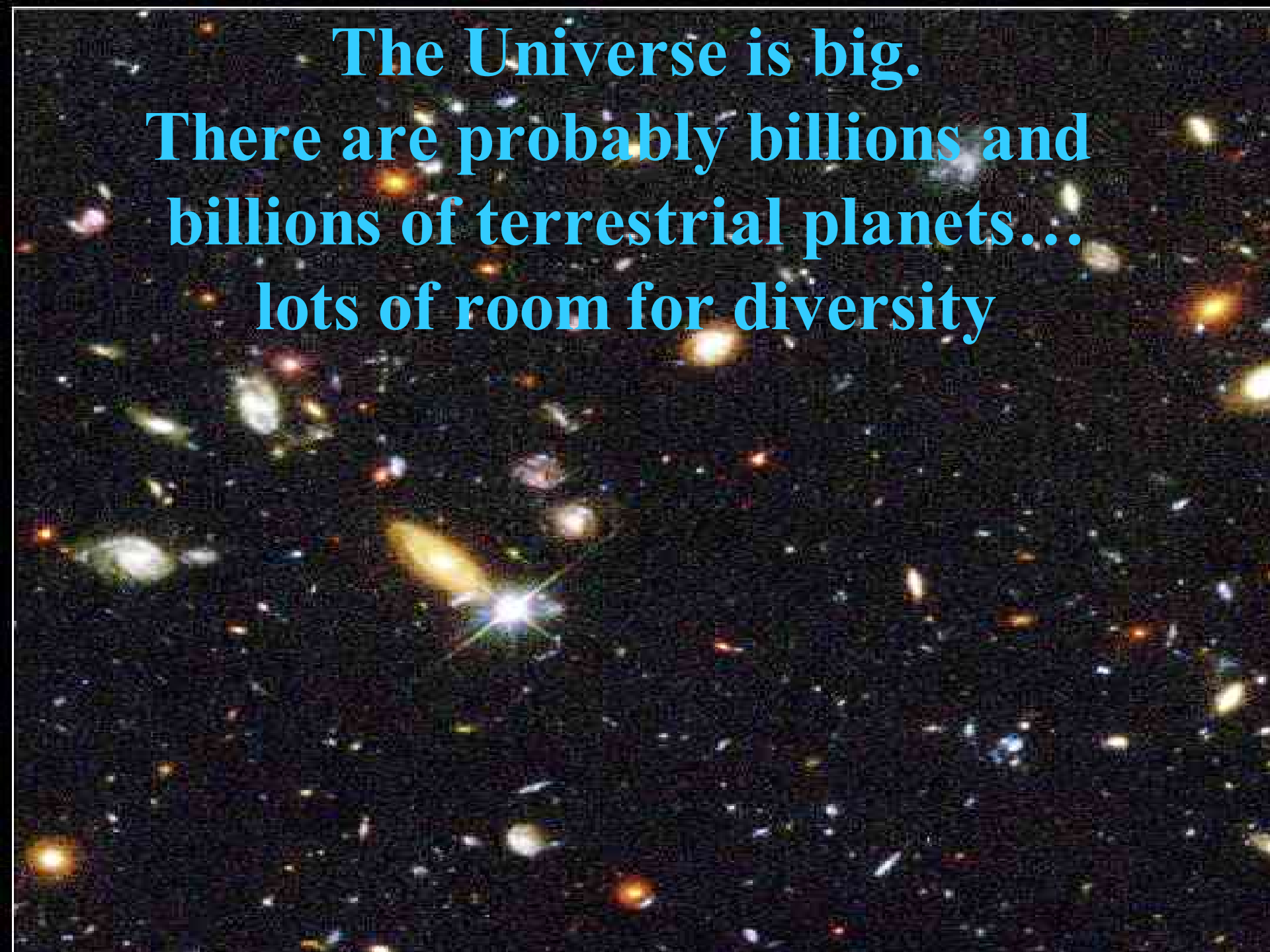
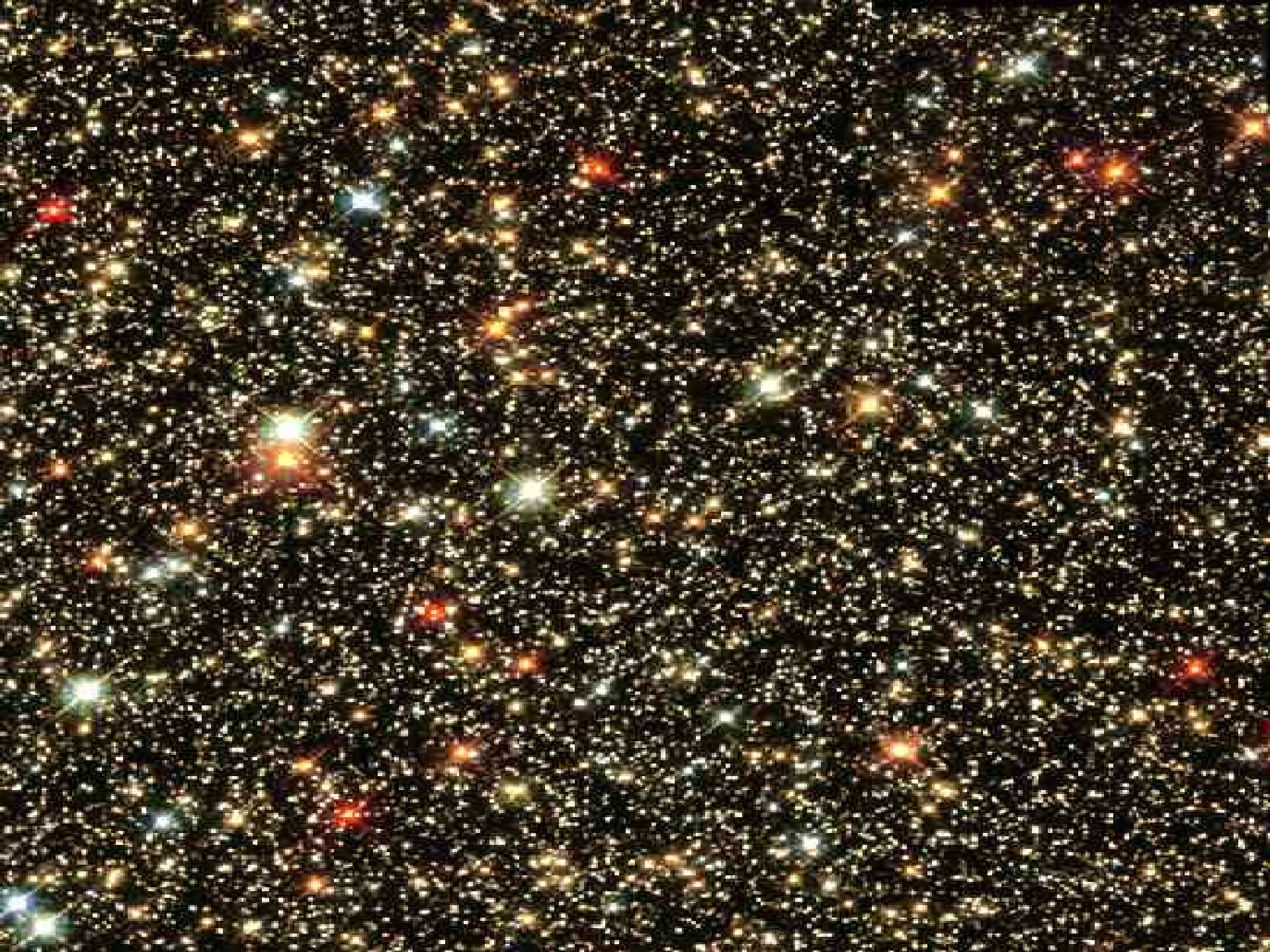
Are aliens smarter than we are? Is intelligence a convergent trait of evolution?

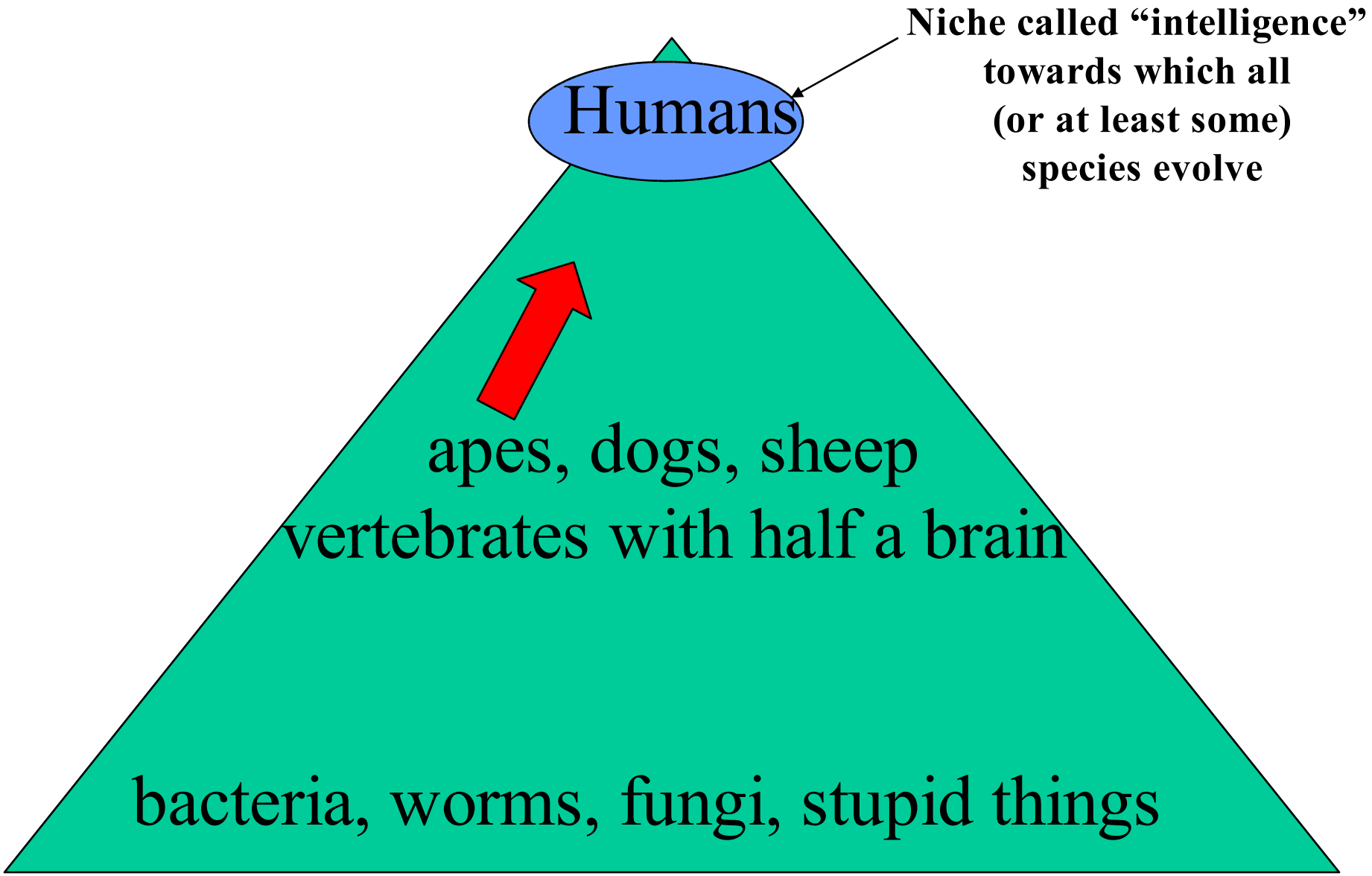

The Universe is big.
There are probably billions and billions of terrestrial planets…
lots of room for diversity



Is there extraterrestrial life?
Is there extraterrestrial intelligence?


Is Human Intelligence a
Convergent Feature of Evolution?

Planet of the Apes Hypothesis



Intelligence is a very useful adaptation. It allows homo sapiens to manipulate the environment, build buildings and cities and roads and air conditioners. It allows them to make carts and cars and clothes and computers and chemical weapons.

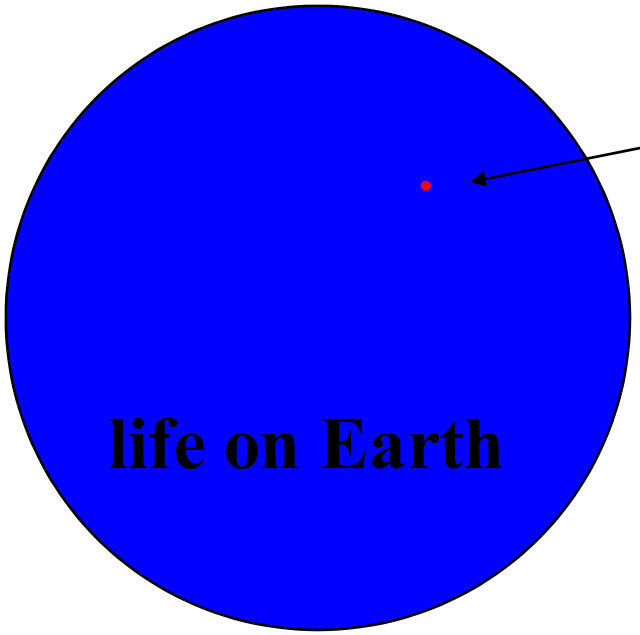
1) The intelligence of homo sapiens sets them apart from the other life forms on Earth.

2) Intelligence is such a useful adaptation that other life forms elsewhere would acquire it just as humans have.

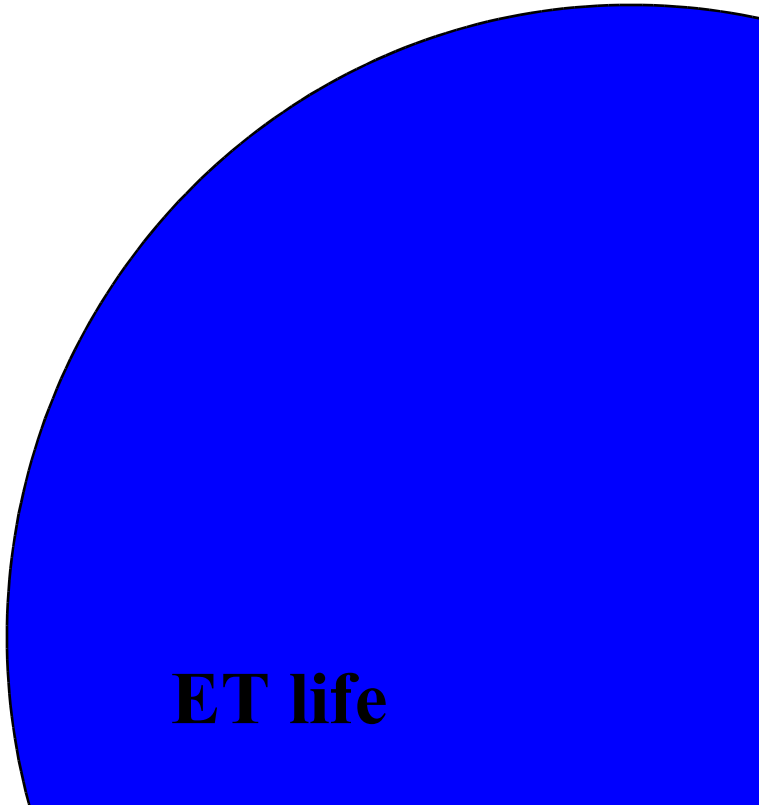
If we had a spaceship that could take us quickly to lots of earth-like planets all over the Galaxy we could answer both questions:

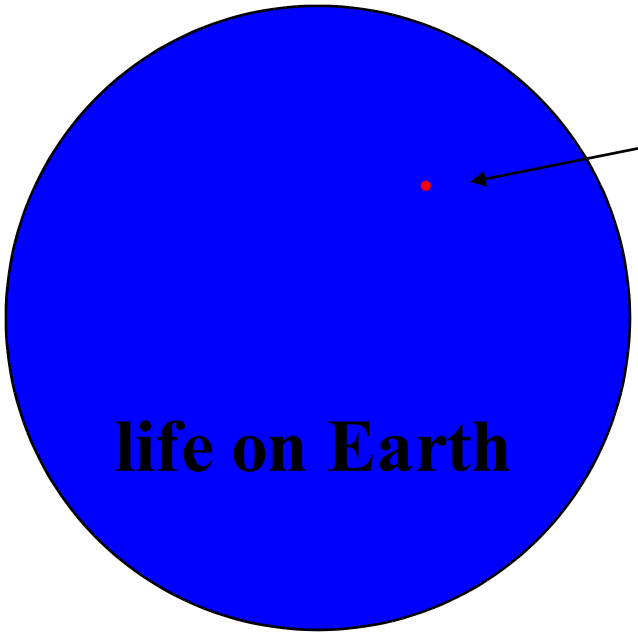
Earth-like planet: 13987

mass:	1.2 earth masses
age:	6.4 Gyr
water:	yes
life:	yes (if yes, describe)
intelligence:	no (if yes, describe)

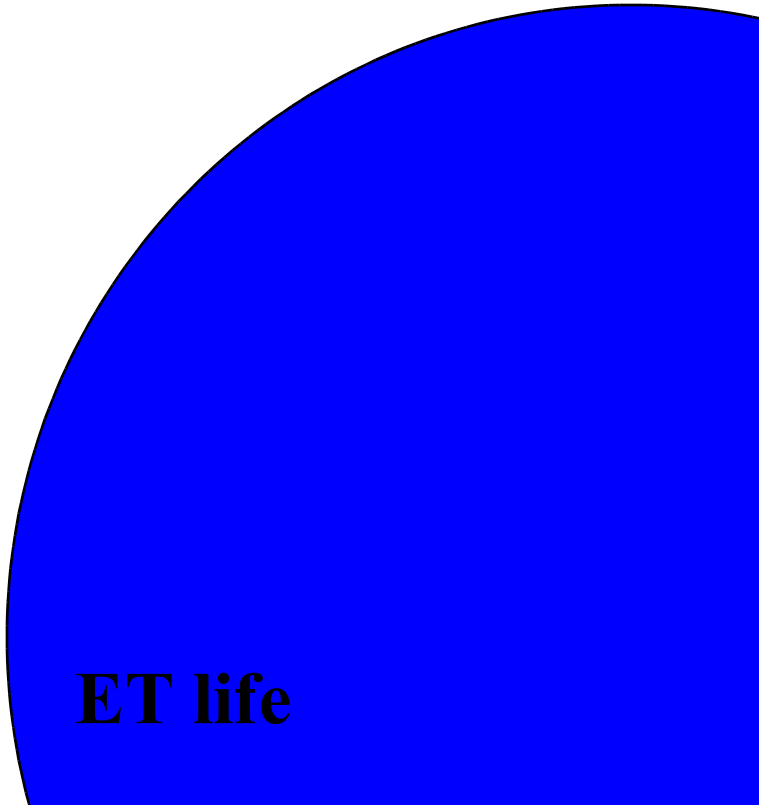


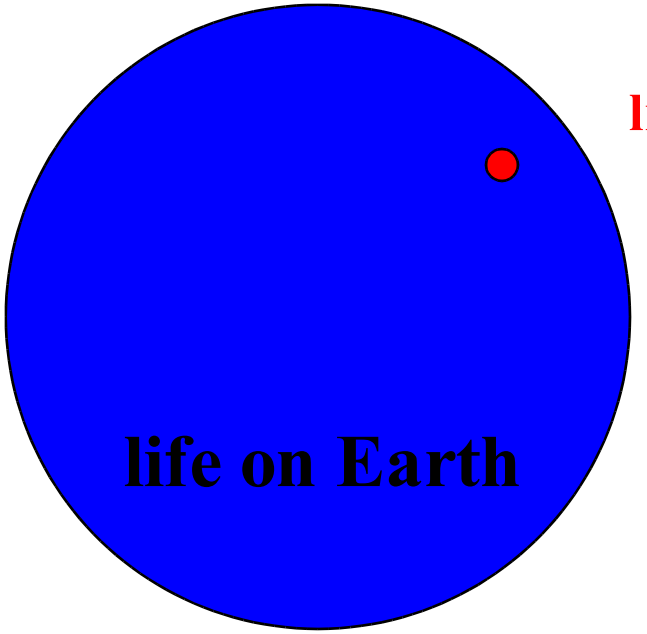
no Homo sapiens





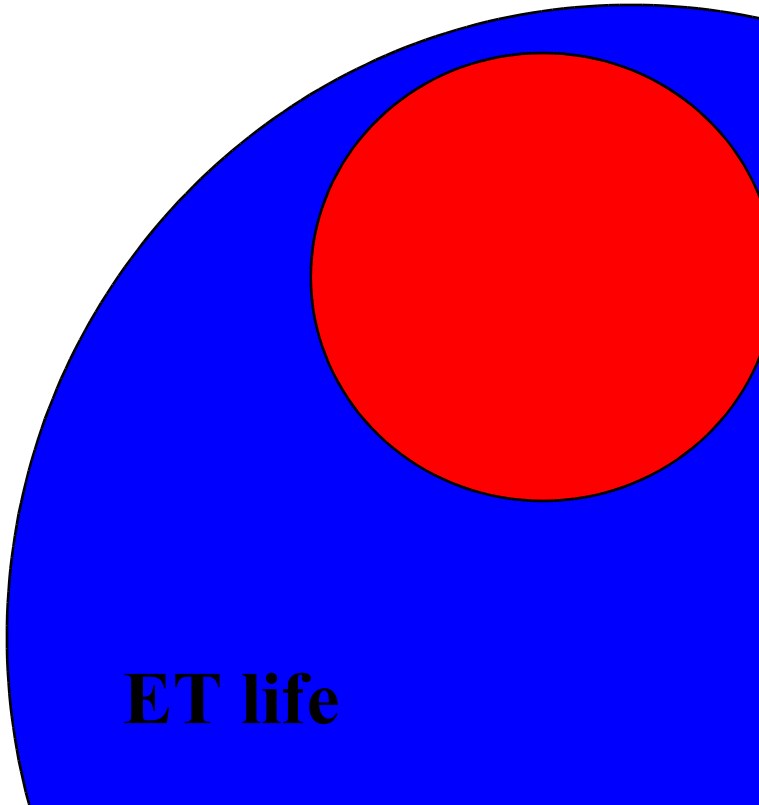
no human intelligence

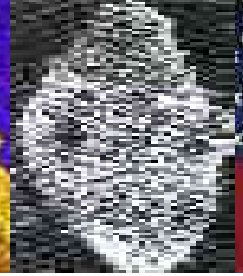


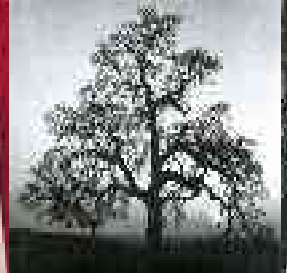


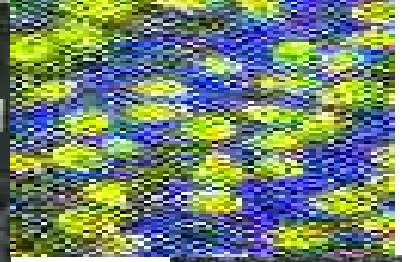
intelligent
life on Earth

intelligent ETs

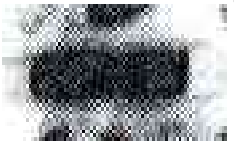












Microsporidia
Animals
Plants
Fungi
Flagellates
Ciliates
Slime molds
Diplomonads
Eucarya
Archaea
Green non-sulfur bacteria
Gram positives
Purple bacteria
Cyano-bacteria
Flavobacteria
Thermotoga
Aquifex
Sulfolobus
Desulfuro-coccus
Pyro-dictium
Thermofilum
Thermoproteus
Pyrobaculum
Thermococcus
Methano-thermus
Methanobacterium
Archaeoglobus
Halococcus
Halobacterium
Methanoplanus
Methanospirillum
Methanosarcina
Methano-pyrus
1
2
3
4
Methanococcus
1 jannaschii
2 igneus
3 thermolithotrophicus
4 vannielii

If some characteristic has evolved several times independently here on Earth (convergence) this suggests we might find it in alien life.

Examples: flight in insects, birds, bats

bipedalism in birds and apes

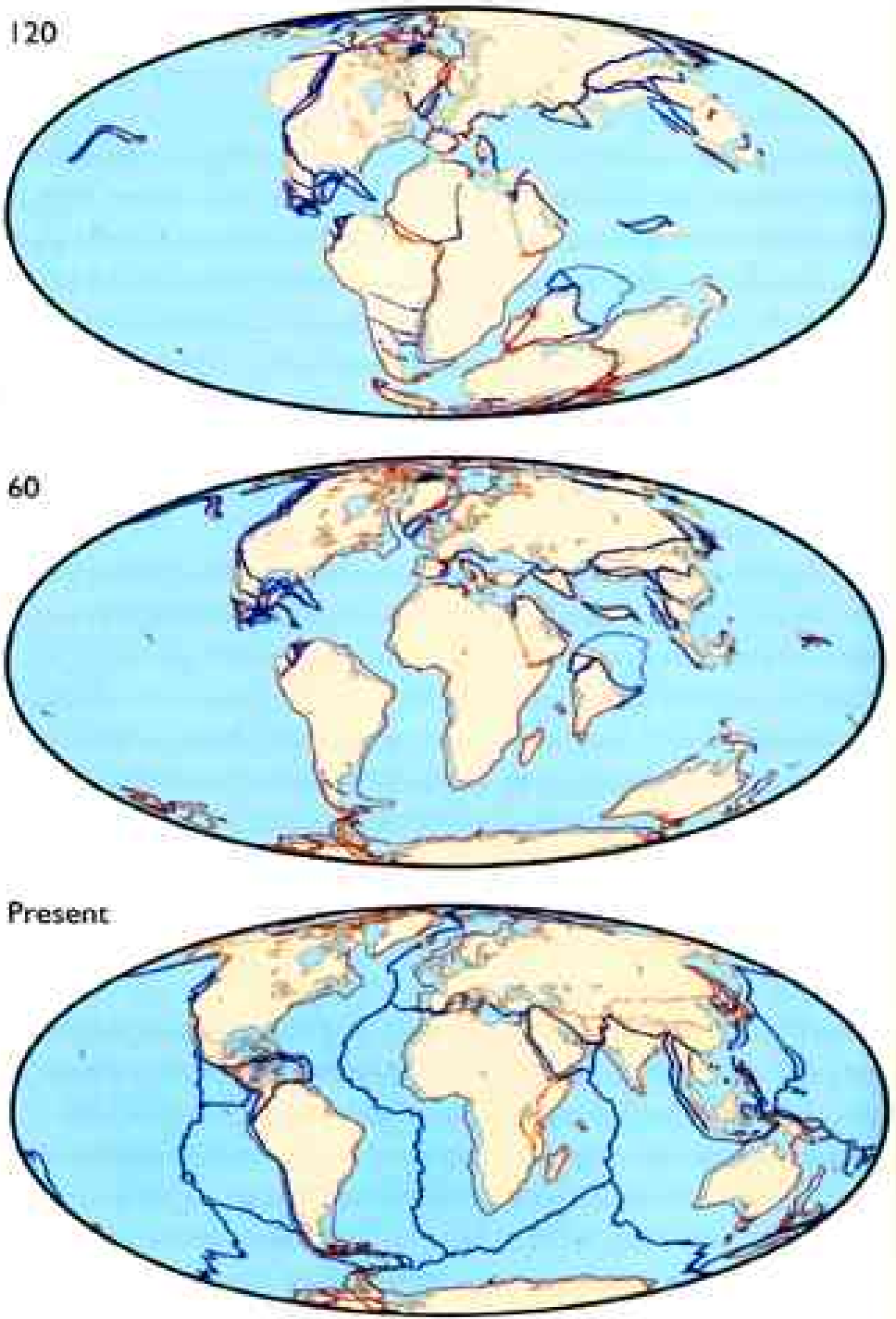
multicellularity in algae and eukaryotes

However, it appears that the following features have only evolved once: heads, backbones, apes, plants, animals.

What about intelligence? Is it a niche?…like the grazer niche filled by deer in the northern hemisphere and by kangaroos in Australia. The carnivore niche filled by coyotes and tigers in the north and by thylacines and Tasmanian devils in Australia.

If it is a niche, then we should expect it to be filled on independent continents. What has evolved to fill the intelligence niches in Australia, New Zealand, South America, North America?

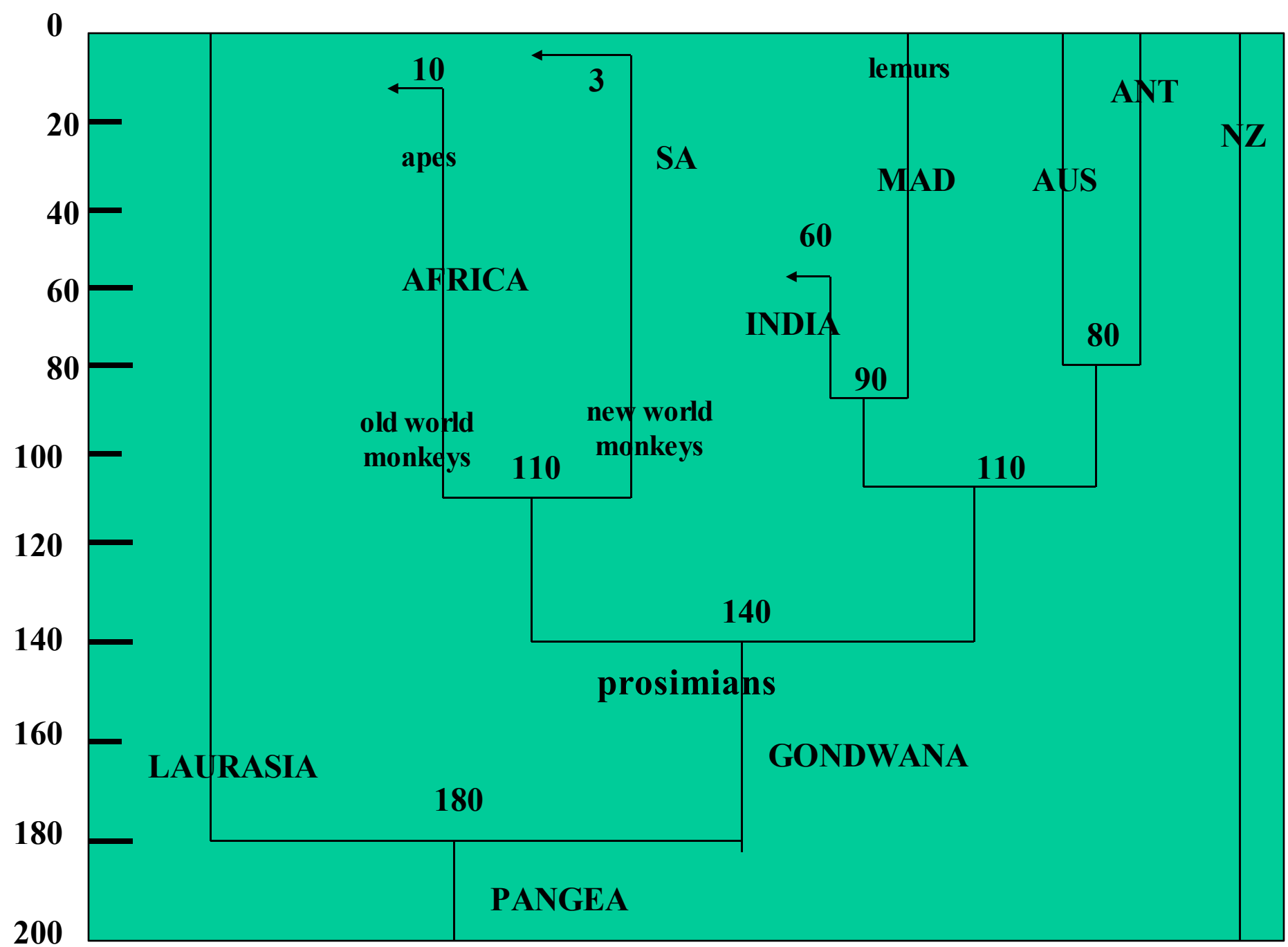
Independent experiments in evolution have been conducted on Earth over the past 200 million years. The names of the individual experiments are South America, Australia, New Zealand, Madagascar, India, North America.


120
60
Present

CONTINENTAL DRIFT
(0 - 750 million years)

by

Christopher R. Scotese
PALEOMAP Project


0
20
40
60
80
100
120
140
160
180
200
10
3
lemurs
ANT
NZ
apes
SA
MAD
AUS
60
AFRICA
INDIA
80
90
old world
monkeys
new world
monkeys
110
110
140
prosimians
LAURASIA
GONDWANA
180
PANGEA

“New Zealand is as close as we will get to the opportunity to study life on another planet.”

Jared Diamond

author of

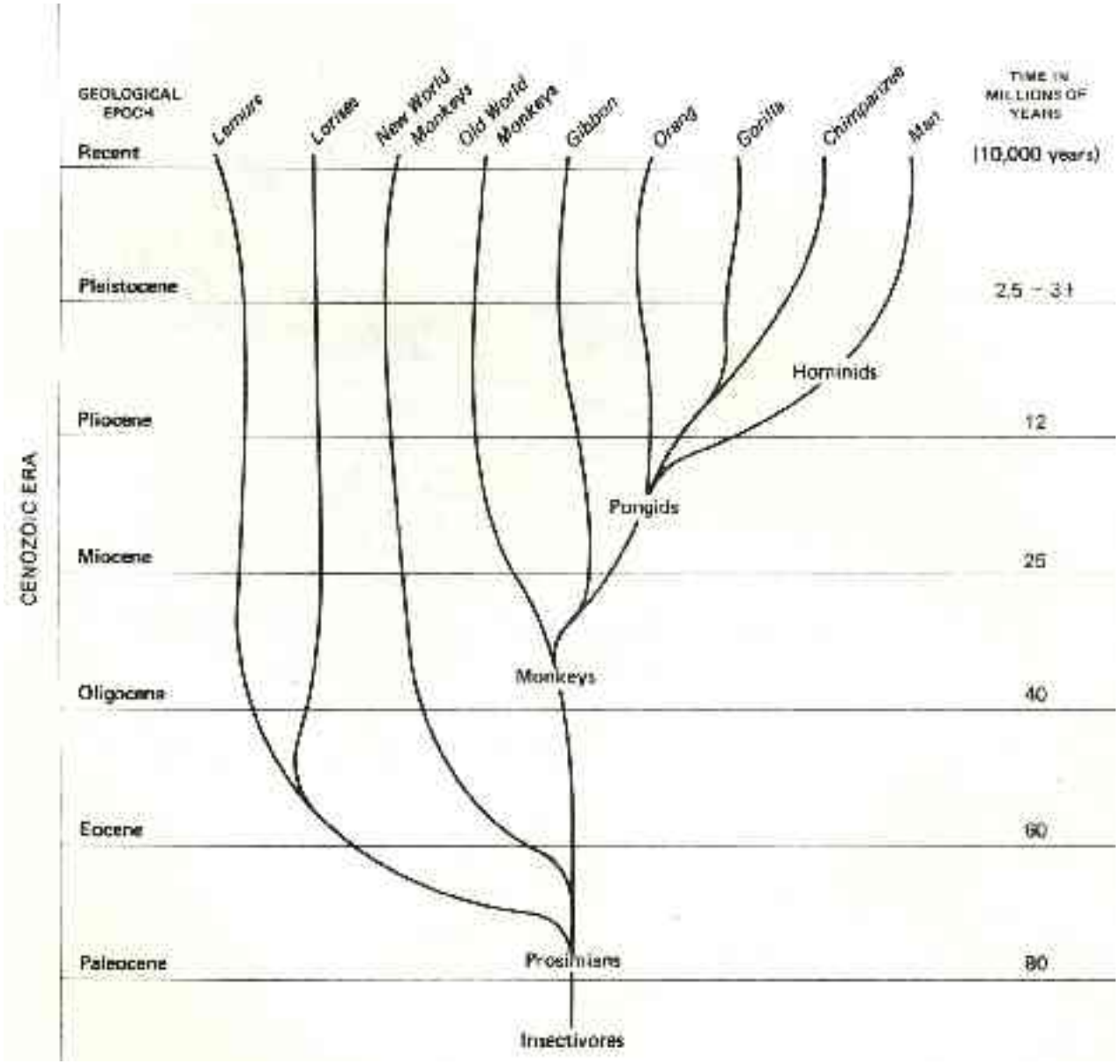
“The Third Chimpanzee”

“Guns, Germs and Steel”

“Why Sex is Fun”

New Zealand 200 Myr
Tuatara, Kiwi

Australia 180 Myr

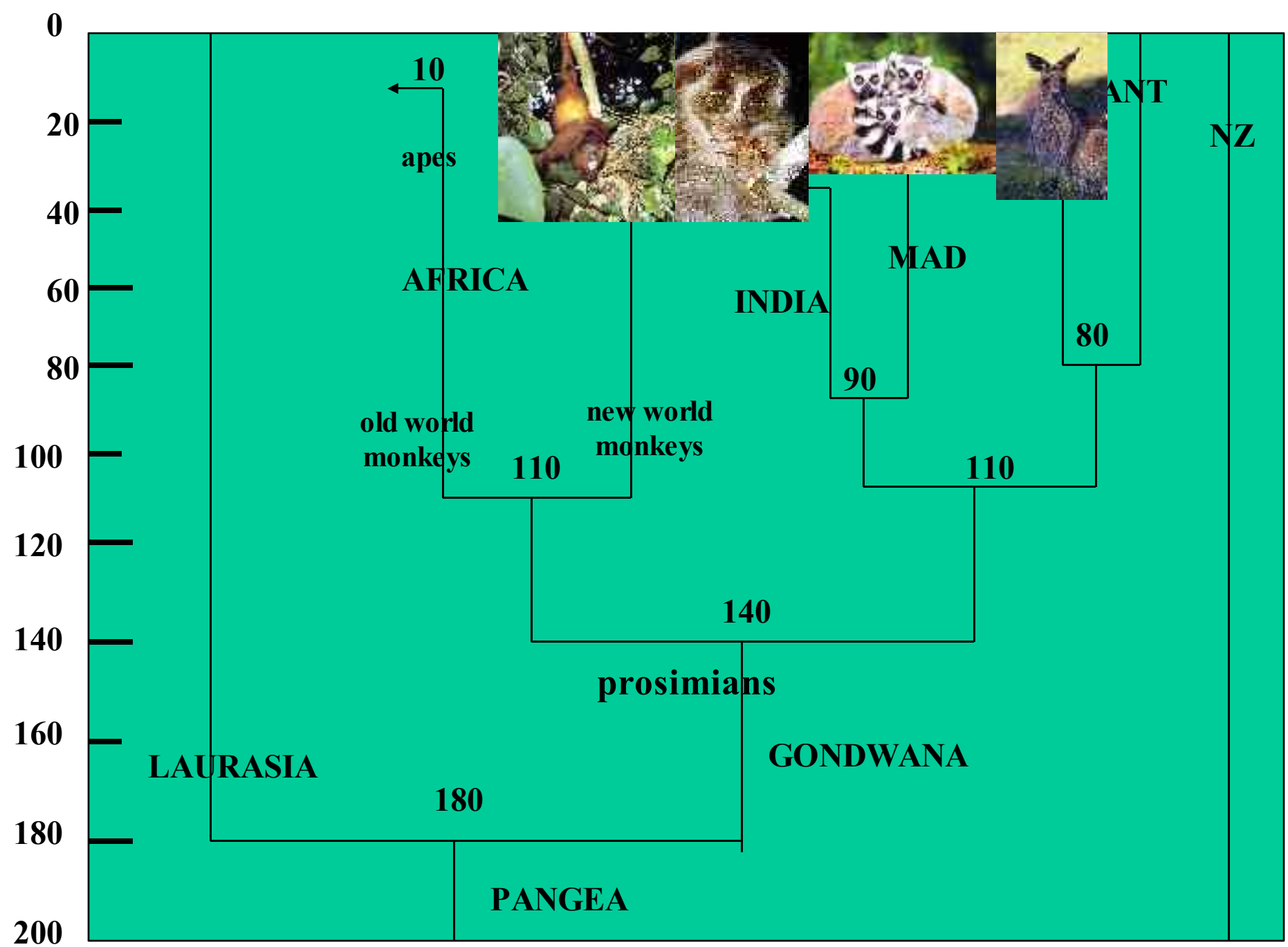

GEOLOGICAL EPOCH
Lemurs
Lorises
New World Monkeys
Old World Monkeys
Gibbon
Orang
Gorilla
Chimpanzee
Man
TIME IN MILLIONS OF YEARS
(10,000 years)
Recent
Pleistocene
2.5 – 3.1
Pliocene
12
Hominids
Pongids
Miocene
25
Monkeys
Oligocene
40
Eocene
60
Prosimians
Paleocene
80
Insectivores
CENOZOIC ERA

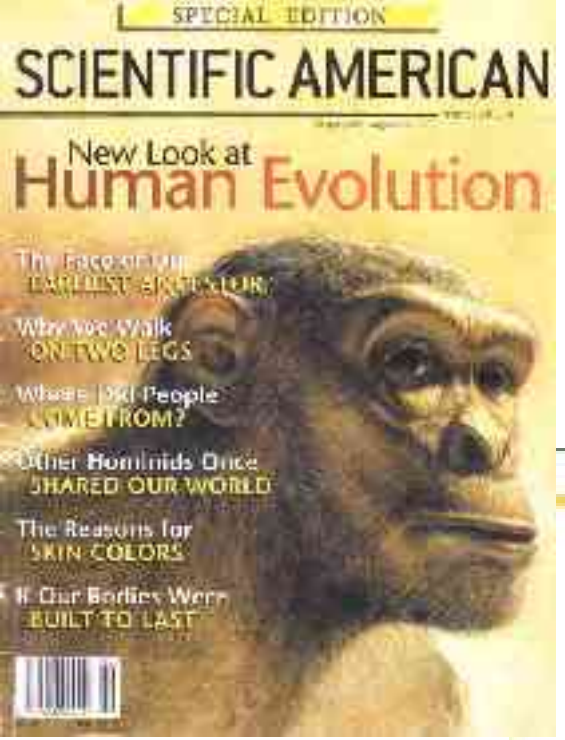
Madagascar 140 Myr

India/Asia 140 Myr


South America 110 Myr


Africa 5 Myr


0
20
40
60
80
100
120
140
160
180
200
10
apes
AFRICA
old world
monkeys
new world
monkeys
110
INDIA
MAD
90
80
ANT
NZ
110
140
prosimians
LAURASIA
GONDWANA
180
PANGEA

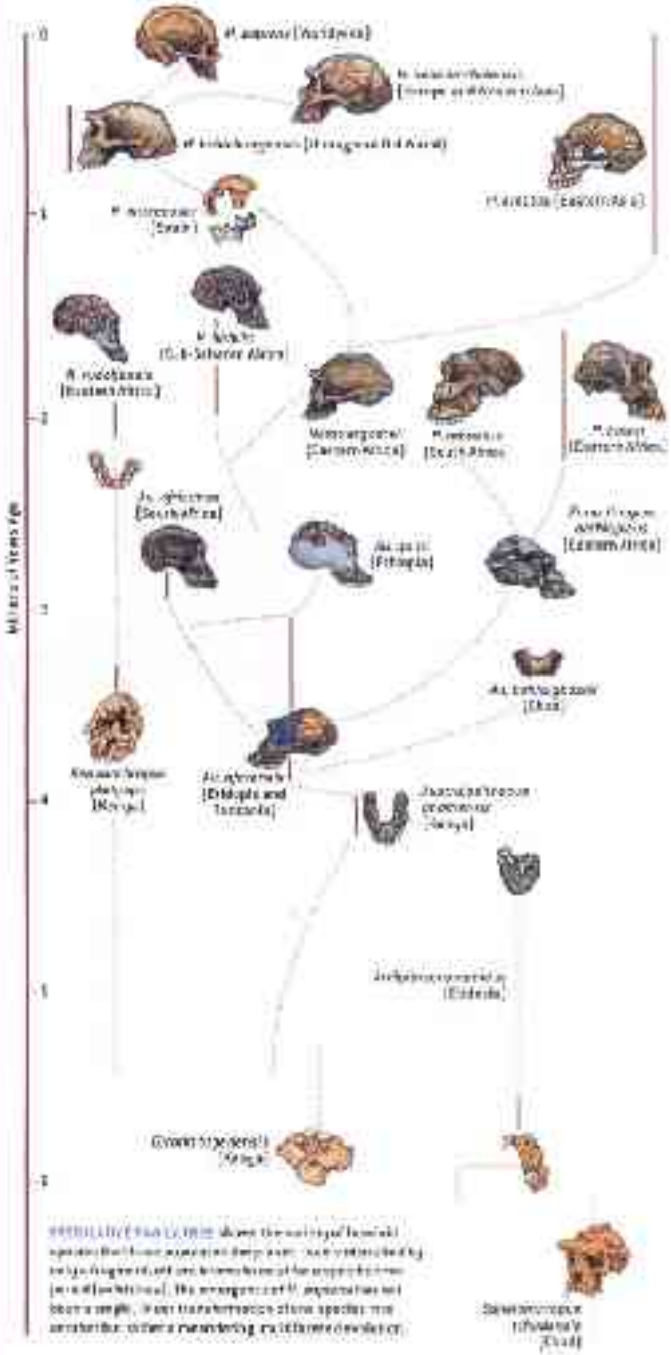


EMERGENCE

TODAY WE TAKE FOR GRANTED THAT *HOMO SAPIENS* IS THE ONLY HOMINID ON EARTH. YET FOR AT LEAST FOUR MILLION YEARS MANY HOMINID SPECIES SHARED THE PLANET. WHAT MAKES US DIFFERENT?

ONCE we were not alone

By Ian Tattersall • Paintings by Jay H. Matternes



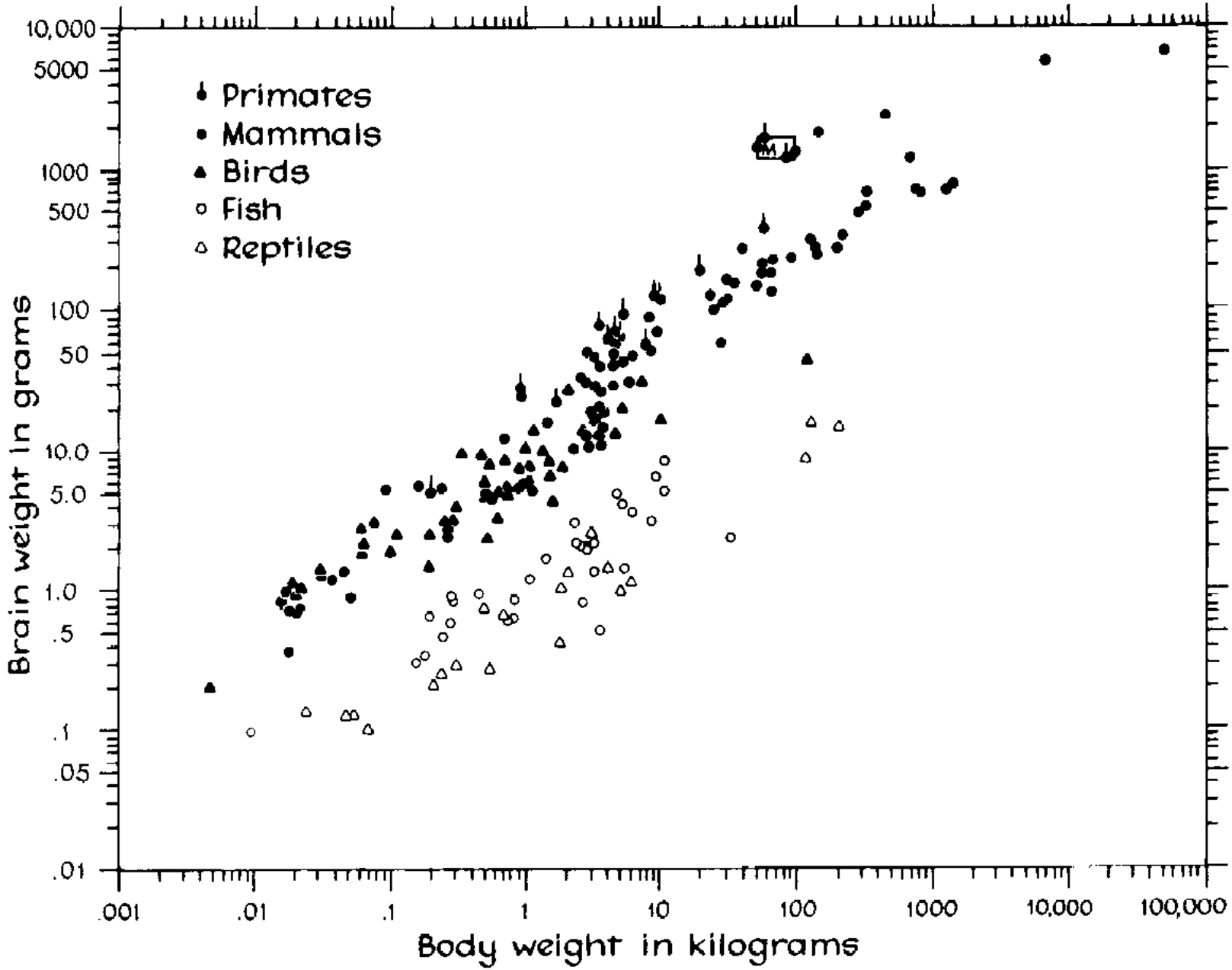


Fig. 14. Brain weights and body weights in 198 species of vertebrates, graphed

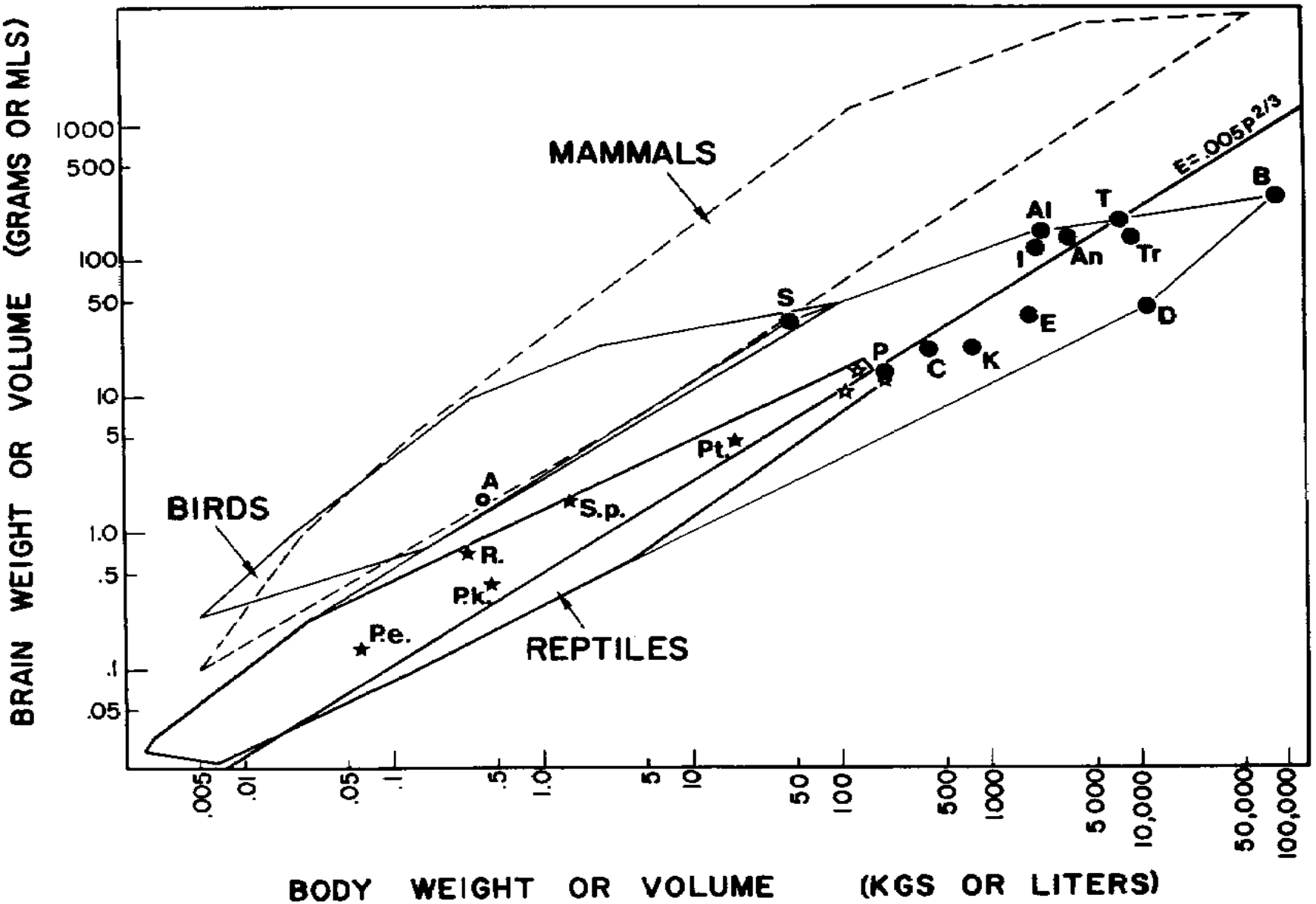
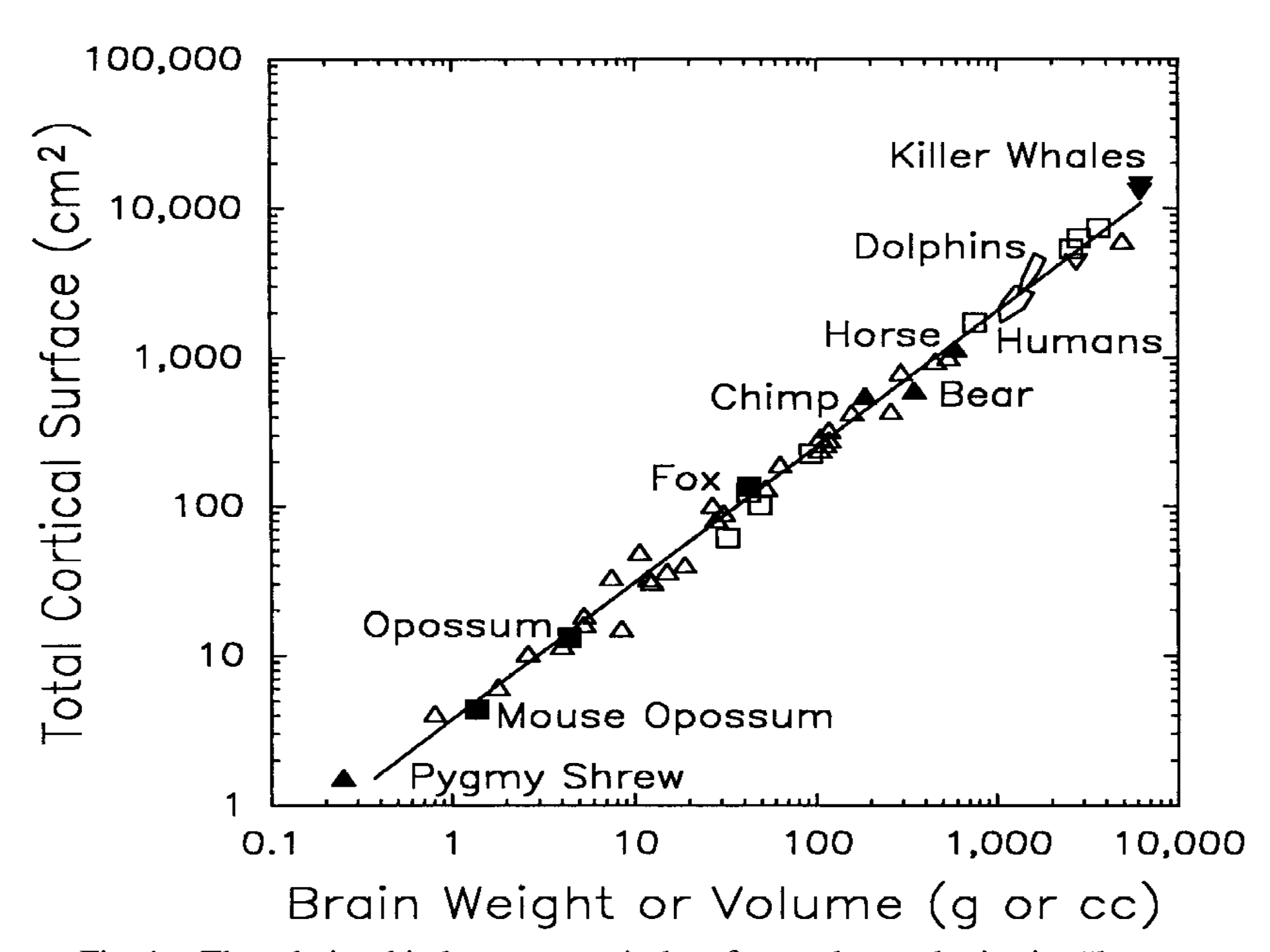
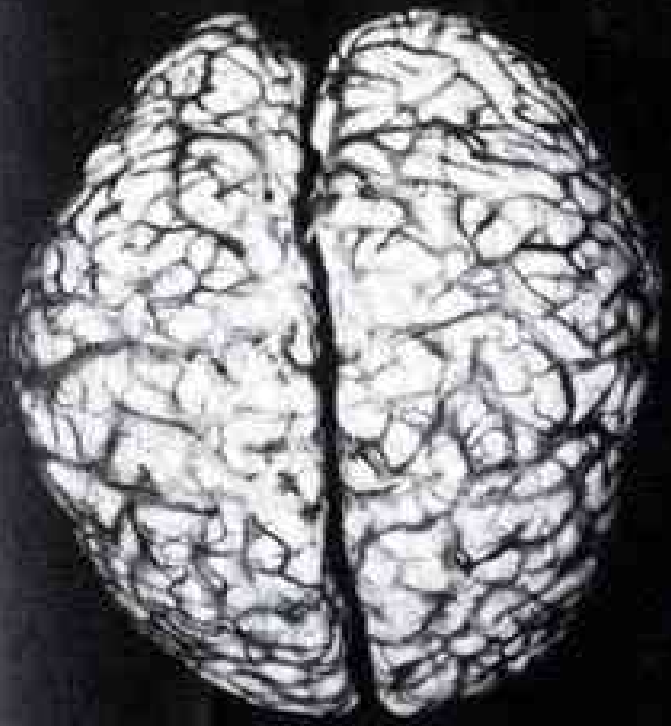


Fig. 16. Fossil reptile data added to mammalian, avian, and reptilian brain-body polygons. (**A.**, *Archaeopteryx*, the earliest bird.)

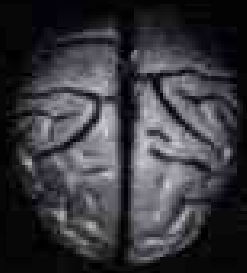
Pterosaurs (★): **P.e.**, *Pterodactylus elegans*; **P.k.**, *Pterodactylus kochi*; **Pt.**, *Pteran-*

Squirrel Monkey
South America
Highest brain to body weight ratio

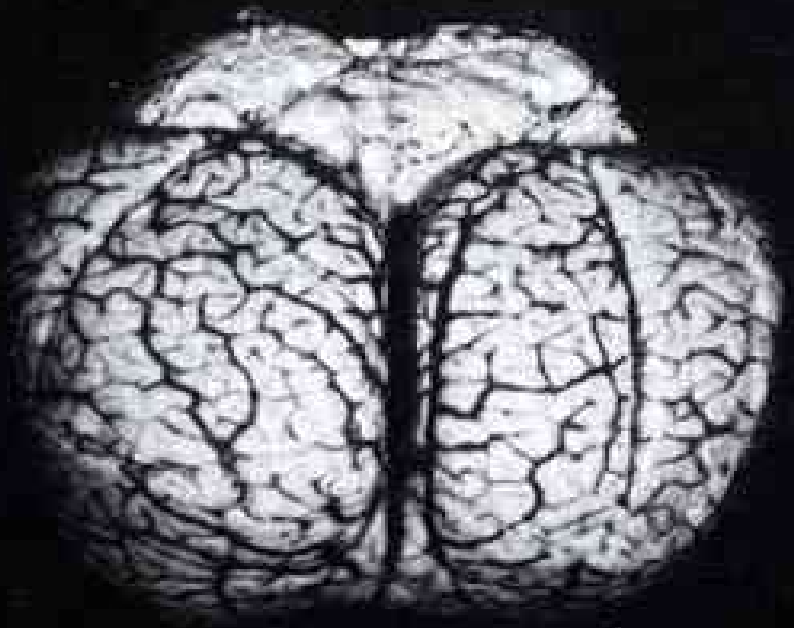

100,000
10,000
1,000
100
10
1
Total Cortical Surface (cm²)
0.1
1
10
100
1,000
10,000
Brain Weight or Volume (g or cc)
Killer Whales
Dolphins
Horse
Humans
Chimp
Bear
Fox
Opossum
Mouse Opossum
Pygmy Shrew



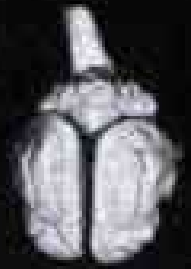
MAN



MONKEY



DOLPHIN



CAT

DOG

Are dolphins the humans of the sea? What does a dolphin do with its brain?

They are probably doing something important with it since although it takes up only 2% of body mass, it uses 20% of the energy

Is pecking wood a niche? Only evolved once.

Universal growth of brain size

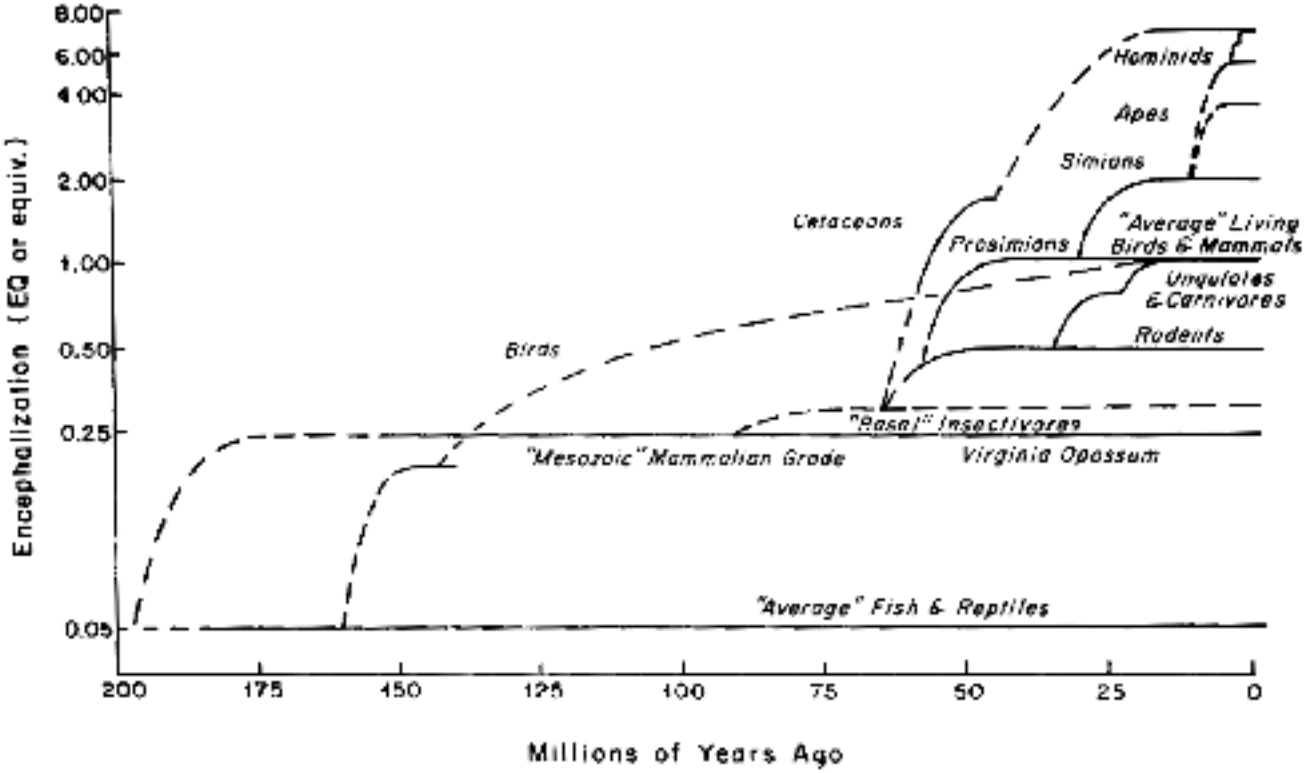
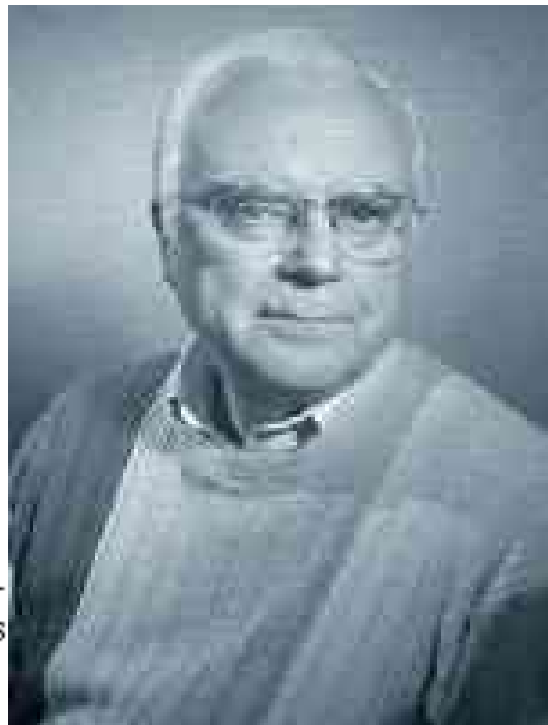
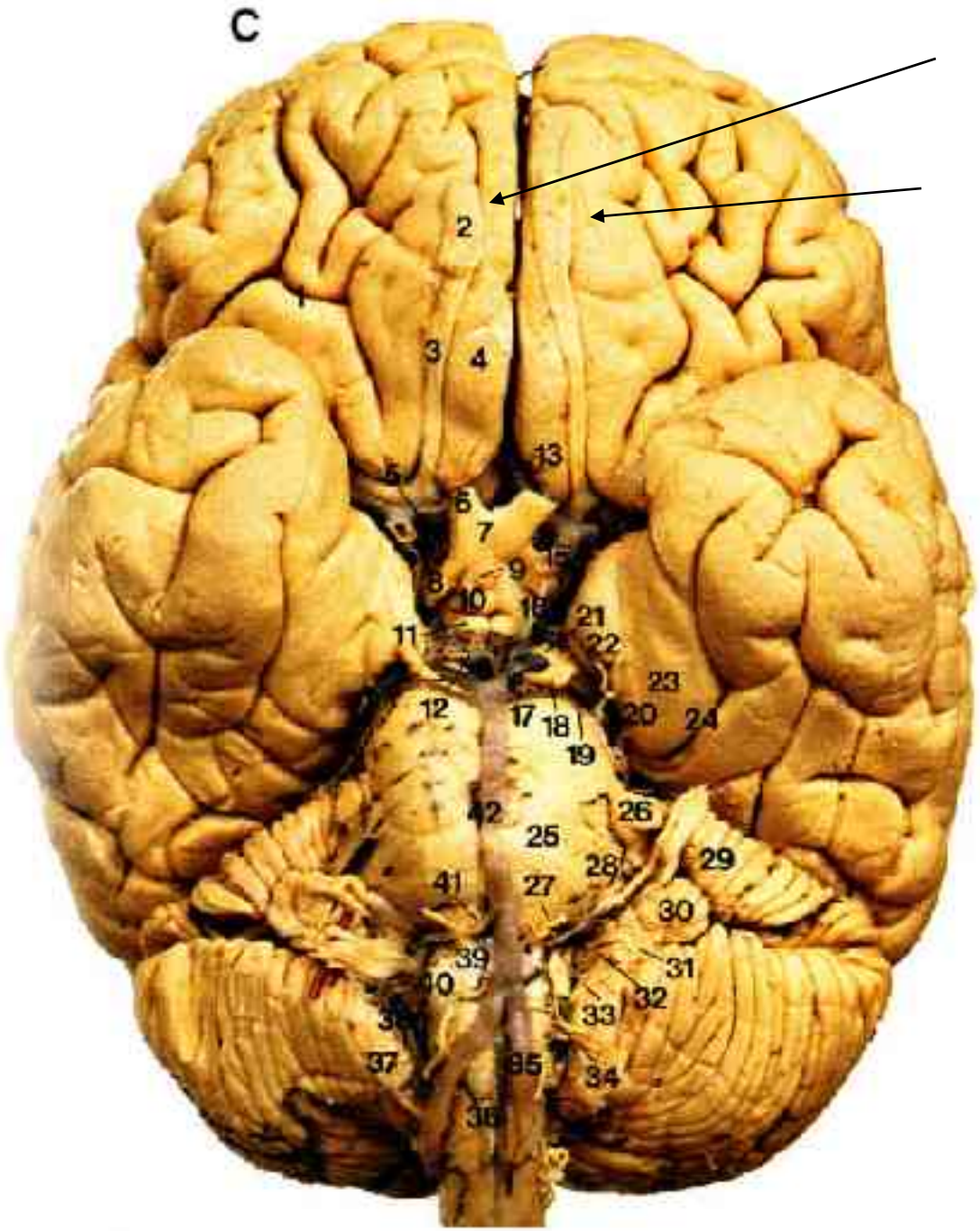


Fig. 17. The time course of encephalization in vertebrates. Encephalization quotients are approximate relative to average living mammals, in which the quotient is defined as 1.0.

Frank Drake
SETI Institute



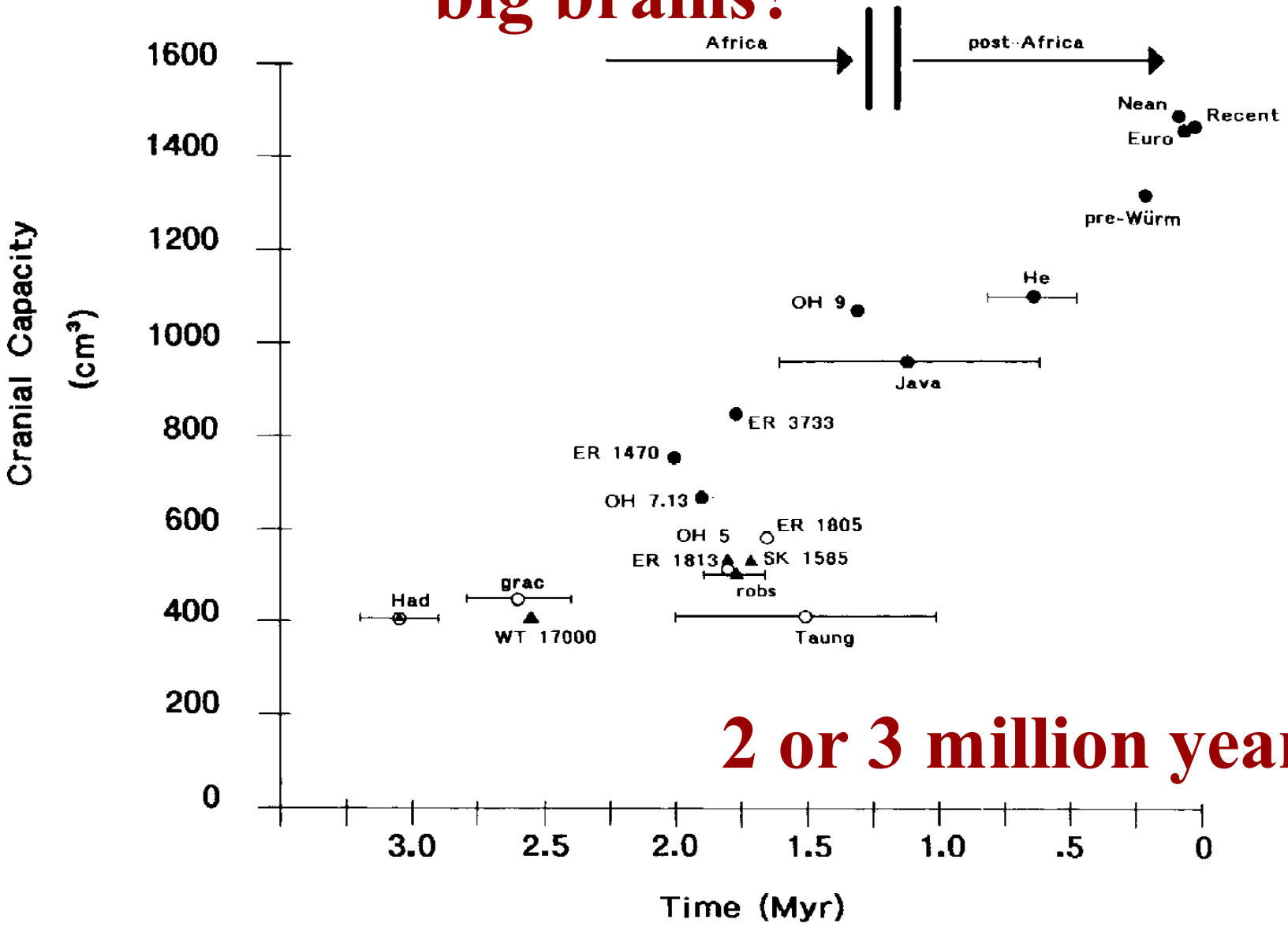
Nasalization quotient



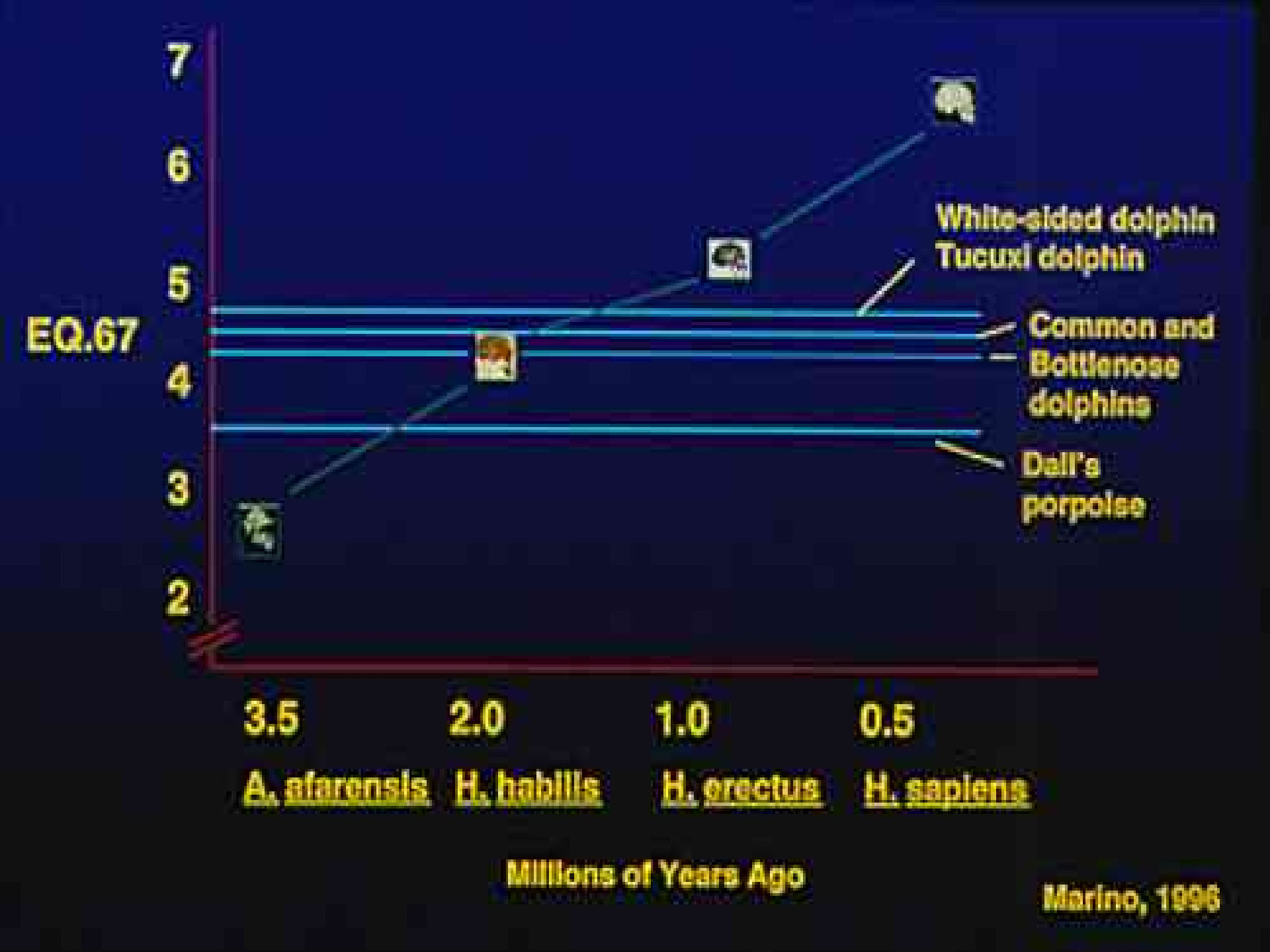
Olfactory lobes

Have a look at our closest non-human relatives

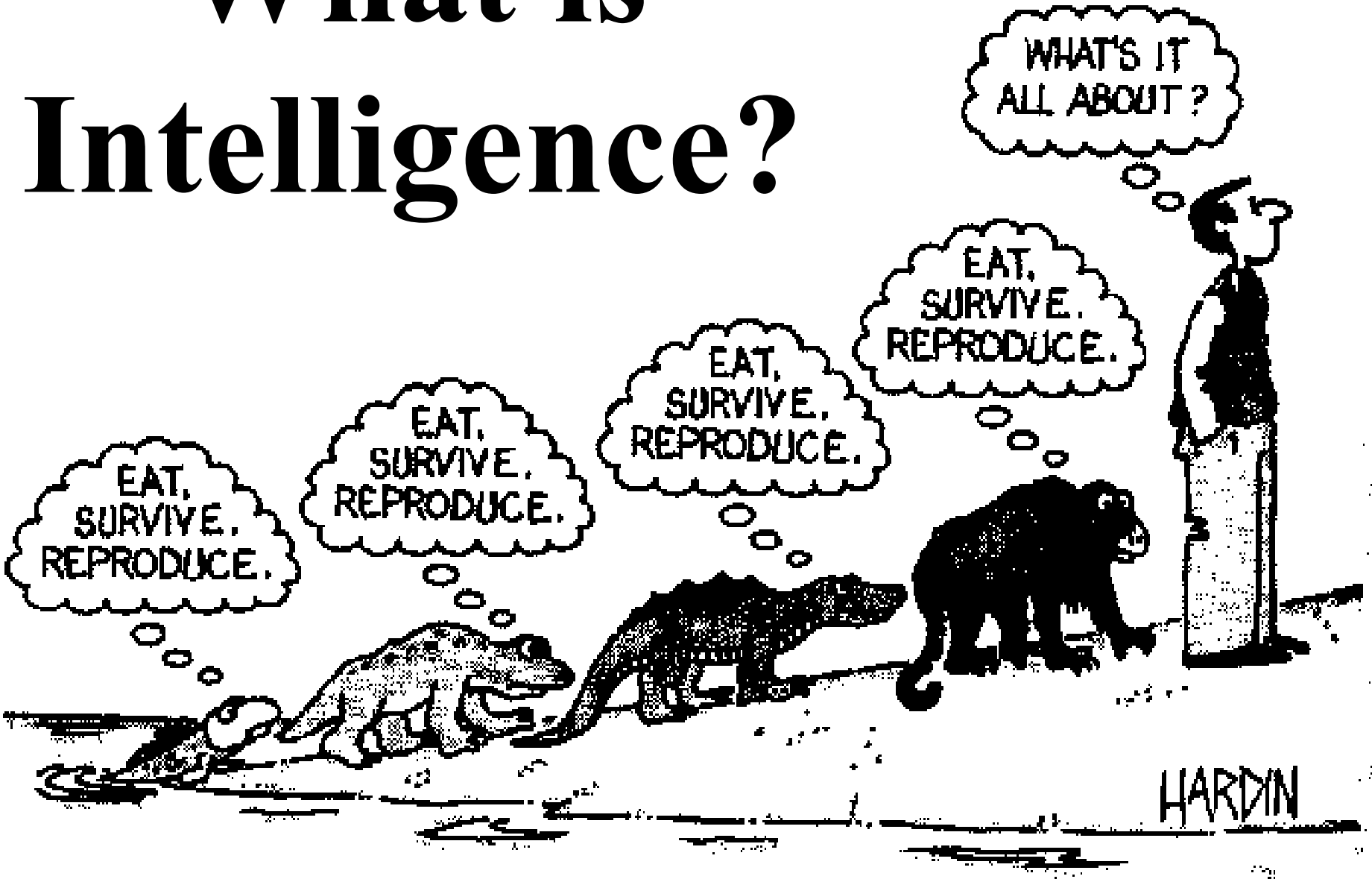
How long did it take us to get such big brains?

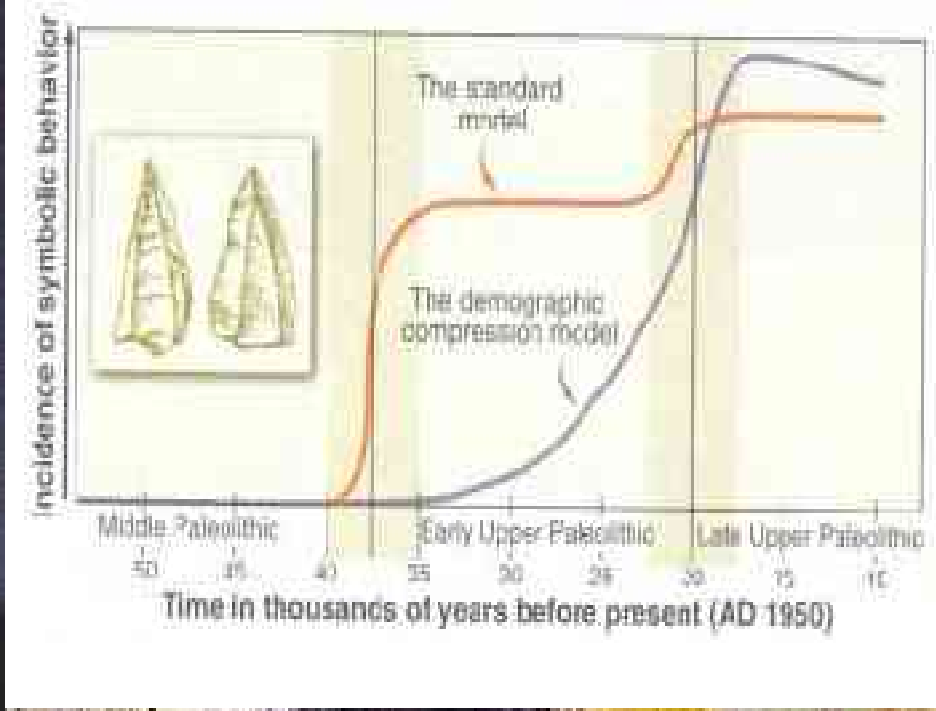


2 or 3 million years


7
6
5
4
3
2
EQ.67
White-sided dolphin
Tucuxi dolphin
Common and
Bottlenose
dolphins
Dall's
porpoise
3.5
2.0
1.0
0.5
A. afarensis
H. habilis
H. erectus
H. sapiens
Millions of Years Ago
Marino, 1996

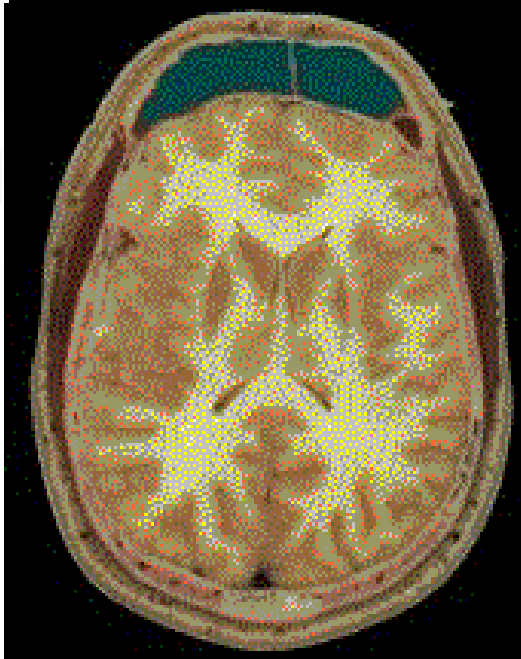
What is Intelligence?

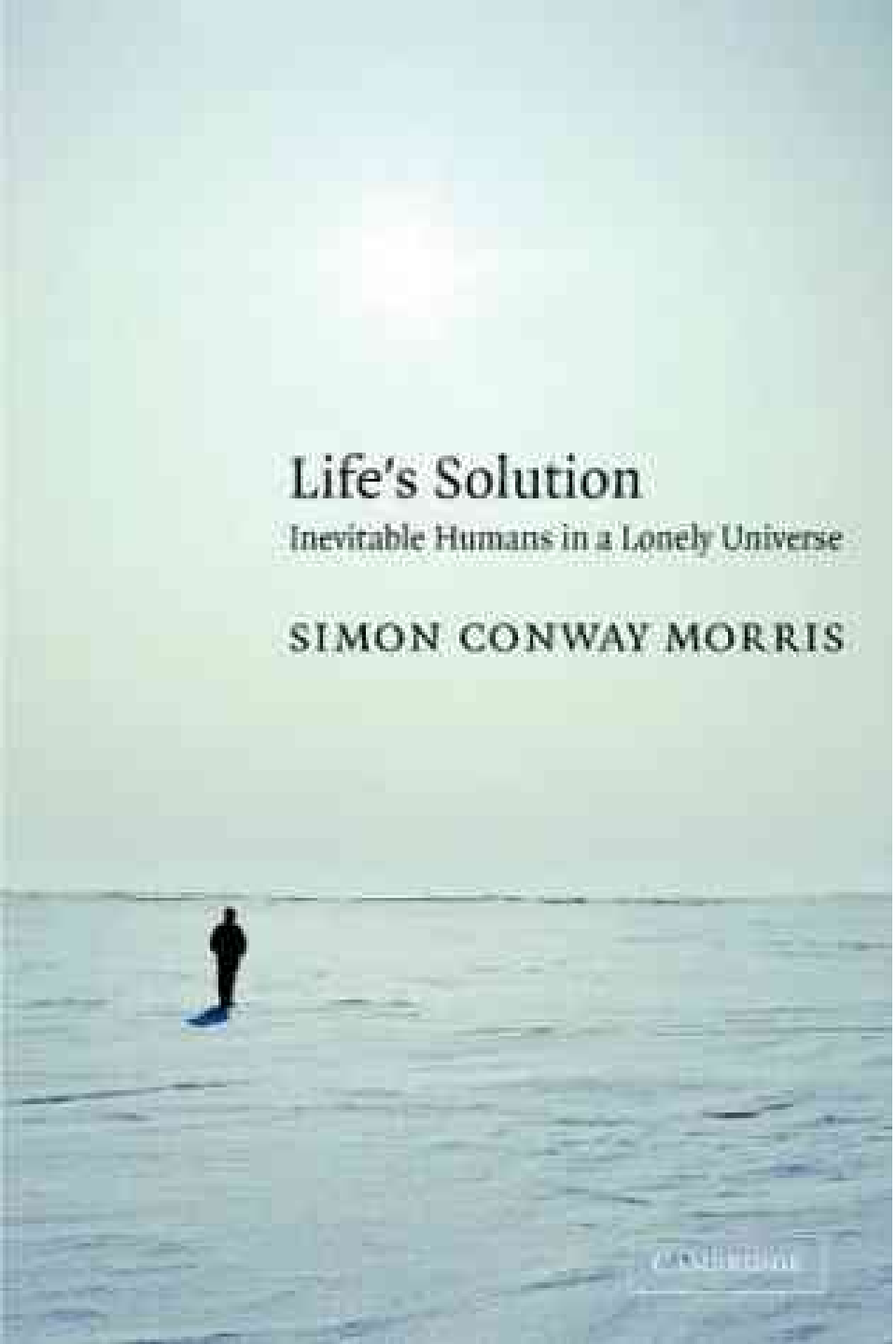



Incidence of symbolic behavior
The standard model
The demographic compression model
Middle Paleolithic
Early Upper Paleolithic
Late Upper Paleolithic
50
45
40
35
30
25
20
15
10
Time in thousands of years before present (AD 1950)

I used to think the brain was the most important organ until I realized what was telling me that.

HAL-9000




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