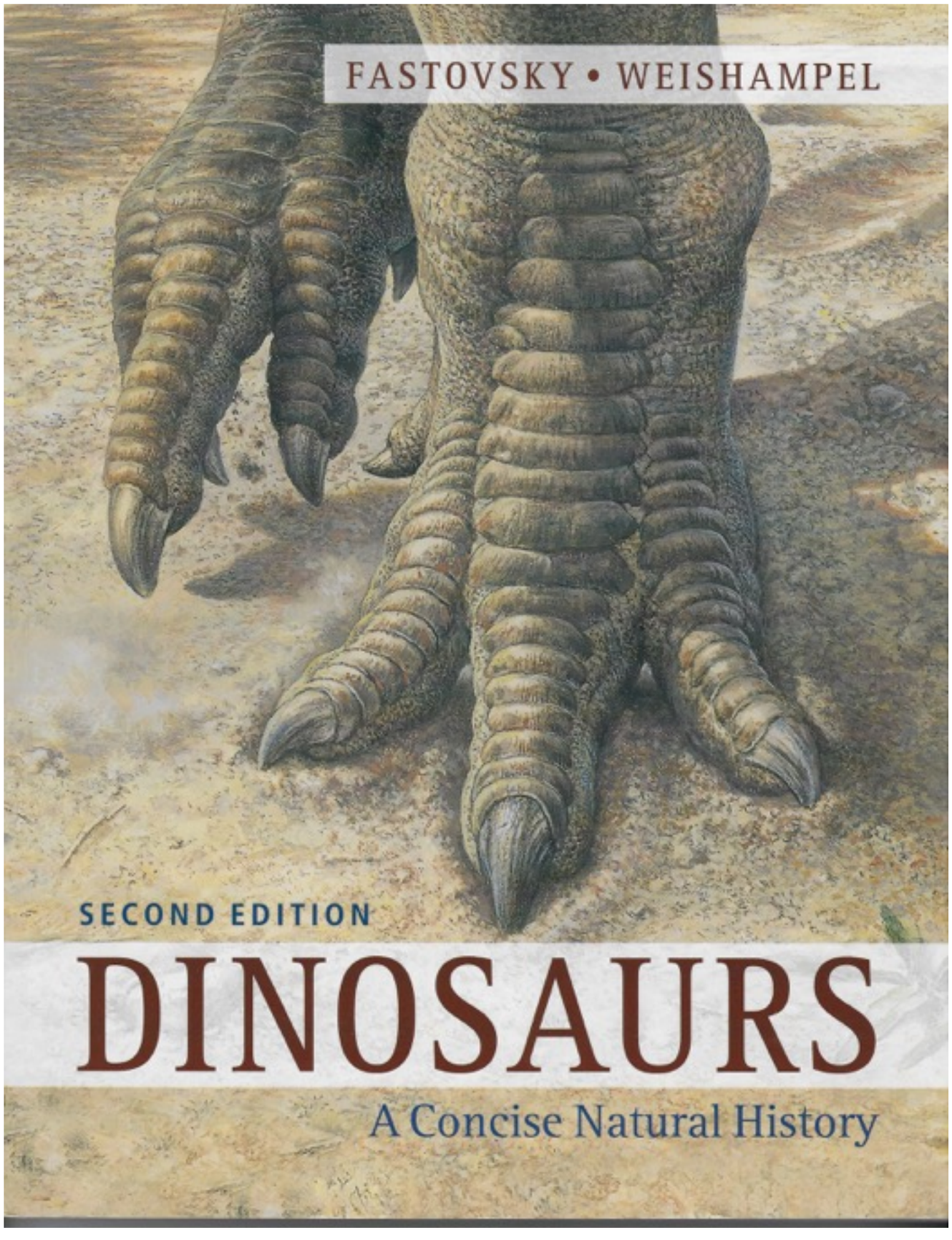
Discussion sections:
- Monday @ 1:30-2:20 Paola
- Monday @ 2:30-3:20 Bobby
- CLSSRM 282

Discussion section starts NEXT week
Make sure you are signed up…

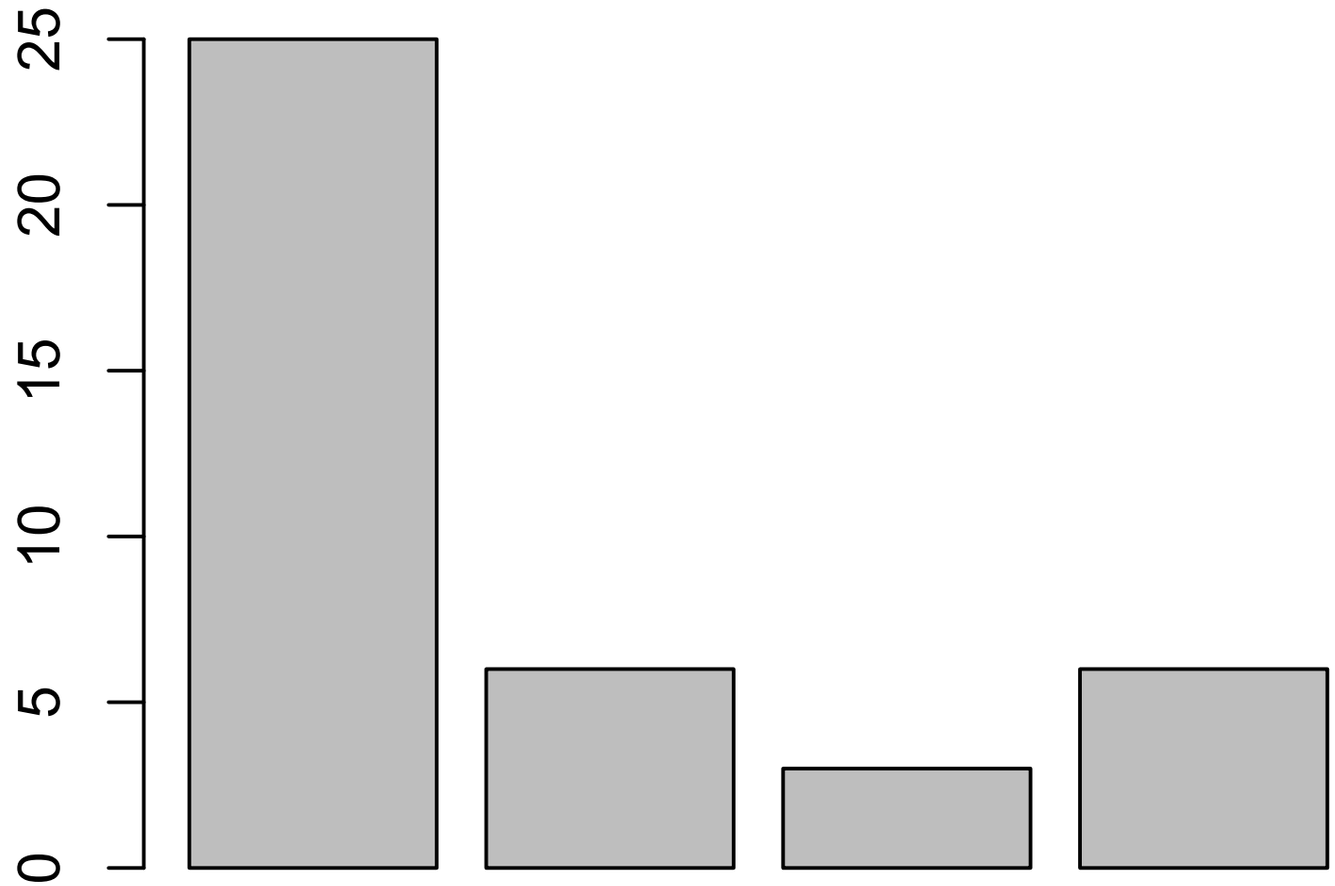
Justin office hours: MW 2-4 (or by appt) SE1 288 (not today)
Paola office hours: W 12:25-1:25 SE1 398
Bobby office hours: WF 10-11 alcove near SE1 281

Important Dates
Class add deadline: 2/8
Course drop deadline: 2/8
Course drop (with W): 4/5

The Textbook

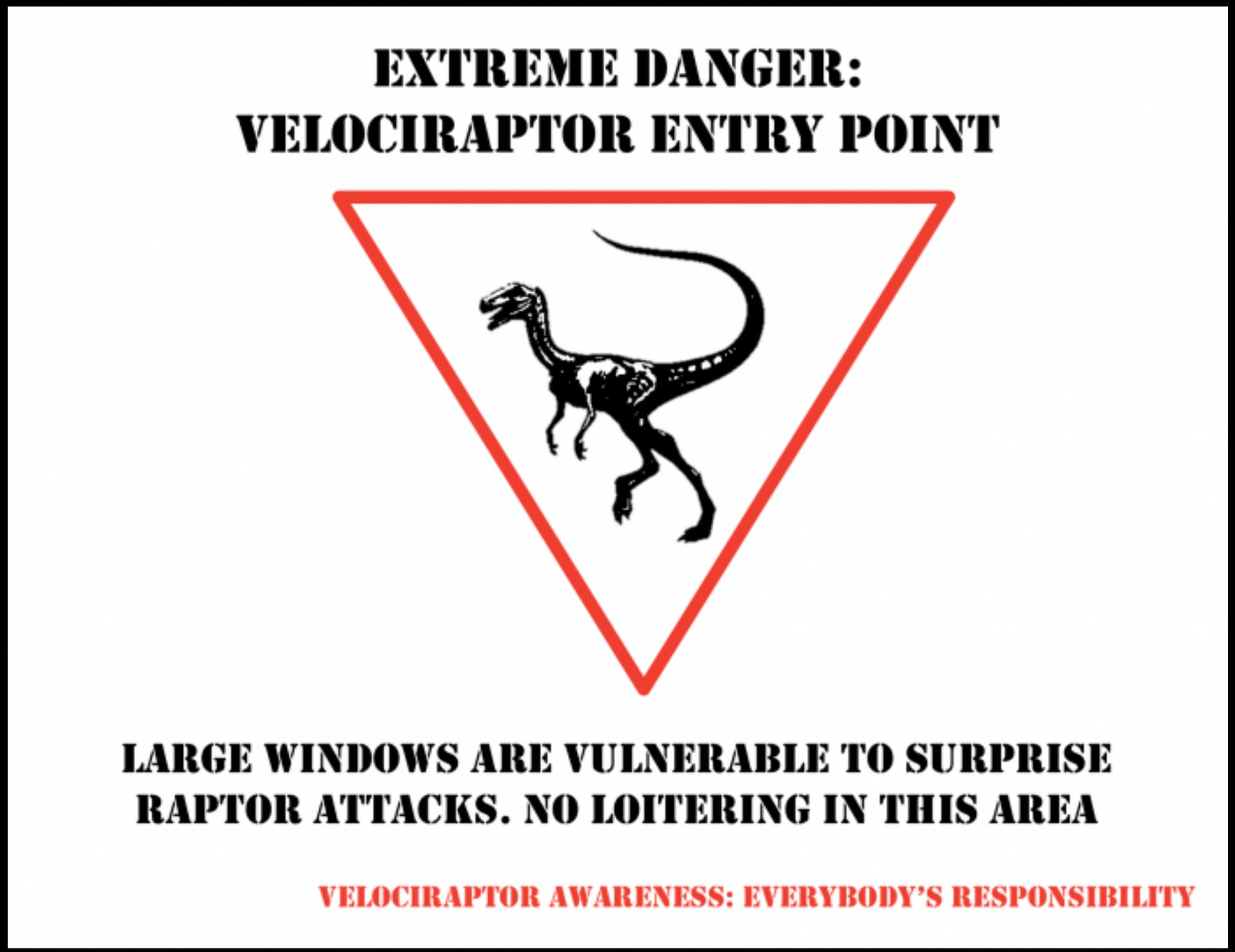


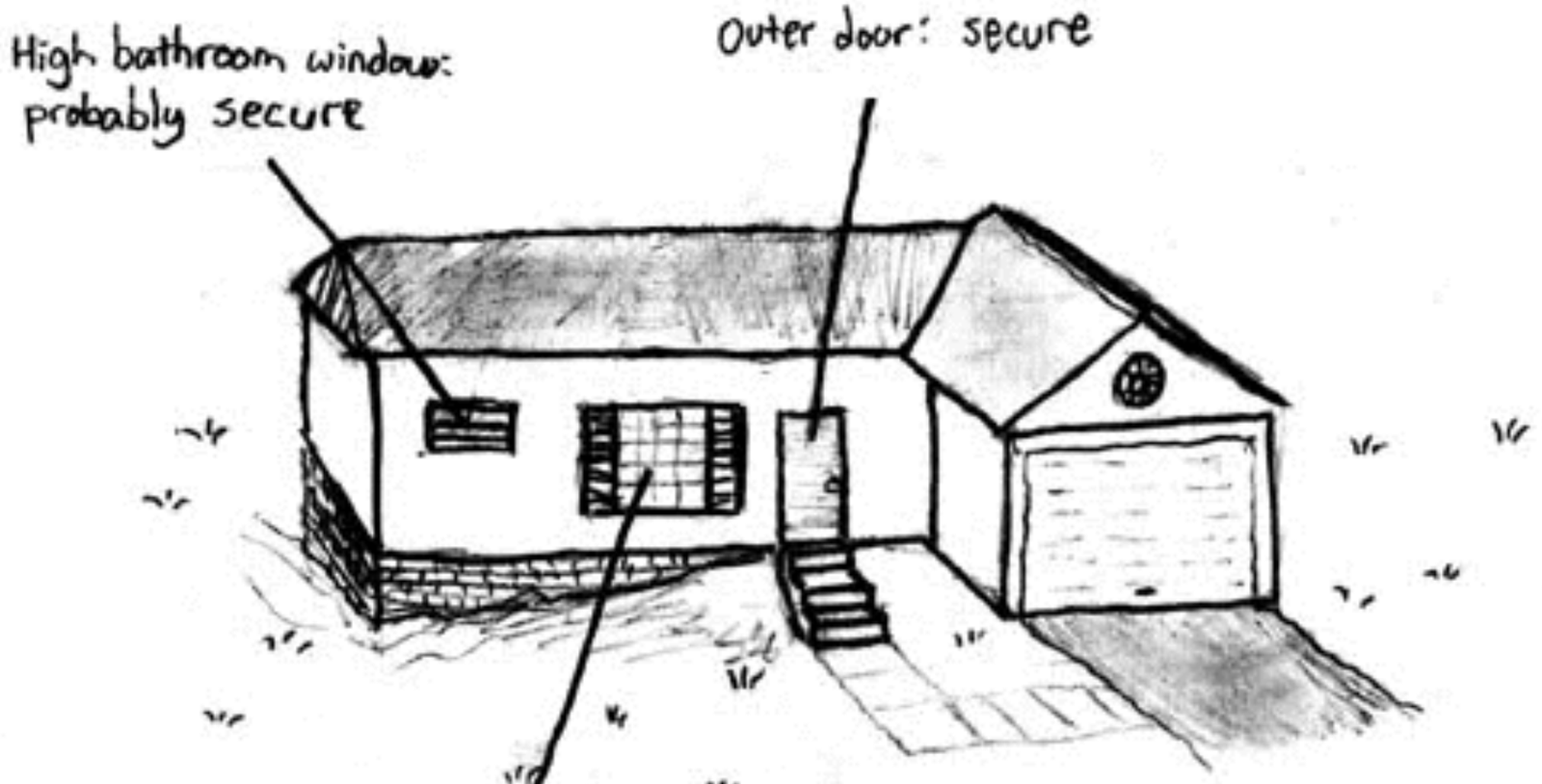
$68.32 on Amazon
?? UC Merced bookstore



“I want to learn everything there is”
“I want to fulfill a requirement”
“Dinosaurs are cool”
“Dinosaurs are fascinating”

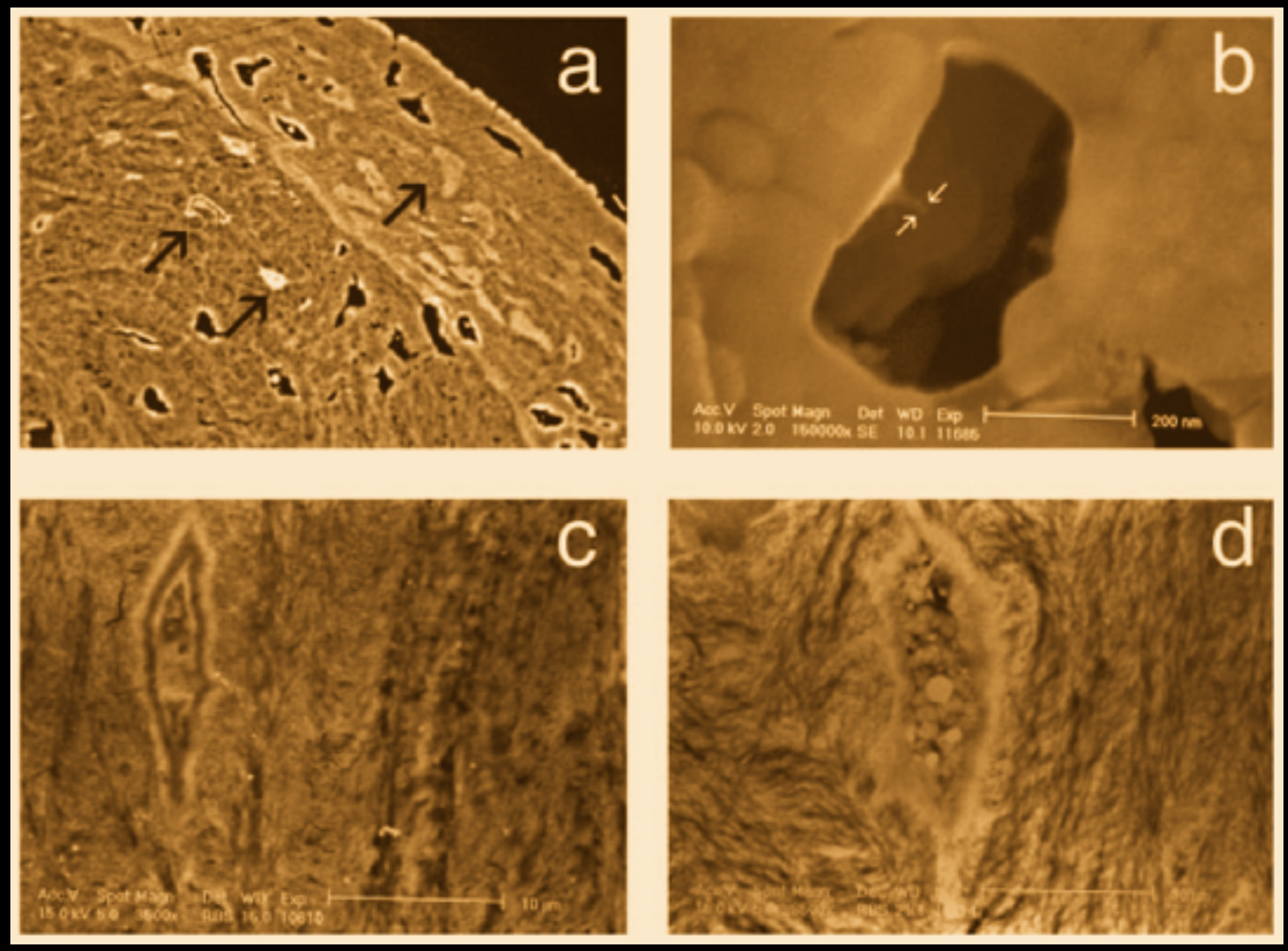
January is Velociraptor Awareness Month!!!





It's been over a decade since Jurassic Park opened, and I still size up buildings for their potential as shelter against velociraptor attacks.

Fossilization: A fine scale



Even osteocytes (bone cells) are preserved

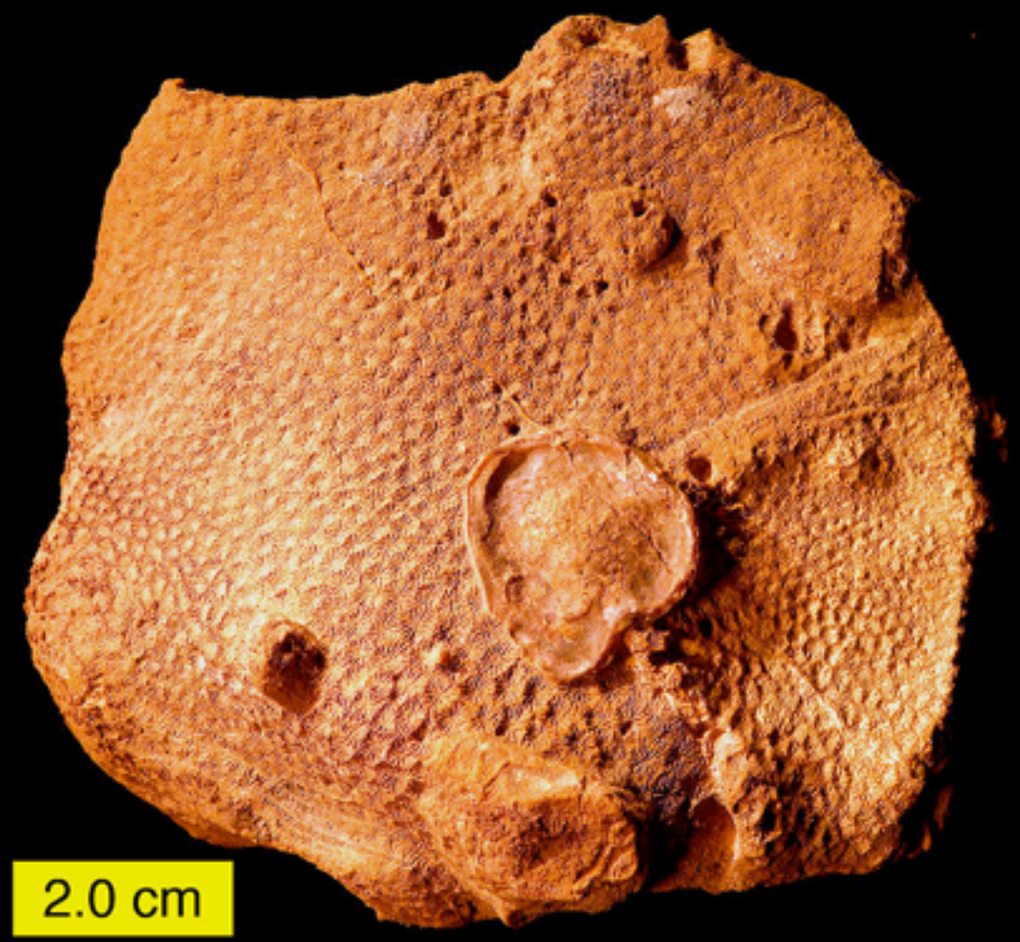
Routes to Fossilization

Trilobite

Permineralization

- **Open spaces in organic material is filled up with minerals**
- Crystals form within cell walls
- This type of preservation conserves cell structure

Routes to Fossilization



Fossil Coral: Jurassic

- Shell, bone, tissue **replaced** with another mineral into a crystal

Mineralization and Recrystalization

Routes to Fossilization

Structure is typically compressed

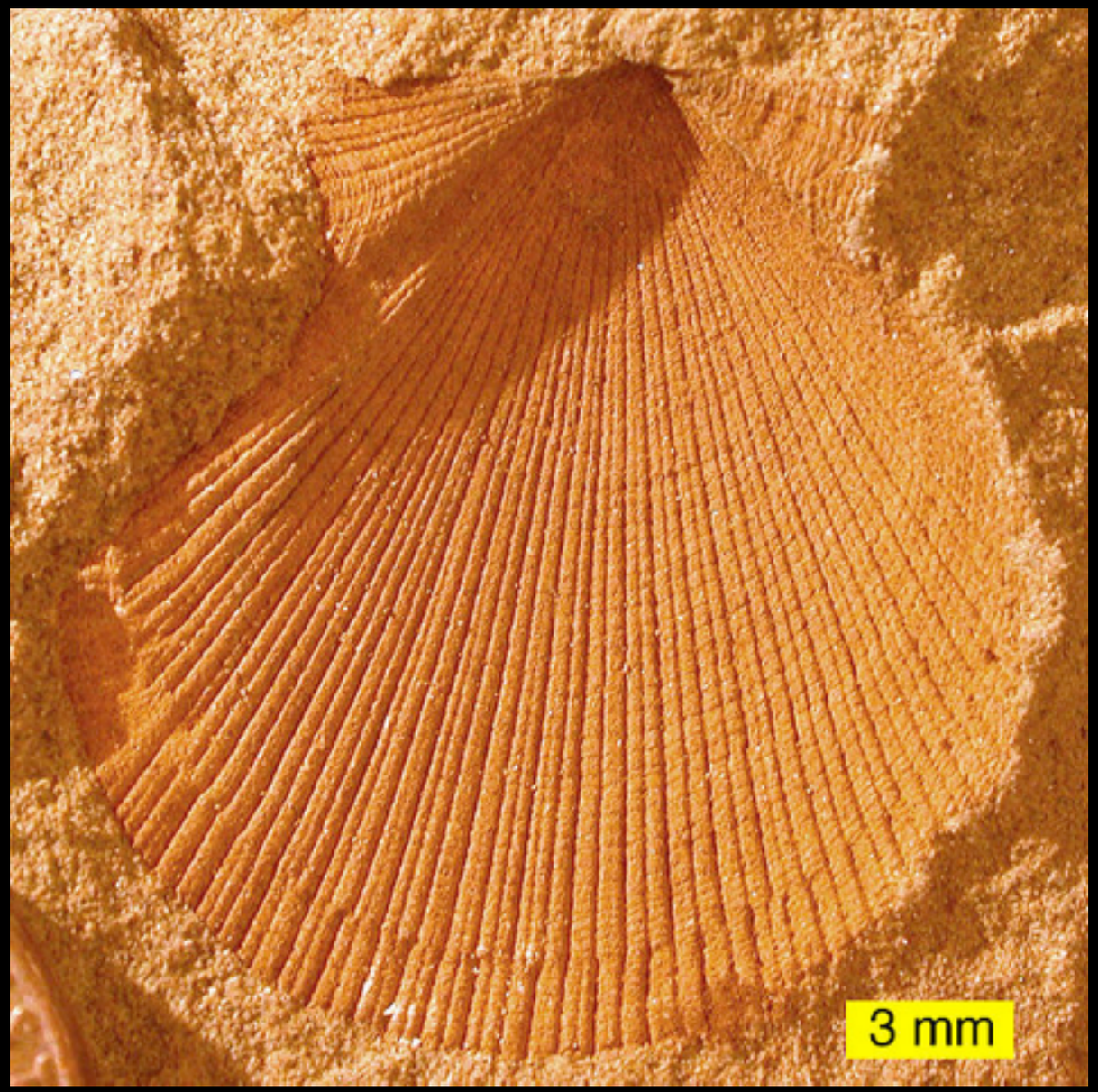
Pressure, heat force out gasses, liquids

Leaves behind a carbon film

!! Soft parts !!

Carbonization

Routes to Fossilization



Molds, casts

- Molds
- Casts
- Little or no original material

T. rex brain cast

4550 Ma: Formation of the Earth

2 Ma: first humans

4527 Ma: formation of the Moon

230 - 65 Ma: Dinosaurs

ca. 380 Ma: First vertebrate land animals

ca. 530 Ma: Cambrian explosion

750 - 635 Ma: two Snowball Earths

ca. 4000 Ma: end of the Late Heavy Bombardment; first life

ca. 3500 Ma: photosynthesis starts

ca. 2300 Ma: atmosphere becomes oxygen-rich; first Snowball Earth

Oldest DNA: 60,000 Ka

Oldest bones 500 Ma

Oldest hard part 600 Ma

Oldest fossils: 3.8 Ga

65 Ma

4,6 Ga

251 Ma

542 Ma

Mesozoic

Cenozoic

Hadean

4 Ga

3,8 Ga

1 Ga

Proterozoic

Archean

3 Ga

2 Ga

2,5 Ga

Legend

- Humans
- Mammals
- Land plants
- Animals
- Multicellular life
- Eukaryotes
- Prokaryotes

How long can fossils last?

Depositional Environments

&
Taphonomy

Taphonomy: study of the transition from the biosphere to the lithosphere

Quick burial

(a)

Replacement and/or permineralization

Nearly complete specimen exposed

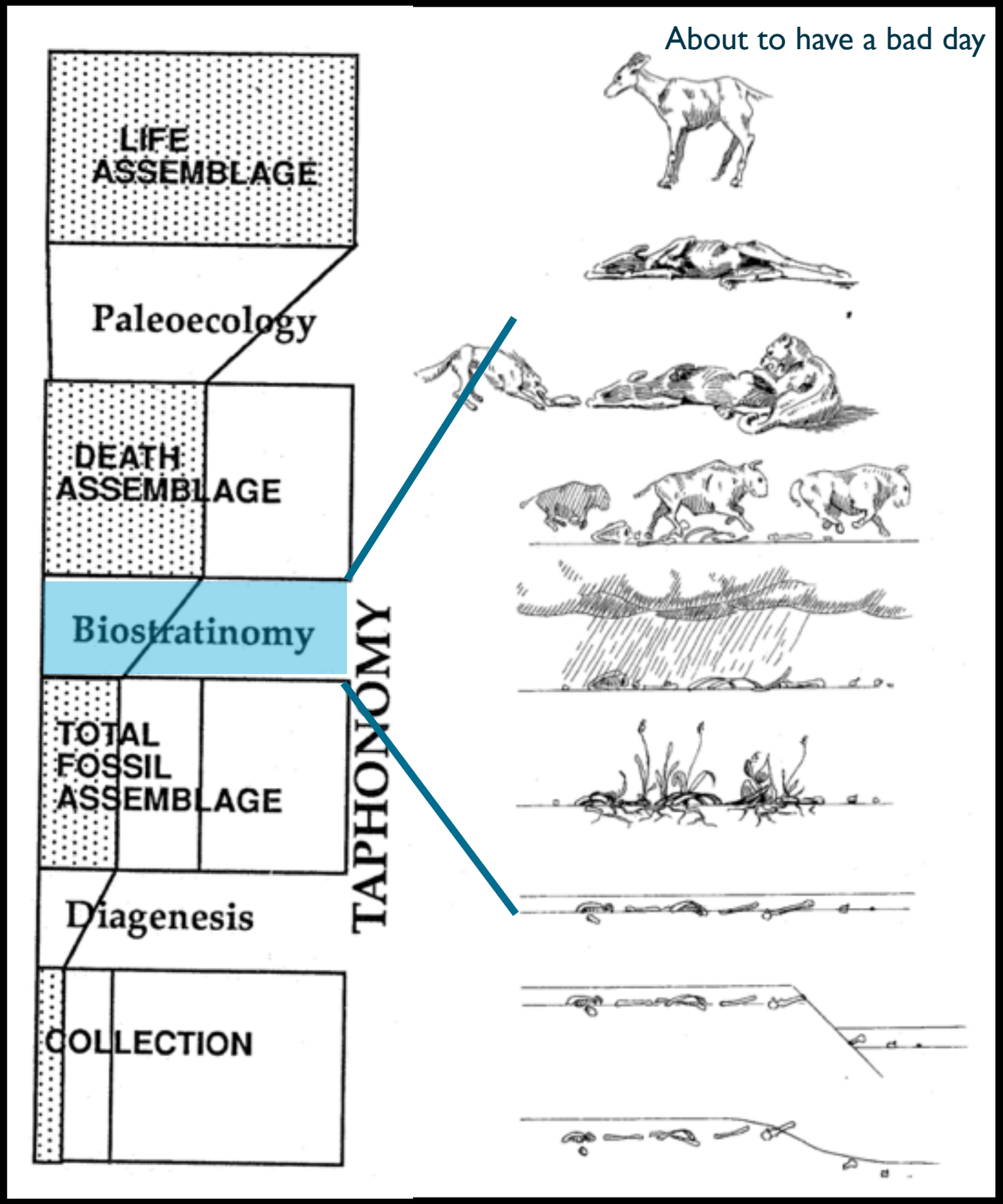
Dinosaur dies

(b)

Dismemberment before burial – scavenging and other natural processes

Isolated bones buried and mineralized

Isolated bones exposed



Key: Rapid Burial!

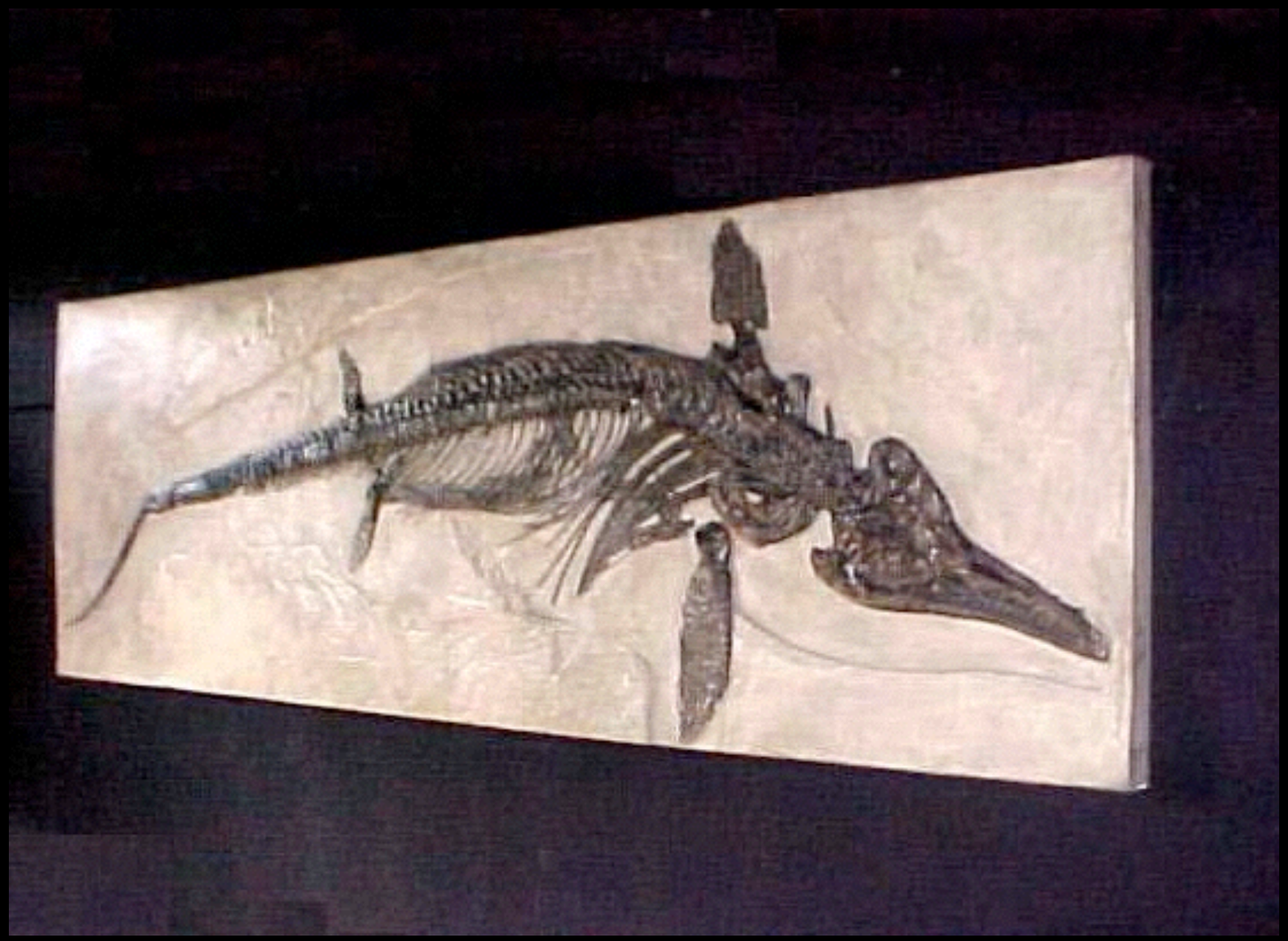
Remains preserved at the death site (autochthonous)

Remains transported (allochthonous)

Fluvial (Rivers)

Deserts
(rare)

Shallow Marine
(rare)

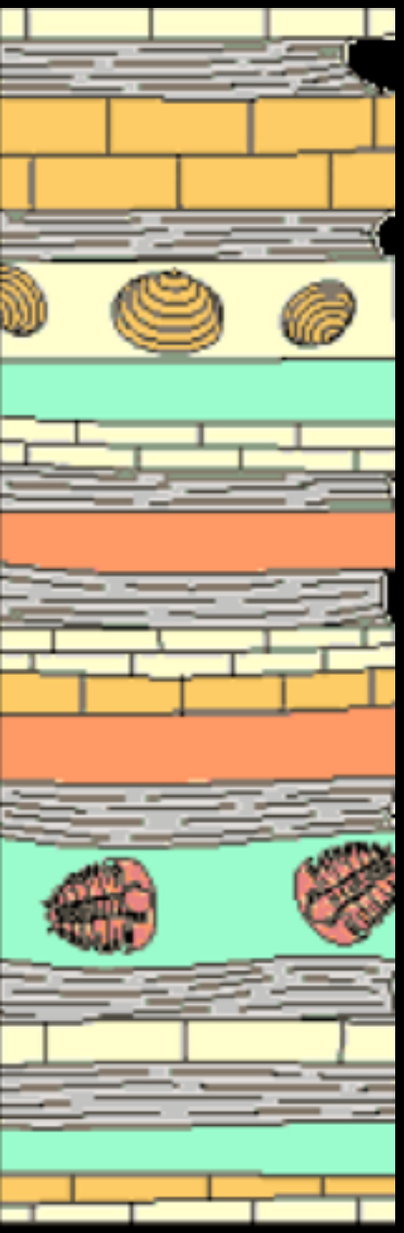


All dinosaurs lived on land. Why do we care about coastal fossil sites, etc.?

Placing fossils in TIME

Relative vs. Absolute Dating

YOUNGER



495 Ma

510 Ma

520 Ma

545 Ma

OLDER

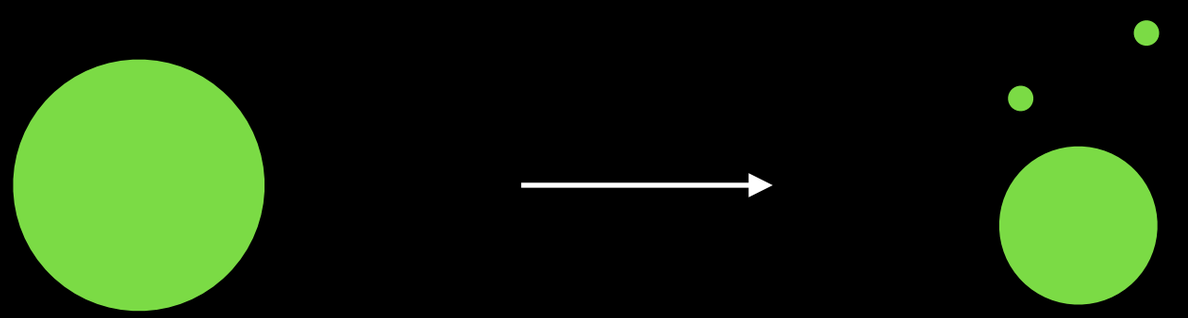
Absolute dates
Volcanic Ash

Relative ages

Issues:

- Last appearance
- Lazarus Taxa

Radiometric Dating
via radioactive (UNSTABLE) isotopes



If we know:
-Original amt of parent isotope
-How much of the parent isotope is left
-Rate of decay of that isotope

Then we can estimate:
Amount of elapsed time

Absolute dating!

Biostratigraphy

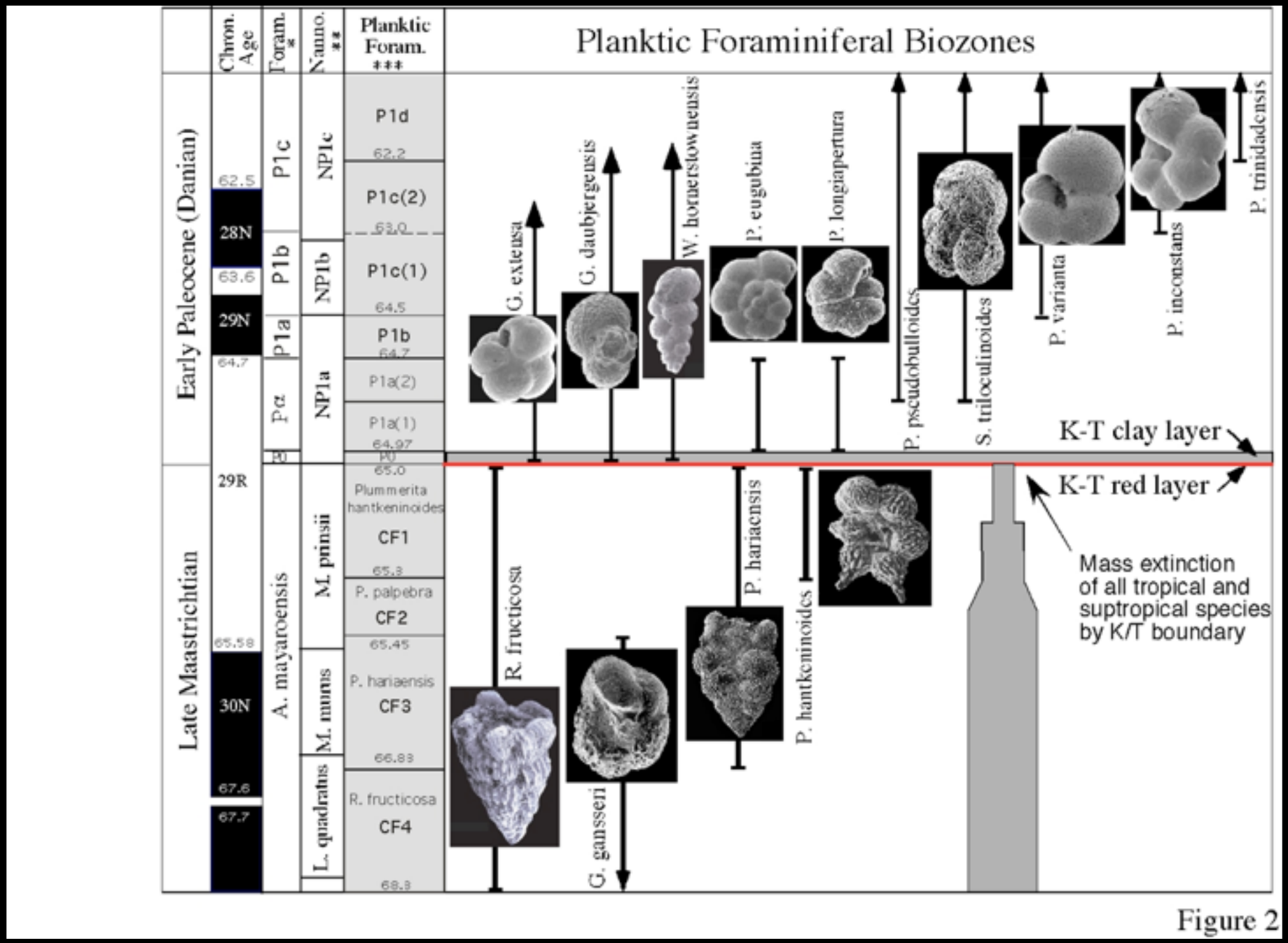


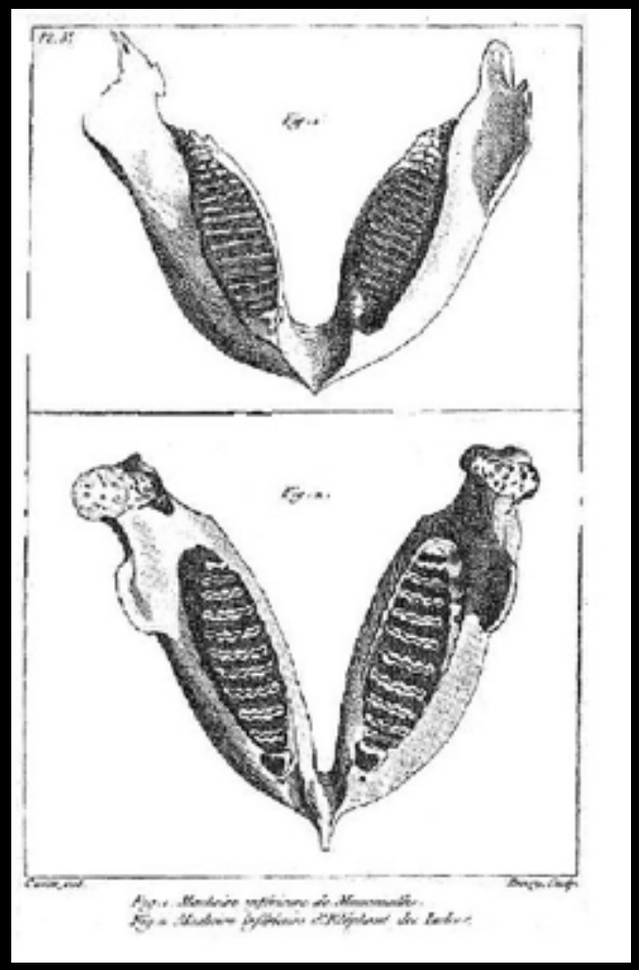
Figure 2

Relative Dating

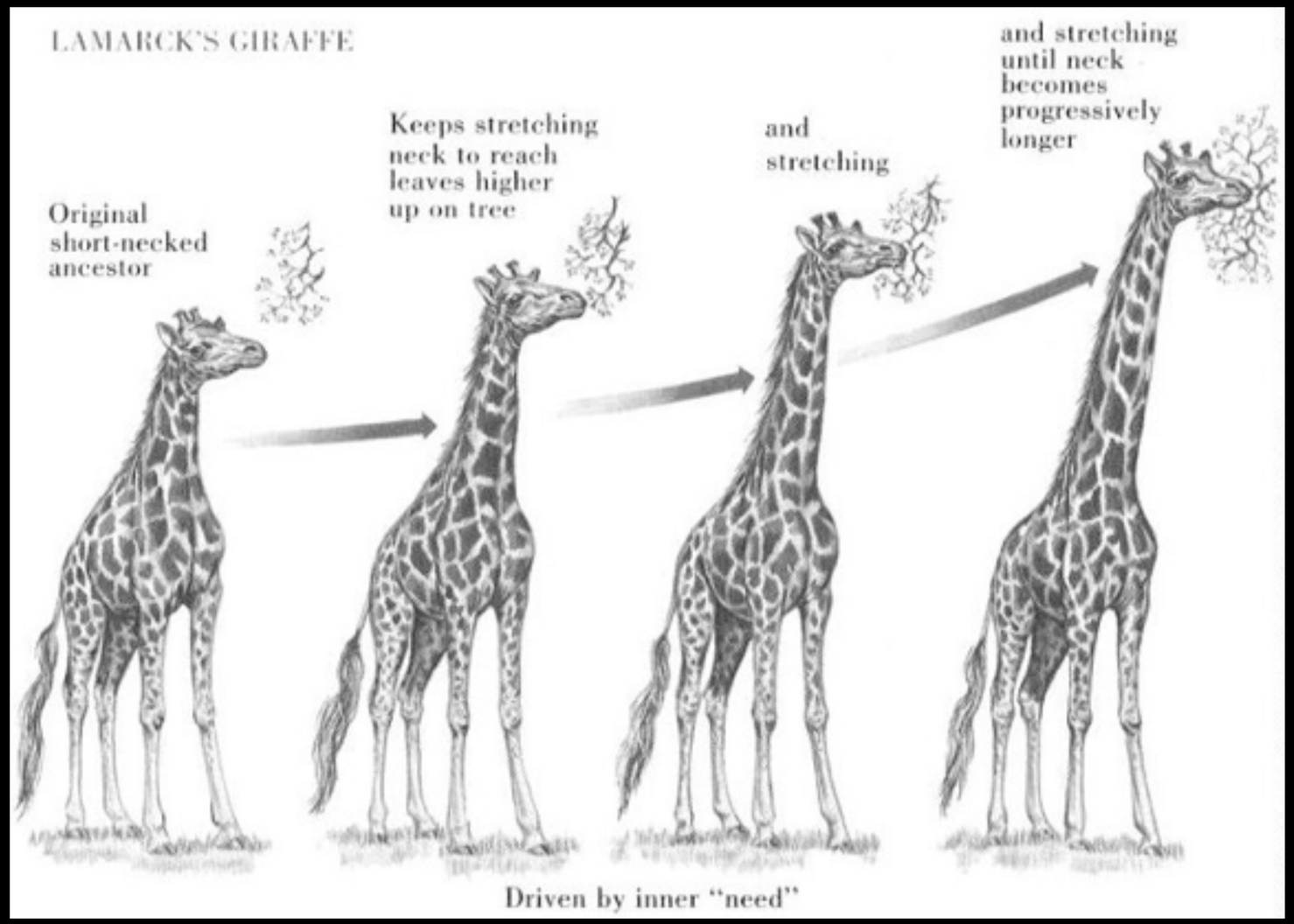
George Cuvier (1769-1832)

Indian elephant

Mammoth

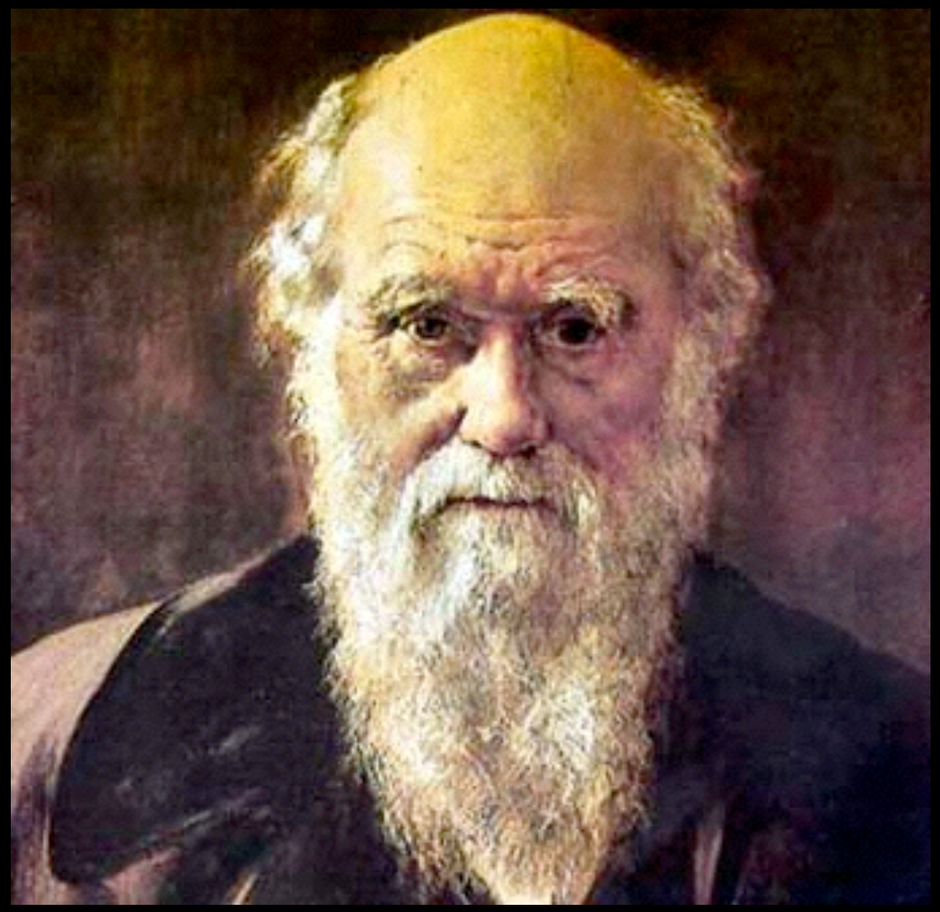


- Lamarckian



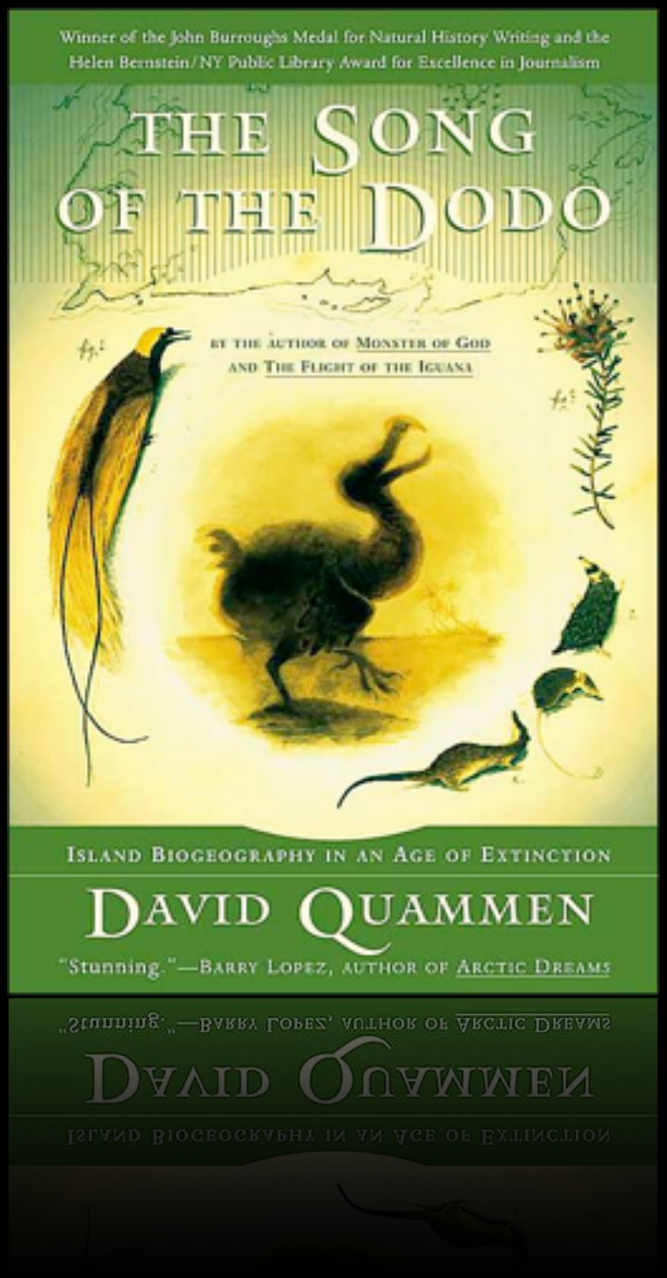

Jean-Baptiste Pierre Antoine de Monet Chevalier de la Marck

Evolution by Natural Selection



Charles Darwin

Alfred Russel Wallace



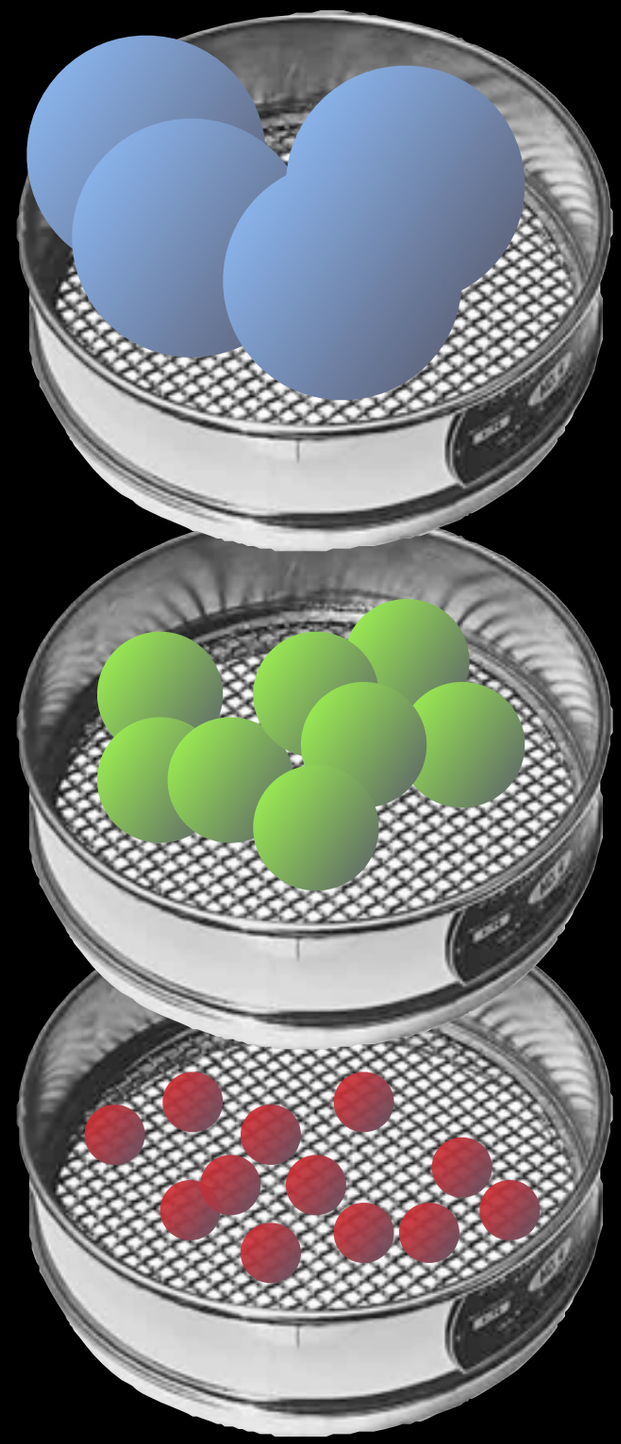
Evolution by Natural Selection!

1. Inheritance
2. Variation
3. Selective ‘force’
   Variants don’t have equal reproductive success

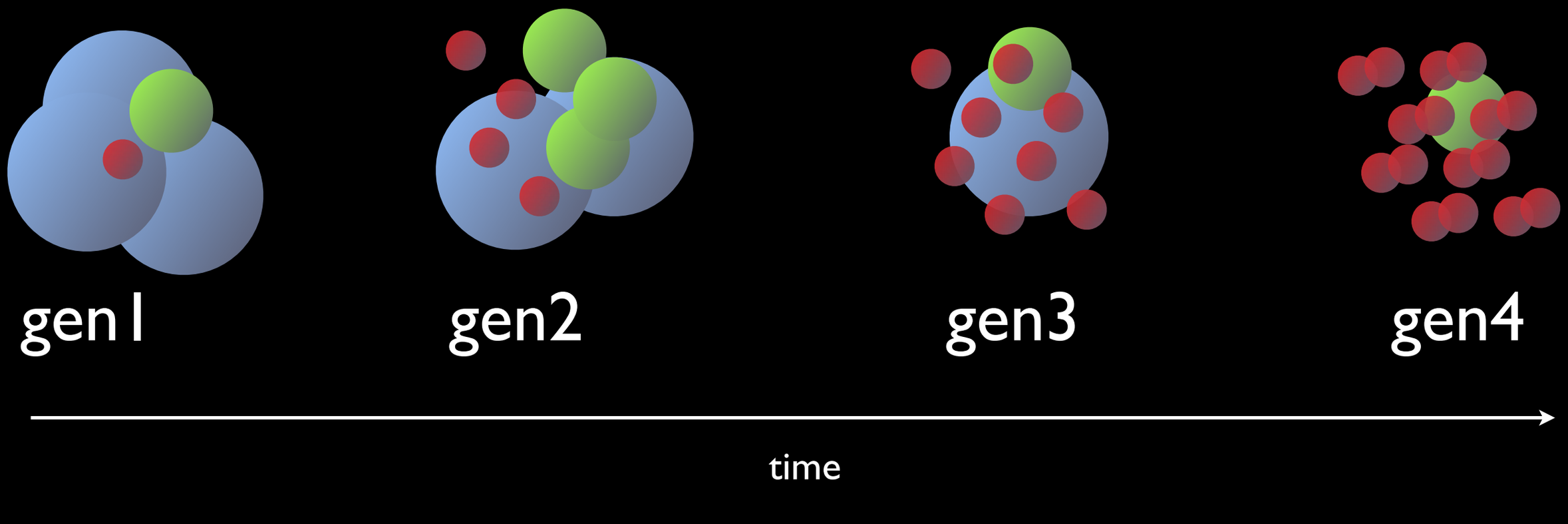
   \+ Fecundity
   \+ Survivorship

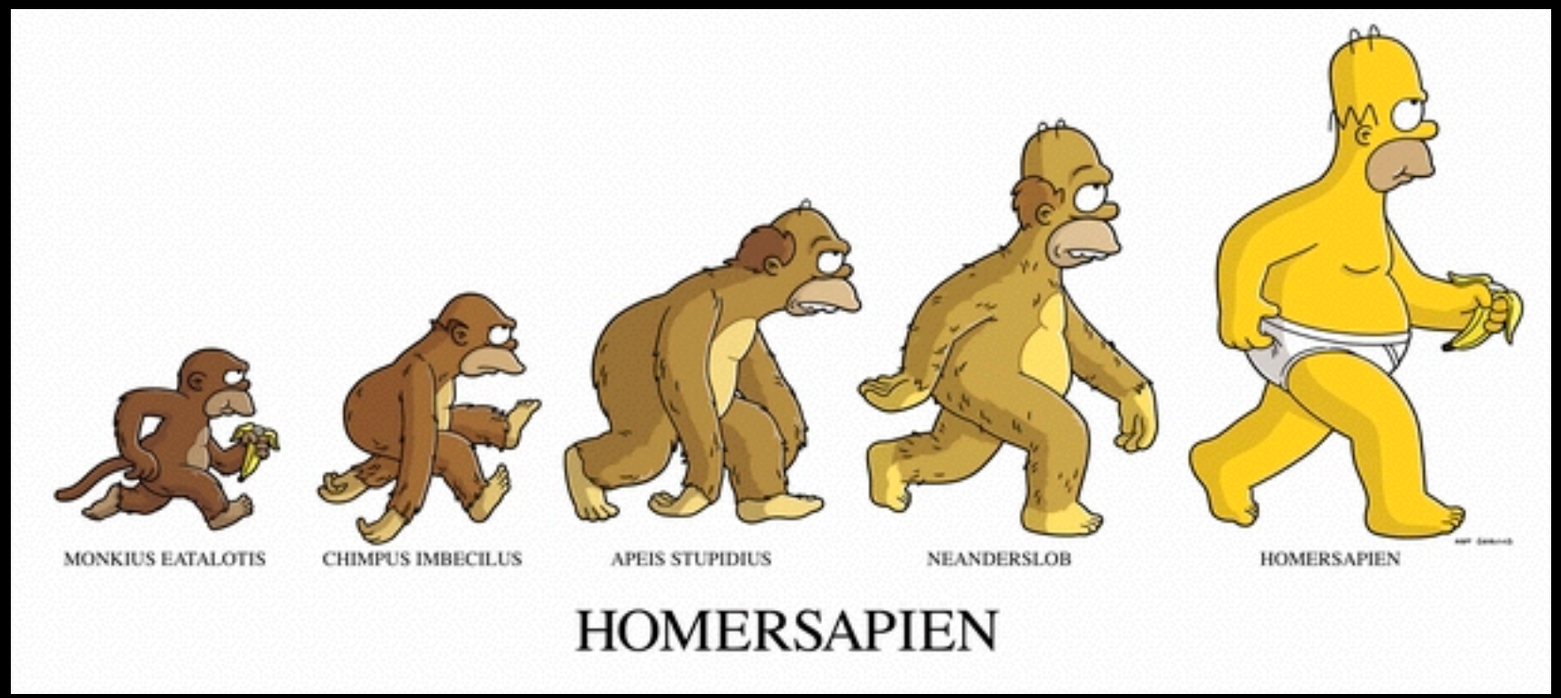
   Fitness

time



Natural Selection: Purely mechanistic, not 'guided'!





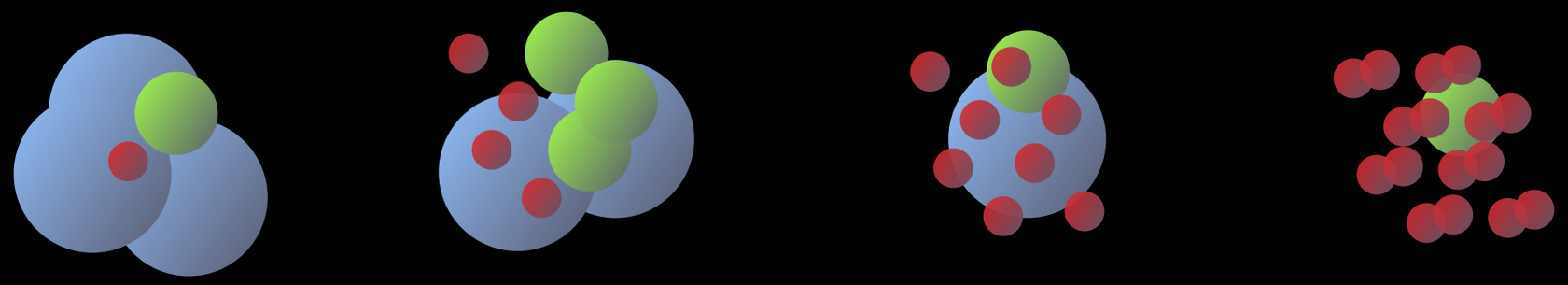
Individuals vs. Populations

Individuals

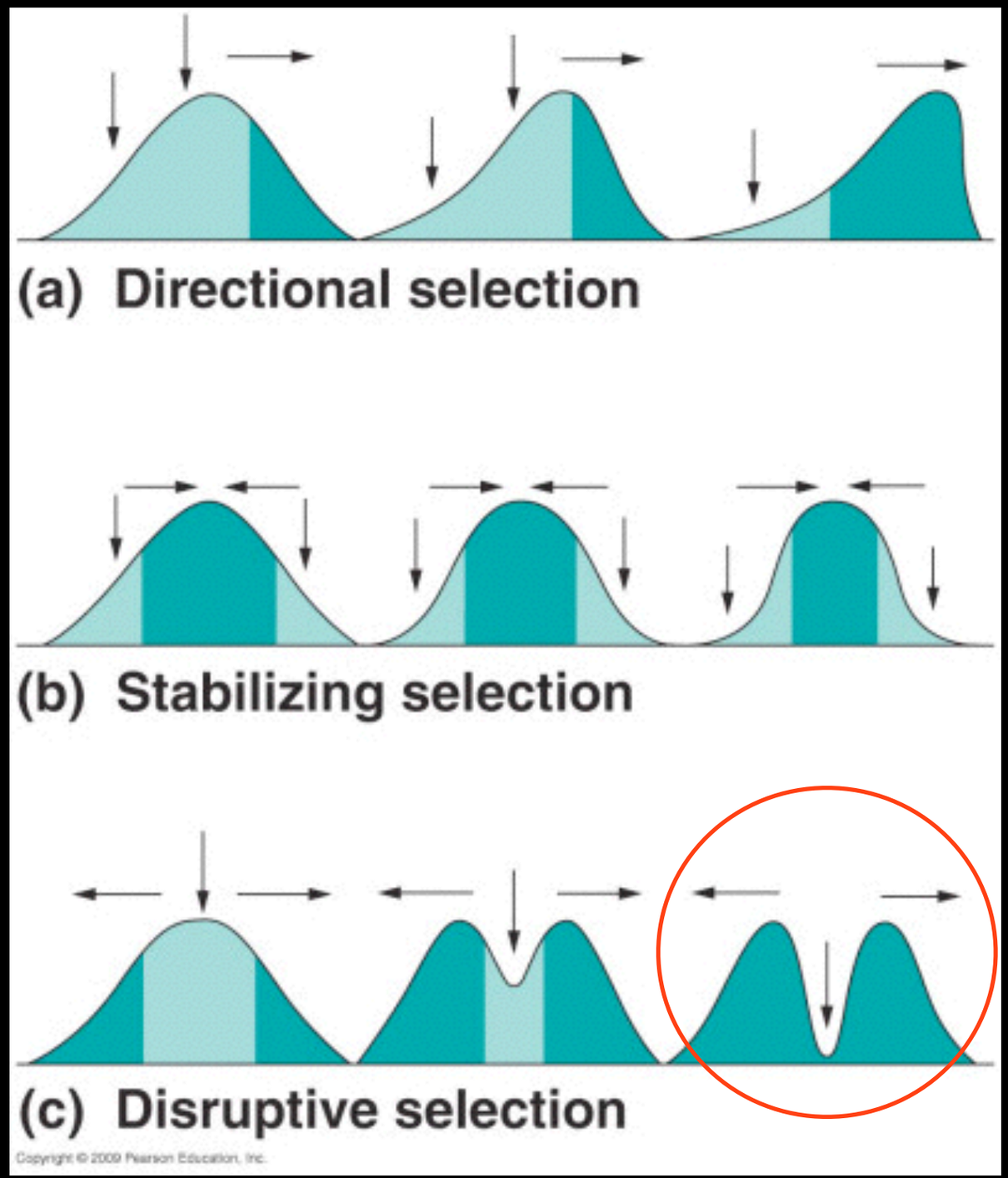
NATURAL SELECTION

Populations

EVOLUTION



Modes of Selection



For Section:
Think of examples
(not the ones I use) for each

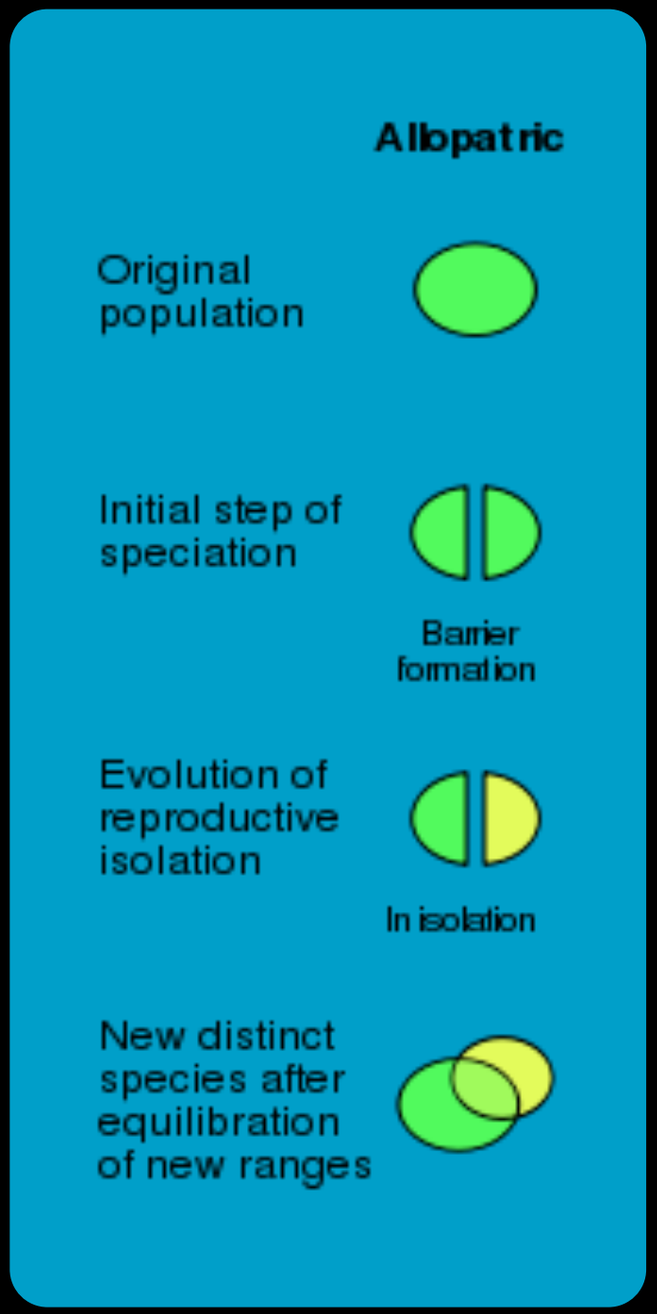
e.g. human height

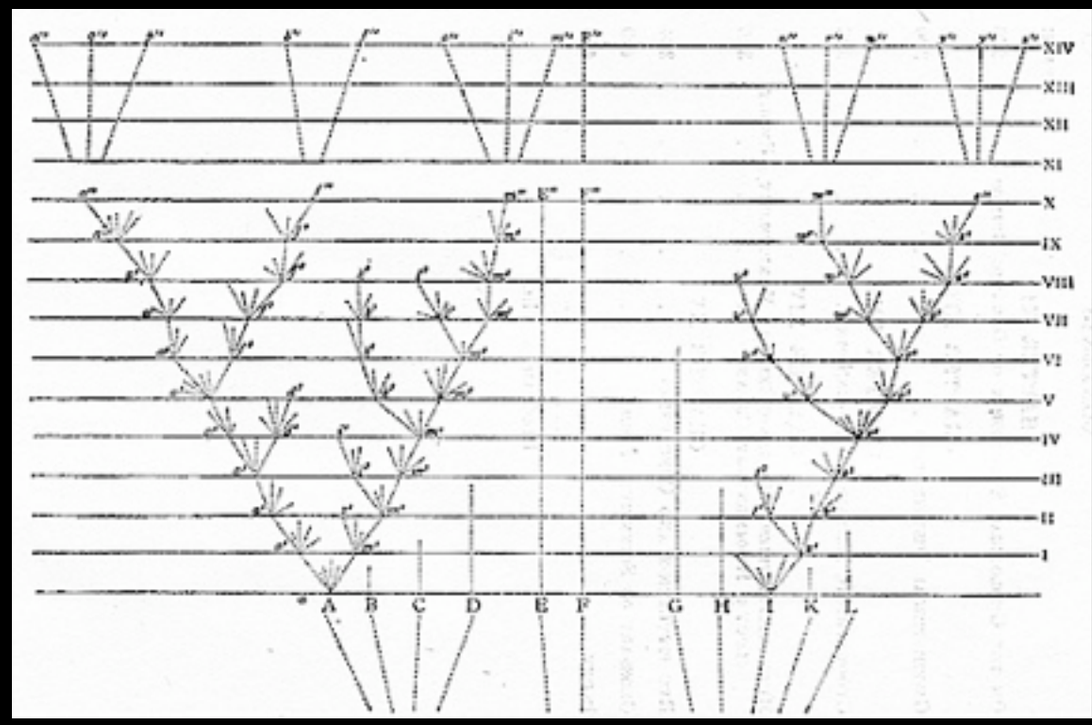
e.g. birth weight in humans

~speciation
(this is what we will be focusing on)

t_1 t_2 t_3

Speciation: Evolution by Natural Selection

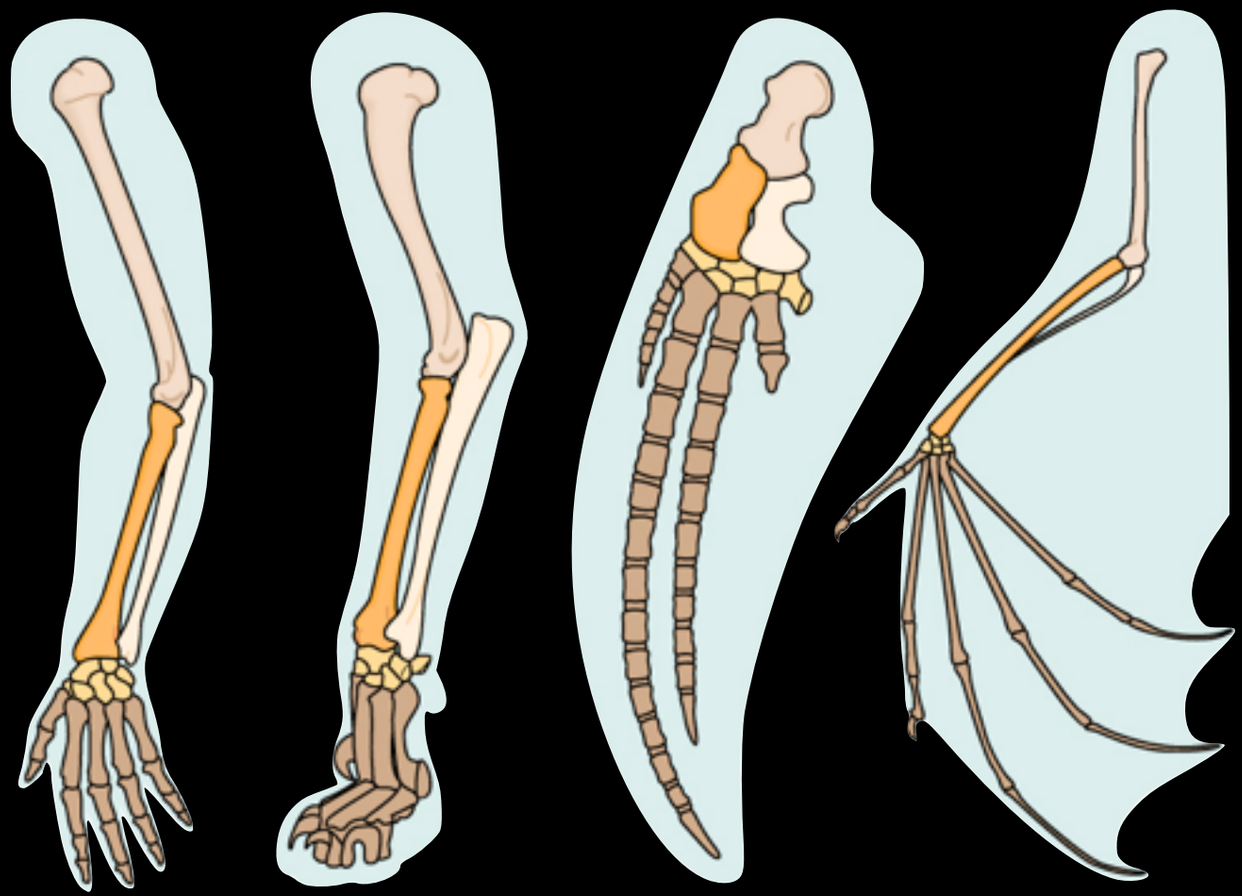




That is the theory... so what is the evidence?

Evidence for Evolution

1.Homologous characteristics



Human Cat Whale Bat

Evidence for Evolution

Evidence for Evolution

Homologous

human limbs ~ dino limbs
{The Tetrapod body plan}

Analagous

fly wings ≠ pterosaur wings