

# Evolution

Because It Frakkin Works Better

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**Richard Carrier, Ph.D.**

**[www.richardcarrier.info](http://www.richardcarrier.info)**

# Resources

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# Resources

## The TalkOrigins Archive

Exploring the  
Creation/Evolution  
Controversy



*In warm memory of [Tero Sand](#) and [Bob Schadewald](#)*

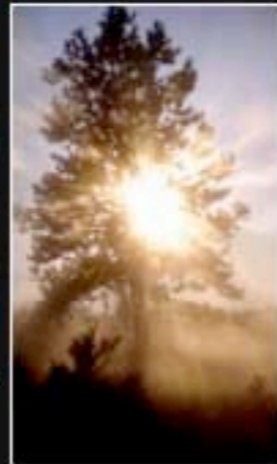
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**TalkOrigins Archive** is a collection of articles and essays, most of which have appeared in talk.origins at one time or another. The primary

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NATIONAL BESTSELLER

"A compelling scientific adventure story that will change forever how you understand what it means to be human."

—Oliver Sacks

## YOUR INNER FISH

A JOURNEY INTO  
THE  
3.5-BILLION-YEAR HISTORY  
OF THE  
HUMAN BODY



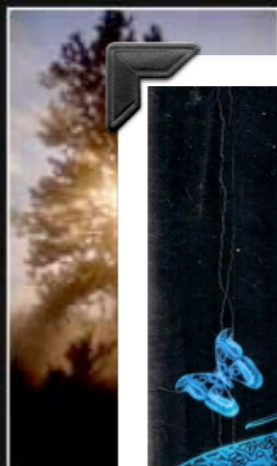
NEIL SHUBIN

WITH A NEW AFTERWORD

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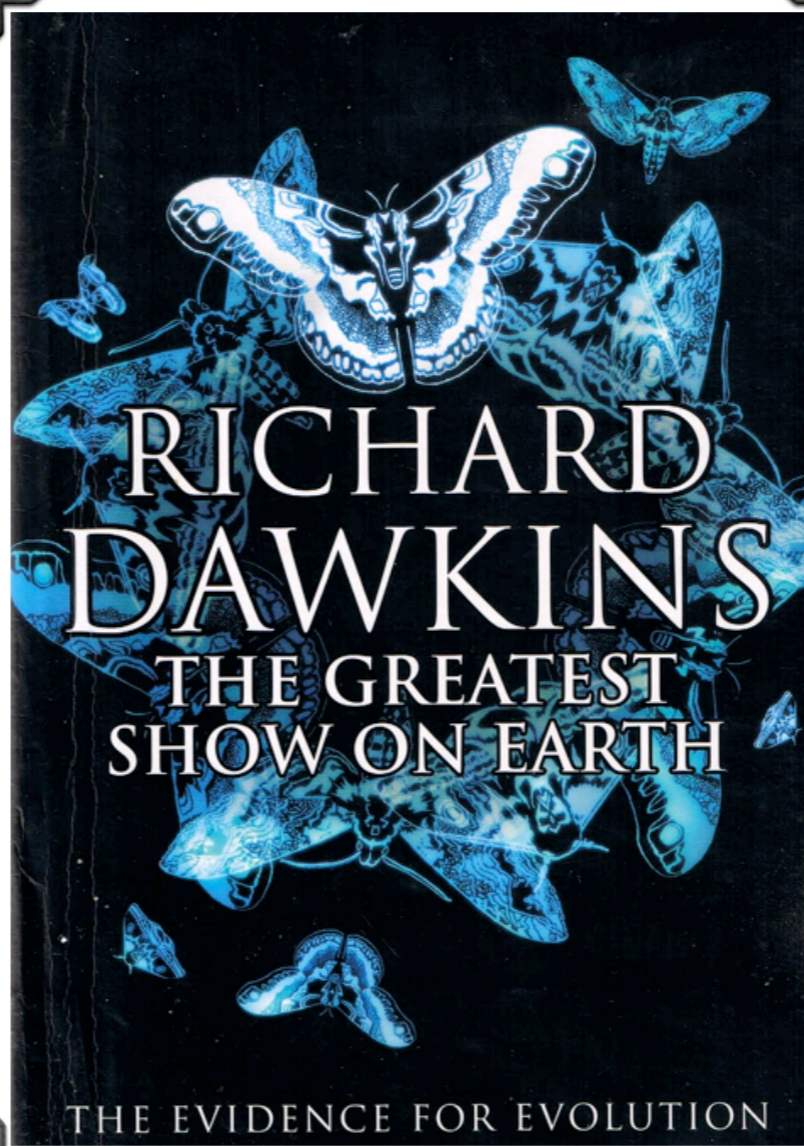
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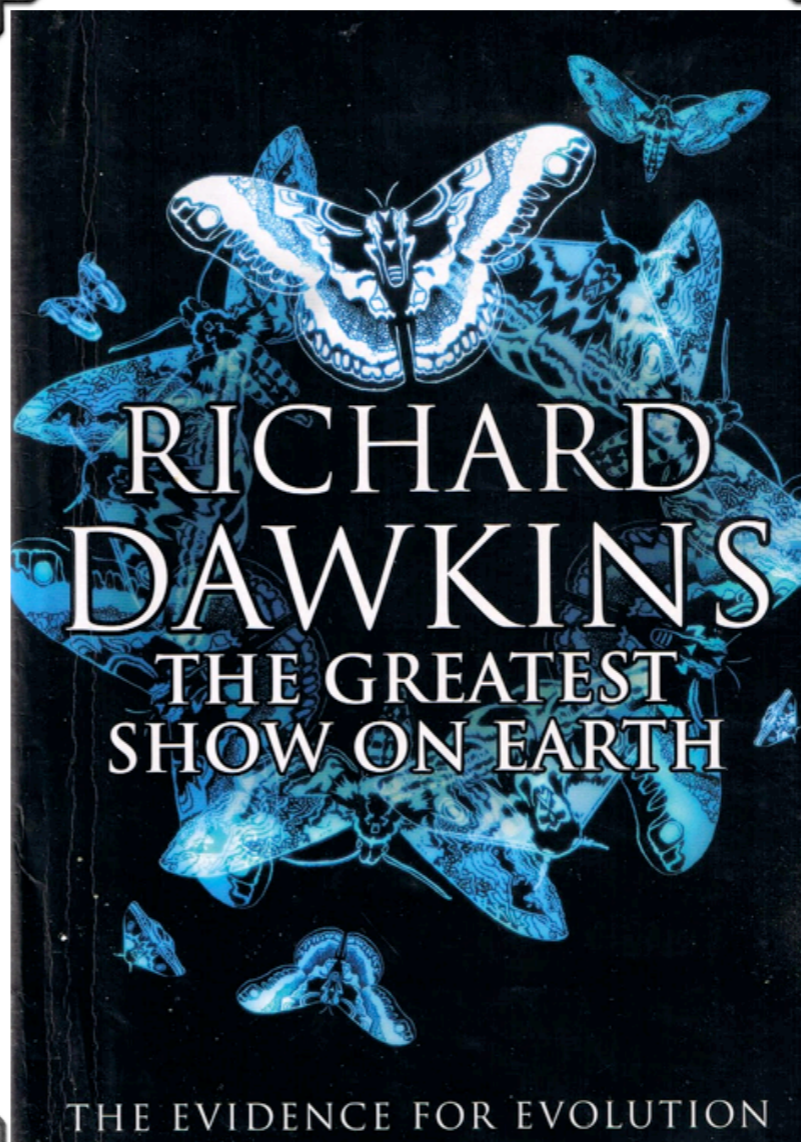
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## WHAT EVOLUTION IS

"The extraordinary Ernst Mayr bestows a wonderful and enduring gift—a companionship through reading with one of the sharpest minds of our age." —*New York Review of Books*

**ERNST MAYR** FOREWORD BY  
JARED DIAMOND



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*Christianity*

EDITED BY JOHN W. LOFTUS

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RICHARD  
W. WALKINS  
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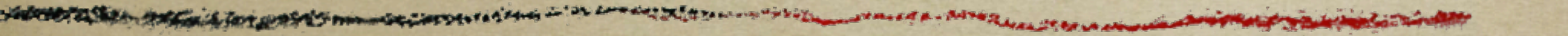
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**start with the facts**





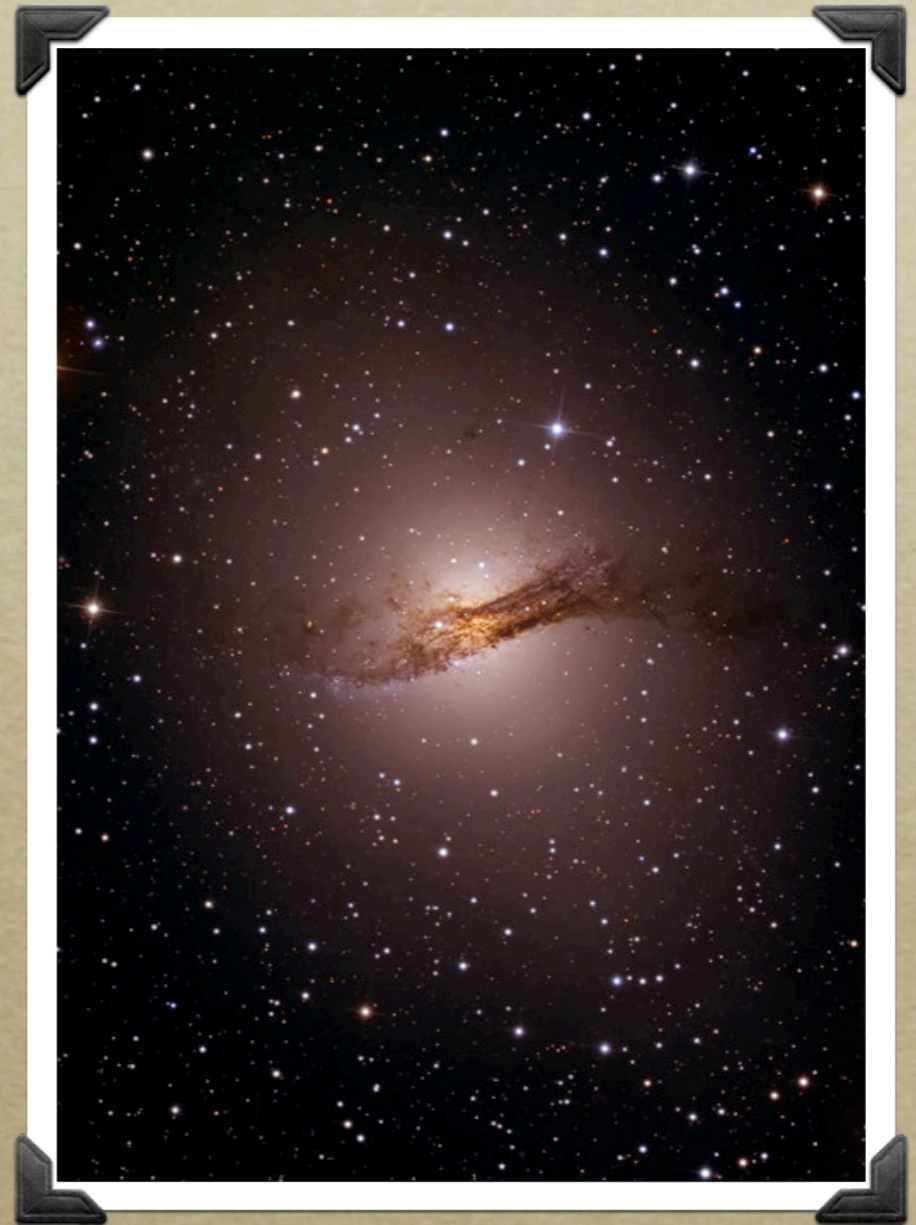


Monty Propps

[b3ta.com](http://b3ta.com)

# The Big Bang Theory & All That Whatnot

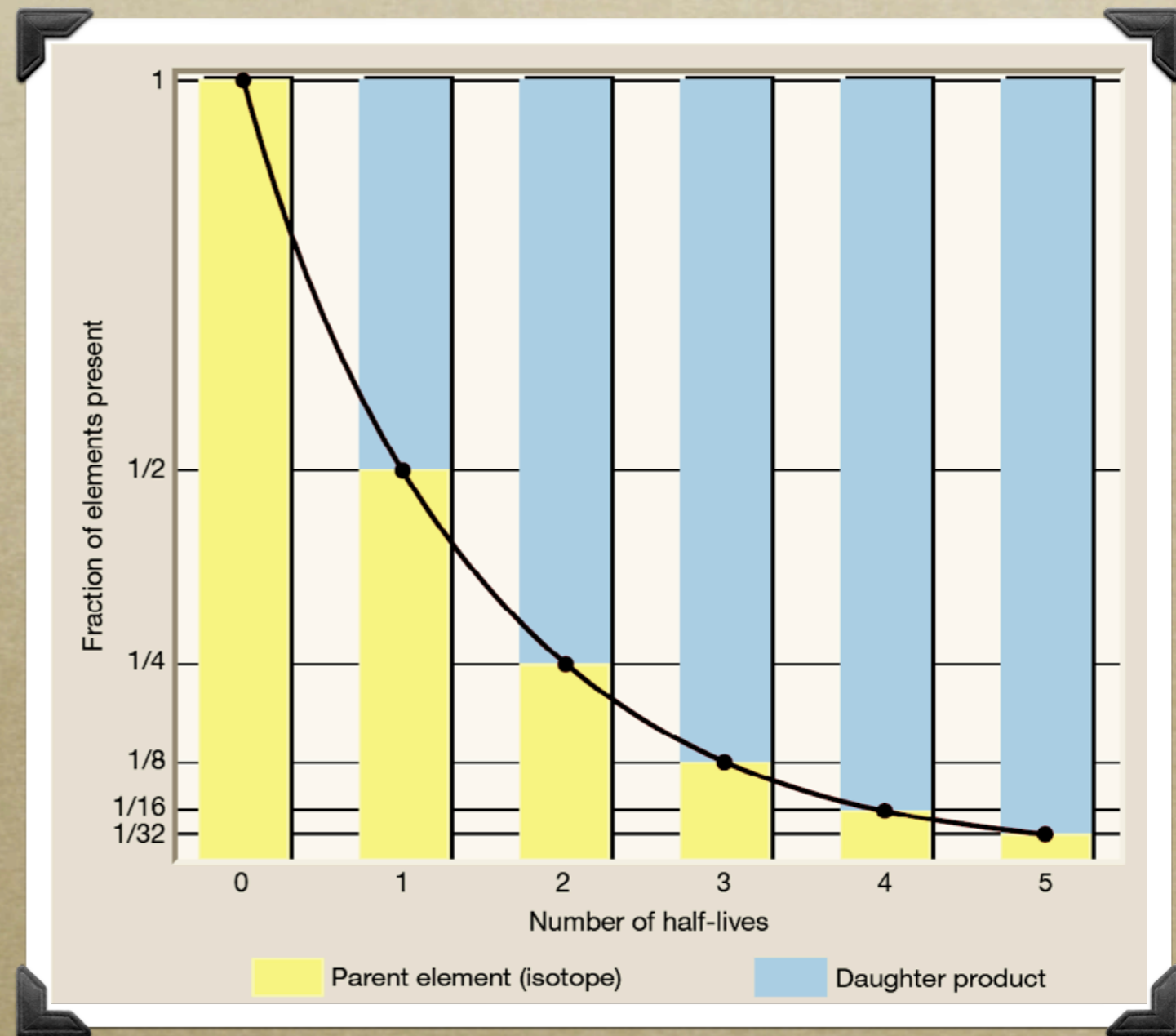
- *Visible universe ~ 14 BYA*
- *Speed of light + standard candles = age of universe*
- *Nuclear physics + stellar spectrometry = same*



# Dating Rocks

(and for grammar geeks, that's an amphibole!)

- *Potassium to Argon*
  - (argon becomes a gas when rock melts)
- *Uranium to Lead*
  - (some minerals won't crystallize with lead)



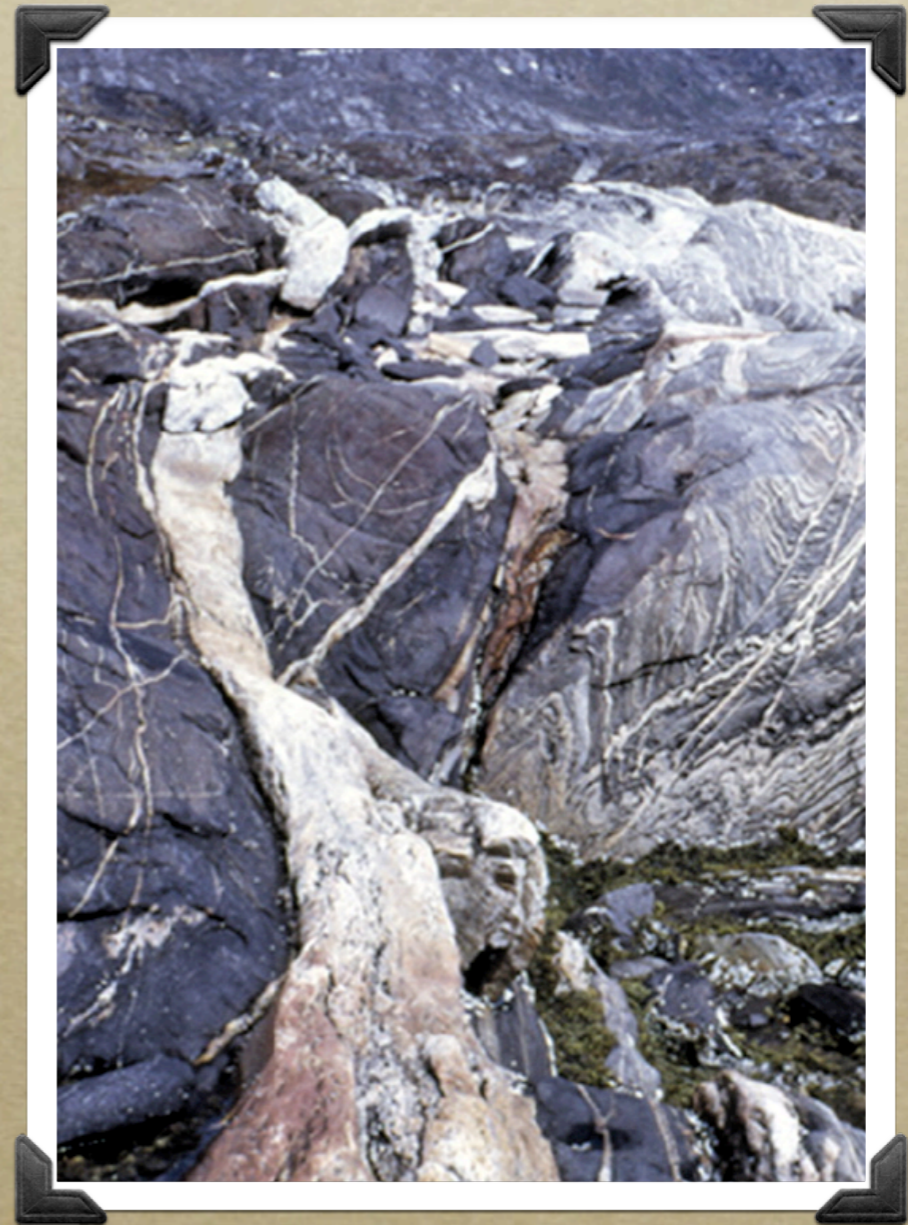
# Earth is Dirty

- *Annual flooding*
  - **(year by year)**
- *Volcanic ash / magma*
  - **(above is younger, below is older)**



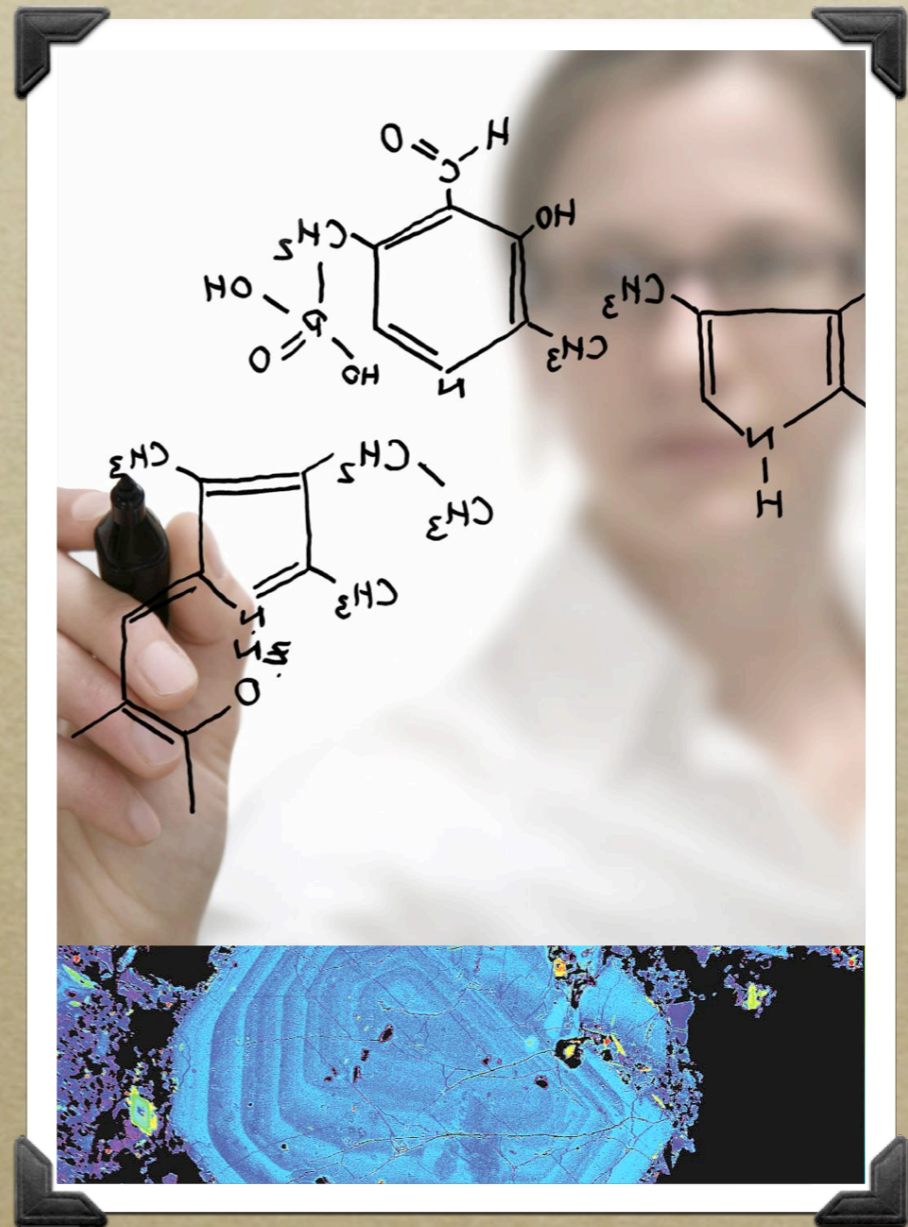
# The ~~Rock of Ages~~ Age of Rocks

- *Earth* ~ **4.5** BYA
- *1st life* ~ **4** BYA
- *1st fossils* ~ **2.5 - 3.7** BYA
- *1st tissues* ~ **0.6** BYA
- *1st bones* ~ **0.4** BYA



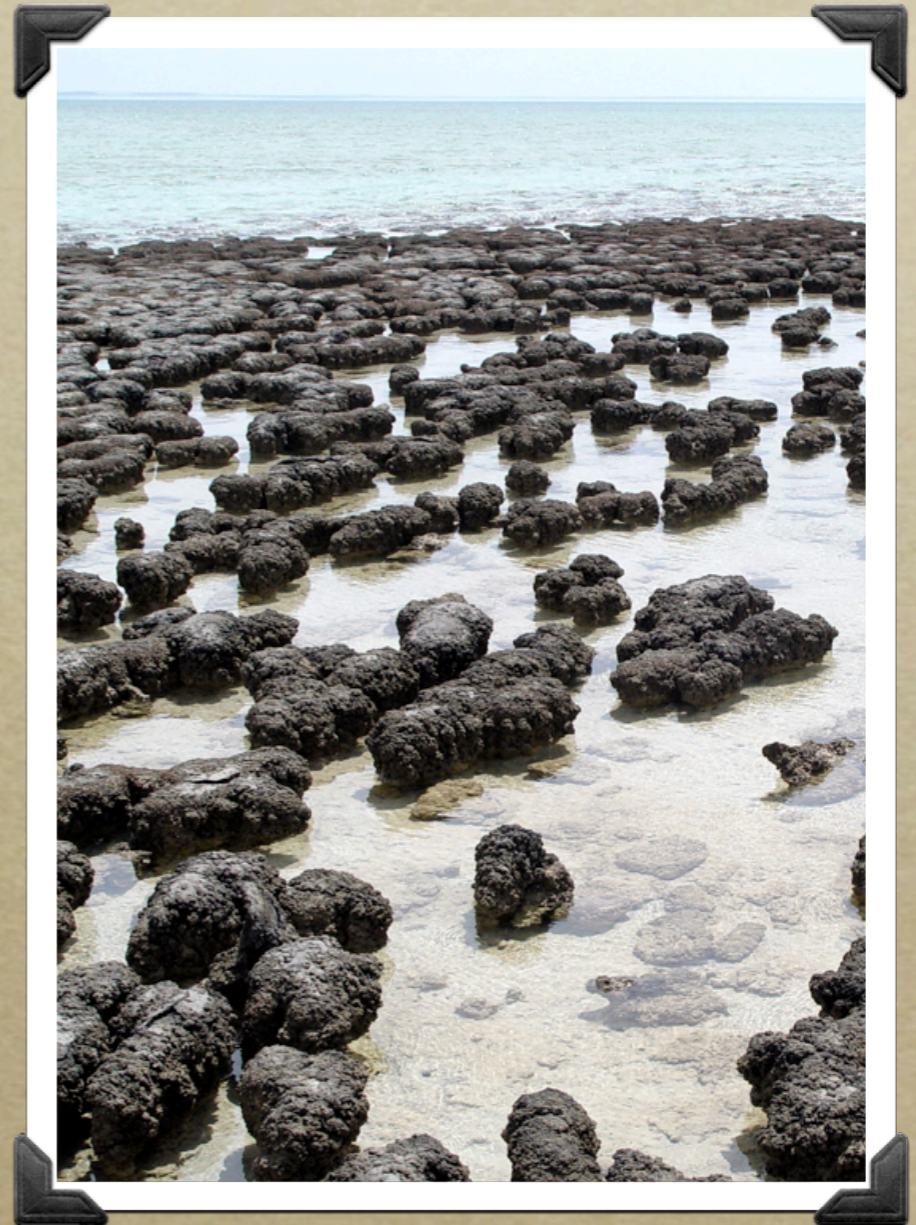
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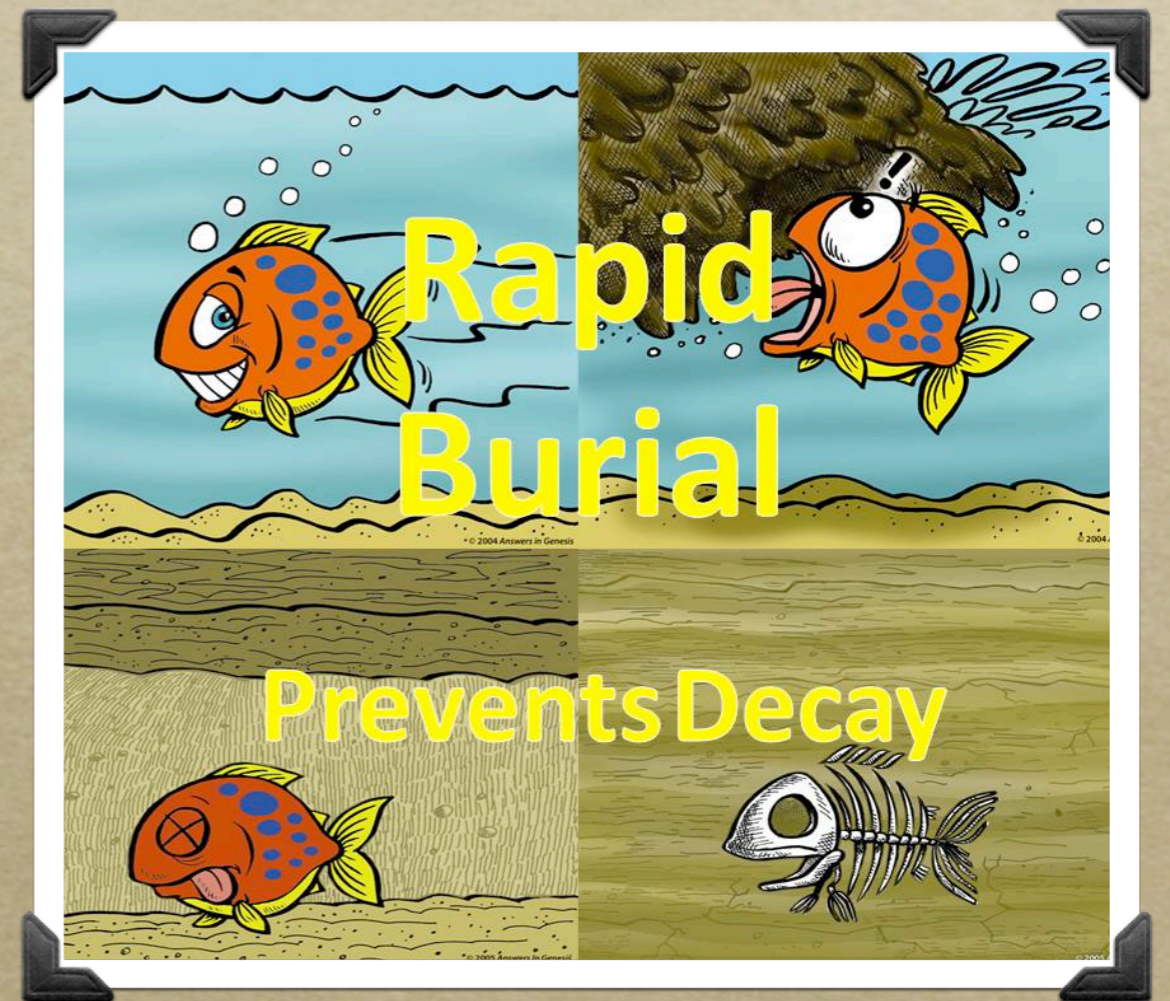
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# Fossils = Lucky Dead Things

- *Usually must be buried completely and rapidly*
- *In anaerobic sediment (that means no oxygen)*
- *So scavengers & bacteria can't eat it nor can it "rust" (oxidize) or be scattered by weather*
- *Must be undisturbed so can be slowly replaced by minerals*

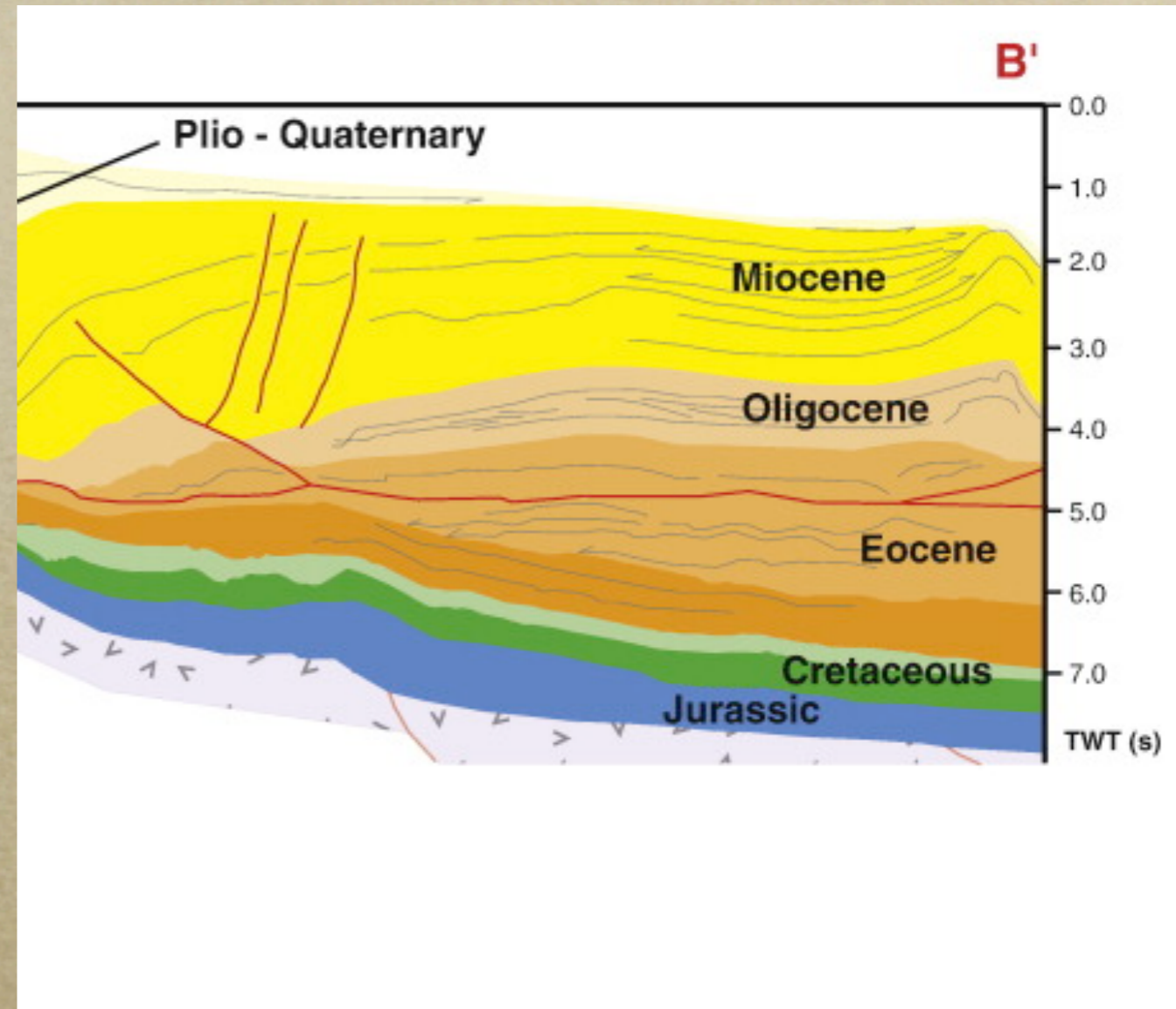


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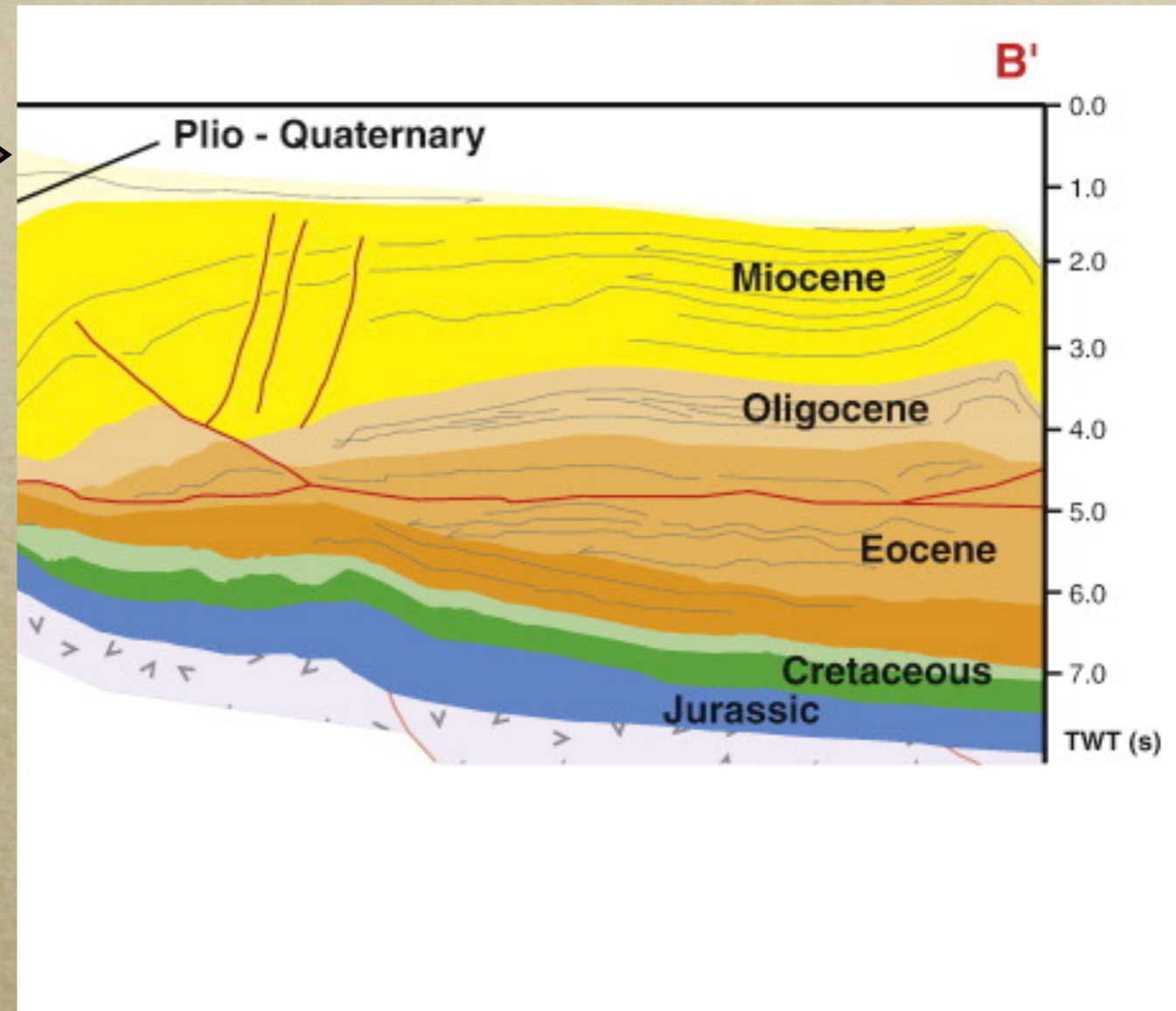
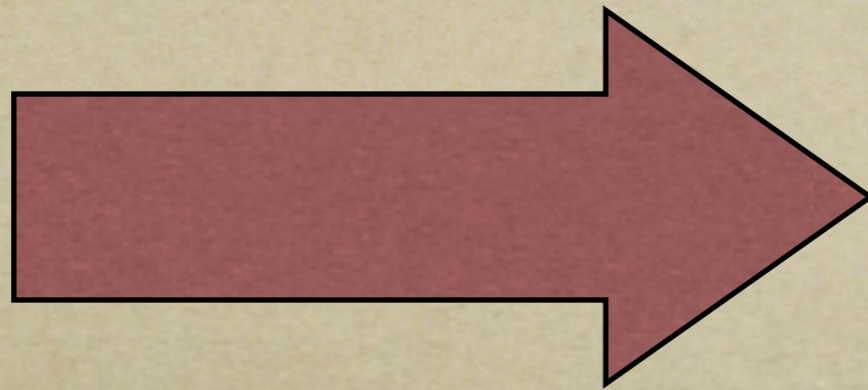
- Usually must be buried completely *and* rapidly
- In anaerobic sediment means no oxygen
- So scavengers can't eat it nor can it be scattered
- Must be undisturbed so can be slowly replaced by minerals

Therefore  
Fossils Are  
Rare



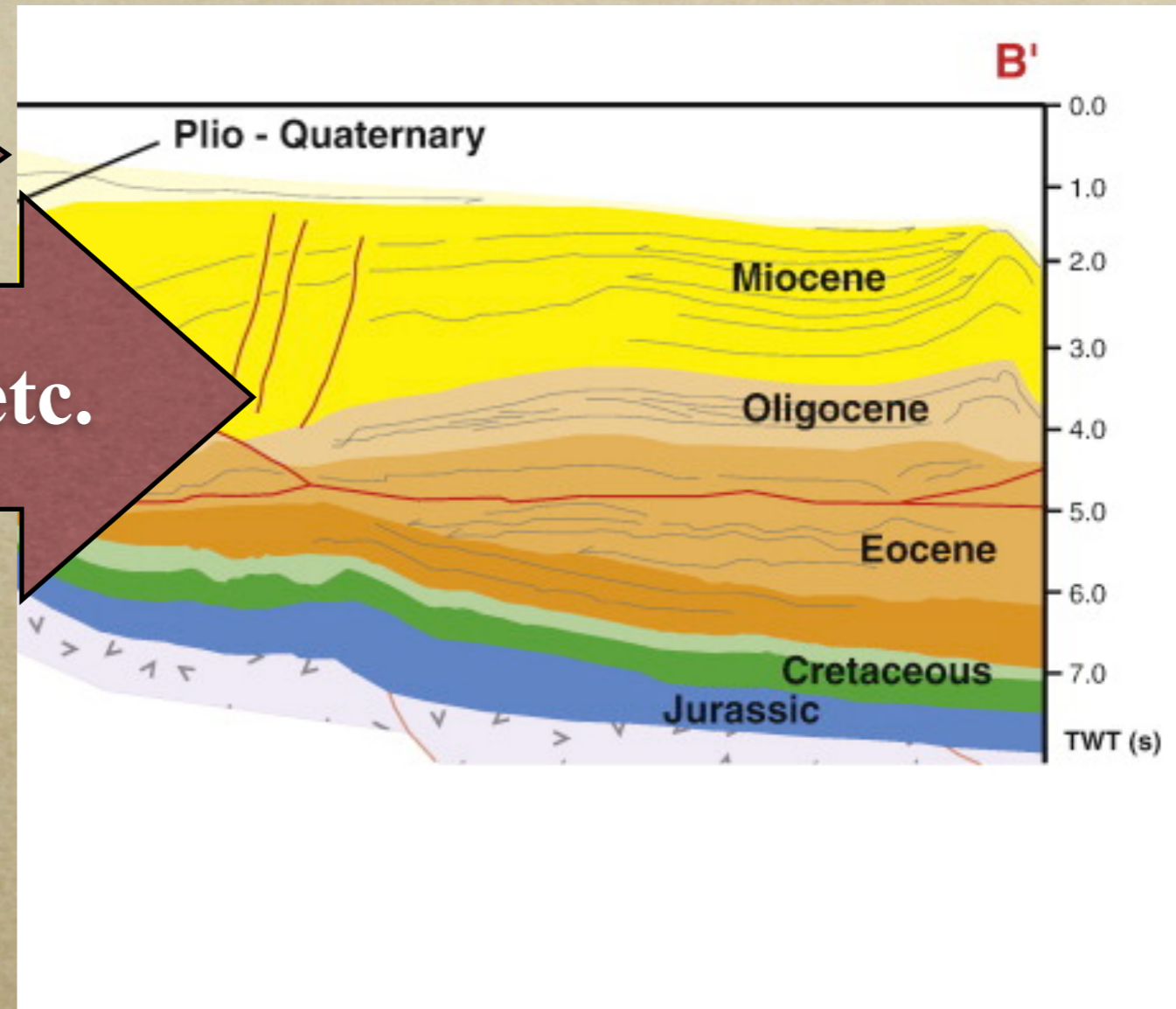


**Not All Created at Once...**

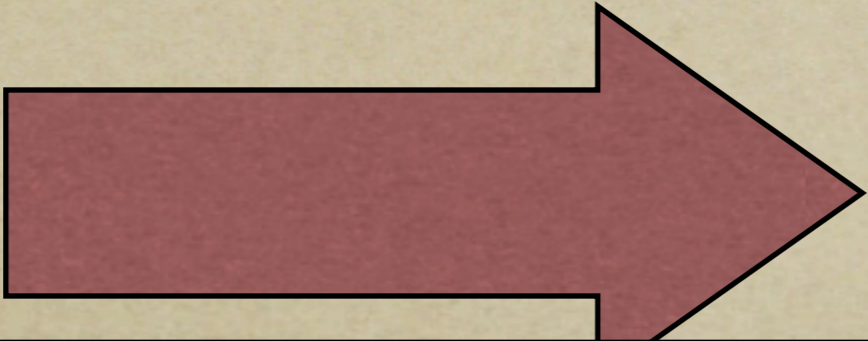


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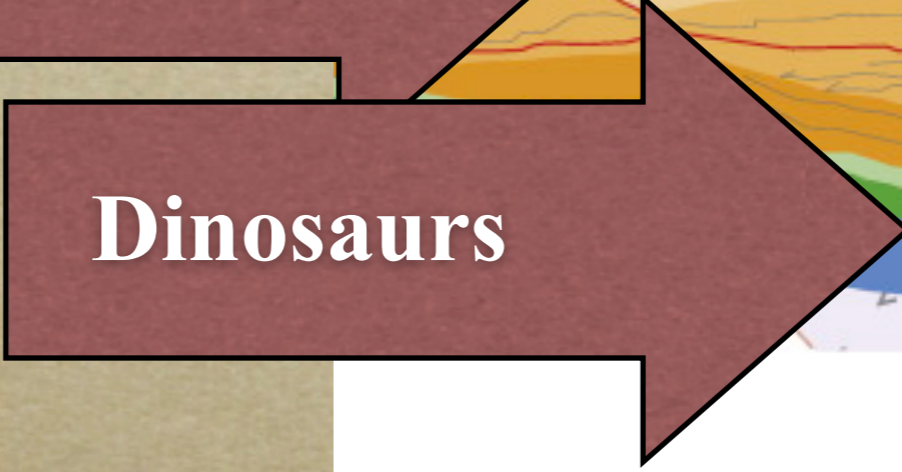
Bats, whales, monkeys, cats, etc.



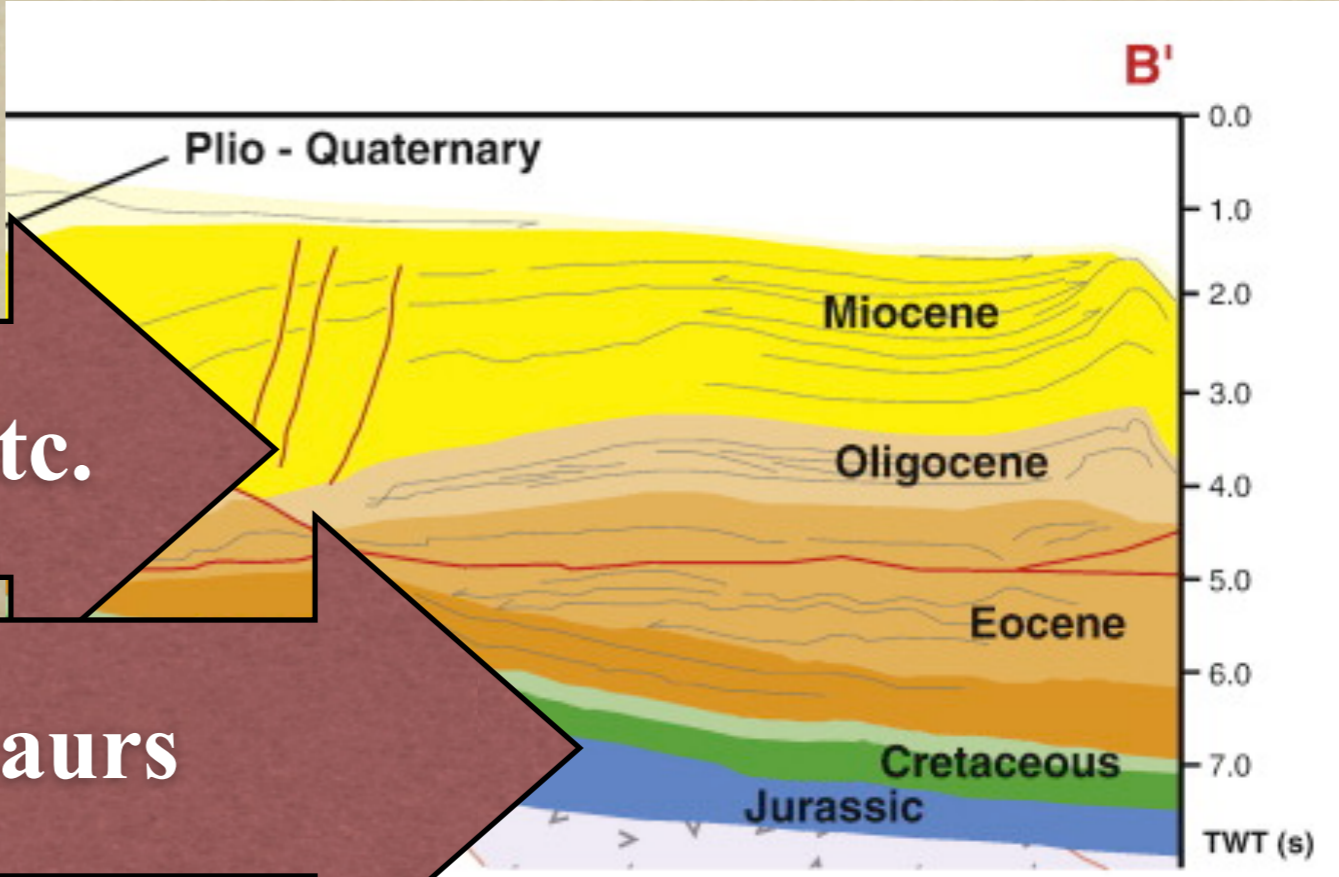
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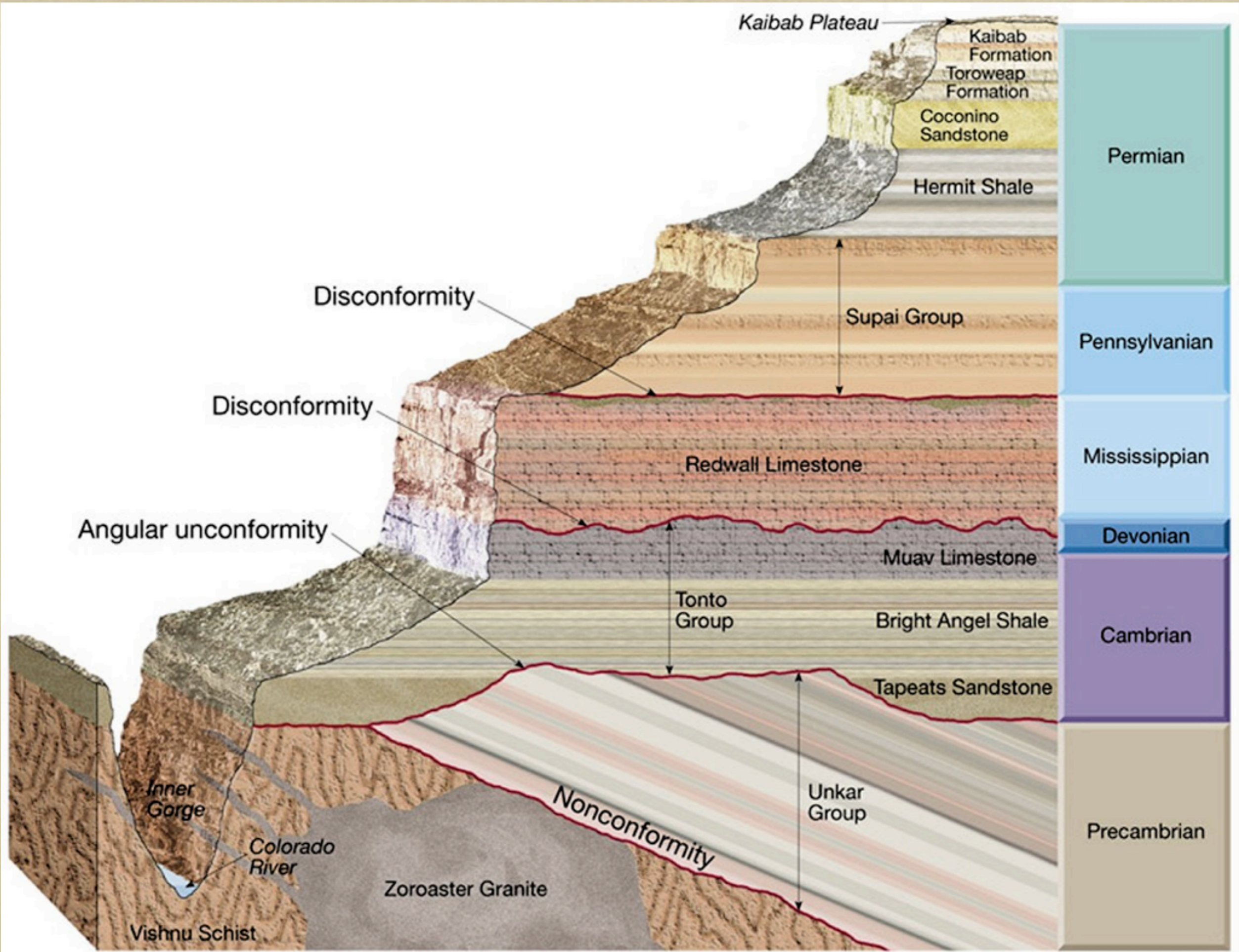


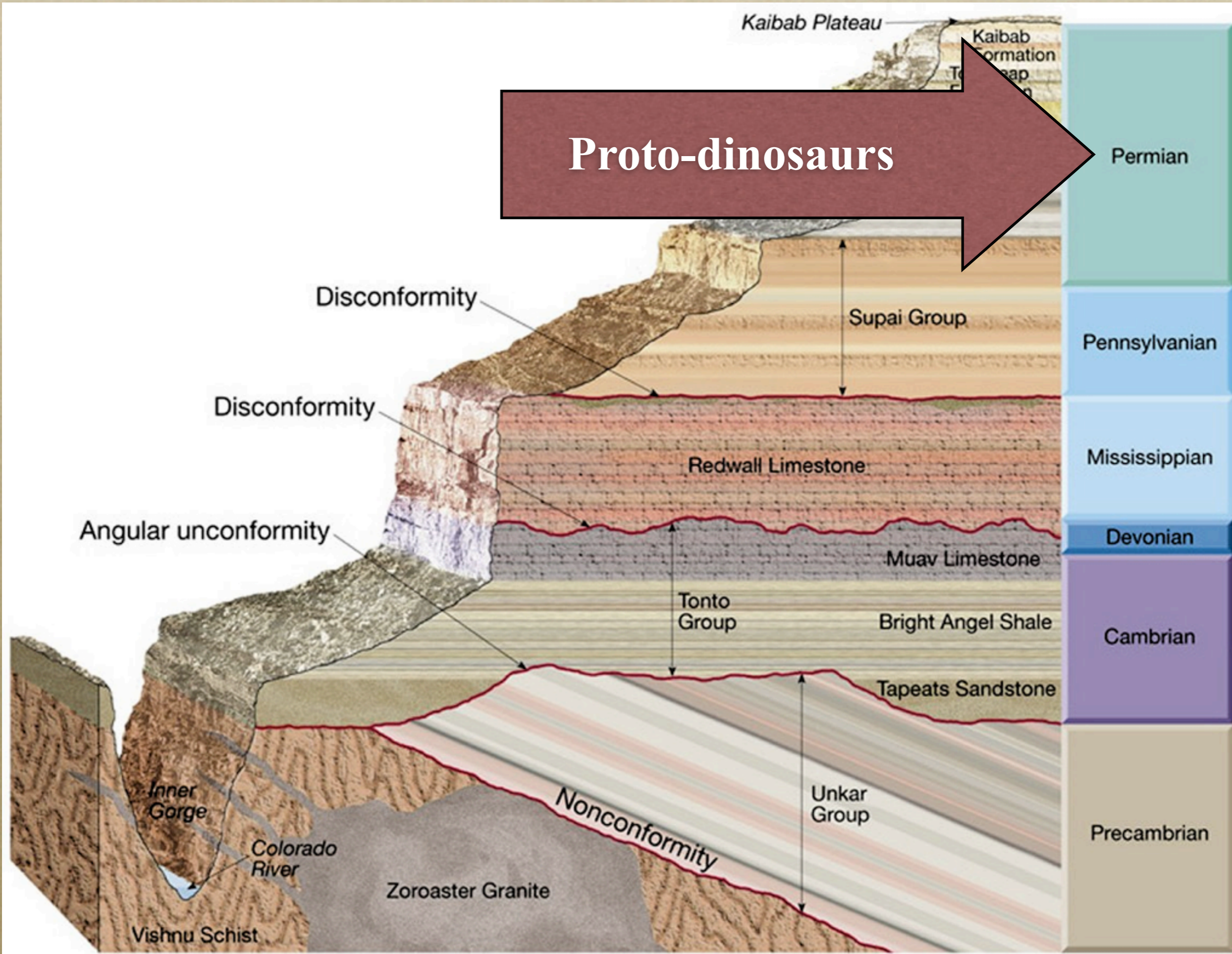
**Dinosaurs**



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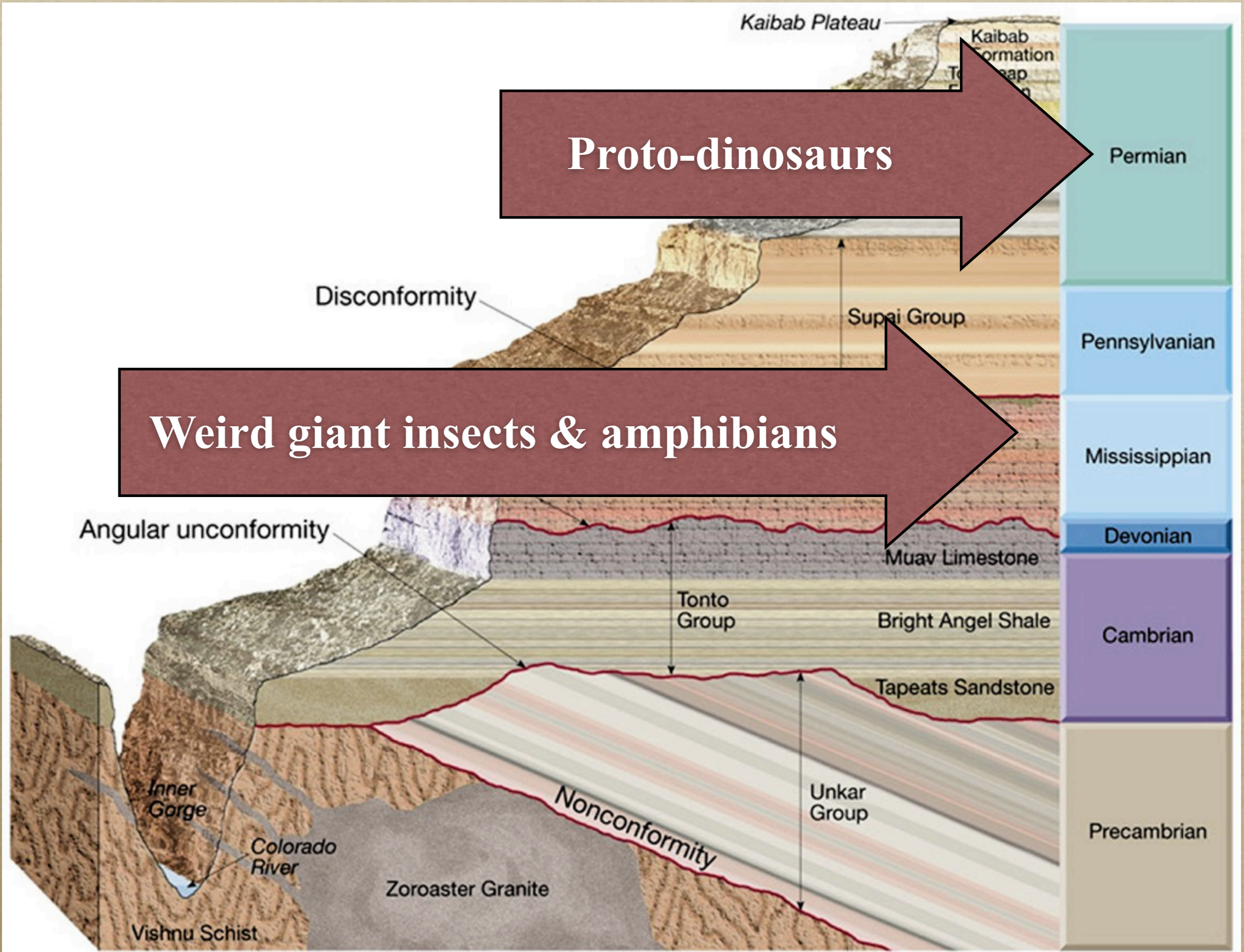






**Proto-dinosaurs**

Permian
Pennsylvanian
Mississippian
Devonian
Cambrian
Precambrian



Proto-dinosaurs

Weird giant insects & amphibians

Permian

Pennsylvanian

Mississippian

Devonian

Cambrian

Precambrian

Kaibab Plateau  
Kaibab Formation

Disconformity

Supai Group

Angular unconformity

Muav Limestone

Tonto Group

Bright Angel Shale

Tapeats Sandstone

Unkar Group

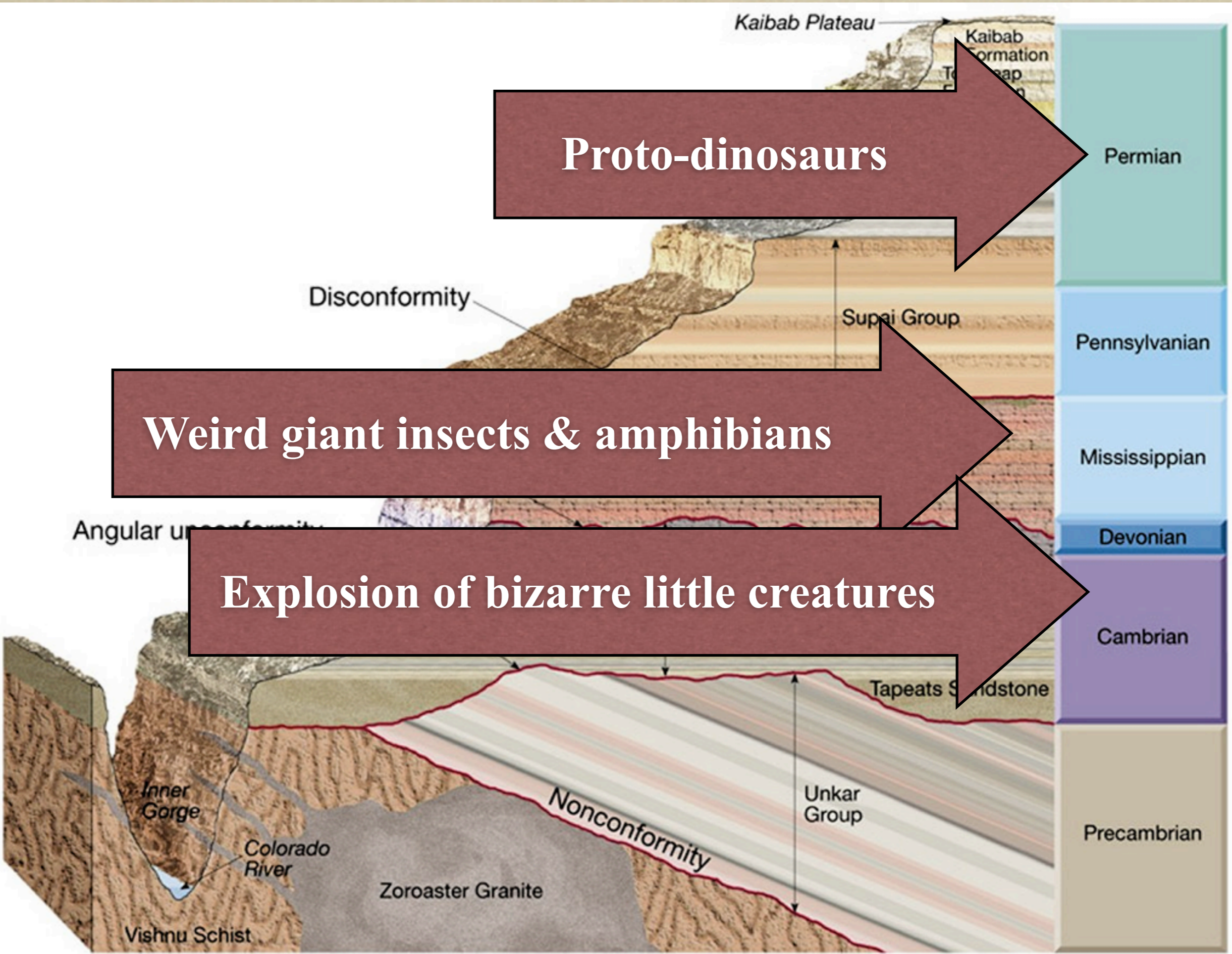
Nonconformity

Inner Gorge

Colorado River

Zoroaster Granite

Vishnu Schist



Proto-dinosaurs

Weird giant insects & amphibians

Explosion of bizarre little creatures

Permian

Pennsylvanian

Mississippian

Devonian

Cambrian

Precambrian

Kaibab Plateau

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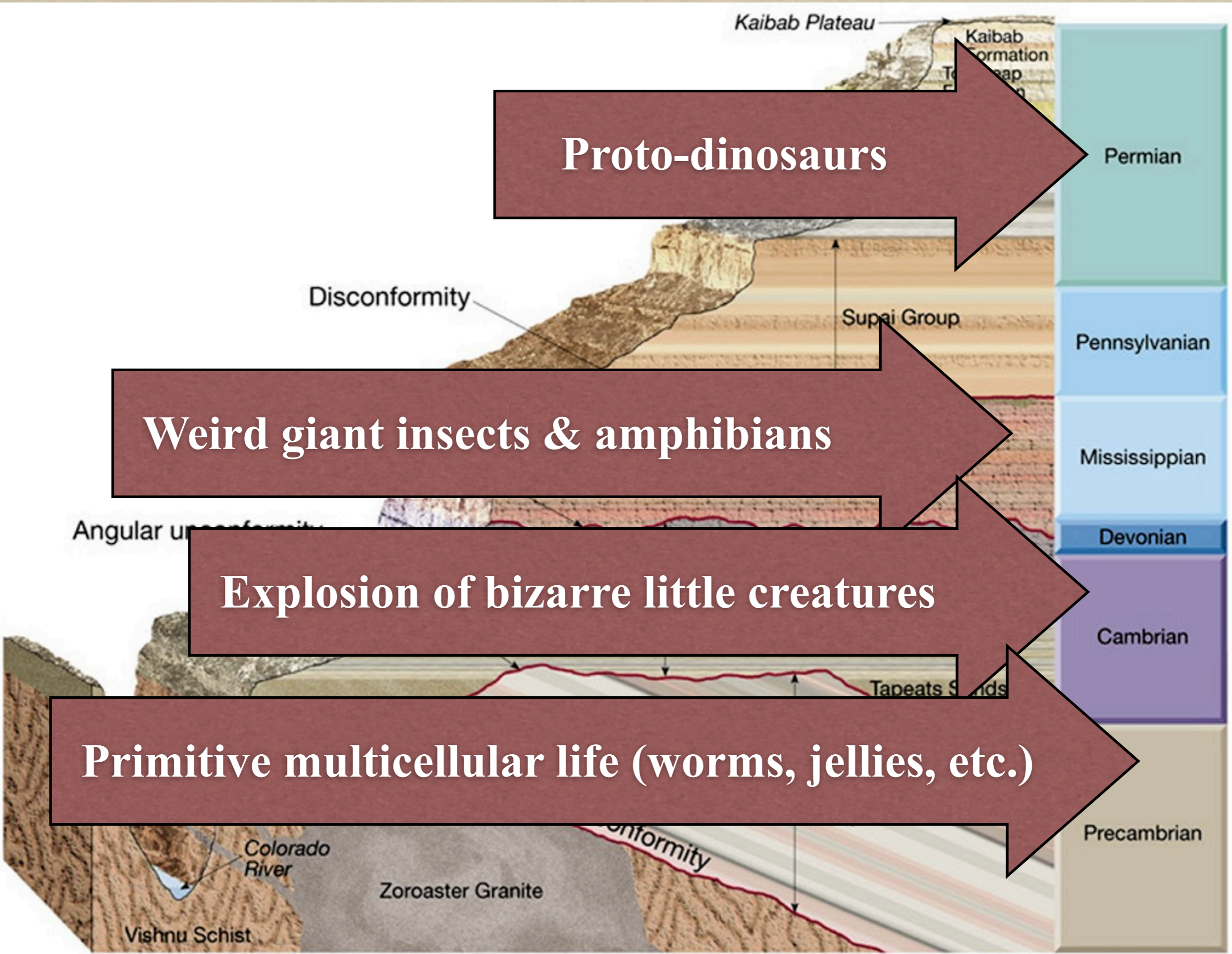
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**Proto-dinosaurs**

**Weird giant insects & amphibians**

**Explosion of bizarre little creatures**

**Primitive multicellular life (worms, jellies, etc.)**



**Cambrian = Diversifies Multicellular Life**  
(over a period of about 80 million years)



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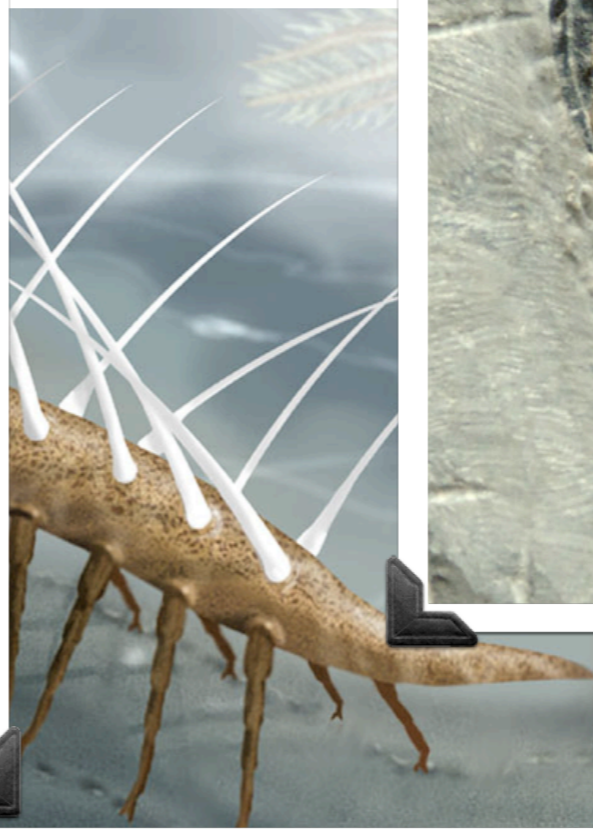


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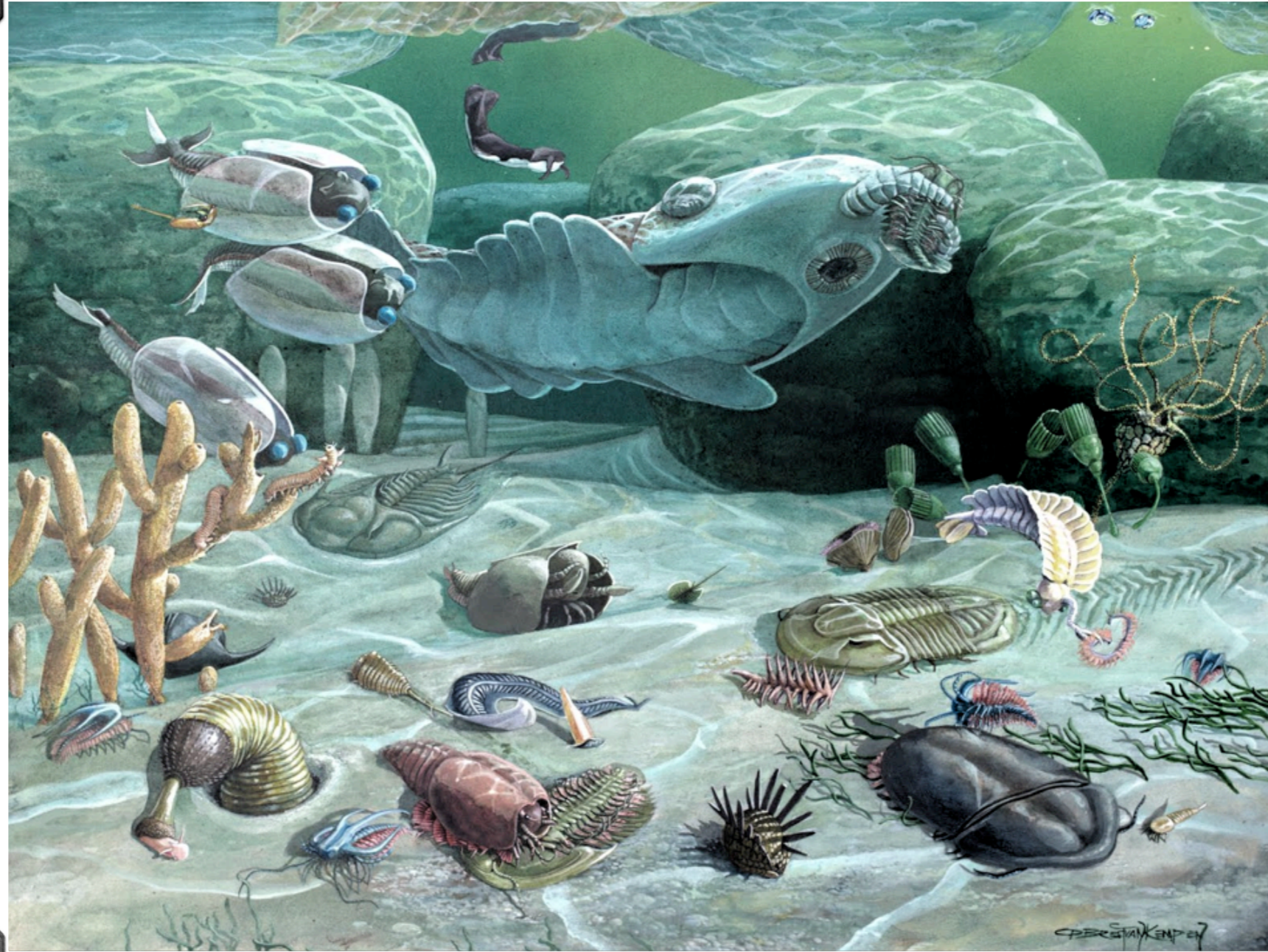




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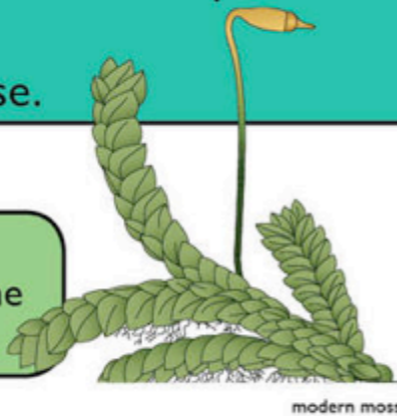


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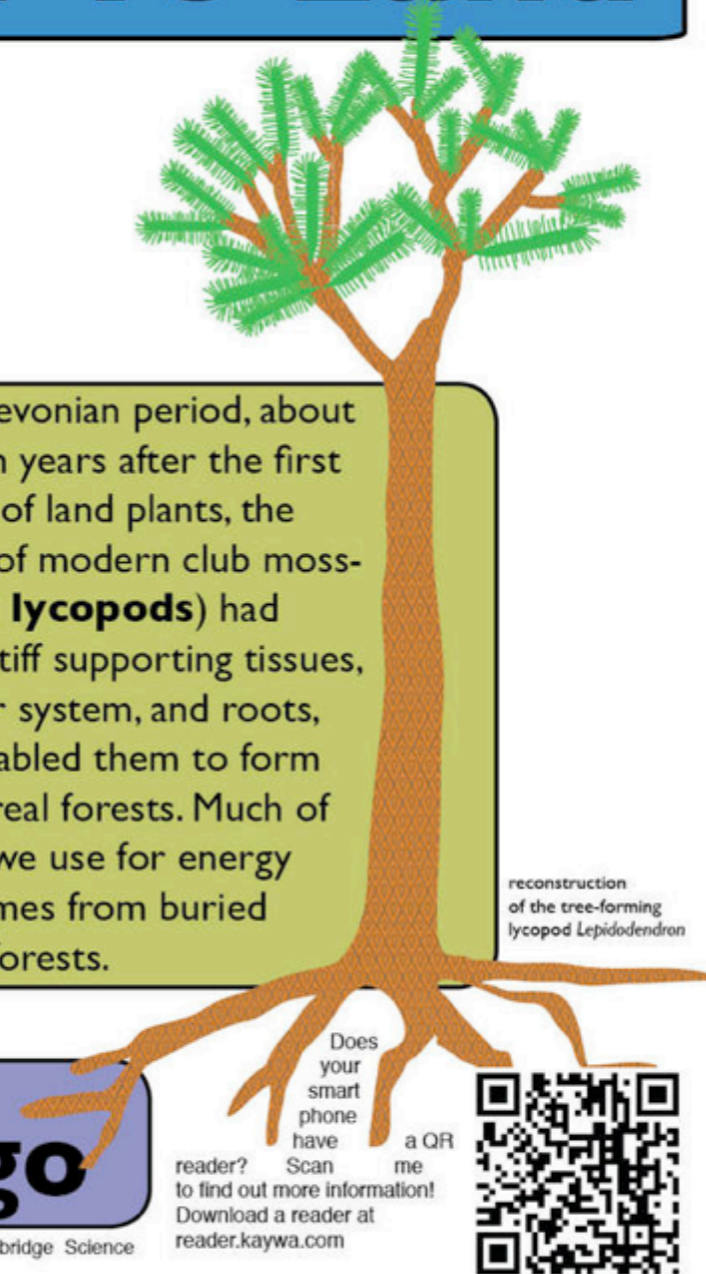
# Plants Move On To Land

The first evidence of plants living on land comes from tough spores similar to those made by modern land plants, found in late Ordovician-aged rocks about 450 million years old. The first plants to move on to land were likely similar to mosses and club mosses, as well as lichens, (a symbiotic union of a fungi and algae). Moving from water to land required plants to adapt systems that would protect them from drying out, support their weight, provide transport of water and nutrients, and allow their seeds to disperse.

All land plants are relatives of green algae, which still live in the world's oceans and lakes today.



By the Devonian period, about 40 million years after the first evidence of land plants, the relatives of modern club mosses (called **lycopods**) had evolved stiff supporting tissues, a vascular system, and roots, which enabled them to form the first real forests. Much of the coal we use for energy today comes from buried lycopod forests.



## 445 million years ago

Produced by the NASA Astrobiology Complex Life Team @ MIT. Sponsored by: Earth Atmospheric and Planetary Sciences @ MIT / Cambridge Science Festival / The Paleontological Society. Visit [www.complex-life.org](http://www.complex-life.org) for more information. *Lepidodendron*: P. Cohen, Moss: IAN

# Plants come *after* Animals!

# What the Rocks Tell Us...

---

- 3.6 billion years: **simple cells**
- 2.5 billion years: **stromatolites**
- 2 billion years: **complex cells (eukaryotes)**
- 1.5 billion years: **algae / seaweed**
- 600 million years: **simple animals (worms, jellies)**
- 570 million years: **arthropods (bugs / crustaceans)**
- 550 million years: **more complex animals**
- 500 million years: **fish and simple amphibians**
- 450 million years: **[ land plants ]**

# What the Rocks Tell Us...

- 3.6 billion years: **simple cells**
- 2.5 billion years: **stromatolites**
- 2 billion years: **stromatolites**
- 1.5 billion years: **stromatolites**
- 600 million years: **first worms, arthropods, mollusks, jellies)**
- 570 million years: **crustaceans)**
- 550 million years: **more complex animals**
- 500 million years: **fish and simple amphibians**
- 450 million years: **[ land plants ]**

# What the Rocks Tell Us...

---

- 400 million years: **insects and [ seeds ]**
- 360 million years: **[ trees ] and complex amphibians**
- 300 million years: **reptiles**
- 200 million years: **early mammals ; dinosaurs**
- 150 million years: **birds**
- 130 million years: **[ flowers ]**
- 65 million years: **no more dinosaurs**
- 2.5 million years: **hominids**
- 250,000 years: **humans**

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- 360 million years: **[ trees ] and complex amphibians**
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- 65 m
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- 250,000 years: **humans**

**So life on earth changed over time.**

**Very slow change.**

**Over a very long time.**



# EXAMPLE: Whales



**Pakicetus**

# EXAMPLE: Whales



# EXAMPLE: Whales



**55**mya



**Ambulocetus**

**50**mya

# EXAMPLE: Whales



**Ambulocetus**

**50<sub>mya</sub>**

# EXAMPLE: Whales



# EXAMPLE: Whales



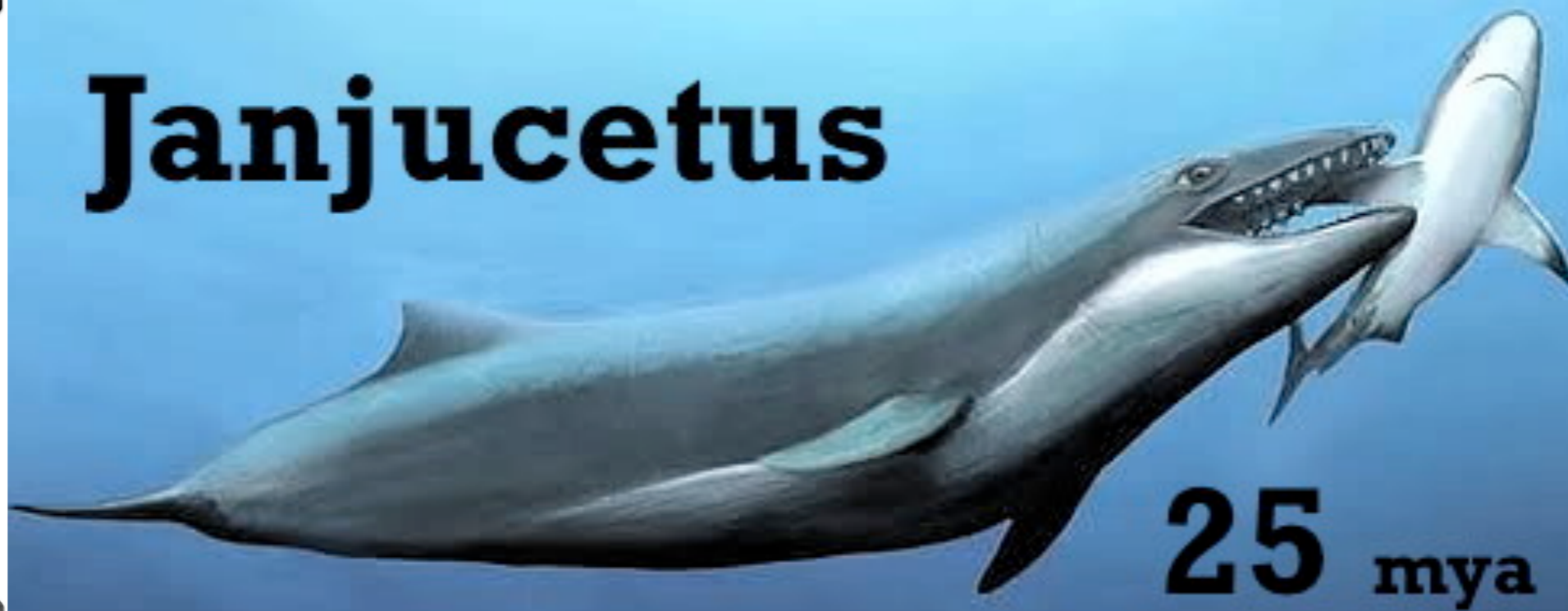
47 mya  
**Rodhocetus**

50 mya

# EXAMPLE: Whales



**Janjucetus**



**25** mya

mya

**US**

**50** mya

# EXAMPLE: Whales



**50 mya**



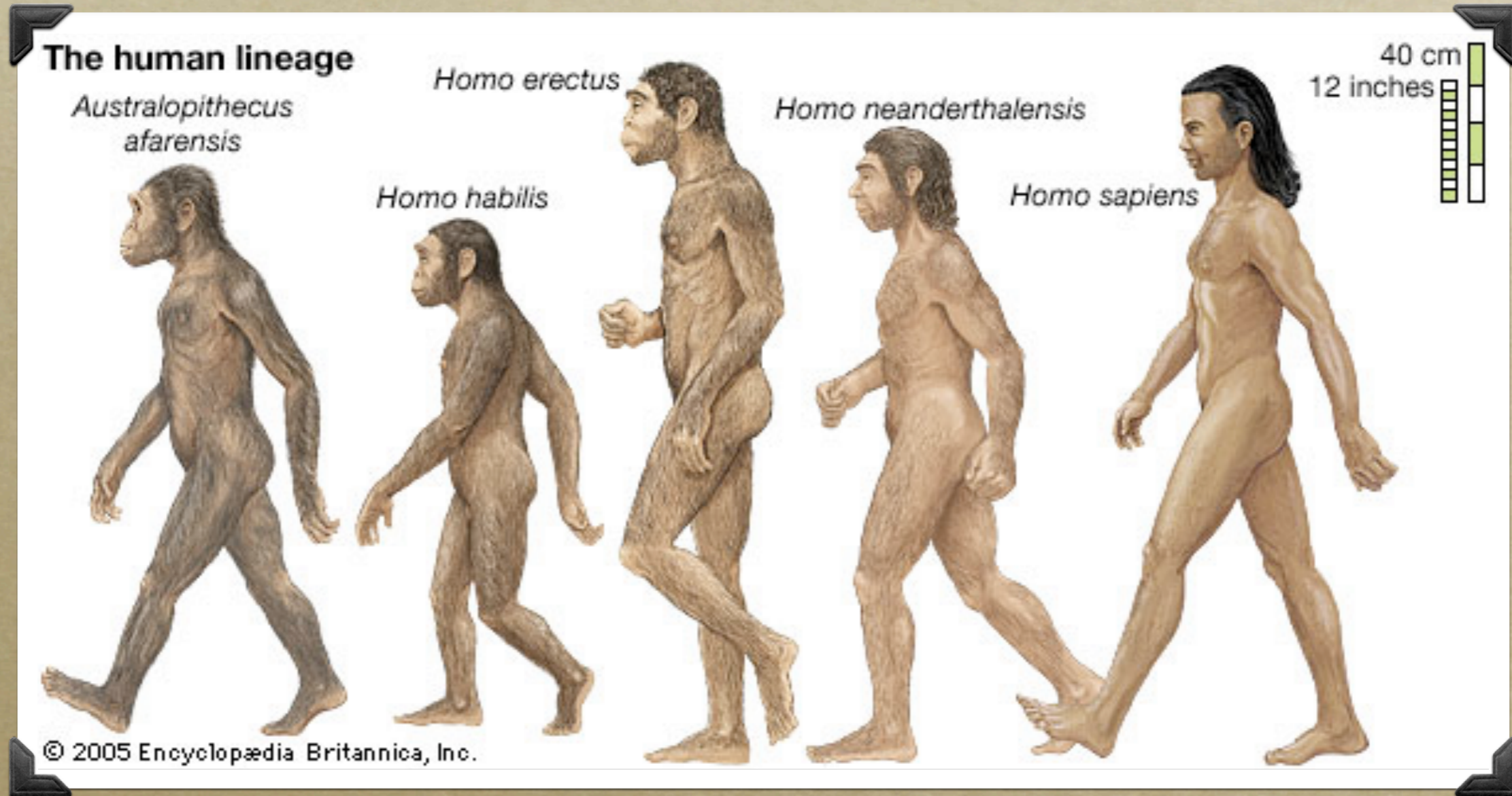
# EXAMPLE: Whales



**Janjucetu**

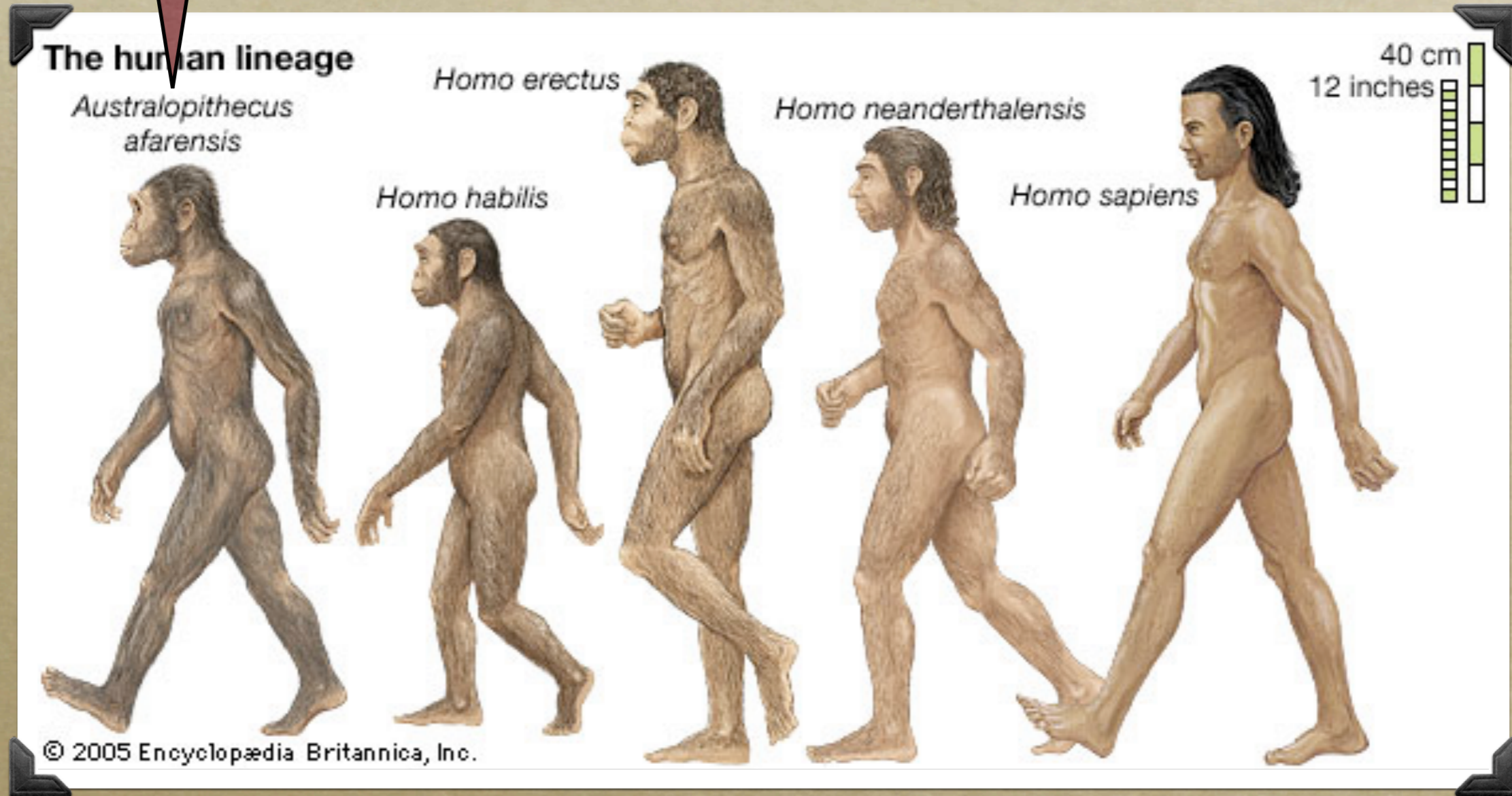


# EXAMPLE: People



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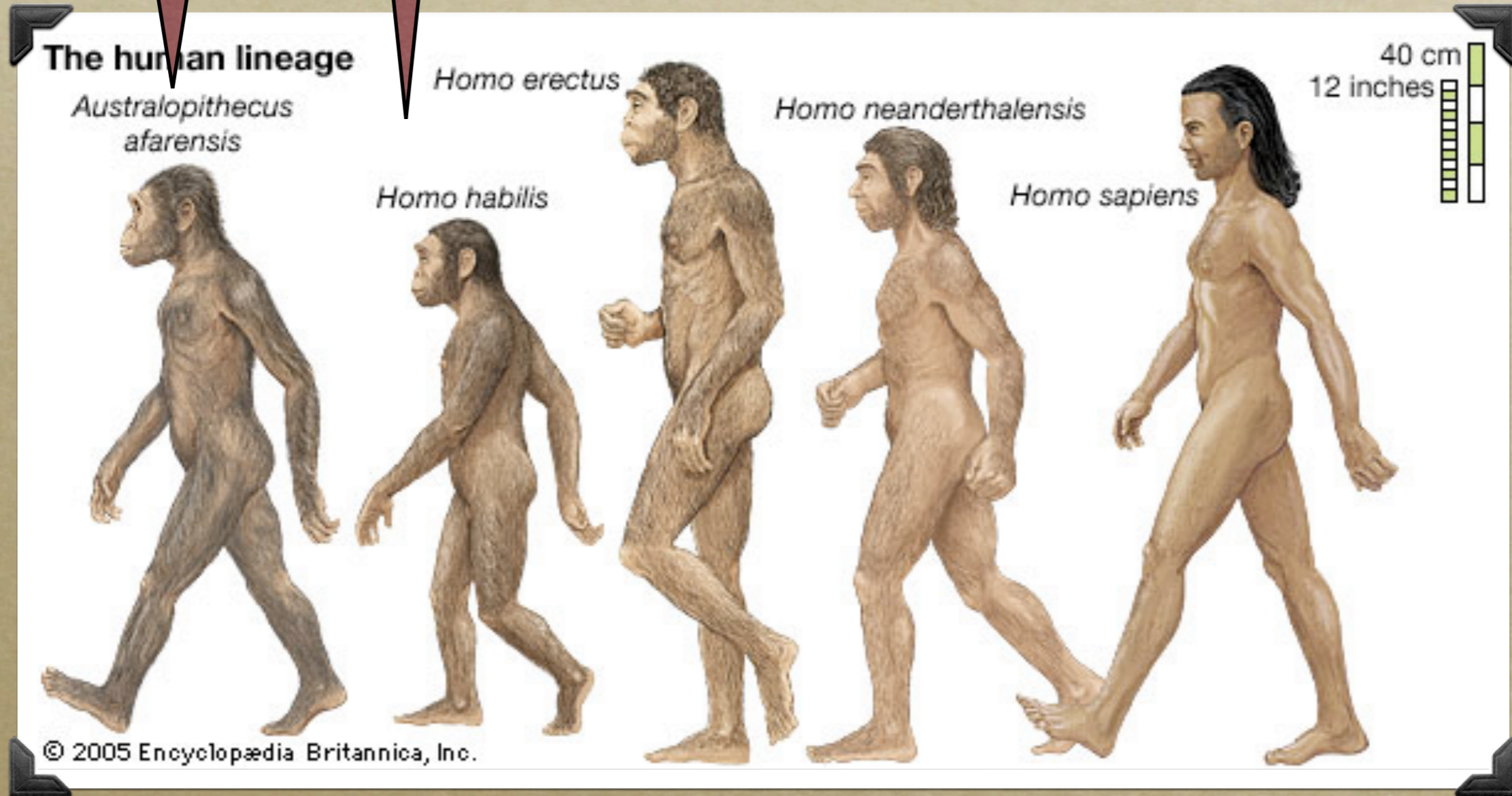
4 - 2 mya



# EXAMPLE: People

4 - 2 mya

2.4 - 1.4 mya

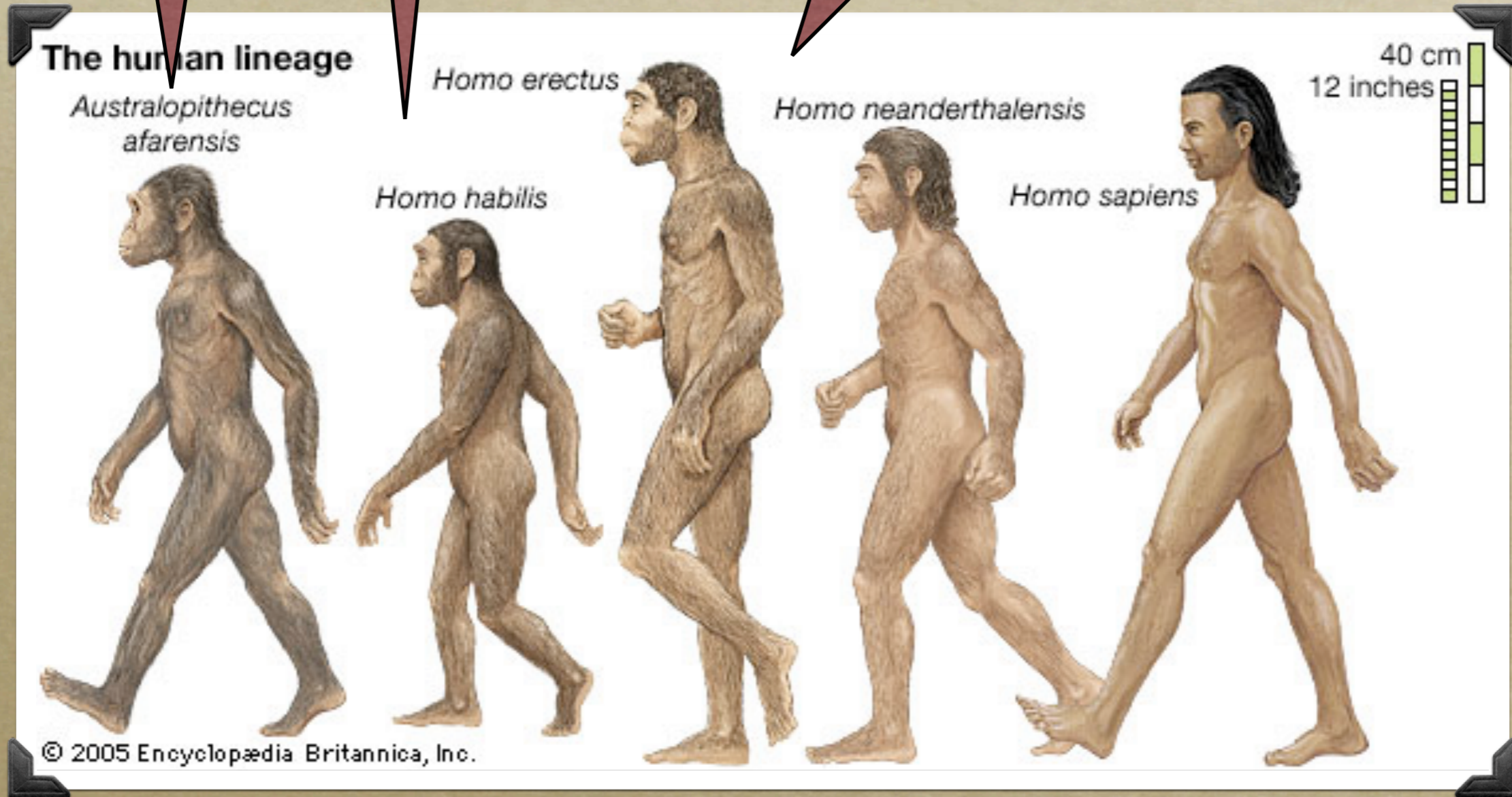


# EXAMPLE: People

4 - 2 mya

2.4 - 1.4 mya

1.8 mya -  
70,000 ya

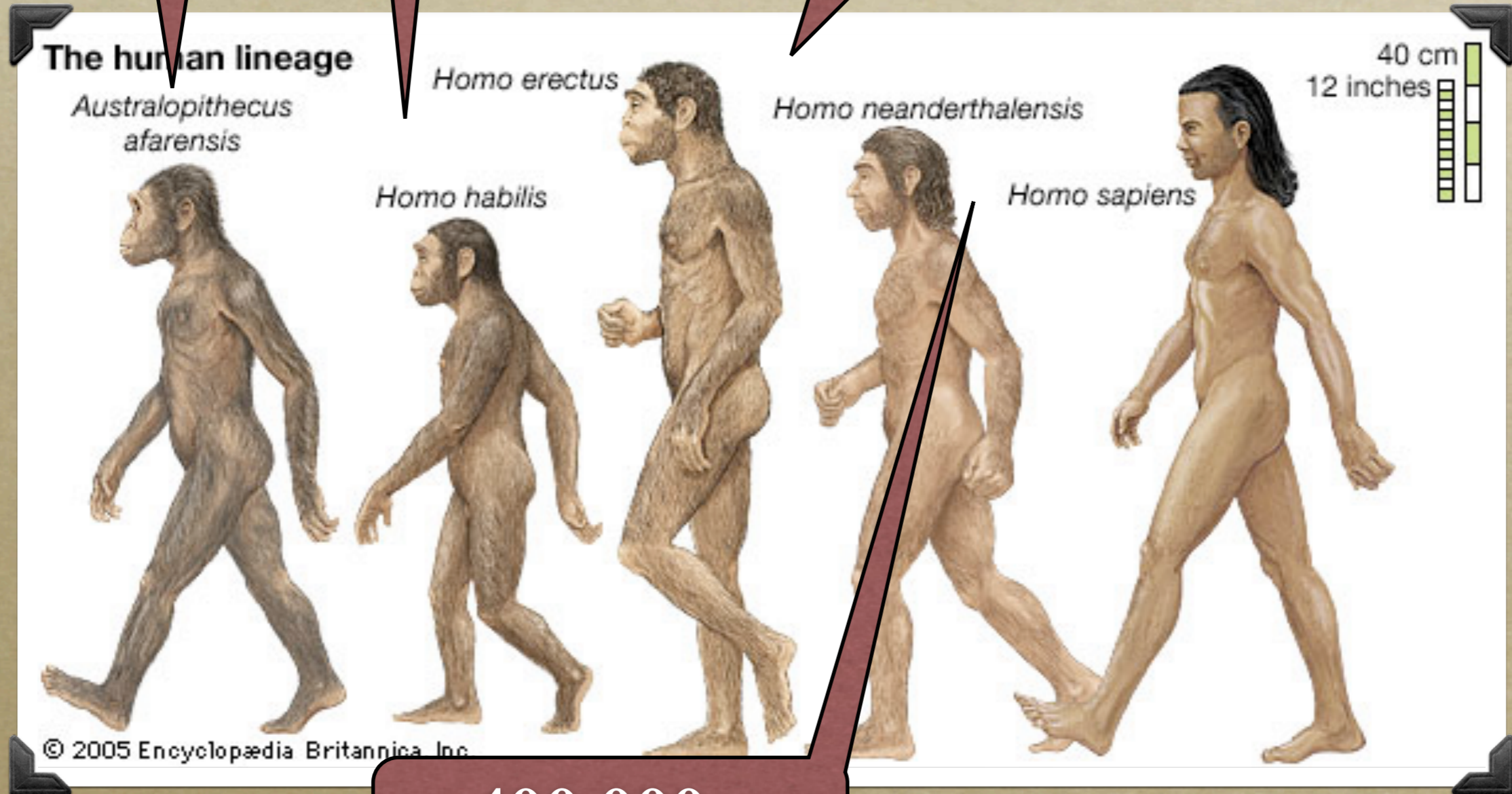


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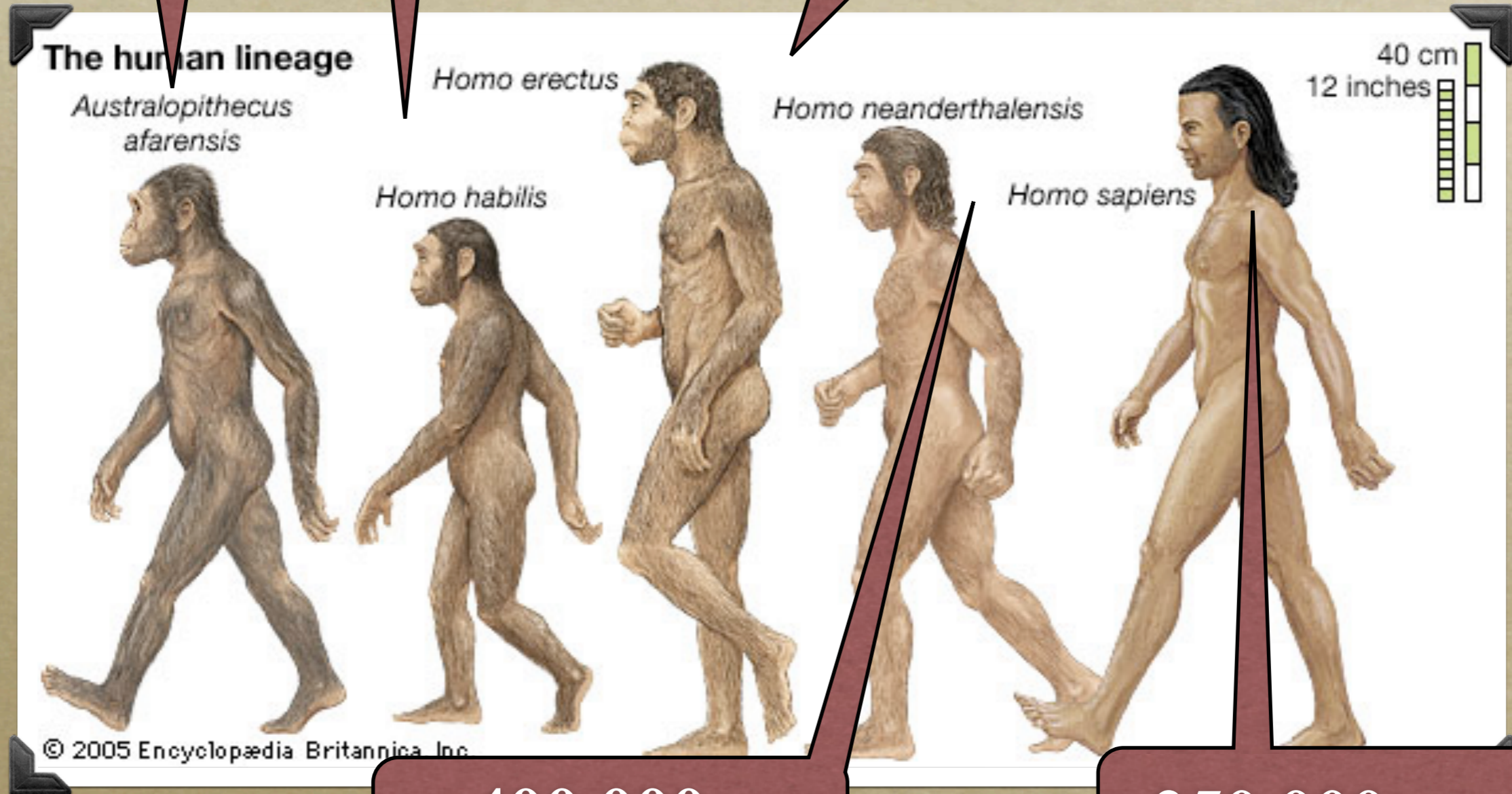
400,000 -  
30,000 ya

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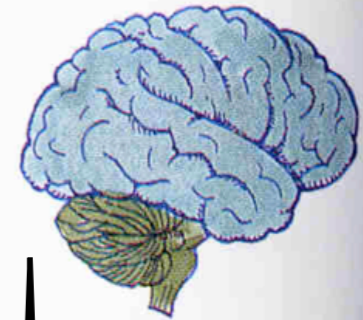
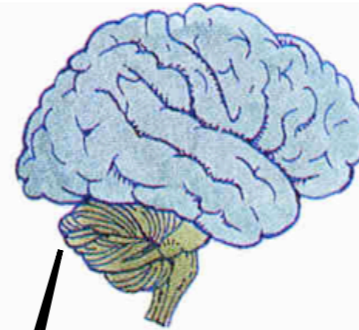
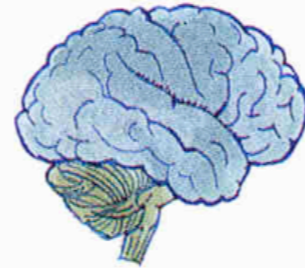
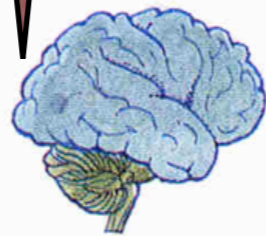
250,000 ya -  
present

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70,000 ya



Australopithecus robustus



Homo habilis



Homo erectus



Homo sapiens neanderthalensis



Homo sapiens sapiens

400,000 -  
30,000 ya

250,000 ya -  
present

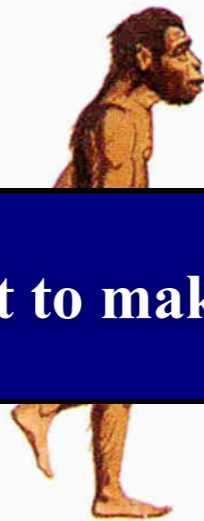
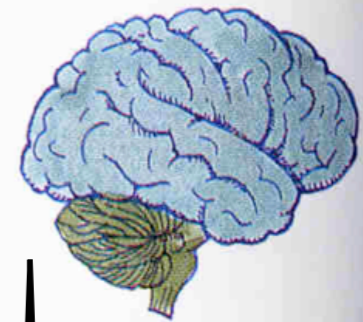
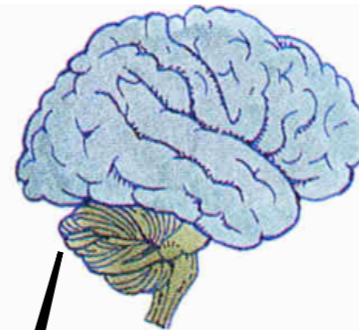
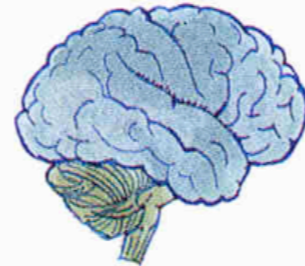
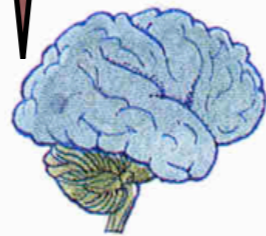


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70,000 ya



first to make tools

Australopithecus robustus

Homo habilis

Homo erectus

Homo sapiens neanderthalensis

Homo sapiens sapiens

400,000 -  
30,000 ya

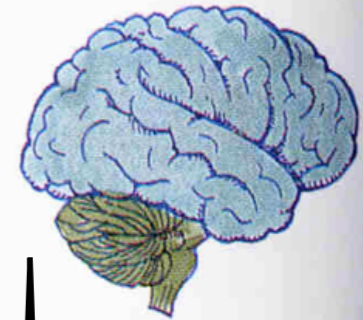
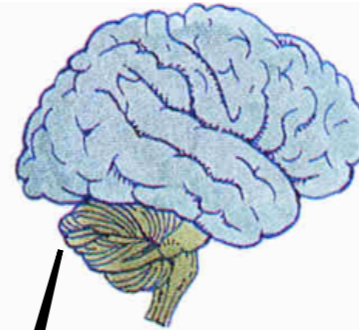
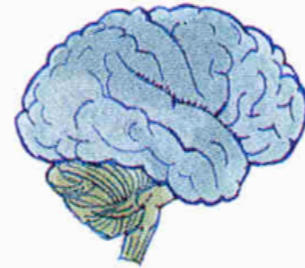
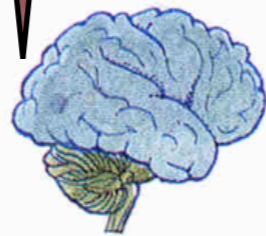
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Australopithecus robustus



Homo habilis



Homo erectus

discovered fire



Homo sapiens neanderthalensis



Homo sapiens sapiens

400,000 -  
30,000 ya

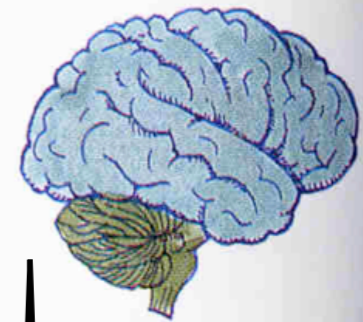
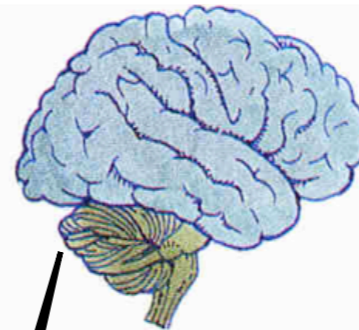
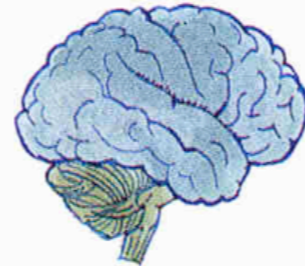
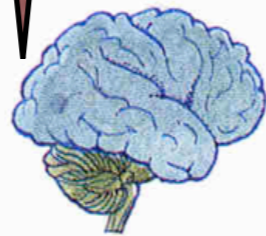
250,000 ya -  
present

# EXAMPLE: People

4 - 2 mya

2.4 - 1.4 mya

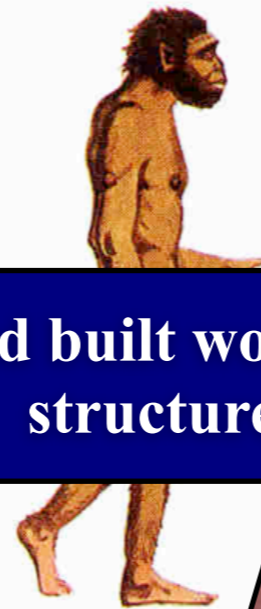
1.8 mya -  
70,000 ya



Australopithecus robustus



Homo habilis



Homo erectus



Homo sapiens neanderthalensis



Homo sapiens sapiens

and built wooden  
structures

400,000 -  
30,000 ya

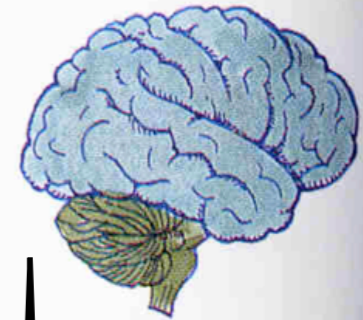
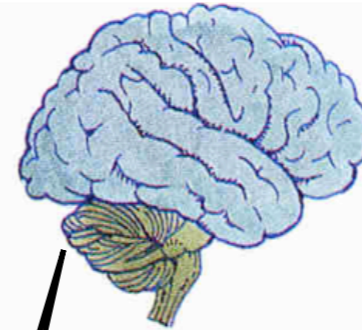
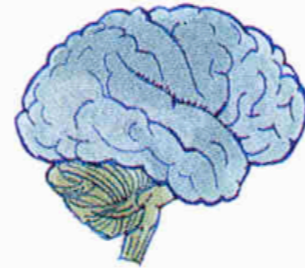
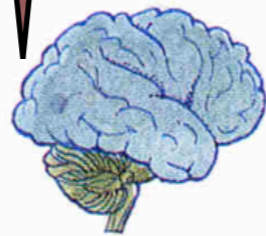
250,000 ya -  
present

# EXAMPLE: People

4 - 2 mya

2.4 - 1.4 mya

1.8 mya -  
70,000 ya



Australopithecus robustus



Homo habilis



Homo erectus



Homo sapiens neanderthalensis



Homo sapiens sapiens

invented clothes,  
decorative art

400,000 -  
30,000 ya

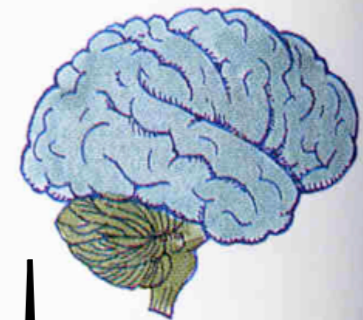
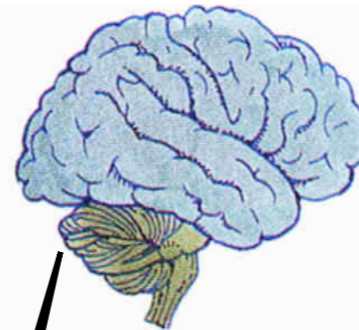
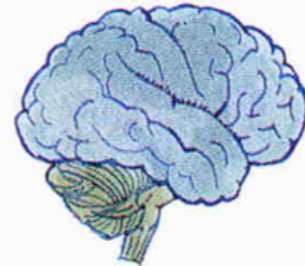
250,000 ya -  
present

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Australopithecus robustus



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Homo sapiens sapiens

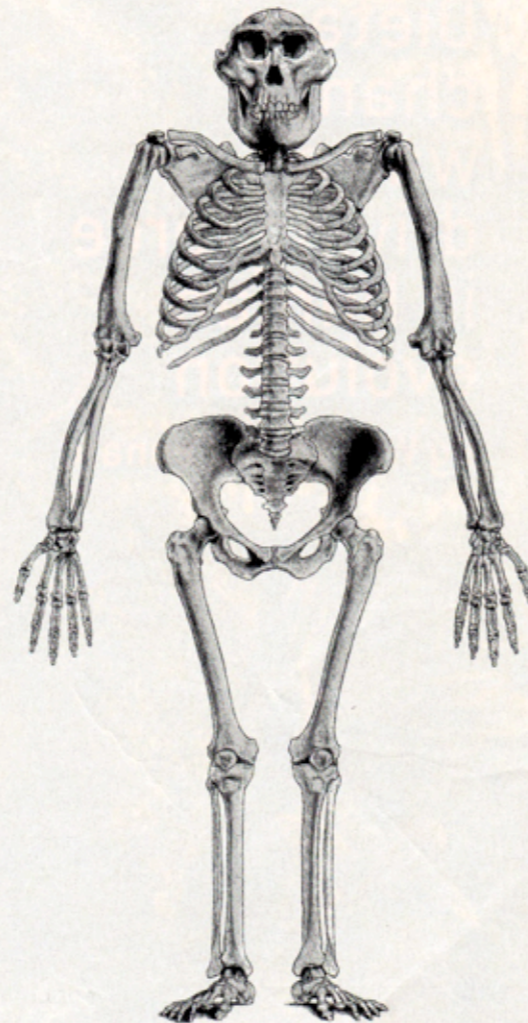
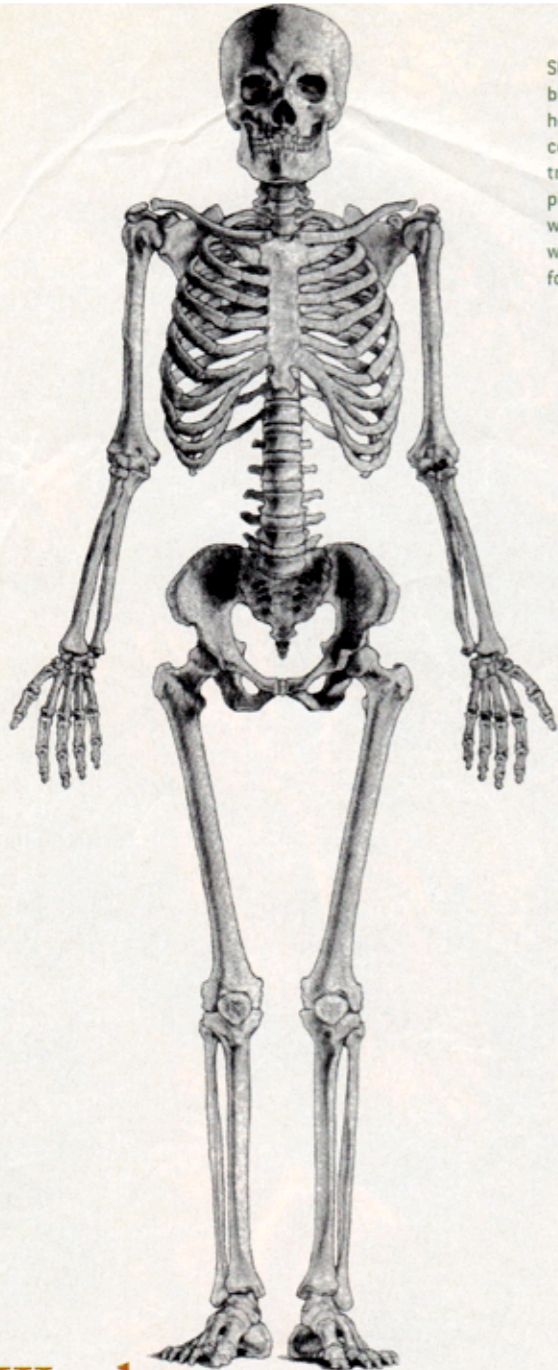
first to bury dead;  
invented religion

400,000 -  
30,000 ya

250,000 ya -  
present

# EXAMPLE: People

SKELETAL REMAINS indicate that our ancient forebears the australopithecines were bipedal by four million years ago. In the case of *A. afarensis* (right), one of the earliest hominids, telltale features include the arch in the foot, the nonopposable big toe, and certain characteristics of the knee and pelvis. But these hominids retained some apelike traits—short legs, long arms and curved toes, among others—suggesting both that they probably did not walk exactly like we do and that they spent some time in the trees. It wasn't until the emergence of our own genus, *Homo* (a contemporary representative of which appears on the left), that the fully modern limb and foot proportions and pelvis form required for upright walking as we know it evolved.



# EXAMPLE: People



# EXAMPLE: People





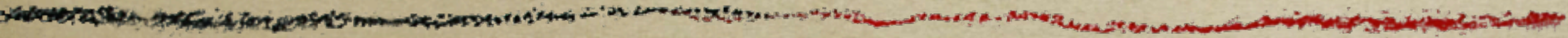
# EXAMPLE: People



# EXAMPLE: People



**looks like ancestry to me!**  
**but there's more...**



Additional \$11900 Laboratory Fee Required

The Most Trusted Name in DNA Testing

**IDENTIGENE®**



# DNA PATERNITY TEST

COLLECTION KIT

For Alleged Father, Mother and Child

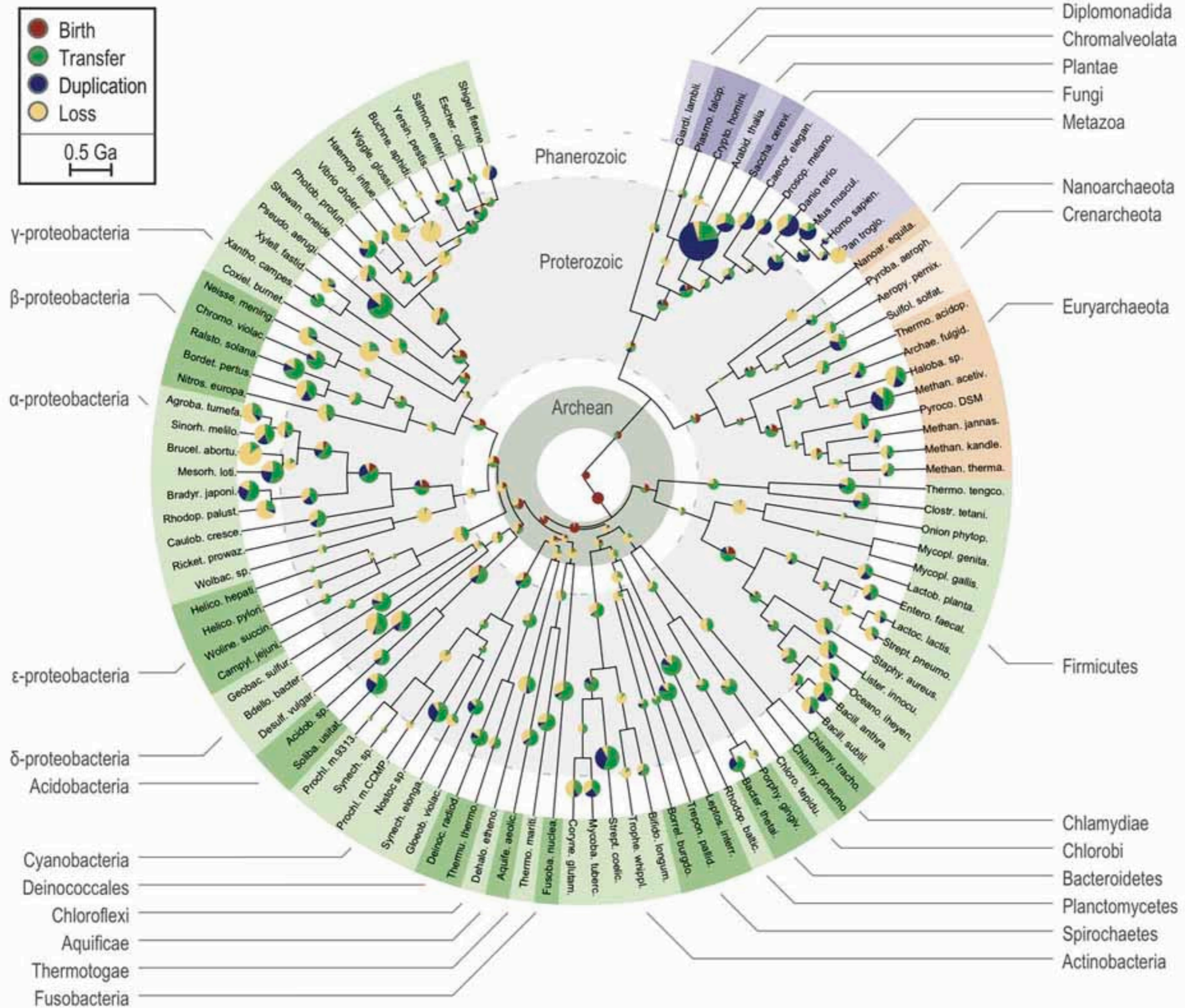
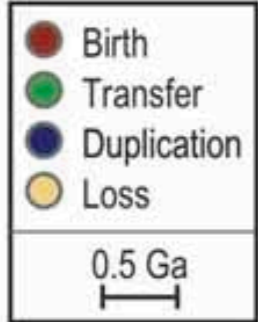
For Questions Only DNA Can Answer  
1-888-404-GENE • www.DNA-testing.com

Additional  
\$11900  
Laboratory Fee  
Required

DNA test results reported to you in 3-5 days

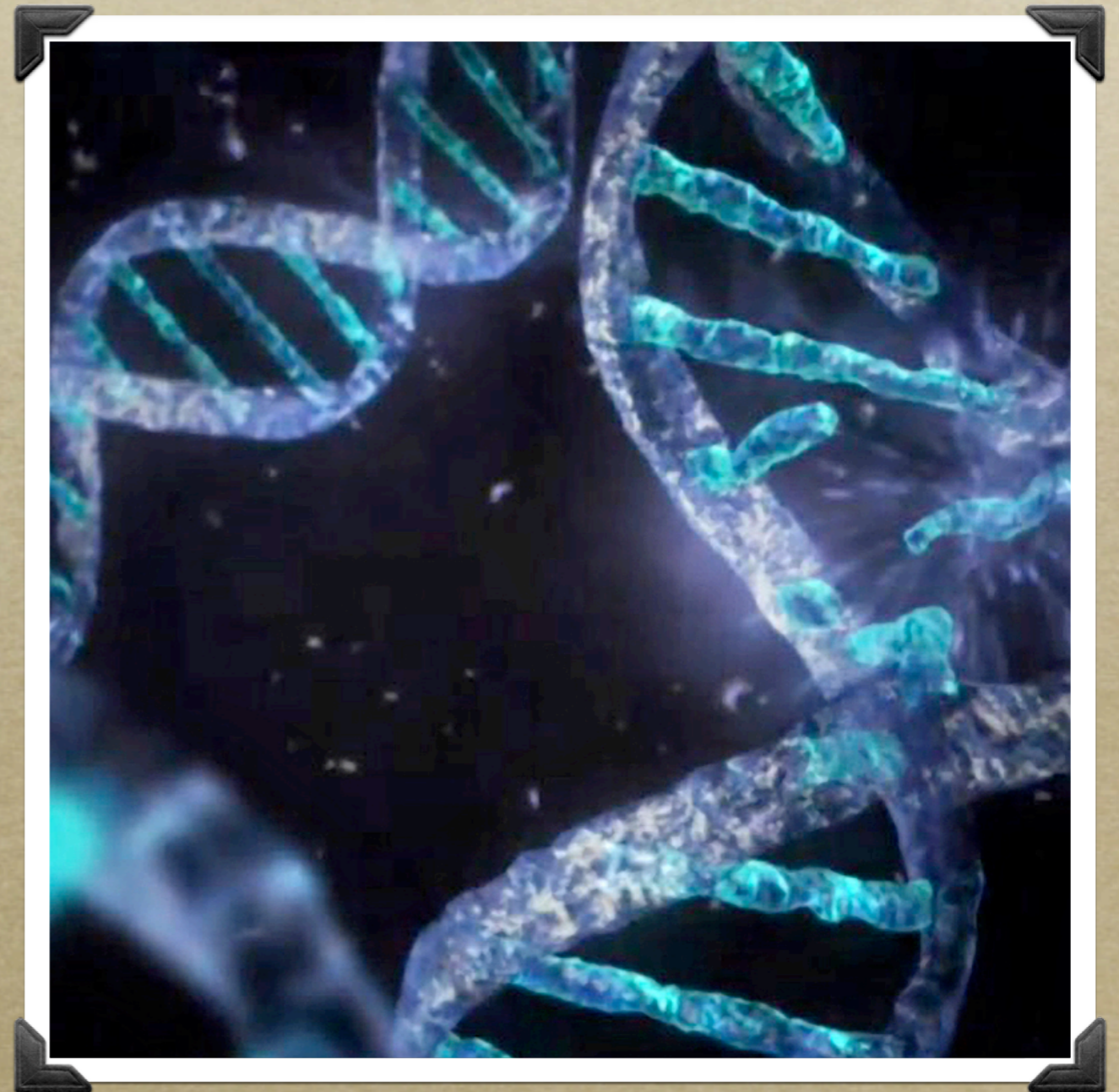


*Dear Sally Hemings...*



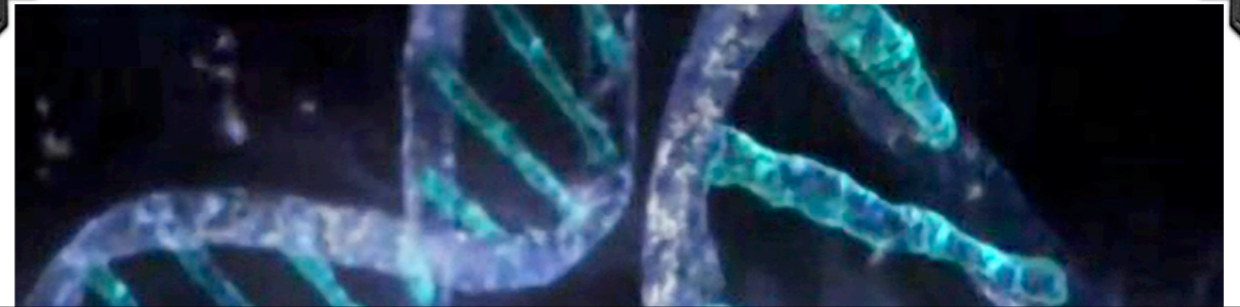
# RATE OF MUTATION

- *2 to 5 lasting mutations per generation.*
- *1 generation for primates = 20 years.*
- *1 generation for worms = 2 years.*
- *1 generation for bacteria = 20 minutes.*

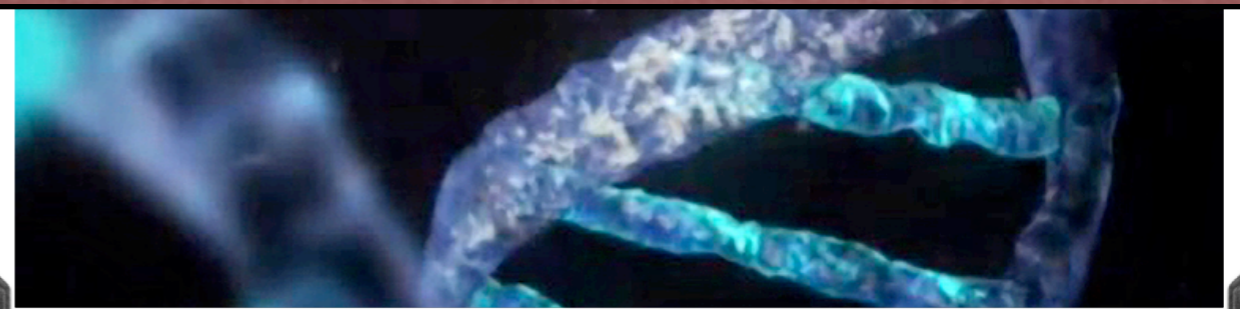


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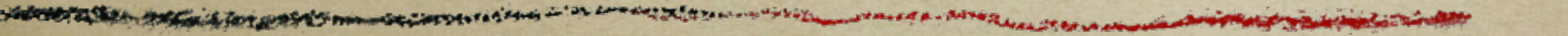


**The simpler the life form,  
the faster it will evolve**

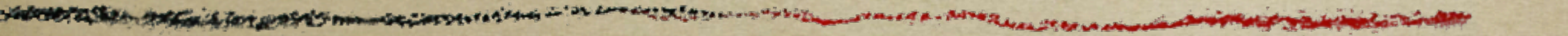




**them's the facts**



**so who or what caused  
all that mutating?**

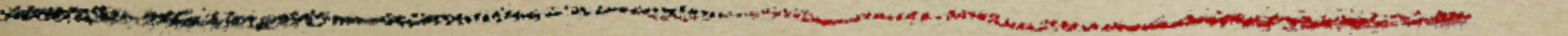


**would an intelligent  
engineer take so long?**

---

**...and keep screwing up  
and killing off failed species  
and building new ones  
... for billions of years?**

**or is there an  
explanation that  
makes more sense?**



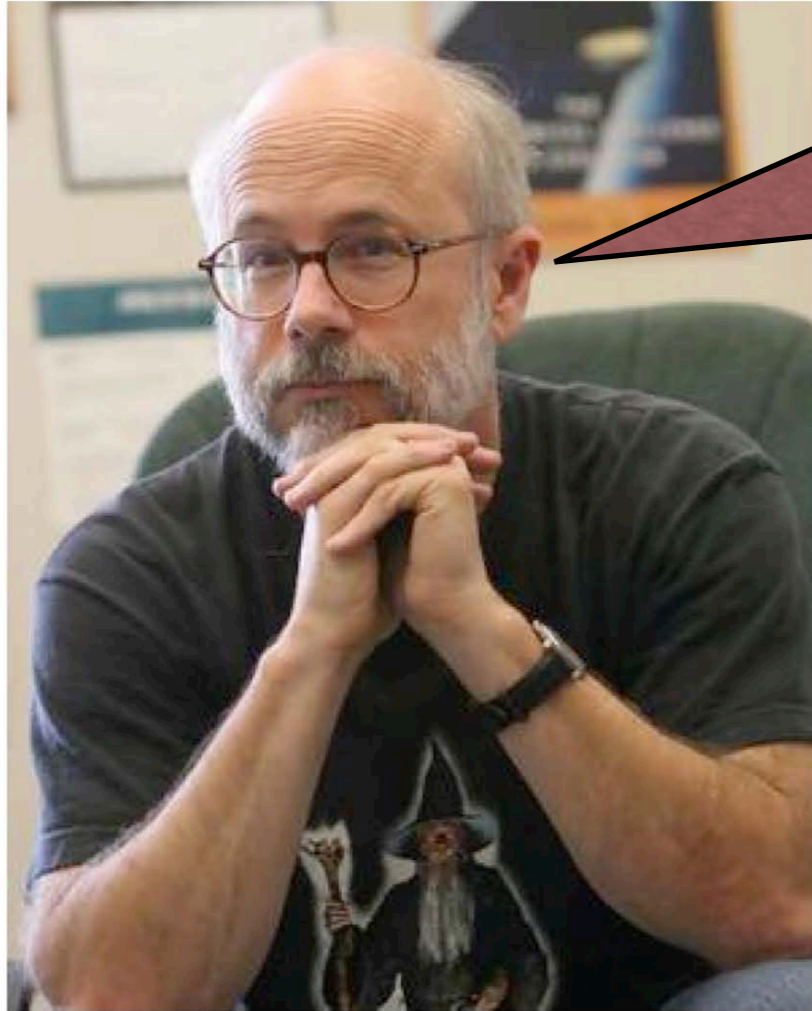
or is there an  
explanation that  
makes more sense?

---

*Yes. It's called*  
***EVOLUTION***



**But no! That can't be! That's  
impossible!**



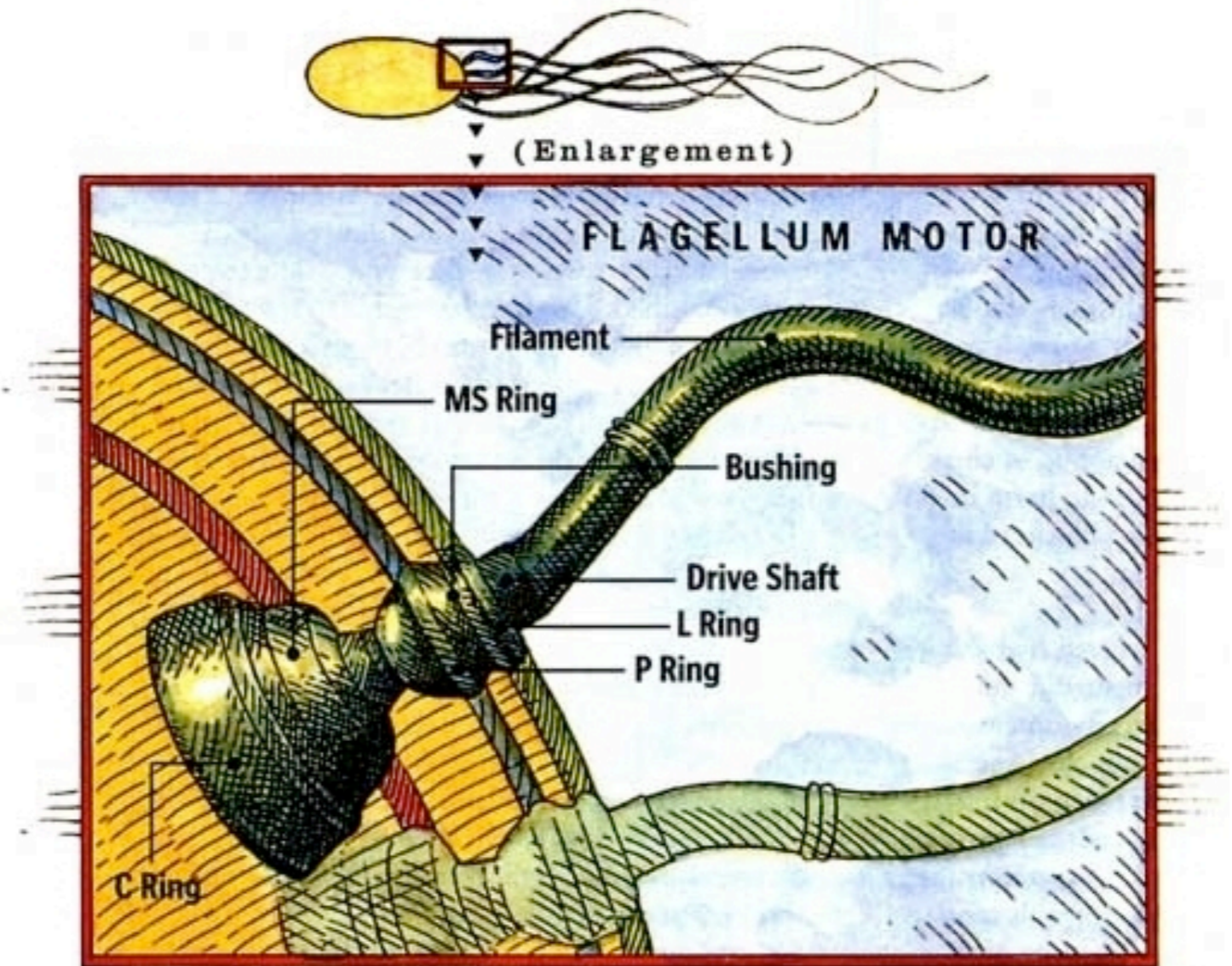
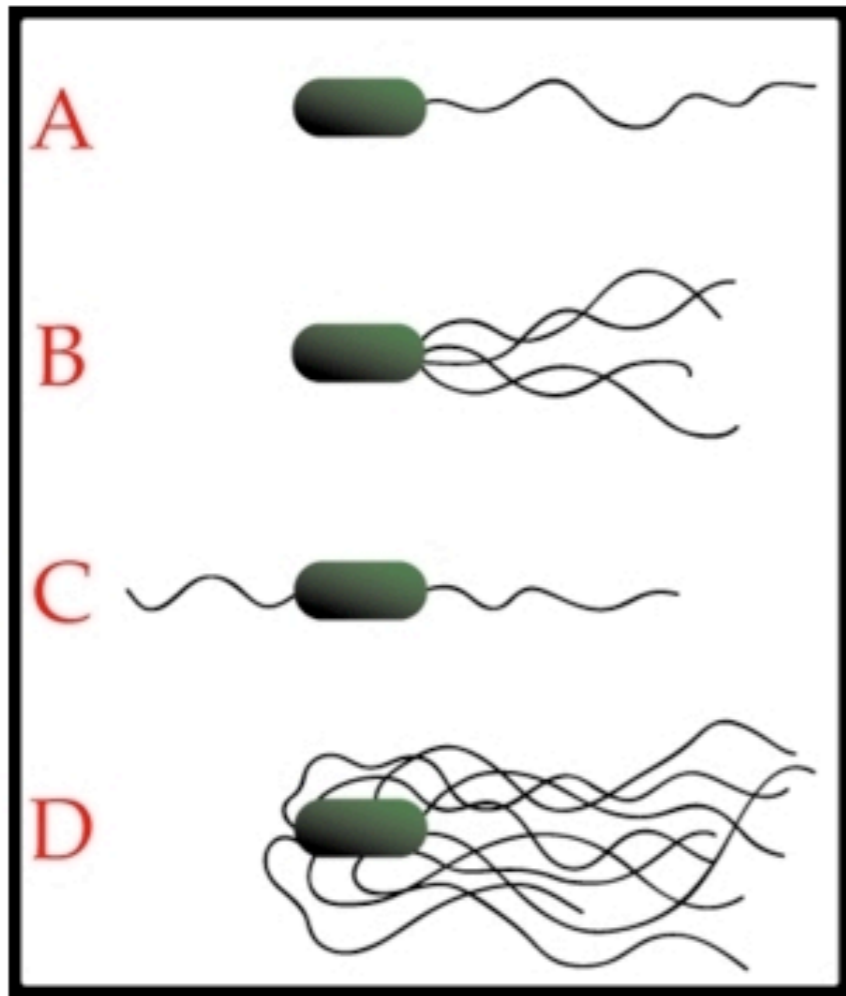
**Michael Behe**

**IRREDUCIBLE  
COMPLEXITY!**

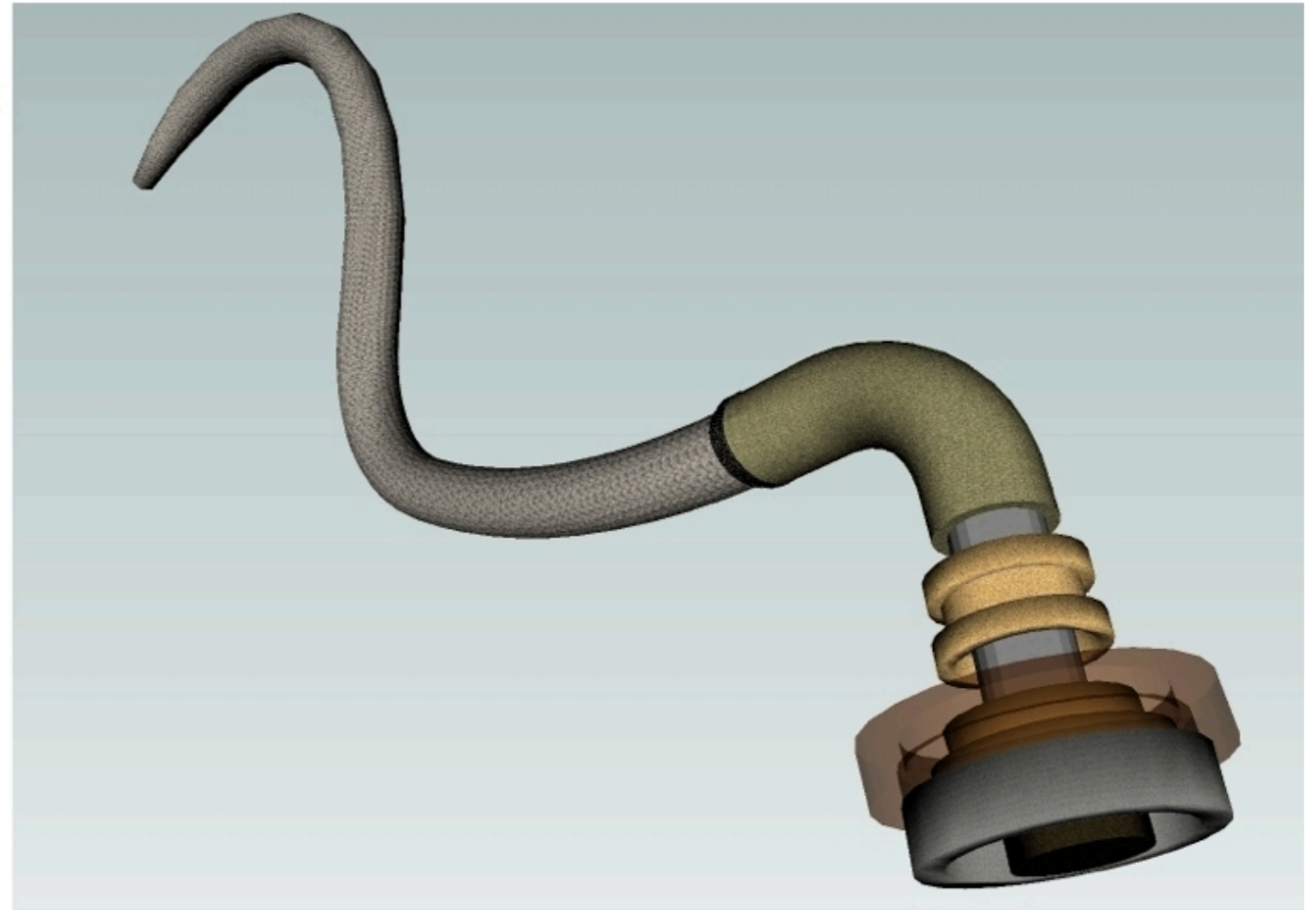
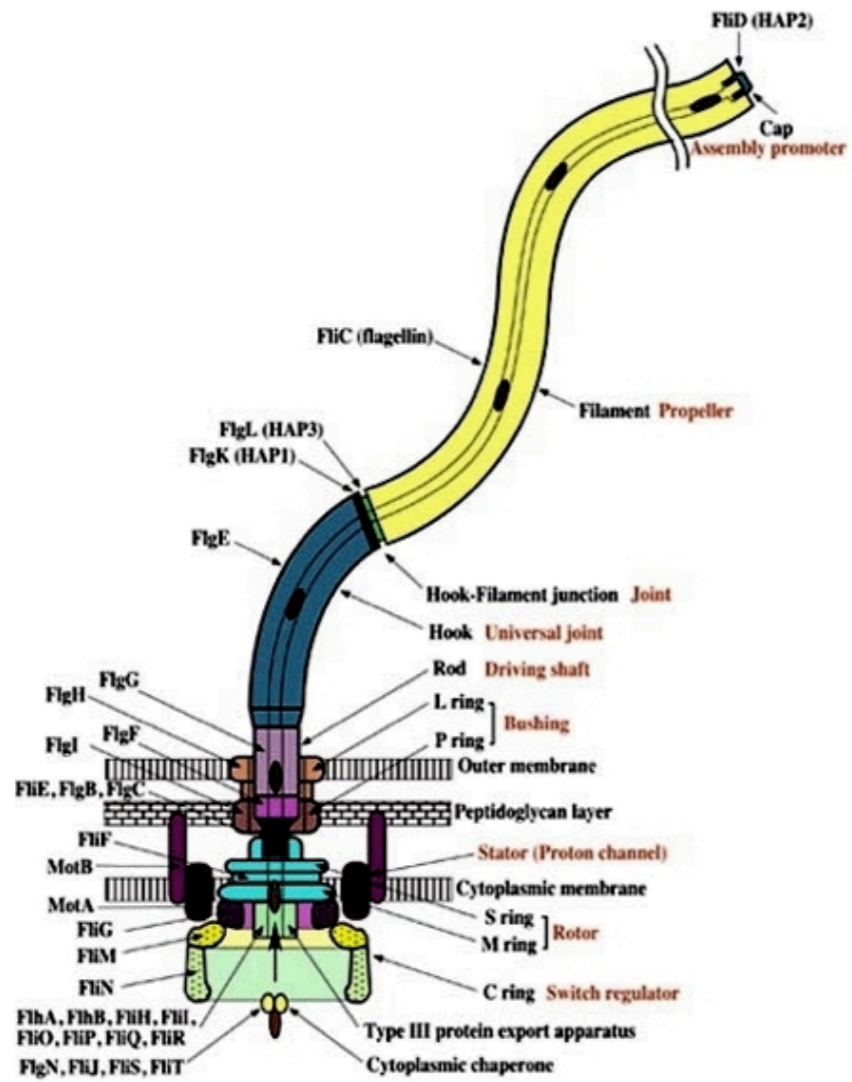


# **Irreducible Complexity**

- **Organ has many well-arranged parts  
(COMPLEX)**
- **Remove any one part & organ is useless  
(IRREDUCIBLE)**
- **Therefore entire organ must arise from a  
single mutation**
- **Such a mutation is so improbable it can never  
have happened by chance in known universe**

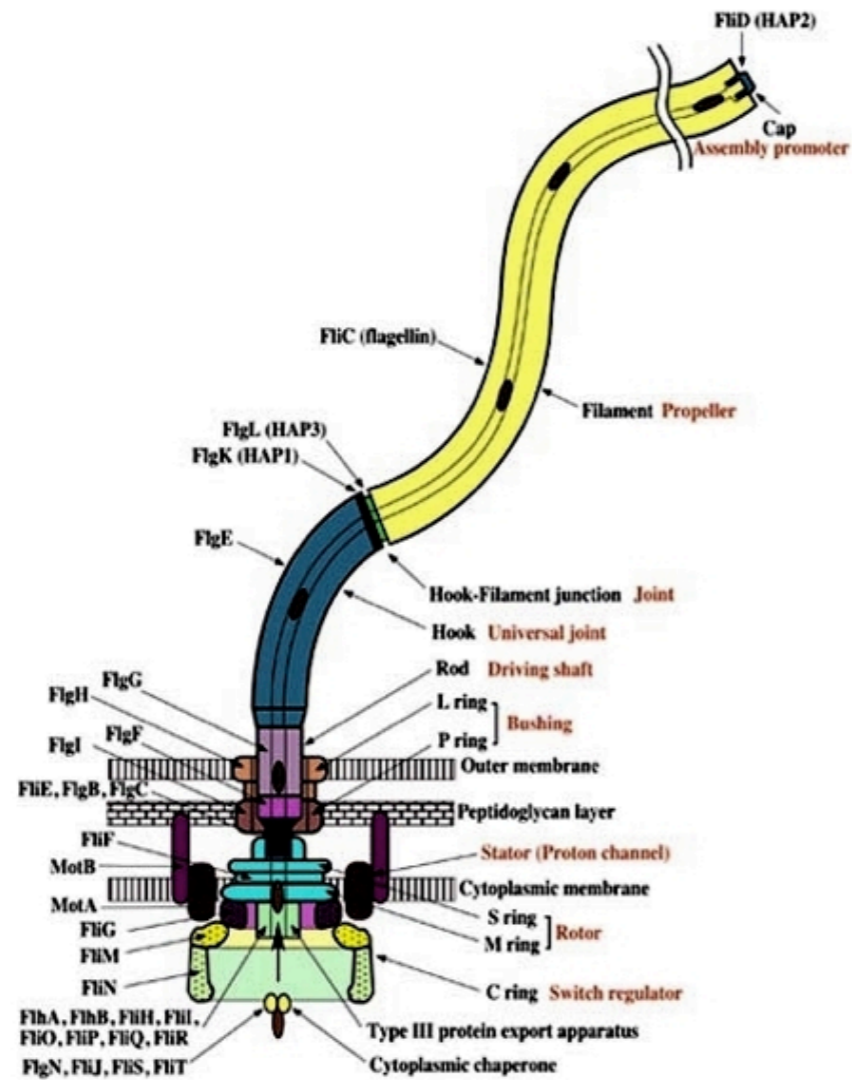


# The Bacterial Flagellum

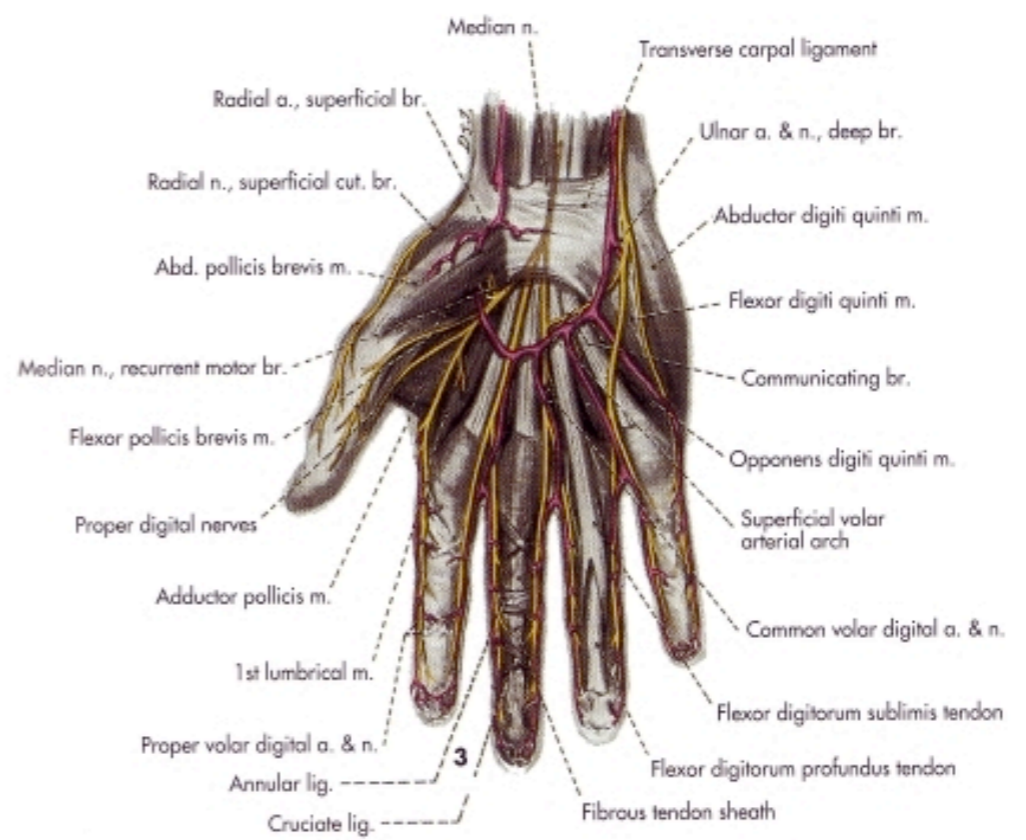
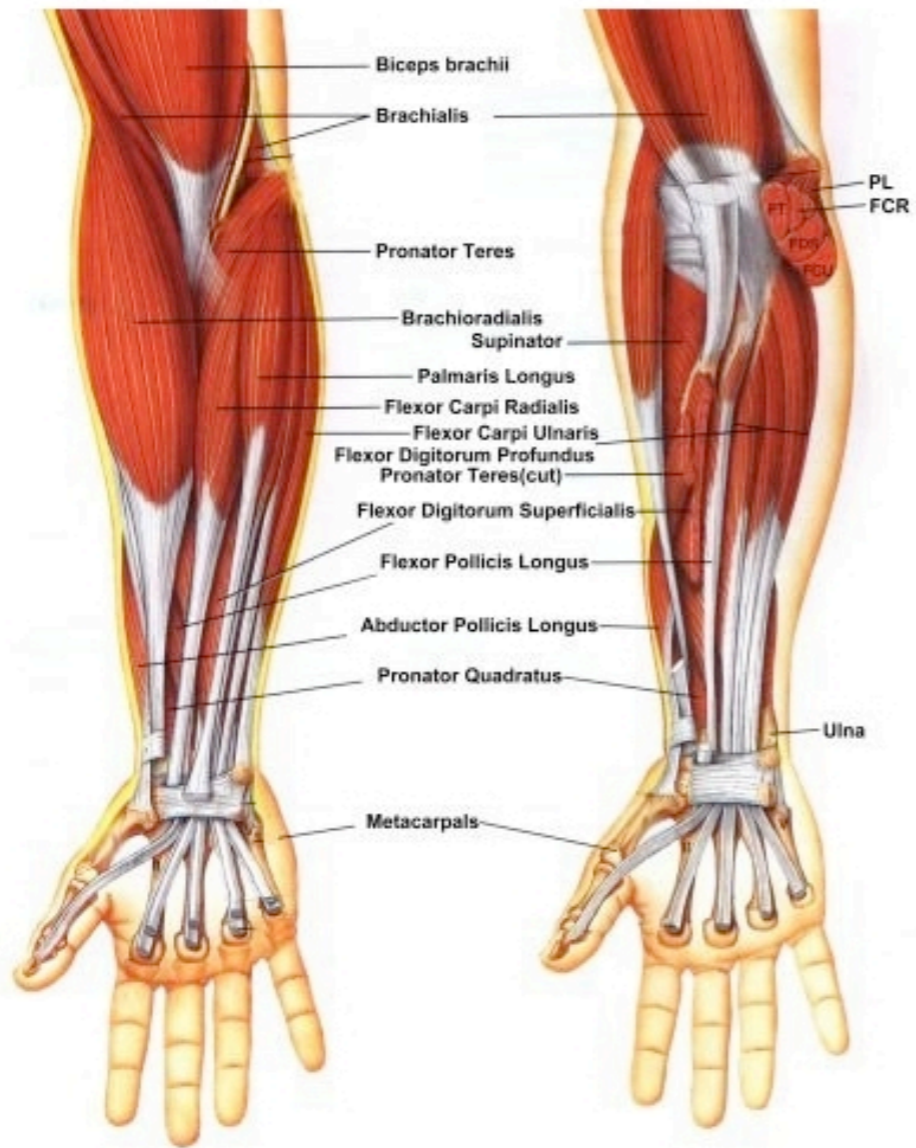


## 30 Protein Components

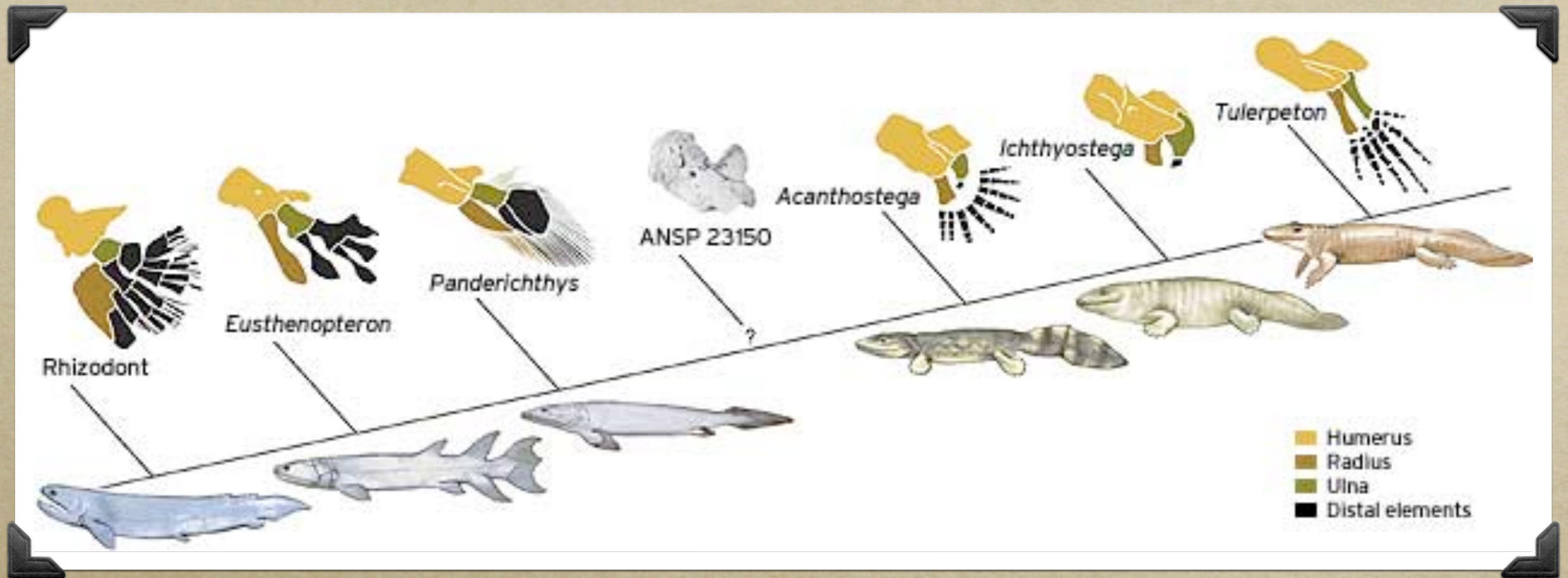
# *Are Aliens Out to Get Us!?*



**30 Protein Components**

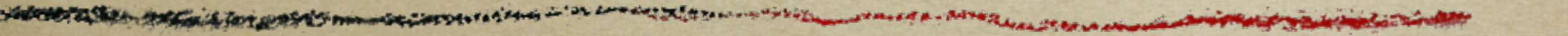


**26 Bones + 40 Muscles + 40 Tendons + Thousands of motor & sensory nerves and other components in the hand**



Limbs began more complex,  
and became simpler and more  
organized over time

**but how could, like, you know,  
a liver just pop into existence?**



**but how could, like, you know,  
a liver just pop into existence?**

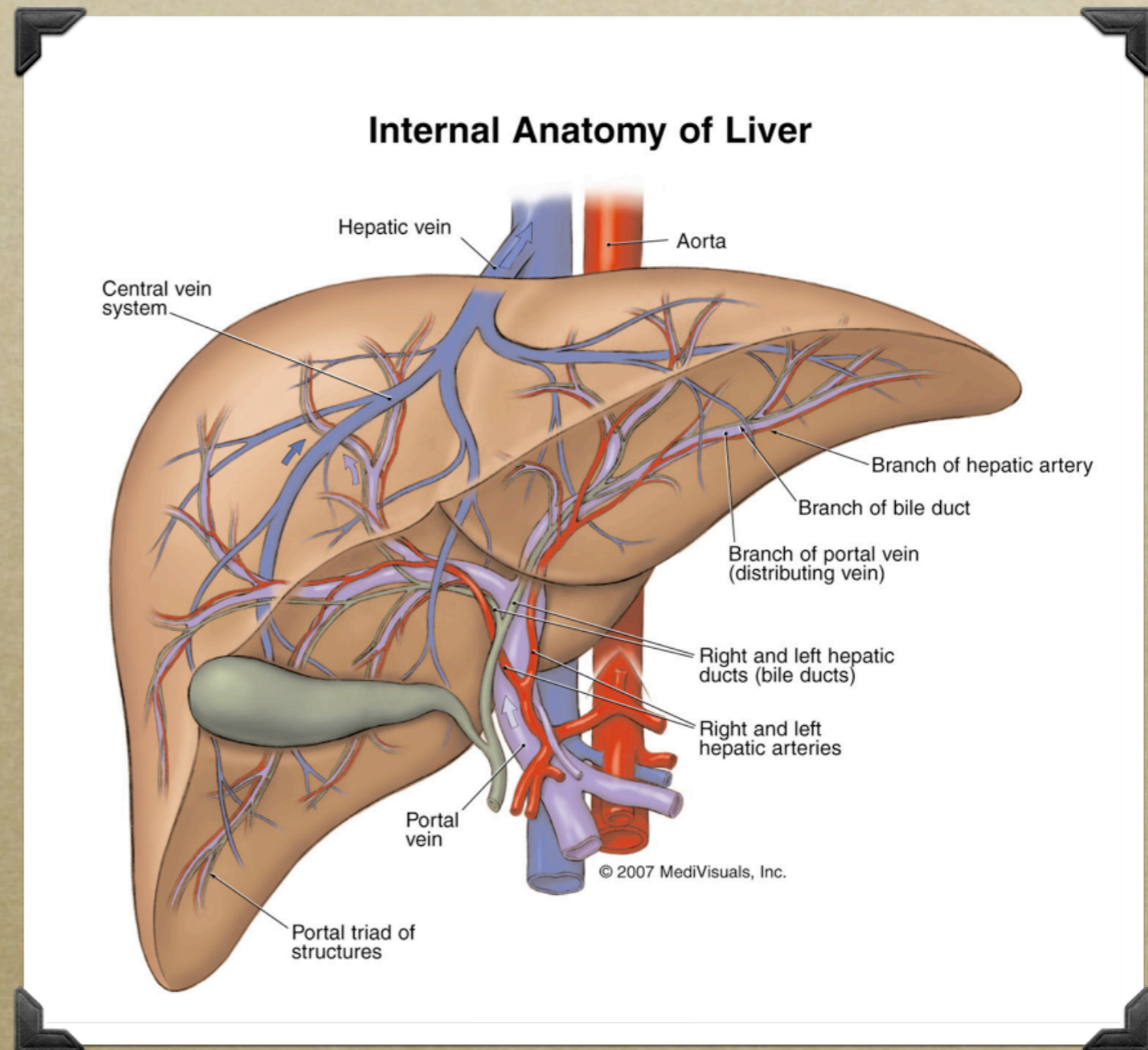
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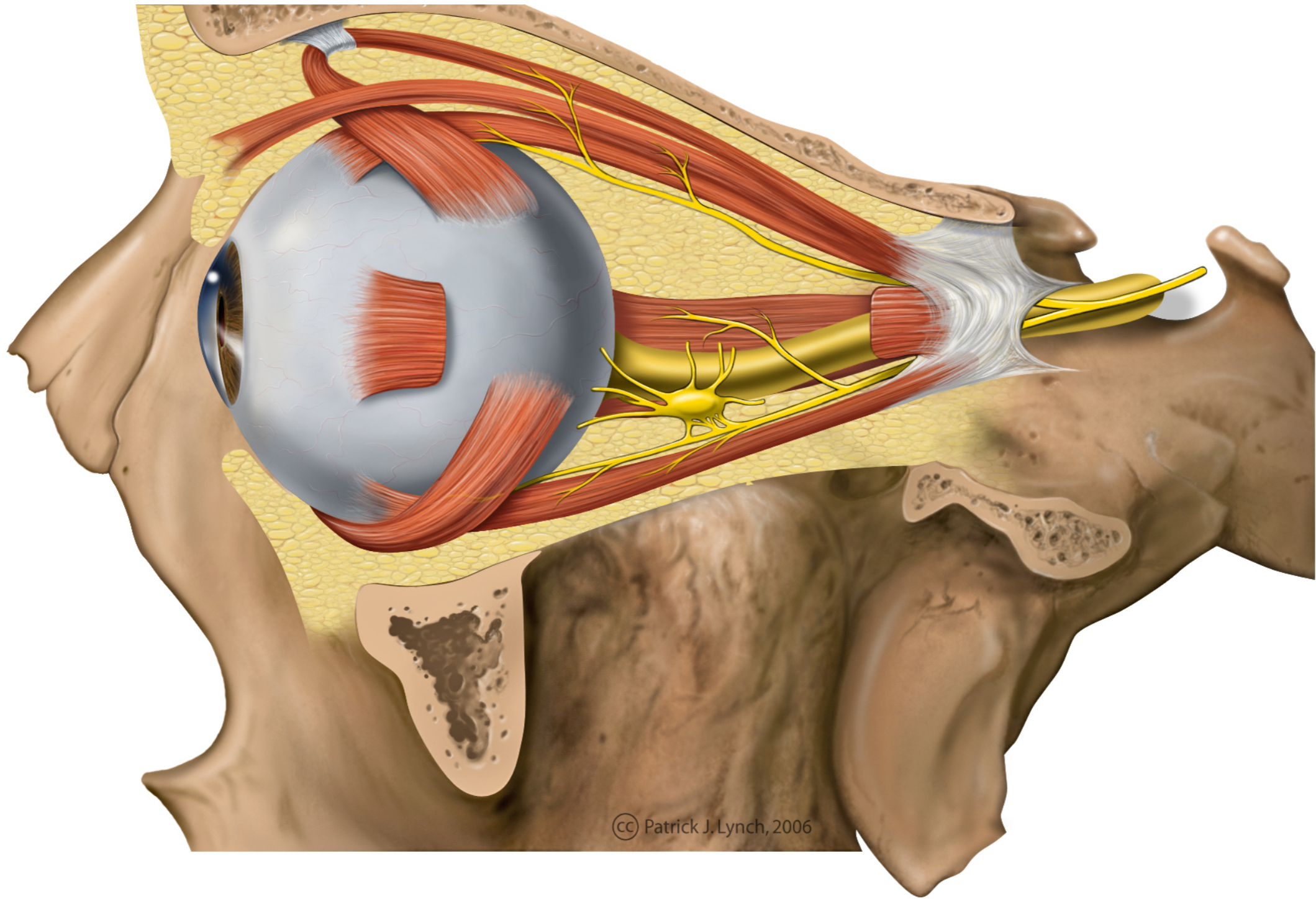
**(or a heart...or an  
eye...or a stomach...?)**



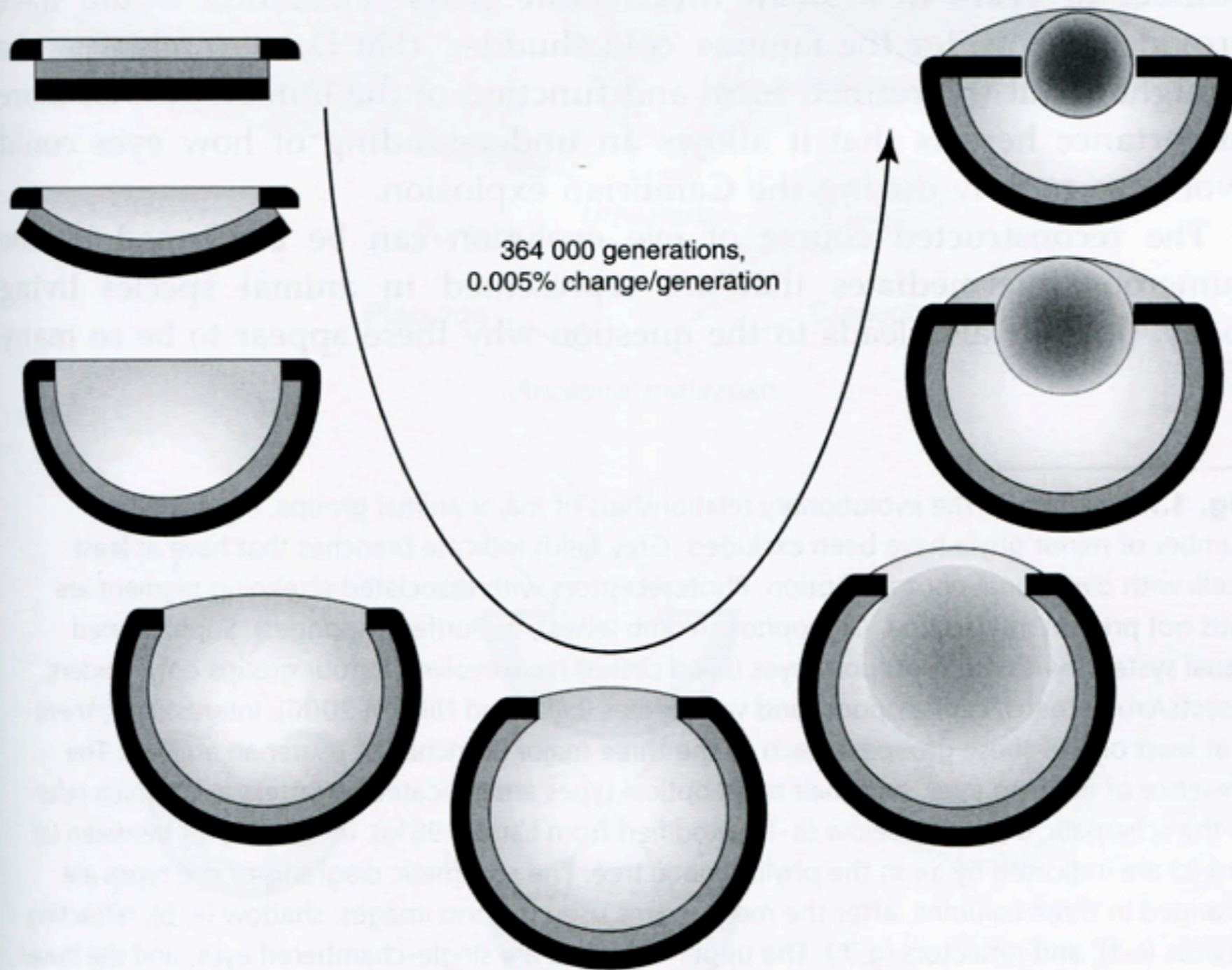
# Where Did the Liver Come from?

- *Fat cells evolved for storing, metabolizing, & releasing nutrients*
- *Liver is just a clump of specialized fat cells that gradually evolved more and more storage-metabolize-and-release functions over time*

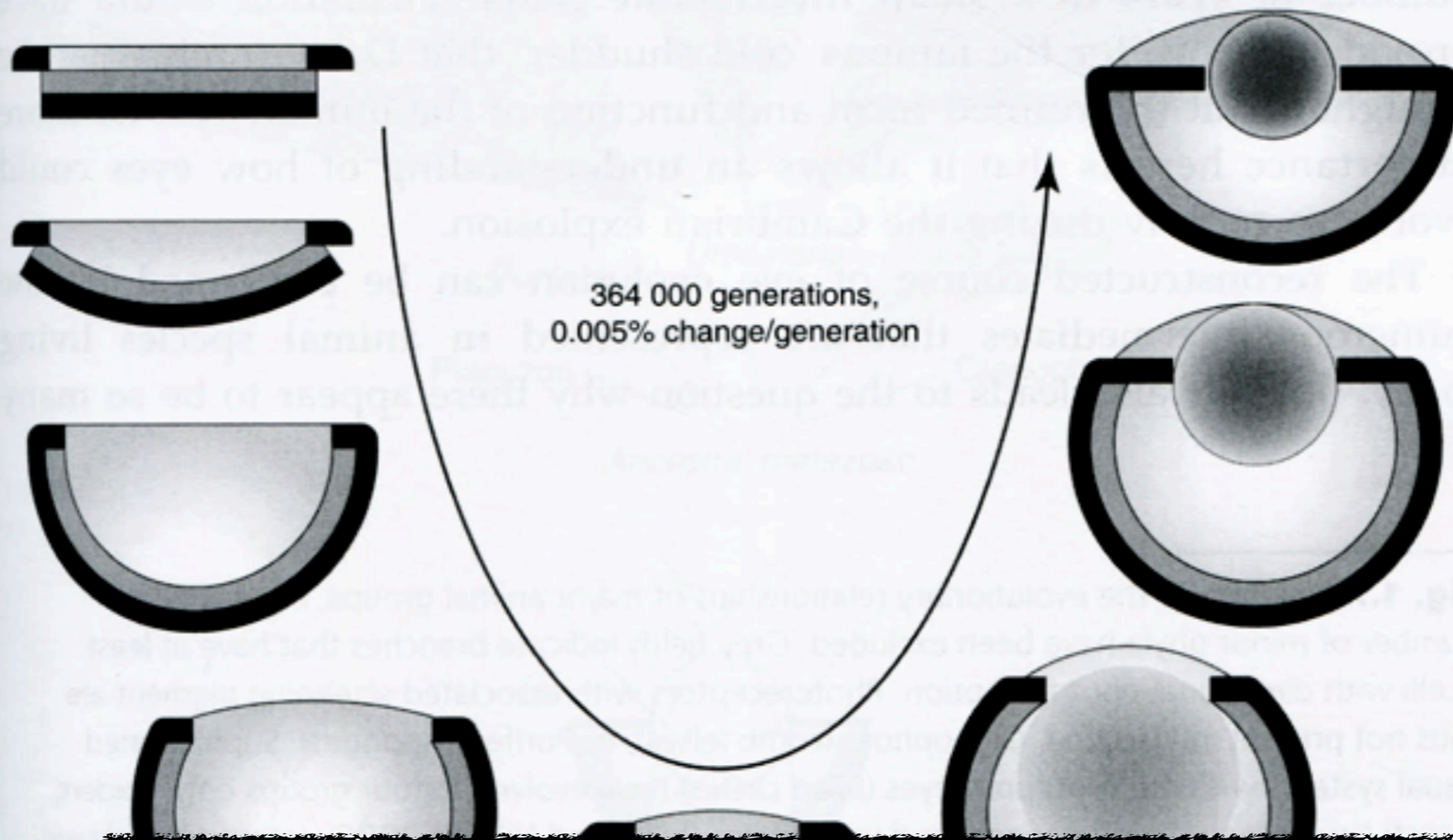




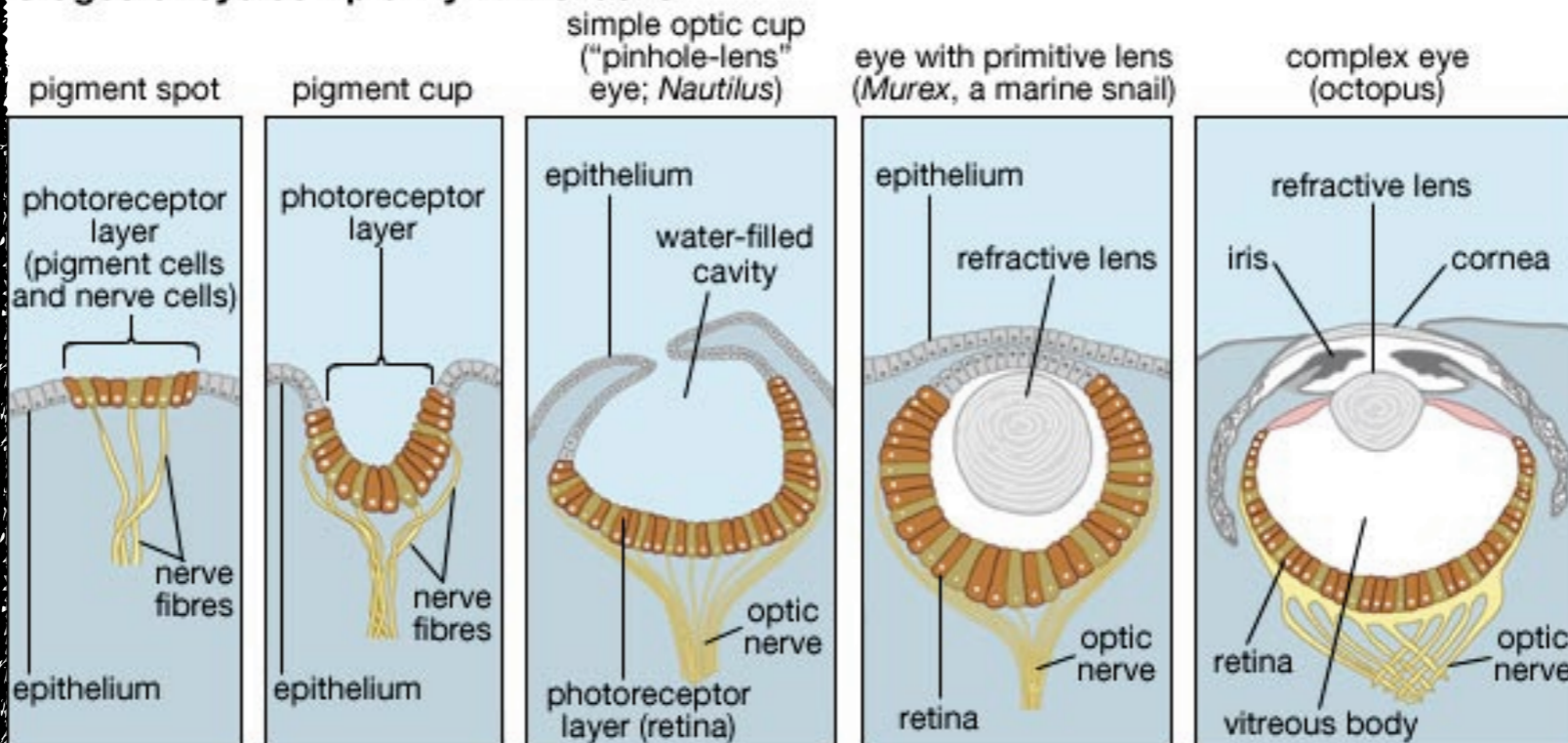
© Patrick J. Lynch, 2006



**Fig. 1.6** A patch of light-sensitive epithelium can be gradually turned into a perfectly focused camera-type eye if there is a continuous selection for improved spatial resolution. A theoretical model based on conservative assumptions about selection pressure and the amount of variation in natural populations suggest that the whole sequence can be accomplished amazingly fast, in less than 400 000 generations. The number of generations between each of the consecutive



**Stages of eye complexity in mollusks**

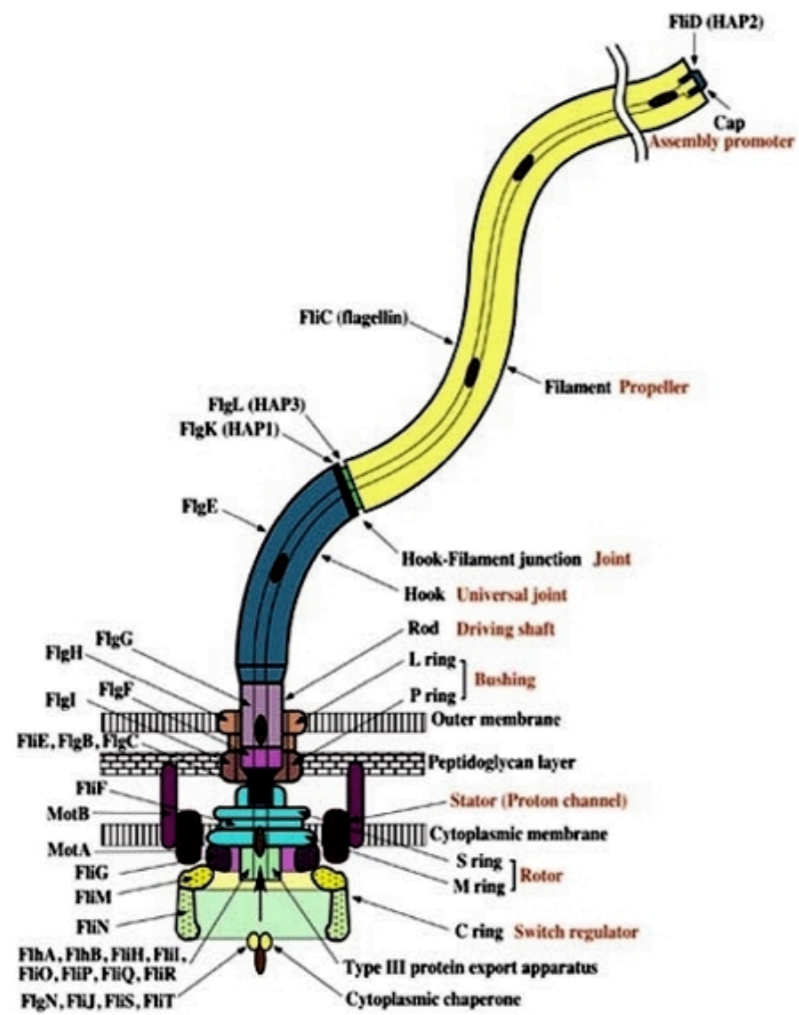


**Fig. 1.**  
camera  
model  
in nature  
in less

# **Basic Evolution Theory**

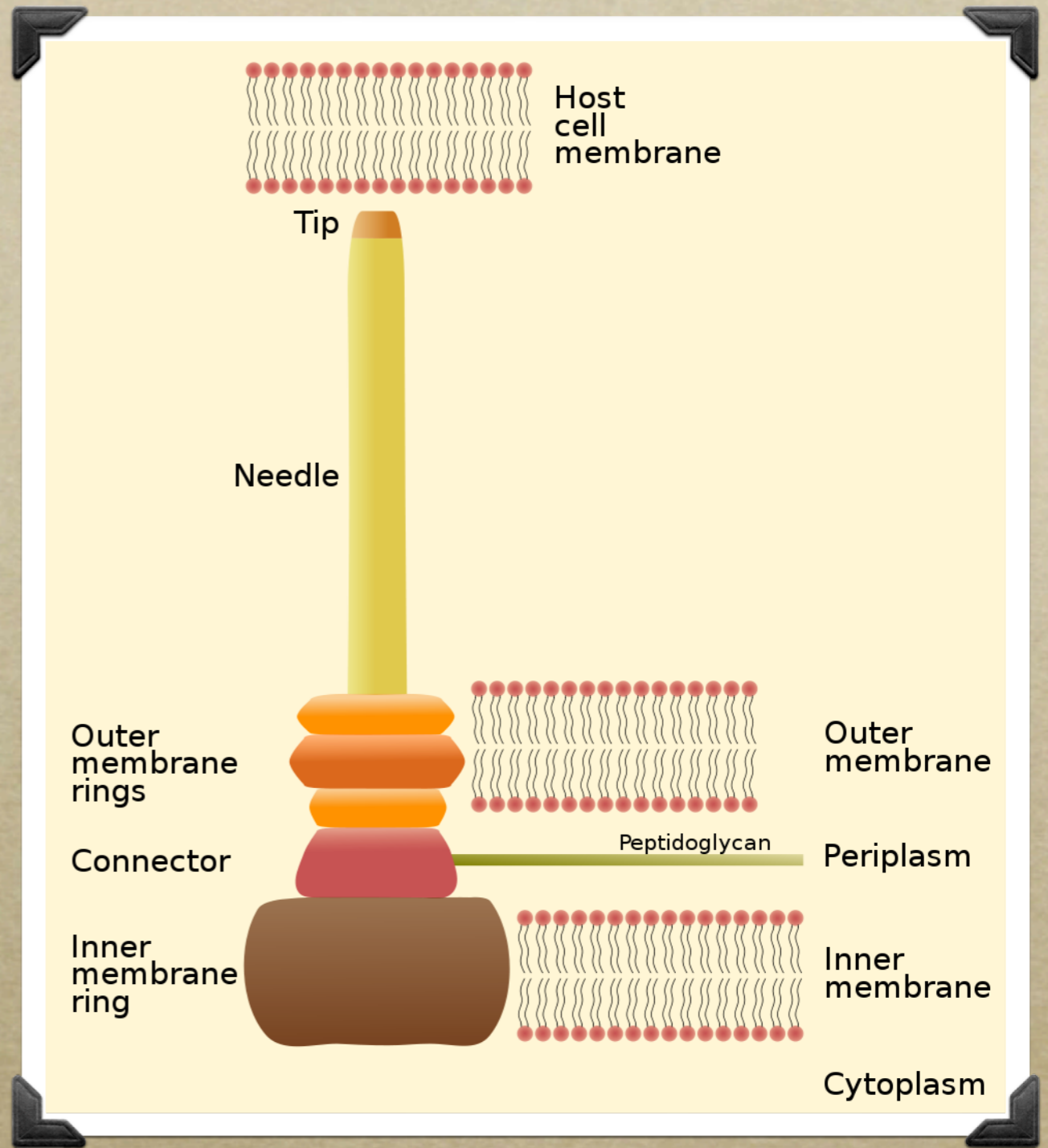
- **Mutations arise by random chance**
- **Environment kills or rewards mutant**
- **Rewarded mutants reproduce & thrive**
- **Process repeats over long period of time**
  - rewarding mutations accumulate (⇒ new species)
  - hindering mutations die off (immediately or gradually)
- **Explains all life of earth**

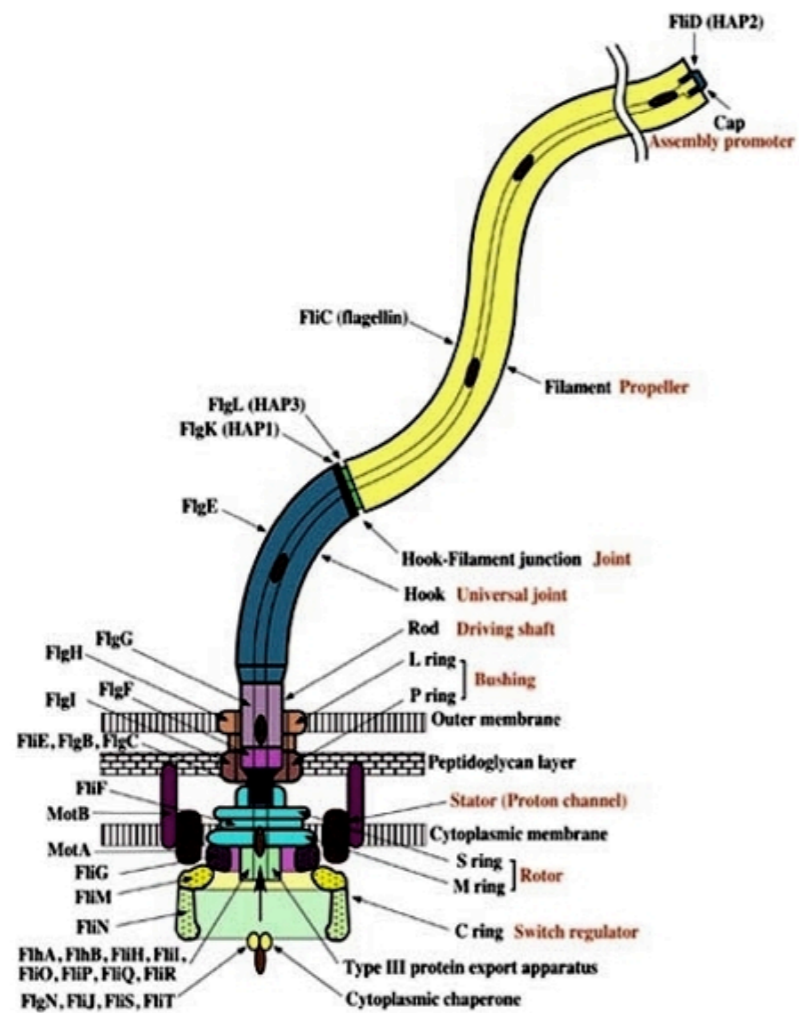
**PREDICTION:** Flagellum (like human hand) arose slowly bit by bit • first there were just a few proteins, then by mutation a few more, and so on, eventually building into the elaborate organ it is now • each useful (or harmless) mutation will be a probable outcome of chance within the time span known to have been available.



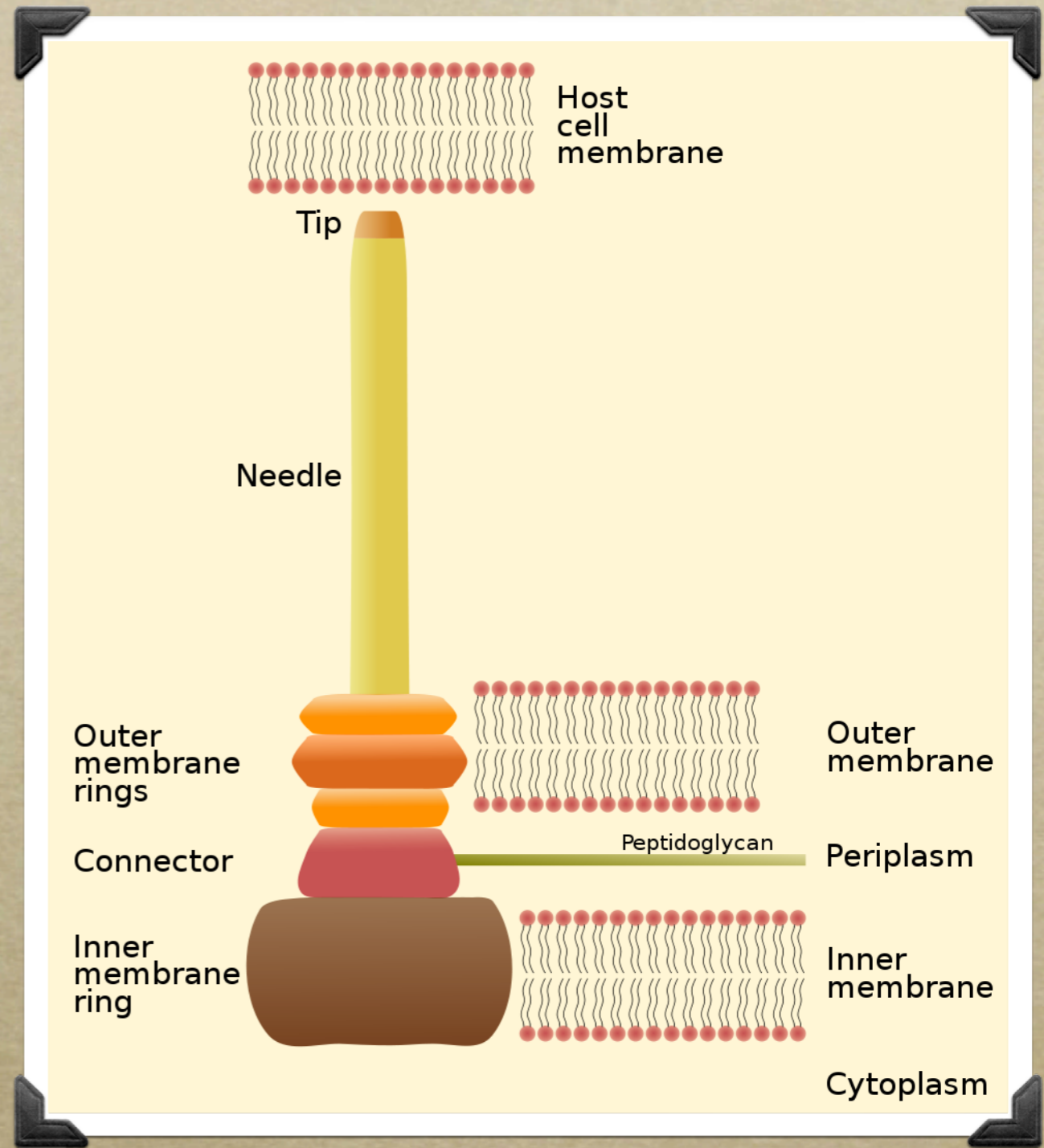
### 30 Protein Components

FliA, FliB, FliH, FliI, FliO, FliP, FliQ, FliR, FliN, FliJ, FliS, FliT





30 Protein Components



# Type III Secretion System



# **Teaching the Controversy Means Teaching This...**

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**If Behe Behaved Like a Scientist...**

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- He would spearhead **experiments & laboratory research** to confirm the key premise of his theoretical model (that the flagellum appeared spontaneously fully-formed).

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- Does no research (*not discovered any new scientific fact of any kind*).

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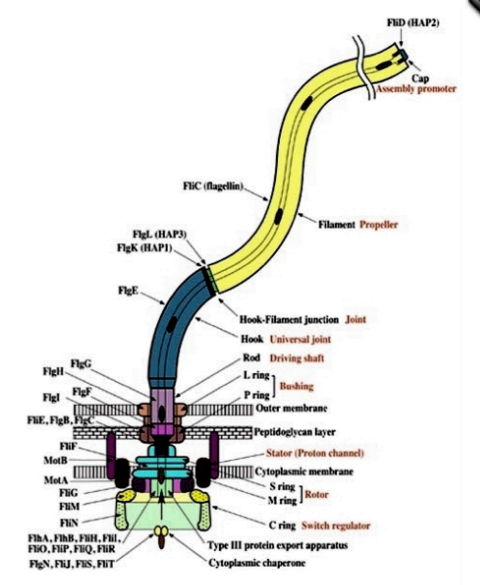
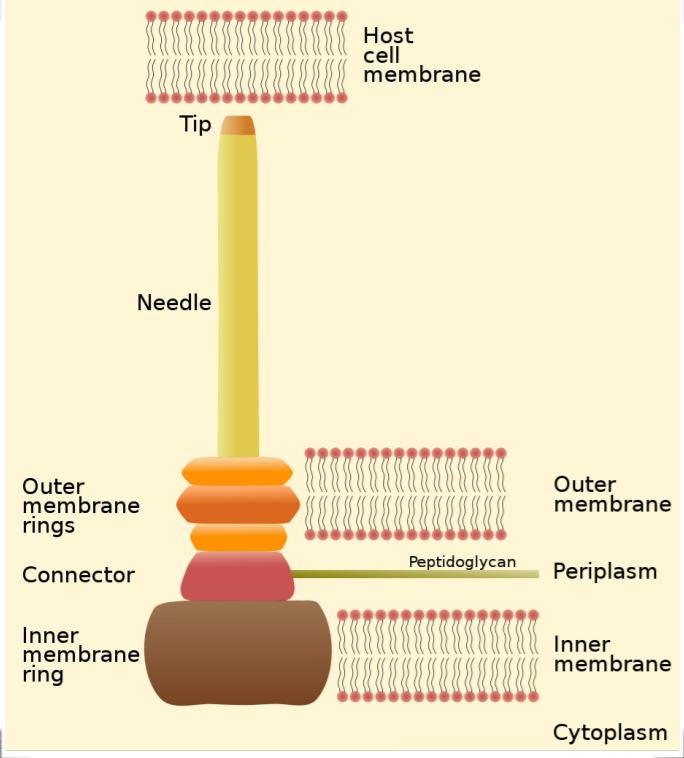
## If Behe Behaved Like a Scientist...

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- He would lobby congress to form a **national defense plan** against the **biowarfare attack** against us that he just discovered.

## **BUT:**

- Does no research (*not discovered any new scientific fact of any kind*).
- Has no actual theory (*as to how, when, why, or by whom*).

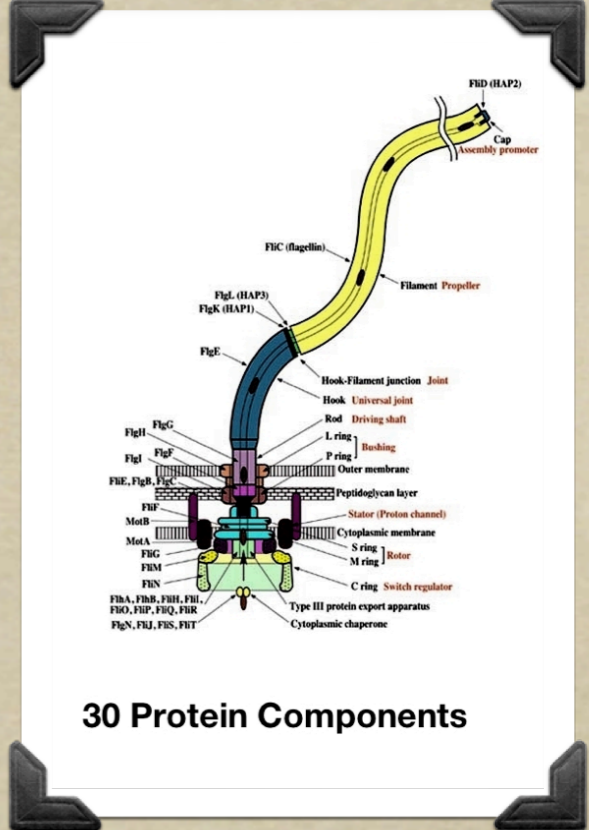
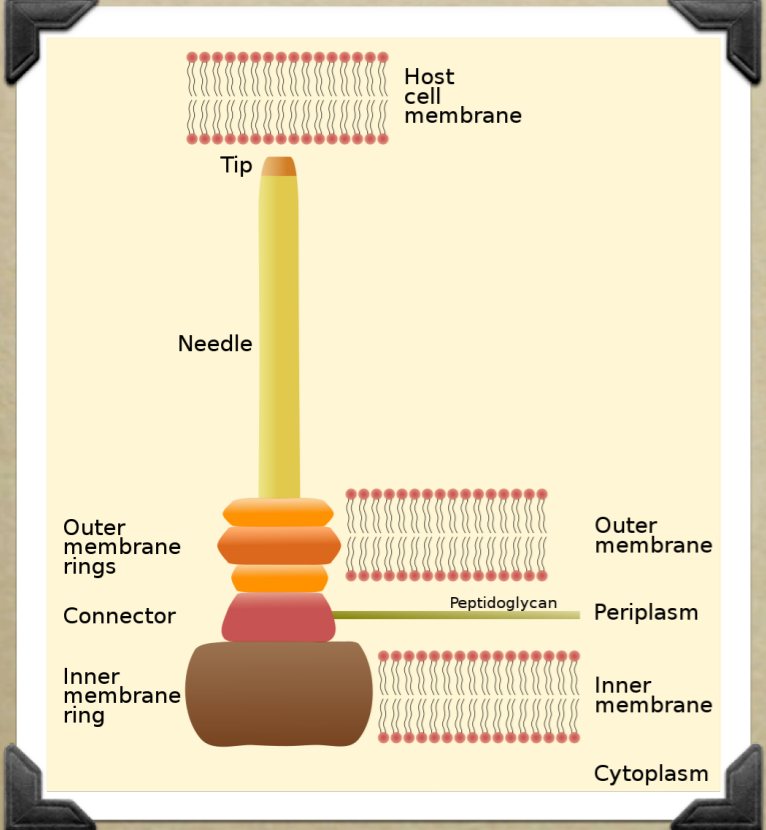
# And This...



30 Protein Components



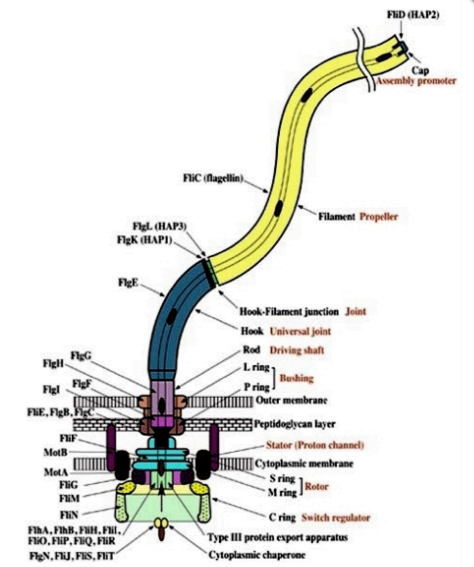
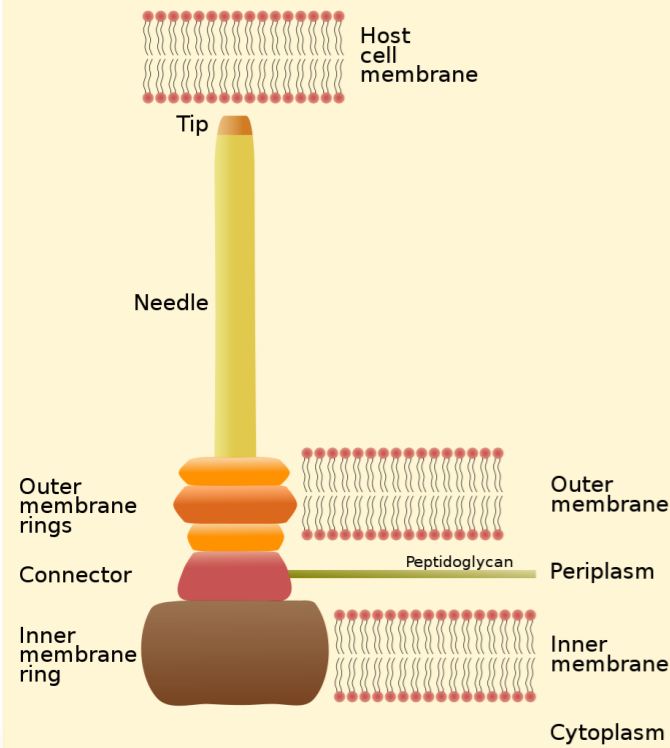
# And This...



30 Protein Components

## How a Scientist Would Act... (especially a biochemist...)

# And This...

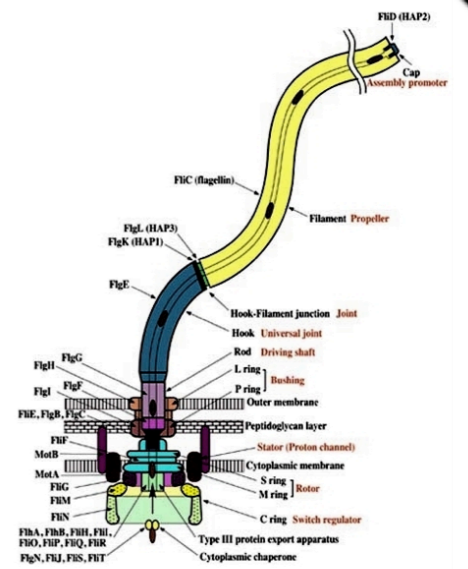
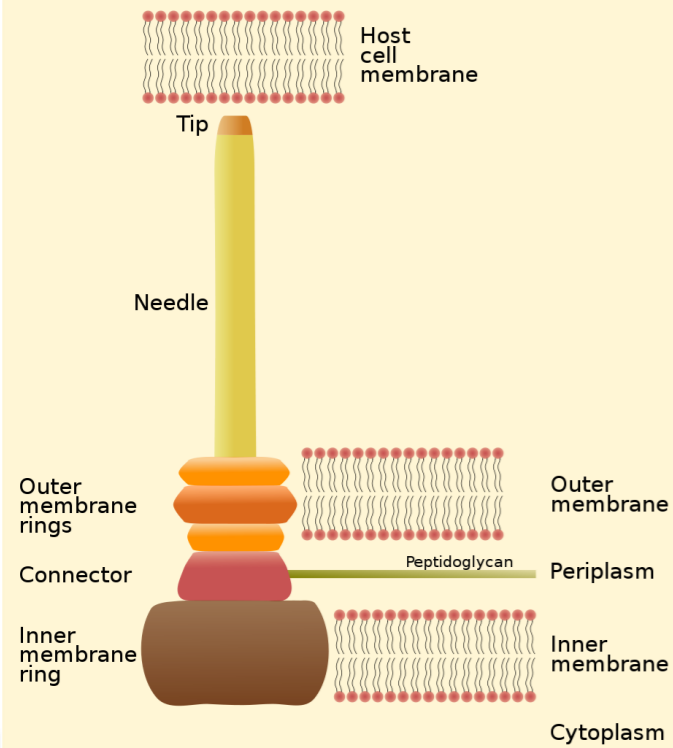


30 Protein Components

## How a Scientist Would Act... (especially a biochemist...)

- He would start by counting the right things: **DNA codons.**  
(Because organs are inevitable outcome of chemistry of DNA code.)

# And This...

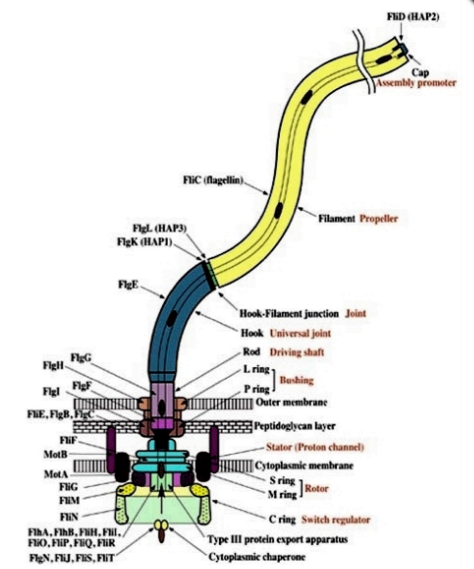
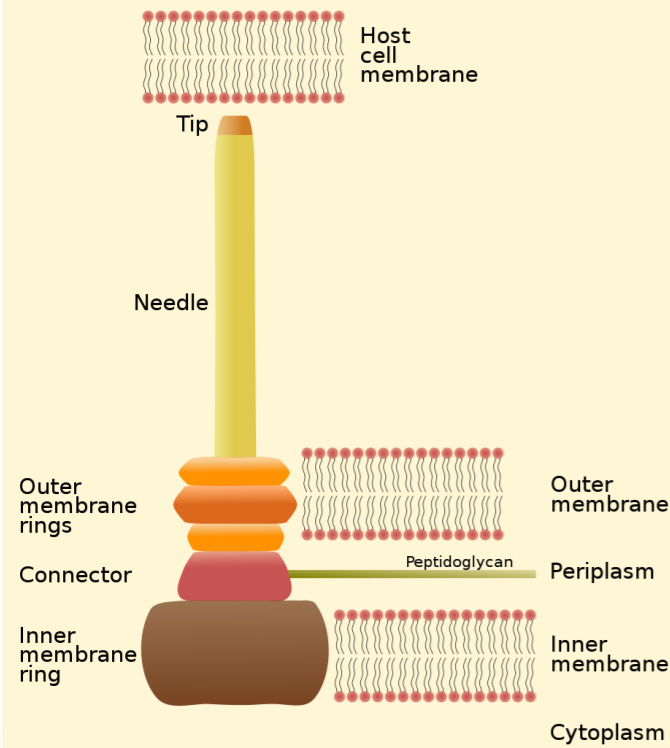


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# And This...

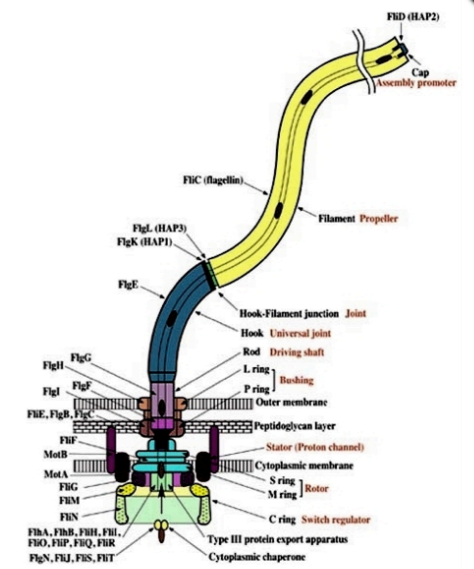
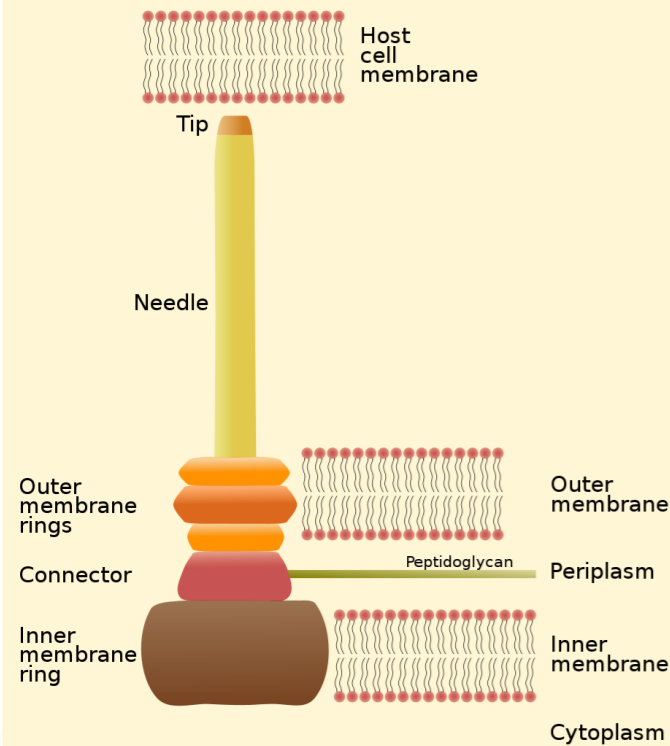


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- Then locating correlates in other microbes (with & w/o flagella).

# And This...



30 Protein Components

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- He would start by counting the right things: **DNA codons.** (Because organs are inevitable outcome of chemistry of DNA code.)
- Requires **isolating the genes** that code for building flagellum. (Because simple code can build a complex part.)
- Then locating correlates in other microbes (with & w/o flagella).
- **Which would contribute new scientific knowledge.**

*plants and  
animals*

**2.4 billion years**

**1 billion years**

**0.6 by**

*single-celled life*

*cooperative  
cells*

- *single-celled life is over **six times** more evolved than plants and animals*
- *rate of evolution for single-celled life is also **up to 500,000 times** faster than for animals*
- *This means single-celled life is around **three billion times** more evolved than your hand*

**What was God doing all  
this time?**

*plants and  
animals*

**2.4 billion years**

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# *plants and animals*

**2.4 billion years**

**1 billion years**

**0.6 by**

*single-celled life*

**He still  
couldn't  
figure it out?**

- *single-celled life is over **six times** more evolved than plants and animals*
- *rate of evolution for single-celled life is also **up to 500,000 times** faster than for animals*
- *This means single-celled life is around **three billion times** more evolved than your hand*



# *plants and animals*

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**Then takes 500 million years to figure out apes...**

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**Then takes 500 million years to figure out apes...**

- *single-celled life is over six times more evolved than plants and animals*
- *rate of evolution for single-celled life is 500,000 times faster than for plants and animals*
- *This means single-celled life is 1.44 billion times more evolved than your hand*

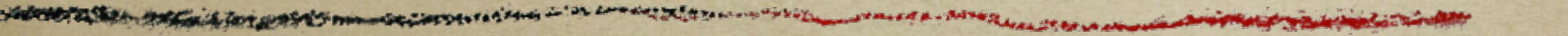
**Then 4 million years of tinkering before he figures out how to make people?**

# Evolution vs. Creationism

## Your Theory Must Explain:

1. Why life began with only **single-celled organisms**.
2. Why animals are constructed from **colonies of single-celled organisms** (cells), rather than uniform tissues.
3. Why bacteria have inhabited the planet **six times longer** than multi-celled plants & animals (*rather than all appearing at once*).
4. Why things kept changing, in lines of obvious development (**corroborated by fossils & DNA**), over hundreds of millions of years (*with tons of flaws and extinction events to boot*).
5. Why humans **weren't the first thinkers and inventors**, but are the evolved ancestors of various extinct species that were.

**but where did all that  
"information" come from?**

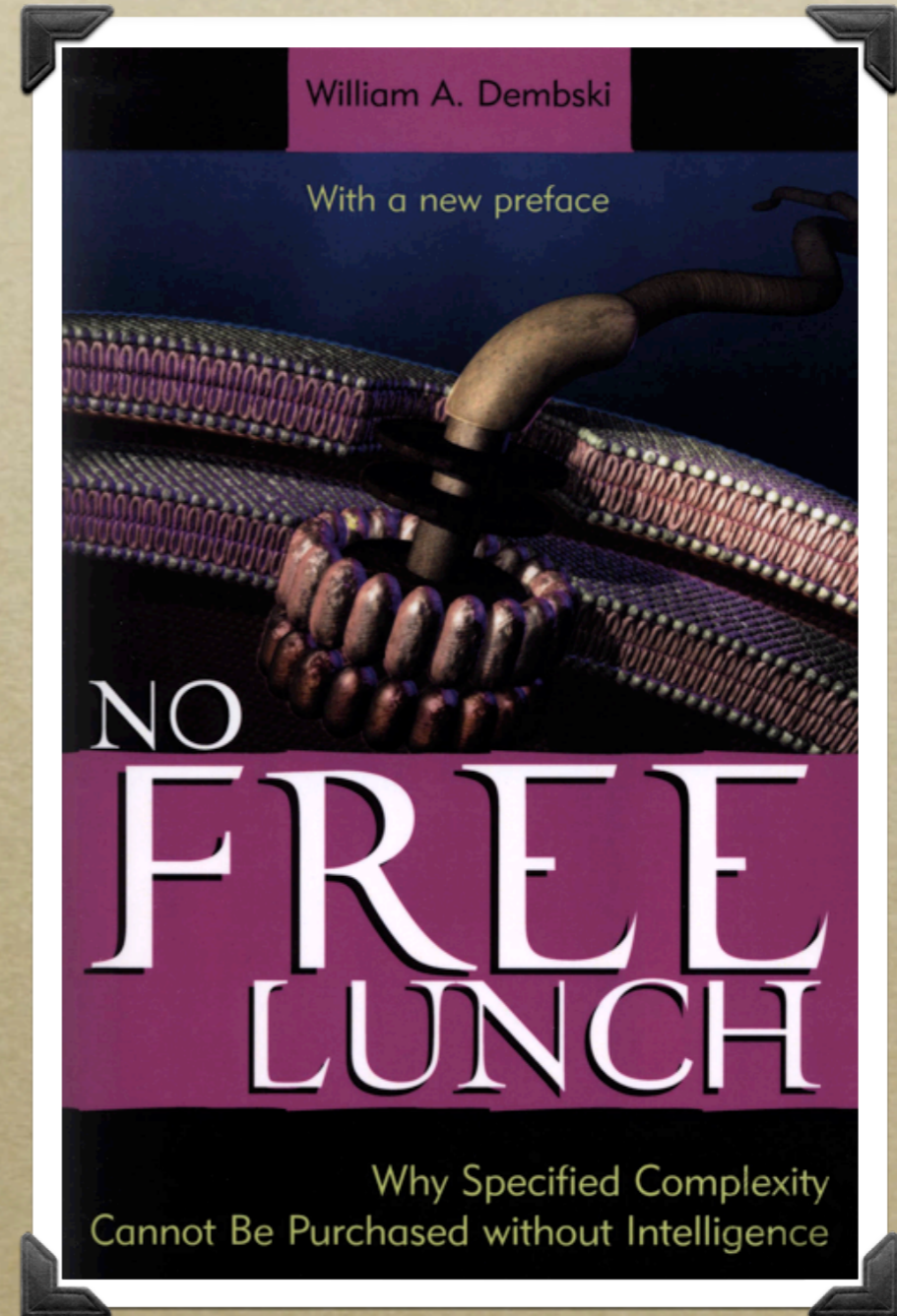


but where did all that  
"information" come from?

---

*ANSWER: The  
Environment*

# Even William Dembski Says So!



# Even William Dembski Says So!



**Up to 500 bits of  
information can  
arise at random in  
any given event**



# RANDOM INFORMATION GAIN

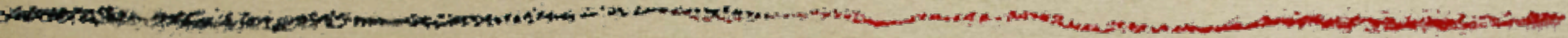
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- To get 1 2 3 4 5 6 . . .
- Keep randomly rolling until you get a “1” (all others die)
- It gets selected to survive and is thereafter copied
- Keep randomly rolling again until you get “2” . . .





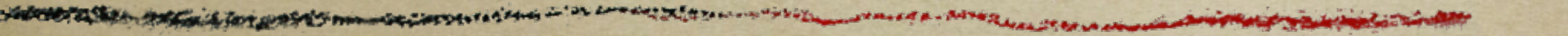
**but where did  
DNA come from?**



**but where did  
DNA come from?**

***ANSWER:  
Chemical  
Evolution***

**but mutations  
are bad, aren't they?**



# **THAT'S WHY THEY HAVE PILES OF BABIES!**

---

1. A nice fish couple hooks up and has 100 babies.
2. 80 die of bad mutations while the other 20 are okay.
3. But that couple only needs 2 to replace themselves.
4. So 18 die from getting eaten or starving and such.
5. **This can go on forever.**

# THAT'S WHY THEY HAVE PILES OF BABIES!

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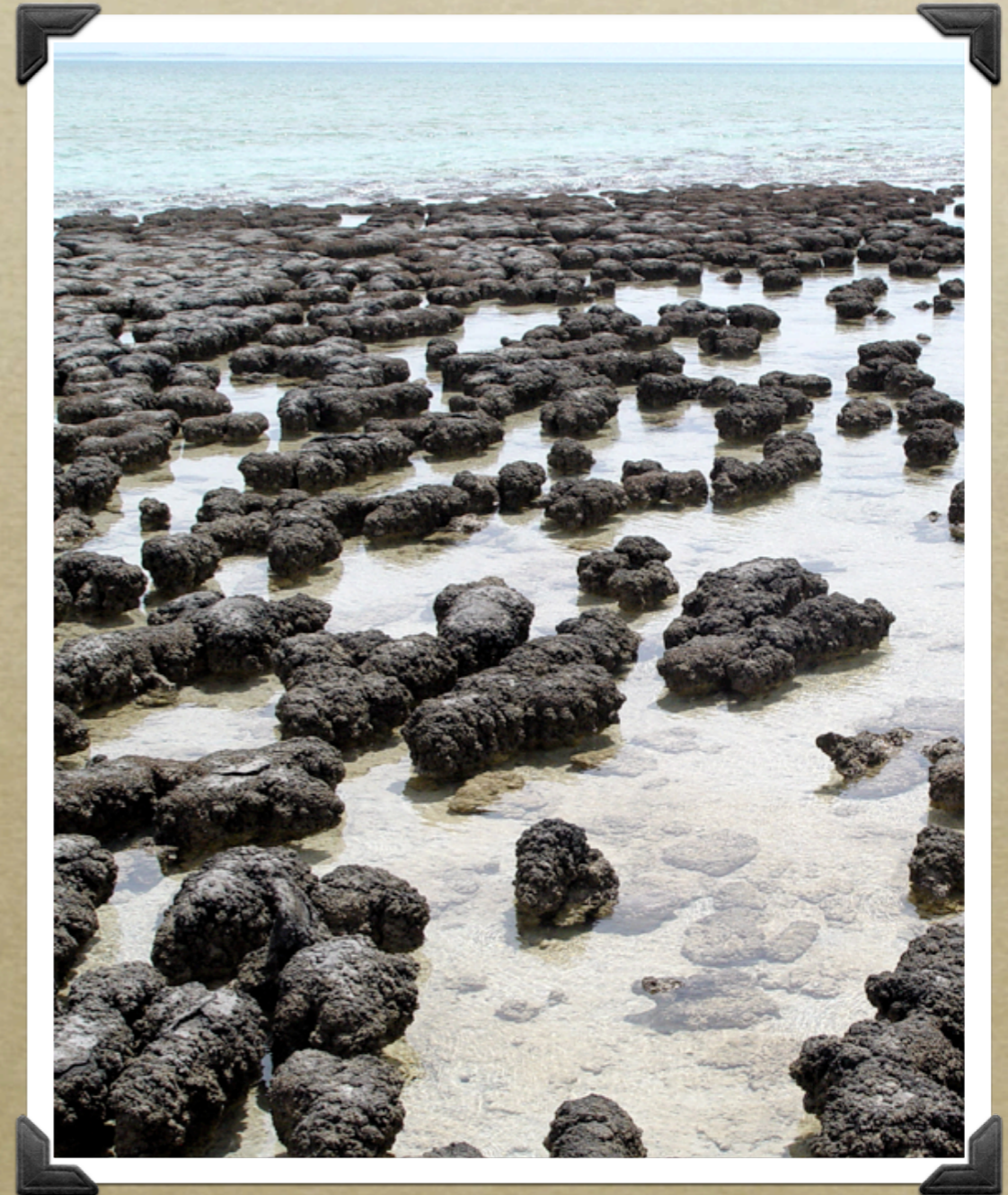
1. So you just have to wait around.
2. In populations of millions, 1 or 2 good mutations come up every generation.
3. But there will be **hundreds of millions of babies** per generation (e.g. 100 babies x millions).
4. So if 1 in a million mutations were useful, then you'd get hundreds of those per generation (**the actual rate is around 1 or 2**).

**but if we evolved from  
monkeys, why are there still  
monkeys?**

---

**WE AREN'T COMPETING WITH THEM**

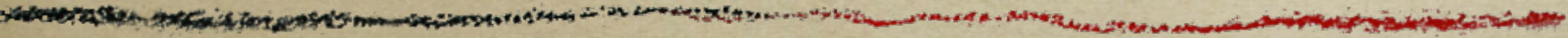
**It's a Niche  
Market**







**ah, but what about the second  
law of thermodynamics!**

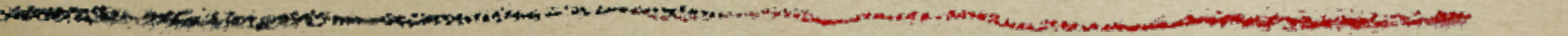


ah, but what about the second  
law of thermodynamics!

*Well, you see, there are these things  
called **suns** and **volcanoes** —  
and **dissipative systems**.*

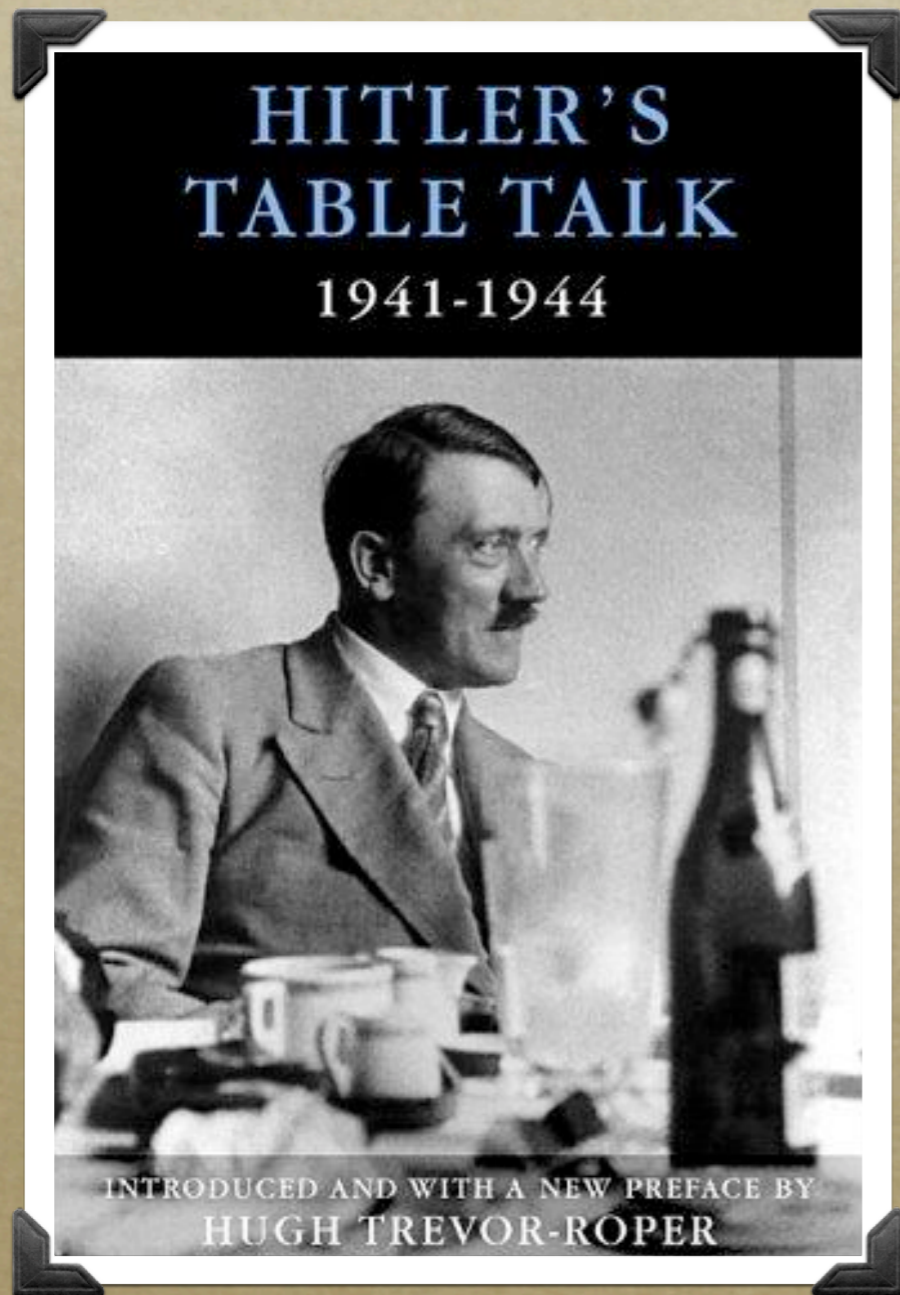


**but evolution can't be true,  
because, you know, Hitler!**



# Hitler Was No Atheist

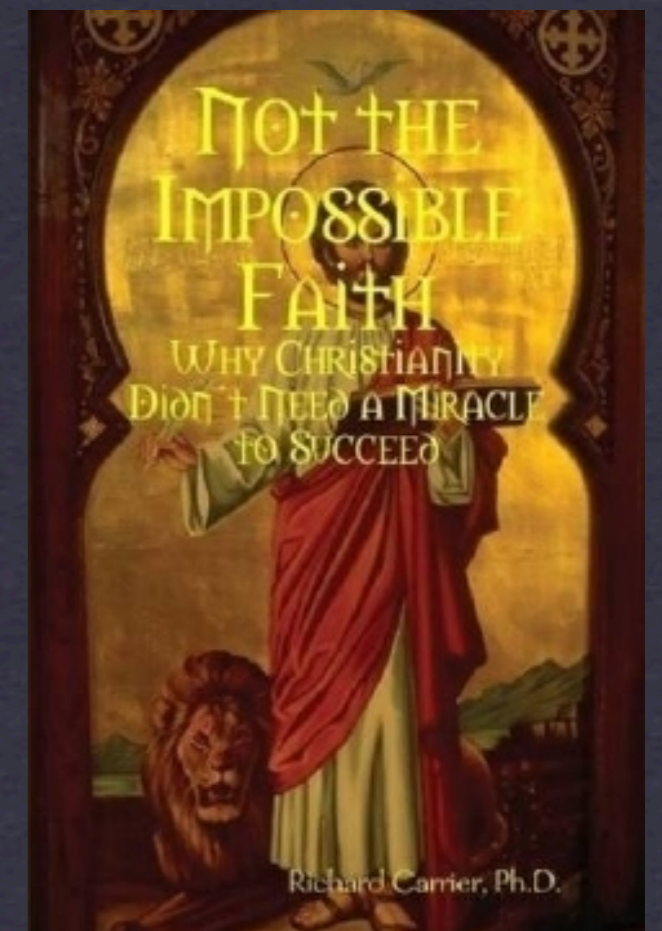
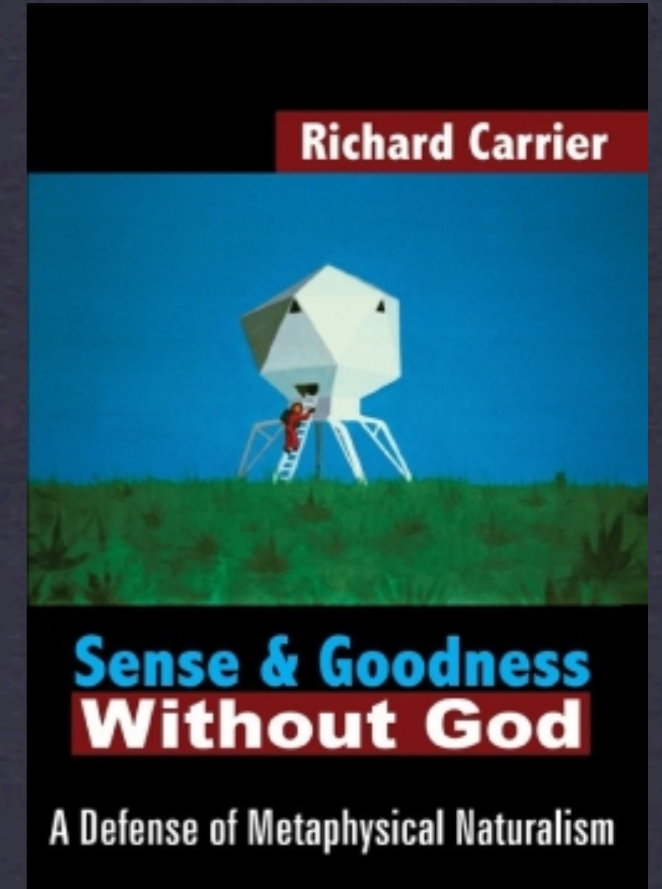
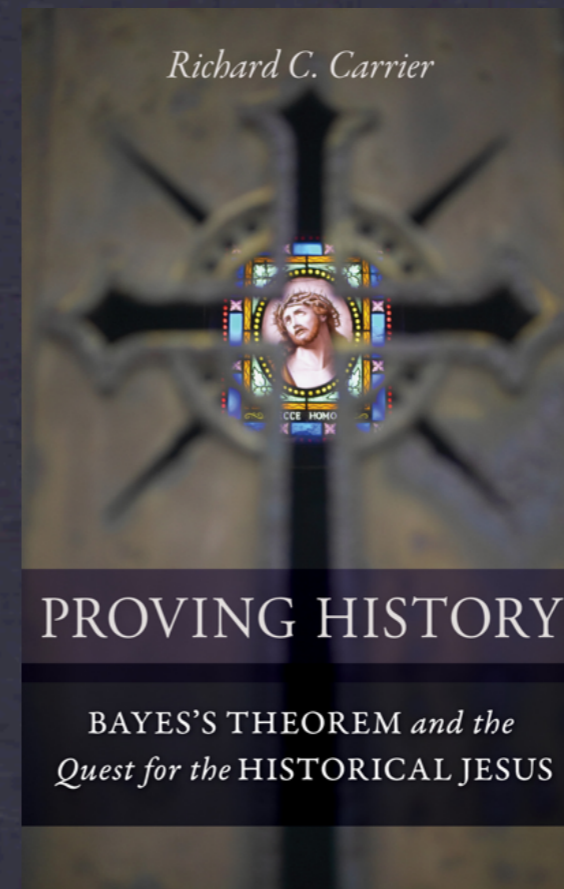
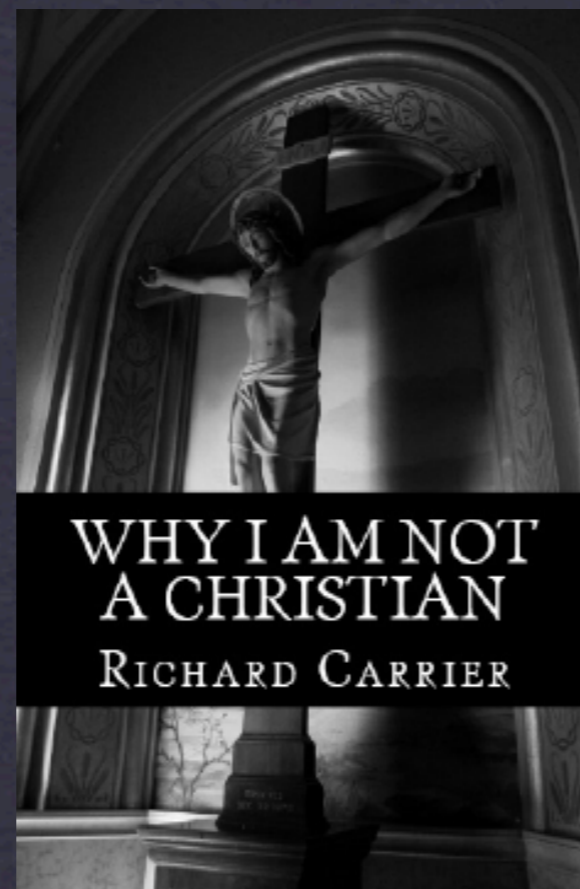
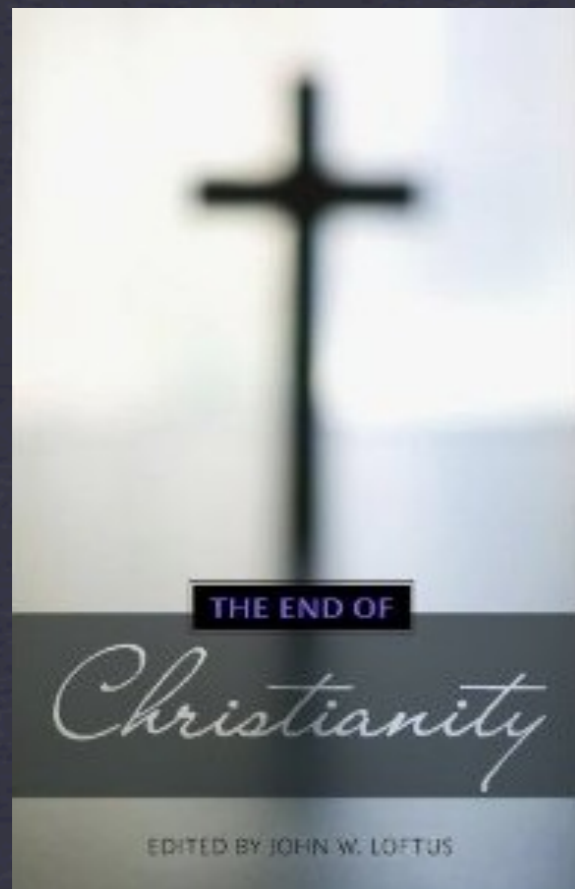
(All Those Quotes You Heard Are Bogus)



**"What man has over the animals, possibly the most marvelous proof of his superiority, is that he has understood there must be a Creator!" — Adolf Hitler**

*A COMPARISON OF HITLER'S ANTI-JEWISH POLICIES AND POLICIES  
ADVOCATED IN ANY OF THE WORKS OF  
MARTIN LUTHER AND CHARLES DARWIN*

<b>Hitler's Policies</b>	<b>Luther</b>	<b>Darwin</b>
Burning Jewish Synagogues	Yes	No
Destroying Jewish Homes	Yes	No
Destroying Sacred Jewish Books	Yes	No
Forbidding Rabbis to Teach	Yes	No
Abolishing Safe Conduct	Yes	No
Confiscating Jewish Property	Yes	No
Forcing Jews into Labor	Yes	No
Citing God as Part of the Reason for Anti-Judaism	Yes	No



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