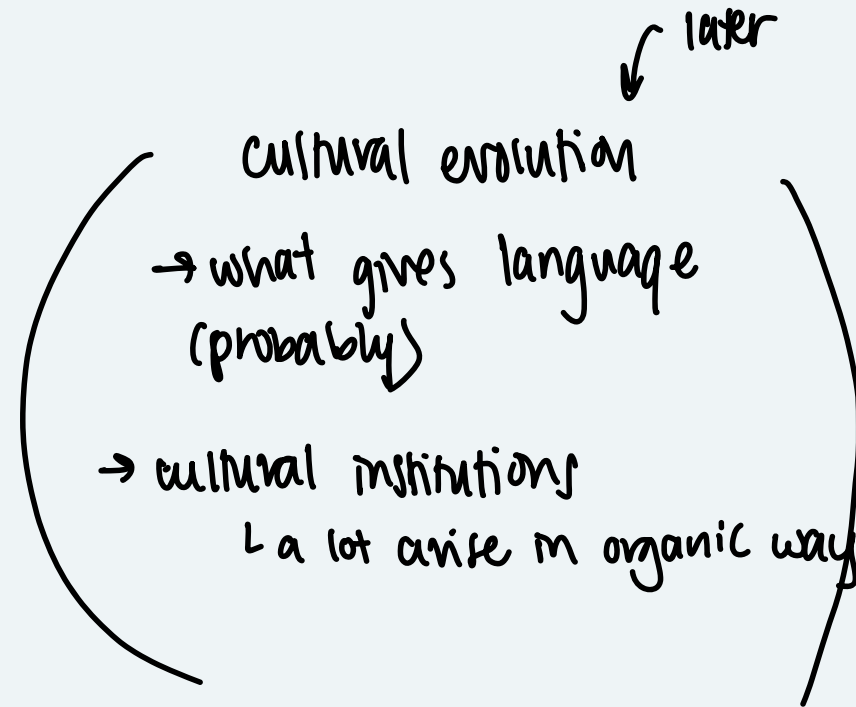


COGS300

Evolution of cognition



Instructor: Márton Sóskuthy

marton.soskuthy@ubc.ca

TAs: Daichi Furukawa · Victoria Lim · Amy Wang

cogs.300@ubc.ca

Evolution

"eel-volution"

-marion

-abt individuals & genes they carry
(not species)

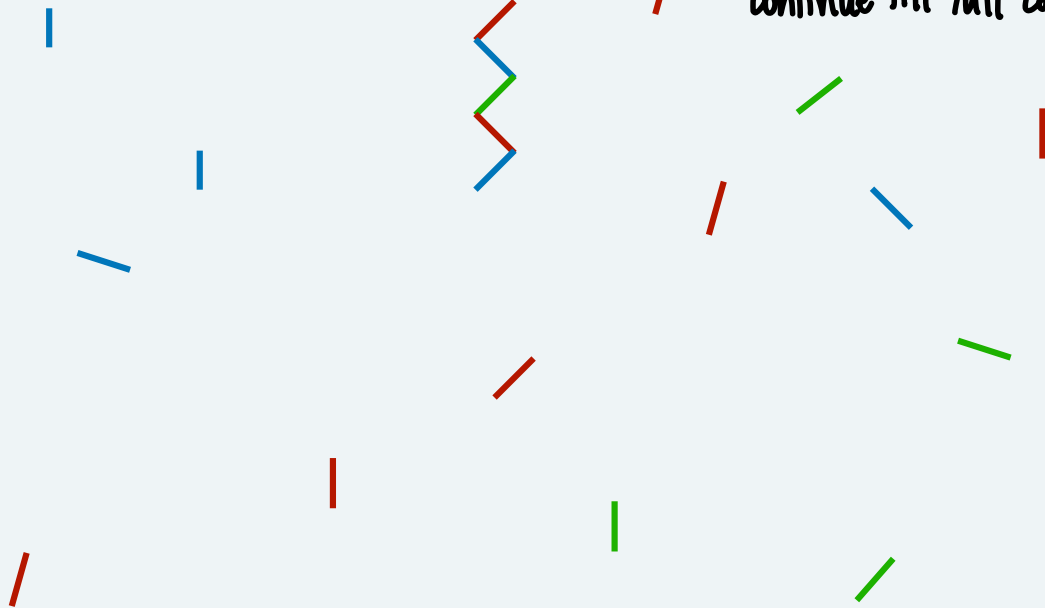
the emergence of life

the replicator



→ able to make copies of itself
-just a molecule floating around

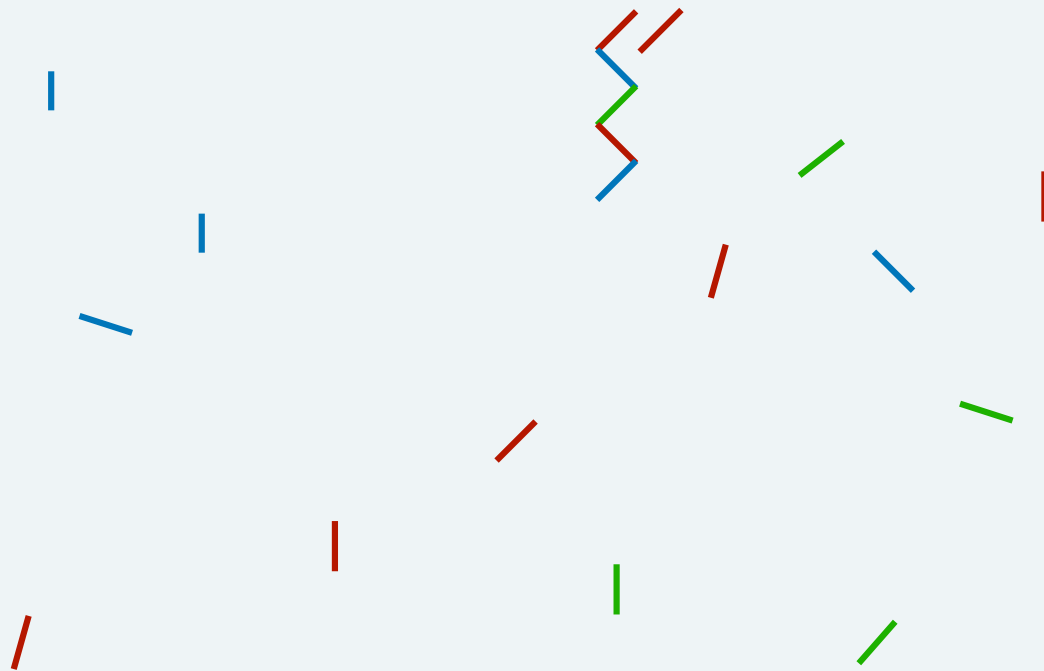
-when it floats by the right kind of molecule & it attaches
continue till full copy, break apart, do again



from: Dawkins (1976)

Evolution

the replicator



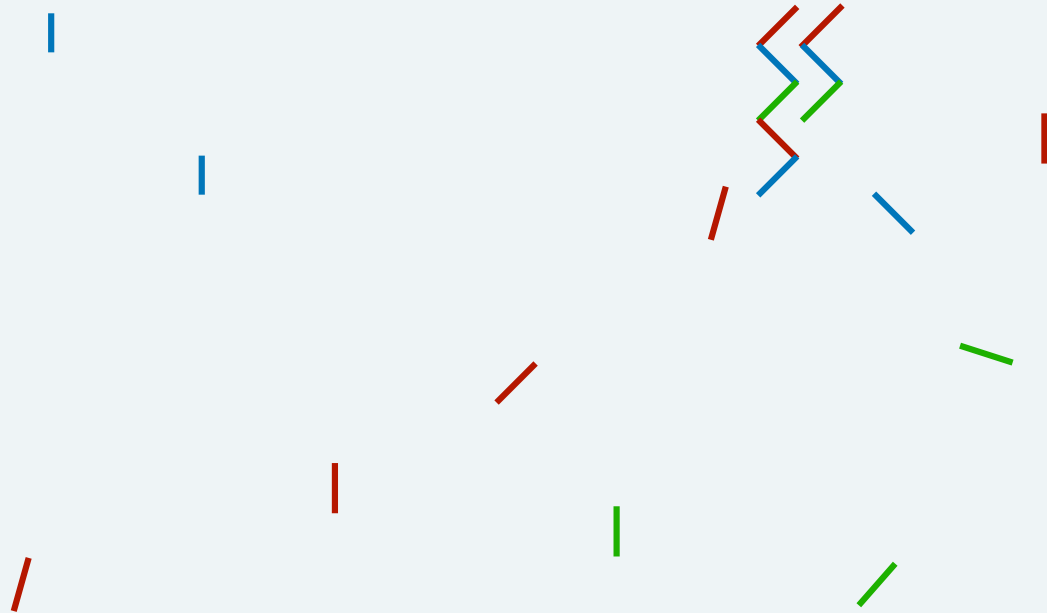
Evolution

the replicator



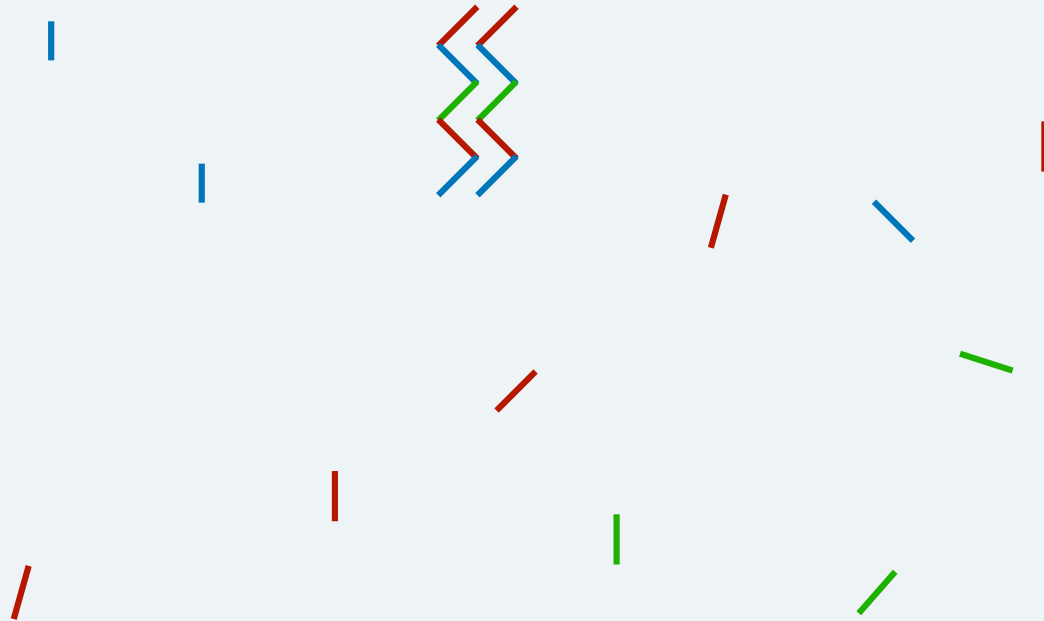
Evolution

the replicator



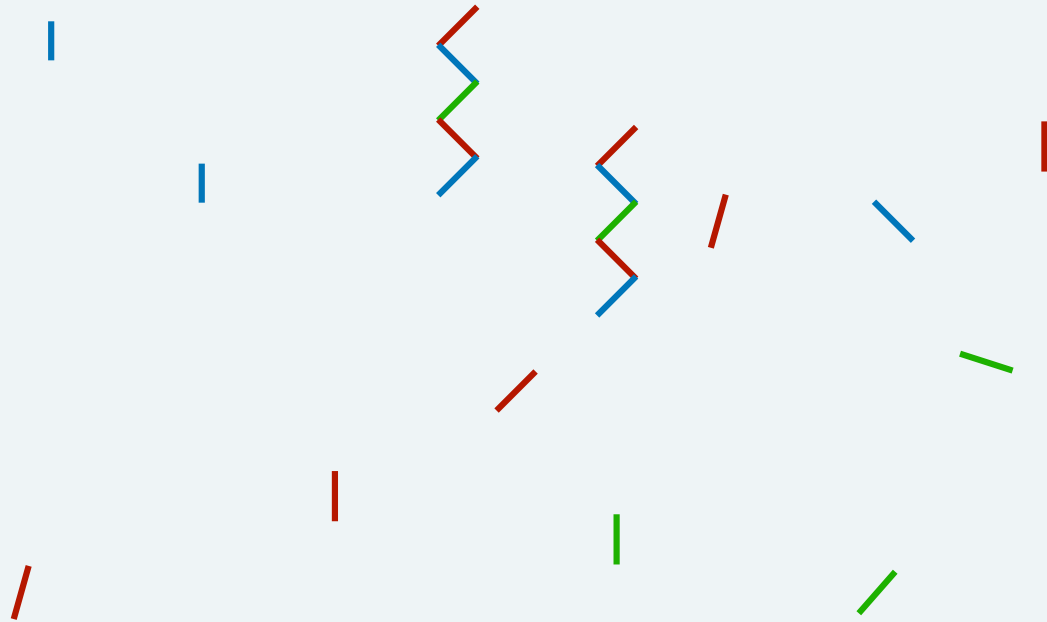
Evolution

the replicator



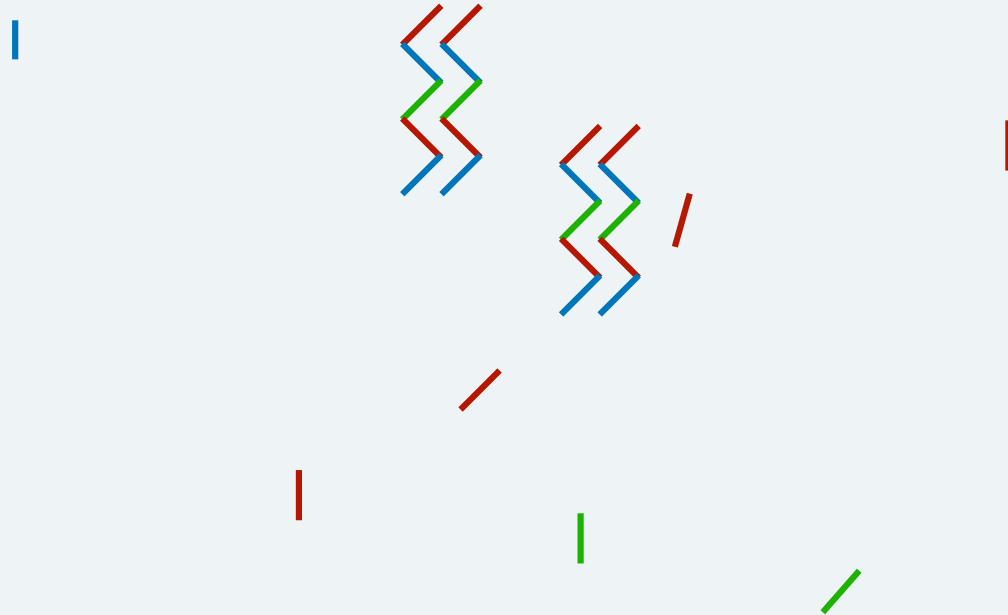
Evolution

the replicator



Evolution

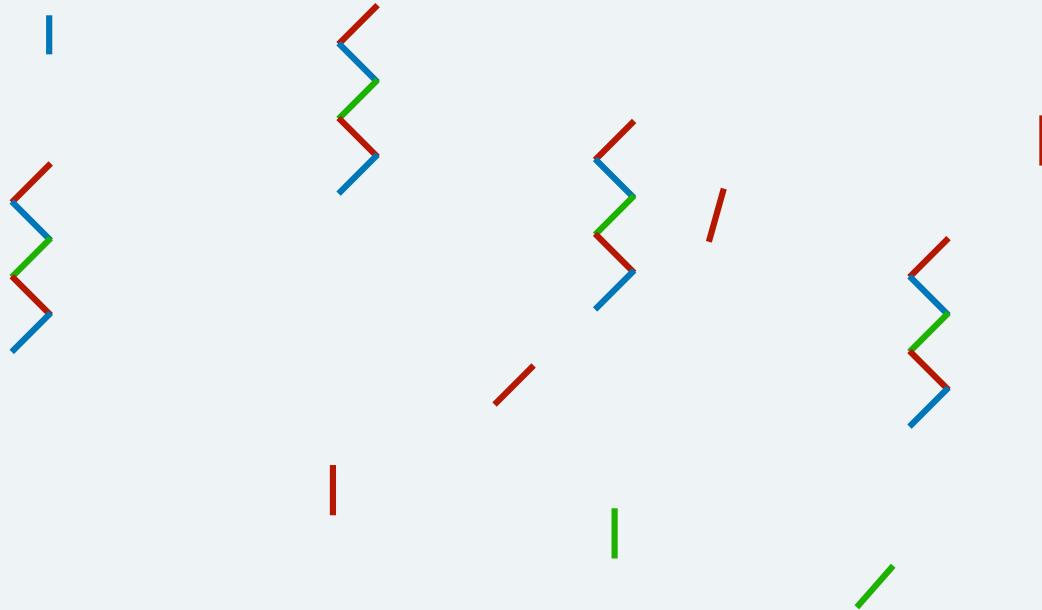
the replicator



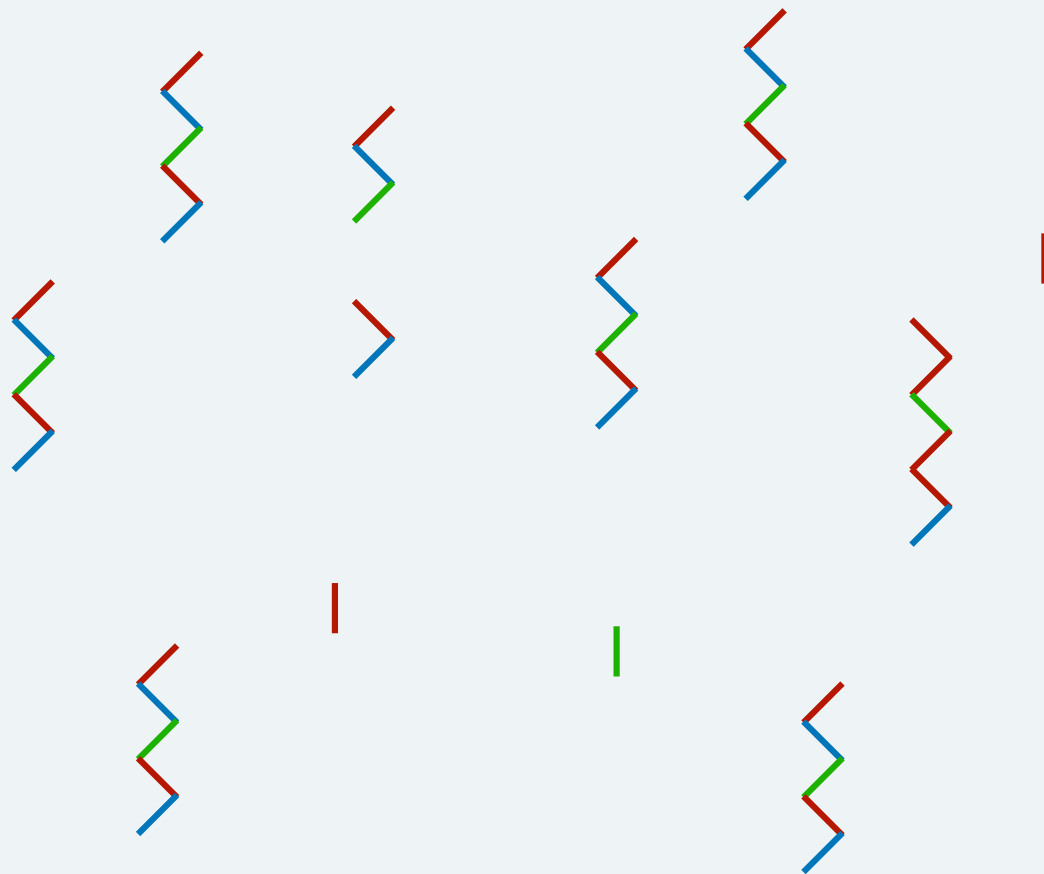
Evolution

exponential growth

the replicator



Evolution

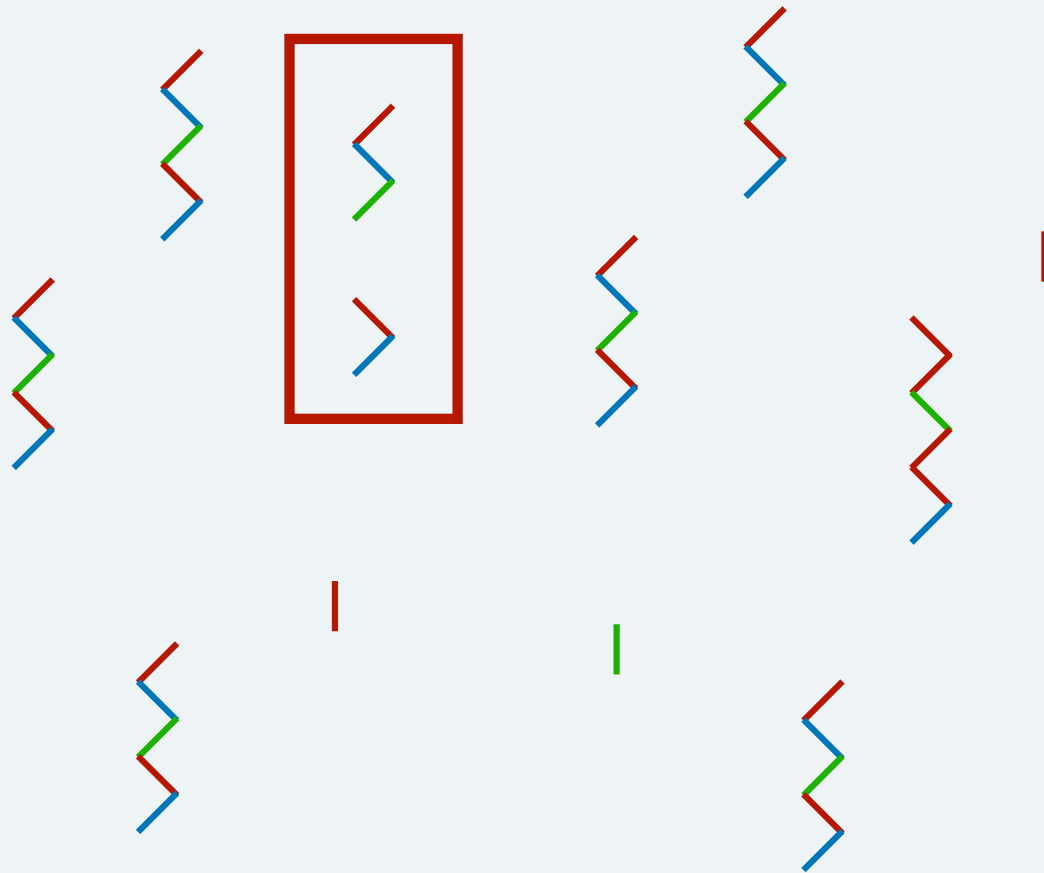


Evolution

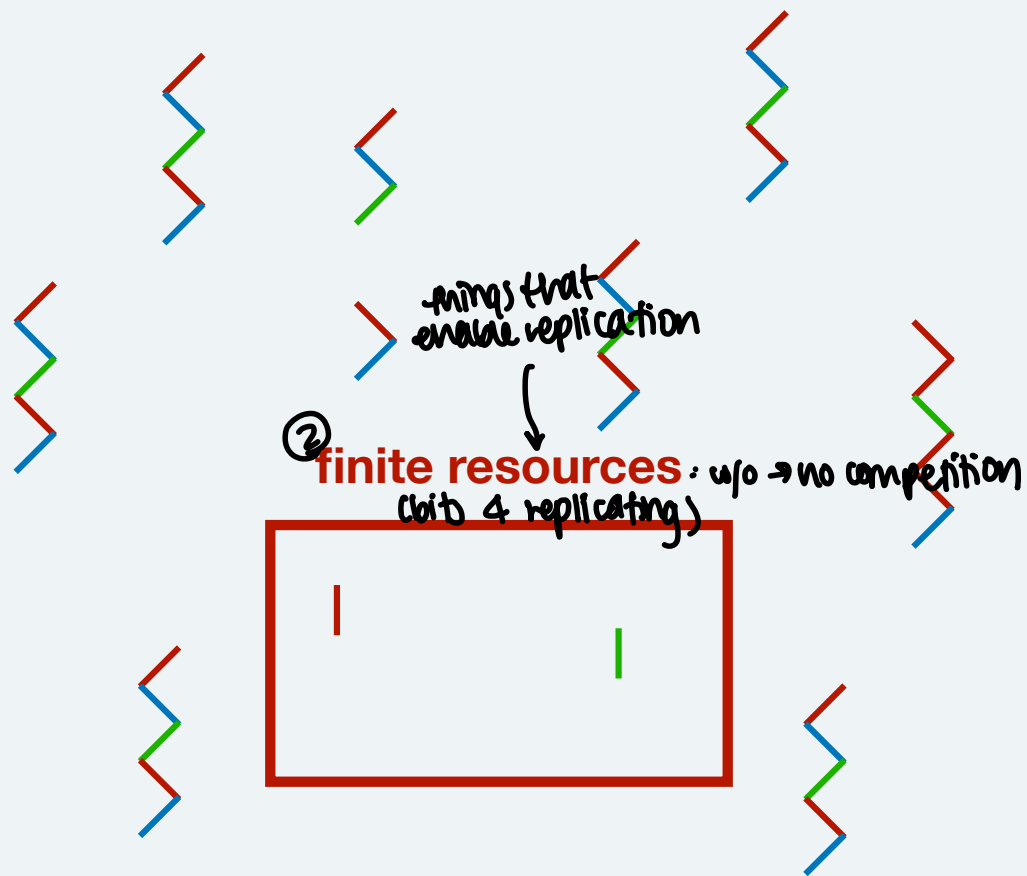
things necessary 4 evolution -

★ ① **limited longevity** : can't last forever

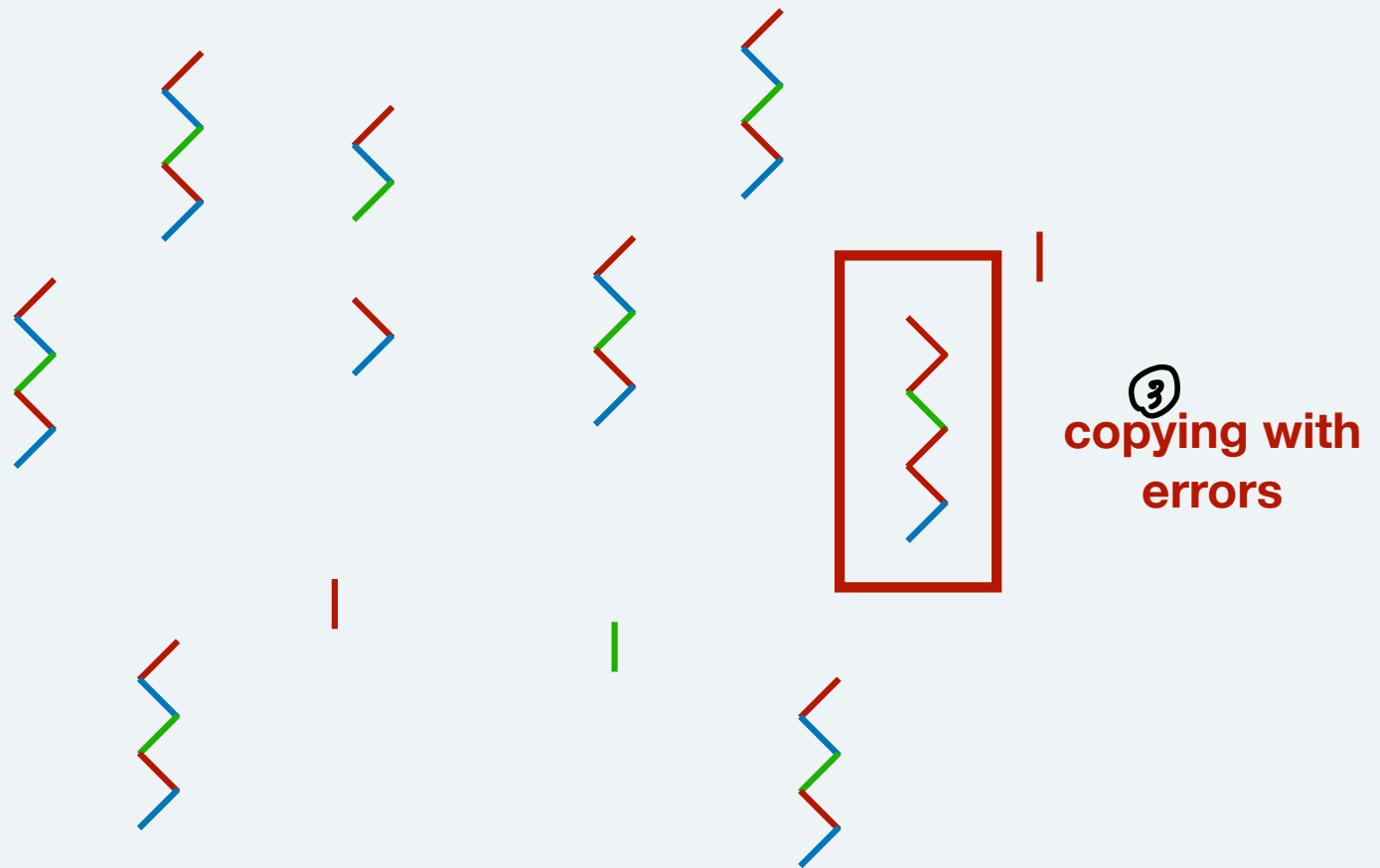
if you just make
perfect copies \Rightarrow
they last forever then
nothing interesting
happens



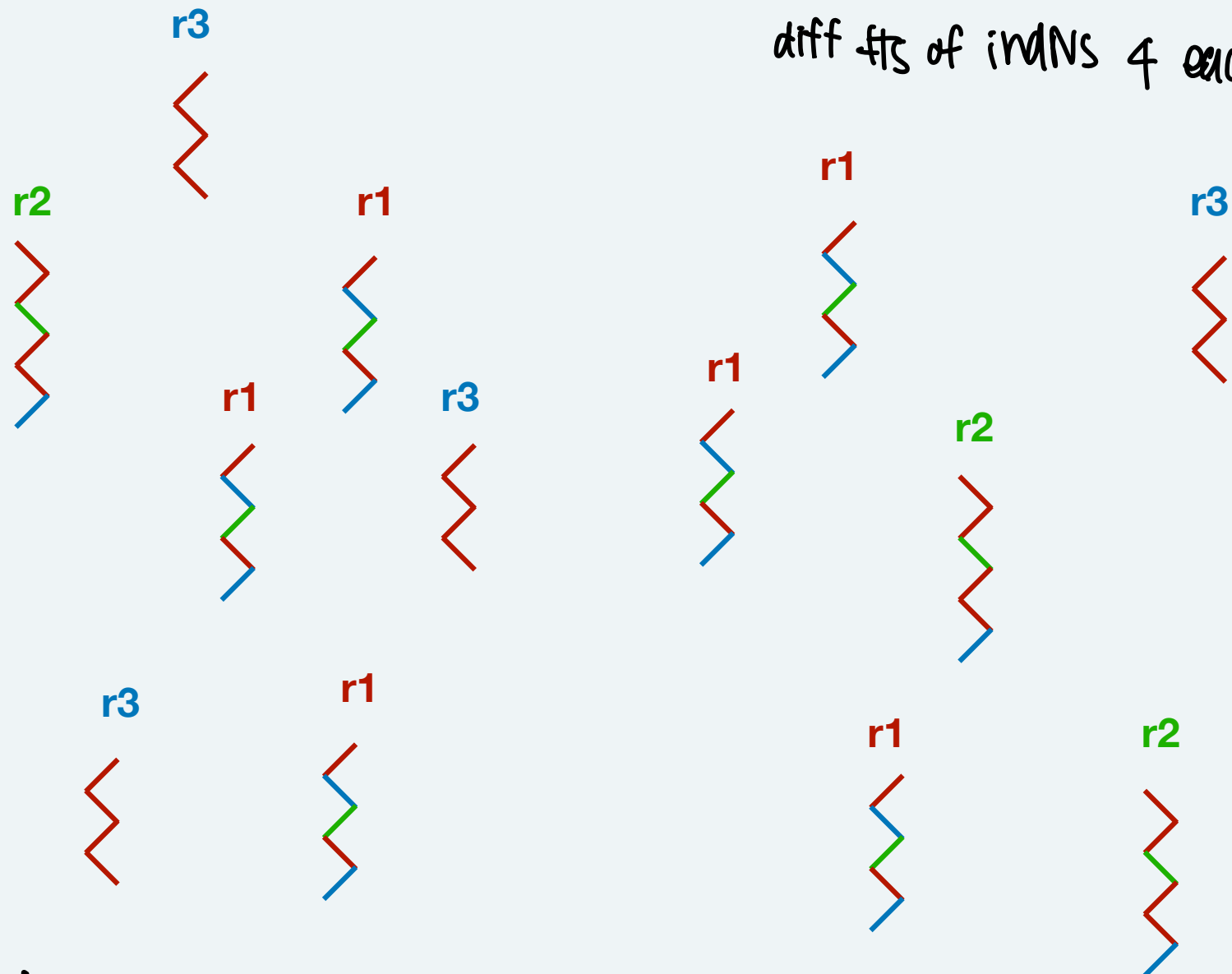
Evolution



Evolution



Evolution

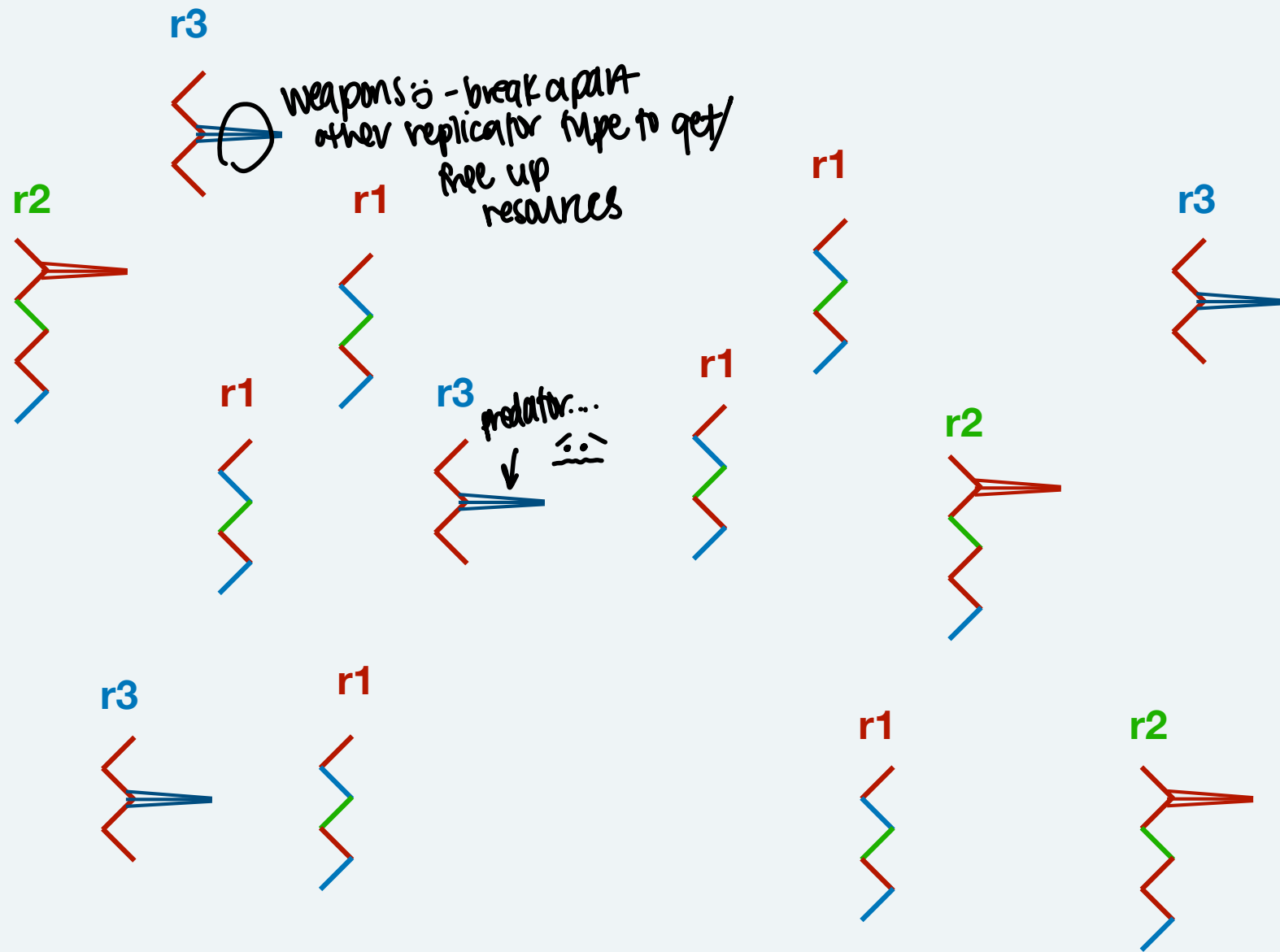


if one of these replicator types is more eff, it will "out-compete" the others

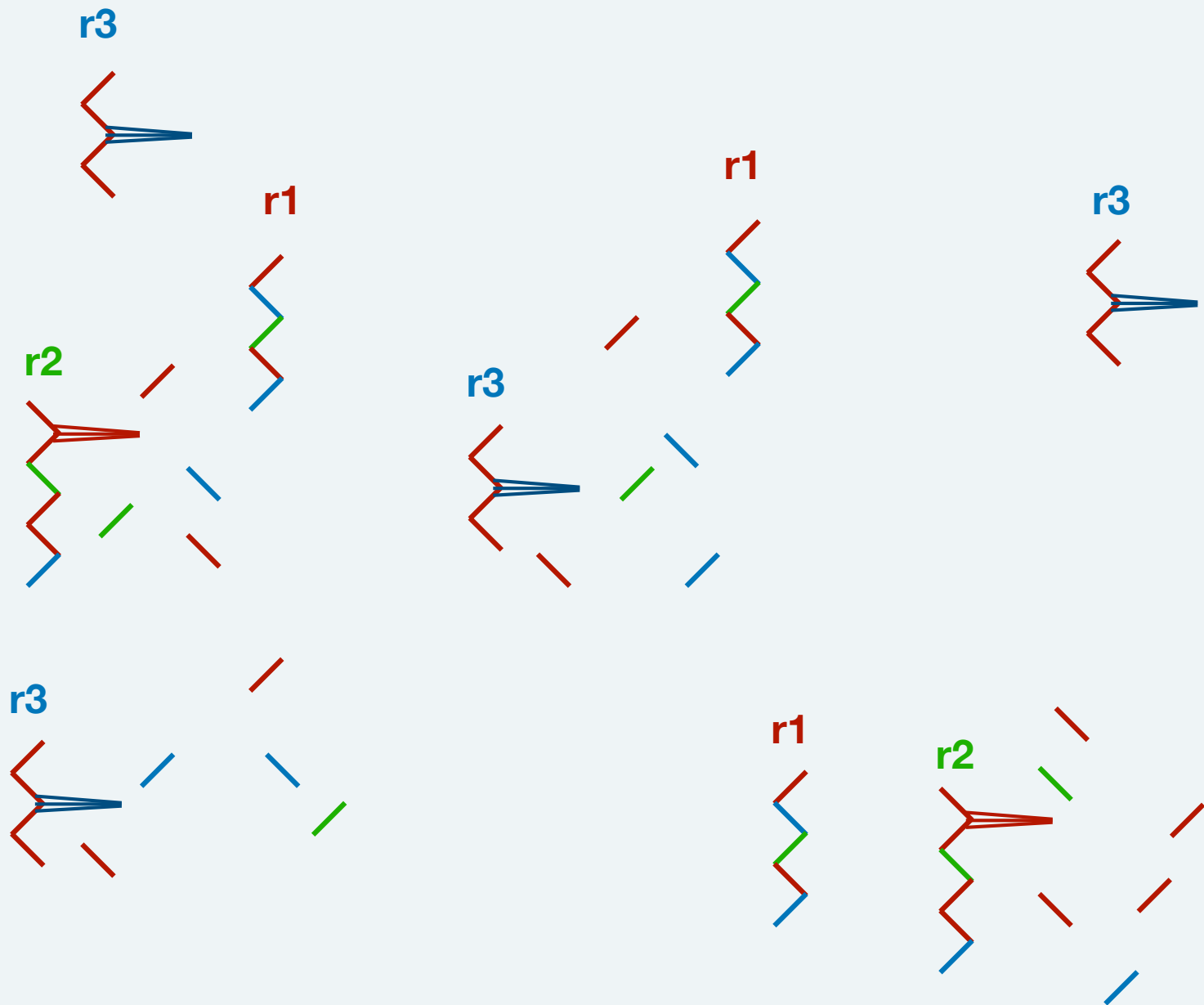
Evolution

- variation introduced through copying
- competition among different types of replicators
- three ways to outcompete others:
 1. faster reproduction 🍷
 2. higher longevity
 3. more faithful copying
- by definition, the most numerous replicators will be the ones who are the best at reproducing themselves
too many mutant offspring → not preserving your replicator type
fitness ↑
- EVOLUTION 🍷!

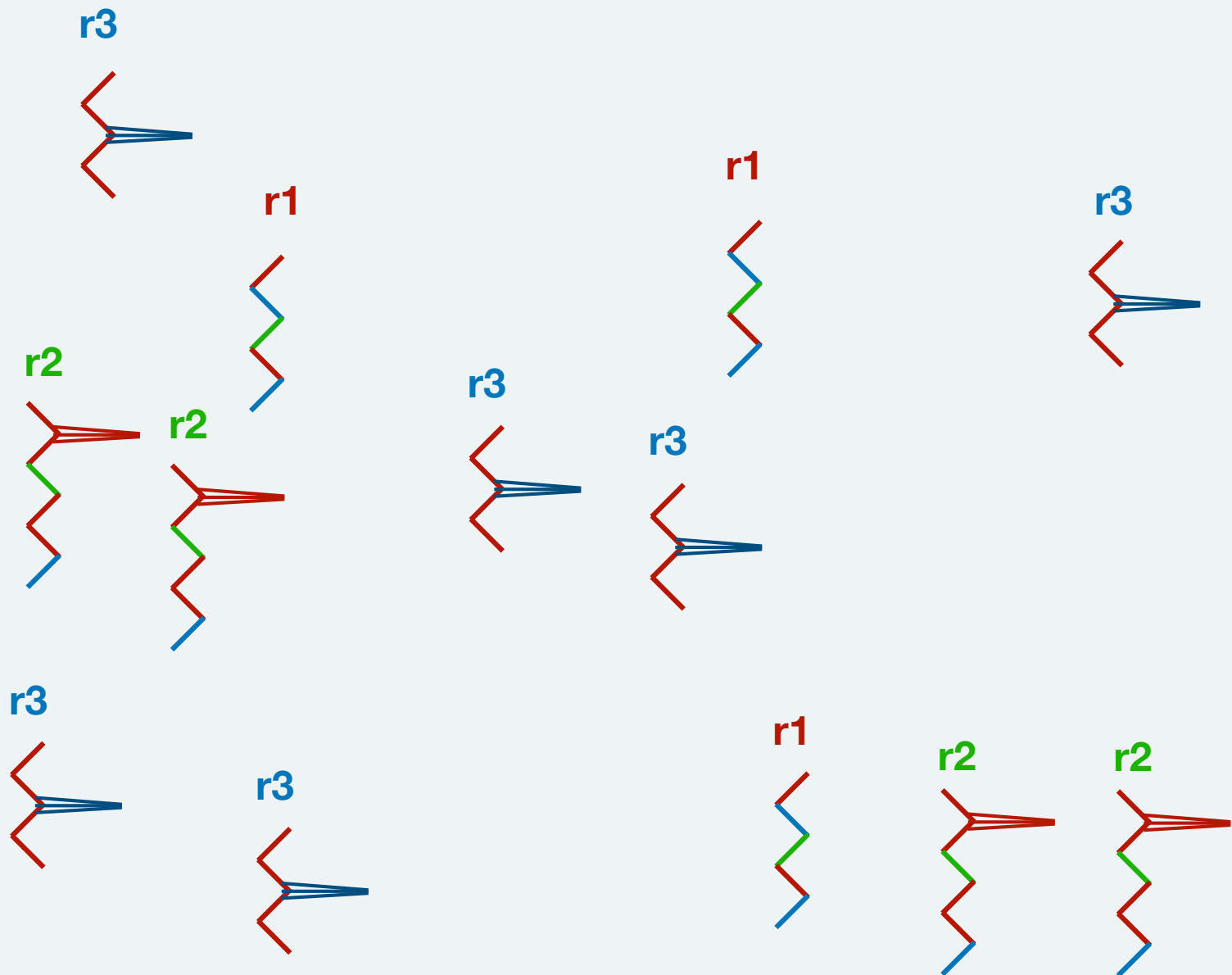
Evolution



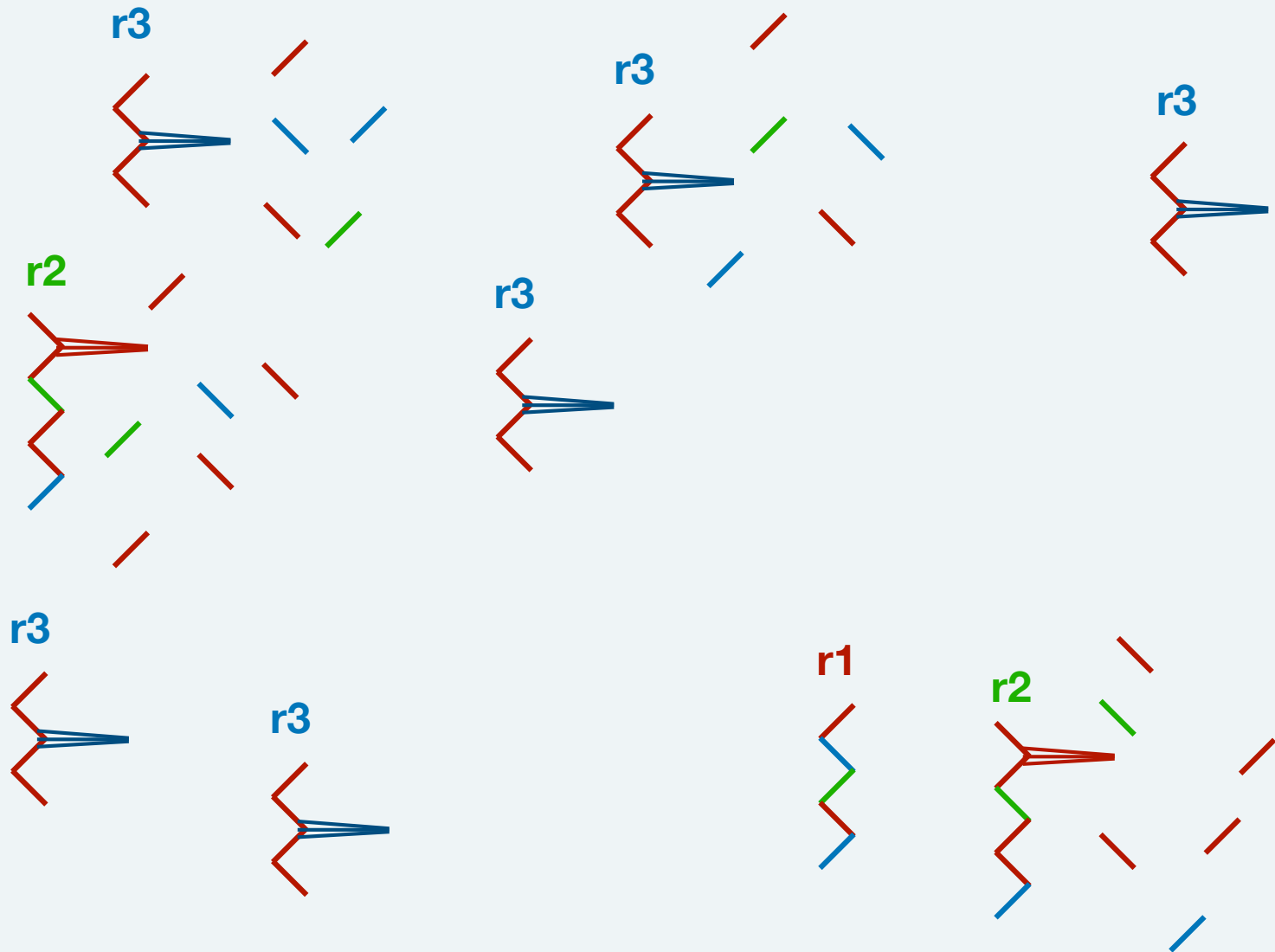
Evolution



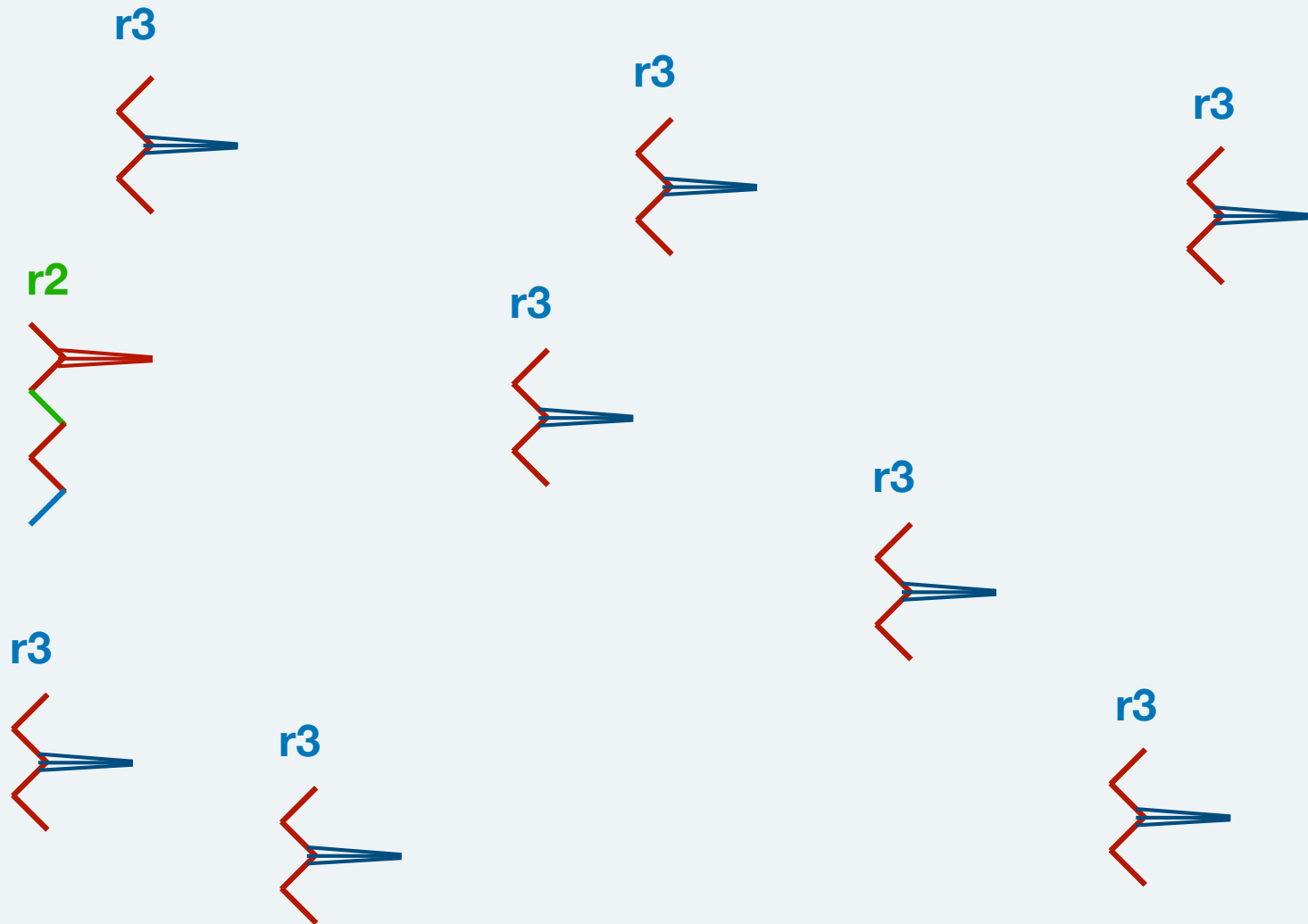
Evolution



Evolution



Evolution



$r1$ extinct 

Evolution

from pt of evolution, all replicators care about is replicating themselves

- “selfish” replicators in evolution:
 - replicators who are not successful at reproducing will disappear
 - replicators who maximise their “replicator type’s” reproductive success will prevail
 - selfish does not imply any kind of agency
 - it also does not mean that a given instance of a replicator will always maximise its own reproductive success (as long as it maximises the replicator type’s success)

not abt your own.

replicators \neq indivs, genes = replicator

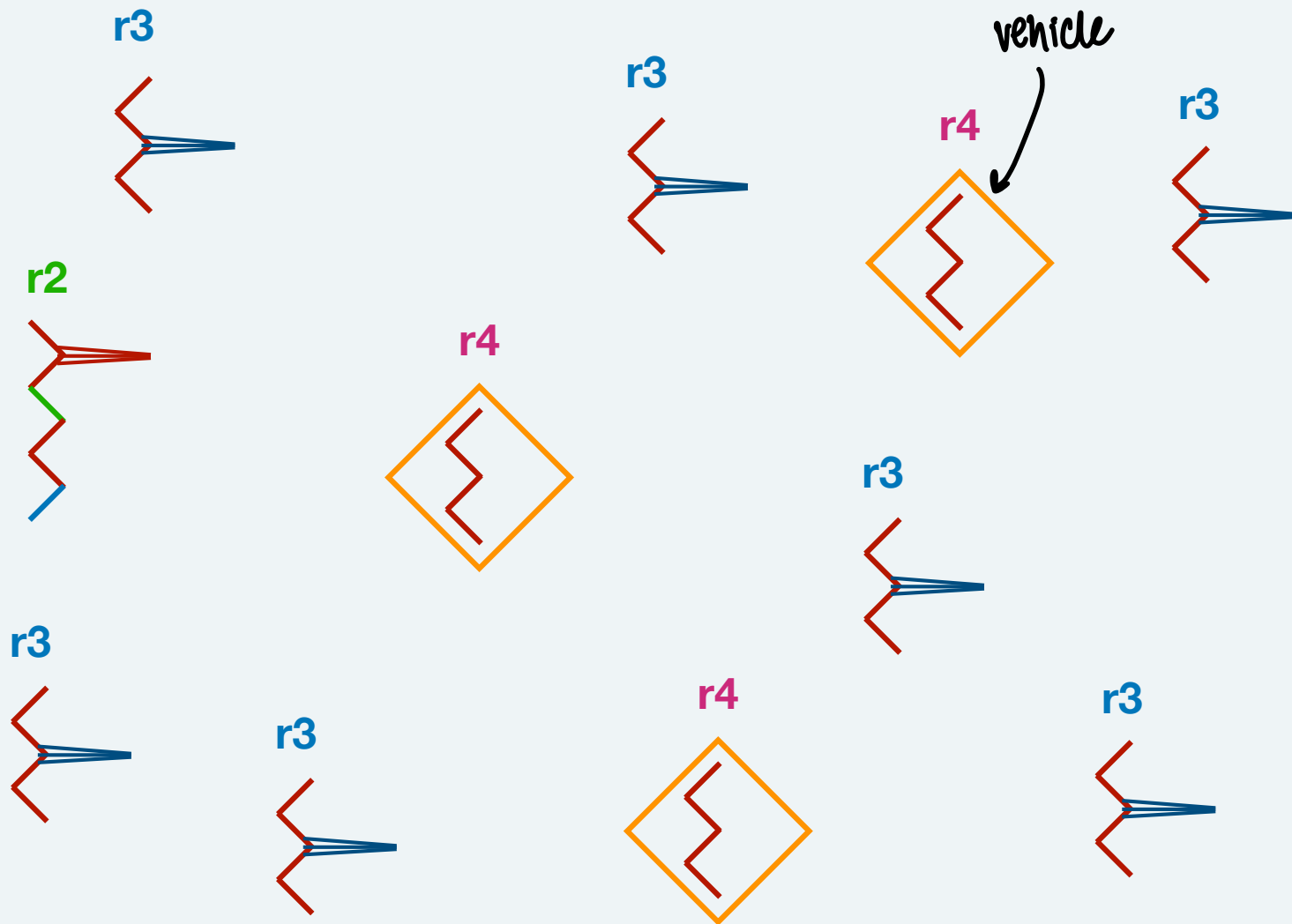
“I am just a vehicle that allows my genes to replicate” - manson



ants!!

most can't reproduce but they protect ones who can (Queen)

Evolution



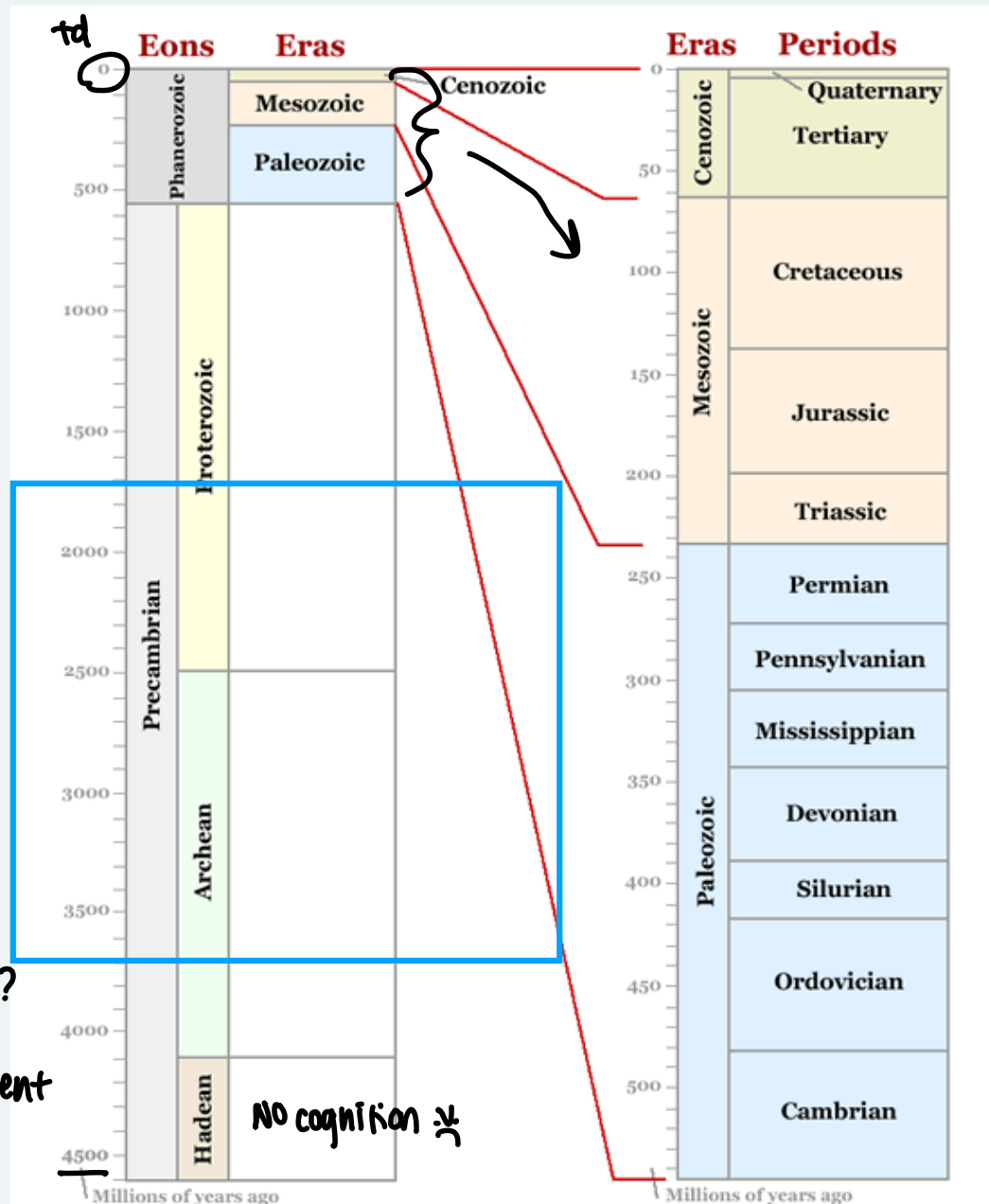
Evolution

- replicators vs. vehicles ~ genotype vs. phenotype
- replicators with more “successful” vehicles will outcompete replicators with less successful vehicles *↓ do the competing*
- “arms races” – a form of positive feedback *that leads to development of complex structures*

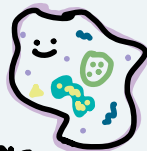


replicator doesn't have to be genes
↳ cultural ideas as replicators / religion
• Ideas - some are better @ replicating than others
don't pet lions or feed bears!
suicide cults can't replicate easily LMAO
manson explains orig meaning of memes lol

Evolution



single celled organisms



cognition? → yeah, has behaviors & responds and stuff but :)

• is a nervous system necessary for cognition?
↳ prob not idk

• funny girl in the front says they're intelligent but mahn doesn't think so

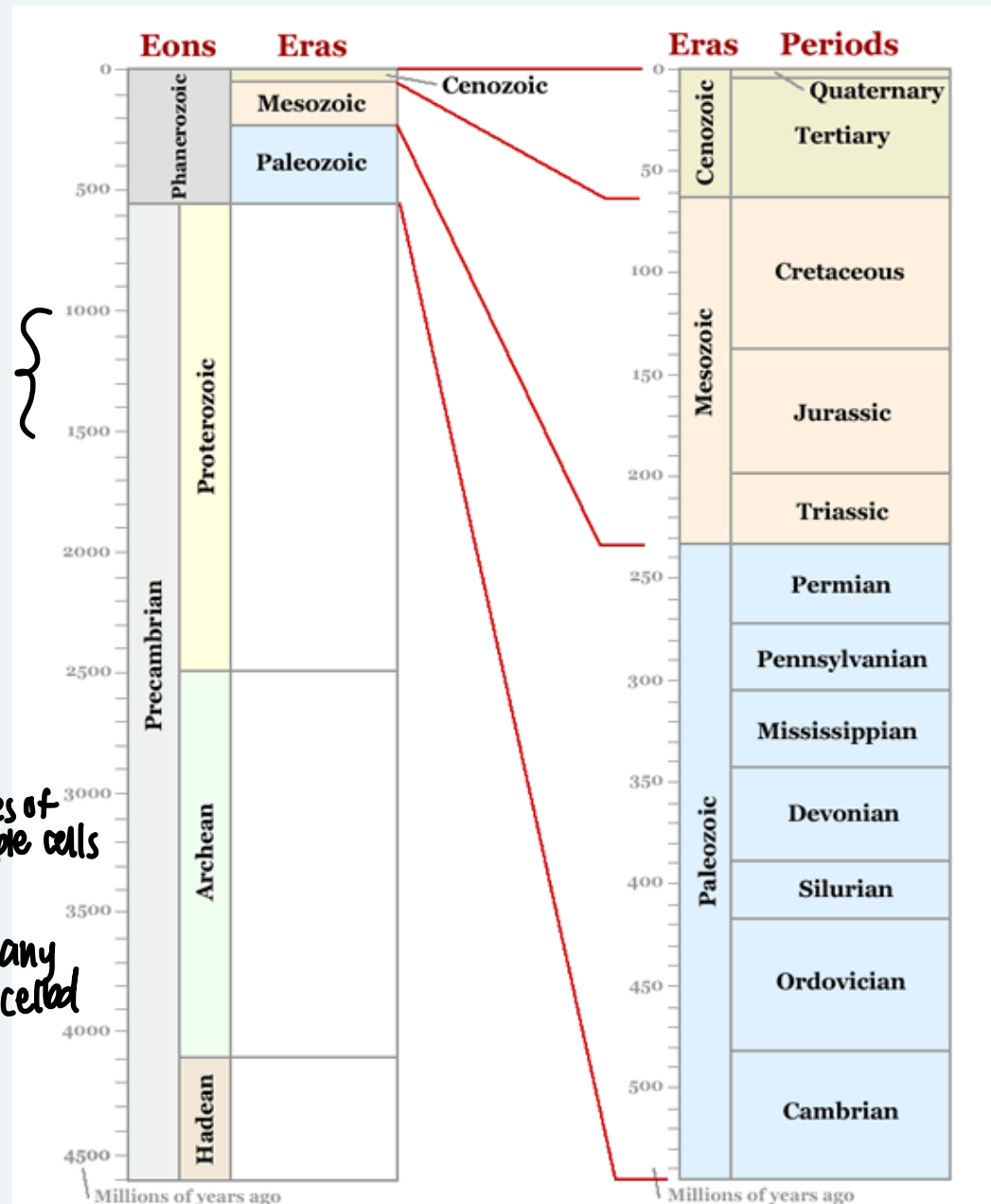
Evolution

appearance
of
multicellular
organisms



colonies of
multiple cells

not complex enough to have any
more cognition than single celled



Evolution

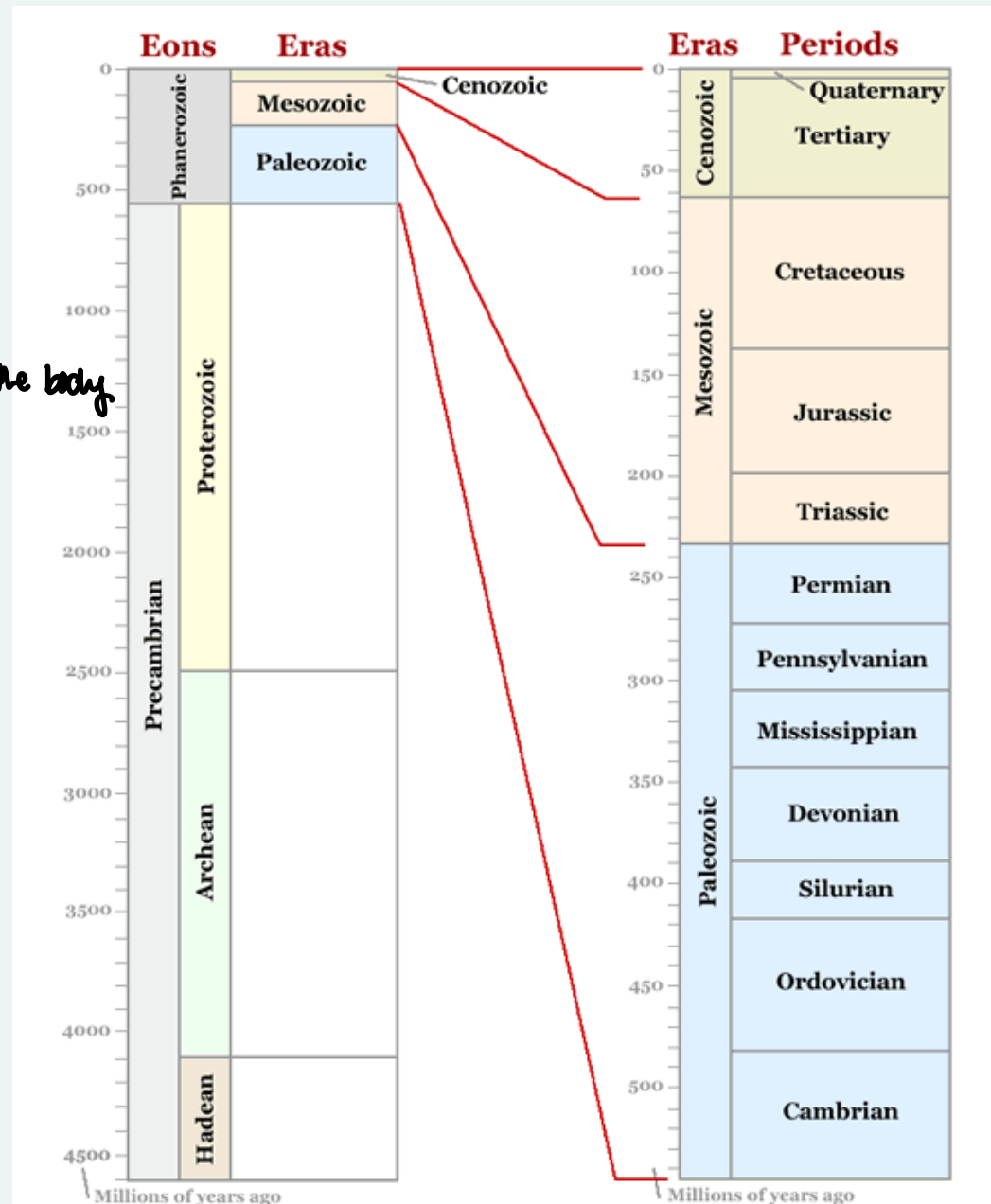
**Ediacaran
origins of
the nervous
system**



"nerve net" - organized distrib across the body



**nerve nets in
Cnidarians**



How is the nervous system advantageous from the point of view of a replicator?

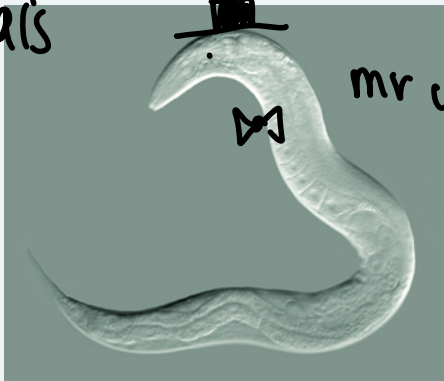


Evolution

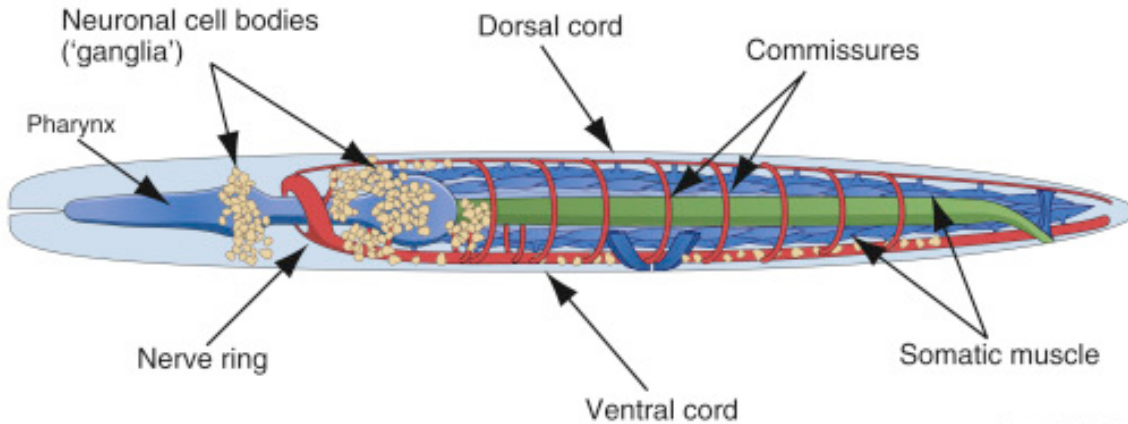
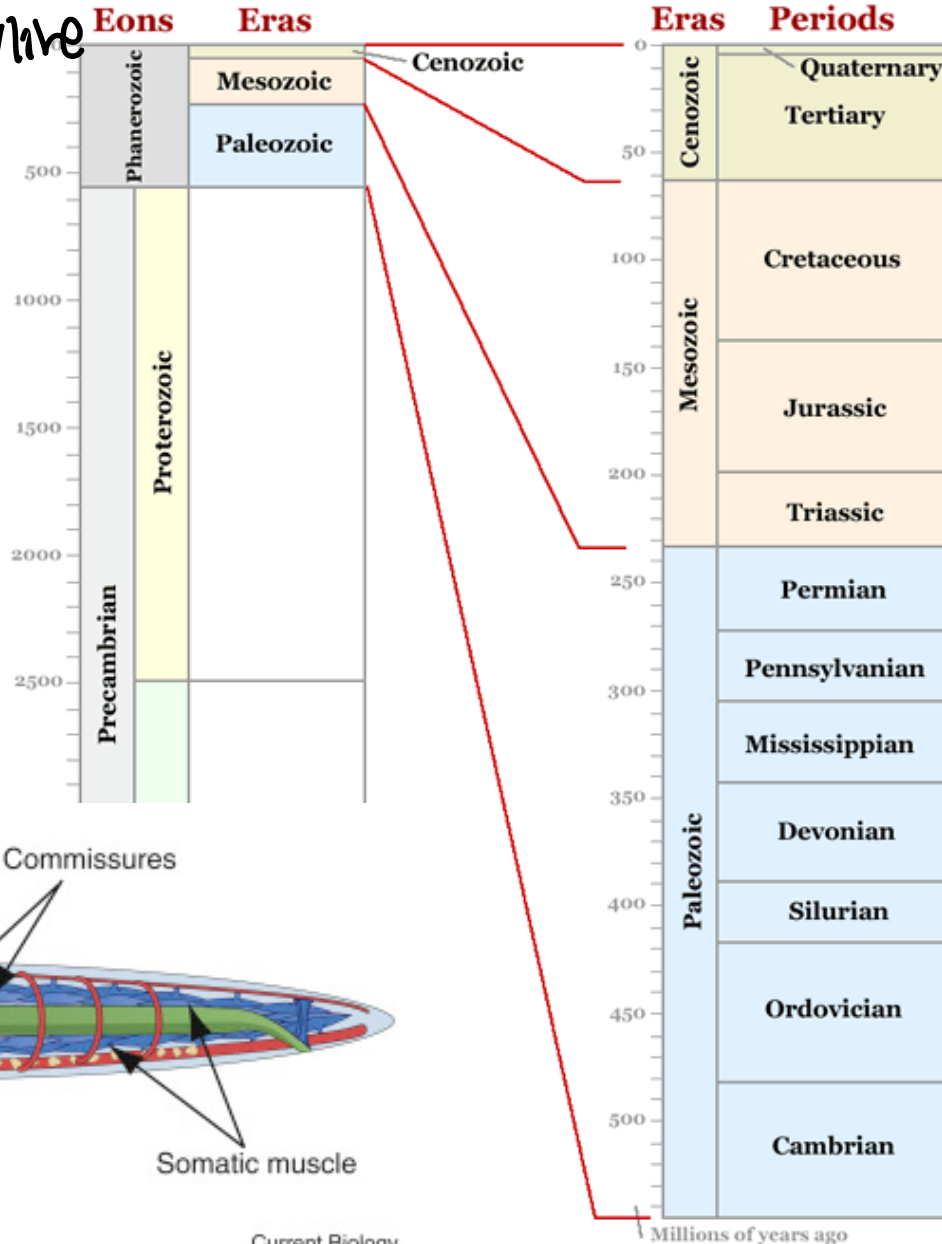
bilateral-symmetrical along centerline

CNS only
really
exists in
bilateral
animals

**Cambrian/
Ediacaran
origins of
bilateria**



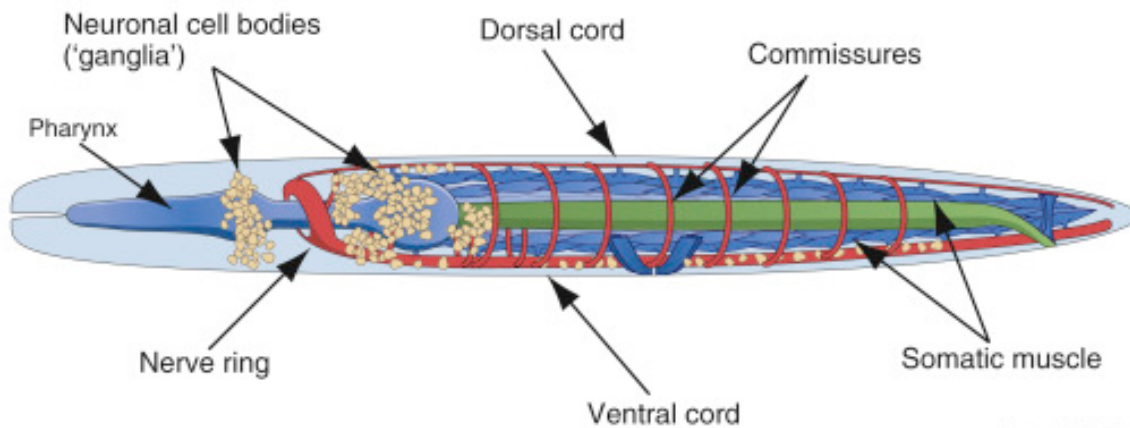
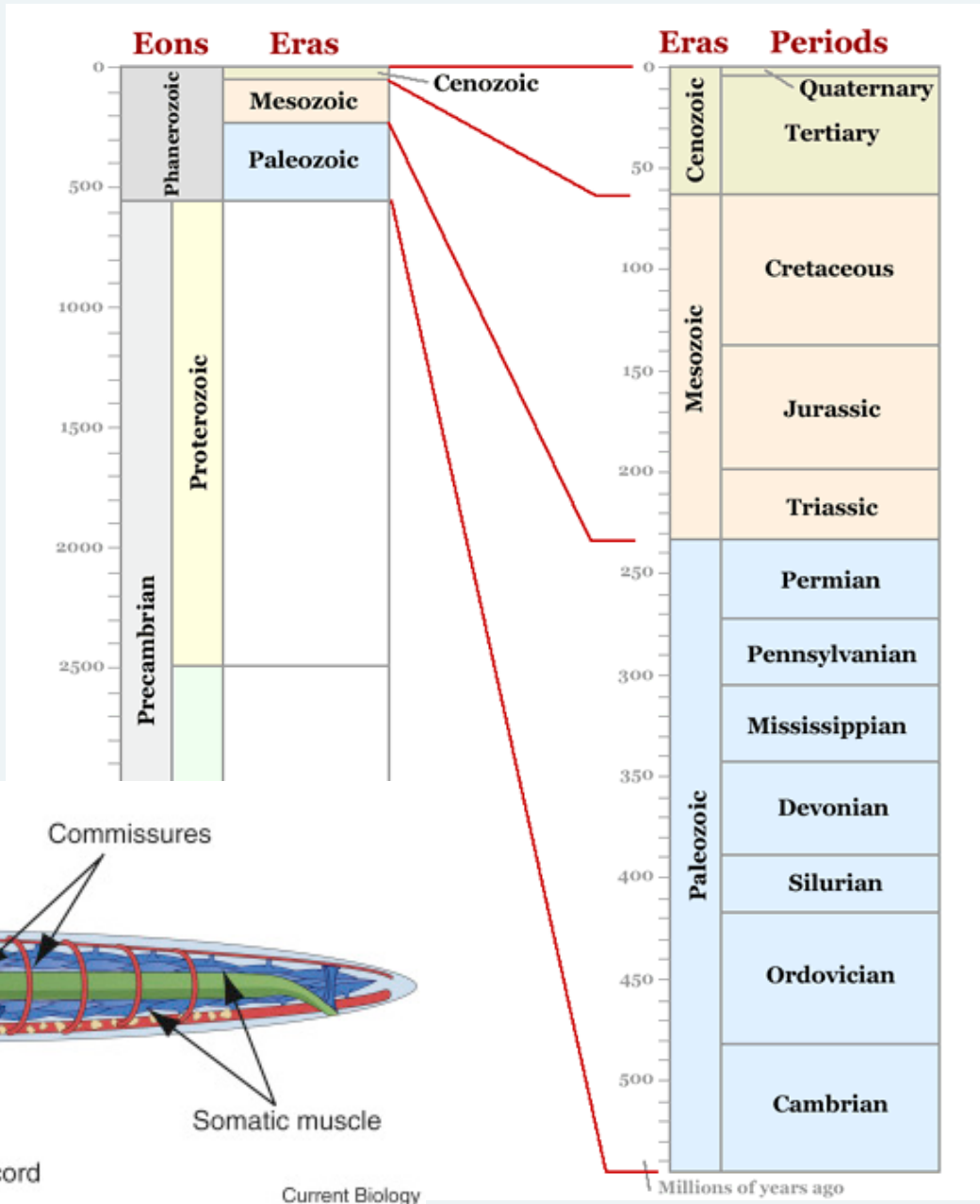
mr worm



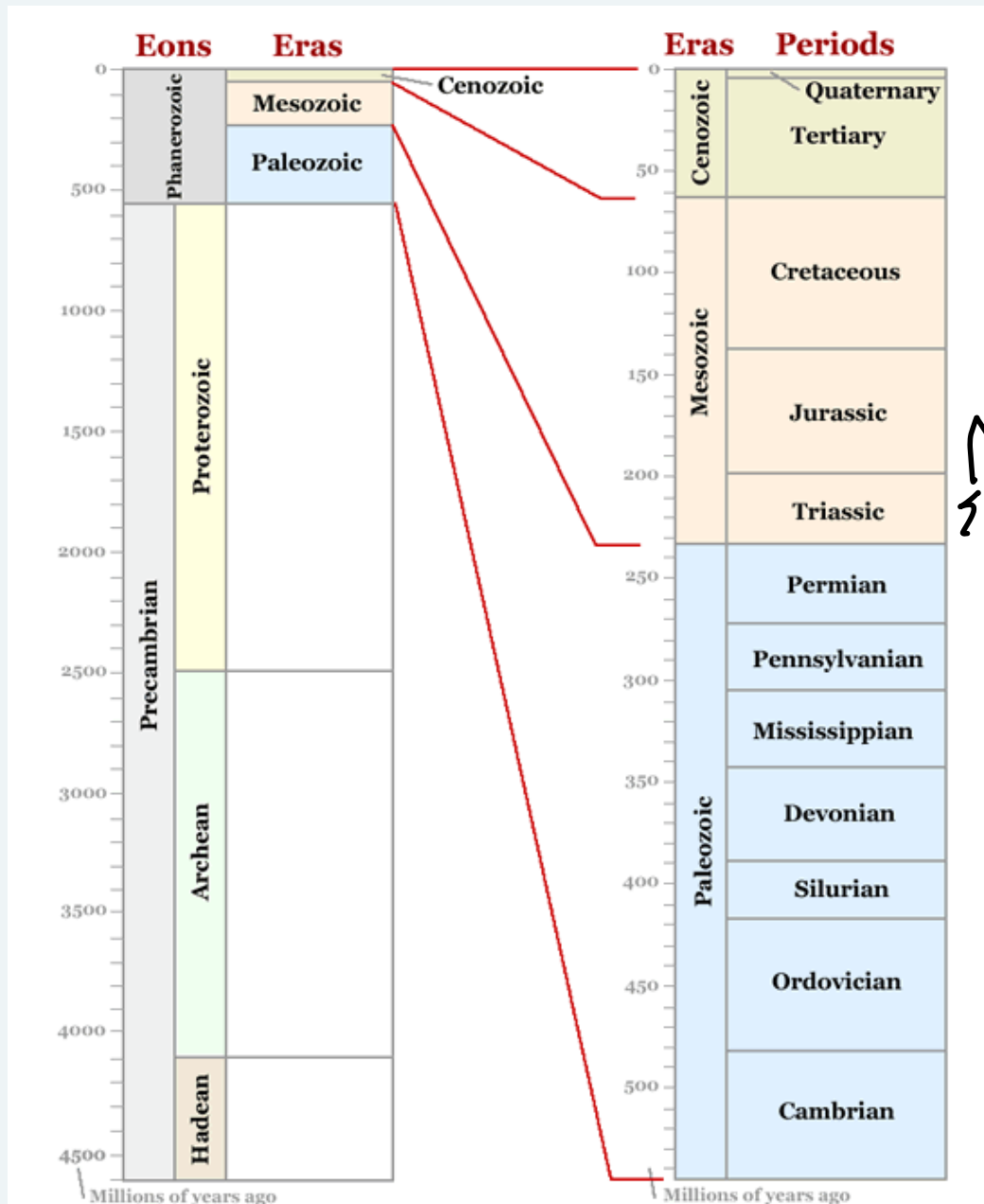
Evolution

"cocktail party fact"

this guy (*C. elegans*) has exactly 308 neurons, by the way ☺!



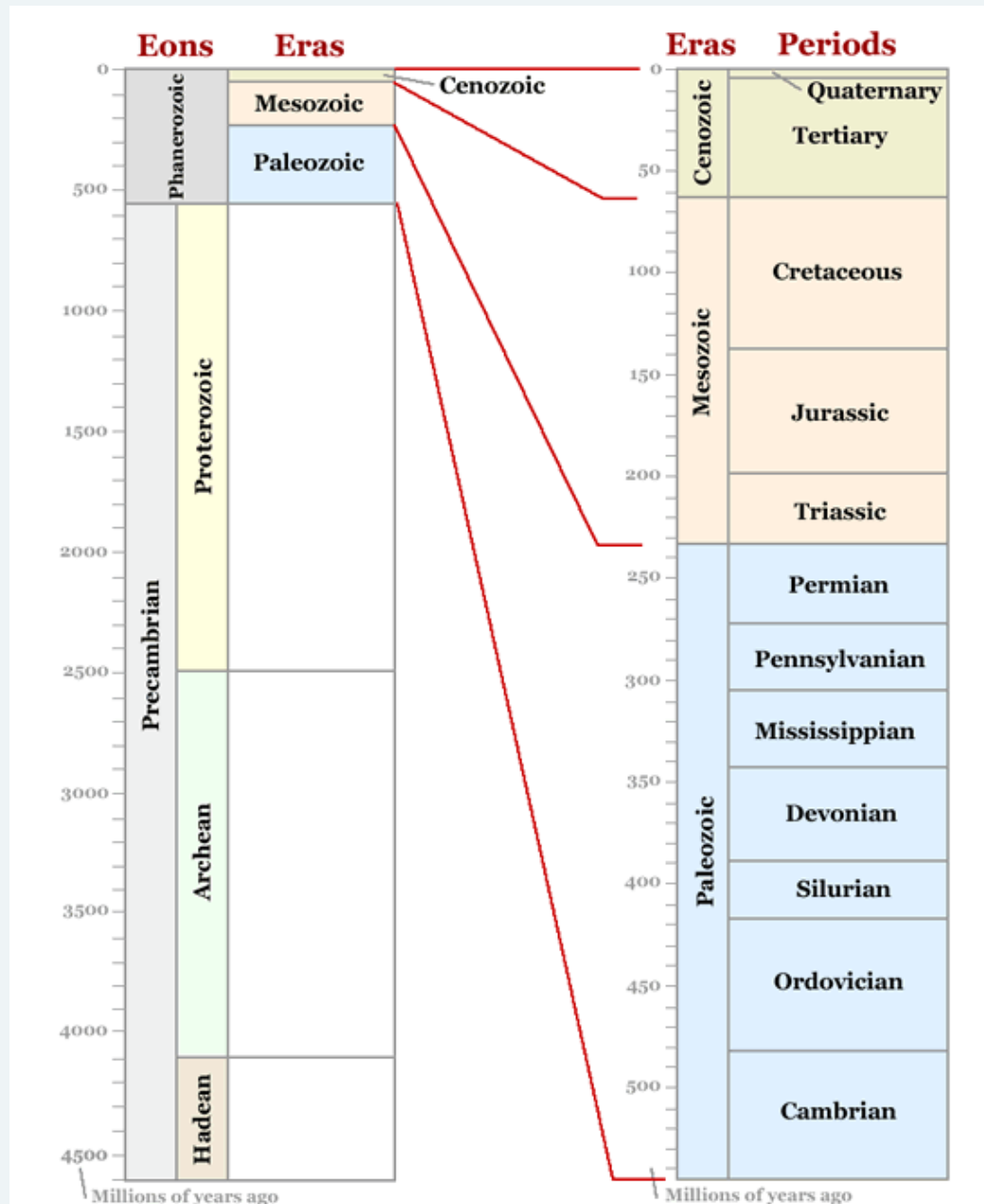
Evolution



I don't know what that is I had a vision but I dk what came out

!!! **SIMPLE BRAINS!** !!!

Evolution



Most parts of human-like brain already in place

Evolution of Human Cognition

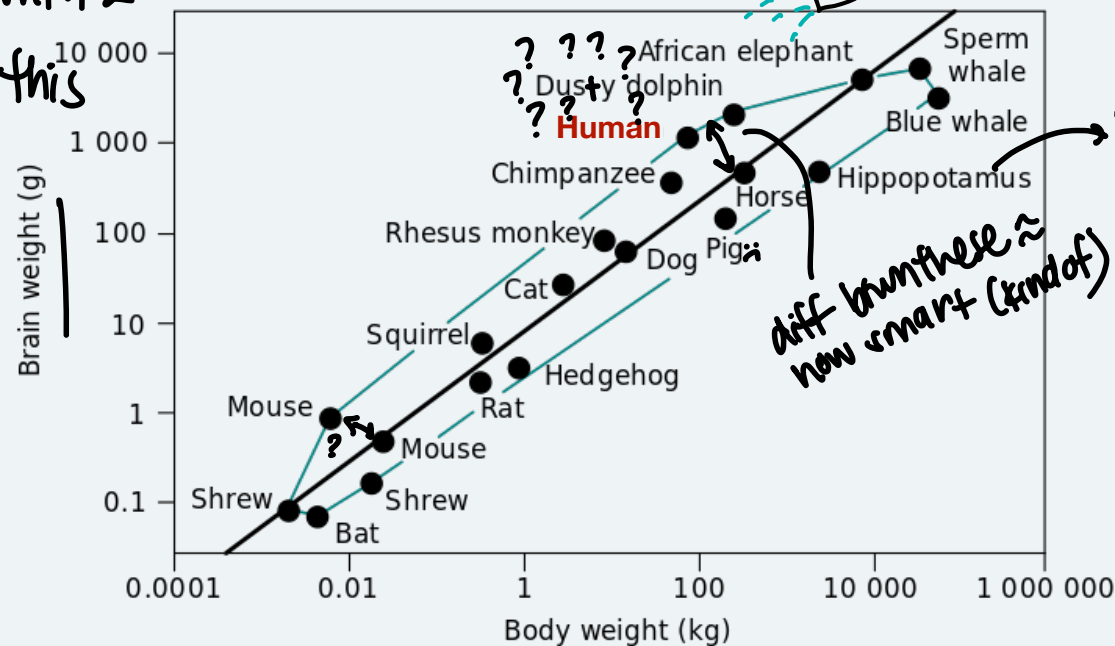
- tricky to study – “cognition doesn’t fossilize”

- reliance on indirect evidence:

- brain size (but beware allometric growth...)

all things equal,
size of brain prop 2 size
of body

jay has smth 2
say abt this



can use this to make
educated guesses at cognitive capacity of species

Evolution of Human Cognition

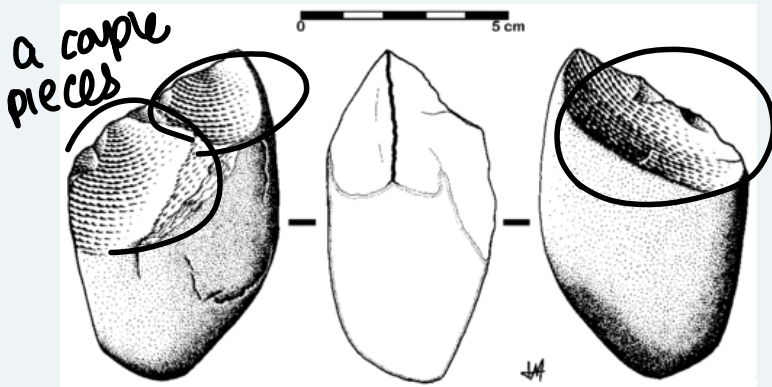
- tricky to study – “cognition doesn’t fossilize”
- reliance on indirect evidence:
 - products of brains – e.g. tools



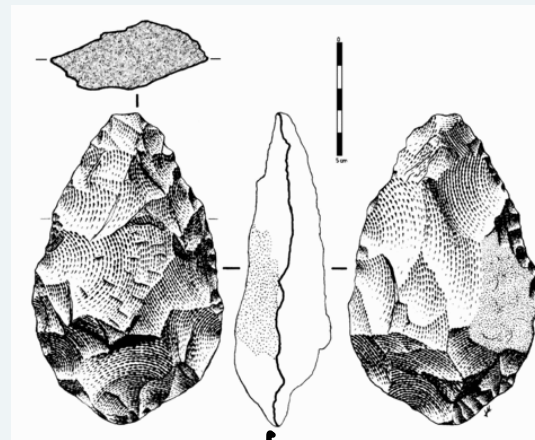
Oldowan
2.6–1.7 Mya

Acheulian
1.8–0.15 Mya

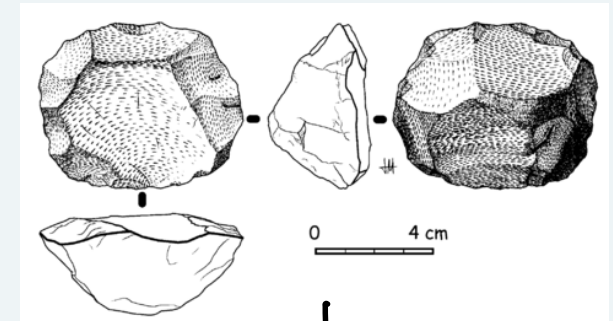
Mousterian
150,000–40,000 ya
Neanderthals
early modern humans



not very cool & slay



more clay & advanced



even better suited & task

Evolution of Human Cognition

- tricky to study – “cognition doesn’t fossilize”
- reliance of indirect evidence:
 - brain size (but beware allometric growth...)
 - products of brains – e.g. tools, social organisation
 - comparisons with close relatives (also tricky since closest live relatives separated from us ~7 Mya)
not perfect bc of parallel evolution

Heyes (2012)

- two alternative views of human cognitive evolution



- little modules*
- the “Swiss army-knife” view *traditional*
- encapsulated
 - specialised *assume cognition is like S.A.K.*
 - evolved for specific purposes



- the “New Thinking”
- integrated
 - domain-general
 - more complex evolutionary history

Heyes (2012)

same kind of debate



Pinker

innate language module

- separate linguistic operations
- linguistic knowledge unique
- linguistic modules evolved for specific purposes



LANGUAGE

non-modular view of language

- integrated with other aspects of cognition
- language use relies partly on domain-general mechanisms
- evolved in tandem with other abilities

tomaseello
sorry brother
i can't
spell

Heyes (2012)



LANGUAGE

- highlighting differences from other communication systems
- e.g. the idea of **MERGE**

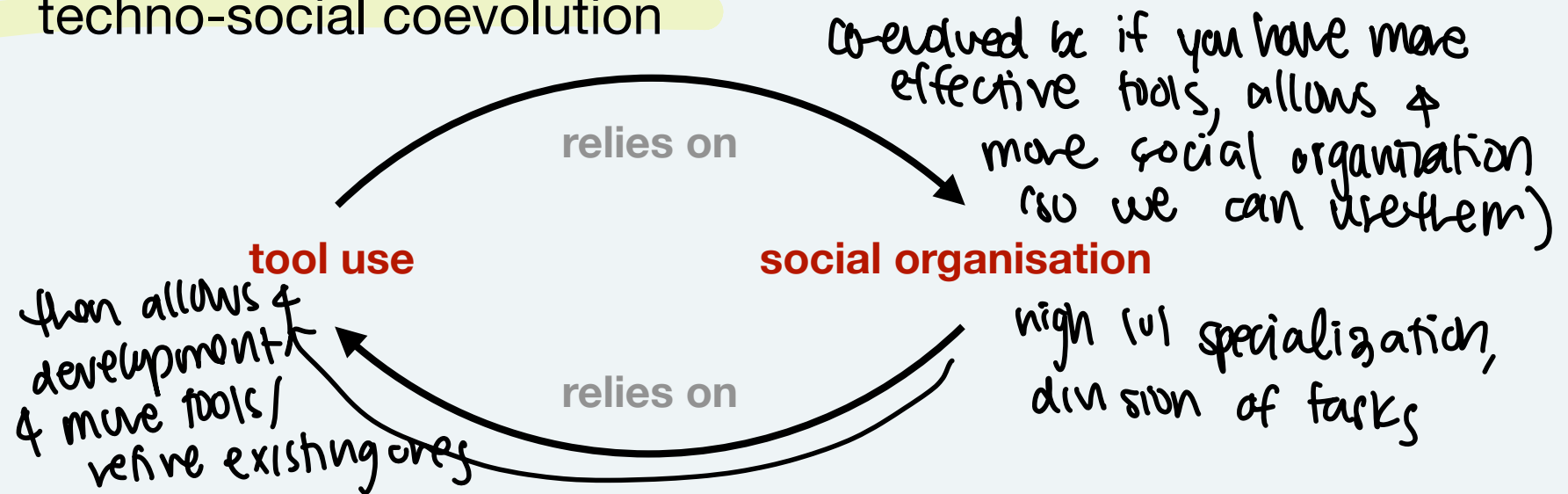
lang is result of mutation (1)
that allows recursion &
other higher level complexity

- highlighting continuity (e.g. gestural / vocal systems in other mammals)
- possibly gradual evolution of language

Heyes (2012)

- **coevolutionary processes** crucial to cognitive evolution

1. techno-social coevolution



2. gene-culture coevolution

- non-cognitive example: lactose tolerance – milk production
related 2 cultural behavior (domesticated cows a long time ago)

- can you think of other examples?

not as much of feedback loop, but parallel evolution

"eat milk" → drive adaptation → EAT MORE MILK!!

Heyes (2012)

- **cultural evolution** – study of the evolution of cultural products such as...
 - tool use
 - language
 - art
- e.g. **cumulative cultural adaptation**

