

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



How to contact me

The screenshot displays the Canvas LMS interface for a course titled "BIO 065 01/ESS 065 01" in Spring 2016. The top navigation bar includes the UCMERGED logo, course links (Courses, Grades, Calendar), and user options (Justin Yeakel, Inbox, Settings, Logout, Help). The "Inbox" link is highlighted with a red circle. The left sidebar lists various course navigation options. The main content area features a notification banner and a section for "Recent Activity in BIO 065 01/ESS 065 01", which includes a conversation message and an assignment notification. The right sidebar contains course management tools like "Choose Home Page", "Course Setup Checklist", "New Announcement", and "View Course Analytics".

UCMERGED Courses ▾ Grades Calendar

Justin Yeakel **Inbox** 1 Settings Logout Help

canvas
BY INSTRUCTURE

BIO 065 01/ESS 065 01 Spring 2016

Home

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Mid/Final Grades

Settings

Notifications. Tell us how and when you would like to be notified of events in Canvas. [Notification Preferences](#)

Recent Activity in BIO 065 01/ESS 065 01

1 Conversation Message [SHOW MORE ▾](#)

1 Assignment Notification [SHOW MORE ▾](#)

Choose Home Page

Course Setup Checklist

New Announcement

View Course Analytics

Coming Up [View Calendar](#)

Nothing for the next week

BY INSTRUCTURE User Research | Help | Privacy policy | Terms of service | Facebook | Twitter

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

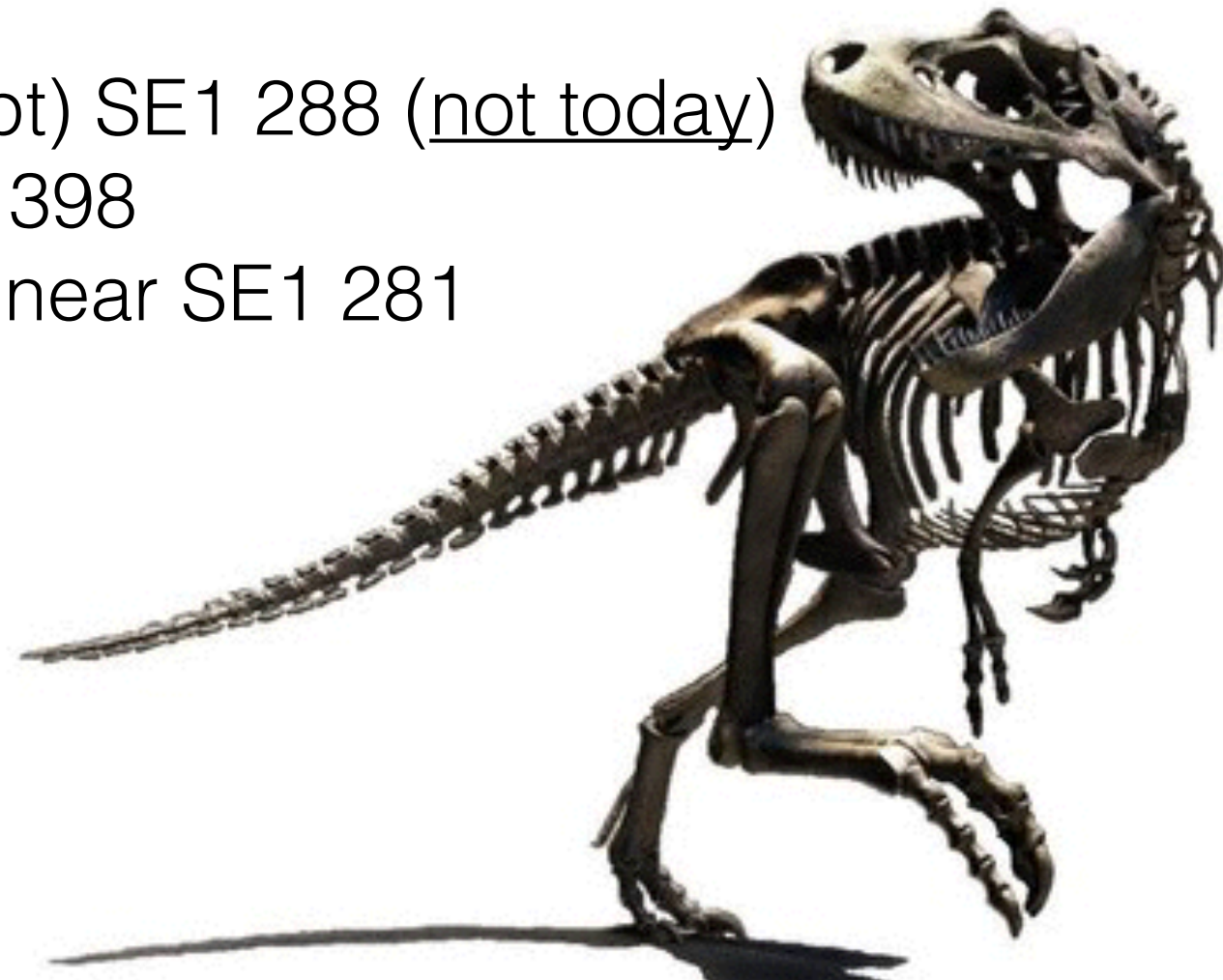
Bobby office hours: WF 10-11 alcove near SE1 281

Important Dates

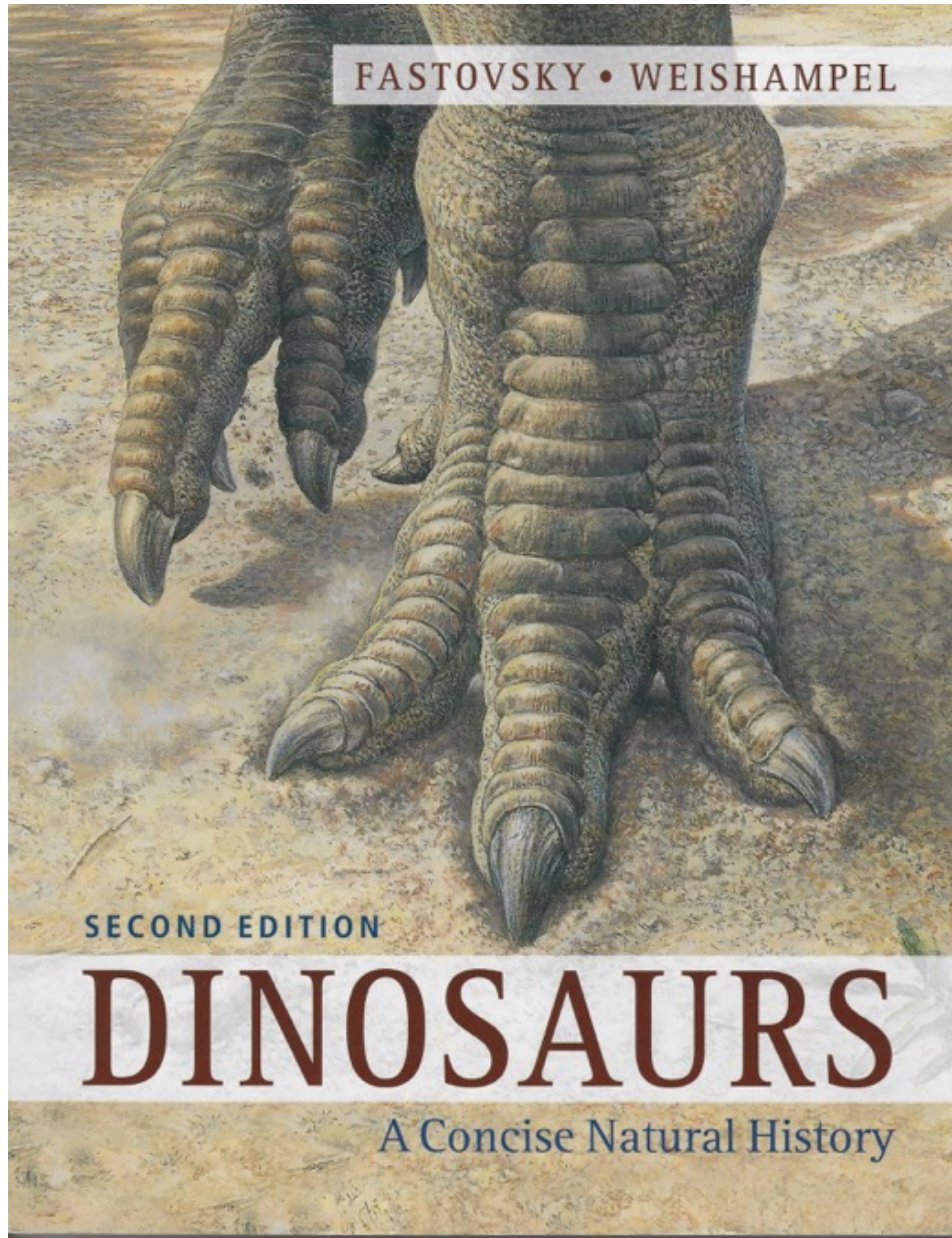
Class add deadline: 2/8

Course drop deadline: 2/8

Course drop (with W): 4/5

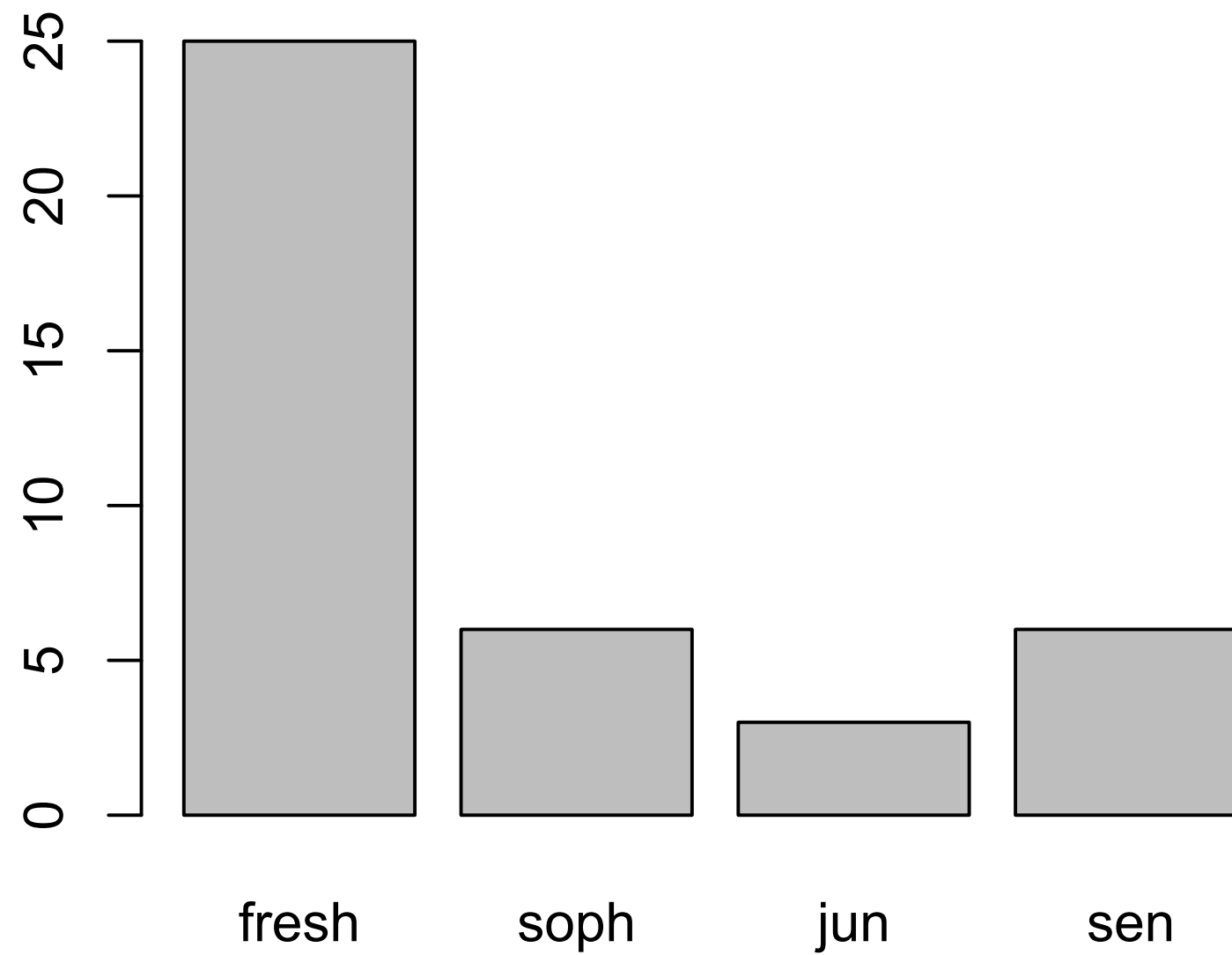


The Textbook



\$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!!!

EXTREME DANGER: VELOCIRAPTOR ENTRY POINT

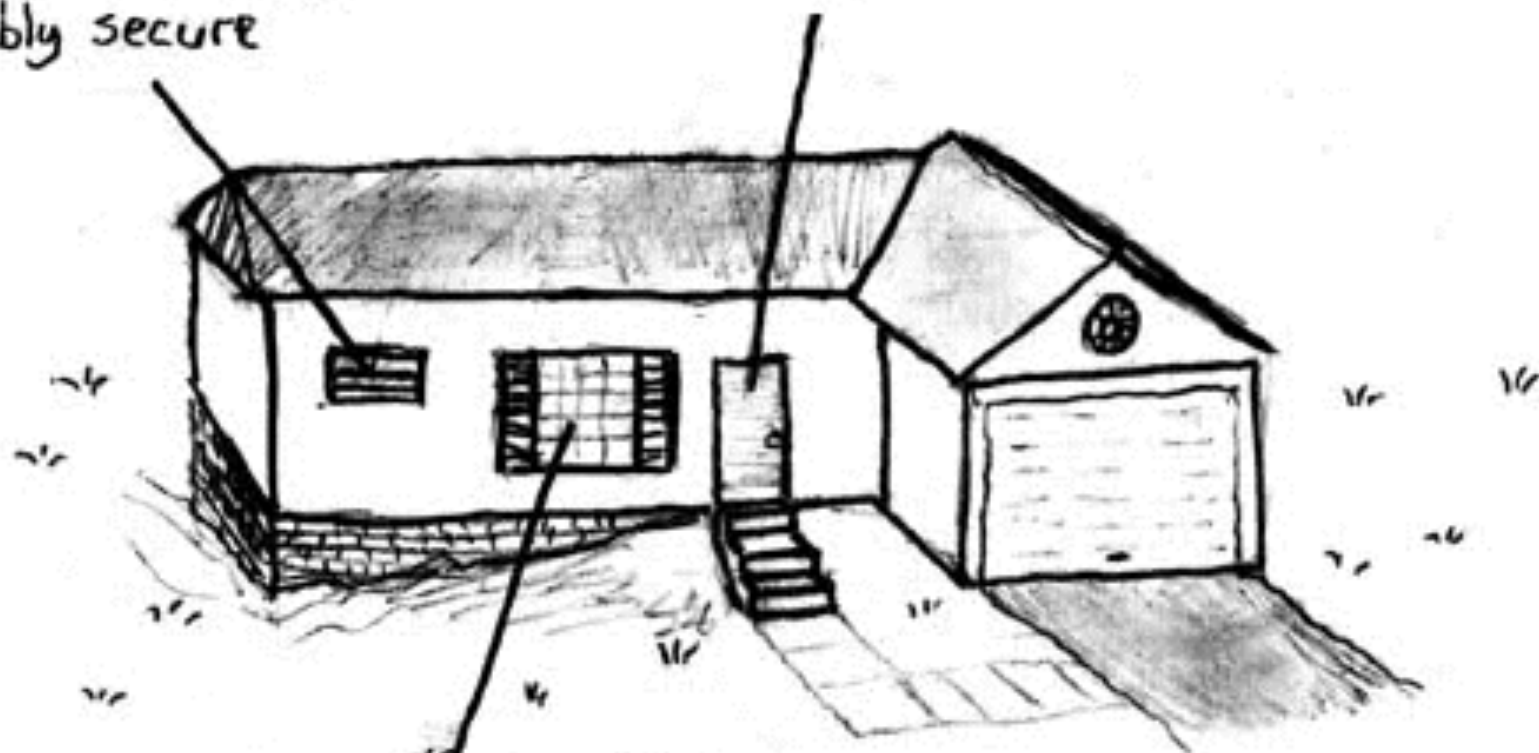


**LARGE WINDOWS ARE VULNERABLE TO SURPRISE
RAPTOR ATTACKS. NO LOITERING IN THIS AREA**

VELOCIRAPTOR AWARENESS: EVERYBODY'S RESPONSIBILITY

High bathroom window:
probably secure

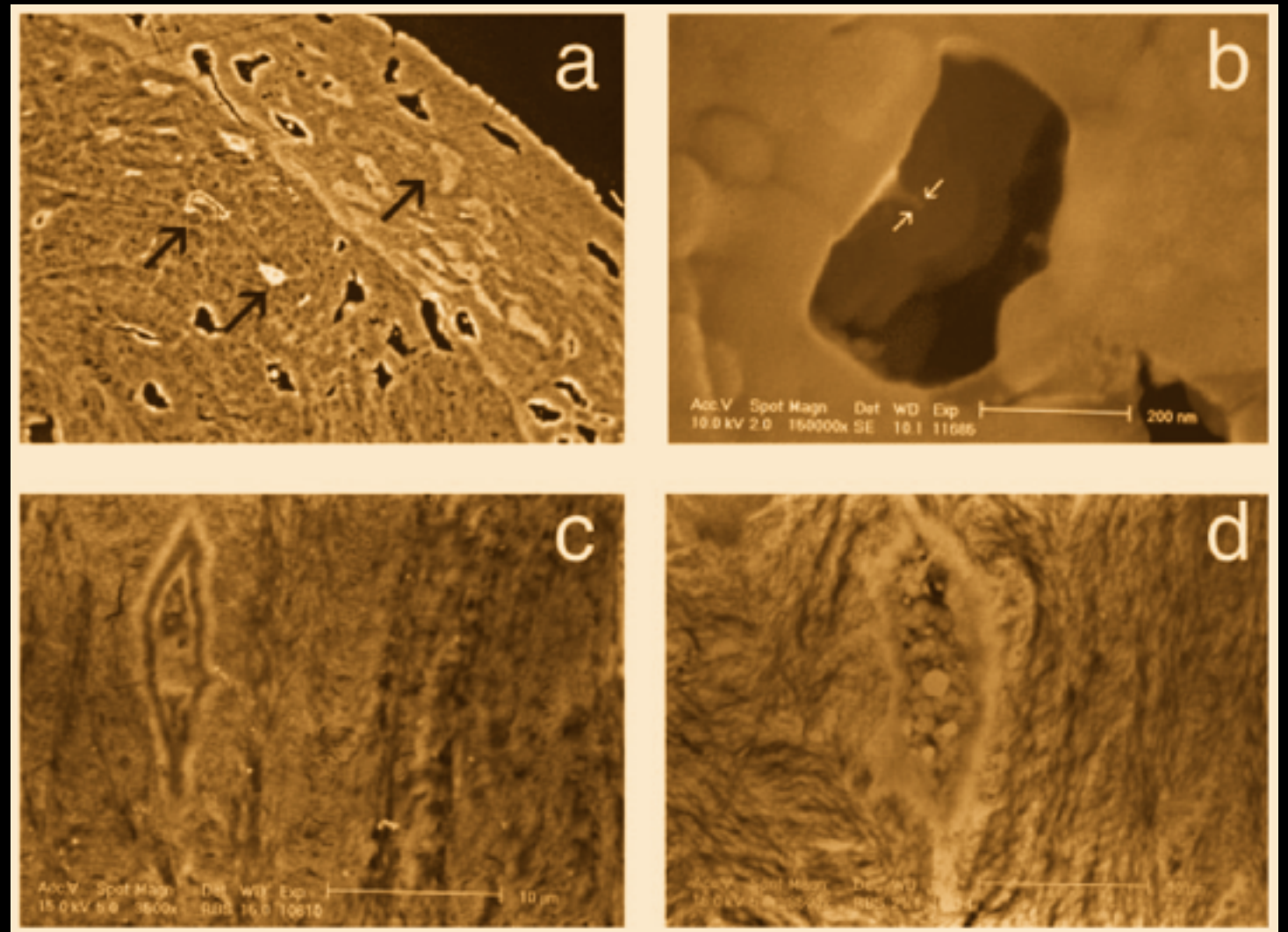
Outer door: secure



picture window:
VELOCIRAPTOR
ENTRY POINT!

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



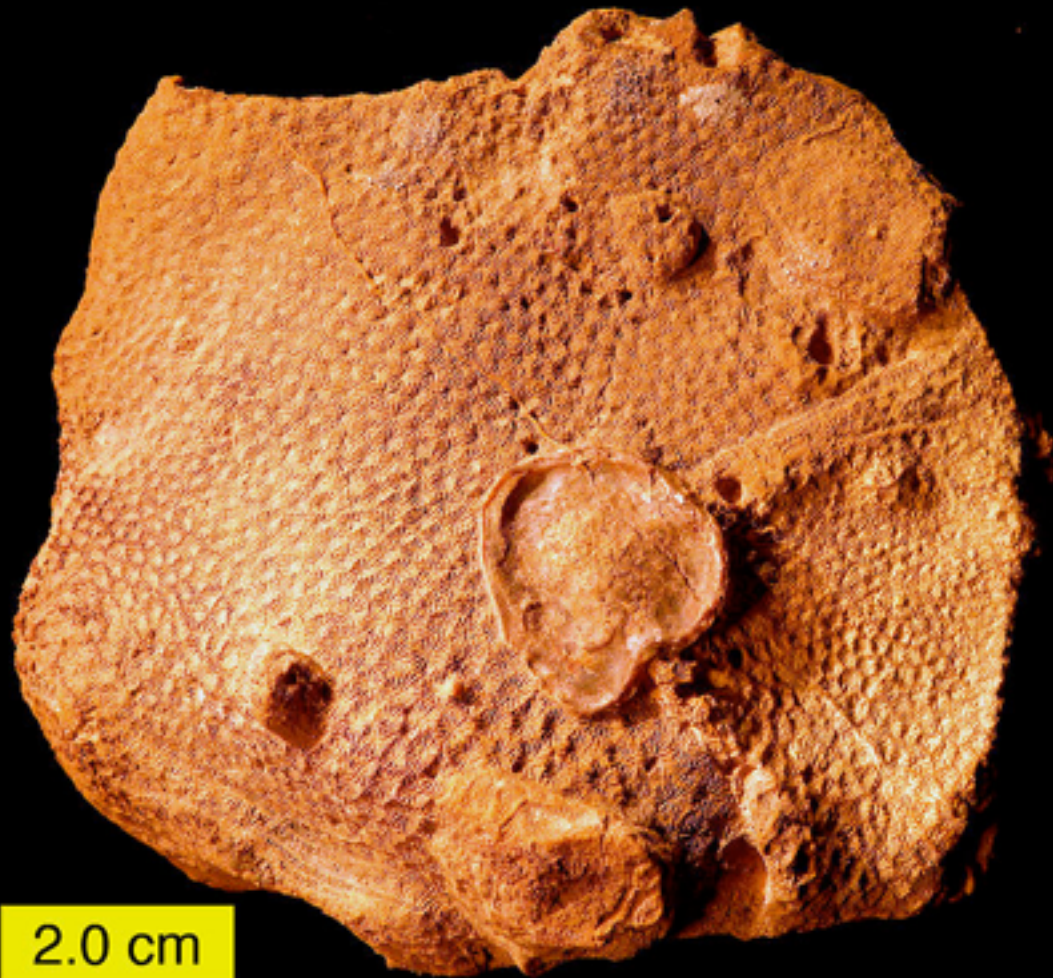
Permineralization

Trilobite

- **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



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

Fossil Coral: Jurassic

Mineralization and Recrystallization

Routes to Fossilization



Structure is typically compressed

Pressure, heat force out gasses, liquids

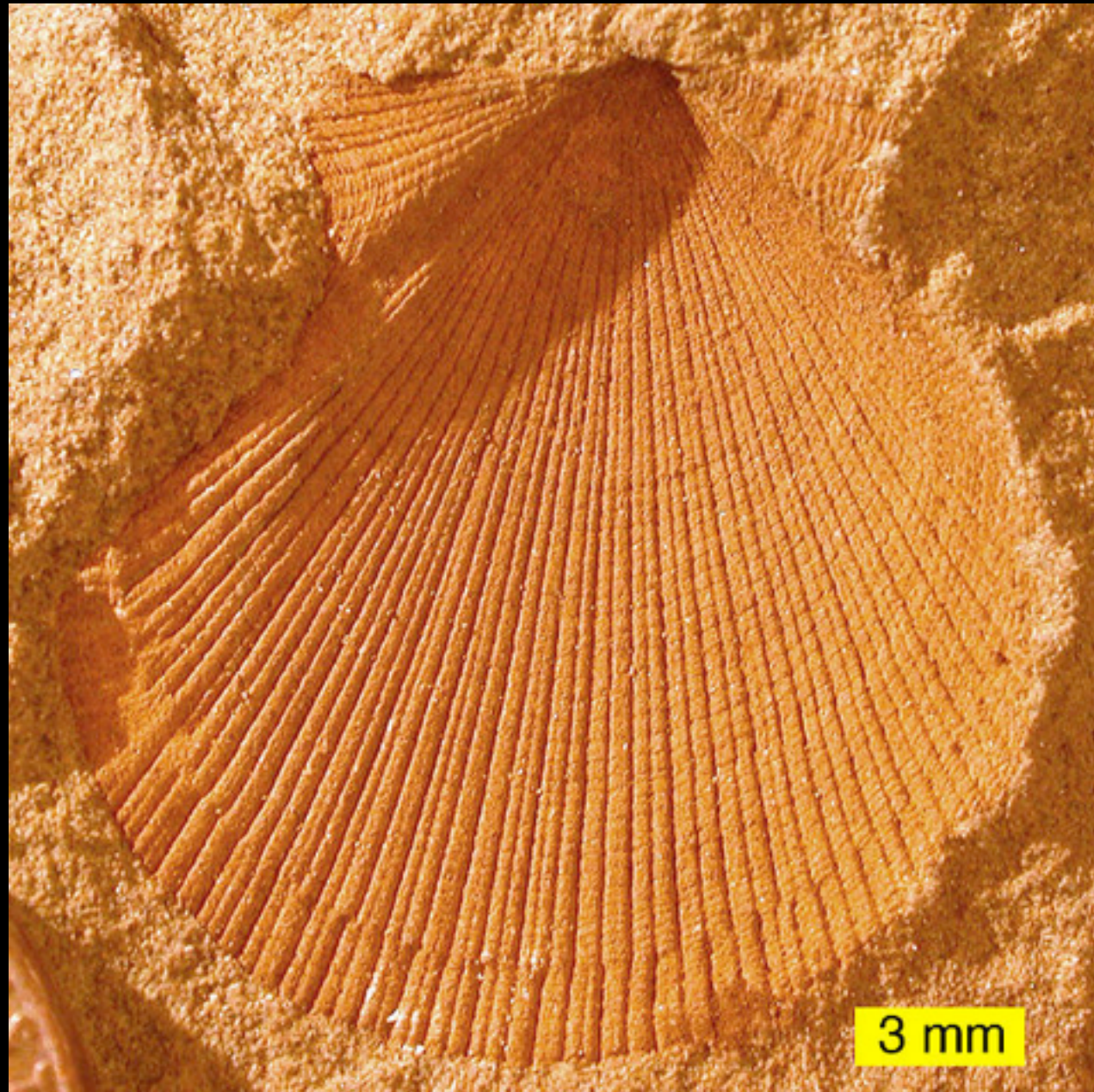
Leaves behind a carbon film

!! Soft parts !!

Carbonization



Routes to Fossilization

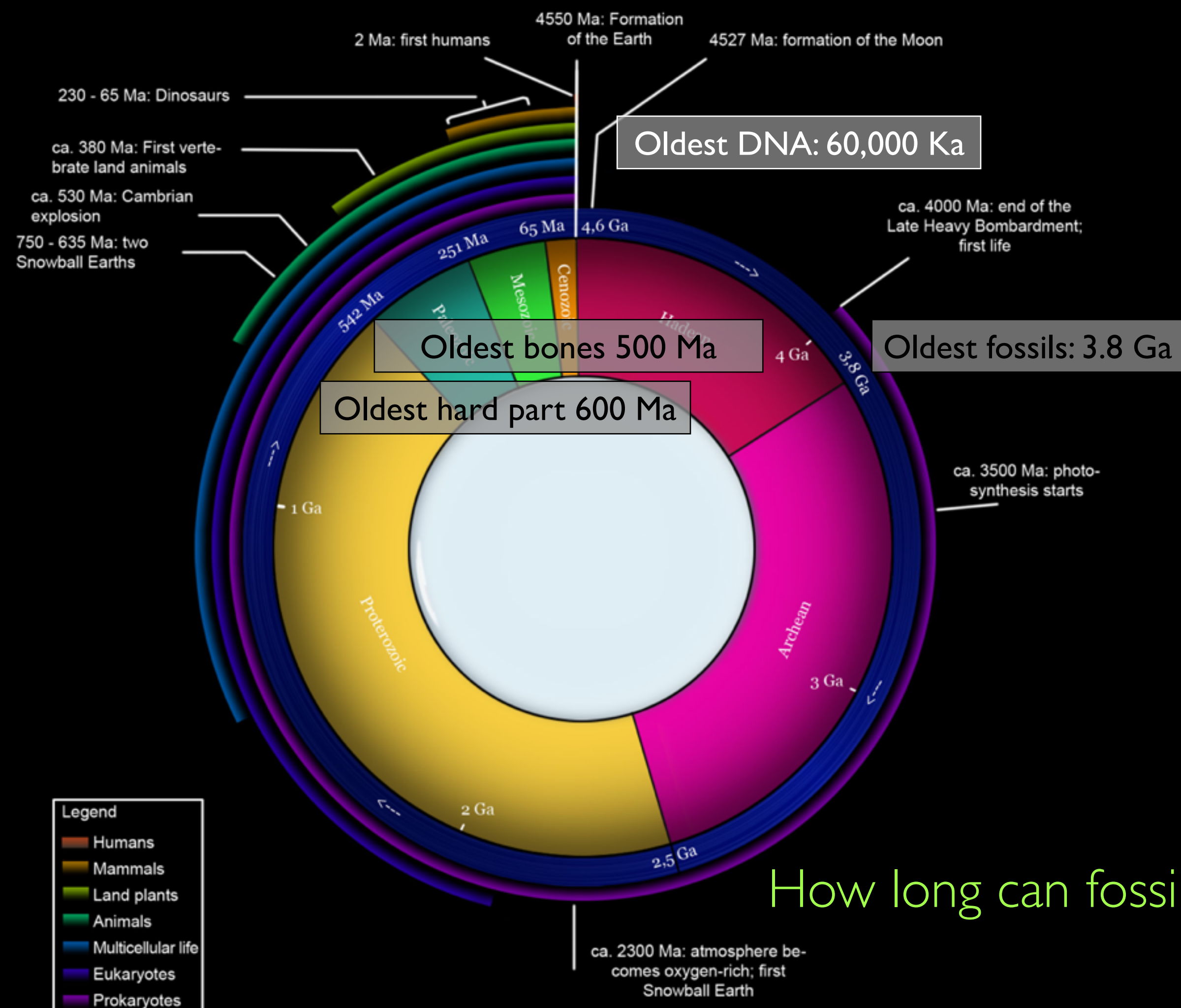


- Molds
- Casts
- Little or no original material



T. rex brain cast

Molds, casts



How long can fossils last?

Depositional Environments



&
Taphonomy

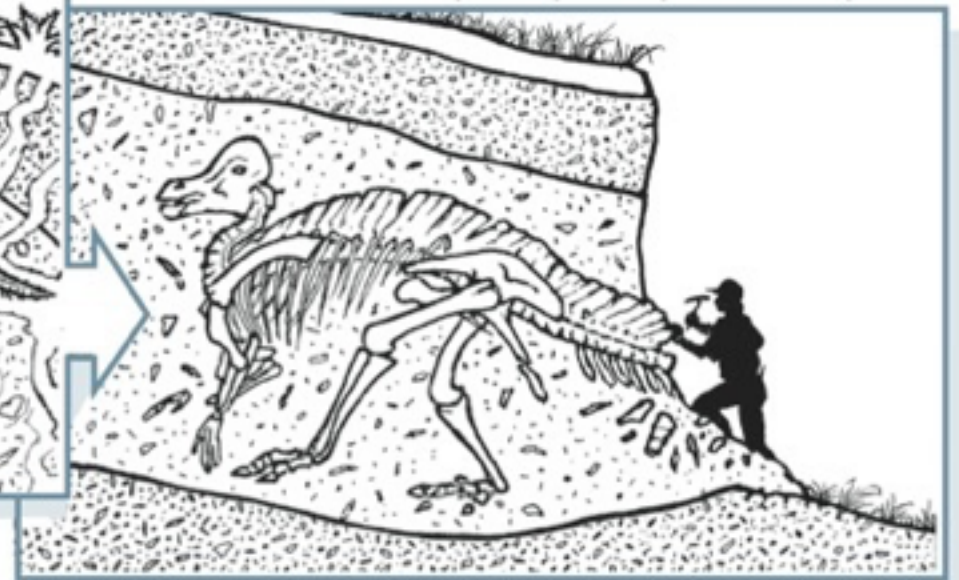
Taphonomy: study of the transition from the biosphere to the lithosphere



Replacement and/or permineralization

Nearly complete specimen exposed

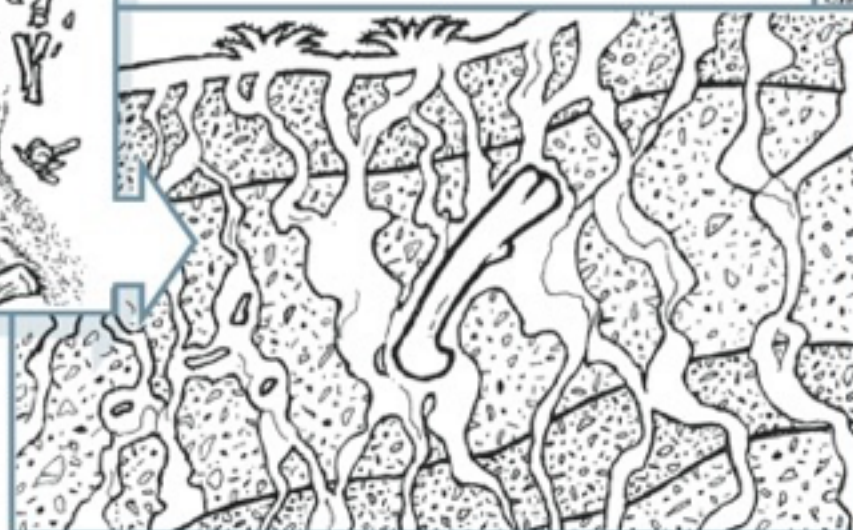
Quick burial



Dinosaur dies



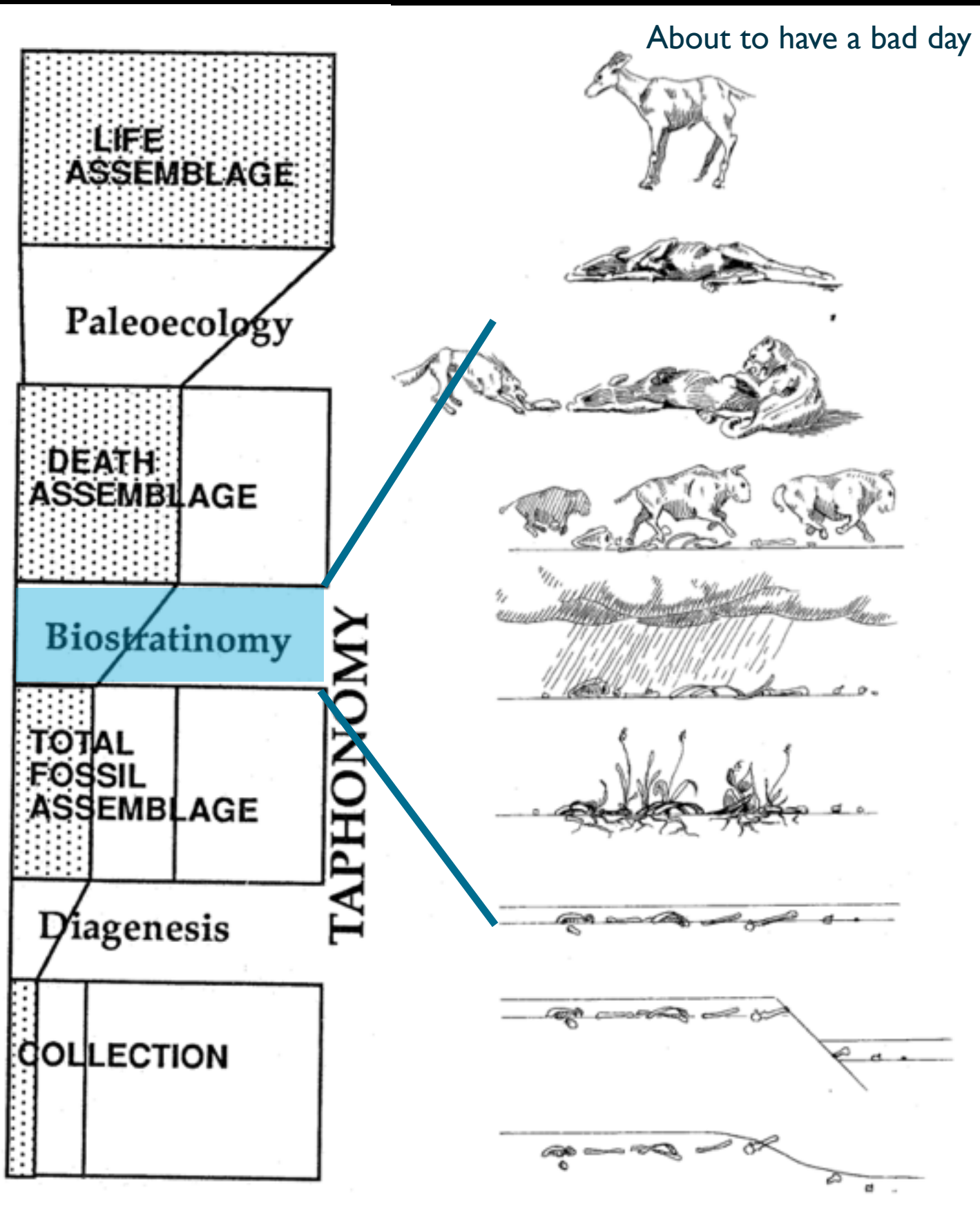
Dismemberment before burial – scavenging and other natural processes



Isolated bones buried and mineralized



Isolated bones exposed



Key: Rapid Burial!

Remains preserved at the death site (autochthonous)



Remains transported (allochthonous)



Fluvial (Rivers)



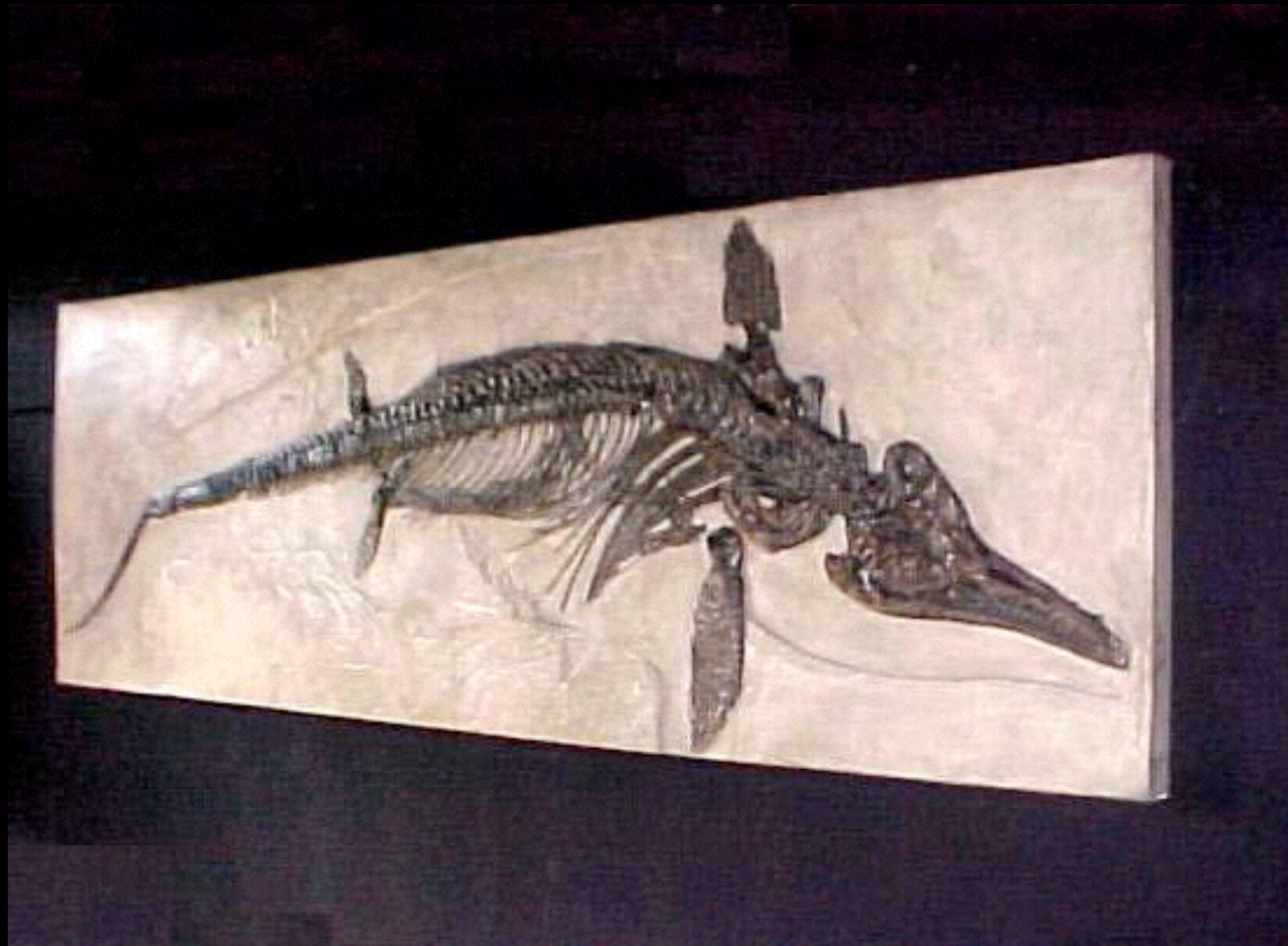


Deserts (rare)

Niger



Shallow Marine (rare)



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

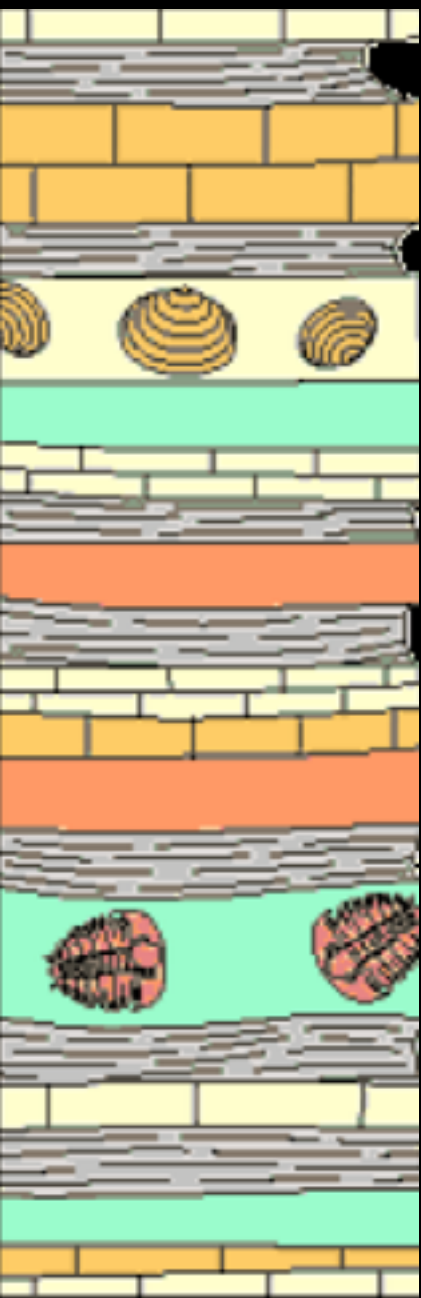


Placing fossils in TIME



Relative vs. Absolute Dating

YOUNGER



495 Ma

510 Ma

520 Ma

545 Ma

Absolute dates

Volcanic Ash

Relative ages

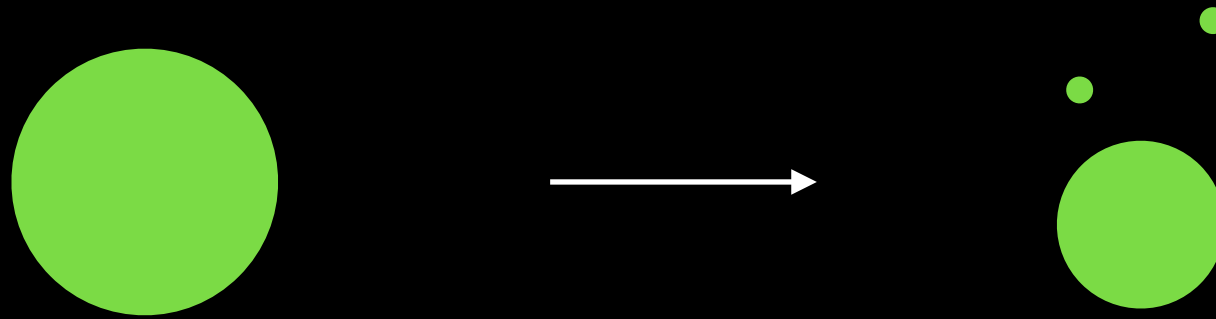
Issues:

- Last appearance
- Lazarus Taxa

OLDER

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

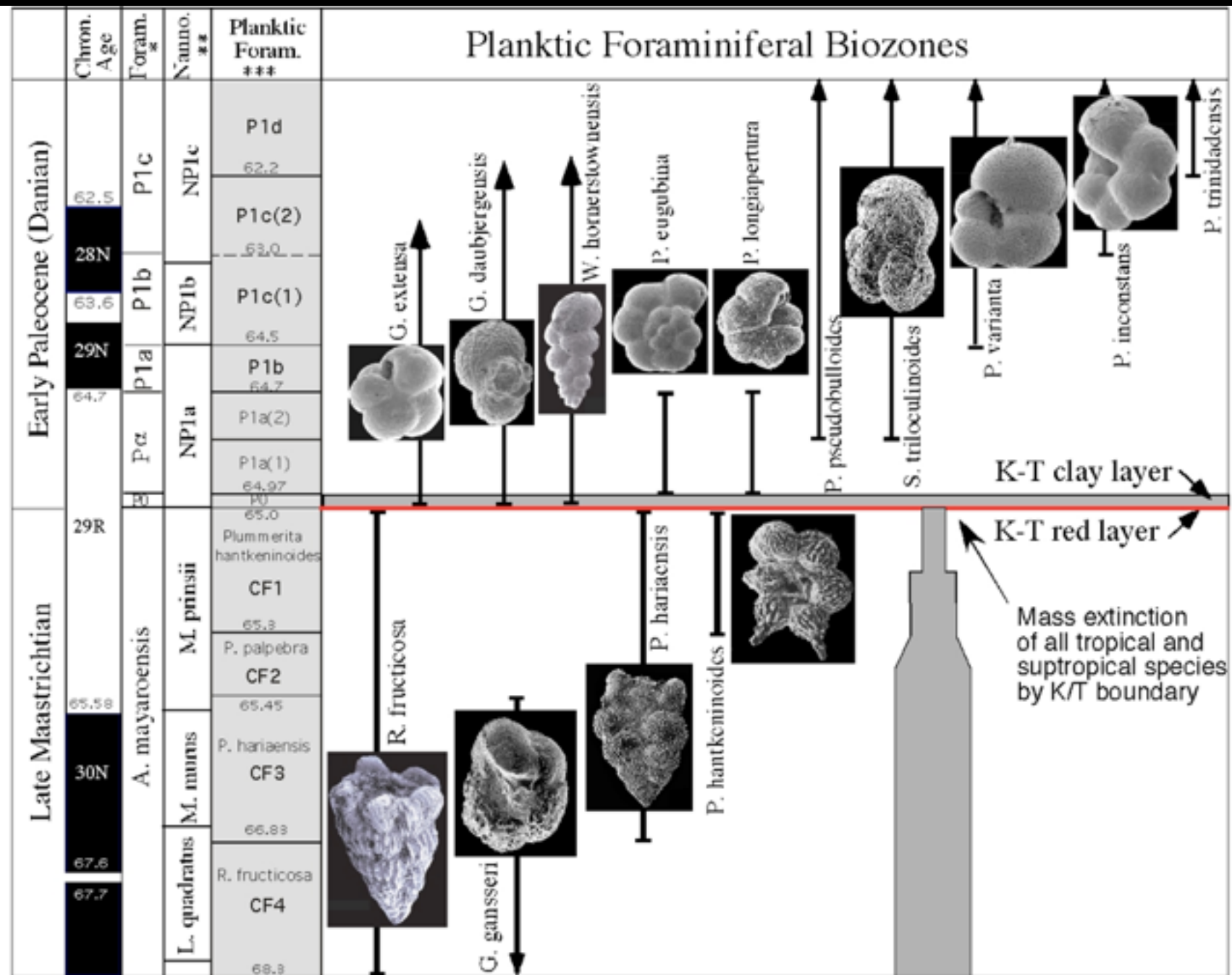


Figure 2

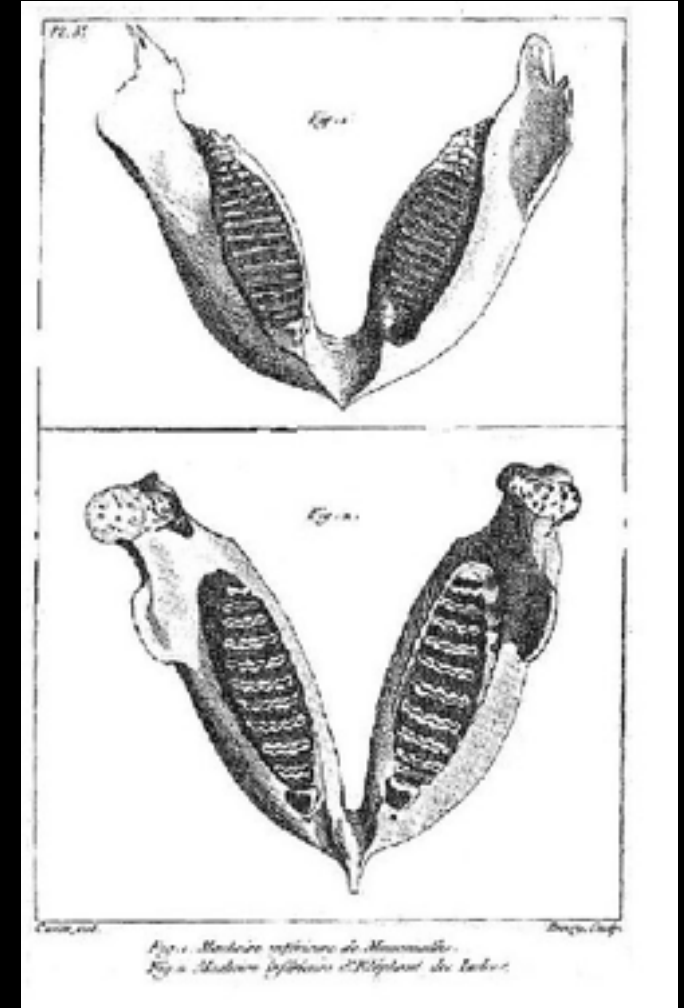
Relative Dating

George Cuvier (1769-1832)

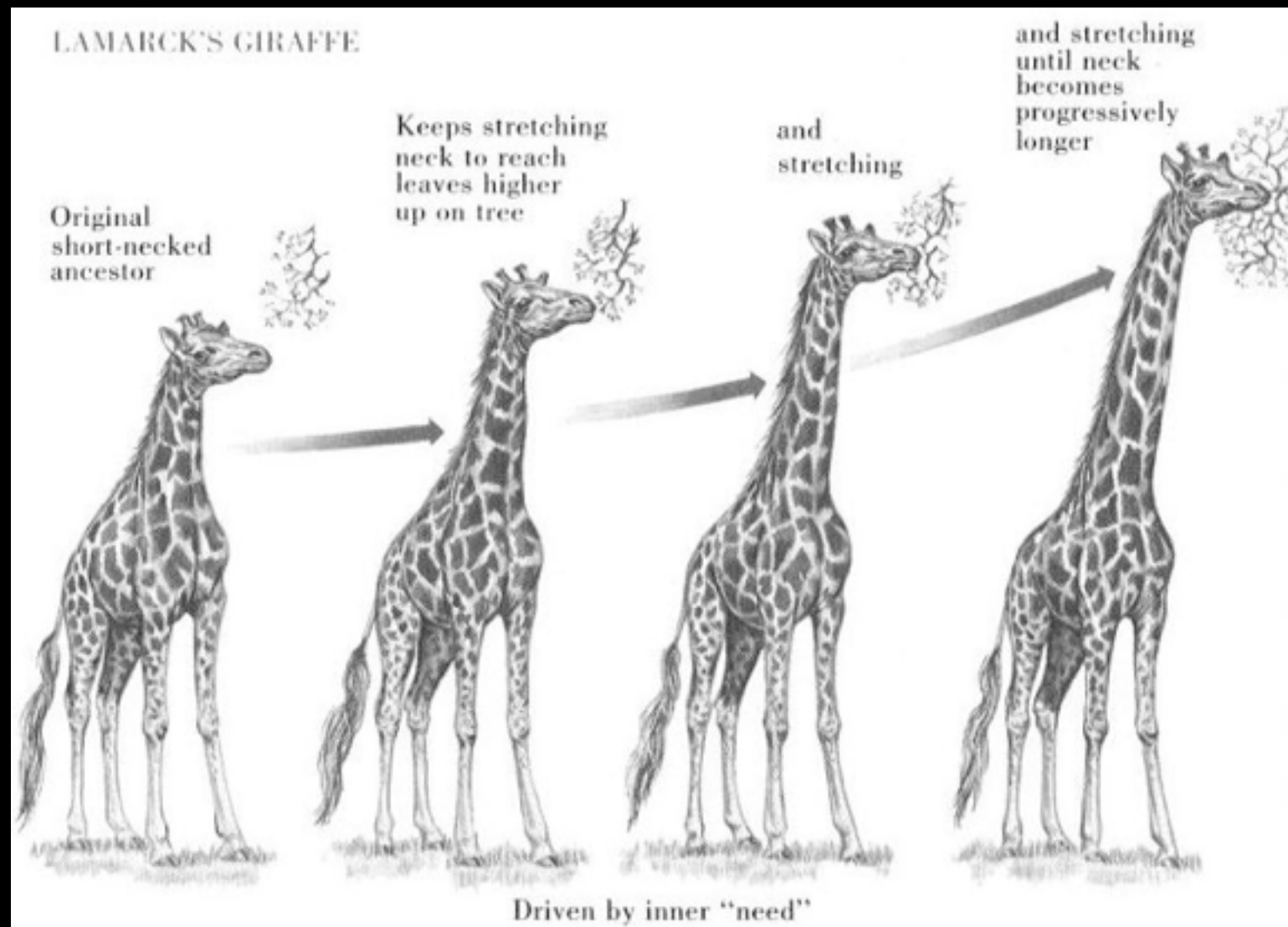


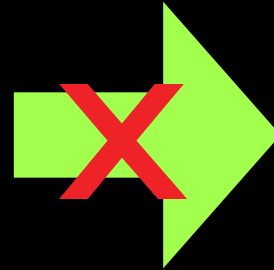
Indian elephant

Mammoth

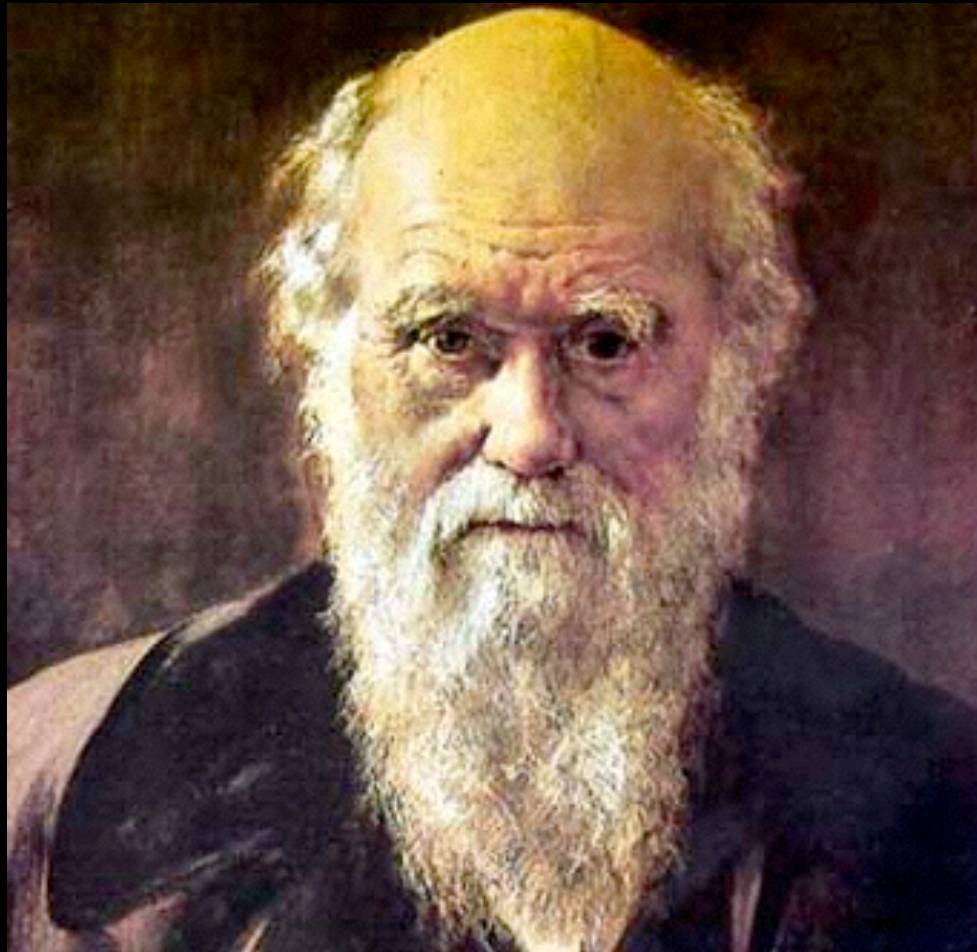


•Lamarckian





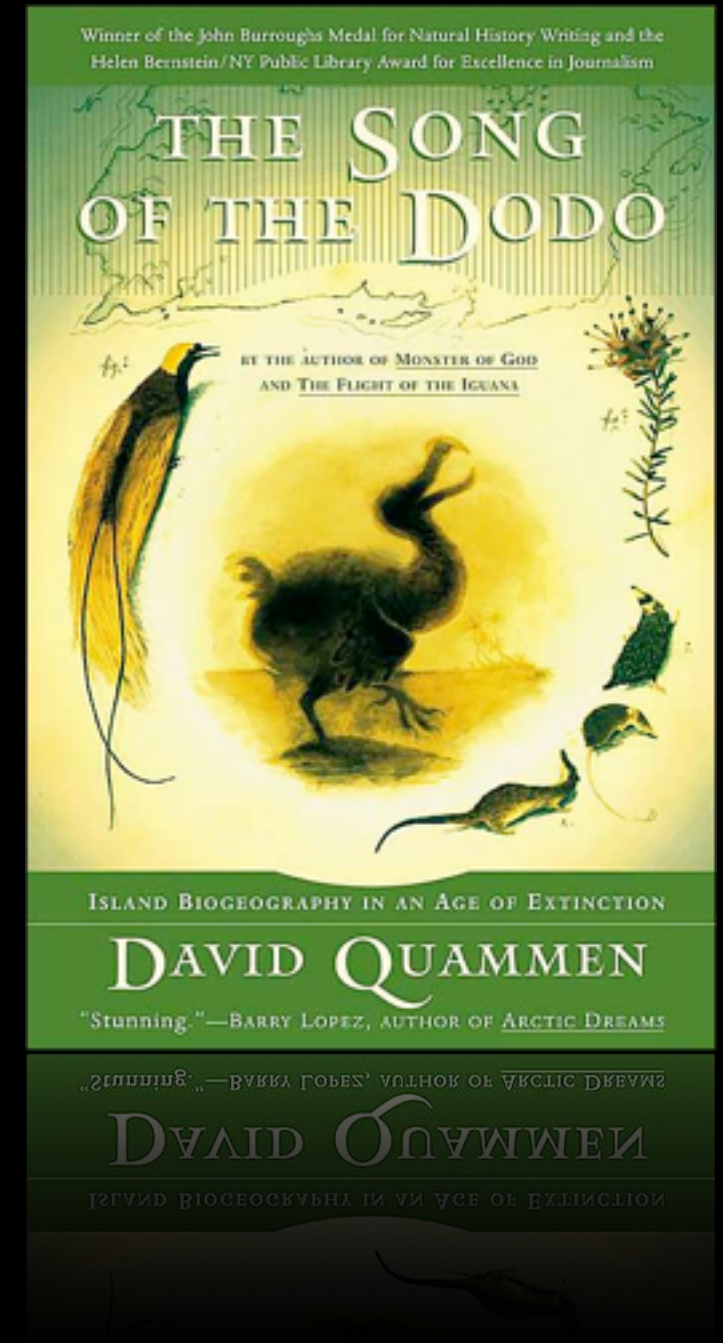
Evolution by Natural Selection



Charles Darwin



Alfred Russel Wallace

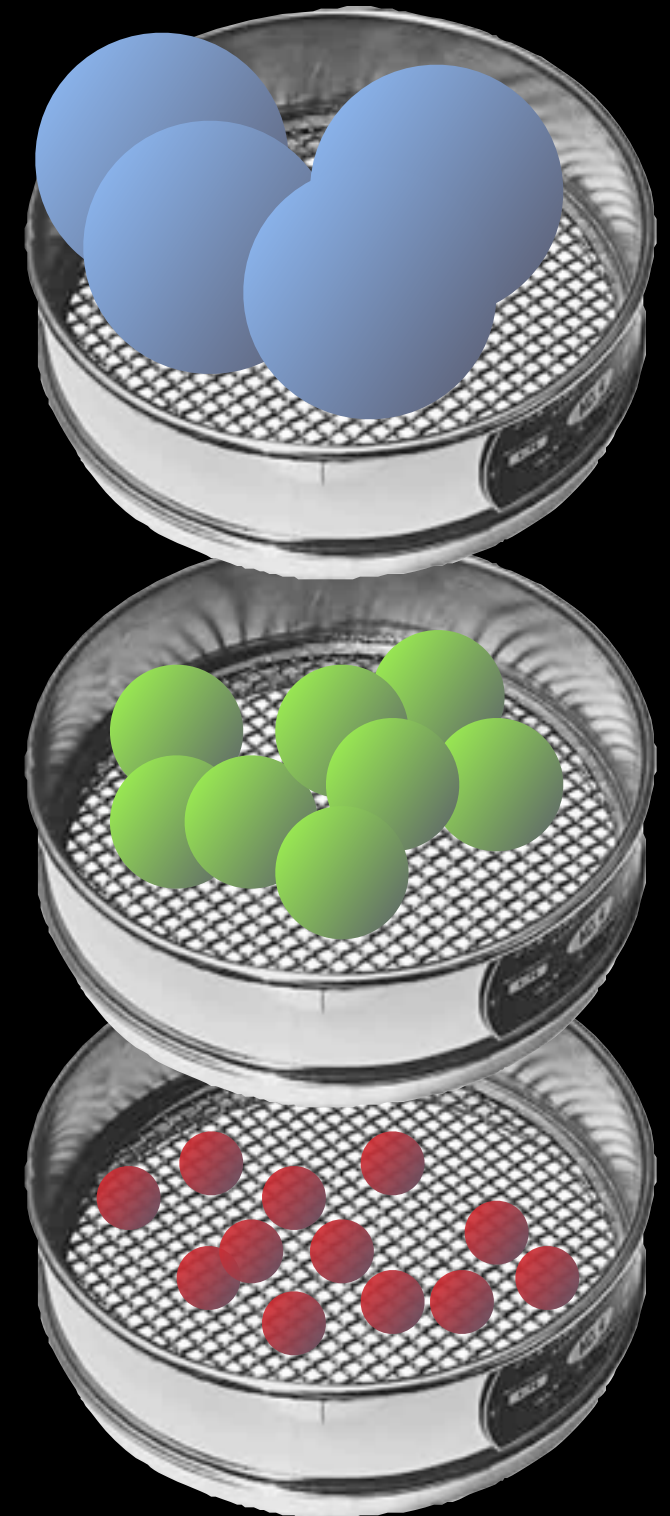


Evolution by Natural Selection!

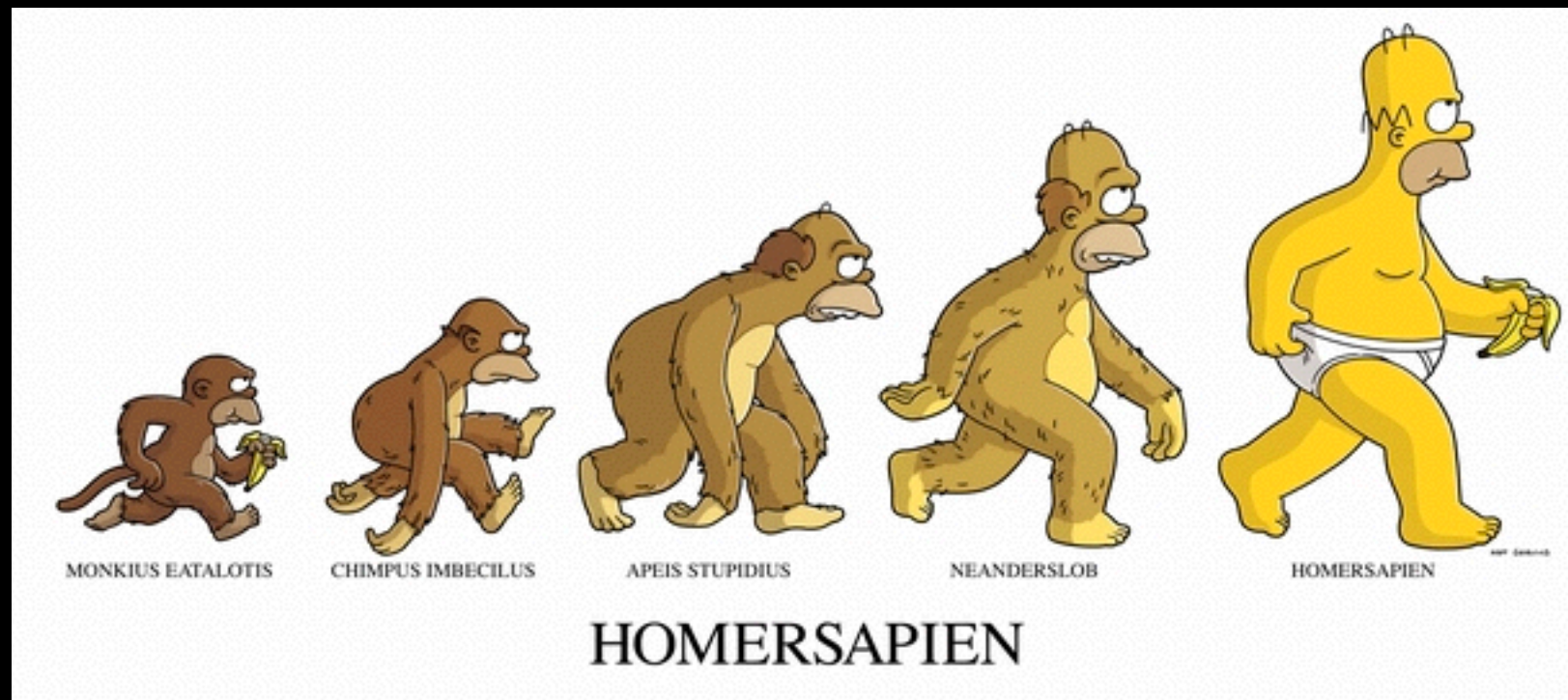
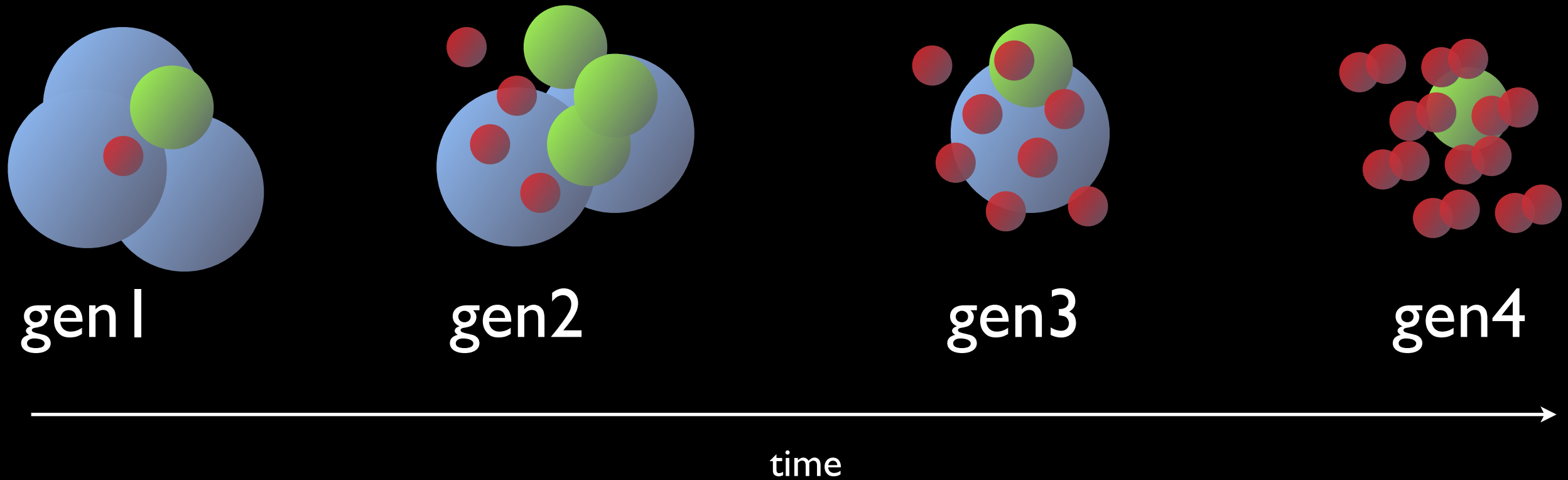


1. Inheritance
 2. Variation
 3. Selective 'force'
- Variants don't have
equal reproductive
success
- $$\frac{\text{Fecundity} + \text{Survivorship}}{\text{Fitness}}$$

time



Natural Selection: Purely mechanistic, not 'guided'!

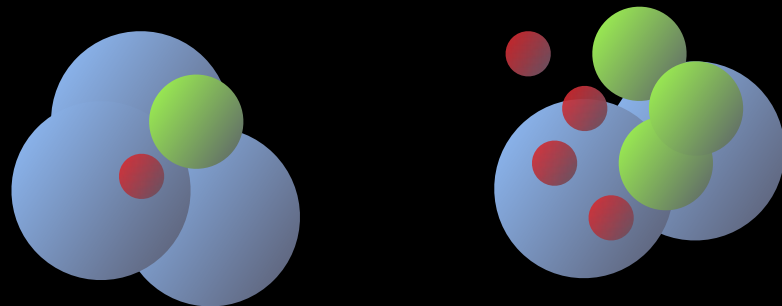


Individuals vs. Populations

Individuals



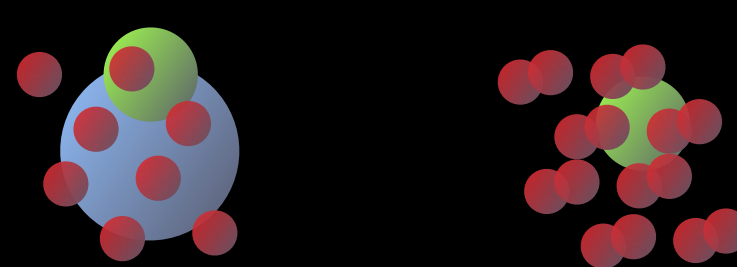
NATURAL
SELECTION



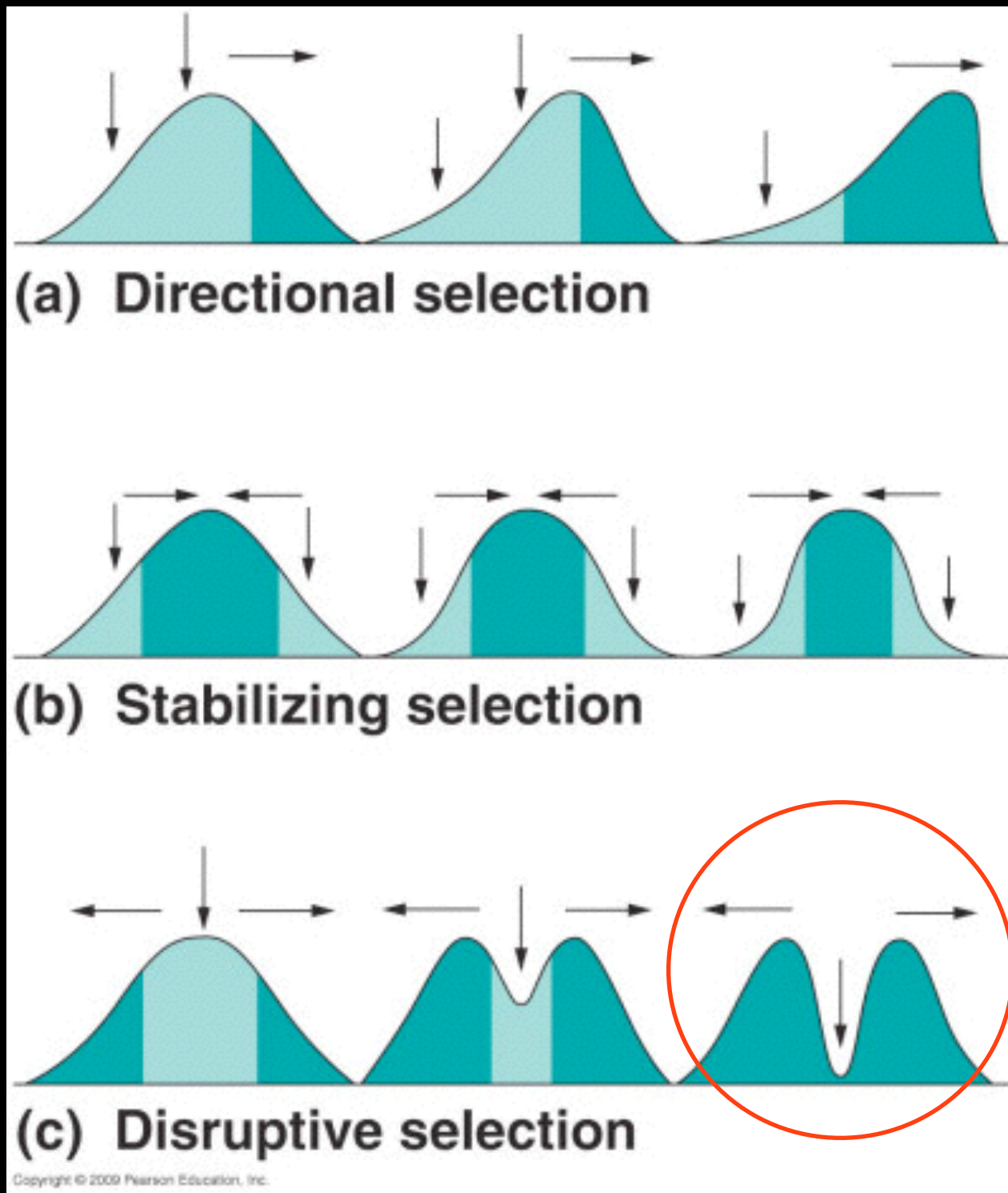
Populations



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

Allopatric

Original population



Initial step of speciation



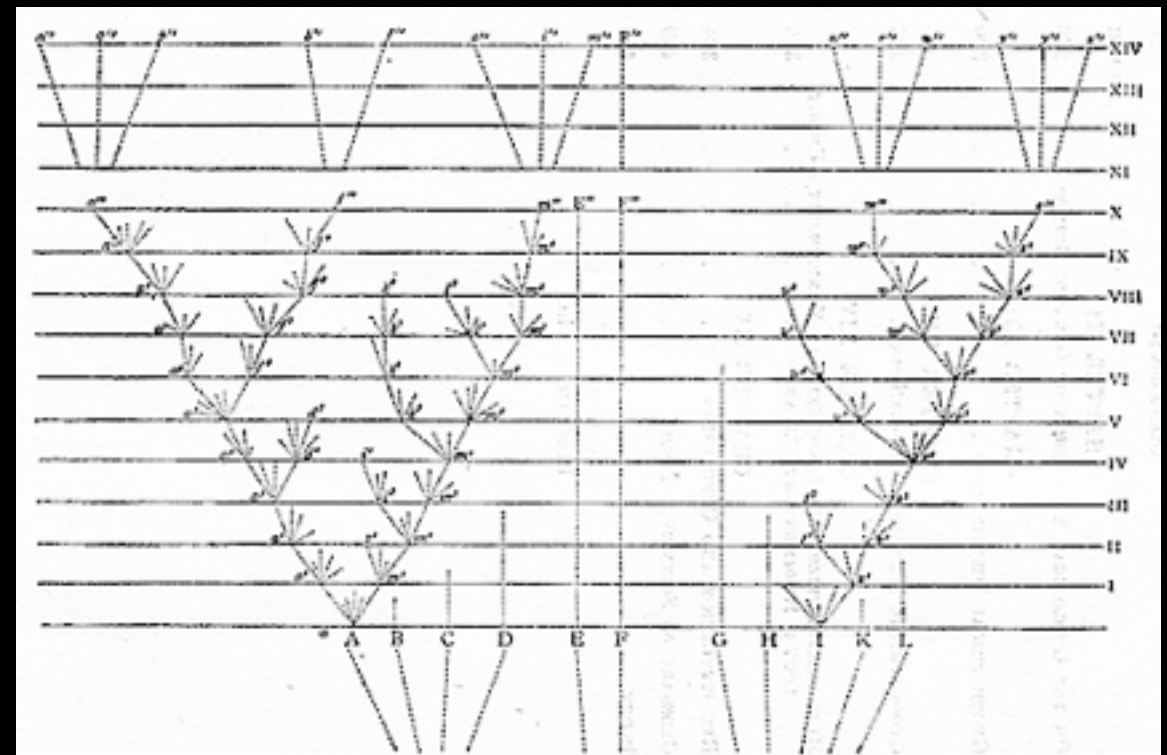
Barrier formation

Evolution of reproductive isolation



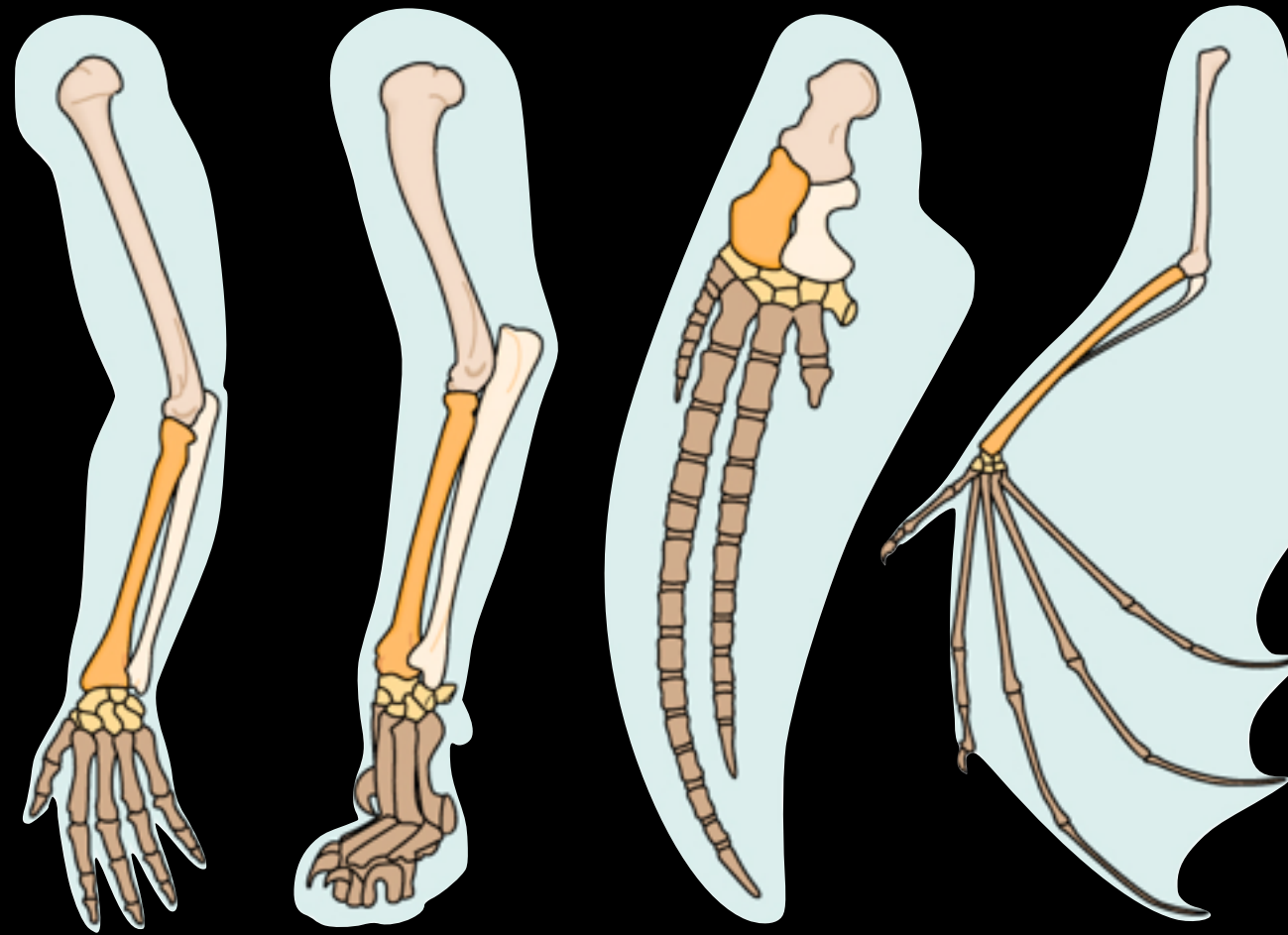
In isolation

New distinct species after equilibration of new ranges



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

I. Homologous characteristics



Human

Cat

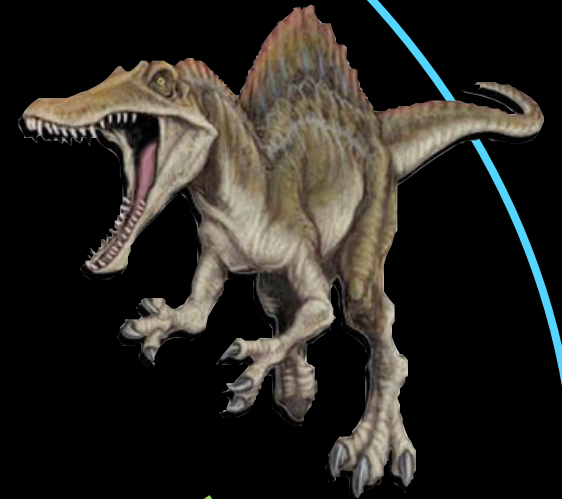
Whale

Bat

Evidence for Evolution

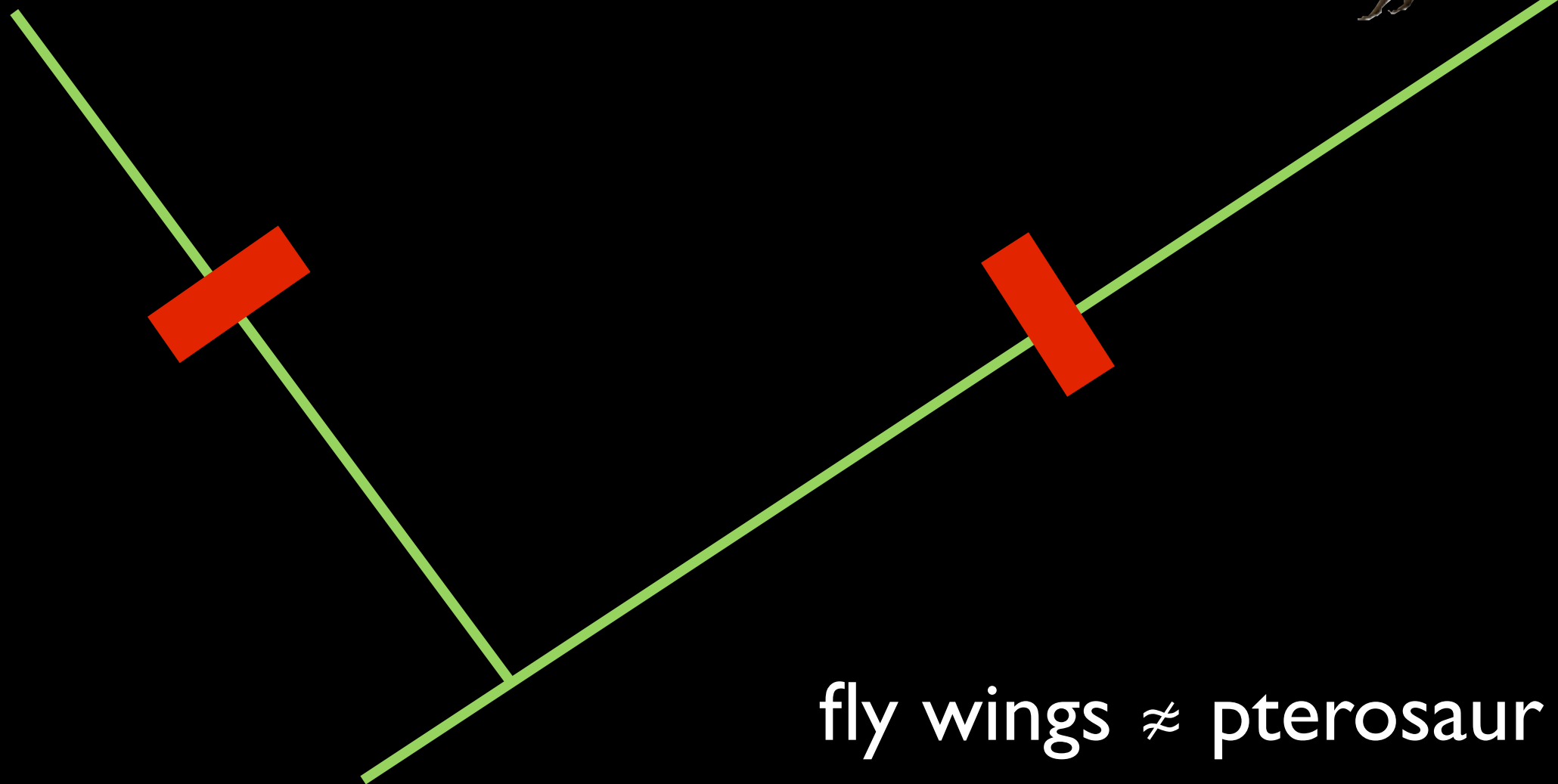


Homologous



human limbs ~ dino limbs
{The Tetrapod body plan}

Analagous



fly wings \neq pterosaur wings