TRUGSCHLUSS

Wer die Fragen nicht beantwortet,
hat die Prüfung bestanden.

TRUGSCHLUSS

Fallacy
! Alert !

Evolutionary theory, naturalistic fallacy & concepts of 'progress'

Marcus Clauss

Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich, Switzerland

BIO124, March 2020

University of Zurich[UZH]

Clinic of Zoo Animals, Exotic Pets and Wildlife

Overview

1. Pre-title sequence: naturalistic fallacy
2. A niche concept focusing on niche specificity
3. Darwinian evolutionary theory
4. Short note on social Darwinism
5. Directional elements in evolutionary theory
   - meet the Red Queen and the Court Jester
   - speed of reproduction as an inherent property in the set of Darwinian rules
   - Radiations
6. Some species' evolution: beyond niche specificity

Use evolution as an example to raise awareness on the relevance of traditions, preconceptions, and emotions on how we deal with science.

The niche concept

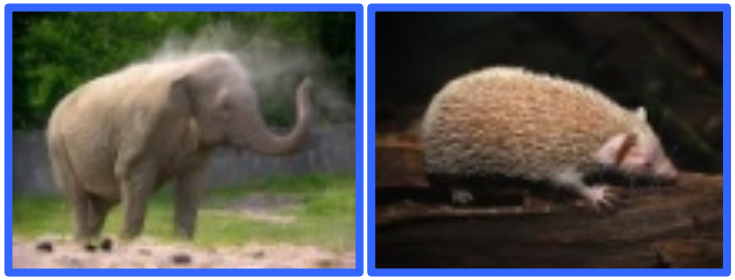
Who is the odd one out?

Elephant

Tenrec

Hedgehog

Who is the odd one out?



Elephant

Tenrec

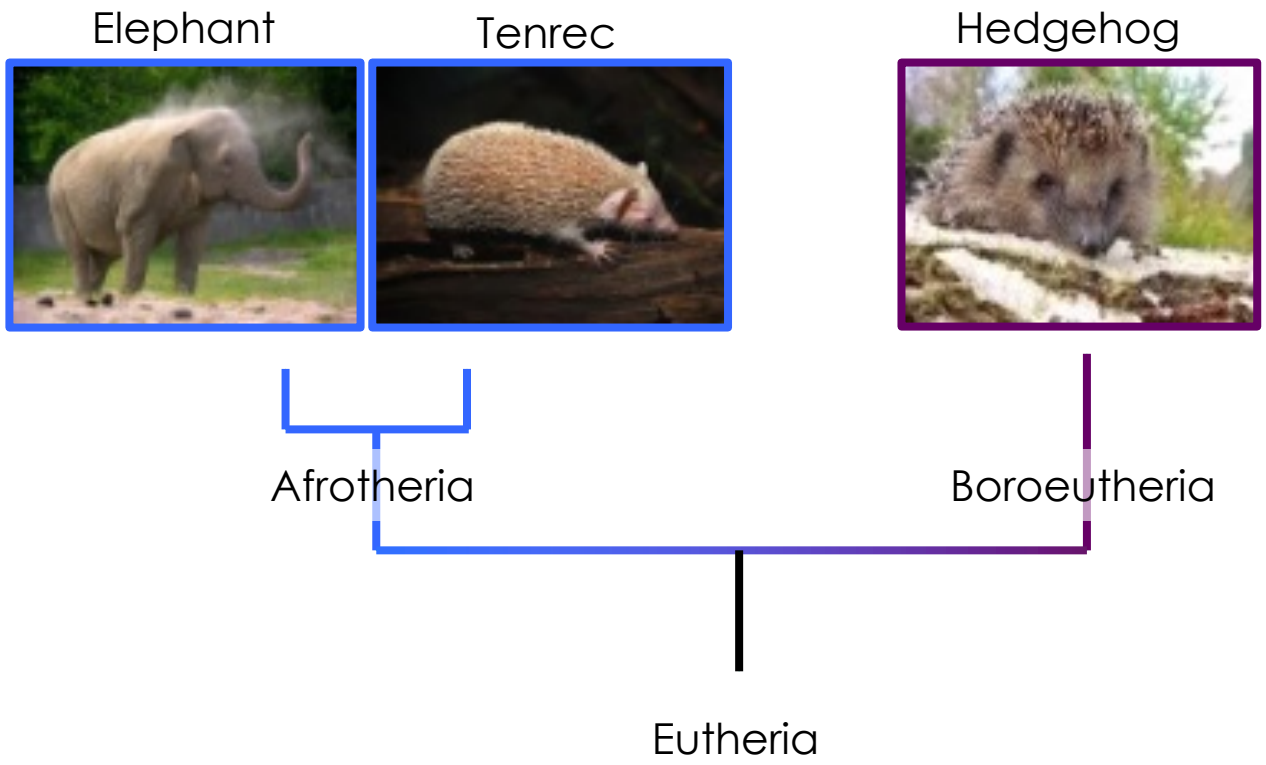
Hedgehog

Afrotheria

Boroeutheria

Eutheria

Ecological niches!



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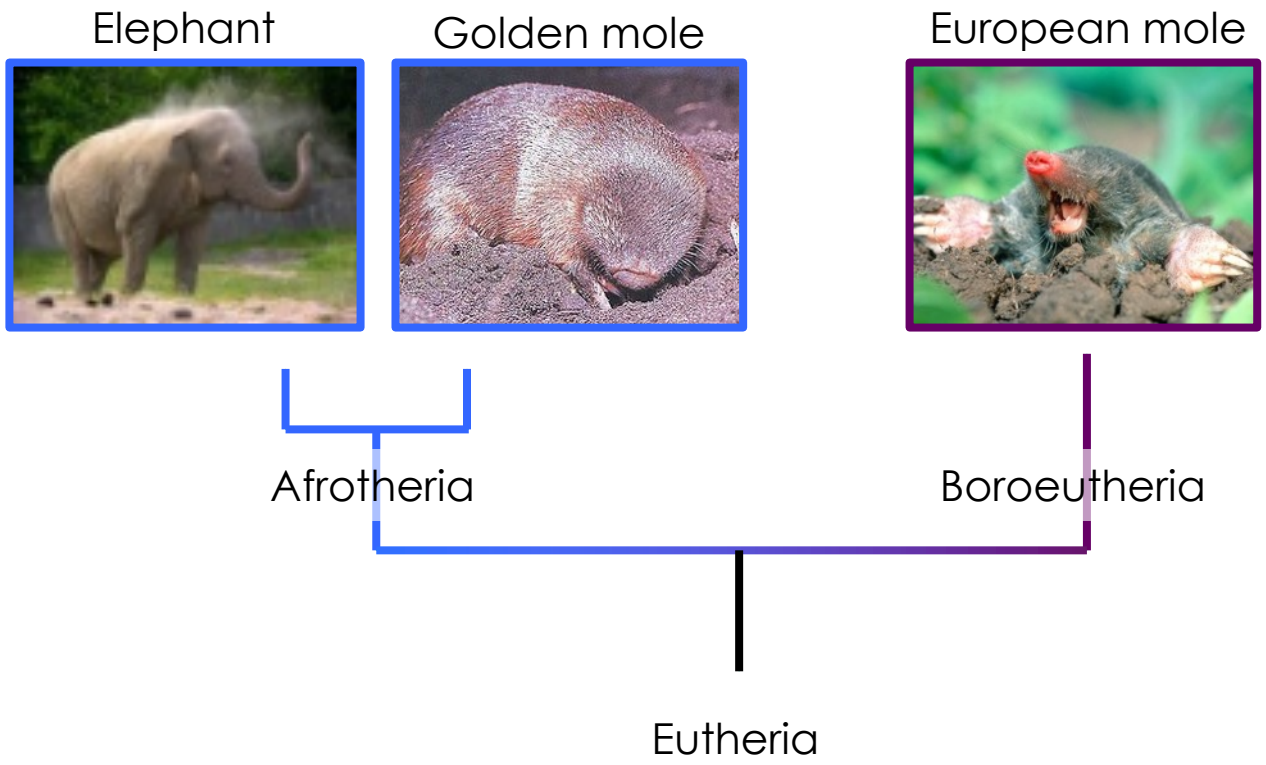

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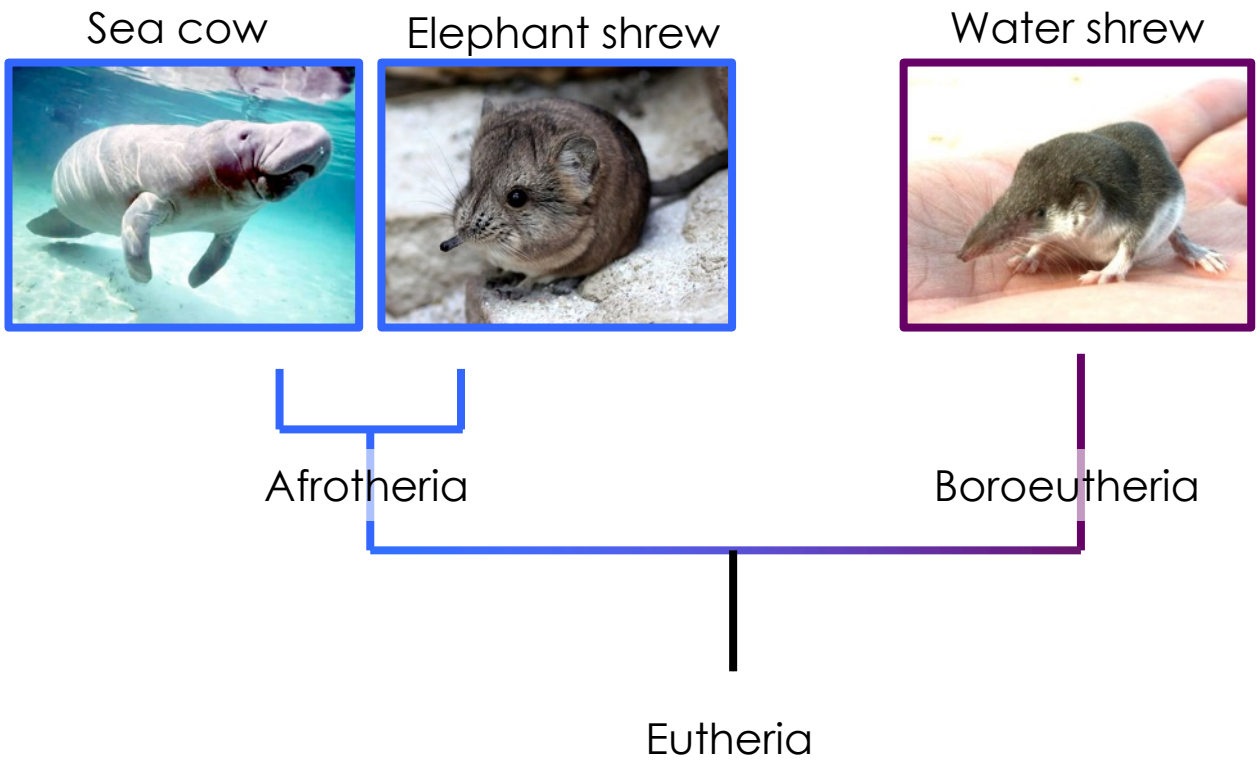

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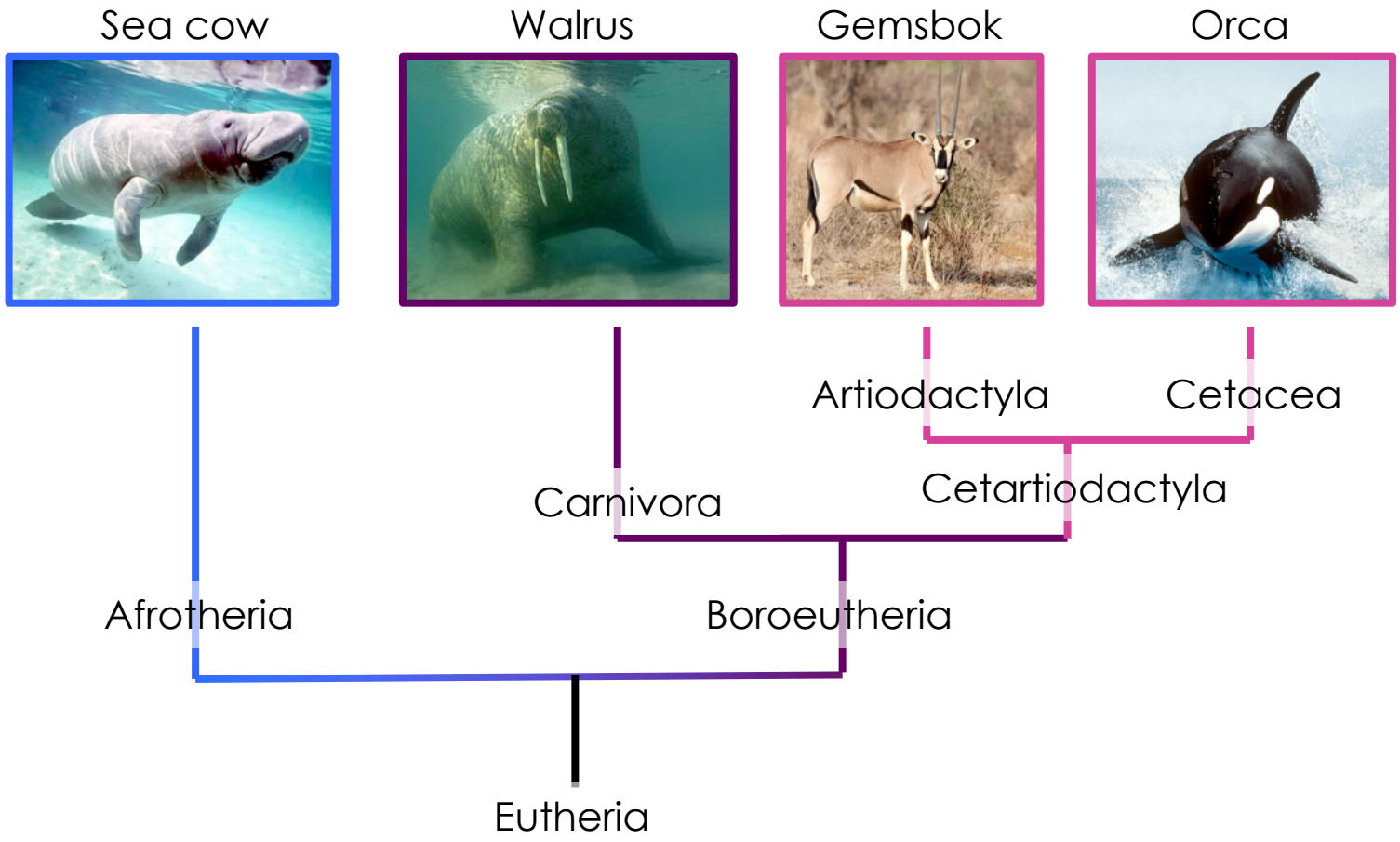
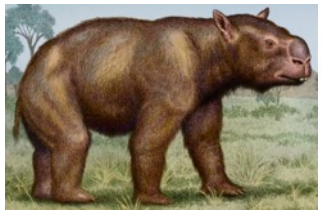
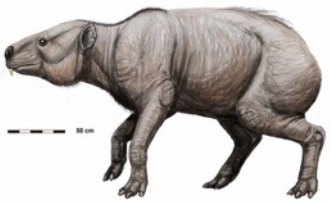
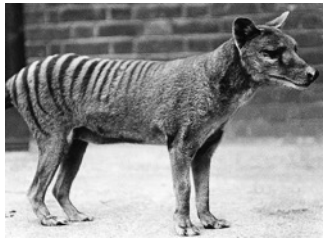


Marsupials	Afrotheria	Boroeutheria
		

Marsupials Afrotheria Boroeutheria



Dealing with resources

By which means can organisms become more efficient?

adapting to optimal resource use
(niche specificity)

The story of niche specificity

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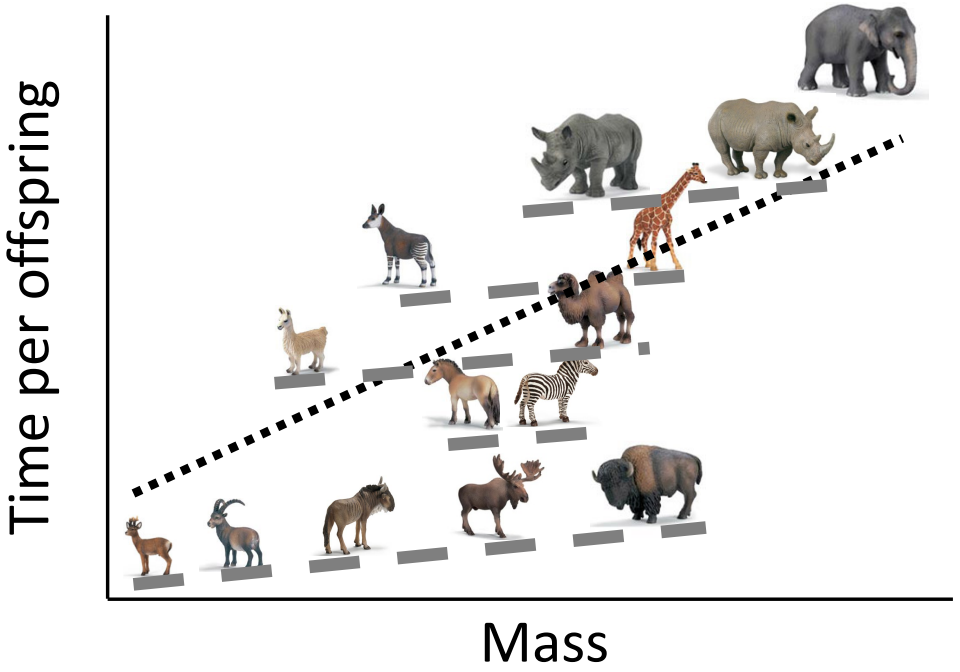
(niche specificity)



The story of niche specificity

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'Being adapted to a niche' is a nice, peaceful, comfortable concept.

It is compatible with intentional creation, and with egalitarian notions of equality.

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Fallacy ! Alert !

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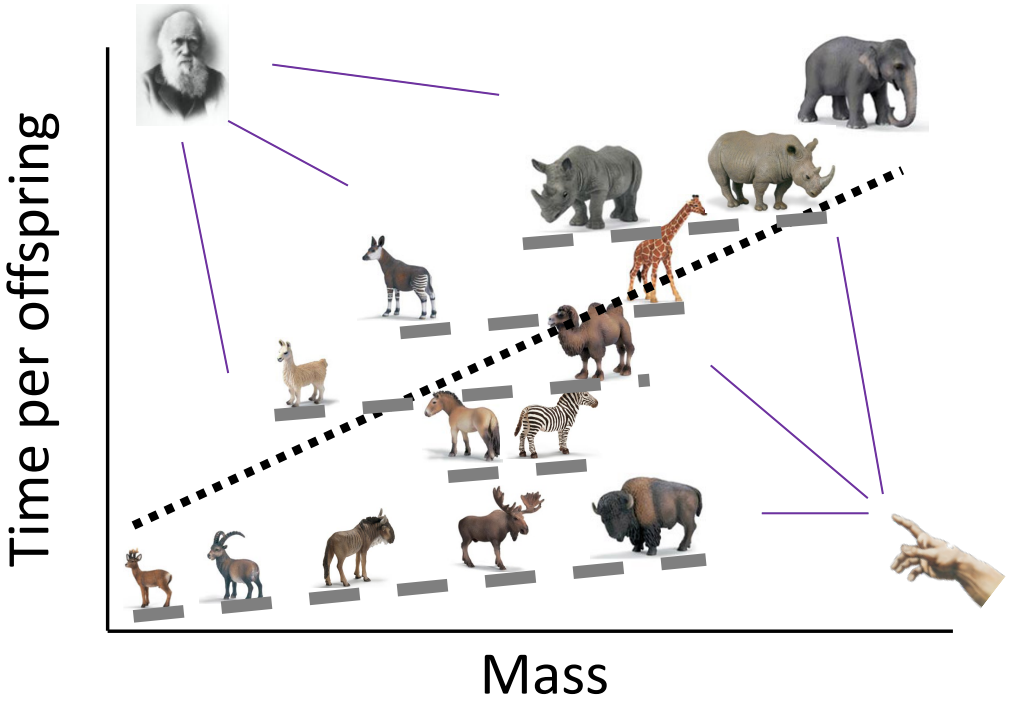
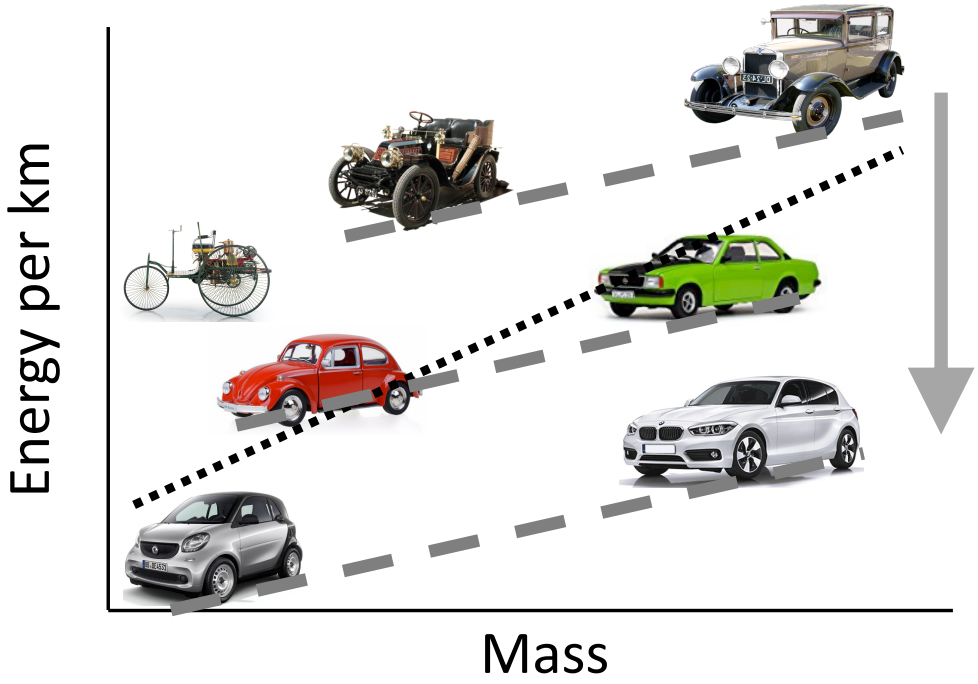
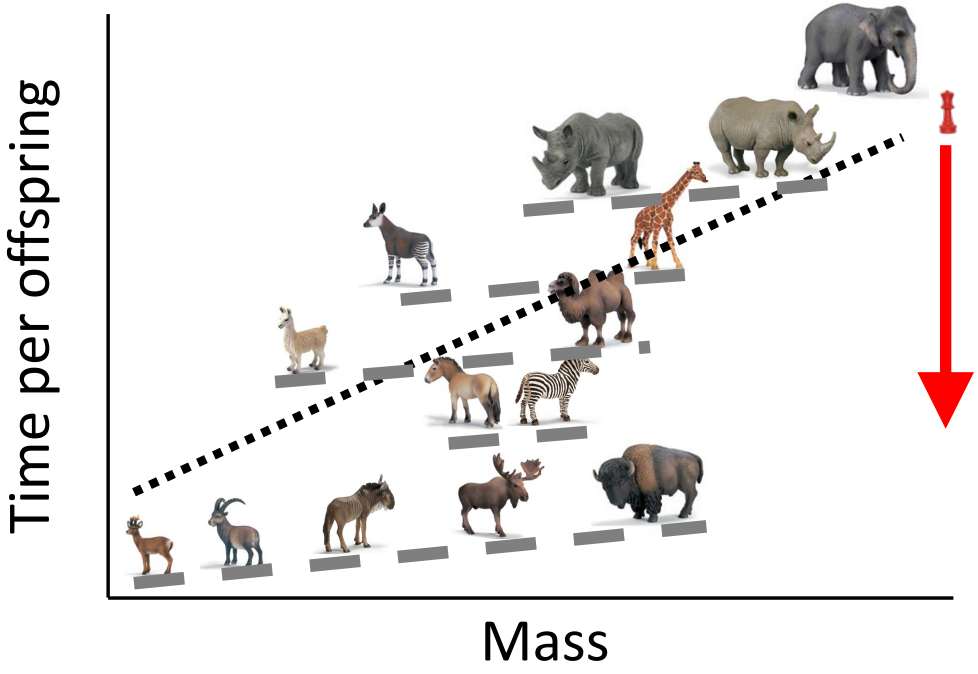




You would not consider the overall pattern a fixed law, but consider it with respect to technical progress.



Why would you consider this a pattern due to fixed life history tradeoff laws, and not rather a ***snapshot*** *in a process of optimization?*

Darwinian evolution in a nutshell

Darwinian evolution

Living things / creatures reproduce and, in doing so, generate surplus.
Resources are finite.
There is competition for resources.
Advantages in resource access and use can translate in increased production of viable offspring.

During reproduction, heritable variation in phenotypes occurs.

Those phenotypes that are advantageous for resource access and use will outreproduce others.

Due to separation (by niche or geography) distinct species will form.

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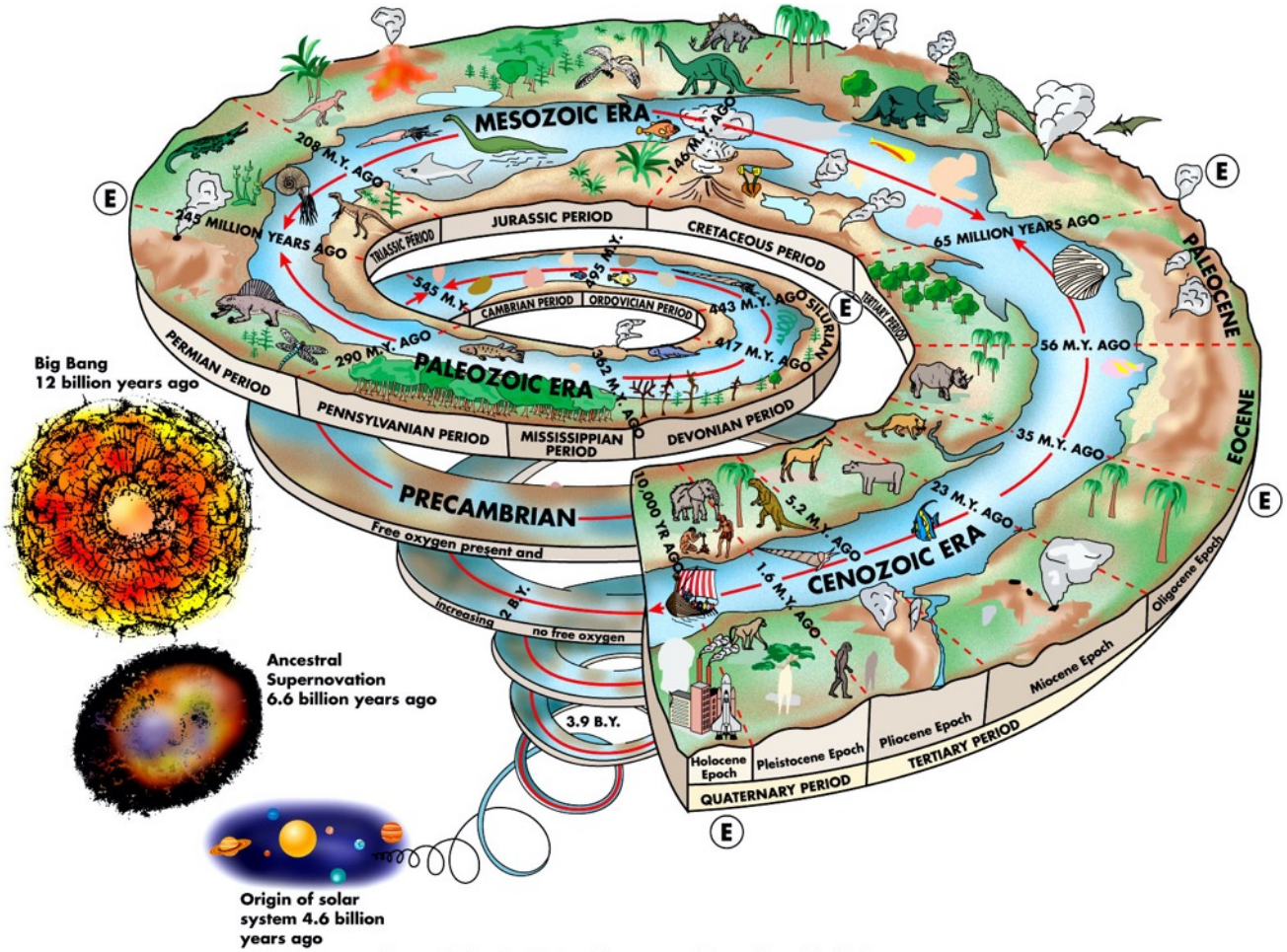
… implies not only adaptation (an absolute value) but competitive adaptation (a relative value)

Darwinian evolution

… is a historical process ('over time')

… it becomes difficult to allow for intentional creation



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Darwinian evolution

... implies not only adaptation (an absolute value) but competitive adaptation (a comparative value)

... you are where you are because you were better than others

A NEW EVOLUTIONARY LAW

Leigh Van Valen

The Red Queen's Hypothesis (32)

(32). "Now here, you see, it takes all the running you can do, to keep in the same place." (L. Carroll, Through the Looking Glass.)

Evol. Theory 1:1-30 (July 1973)

‘Evolutionary progress’ – directional evolution

The crab is the natural predator of the snail.

Natural selection favors snails with thicker shells and spines.

Through natural selection, crabs evolve more powerful claws that can pierce the snails’ thick, spiny shells.

In response, natural selection favors snails with even thicker shells and spines.

‘Evolutionary progress’ – directional evolution

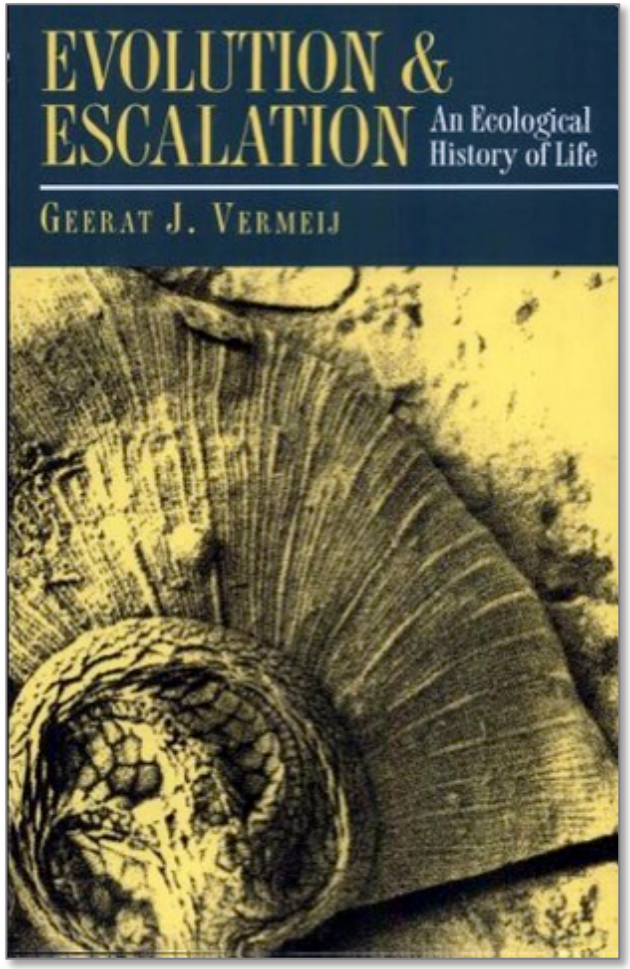
Proc. R. Soc. Lond. B **205**, 489–511 (1979)
Printed in Great Britain

Arms races between and within species

By R. Dawkins and J. R. Krebs

reverse as to continue the previous one. But in fact consistent directionality is introduced because the environment of any one evolving lineage includes other evolving lineages. Above all, it is because adaptations in one lineage call forth counter-adaptations in others, setting in motion the unstable evolutionary progressions we call arms races.

‘Evolutionary progress’ – directional evolution



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On Escalation

Geerat J. Vermeij

Department of Geology, University of California, Davis, California 95616; email: gjvermeij@ucdavis.edu

Annu. Rev. Earth Planet. Sci. 2013. 41:1–19

The *Annual Reviews of Earth and Planetary Sciences* is online at earth.annualreviews.org

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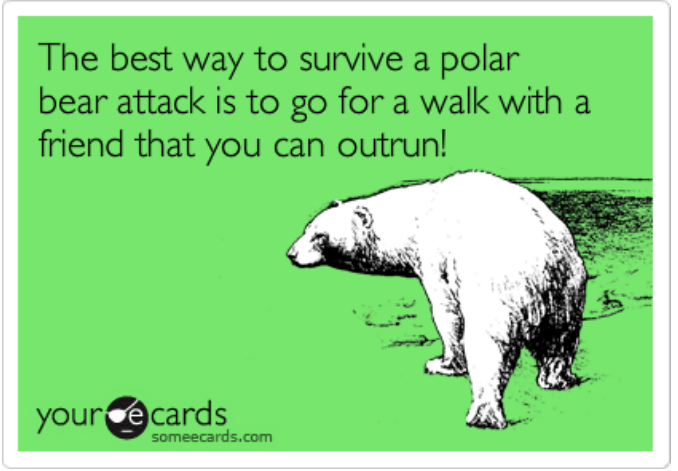
Keywords

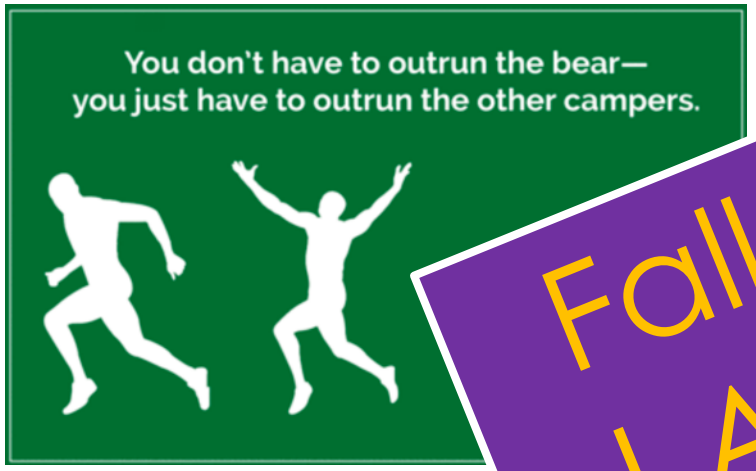
Red Queen, coevolution, Phanerozoic, enabling factors, predation, competition

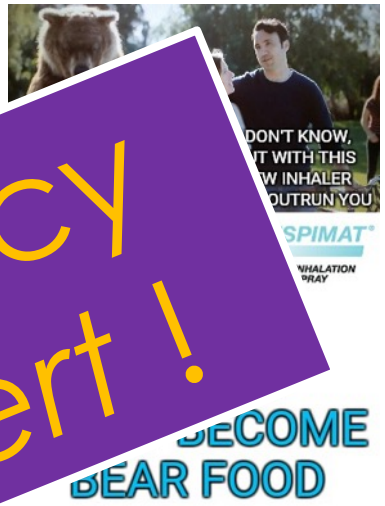
Abstract

Organisms have been important agents of selection throughout the history of life. The processes and outcomes of this selection are the subject of this review. Among these, escalation is the most widespread. The primary selective agents are powerful competitors and consumers, which together push many populations toward higher performance in acquiring and defending resources while relegating less competitive species to physiologically marginal settings, where escalation also ensues. The extent to which performance standards rise depends on enabling factors, which control availability of and access to resources. By establishing positive feedbacks between species and enabling factors, effective competitors regulate and enhance resource supply. The pace of escalation toward greater power and reach is dictated by geological factors as well as by growing interdependencies between species and their resources. Evolutionary events on land related to the production of oxygen may have been instrumental in triggering the major episodes of escalation.

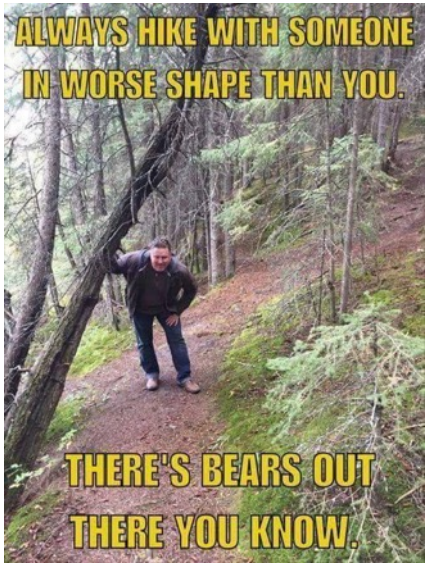
'Arms races' do not only occur between predator and prey.

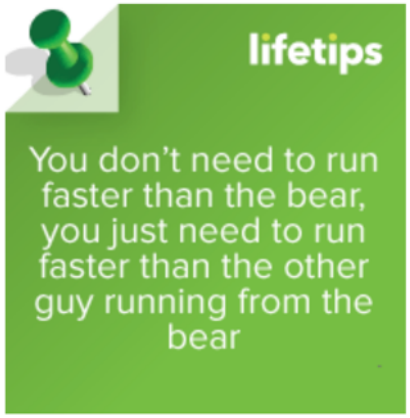






Fallacy
! Alert !



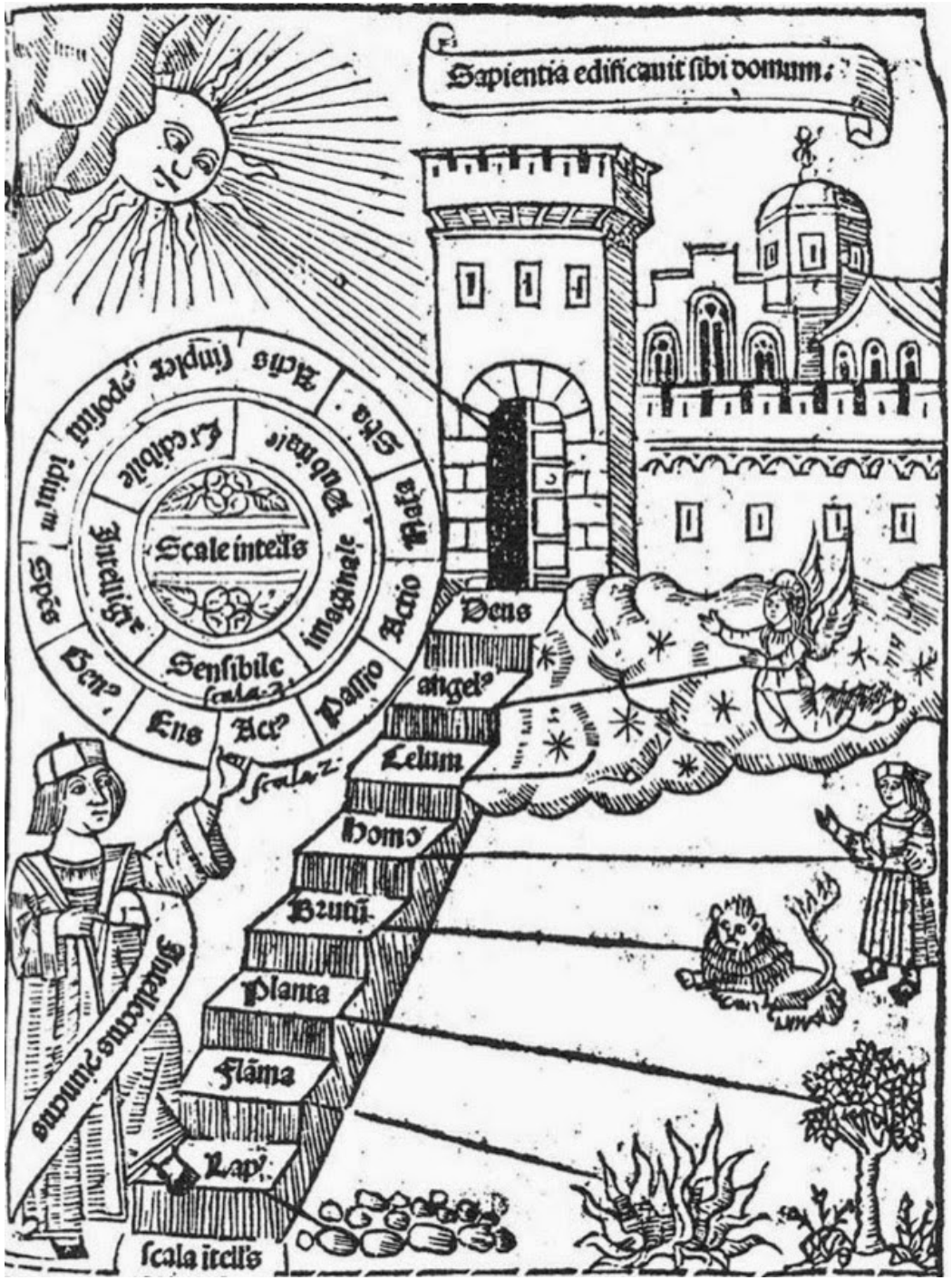


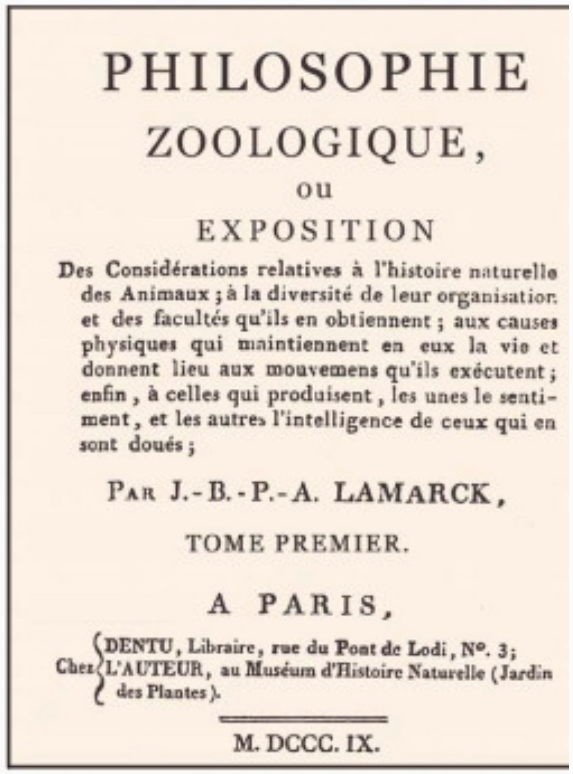
Darwinian evolution

... implies not only adaptation (an absolute value) but competitive adaptation (a comparative value)

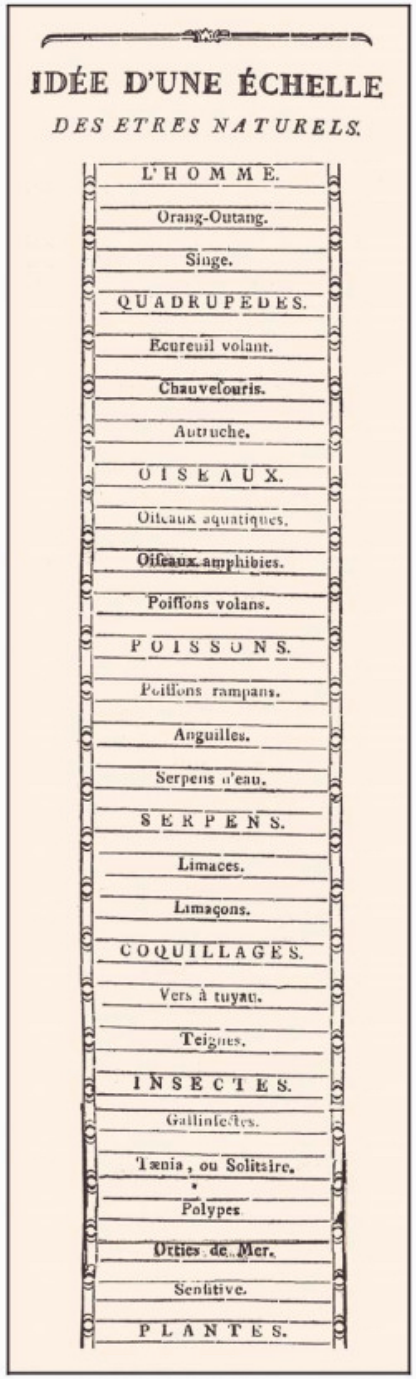
... you are where you are because you were better than others

Many evolutionary biologists abhor the concept of 'progress'.


Sapientia edificauit sibi domum.
Scale intell's
Sensibile
Intellig
Dubitabile
Imaginale
Deus
angel
Celum
Homo
Brutū
Planta
Flāma
Lap
scala itell's



PHILOSOPHIE
ZOOLOGIQUE,
ou
EXPOSITION
Des Considérations relatives à l'histoire naturelle des Animaux ; à la diversité de leur organisation et des facultés qu'ils en obtiennent ; aux causes physiques qui maintiennent en eux la vie et donnent lieu aux mouvemens qu'ils exécutent ; enfin, à celles qui produisent, les unes le sentiment, et les autres l'intelligence de ceux qui en sont doués ;
PAR J.-B.-P.-A. LAMARCK,
TOME PREMIER.
A PARIS,
Chez DENTU, Libraire, rue du Pont de Lodi, N°. 3;
L'AUTEUR, au Muséum d'Histoire Naturelle (Jardin des Plantes).
M. DCCC. IX.



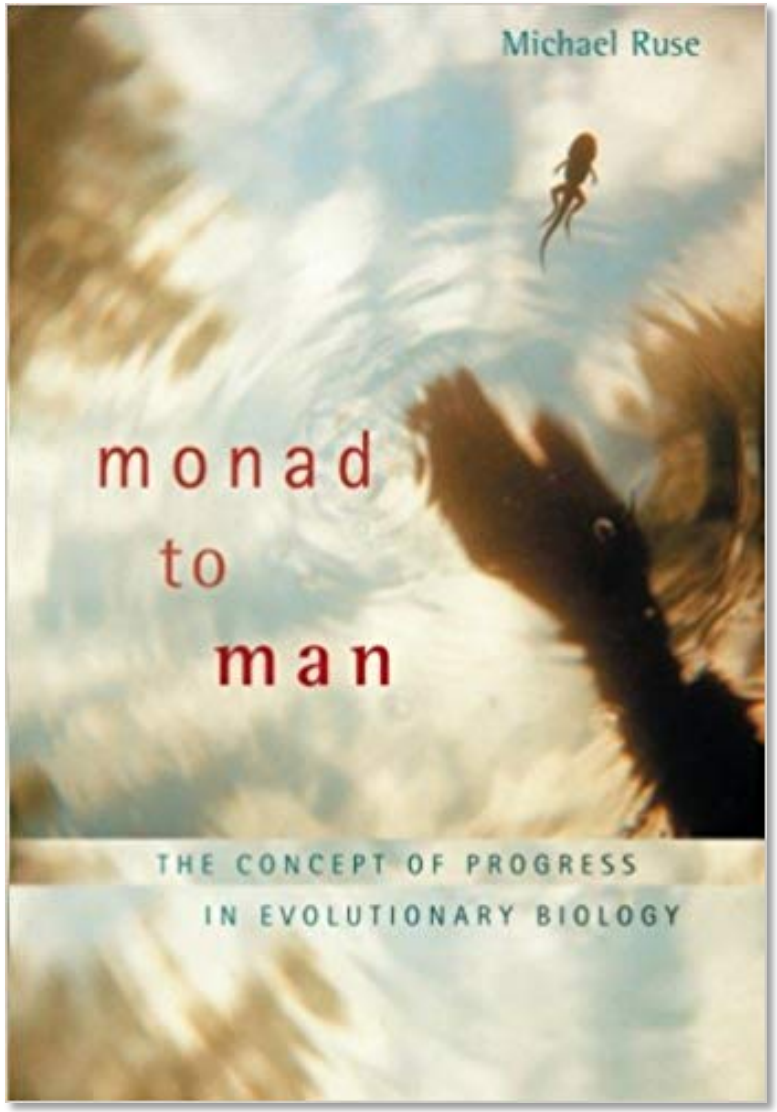
IDÉE D'UNE ÉCHELLE
DES ETRES NATURELS.
L'HOMME.
Orang-Outang.
Singe.
QUADRUPEDES.
Ecureuil volant.
Chauvesouris.
Autruche.
OISEAUX.
Oiseaux aquatiques.
Oiseaux amphibies.
Poissons volans.
POISSONS.
Poissons rampans.
Anguilles.
Serpens d'eau.
SERPENS.
Limaces.
Limaçons.
COQUILLAGES.
Vers à tuyau.
Teignes.
INSECTES.
Gallinsectes.
Taenia, ou Solitaire.
Polypes.
Orties de Mer.
Sensitive.
PLANTES.

Evolutionary Ecology Research, 2013, **15**: 747–756

Cope's Law of the Unspecialized, Cope's Rule, and weak directionality in evolution

Pasquale Raia[1] and Mikael Fortelius[2]

Understanding of directionality was akin to Lamarck's concept of linear progress up life's ladder, and ever since the many evils of social Darwinism were recognized and abandoned, evolutionary biologists have been extremely cautious about considering evolutionary progress of any sort.



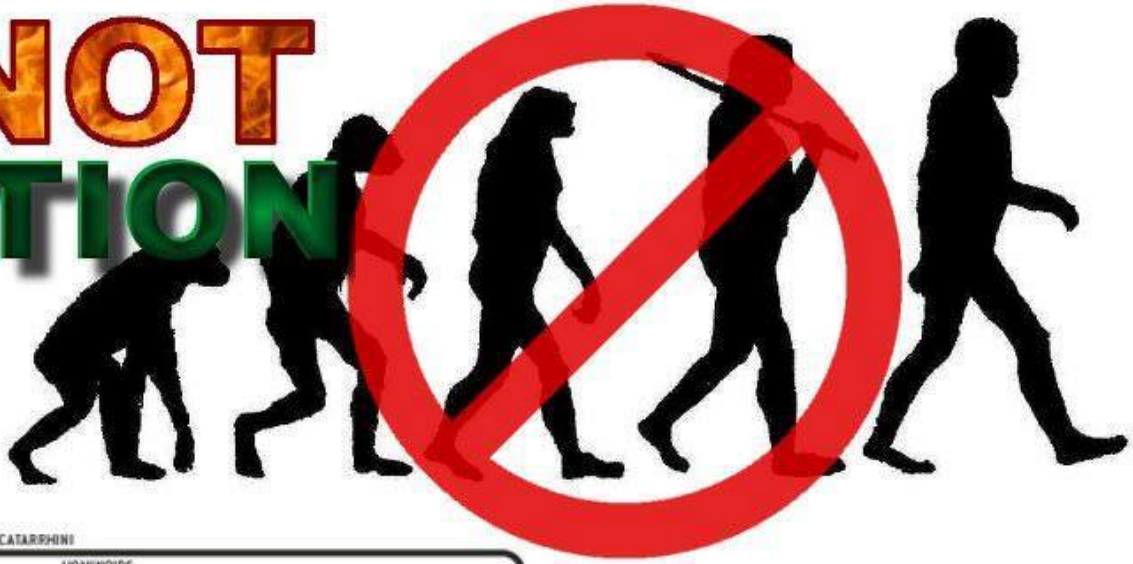
Stephen Gould

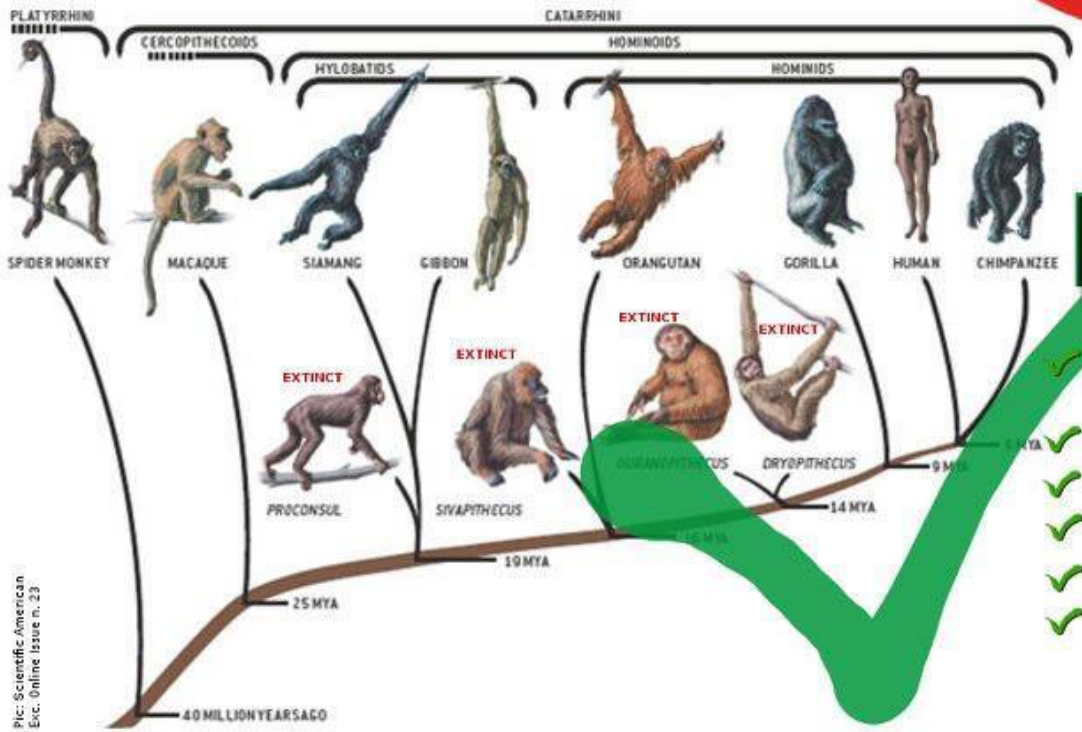
… my favourite theme that Darwinian evolution cannot be read as a theory of progress, but only as a mechanism for building better adaptation to changing local environments - and that the equation of evolution with progress represents our strongest cultural impediment to a proper understanding of evolution

Our failure to find any clear vector of [...] accumulating progress [...] represents our greatest dilemma for a study of patterns in life's history.

THIS IS NOT EVOLUTION

- This is *Scala Naturae*, an incorrect pre-evolutionary concept
- Suggests progress, not adaptation
- Human is a target, superior being
- Ancestor being resembles a chimp
- No branches or extinctions





THIS IS EVOLUTION

- Humans are not special. Just a species, not superior, "more evolved" or a target.
- Some species become extinct (99% of them)
- Chimps are not portraited as ancestors
- Individual beings do not change. Populations do
- Ancestor species branches into other species
- Adaptations might lead to smaller size, loss of unused features and extinction

Darwinian play on words

"Existence of those life forms that are more efficient, under the condition they are exposed to, at transforming resources into fertile offspring, than ***recent*** life forms with alternative properties"?

‘Evolutionary progress’ – directional evolution

Biol. Rev. (1987), **62**, *pp.* 305–338

PROGRESS AND COMPETITION IN MACROEVOLUTION

By MICHAEL J. BENTON

It is merely a tautology to identify the later animal (the ‘winner’) as a ‘superior competitor’ in the absence of any other evidence (Schopf, 1979).

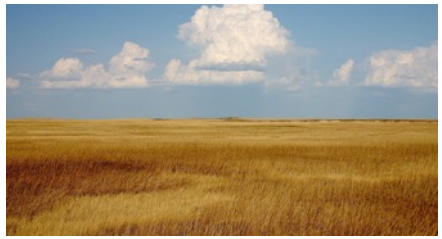
it is hard to envisage a constant competitive advantage that lasted so long and persistently favoured all of the species of one large taxon against all of the species of another in all environments.

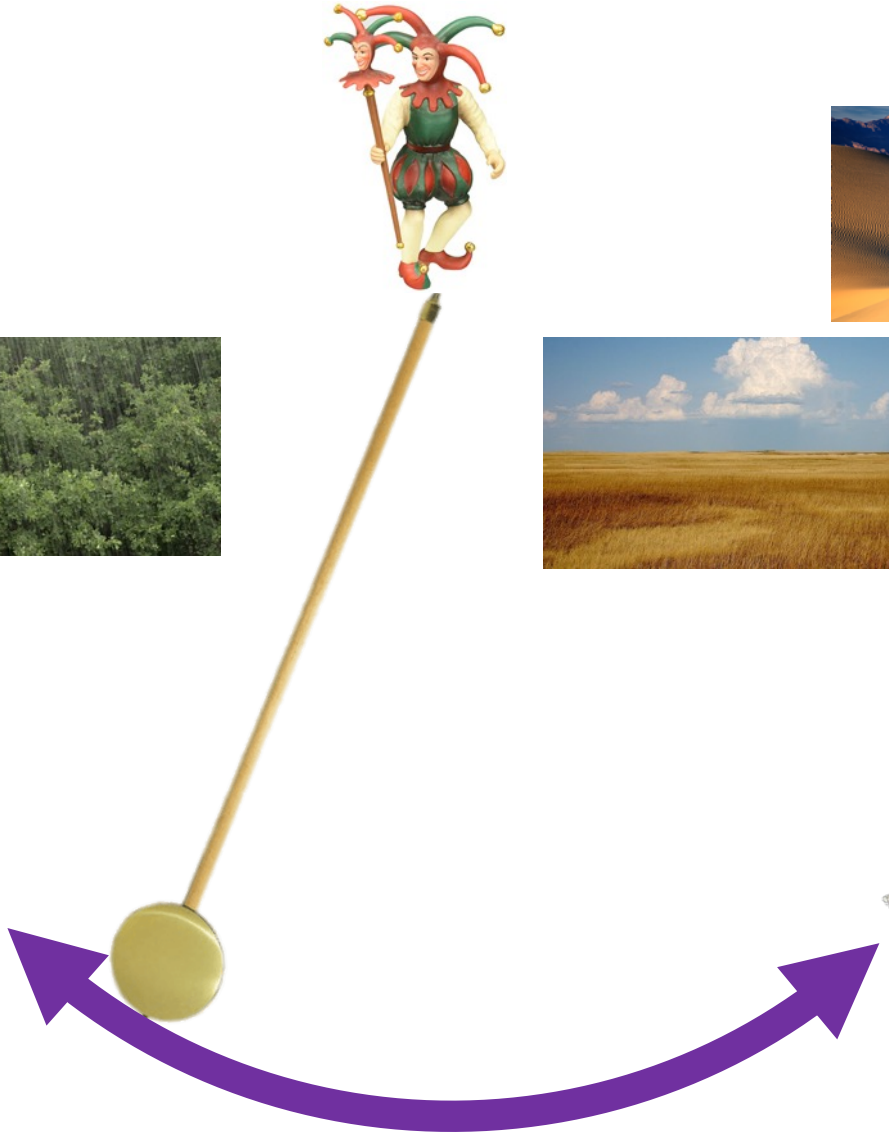
The Red Queen and the Court Jester: Species Diversity and the Role of Biotic and Abiotic Factors Through Time

Michael J. Benton

FEBRUARY 2009 VOL 323 SCIENCE

The Court Jester's pendulum





Probabilistic directionality in evolution

A priori conditions and their consequences

Life requires input of resources.

Life starts simple (non-complex).

Life means reproduction.

- spontaneously occurring yet heritable variability

Probabilistic directionality I: towards non-stasis

A priori conditions and their consequences

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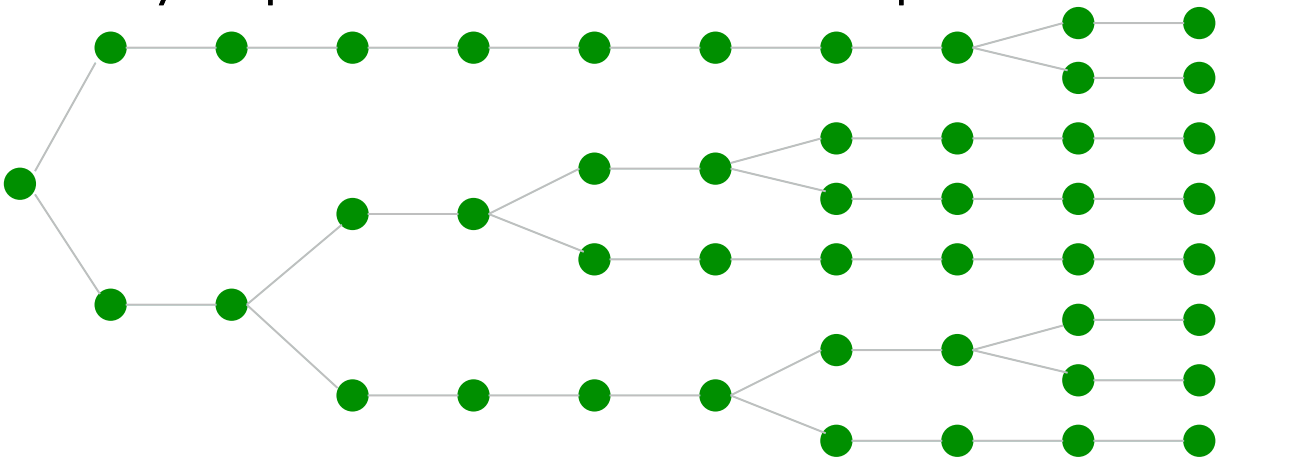
Probabilistic directionality I: towards non-stasis

- not only replacement but multiplication



Probabilistic directionality II: more

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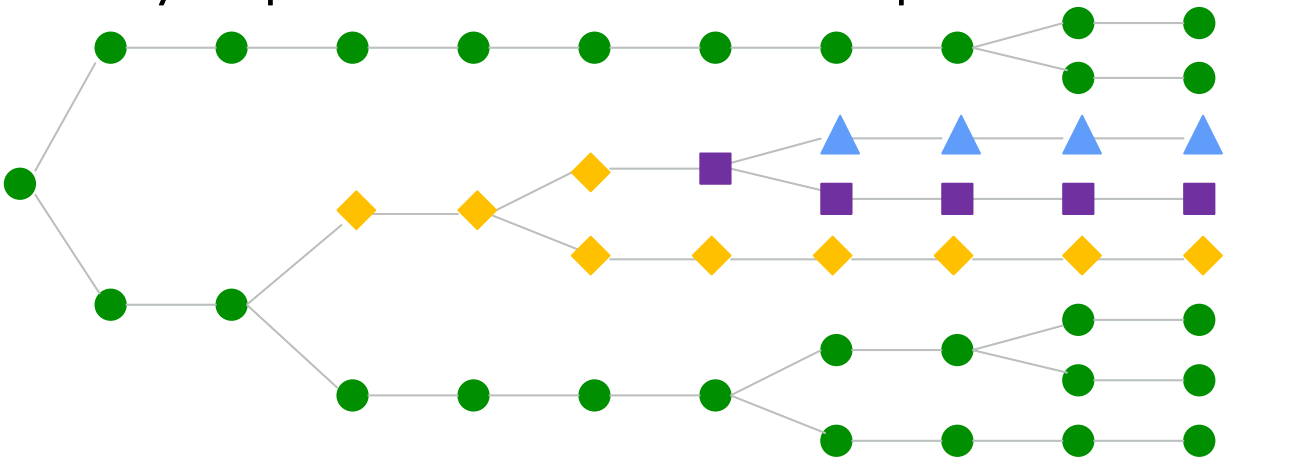

Probabilistic directionality II: more diversity

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Probabilistic directionality I: towards non-stasis

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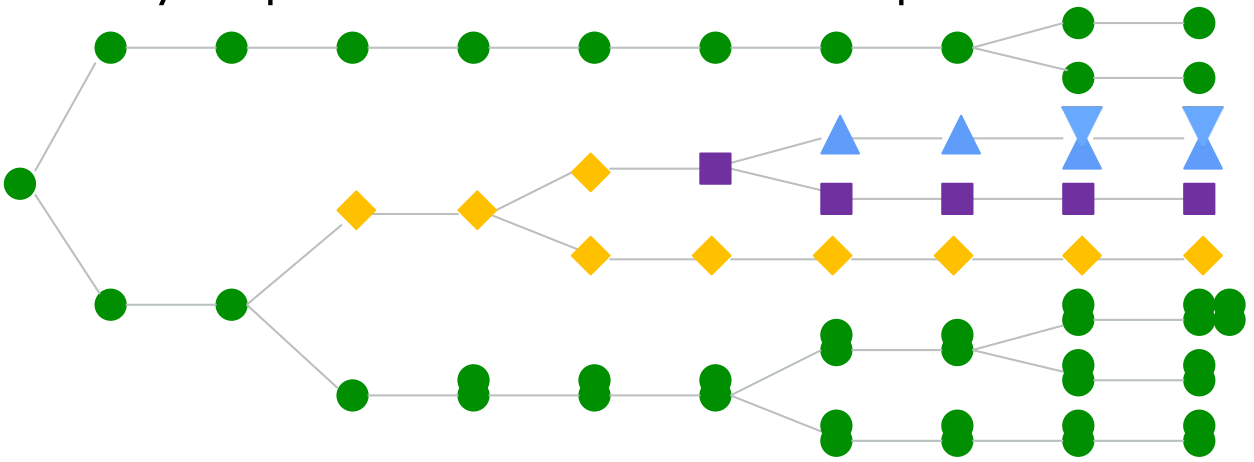
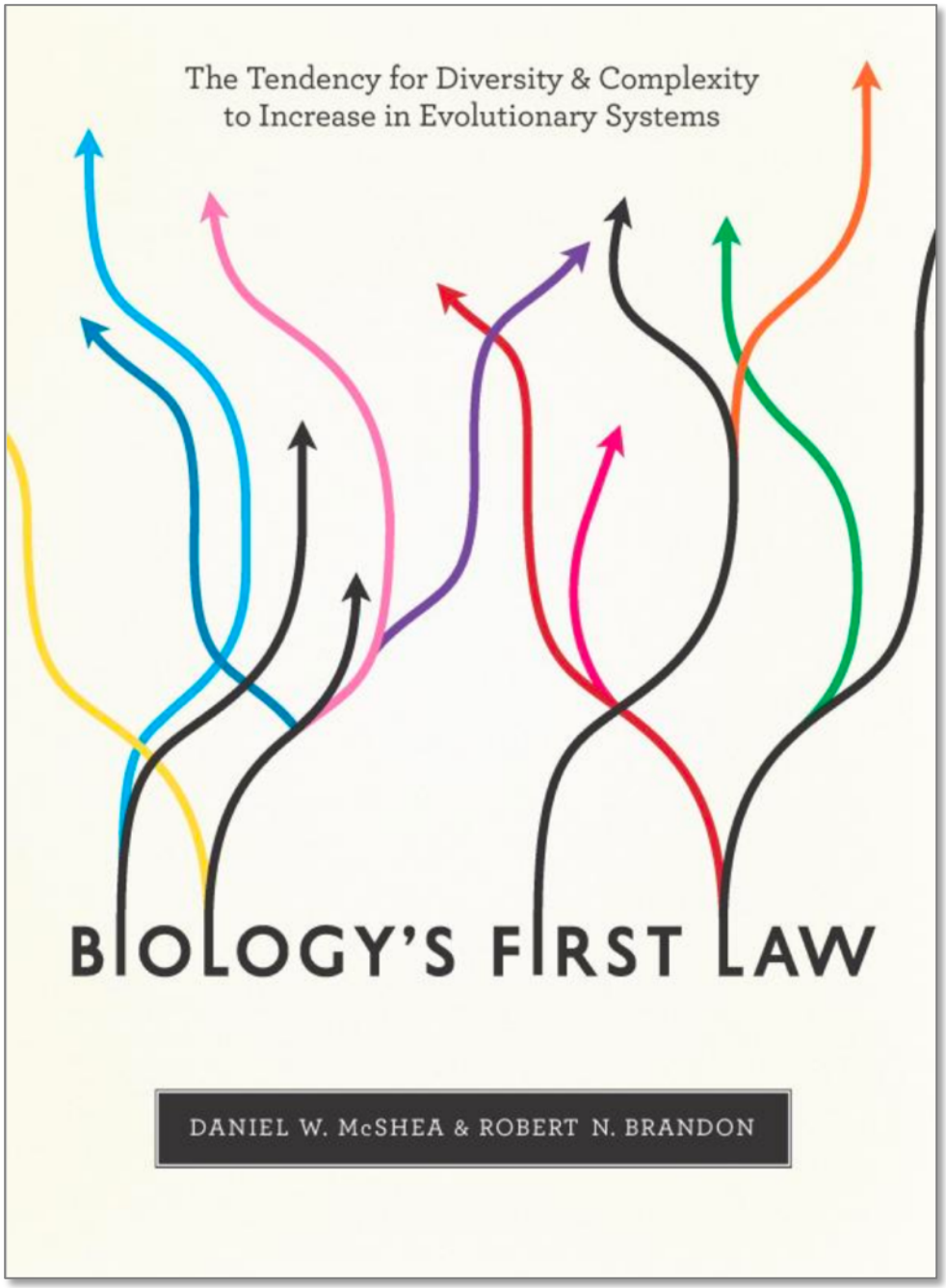
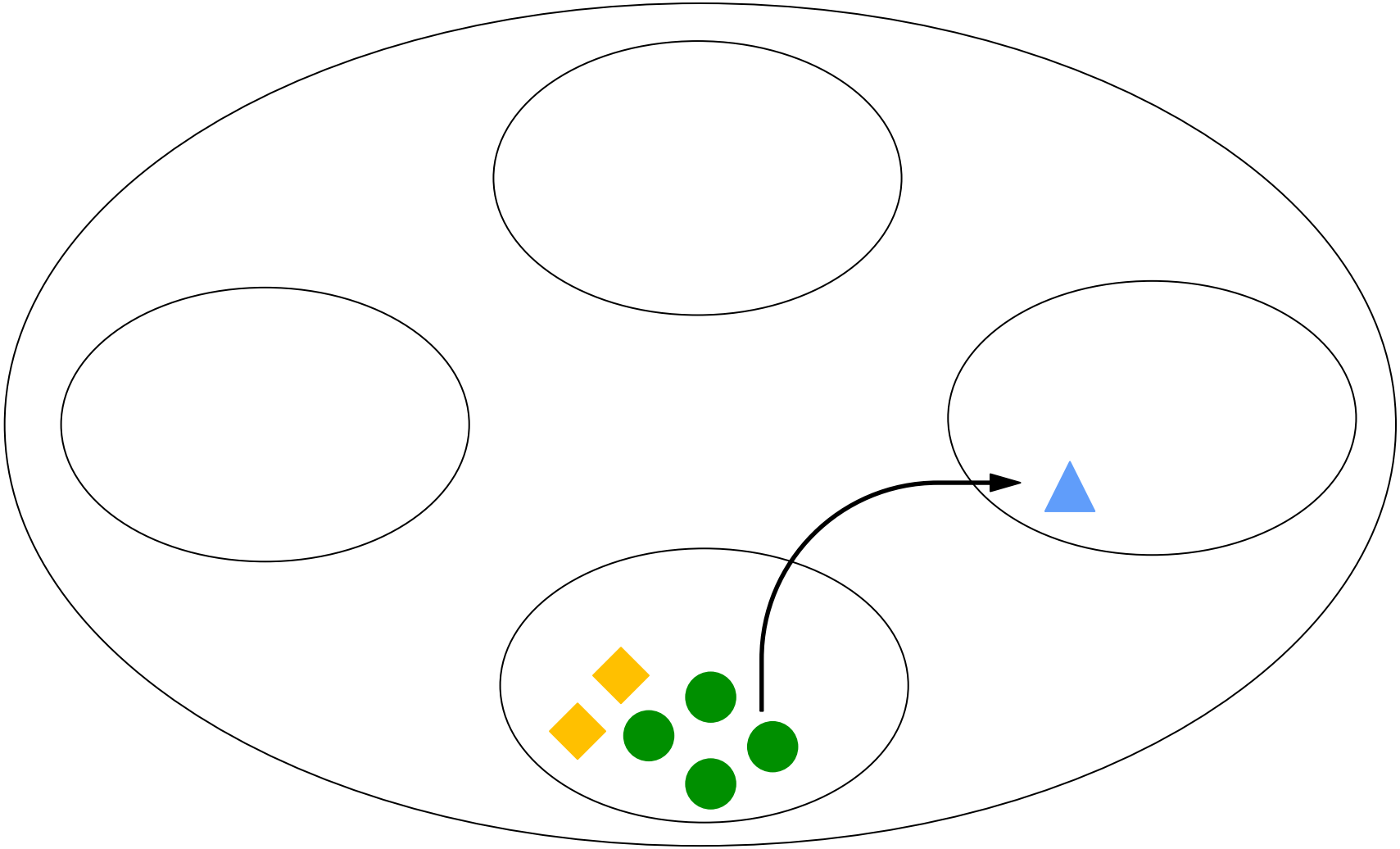


Probabilistic directionality II: more diversity & complexity


The Tendency for Diversity & Complexity
to Increase in Evolutionary Systems
BIOLOGY'S FIRST LAW
DANIEL W. McSHEA & ROBERT N. BRANDON

A priori conditions and their consequences

Resources are finite.



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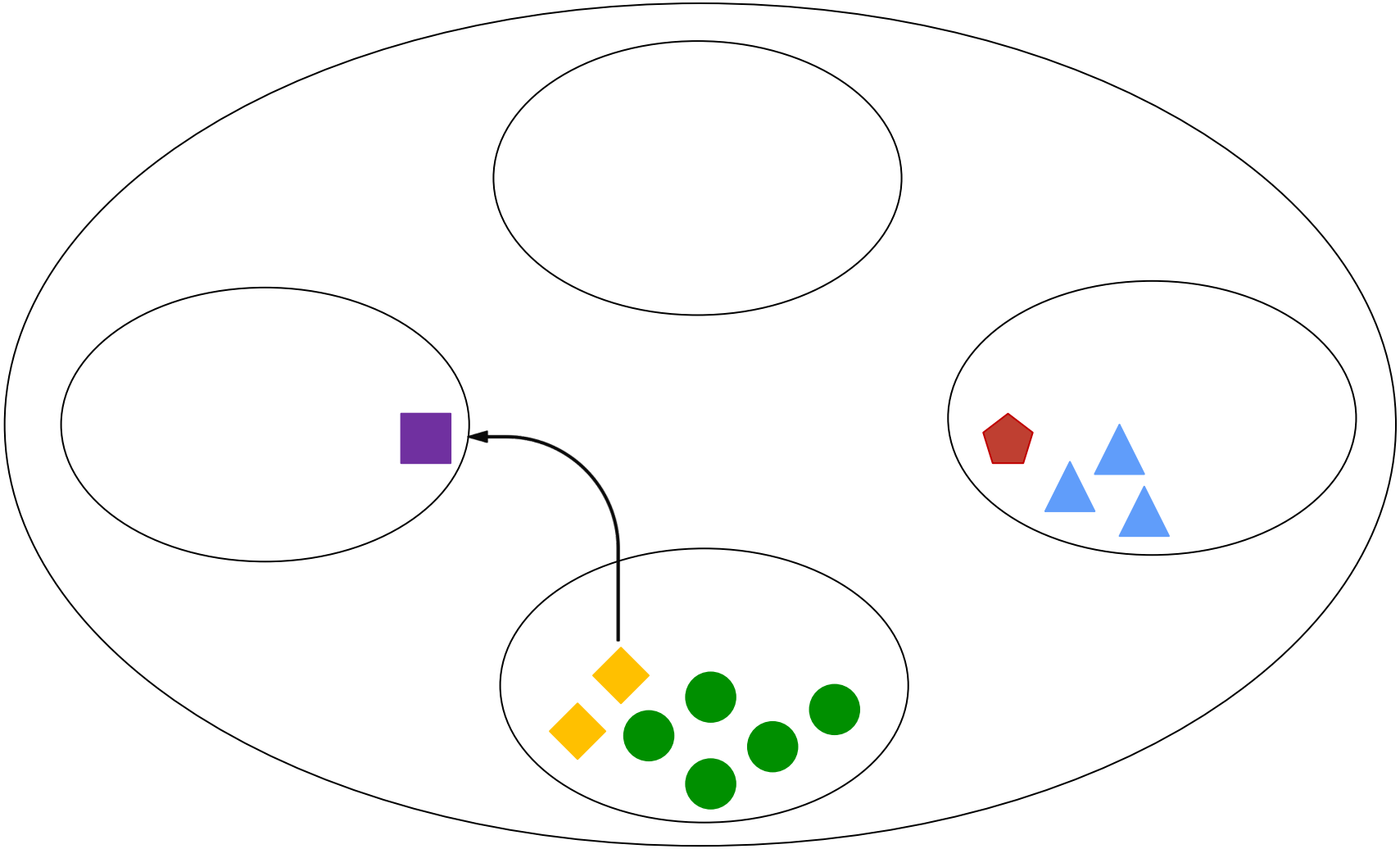

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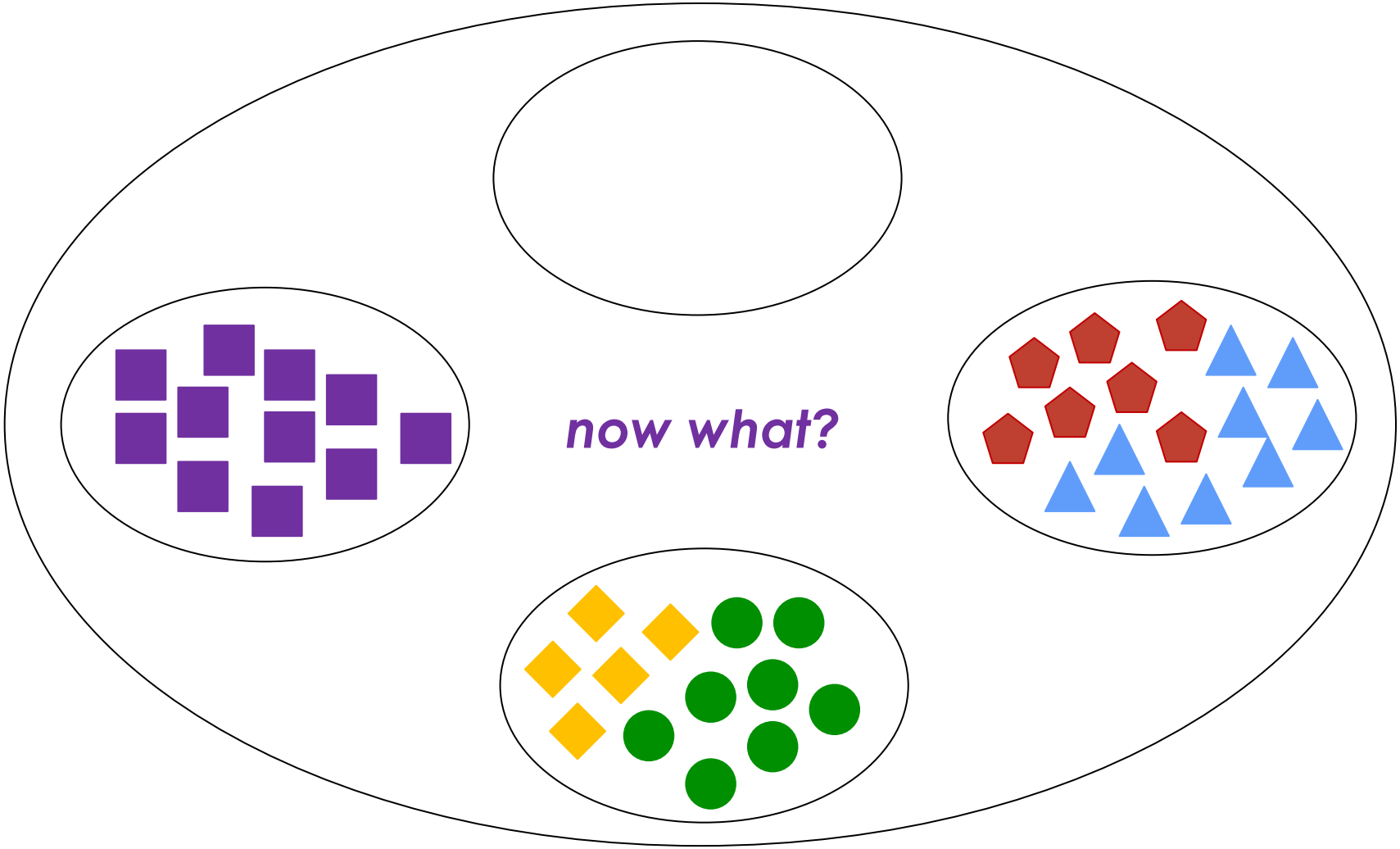
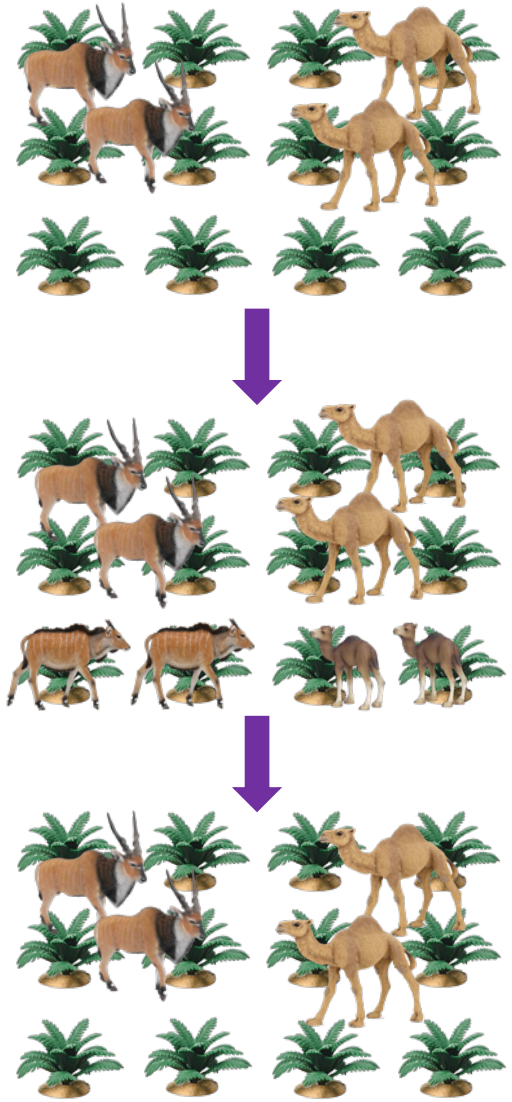
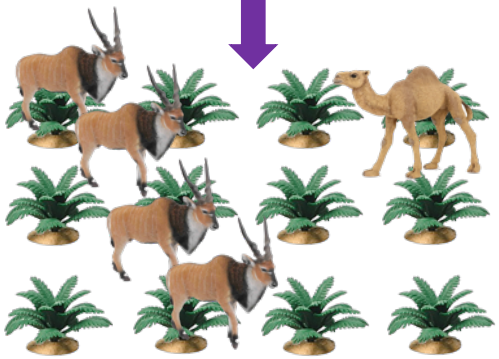
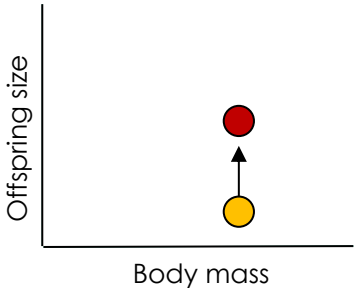


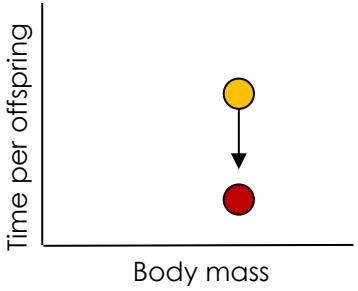
Equivalent use of limited resources

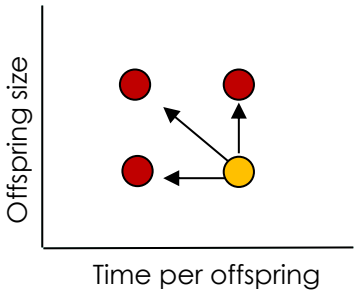


Competition for limited resources

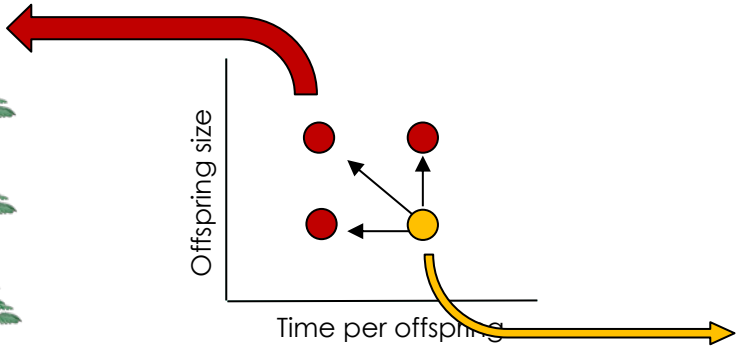








Competition for limited resources



‘Evolutionary progress’ – directional evolution

Biol. Rev. (1987), **62**, *pp.* 305–338

PROGRESS AND COMPETITION IN MACROEVOLUTION

By MICHAEL J. BENTON

It is merely a tautology to identify the later animal (the ‘winner’) as a ‘superior competitor’ in the absence of any other evidence (Schopf, 1979).

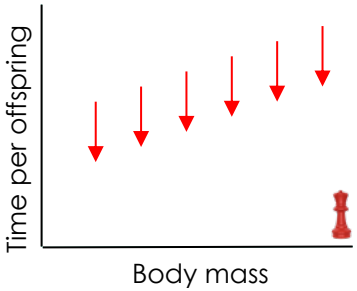
it is hard to envisage a constant competitive advantage that lasted so long and persistently favoured all of the species of one large taxon against all of the species of another in all environments.

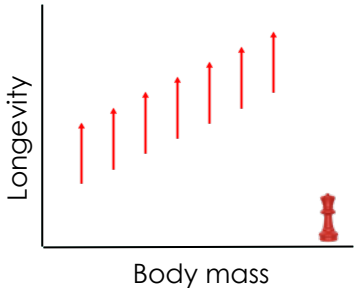
Darwinian evolution is a set of rules where the one constant (demographic) selective pressure is to outreproduce competitors.

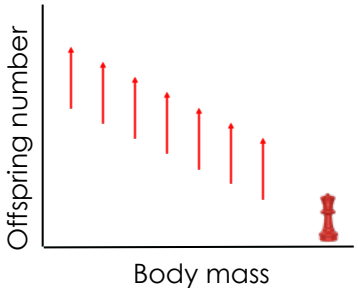
In the presence of competitors, Darwinian selecetion should always go in the ***direction*** *of a 'Darwinian Demon'.*

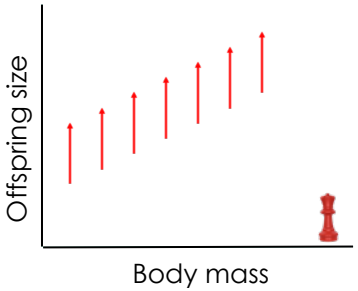
Darwinian demon

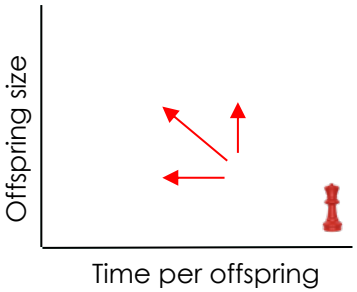
An organism that starts reproducing directly after birth, producing a large number of surviving offspring at extreme speed without ever dying.

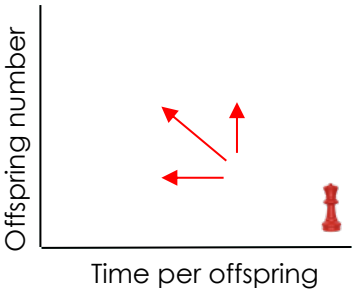








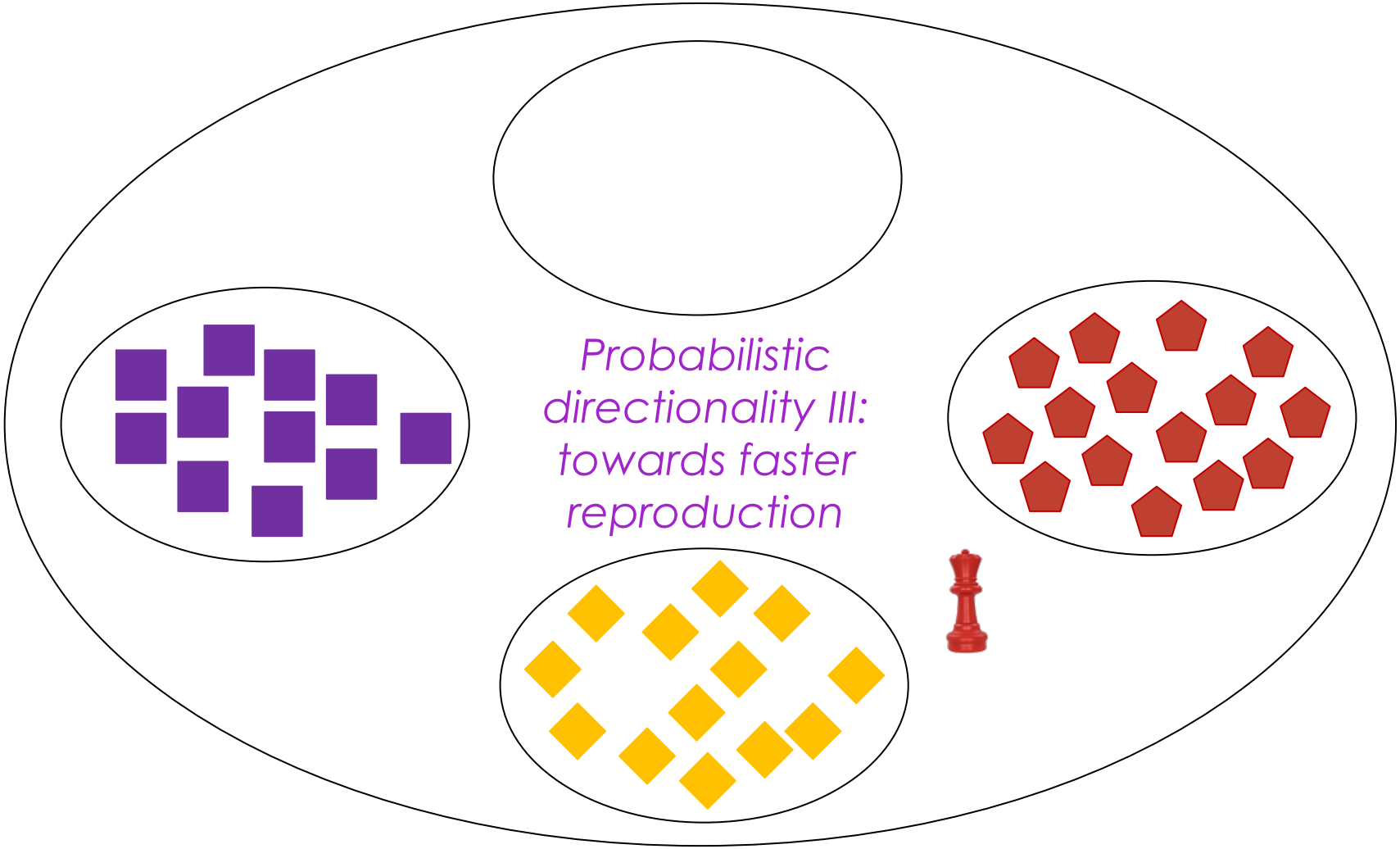




FASTER

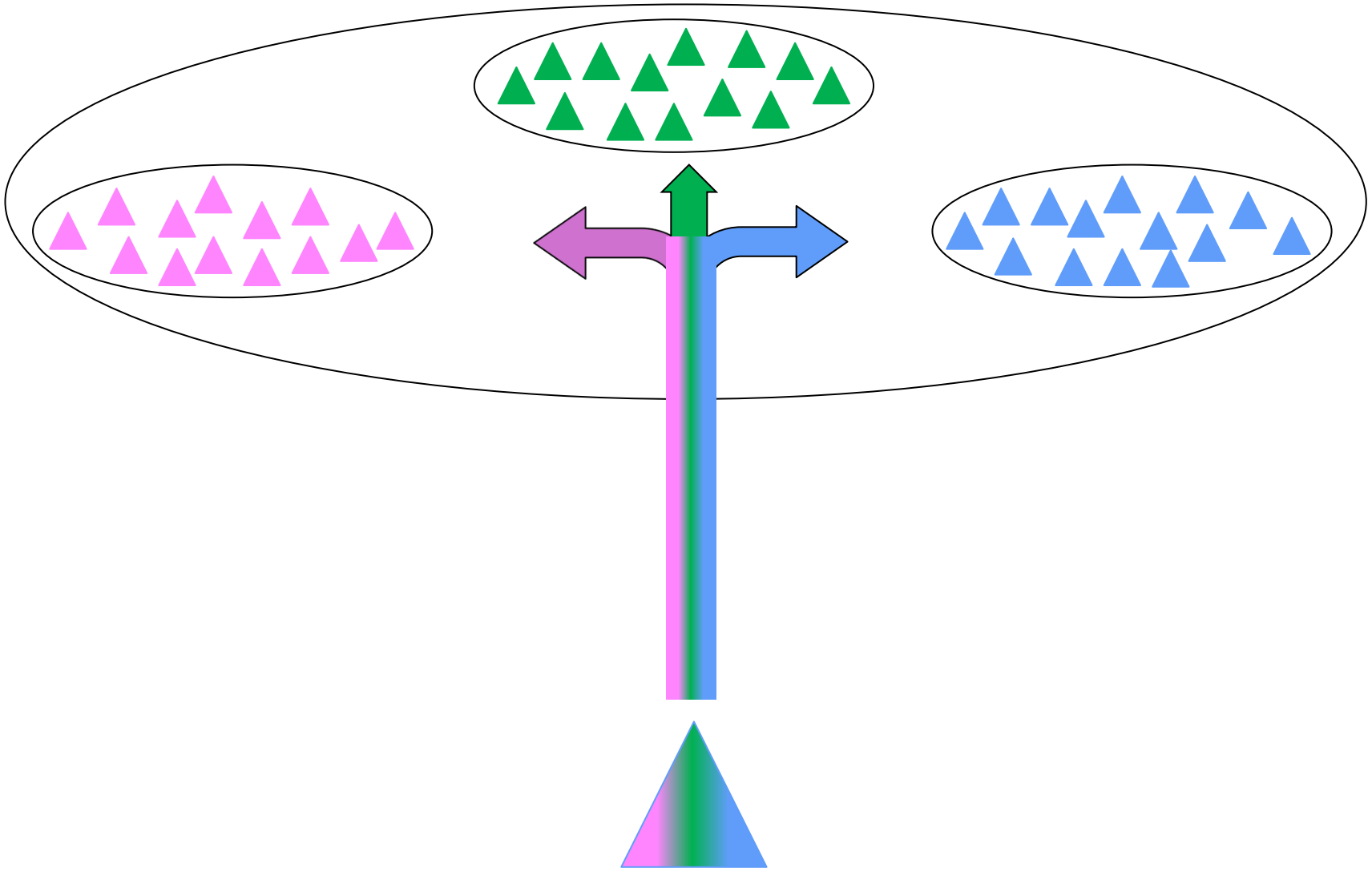
A priori conditions and their consequences

Resources are finite.

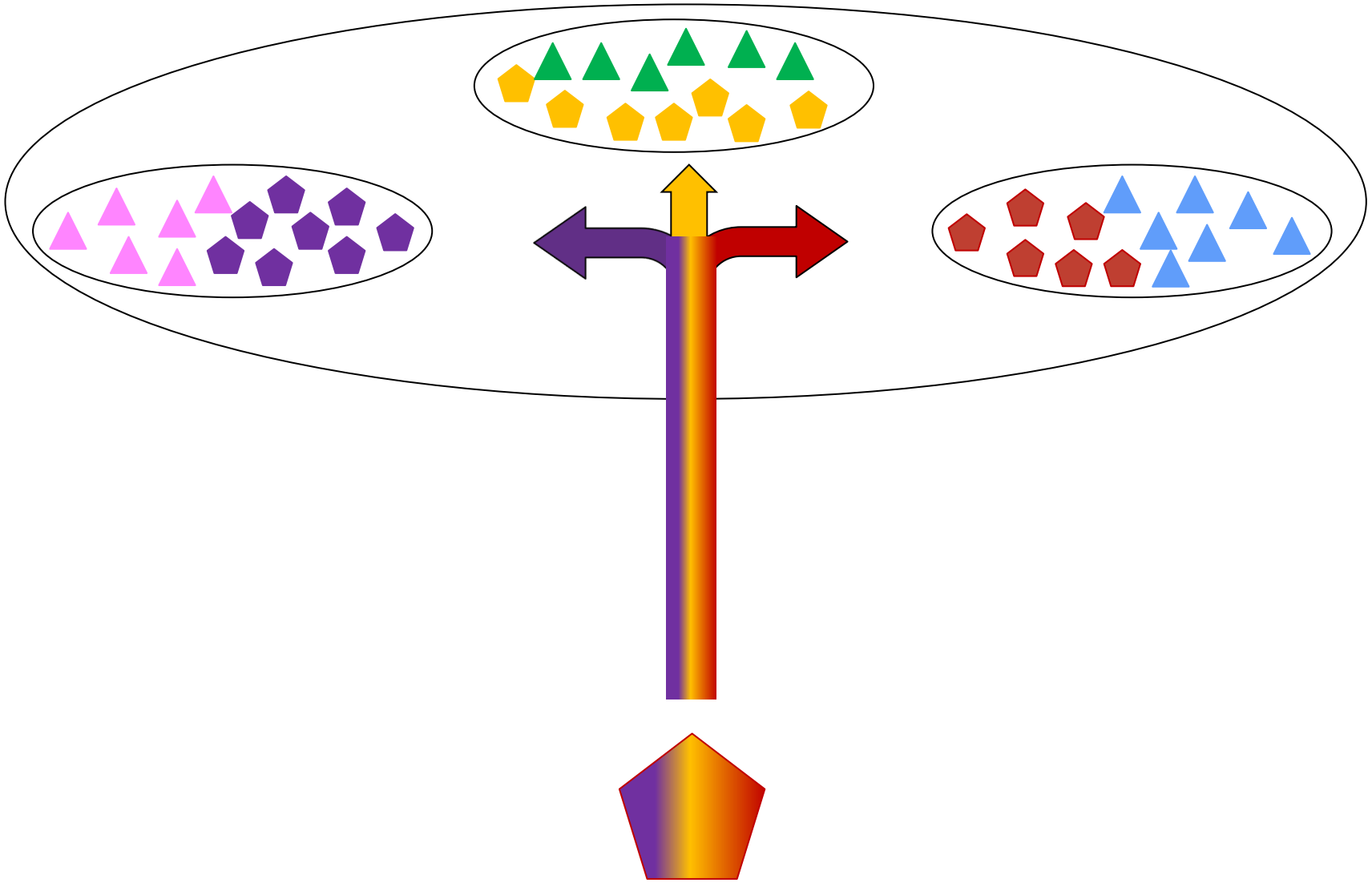


Bursts of adaptive radiation

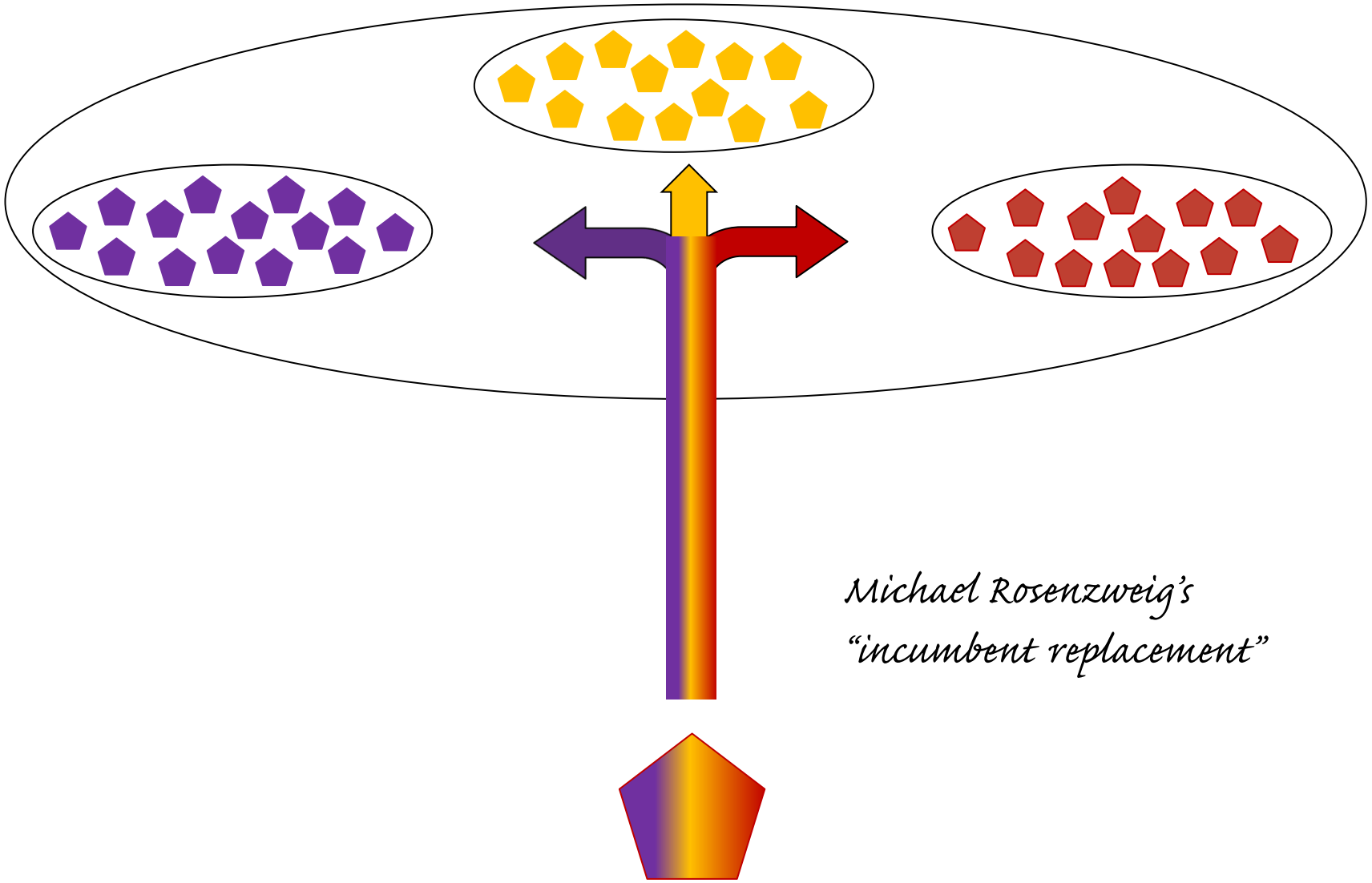
Radiation into ***new*** niches



Radiation into ***new or old*** niches



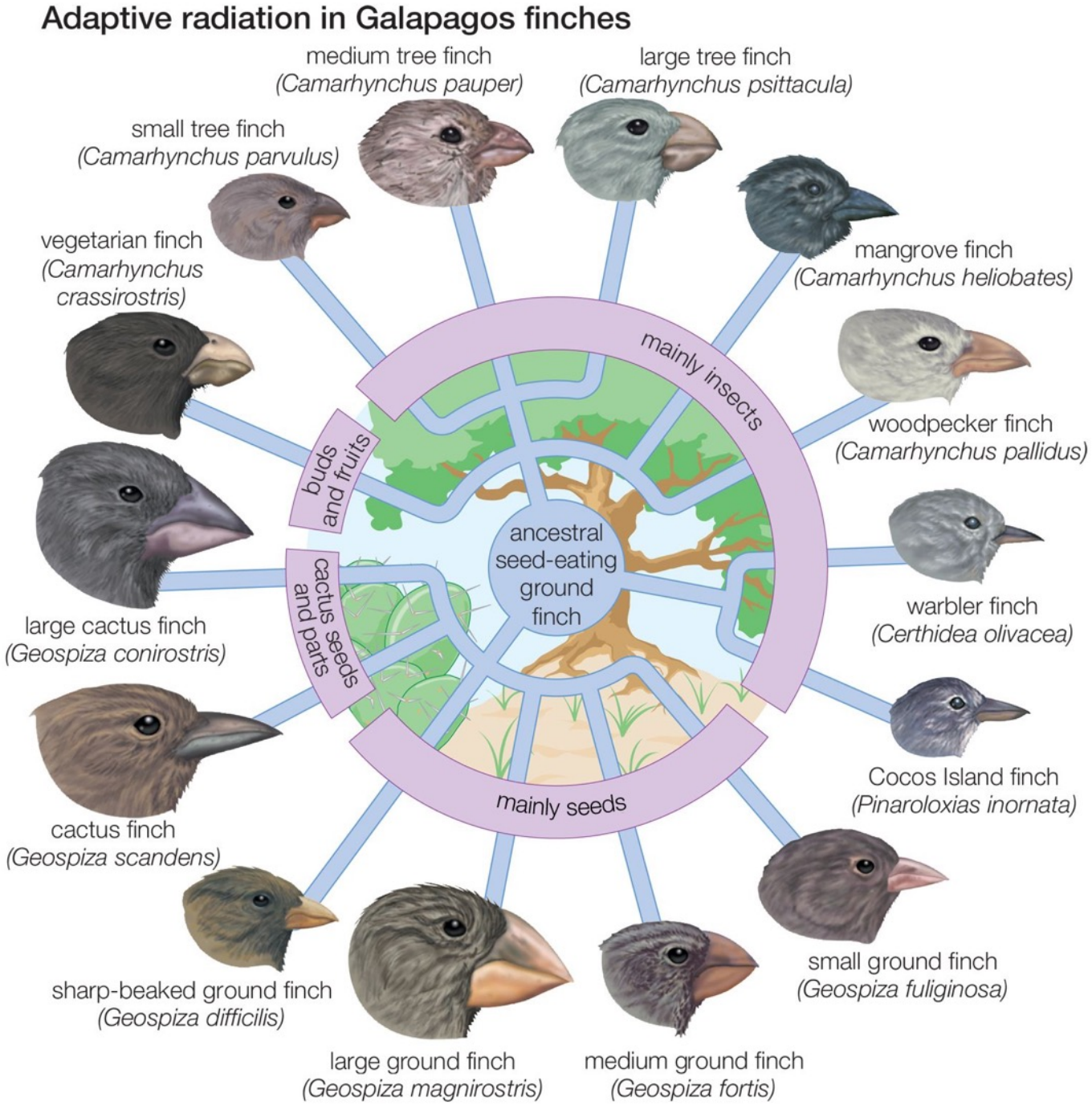
Radiation into ***new or old*** niches



Michael Rosenzweig's "incumbent replacement"

Evolution is
life's permanent suggestion
of new solutions
to the question of life itself.

Bursts of radiation occur when a life form meets a series of niches that is not occupied or occupied by 'lesser solution'.



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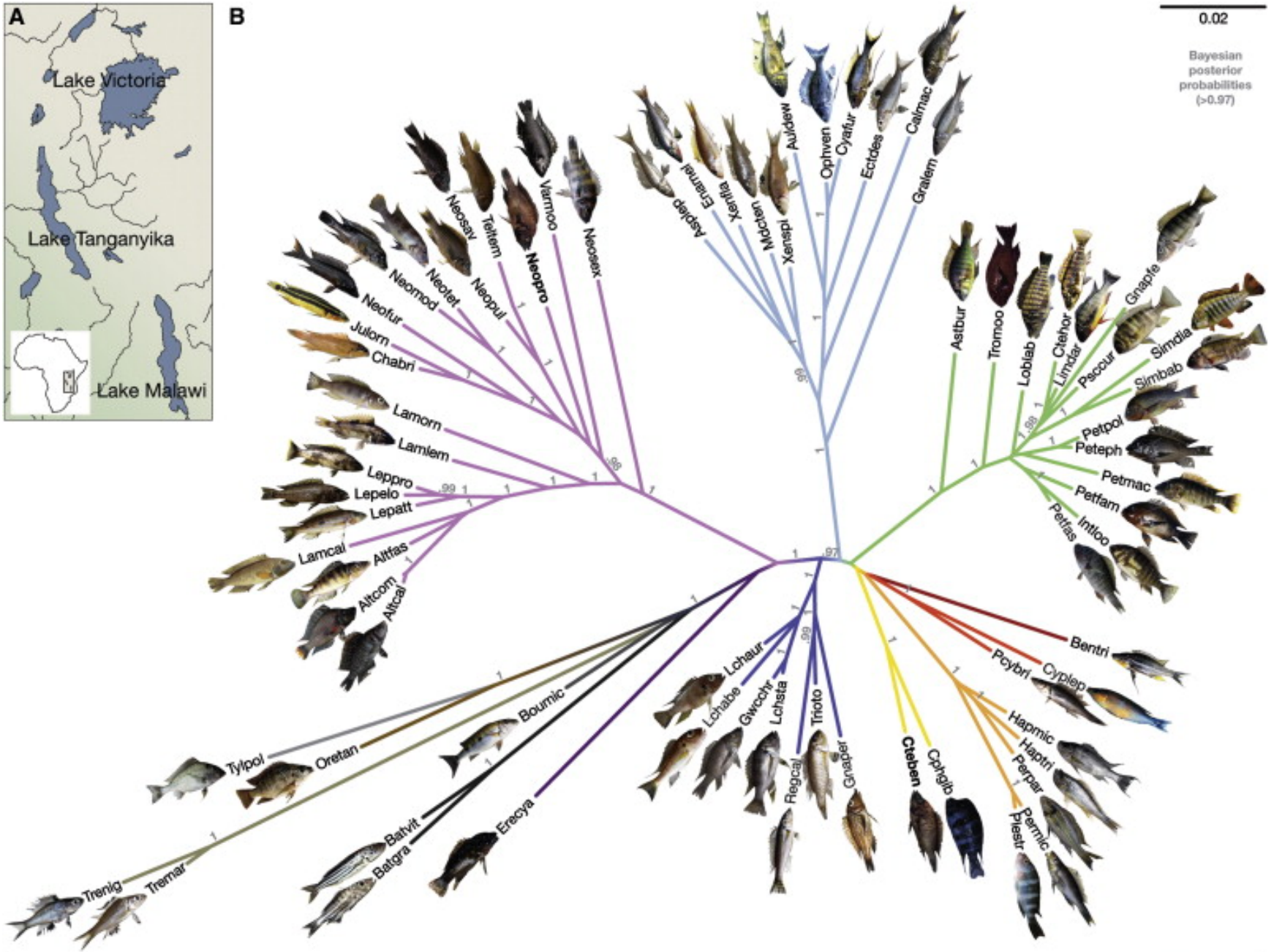
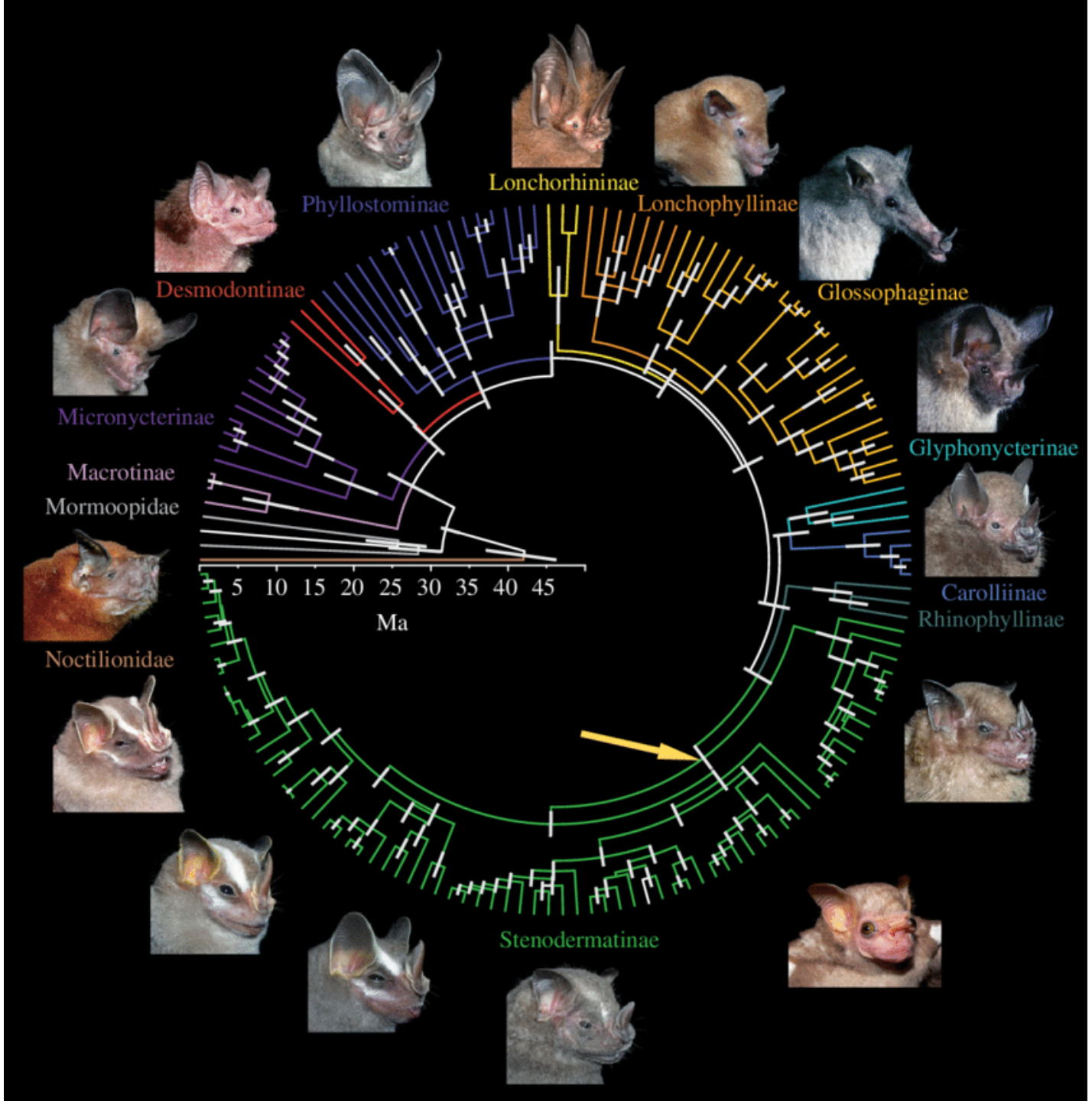
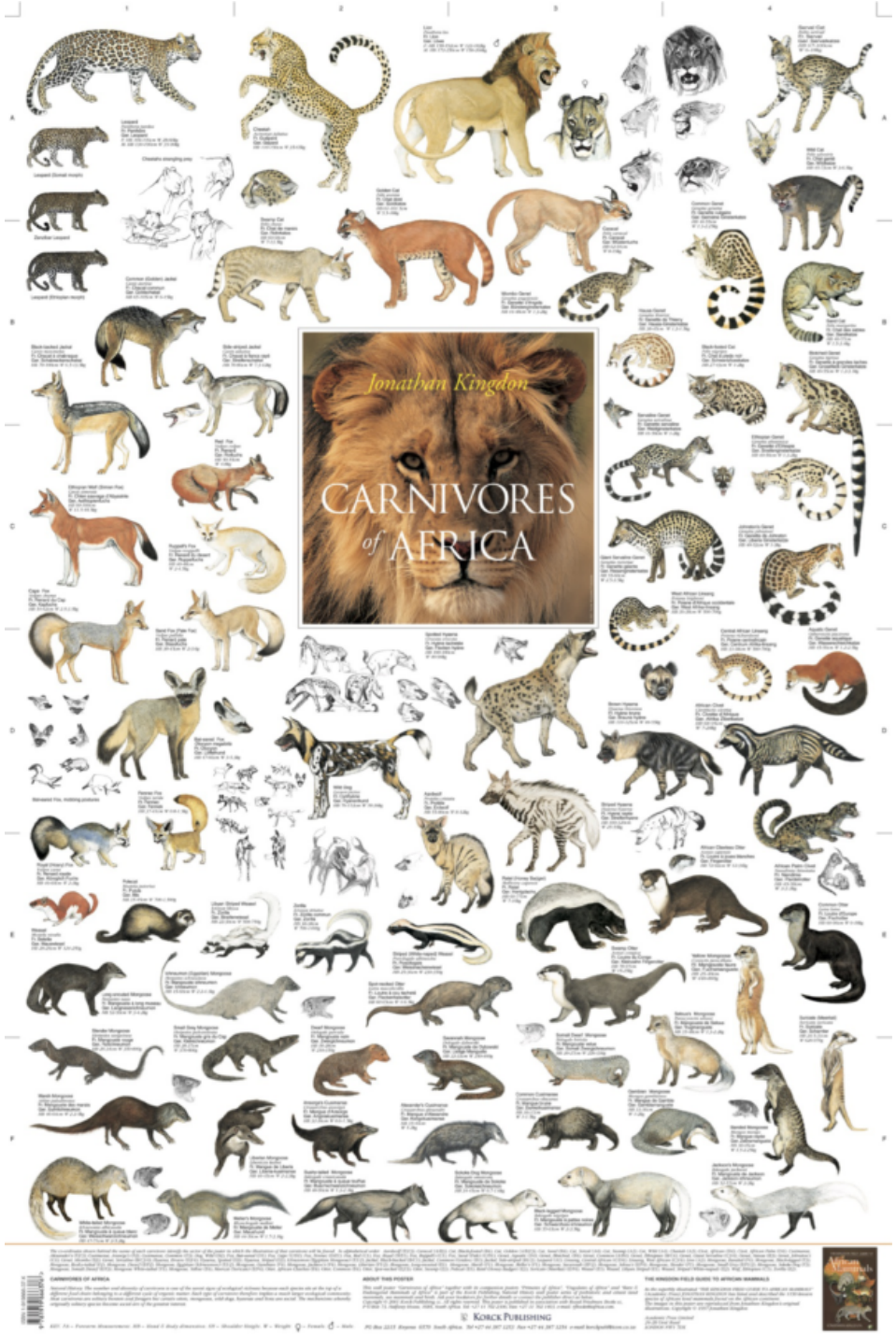
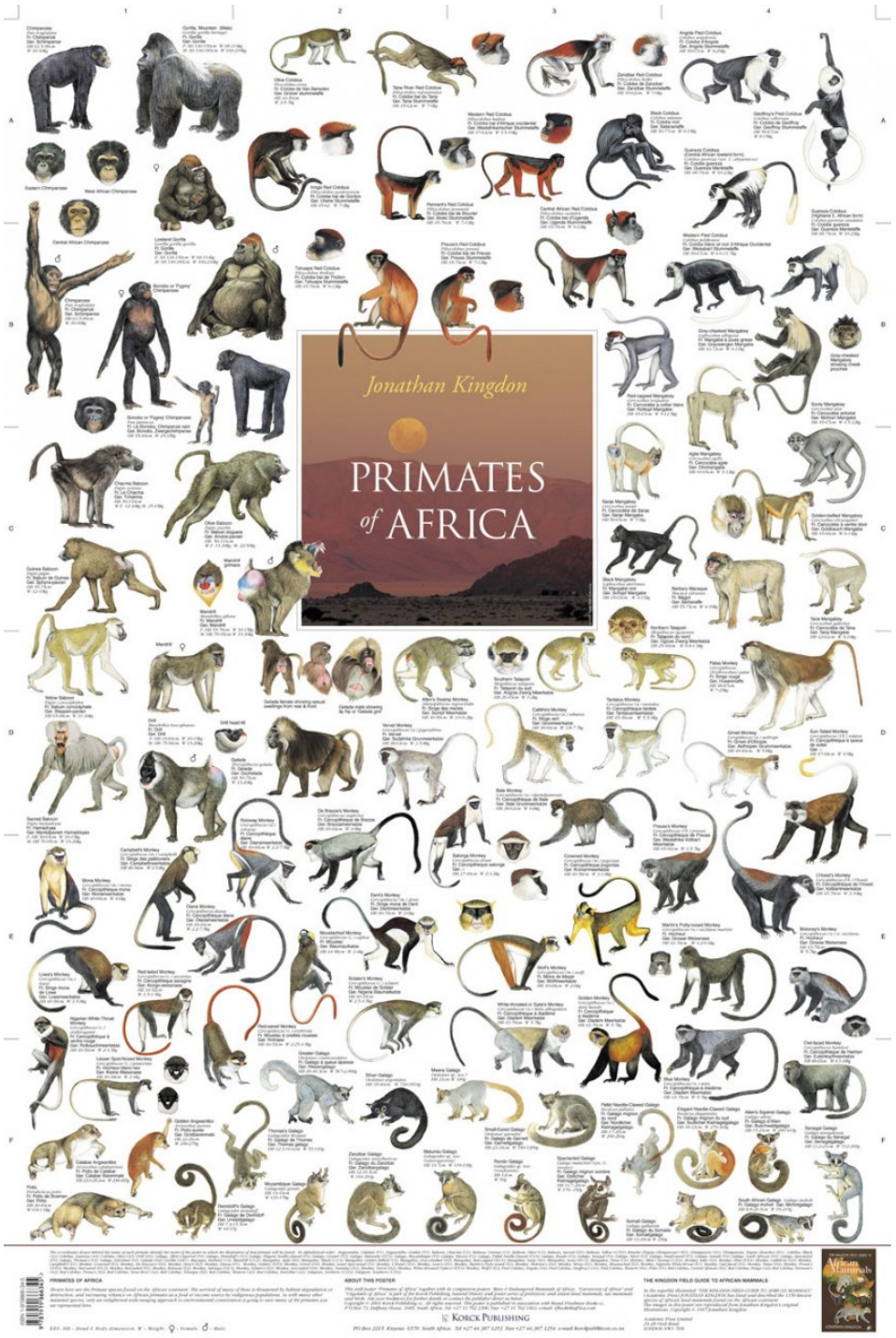
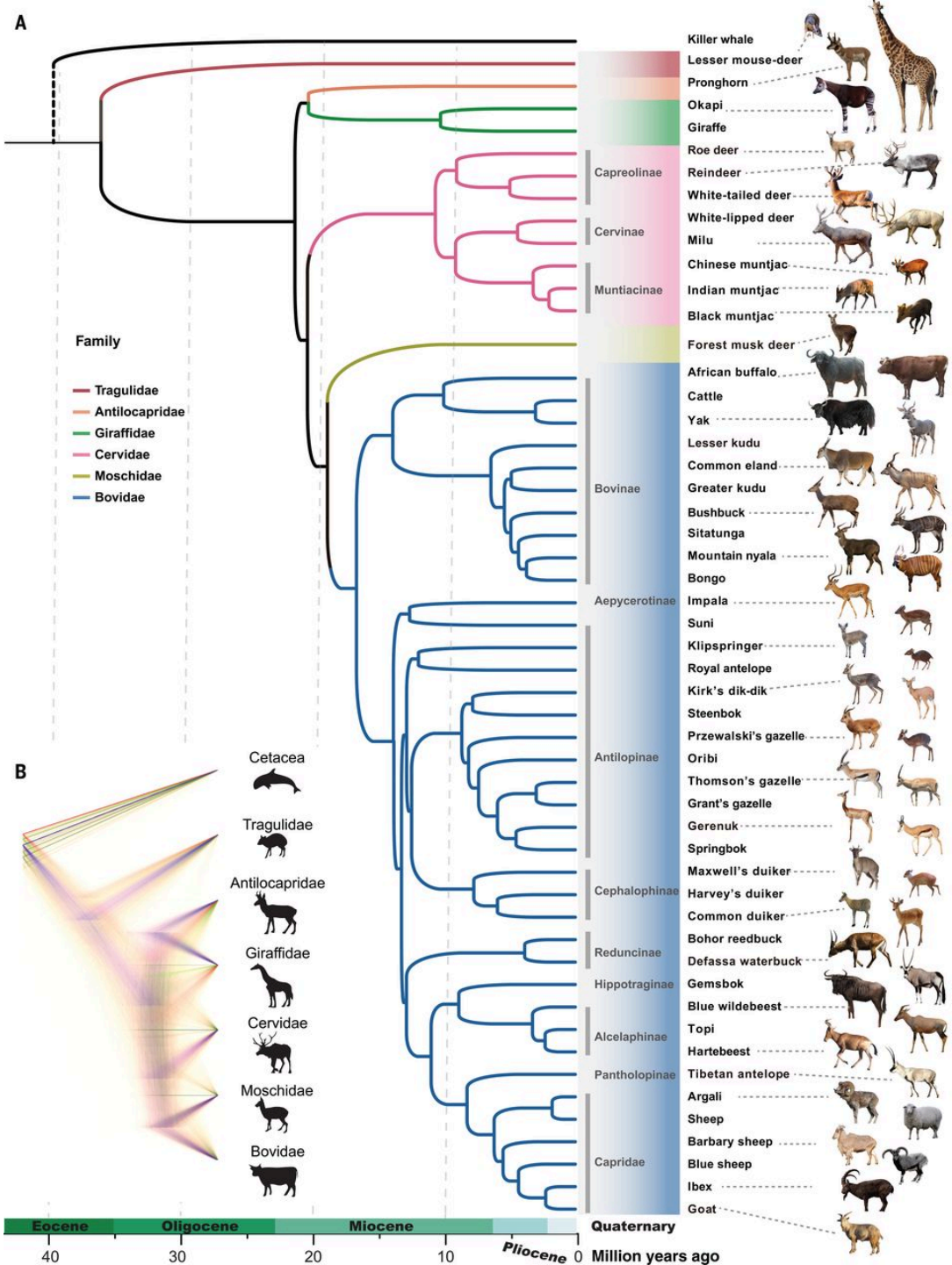
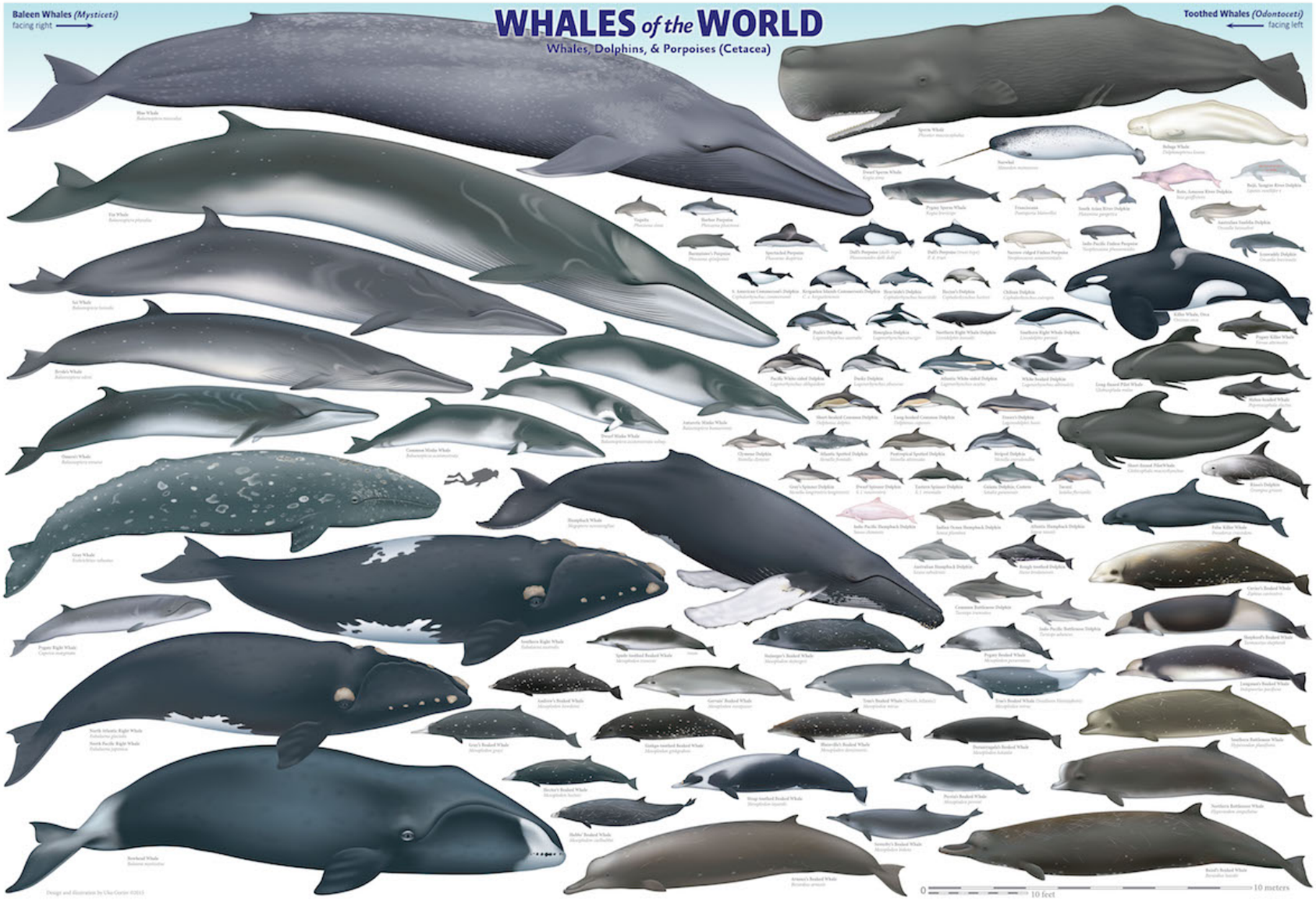

A
Lake Victoria
Lake Tanganyika
Lake Malawi
B
0.02
Bayesian posterior probabilities (>0.97)
Tanganyikan cichlid tribes:
Bathybatini
Boulengerochromini
Tylochromini
Tilapiini
Trematocarini
Eretmodini
Lamprologini
Limnochromini
Ectodini
Tropheini (Haplochromini)
Cyphotilapiini
Perissodini
Cyprichromini
Benthochromini


Phyllostominae
Lonchorhininae
Lonchophyllinae
Glossophaginae
Desmodontinae
Micronycterinae
Glyphonycterinae
Macrotinae
Mormoopidae
Carolliinae
Rhinophyllinae
Noctilionidae
Stenodermatinae
5 10 15 20 25 30 35 40 45
Ma


Jonathan Kingdon
CARNIVORES of AFRICA

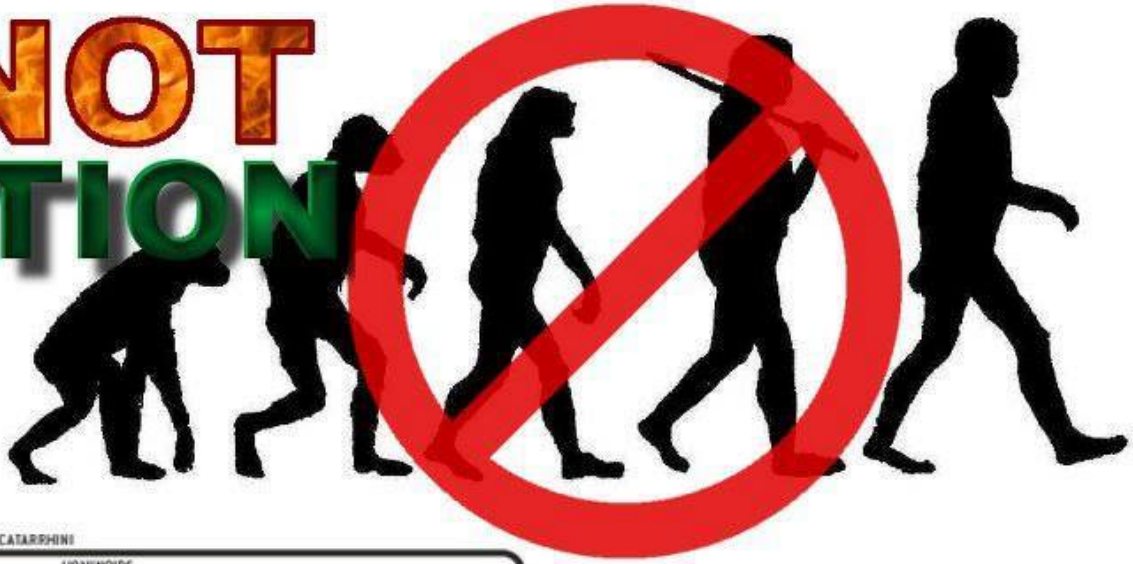

Jonathan Kingdon
PRIMATES of AFRICA


A
Killer whale
Lesser mouse-deer
Pronghorn
Okapi
Giraffe
Roe deer
Reindeer
White-tailed deer
White-lipped deer
Milu
Chinese muntjac
Indian muntjac
Black muntjac
Forest musk deer
African buffalo
Cattle
Yak
Lesser kudu
Common eland
Greater kudu
Bushbuck
Sitatunga
Mountain nyala
Bongo
Impala
Suni
Klipspringer
Royal antelope
Kirk's dik-dik
Steenbok
Przewalski's gazelle
Oribi
Thomson's gazelle
Grant's gazelle
Gerenuk
Springbok
Maxwell's duiker
Harvey's duiker
Common duiker
Bohor reedbuck
Defassa waterbuck
Gemsbok
Blue wildebeest
Topi
Hartebeest
Tibetan antelope
Argali
Sheep
Barbary sheep
Blue sheep
Ibex
Goat
Capreolinae
Cervinae
Muntiacinae
Bovinae
Aepycerotinae
Antilopinae
Cephalophinae
Reduncinae
Hippotraginae
Alcelaphinae
Pantholopinae
Capridae
Family
Tragulidae
Antilocapridae
Giraffidae
Cervidae
Moschidae
Bovidae
B
Cetacea
Tragulidae
Antilocapridae
Giraffidae
Cervidae
Moschidae
Bovidae
Eocene
Oligocene
Miocene
Pliocene
Quaternary
40
30
20
10
0
Million years ago

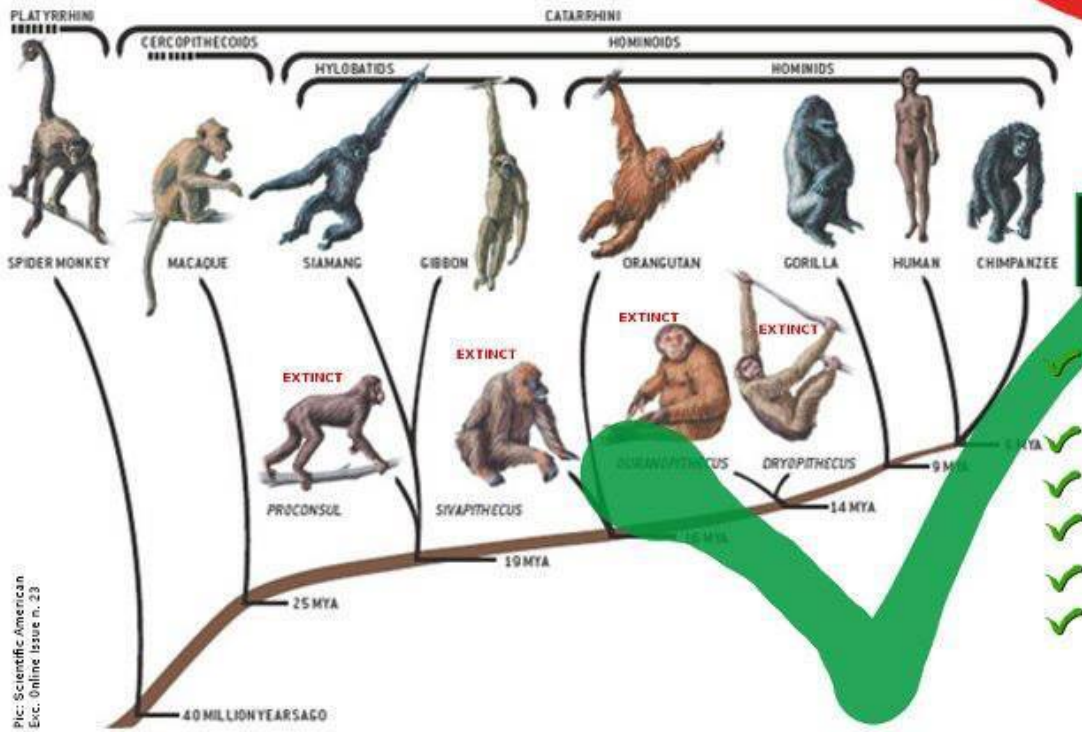

WHALES of the WORLD
Whales, Dolphins, & Porpoises (Cetacea)
Baleen Whales (Mysticeti)
facing right
Toothed Whales (Odontoceti)
facing left
0
10 feet
10 meters

Looking at human evolution

THIS IS NOT EVOLUTION



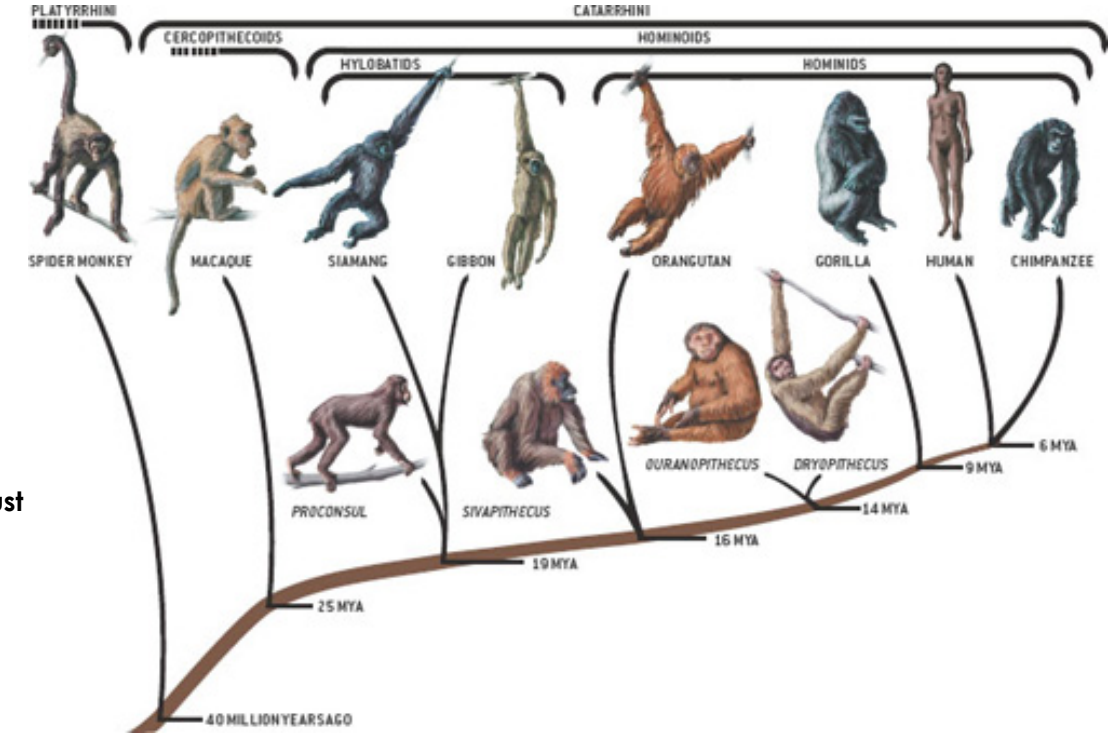
- This is *Scala Naturae*, an incorrect pre-evolutionary concept
- Suggests progress, not adaptation
- Human is a target, superior being
- Ancestor being resembles a chimp
- No branches or extinctions



THIS IS EVOLUTION

- Humans are not special. Just a species, not superior, "more evolved" or a target.
- Some species become extinct (99% of them)
- Chimps are not portraited as ancestors
- Individual beings do not change. Populations do
- Ancestor species branches into other species
- Adaptations might lead to smaller size, loss of unused features and extinction

suggests humans are not special but just another species

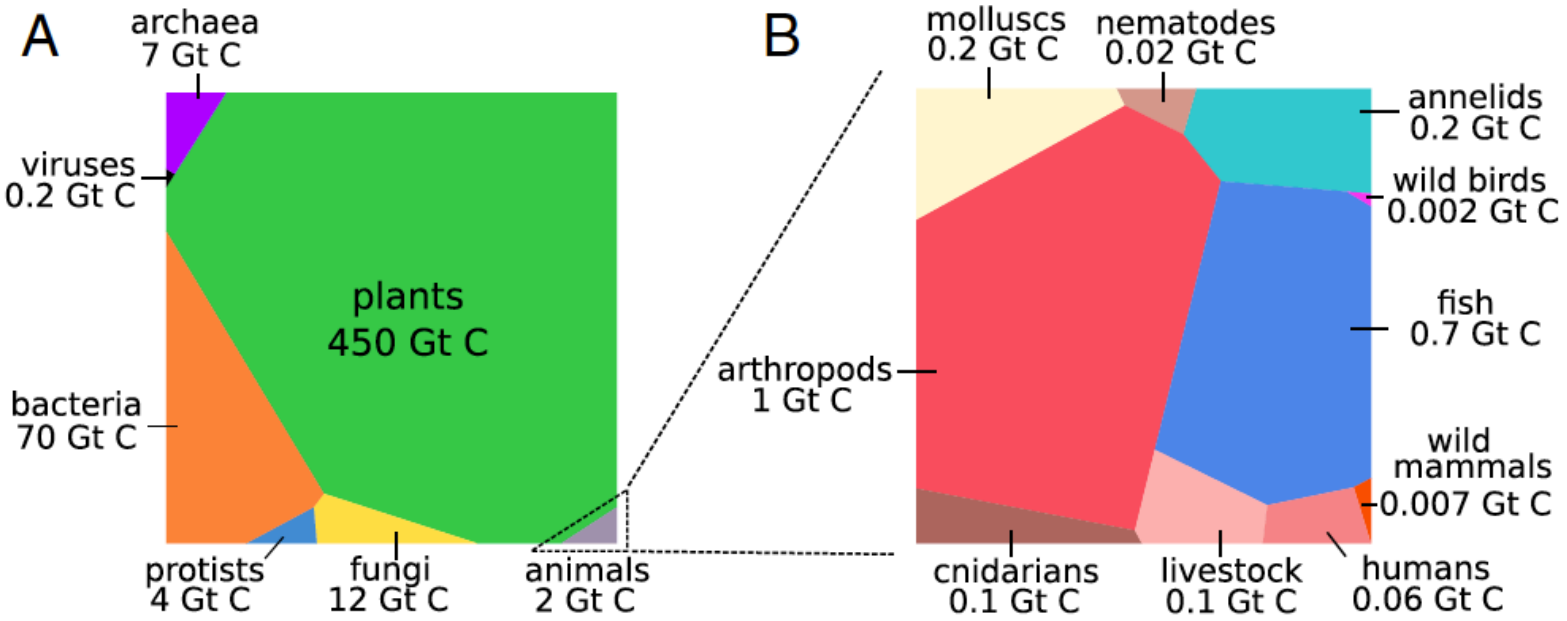


The state of the planet

The biomass distribution on Earth

Yinon M. Bar-On[a], Rob Phillips[b,c], and Ron Milo[a,1]

www.pnas.org/cgi/doi/10.1073/pnas.1711842115



estimate for reptiles similar magnitude as wild birds (but more assumptions; estimate for amphibians not possible)

The state of the planet

The biomass distribution on Earth

Yinon M. Bar-On[a], Rob Phillips[b,c], and Ron Milo[a,1]

www.pnas.org/cgi/doi/10.1073/pnas.1711842115

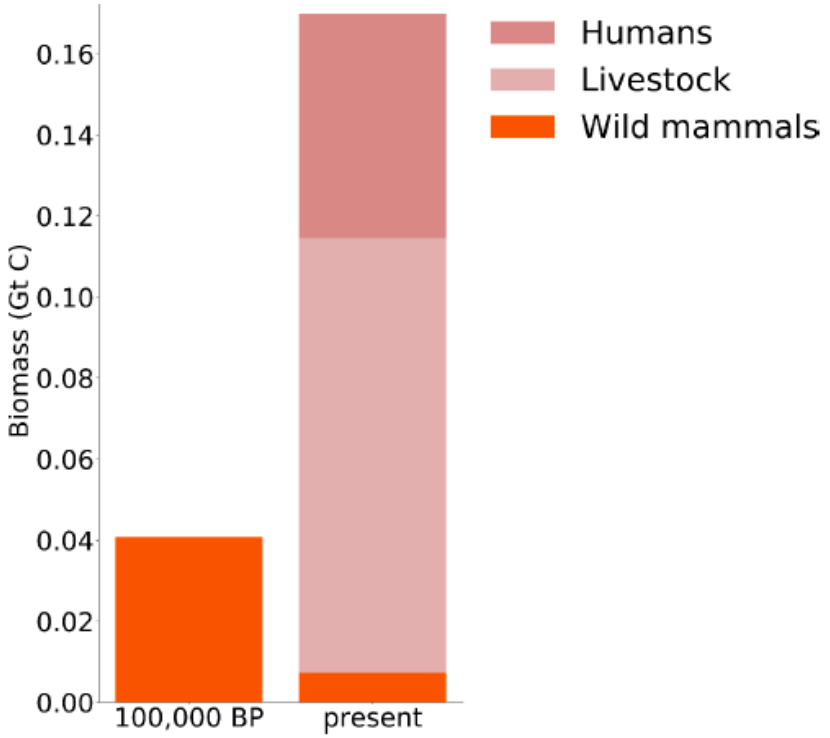
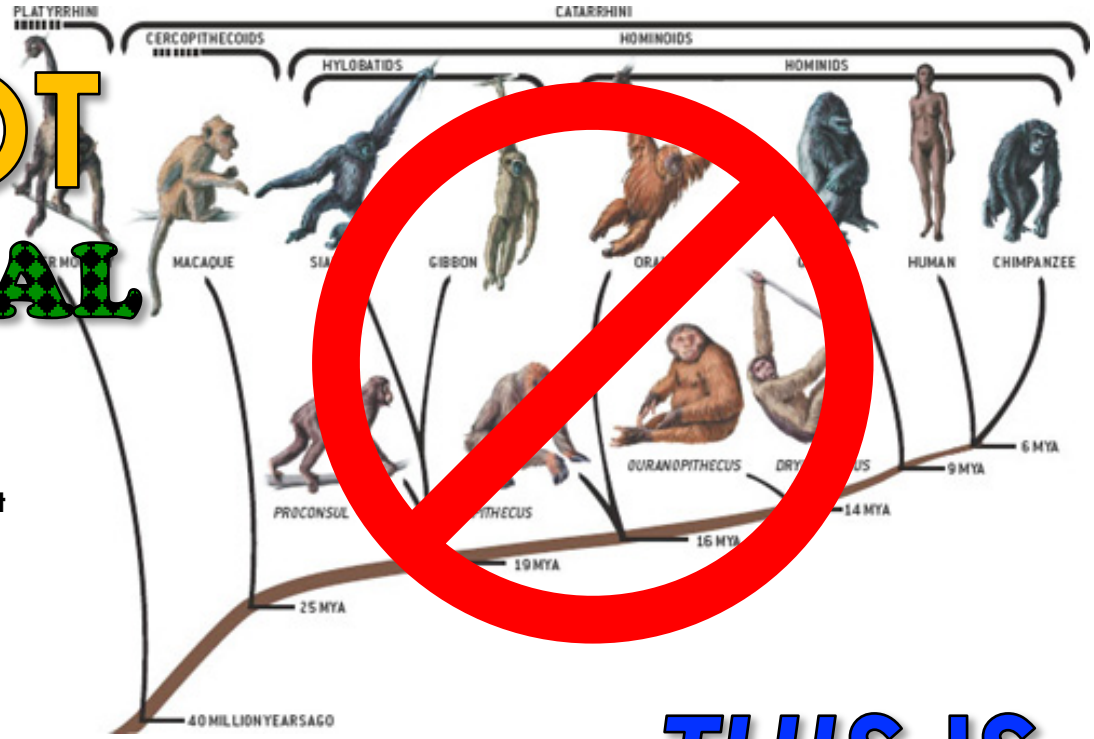


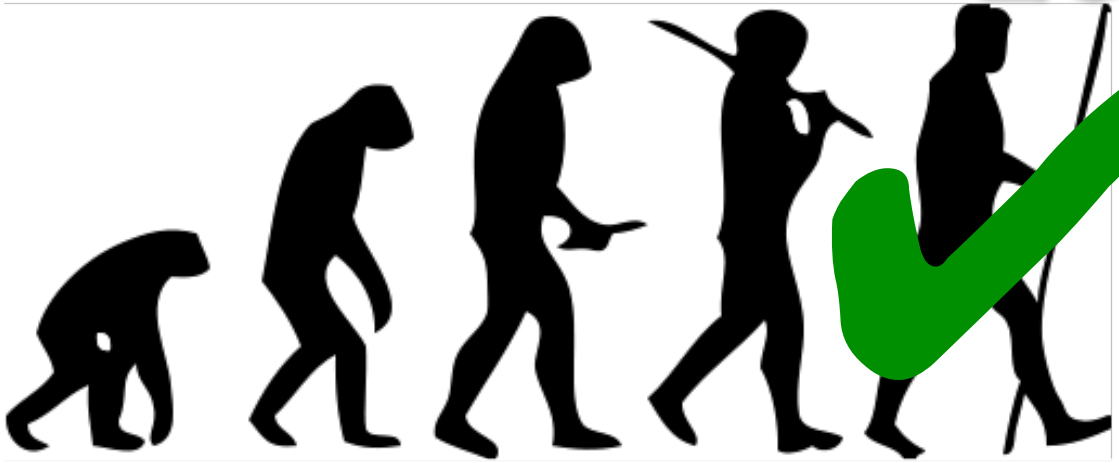
Fig. S5. The impact of human civilization on the biomass of mammals.

THIS IS NOT ECOLOGICAL REALITY



⊘ suggests humans are not special but just another species

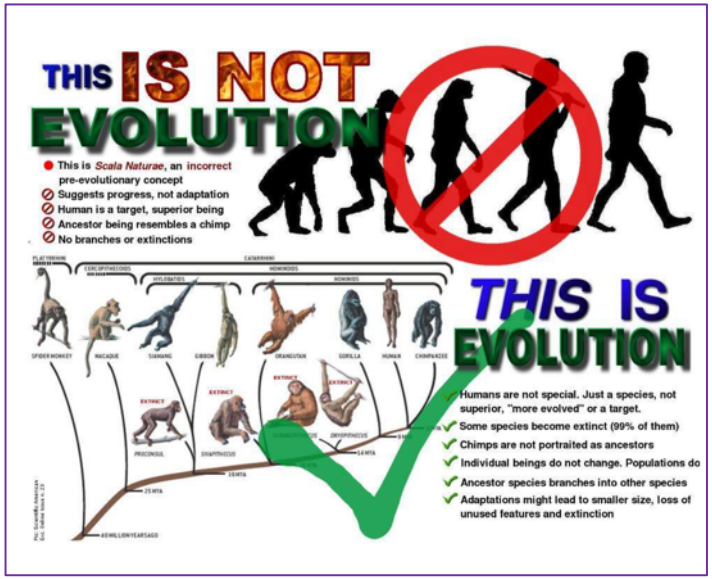
THIS IS ECOLOGICAL REALITY

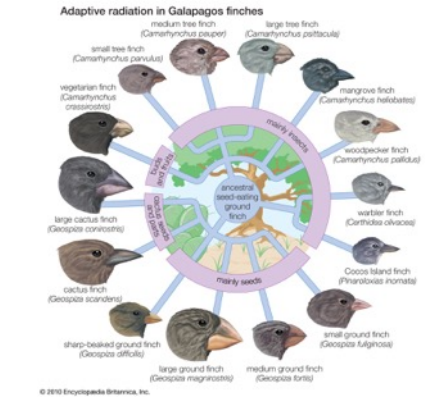


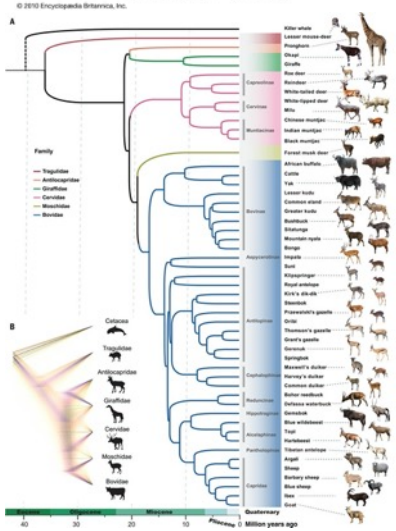
✔ suggests not only adaptation but something beyond ('progress')

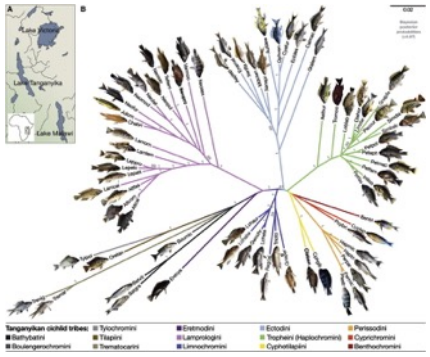
✔ suggests modern humans are ecologically dominant

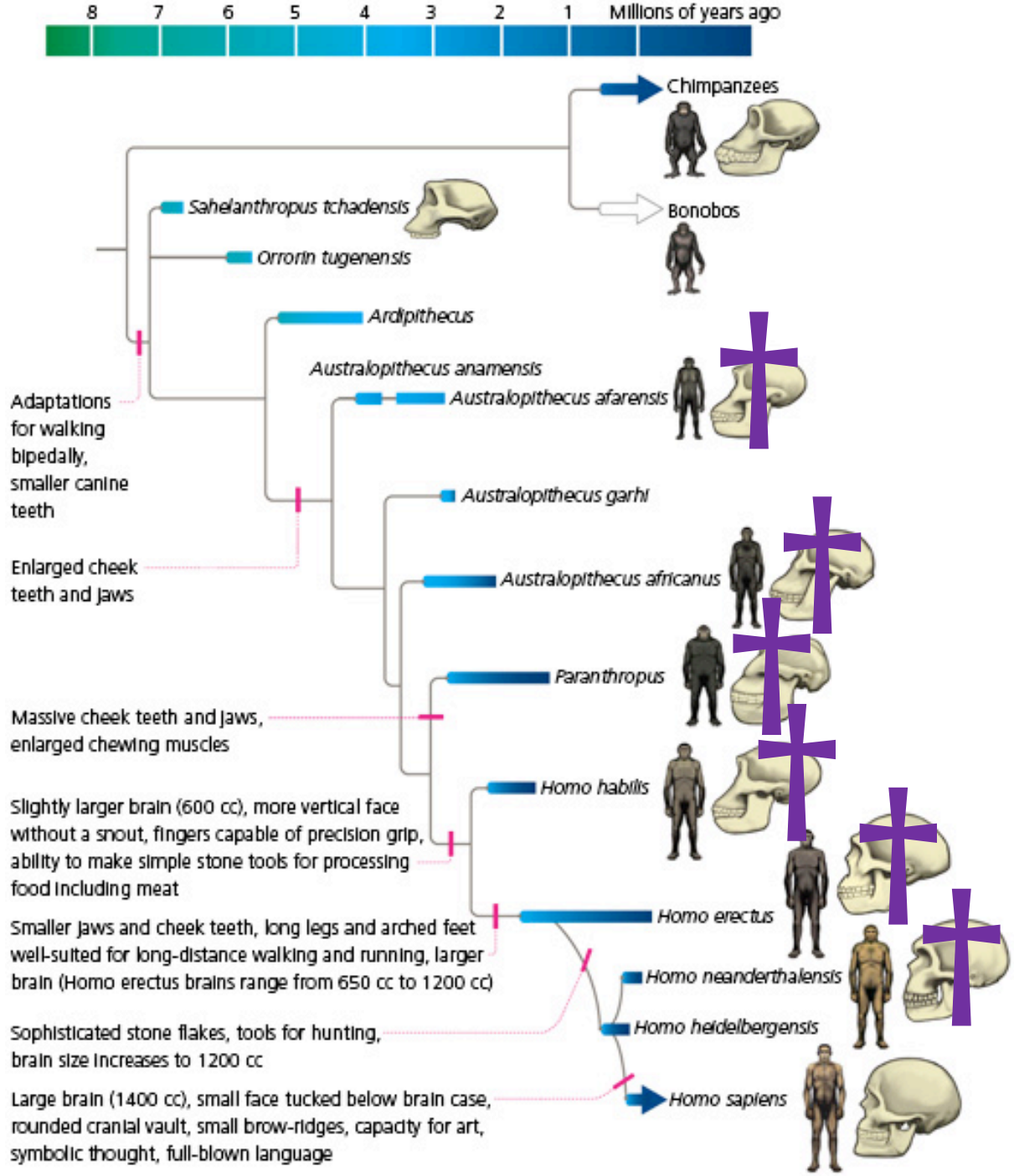
The evolution of ecological dominance

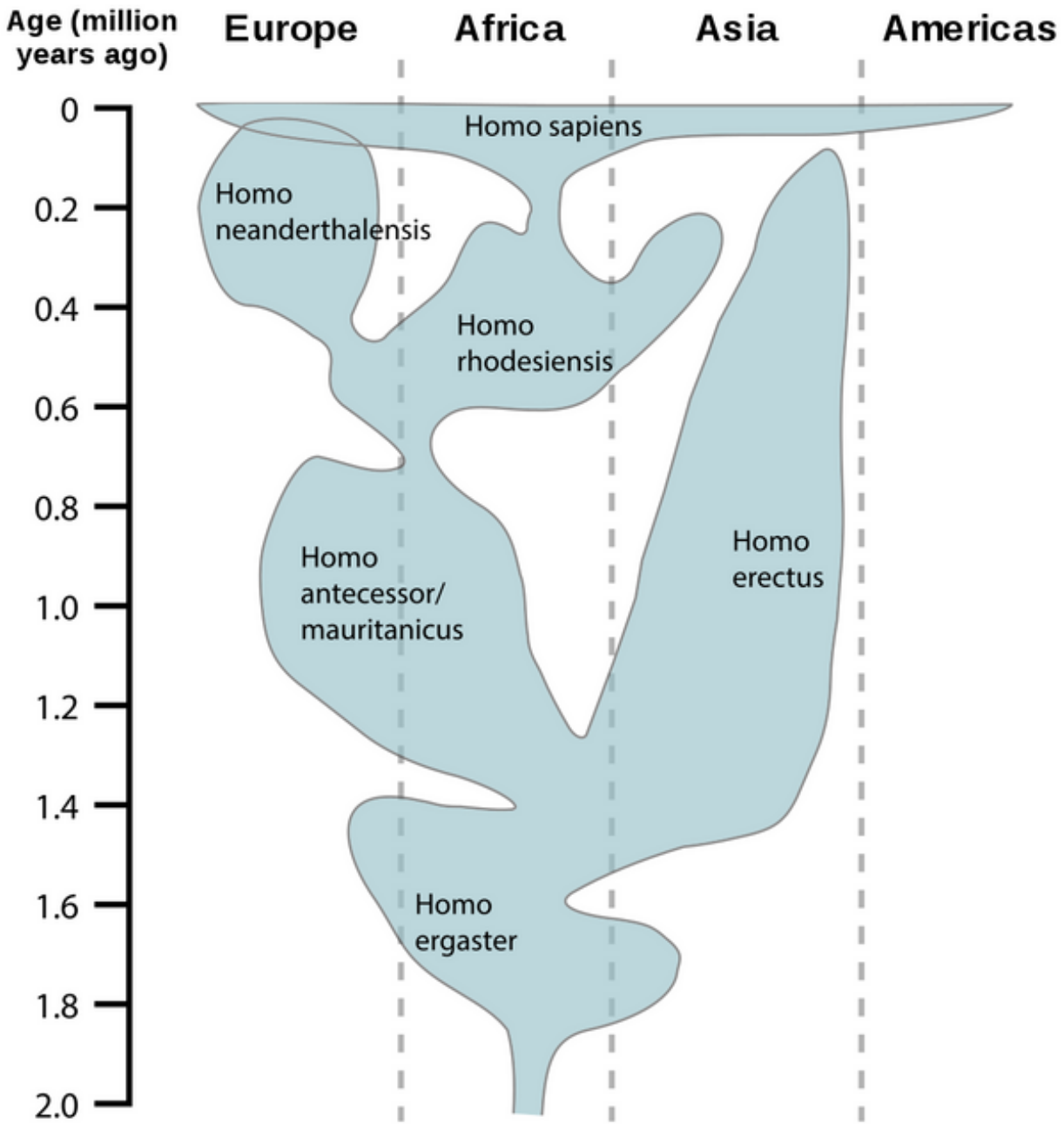



Adaptive radiation in Galapagos finches
medium tree finch (Camarhynchus pauper)
large tree finch (Camarhynchus psittacula)
small tree finch (Camarhynchus parvulus)
vegetarian finch (Camarhynchus crassirostris)
mangrove finch (Camarhynchus heliobates)
woodpecker finch (Camarhynchus pallidus)
warbler finch (Certhidea olivacea)
Cocos Island finch (Pinarolaxias inornata)
small ground finch (Geospiza fuliginosa)
medium ground finch (Geospiza fortis)
large ground finch (Geospiza magnirostris)
sharp-beaked ground finch (Geospiza difficilis)
cactus finch (Geospiza scandens)
large cactus finch (Geospiza conirostris)
mainly insects
mainly seeds
ancestral seed-eating ground finch
© 2010 Encyclopaedia Britannica, Inc.


A
B
Family
Cetacea
Traguliidae
Antilocapridae
Giraffidae
Cervidae
Moschidae
Bovidae
Quaternary
Million years ago


A
B
Lake Victoria
Lake Tanganyika
Lake Malawi
Tanganyikan cichlid tribes:
Tylochromini
Eretmodini
Ectodini
Perissodini
Bathybatini
Tilapiini
Lamprologini
Trophein (Haplochromini)
Cyprichromini
Boulengerochromini
Trematocarini
Limnochromini
Cyphotilapiini
Benthochromini


8
7
6
5
4
3
2
1
Millions of years ago
Chimpanzees
Bonobos
Sahelanthropus tchadensis
Orrorin tugenensis
Ardipithecus
Australopithecus anamensis
Australopithecus afarensis
Australopithecus garhi
Australopithecus africanus
Paranthropus
Homo habilis
Homo erectus
Homo neanderthalensis
Homo heidelbergensis
Homo sapiens
Adaptations for walking bipedally, smaller canine teeth
Enlarged cheek teeth and jaws
Massive cheek teeth and jaws, enlarged chewing muscles
Slightly larger brain (600 cc), more vertical face without a snout, fingers capable of precision grip, ability to make simple stone tools for processing food including meat
Smaller jaws and cheek teeth, long legs and arched feet well-suited for long-distance walking and running, larger brain (Homo erectus brains range from 650 cc to 1200 cc)
Sophisticated stone flakes, tools for hunting, brain size increases to 1200 cc
Large brain (1400 cc), small face tucked below brain case, rounded cranial vault, small brow-ridges, capacity for art, symbolic thought, full-blown language


Age (million years ago)
Europe
Africa
Asia
Americas
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Homo sapiens
Homo neanderthalensis
Homo rhodesiensis
Homo antecessor/ mauritanicus
Homo erectus
Homo ergaster

Bursts of radiation occur when a life form meets ***a series of niches*** *that is not occupied or occupied by 'lesser solutions'.*

Dealing with resources

By which means can organisms become more efficient?

adapting to optimal resource use
(niche specificity)

The Human Ecological Niche

DONALD L. HARDESTY

AMERICAN ANTHROPOLOGIST

1972

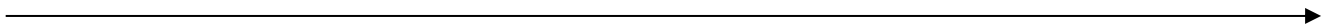
Man is not specialized for a specific physical environment;

Dealing with resources

By which means can organisms become more efficient?

adapting to optimal resource use
(niche specificity)

controlling a broad set of resources
(niche generalism)
"super-niche" emergence



Probabilistic directionality IV: from use towards control

Hypothesis:
The characteristics required to facilitate 'resource control' are of such a generic nature, and independent of any specific resource itself, that ***no several 'control niches' exist****.*
There is no room for several species.

Changing the taxonomic level

adapting to optimal resource use
(niche specificity)

controlling a broad set of resources
(niche generalism)
"super-niche" emergence

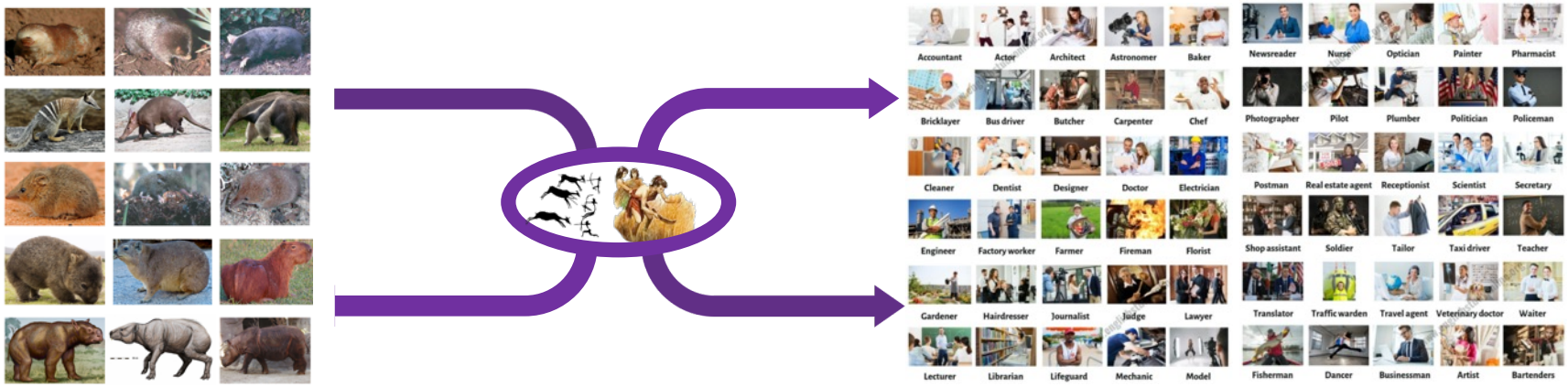
niche specificity between species

niche specificity within the single species

Changing the taxonomic level

adapting to optimal resource use
(niche specificity)

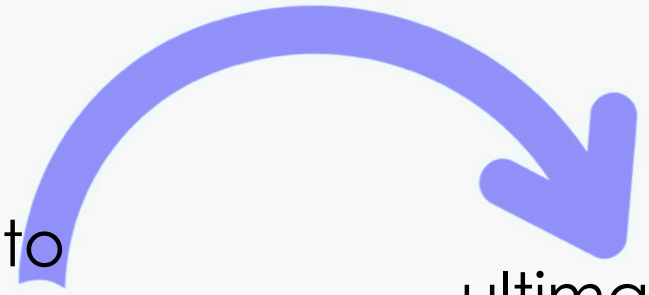
controlling a broad set of resources
(niche generalism)
"super-niche" emergence



niche specificity between species

niche specificity within the single species

Adaptation ➟ Ecological Dominance ➟ Control

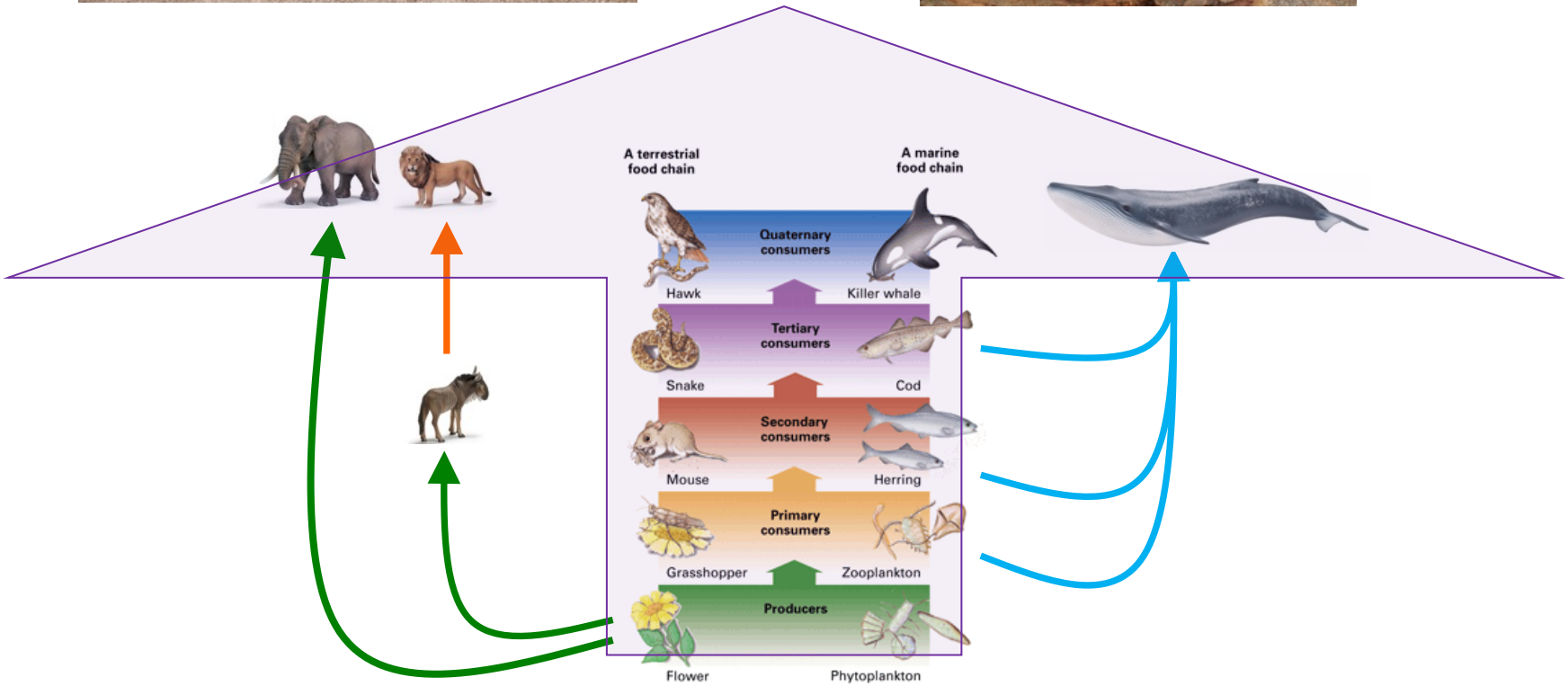


adapting to optimal resource use
(niche specificity)

ultimate predator
(by cooperation, fire, distance weaponry)

resource control
(niche generalism)

Food chain dominance



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Evolution of Coalitionary Killing

RICHARD W. WRANGHAM

YEARBOOK OF PHYSICAL ANTHROPOLOGY 42:1–30 (1999)

The evolution of lethal intergroup violence

Raymond C. Kelly*

PNAS | October 25, 2005 | vol. 102 | no. 43

resources.† Thus, although intercommunity dominance "tends to lead to increased fitness of the killers through improved access to resources such as food, females, or safety" (ref. 6, p. 12), territorial gain is the critical ingredient for the realization of this fitness enhancement.

Human Evolution and Human History: A Complete Theory

PAUL M. BINGHAM

Evolutionary Anthropology 2000

. . . weaponry innovations are not merely permissive here. They actually drive the emergence of a new scale or level of social cooperation . . .

Adaptation ➟ Ecological Dominance Social Competition ➟ Control

adapting to optimal resource use
(niche specificity)

more efficient threat to other groups

ultimate predator
(by cooperation, fire, distance weaponry)

less intra-group violence

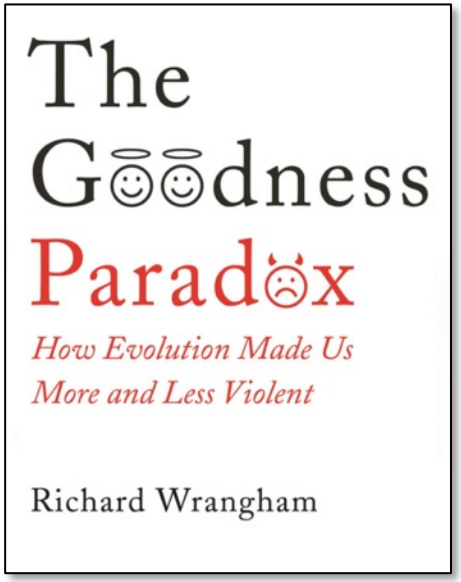
better cooperation

resource control
(niche generalism)

Two types of aggression in human evolution

Richard W. Wrangham[a,1]

PNAS | **January 9, 2018** | vol. 115 | no. 2 | **245–253**



"A hydrogen bomb is an example of mankind's enormous capacity for friendly cooperation."

Bigelow (1968)

Volleyball

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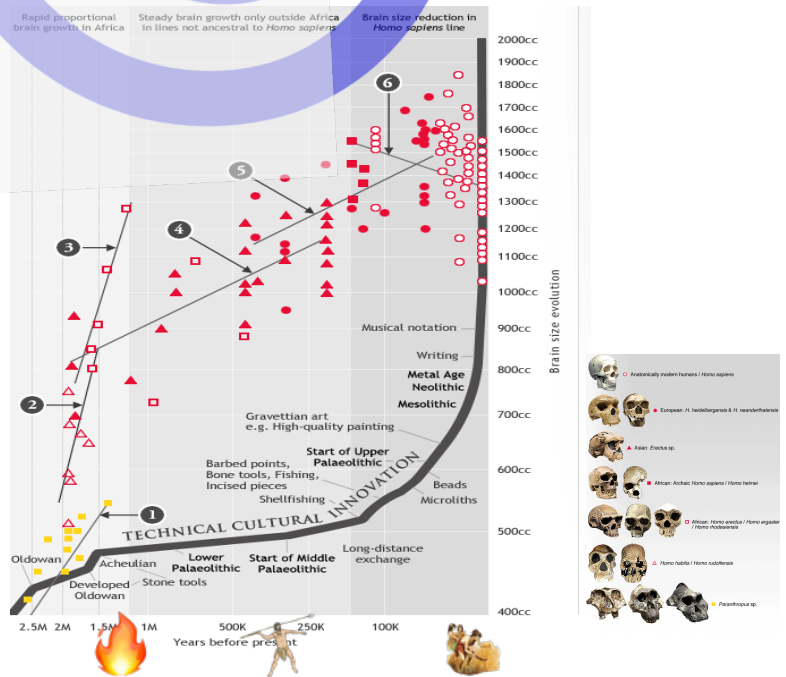

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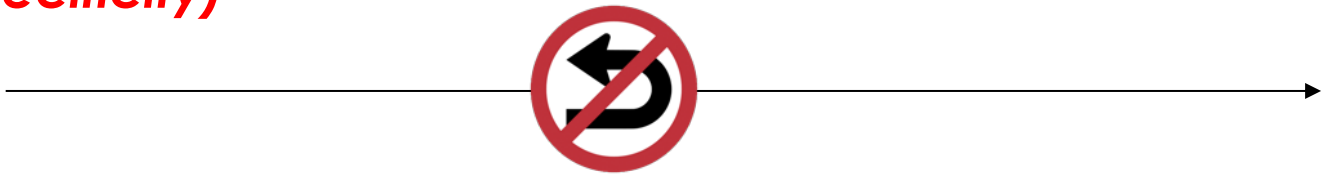
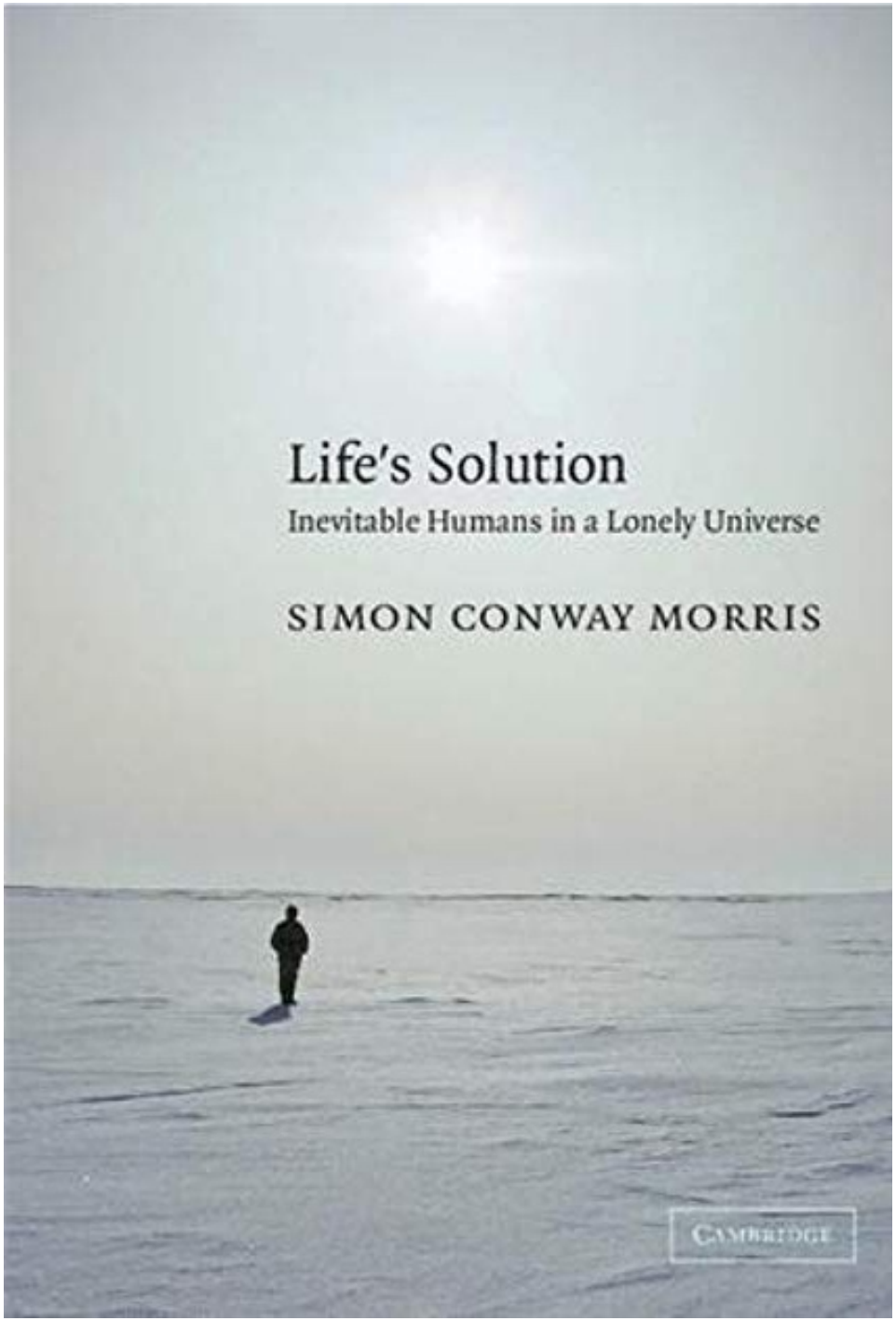


Probabilistic directionality IV: from use towards control

once control evolves,
there is no turning back

Evolution is
life's permanent suggestion
of new solutions
to the question of itself.


Life's Solution
Inevitable Humans in a Lonely Universe
SIMON CONWAY MORRIS
CAMBRIDGE

Adaptation ➟ Ecological Dominance Social Competition ➟ Control

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resource control

Probabilistic directionality IV: from use towards control

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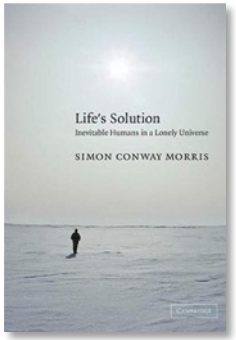

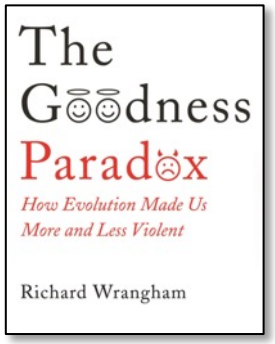

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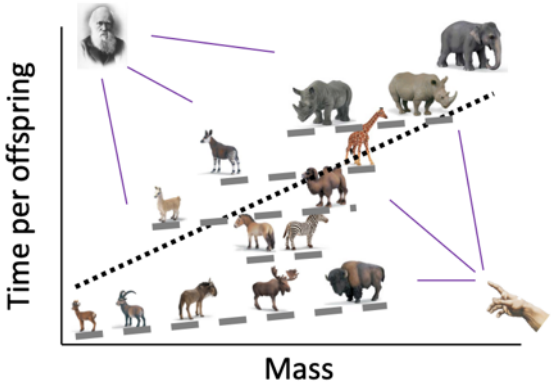
Niches exist and are filled by organisms evolving into them. The concept of Darwinian evolution includes change over time, and competition. We need to be aware what this means for our narratives.



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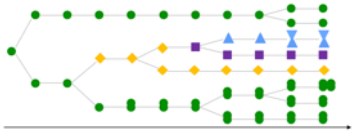
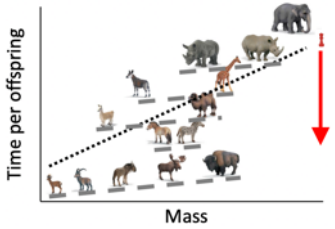
Regardless of environmental stochasticity, life evolution contains directional elements that do not represent a plan but inevitability.





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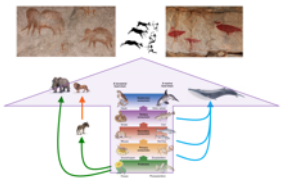

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Fallacy ! Alert !

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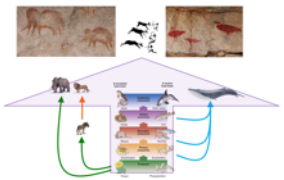

thank you for your attention