Sc. Biologiche

LM **Genetica e Biologia Molecolare**

Biodiversità umana ed evoluzione

AA 2023-2024

6 cfu

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iscriversi e-learning

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Consultate la mia pagina docente per comunicazioni sulle lezioni (anche eventuali lezioni rinviate e contrattempi)... avete gruppo whatsapp?

scaricare slides da elearning entro 20 giorni

ma prima email

SUBJECT: DICHIARAZIONE corso di Biodiversità umana 2024

Mi impegno a usare i file video e PDF relativi al corso di Biodiversità umana dell'Università La Sapienza tenuto da Giovanni Destro Bisol solo per scopo personale e a non condividerli con altri.

Corso

fino a fine maggio

24 lezioni

Quanti stud altri corsi?
Quanti esame antropologia?

Esami

anche presentazione per chi segue

Seguire non è obbligatorio, non informarsi può essere penalizzante: non cascate dal pero…


inizio shalla
relax… and listen

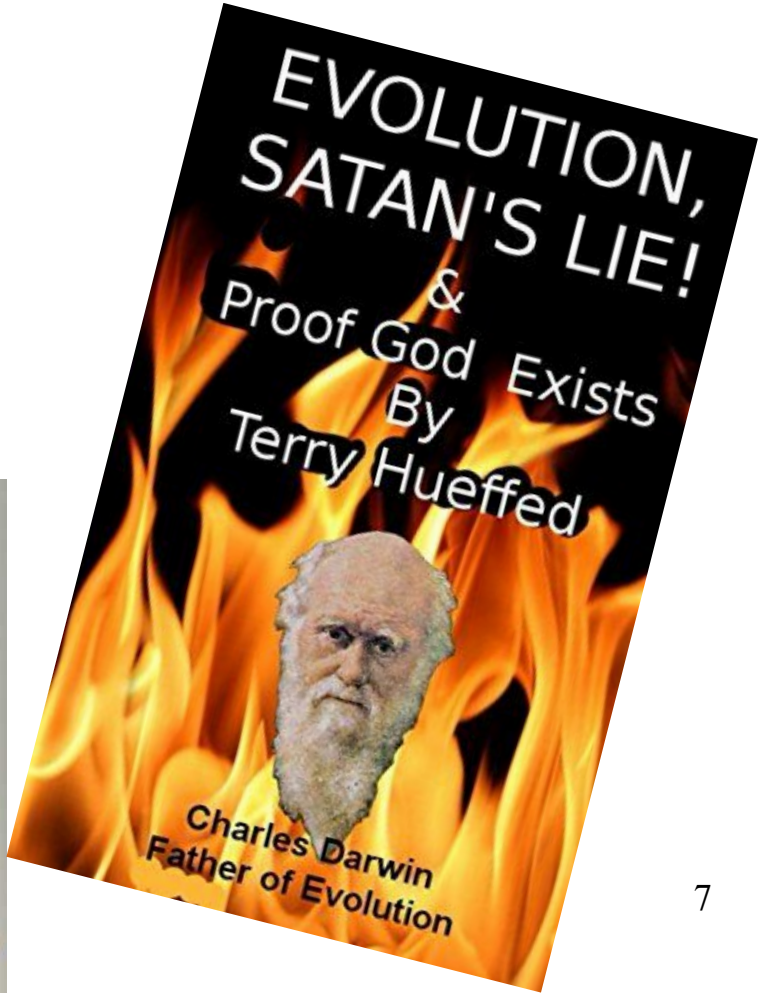
1. Togliamo di mezzo un po' di equivoci (4 per la precisione)

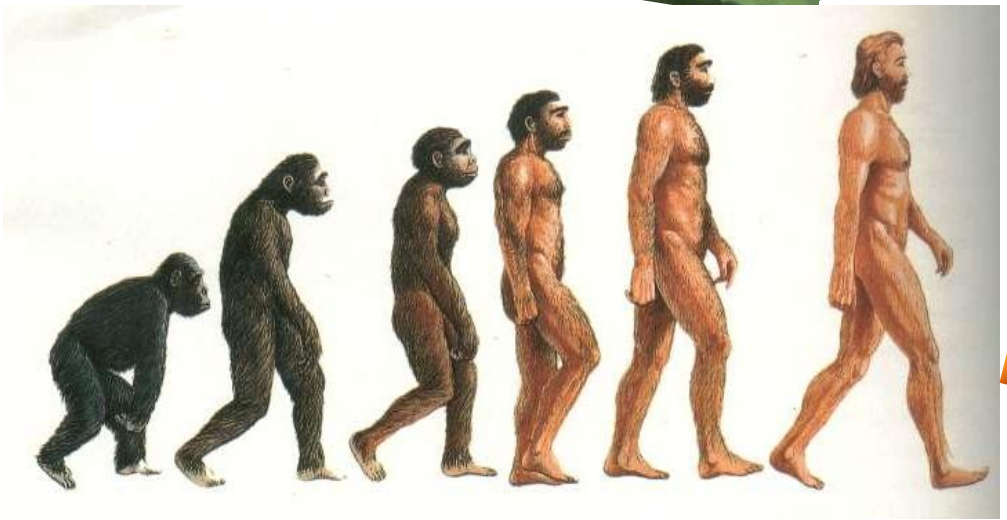
2. La biodiversità (umana) è …

3. Perchè mettiamo insieme biologia, evoluzione e cultura

4. Struttura e contenuti del corso

gli equivoci…

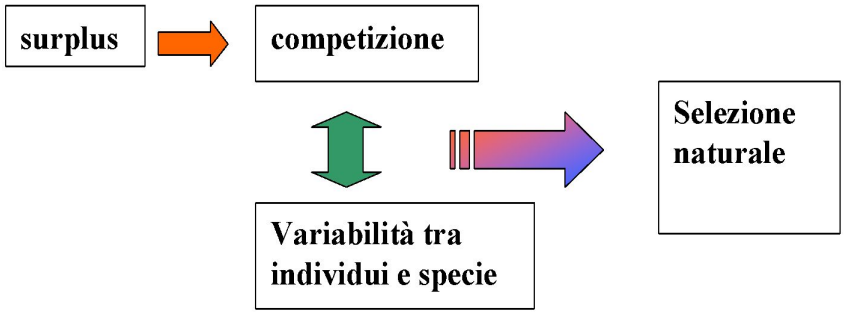




Biodiversità ed **Evoluzione**

Etimologia: « dal fr. évolution, che è dal lat. evolutiōne(m) 'atto dello svolgere', deriv. di evolvĕre 'svolgere, spiegare'.

Evoluzione darwiniana



Il processo di cambiamento per il quale tutte le specie viventi mutano di generazione in generazione per adattarsi all'ambiente in continua trasformazione o per effetto di processi casuali.

1. 

L’evoluzione è solo una “teoria”, nulla che, per esempio, incida sulla salute umana…

Navighiamo controcorrente…

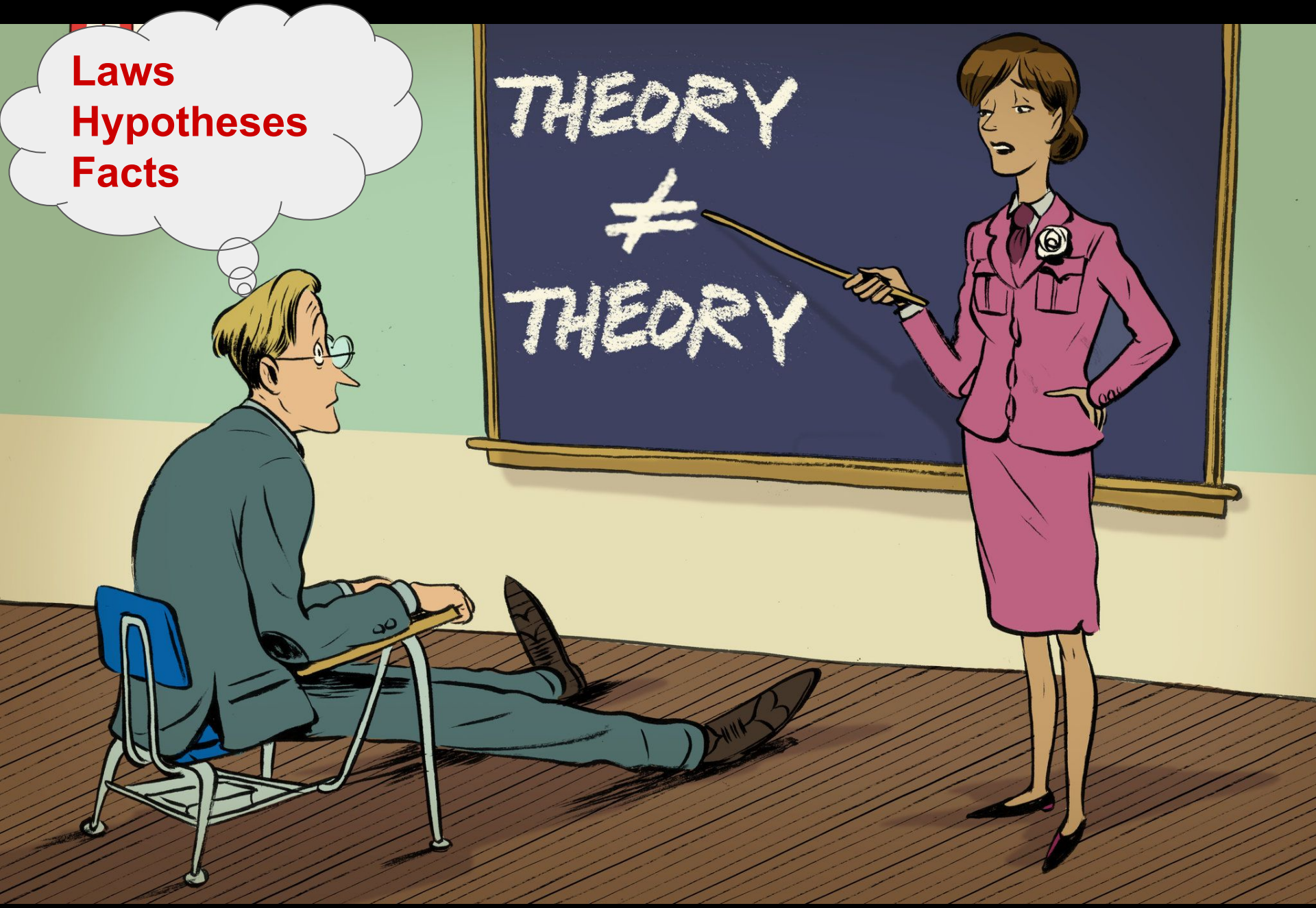
*In media a **credere nell'evoluzione** è il 41% della popolazione mondiale. Il 28% si dichiara invece creazionista. Il 31% è incerto.

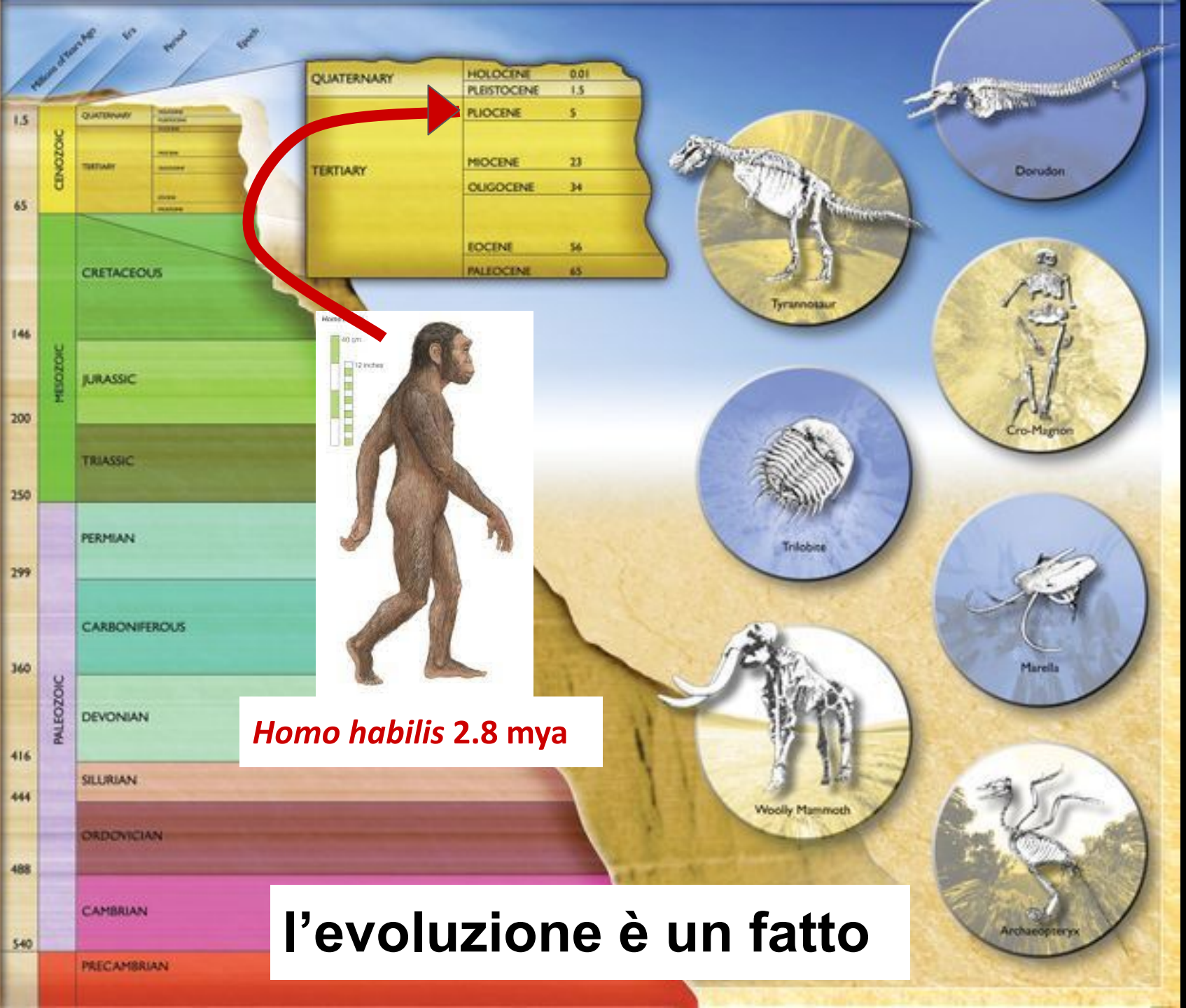
In testa nella schiera dei Paesi in cui vincono la scienza e l'evoluzionismo ci sono Svezia, Germania e Cina, in coda Arabia Saudita, Turchia, Indonesia e Sud Africa. **L'Italia**, secondo questa rilevazione, sarebbe nel gruppo dei più incerti, con un 39% di persone incapaci di prendere posizione.

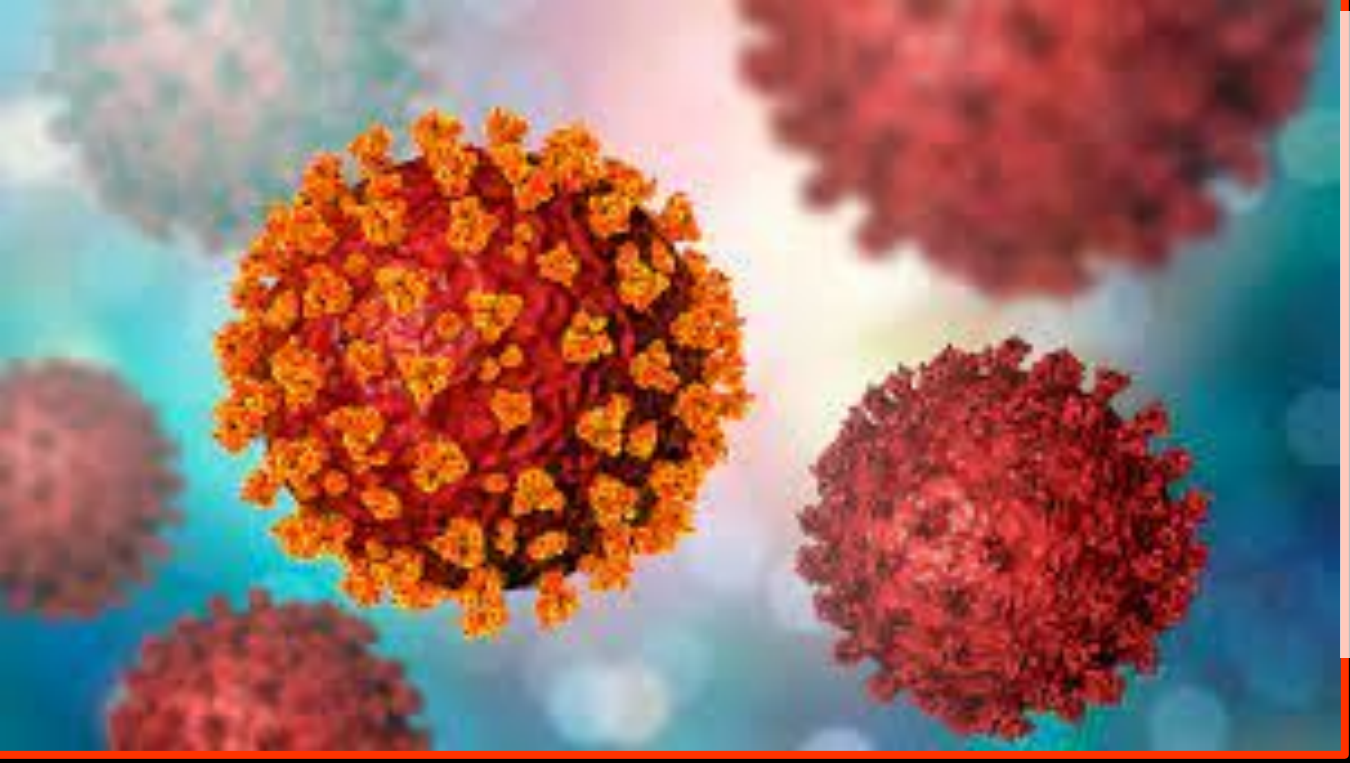
**Sondaggio dell'Istituto francese Ipsos per la Reuters nel 2010*

^Gli italiani credono ai **Flintstones**,
3 su 10 pensano che uomini e dinosauri siano vissuti nella stessa epoca.

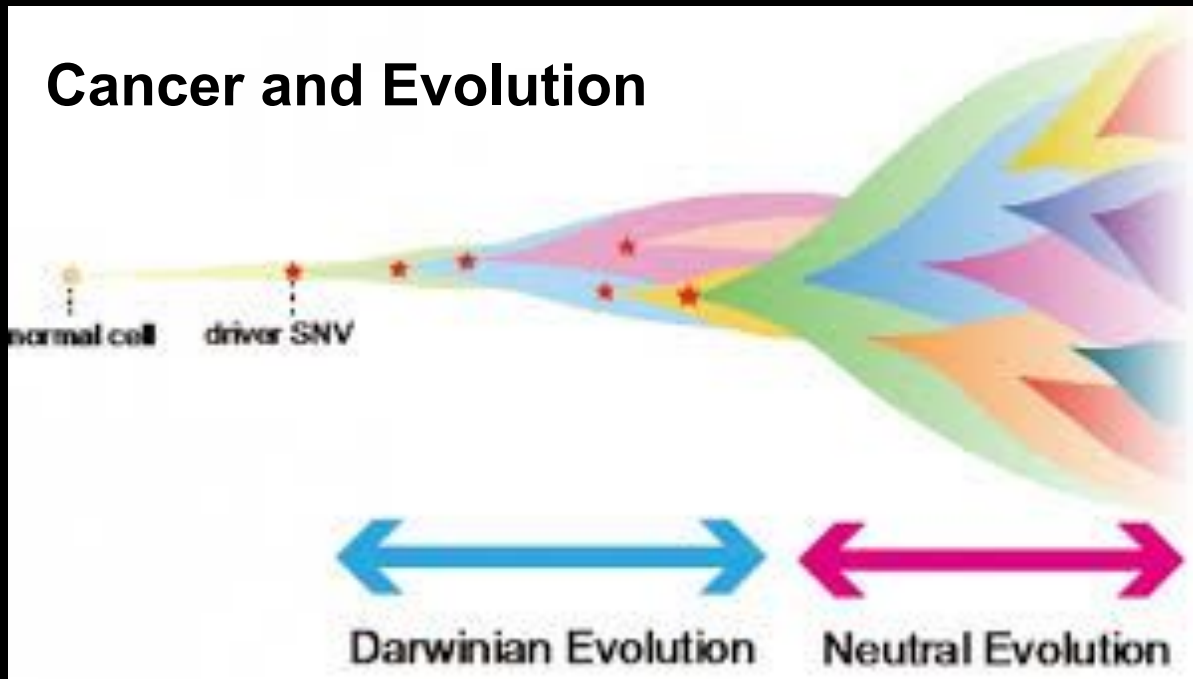
^Eurobarometro 2021


Laws
Hypotheses
Facts
THEORY
≠
THEORY


Millions of Years Ago
Era
Period
Epoch
1.5
65
146
200
250
299
360
416
444
488
540
CENOZOIC
MESOZOIC
PALEOZOIC
QUATERNARY
TERTIARY
CRETACEOUS
JURASSIC
TRIASSIC
PERMIAN
CARBONIFEROUS
DEVONIAN
SILURIAN
ORDOVICIAN
CAMBRIAN
PRECAMBRIAN
QUATERNARY
HOLOCENE 0.01
PLEISTOCENE 1.5
TERTIARY
PLIOCENE 5
MIOCENE 23
OLIGOCENE 34
EOCENE 56
PALEOCENE 65
Dorudon
Tyrannosaur
Cro-Magnon
Trilobite
Mareilla
Woolly Mammoth
Archaeopteryx
Homo habilis 2.8 mya
l'evoluzione è un fatto



l'evoluzione è un fatto



Evoluzione e salute

mutazione

selezione

deriva

flusso genico

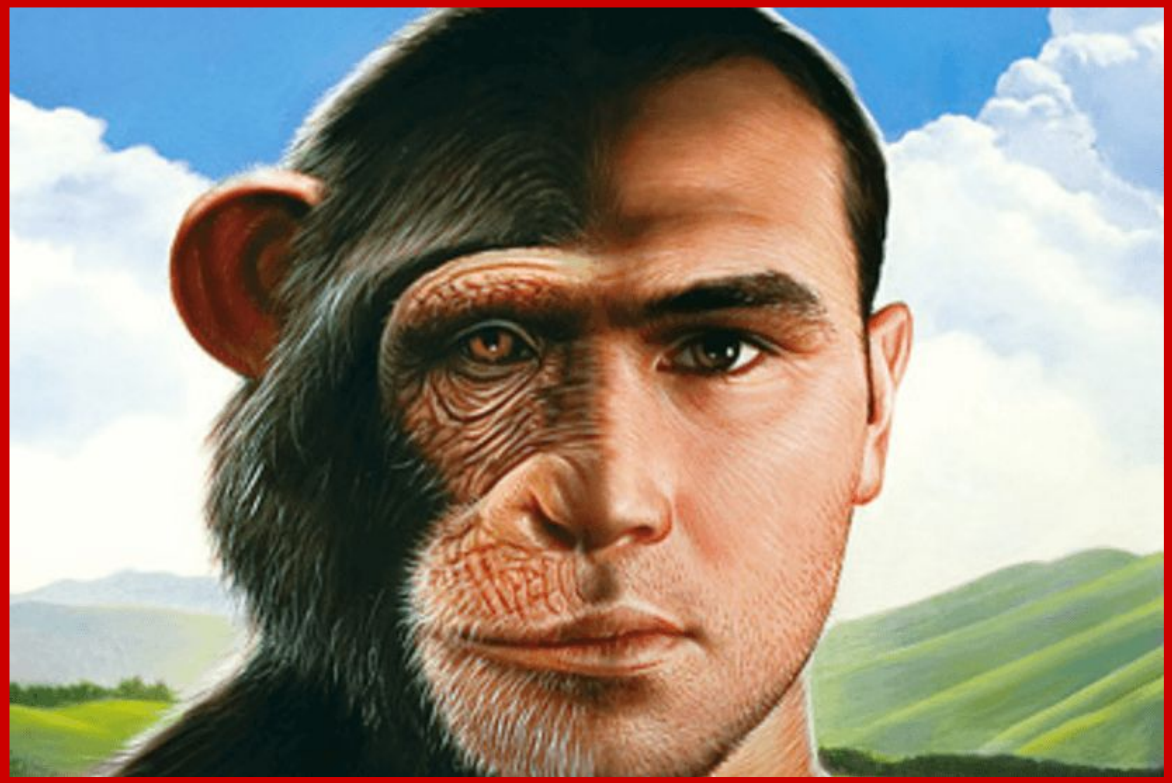
Le malattie genetiche sono un prodotto “inevitabile” dell'evoluzione

Complessità, efficienza e “rischio”

high gain – high risk (funzioni cognitive umane)

2.

Deriviamo dalle scimmie



Monkey is a common name that may refer to groups or species of mammals, in part, the simians of infraorder Simiiformes. The term is applied descriptively to groups of primates, such as families of new world monkeys and old world monkeys, yet can exclude the hominoids, also referred to as apes.


©SIMONE SERAGLIA PHOTOGRAPHY

Un piccolo test

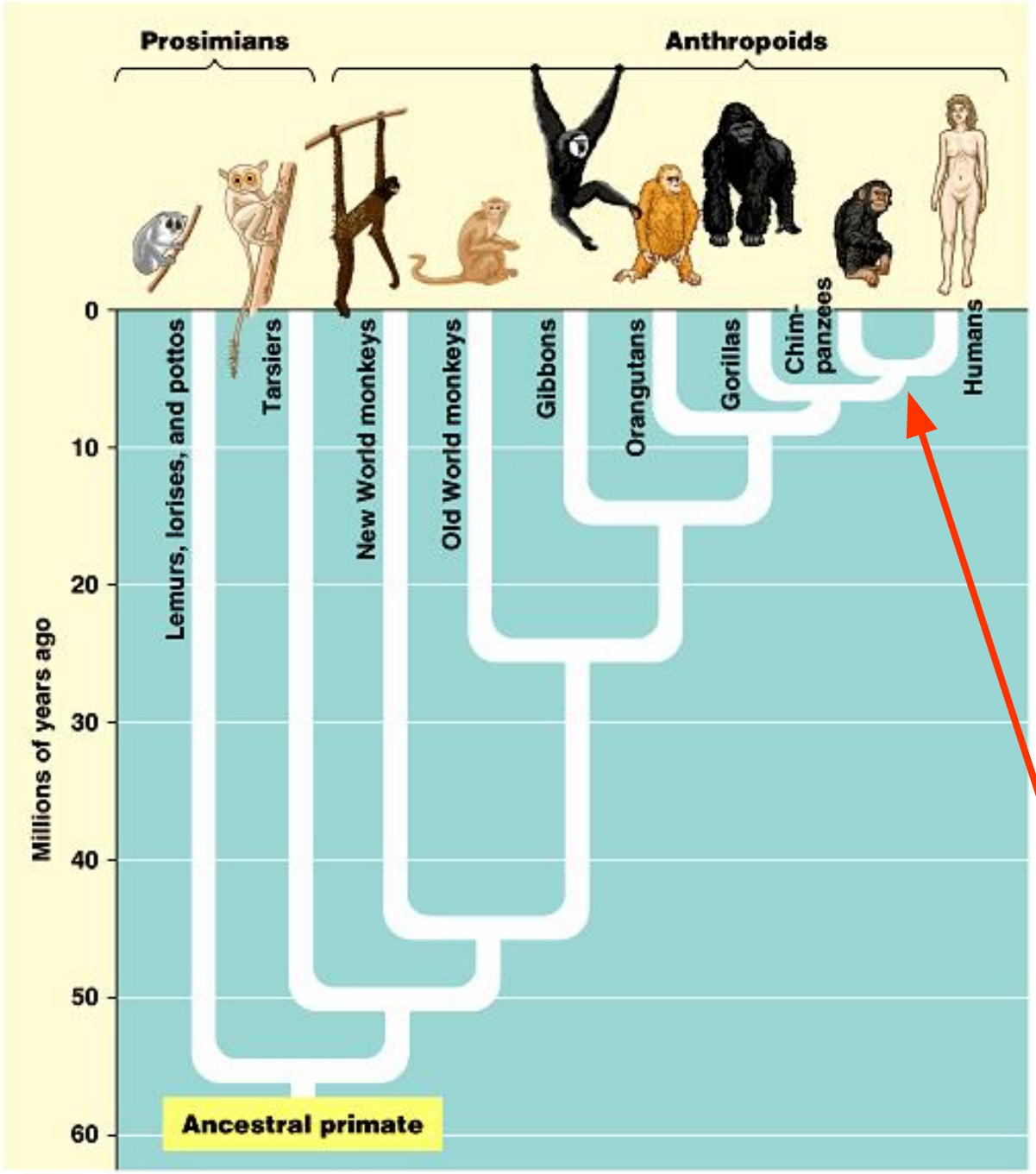
1. 1. qual'è il nostro rapporto di parentela con Pan troglodytes?

A ... nostro padre

B ... nostro fratello

C .... nostro cugino

D non siamo imparentati



Non siamo in rapporto di discendenza diretta e le nostre linee evolutive si sono separate troppo tempo fa per definirci “fratelli”

Abbiamo un “nonno” in comune (in senso evoluzionistico).

Siamo cugini

JONATHAN MARKS

what it means to be 98% chimpanzee

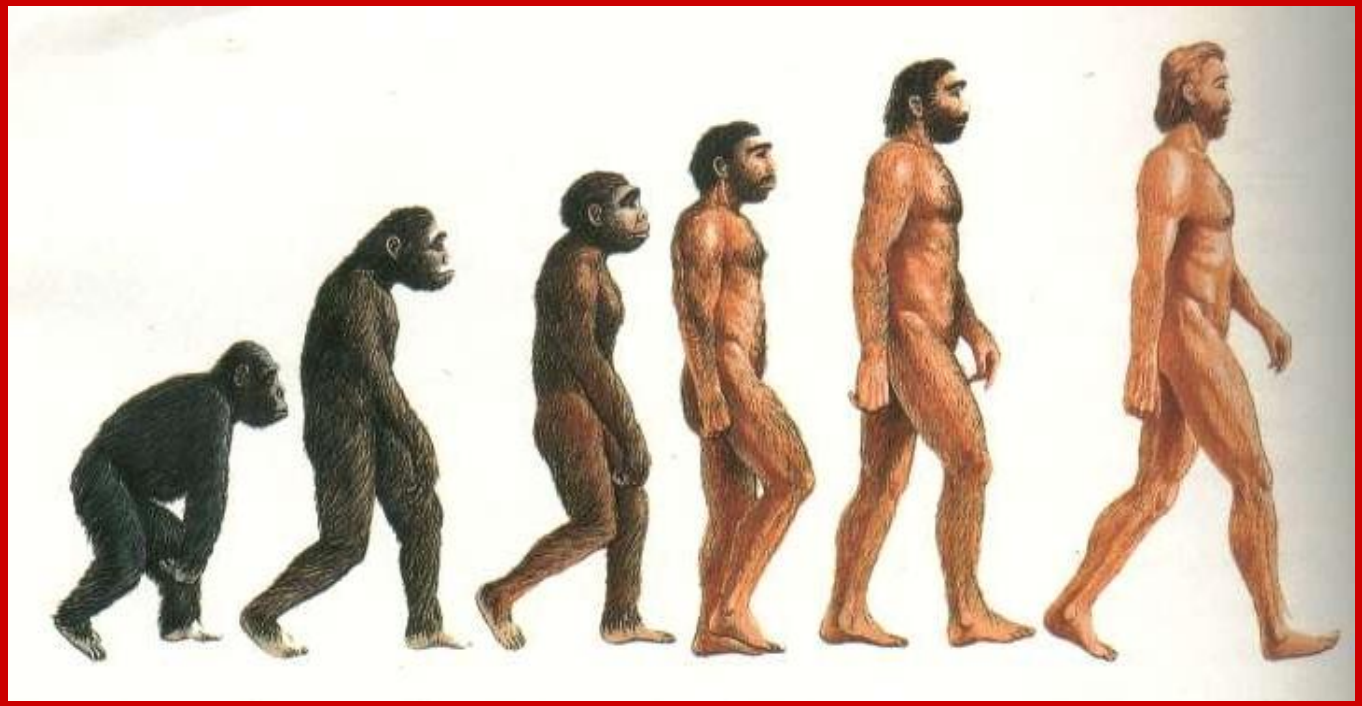
APES, PEOPLE, AND THEIR GENES

"A compulsively readable, erudite, and intensely personal view of our biology and our place in nature."

IAN TATTERSALL, author of *Becoming Human: Evolution and Human Uniqueness*

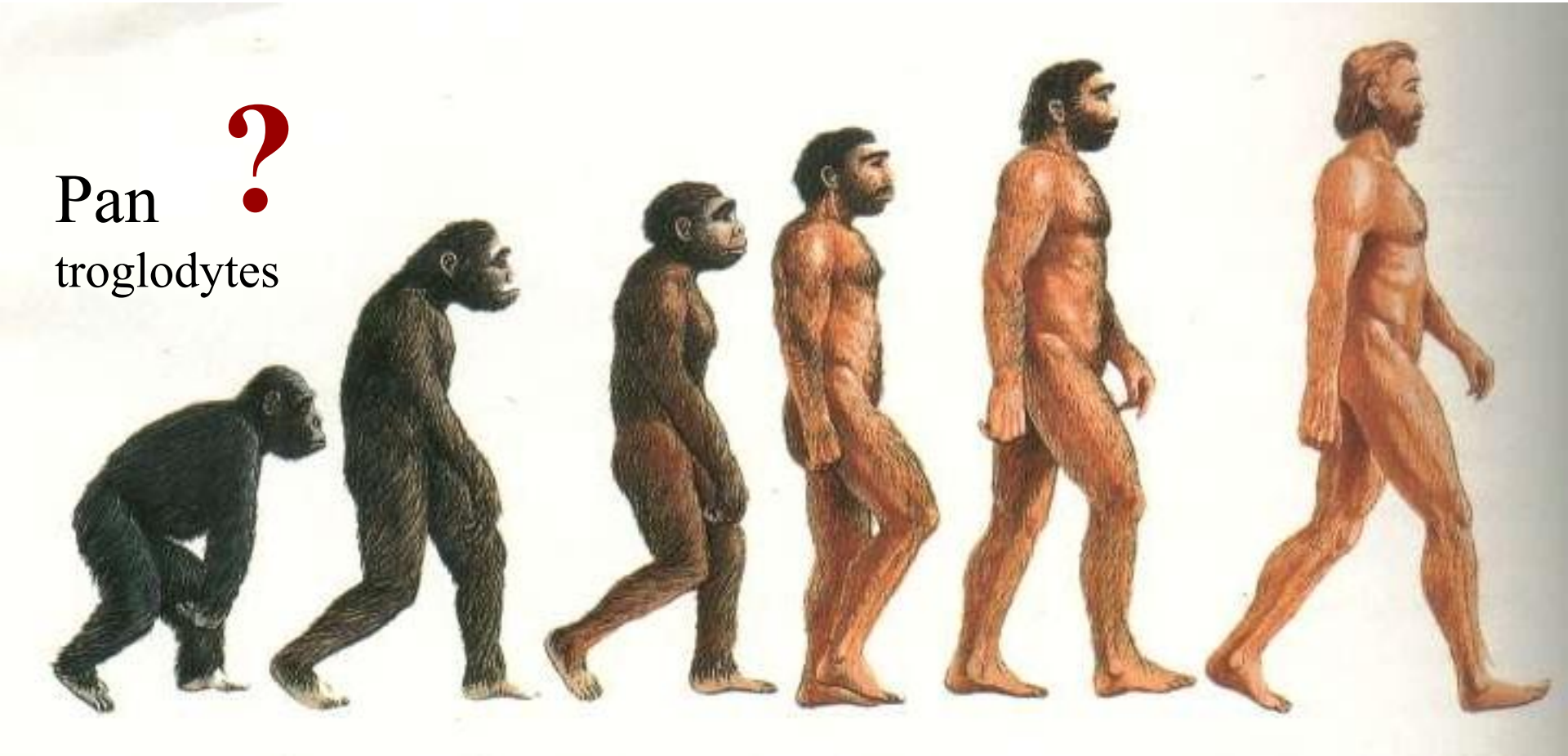
3.

Questa immagine descrive l'evoluzione umana

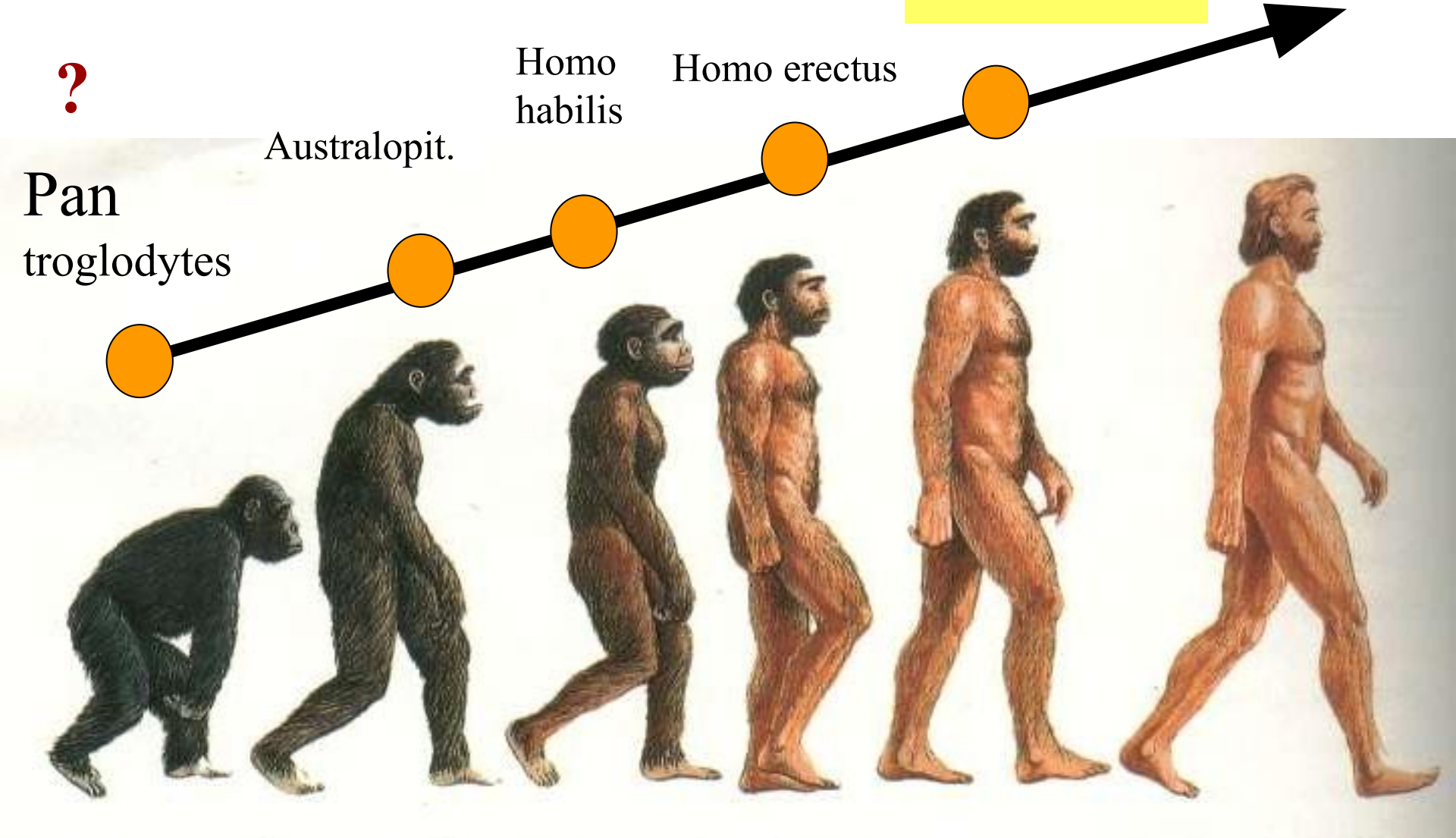


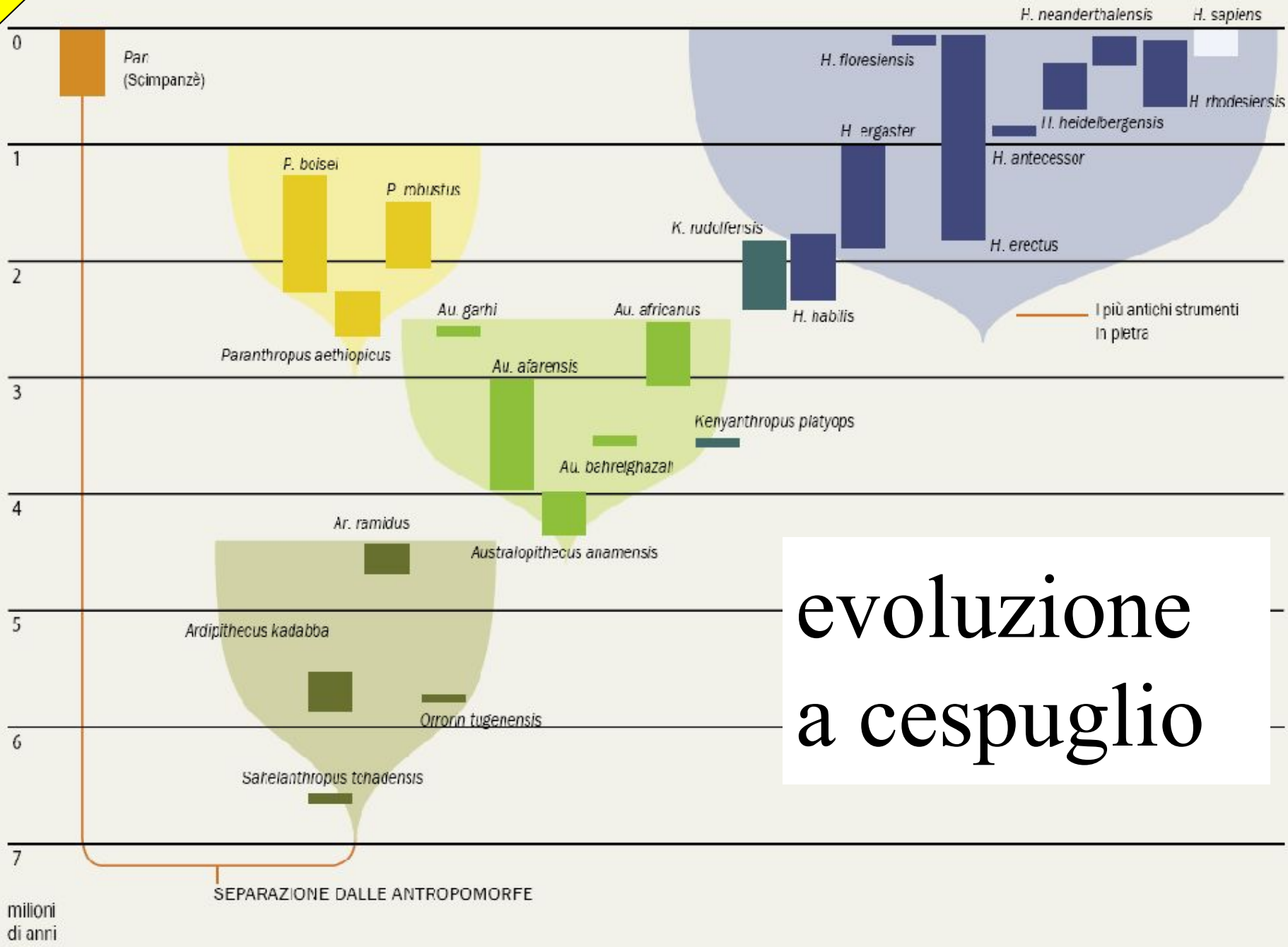
…sei errori 6

1. Non deriviamo da una specie… di scimpanzè



2. L'evoluzione umana non è il prodotto di un processo lineare





evoluzione a cespuglio

3. non deriviamo da Neandertal

Pan troglodytes

Austral opith

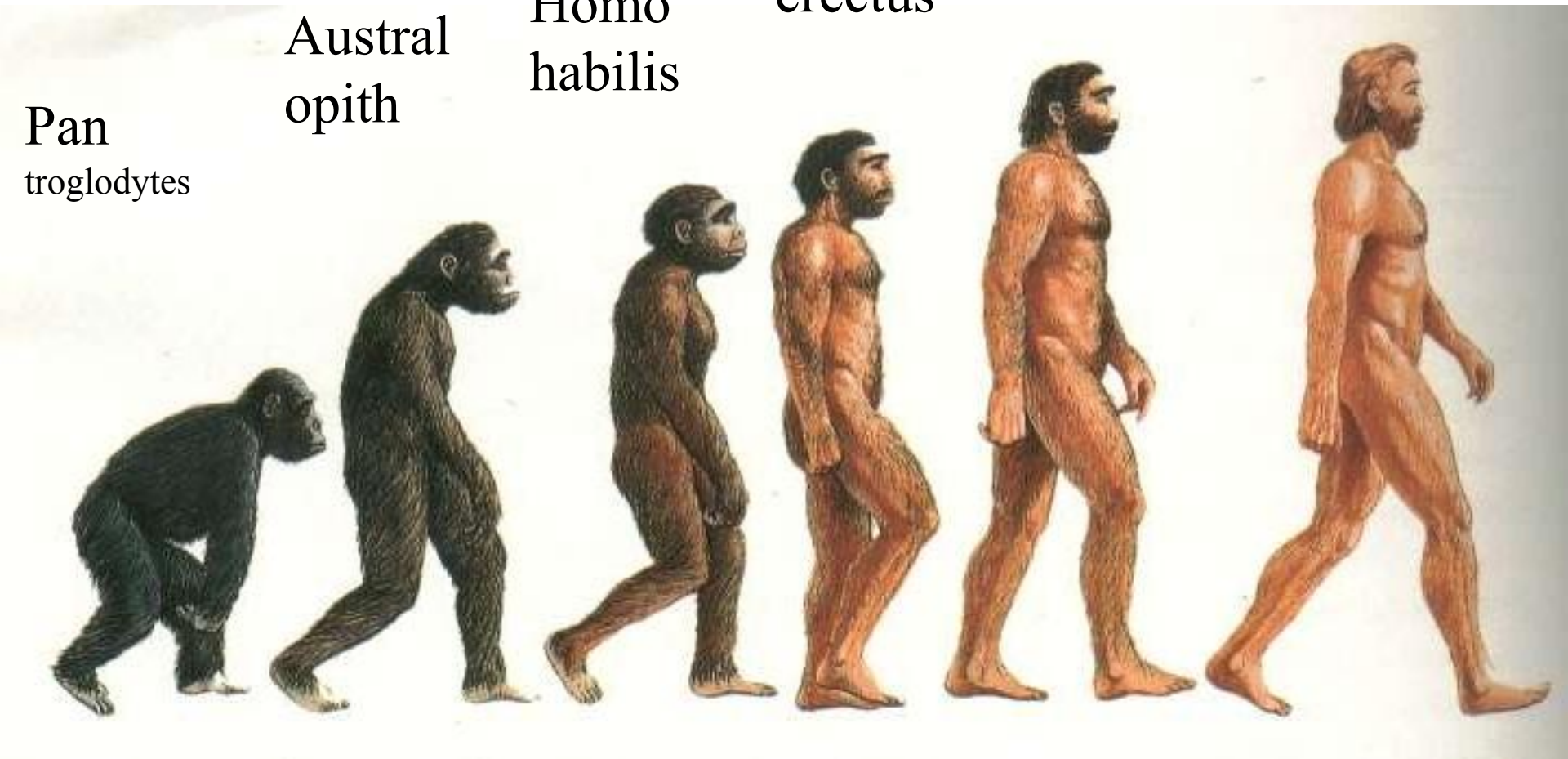
Homo habilis

Homo erectus

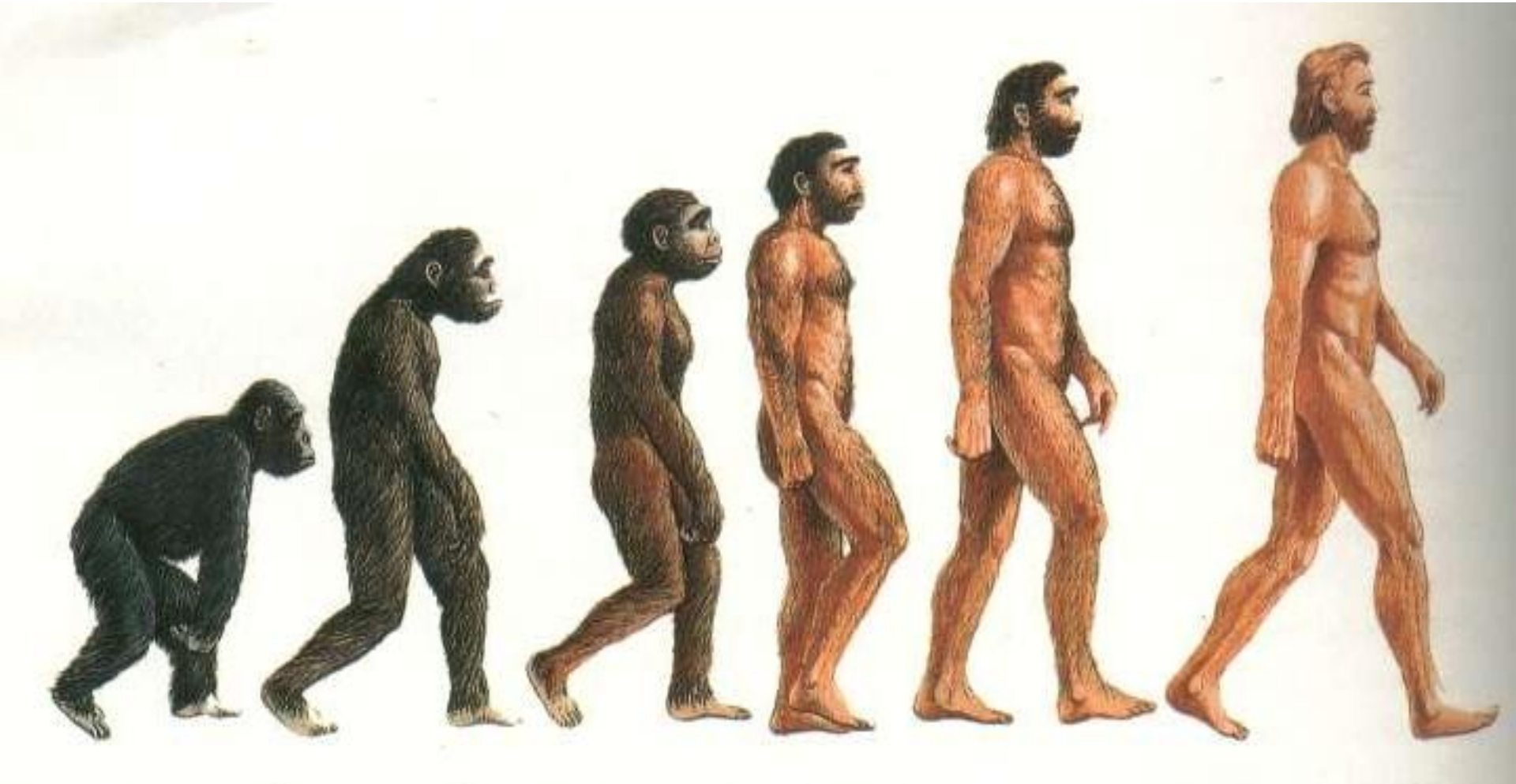
Homo neandertalensis

Homo sapiens

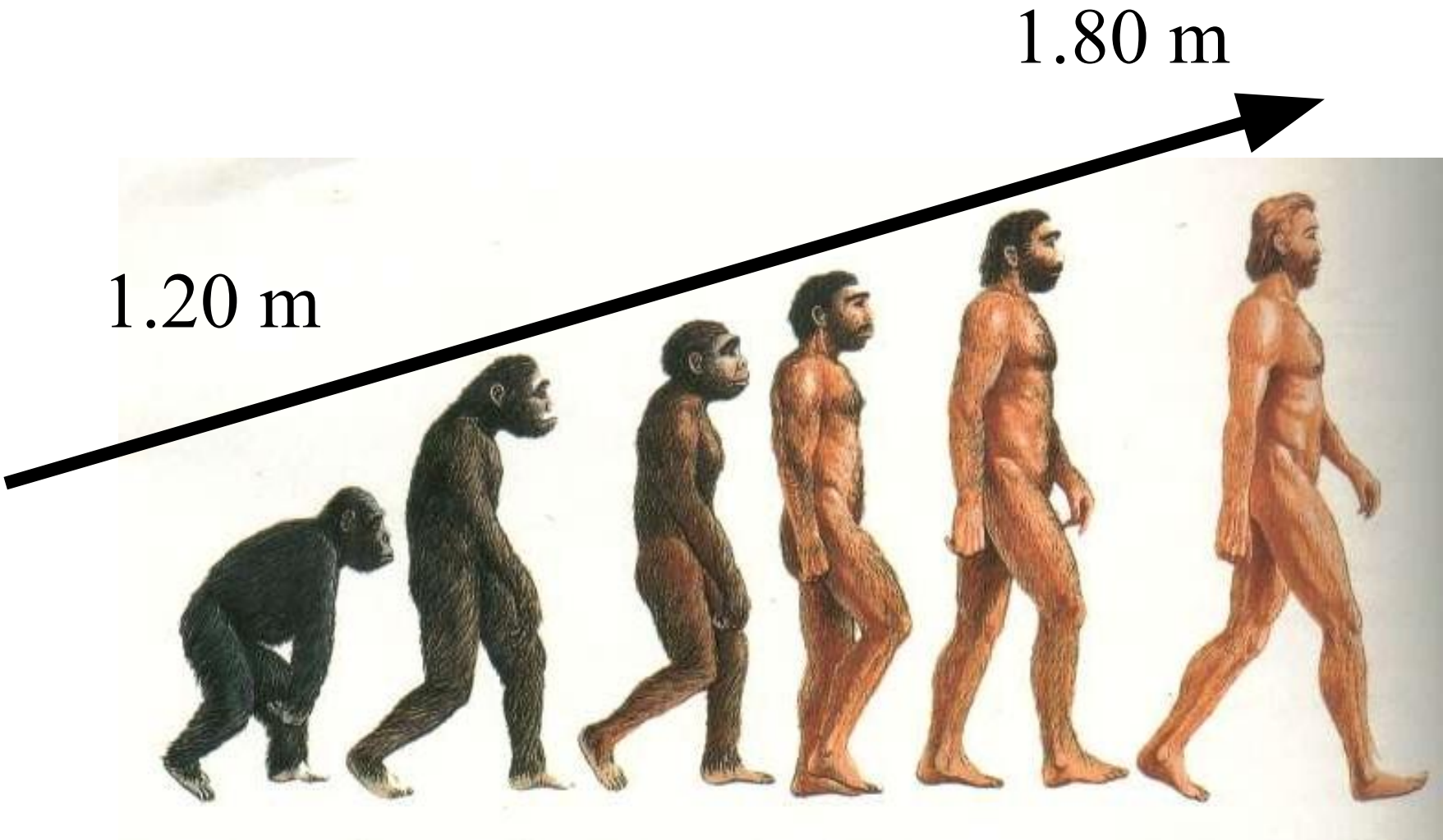
4. I primi Sapiens avevano la pelle scura

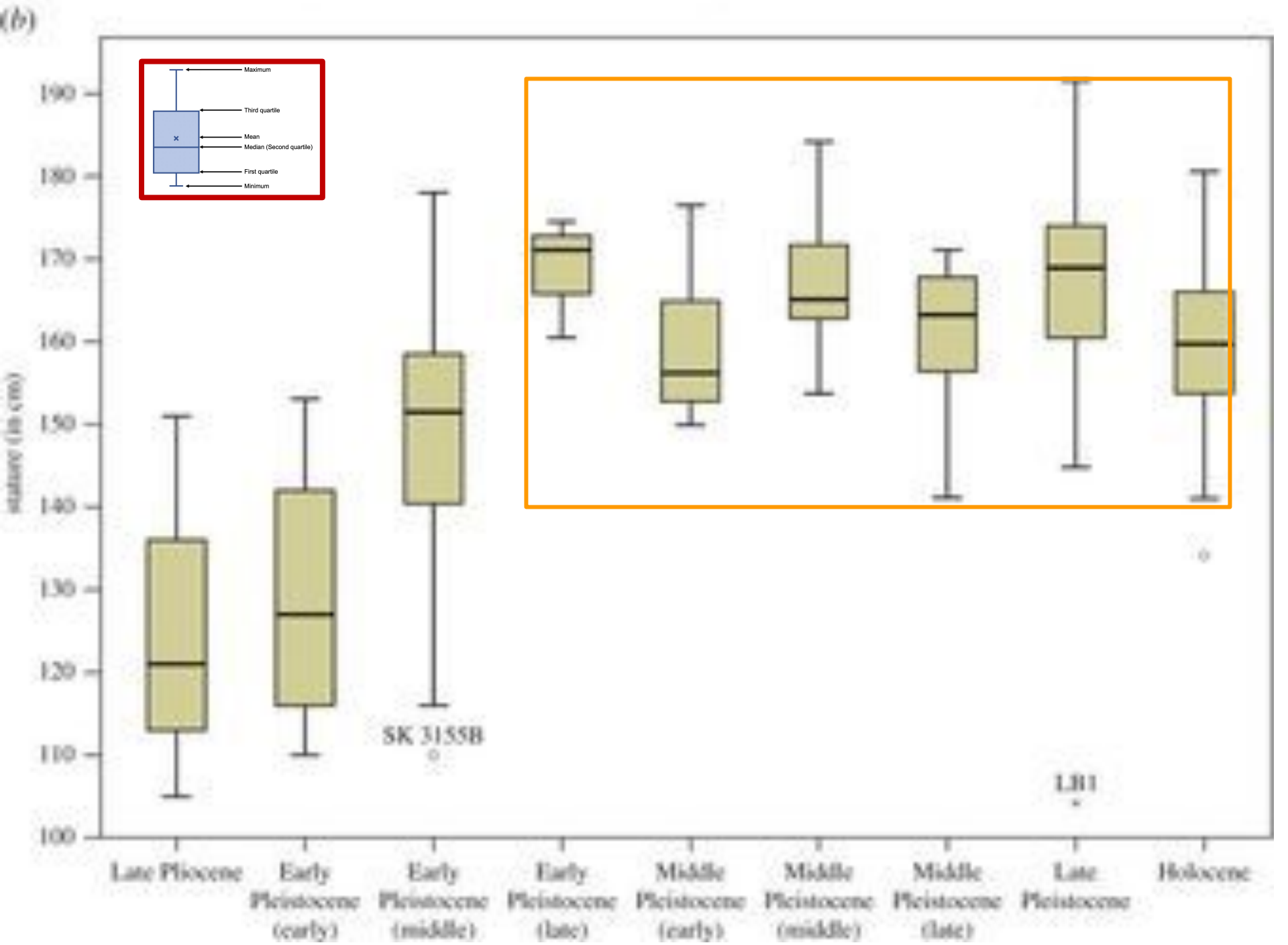


effetto **texas ranger**

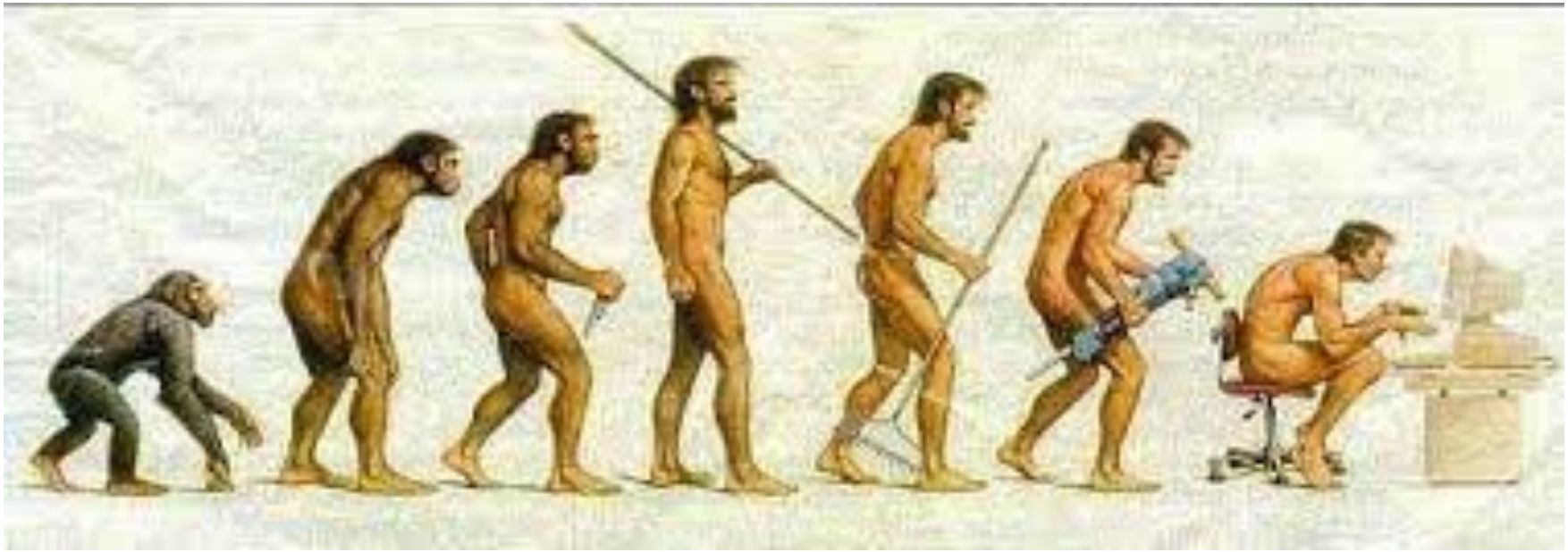


5. La statura non è sempre aumentata nel corso dell'evoluzione umana




(b)
Maximum
Third quartile
Mean
Median (Second quartile)
First quartile
Minimum
stature (in cm)
190
180
170
160
150
140
130
120
110
100
SK 3155B
LB1
Late Pliocene
Early Pleistocene (early)
Early Pleistocene (middle)
Early Pleistocene (late)
Middle Pleistocene (early)
Middle Pleistocene (middle)
Middle Pleistocene (late)
Late Pleistocene
Holocene

6. Evoluzione non è sinonimo di miglioramento



anche se…

evoluzióne = *lat.* EVOLUTIÓNEM da EVOLÚTUS p. p. di EVÒLVERE *svolgere* (v. q. v.).
L'atto e l'effetto dell'evolvere e dell'evolversi; piú specialm. Lo svolgersi degli esseri da forme inferiori e rudimentali a forme piú perfette, passando gradatamente dall'una all'altra, secondo la teoria di Darwin. — E nella milizia Movimento per il quale un esercito o parte di esso prende una disposizione diversa da quella che aveva.

Il Dna dell'uomo

25mila i geni

3,2miliardi le "basi" o lettere

99,9% la parte del Dna condivisa da tutti

20 aminoacidi codificati dal Dna

1800 geni si sono evoluti rapidamente tra 10mila e 40mila anni fa

7% del patrimonio genetico umano

Ecco l'evoluzione sbagliata dell'uomo

Quel che aiutava i primitivi a sopravvivere oggi spesso è uno svantaggio

ELENA DUSI

ROMA — Funzionale, ma non troppo elegante. Leonardo disegnò l'uomo vitruviano con proporzioni perfette. "Ma se arrivasse un alieno a osservarci attentamente, avrebbe l'impressione di un'accozzaglia di organi uniti da scotch e spago" scrive Lewis Held, genetista alla Texas Tech University nella prefazione del suo libro "Quirks of human anatomy", ovvero le bizzarrie dell'anatomia umana.

Non che l'opera di tanti anni di evoluzione sia da disprezzare, spiega l'autore. Ma quel che ci permetteva di sopravvivere migliaia di anni fa nella savana tropicale in molti casi si traduce in uno svantaggio ora che viviamo fra auto, scrivanie, tv e computer. "Per molti versi, l'uomo si è malamente adattato alla modernità" aggiunge Stephen Stearns, biologo evoluzionista dell'univer-

Orecchie
Il 20% delle persone riescono ancora a muoverle un po'. Residuo dei padiglioni orientabili che permettevano agli antenati di ascoltare meglio

Cranio
Si è assottigliato nel corso dei millenni. Probabilmente perché oggi viviamo in ambienti meno violenti

Occhi
La retina, la parte sensibile dell'occhio, è in parte coperta da nervi e capillari. Al centro ha un "punto cieco"

Occhi blu
Sono apparsi probabilmente nell'area baltica 10mila anni fa e oggi hanno "conquistato" 500 milioni di persone. Ma non hanno alcun vantaggio e rendono gli occhi più vulnerabili alla luce

Colonna vertebrale
Camminare in posizione eretta permette di usare le mani per molti scopi, ma favorisce il mal di schiena

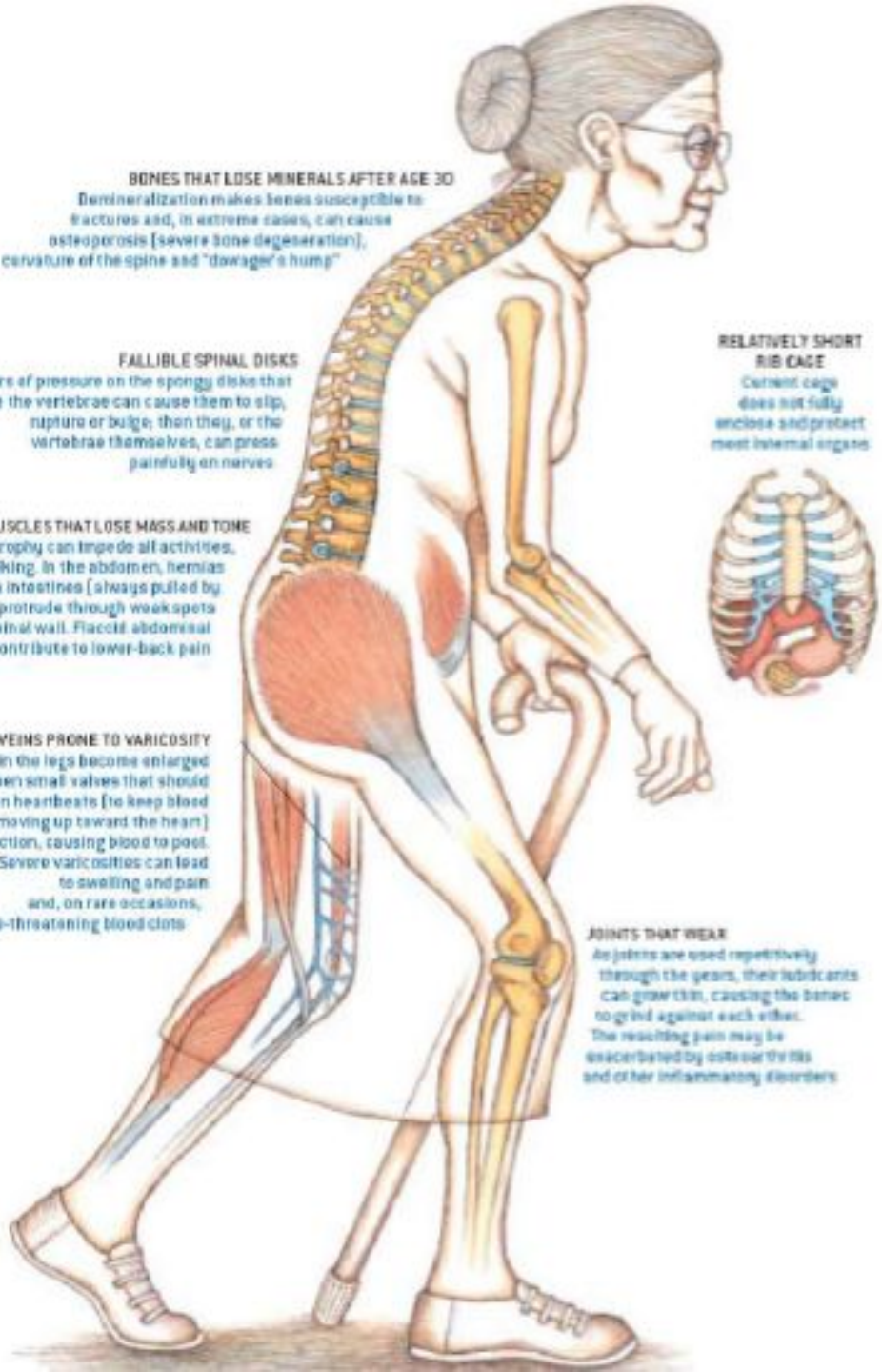
Sistema cardiovascolare

Come si è adattato il corpo umano

Denti
Le mascelle si sono rimpicciolite, ma il numero dei denti è rimasto identico causando problemi

e invece…

FLAWS



BONES THAT LOSE MINERALS AFTER AGE 30
Demineralization makes bones susceptible to fractures and, in extreme cases, can cause osteoporosis (severe bone degeneration), curvature of the spine and "dowager's hump"

FALLIBLE SPINAL DISKS
Years of pressure on the spongy disks that separate the vertebrae can cause them to slip, rupture or bulge; then they, or the vertebrae themselves, can press painfully on nerves

MUSCLES THAT LOSE MASS AND TONE
Such atrophy can impede all activities, including walking. In the abdomen, hernias can arise as the intestines (always pulled by gravity) protrude through weak spots in the abdominal wall. Flaccid abdominal muscles also contribute to lower-back pain

LEG VEINS PRONE TO VARICOSITY
Veins in the legs become enlarged and twisted when small valves that should snap shut between heartbeats (to keep blood moving up toward the heart) malfunction, causing blood to pool. Severe varicosities can lead to swelling and pain and, on rare occasions, to life-threatening blood clots

RELATIVELY SHORT RIB CAGE
Current cage does not fully enclose and protect most internal organs

JOINTS THAT WEAR
As joints are used repetitively through the years, their lubricants can grow thin, causing the bones to grind against each other. The resulting pain may be exacerbated by osteoarthritis and other inflammatory disorders

FIXES

Statura minore

Would provide a lower center of gravity, perhaps preventing the falls that often fracture demineralized bones

FORWARD-TILTING UPPER TORSO
Would relieve pressure on vertebrae, thereby lessening the risk of ruptured or slipped disks, which contribute, along with weakening abdominal muscles, to lower-back pain

CURVED NECK WITH ENLARGED VERTEBRAE
Would counterbalance the tilted torso and enable the head to stay up and face forward

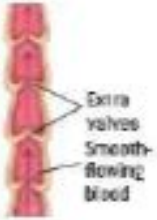
CAGE WITH ADDED RIBS
Could help prevent hernias and other problems by holding organs in place more effectively

THICKER DISKS
Would resist destructive pressures

EXTRA MUSCLES AND FAT
Would add weight on the bones, which would help counter the effects of demineralization; they would also cushion bones against breakage during falls

THICKER BONES
Would protect against breakage during falls

LEG VEINS WITH MORE CHECK VALVES
Would combat the development of varicose veins



KNEE ABLE TO BEND BACKWARD
Would make the bones less likely to grind and deteriorate, especially if the knee never locked in place. But the absence of a locking mechanism would make it hard to stand for very long, so further modifications would be needed

LARGER HAMSTRINGS AND TENDONS
Would help support the leg and hip

4.

L’intelligenza dipende dall’origine geografica

(o peggio dalla “razza”)

Intelligence 38 (2010) 93–100

Contents lists available at ScienceDirect

Intelligence

In Italy, north–south differences in IQ predict differences in income, education, infant mortality, stature, and literacy

Richard Lynn

University of Ulster, Coleraine, Northern Ireland, United Kingdom

A B S T R A C T

Regional differences in IQ are presented for 12 regions of Italy showing that IQs are highest in the north and lowest in the south. Regional IQs obtained in 2006 are highly correlated with average incomes at $r = 0.937$, and with stature, infant mortality, literacy and education. The lower IQ in southern Italy may be attributable to genetic admixture with populations from the Near East and North Africa.

In Italy, north–south differences in IQ predict differences in income, education, infant mortality, stature, and literacy

Richard Lynn

University of Ulster, Coleraine, Northern Ireland, United Kingdom

The lower IQ in southern Italy may be attributable to genetic admixture with populations from the Near East and North Africa.

Table 1
Descriptive statistics fɞ.

Region	IQ	Stature 1980	Per cap income 2003
Friuli-Venezia	103	178.0	20,750
Trentino	101	177.1	23,079
Veneto	101	177.0	20,338
Tuscany	–	175.8	19,666
Lombardy	100	175.2	22,639
Piedmont	100	175.3	20,519
Liguria	97	175.1	20,000
Emilia Romana	100	175.4	22,439
Umbria	–	175.8	17,070
Lazio	–	175.5	20,207
Abruzzi Basilicata	92	174.0	15,480
Campania	90	173.1	11,862
Puglia Arulia	91	173.3	12,030
Sardinia	90	171.6	13,722
Calabria	–	172.4	11,595
Sicily	89	172.7	12,488

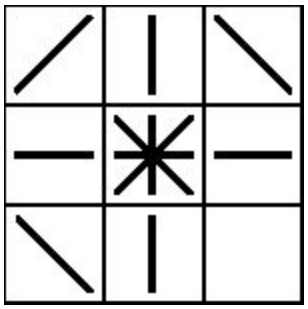
1 - 8) Aggiungi a questa successione di lettere-numeri la lettera o il numero che seguono a logica

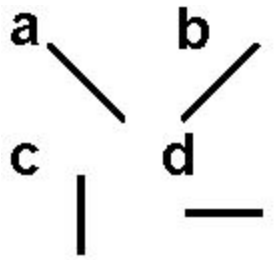
1, 3, 6, 10,

1, 1, 2, 3, 5,

21, 20, 18, 15, 11,

9 - 15) Riempi il settore vuoto sul lato sinistro con la figura corretta (a b c d) del lato destro.





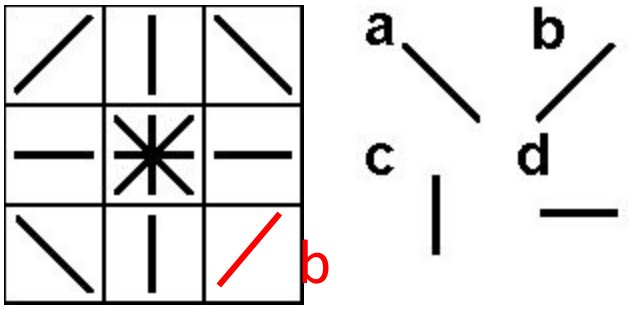
1 - 8) Aggiungi a questa successione di lettere-numeri la lettera o il numero che seguono a logica

1, 3, 6, 10, 15

1, 1, 2, 3, 5, 8

21, 20, 18, 15, 11, 6

9 - 15) Riempi il settore vuoto sul lato sinistro con la figura corretta (a b c d) del lato destro.



Come definire l'intelligenza?

1. Quella cosa che fa superare gli esami senza studiare?

La capacità di sfruttare in maniera ottimale le risorse, far cui il tempo, per raggiungere obiettivi

La capacità complessiva di agire secondo un progetto, di pensare razionalmente, di misurarsi efficacemente con l'ambiente

L’intelligenza è molto piu del QI

Complesso di facoltà psichiche e mentali che consentono di pensare, comprendere o spiegare i fatti o le azioni, elaborare modelli astratti della realtà, intendere e farsi intendere dagli altri, giudicare, e adattarsi all'ambiente.

1. Linguistica
2. Logico matematica
3. Spaziale
4. Corporea
5. Musicale
6. Interpersonale
7. Intrapersonale

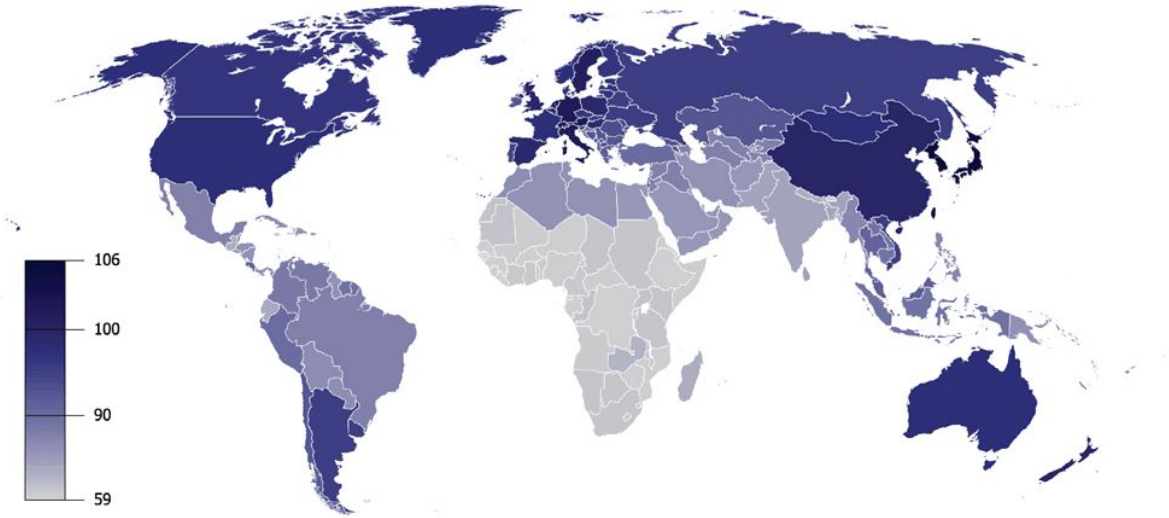
Intelligenza emotiva

riconoscere, di **discriminare** e **identificare**, di **etichettare** nel modo appropriato e, conseguentemente, di **gestire** le proprie emozioni e quelle degli altri allo scopo di **raggiungere determinati obiettivi**.

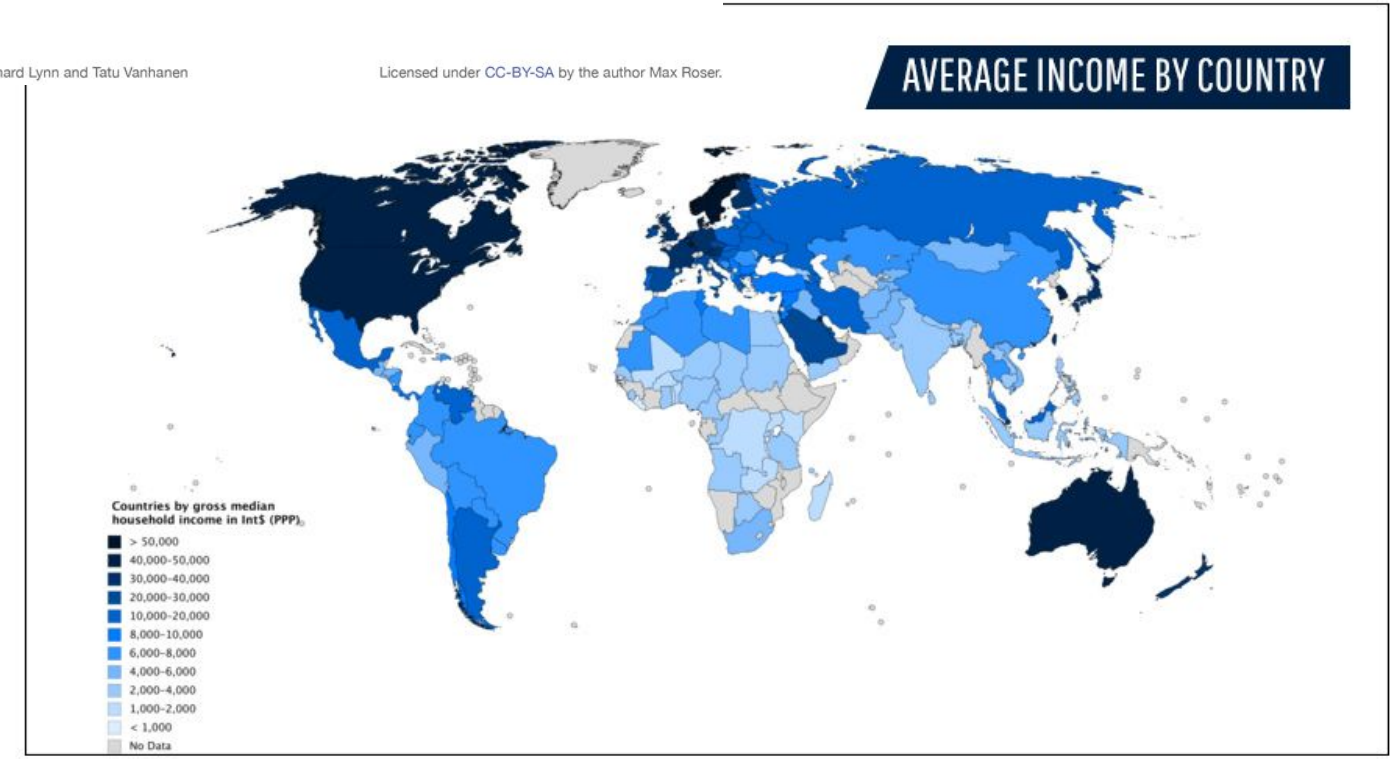
Average IQ by country – Lynn and Vanhanen

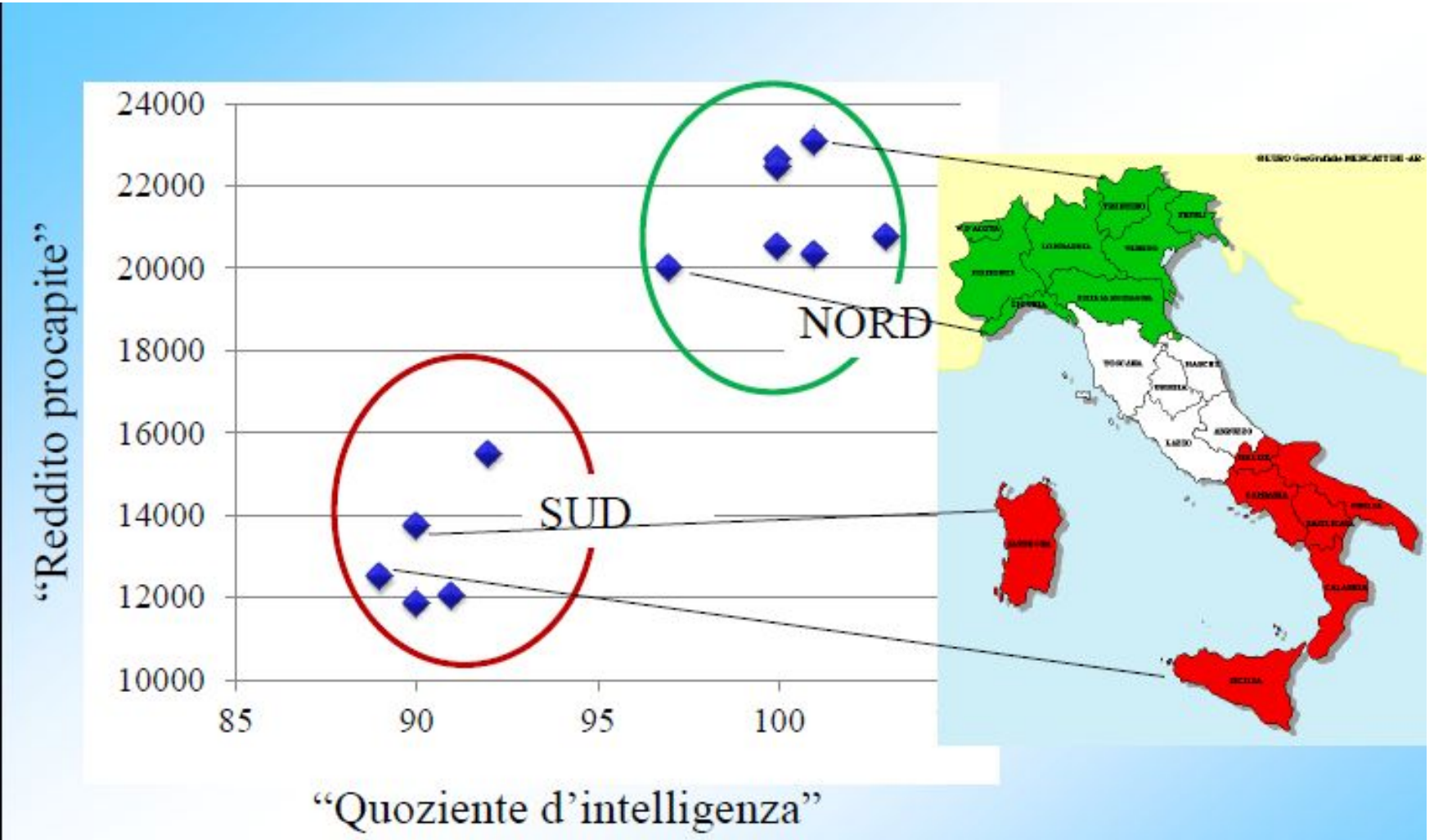
The research conducted by Richard Lynn and Tatu Vanhanen is not endoresed or supported by Our World in Data. The objection to the results and conclusions of the authors is explained at ourworldindata.org/data/education-knowledge/intelligence/.

Our World in Data



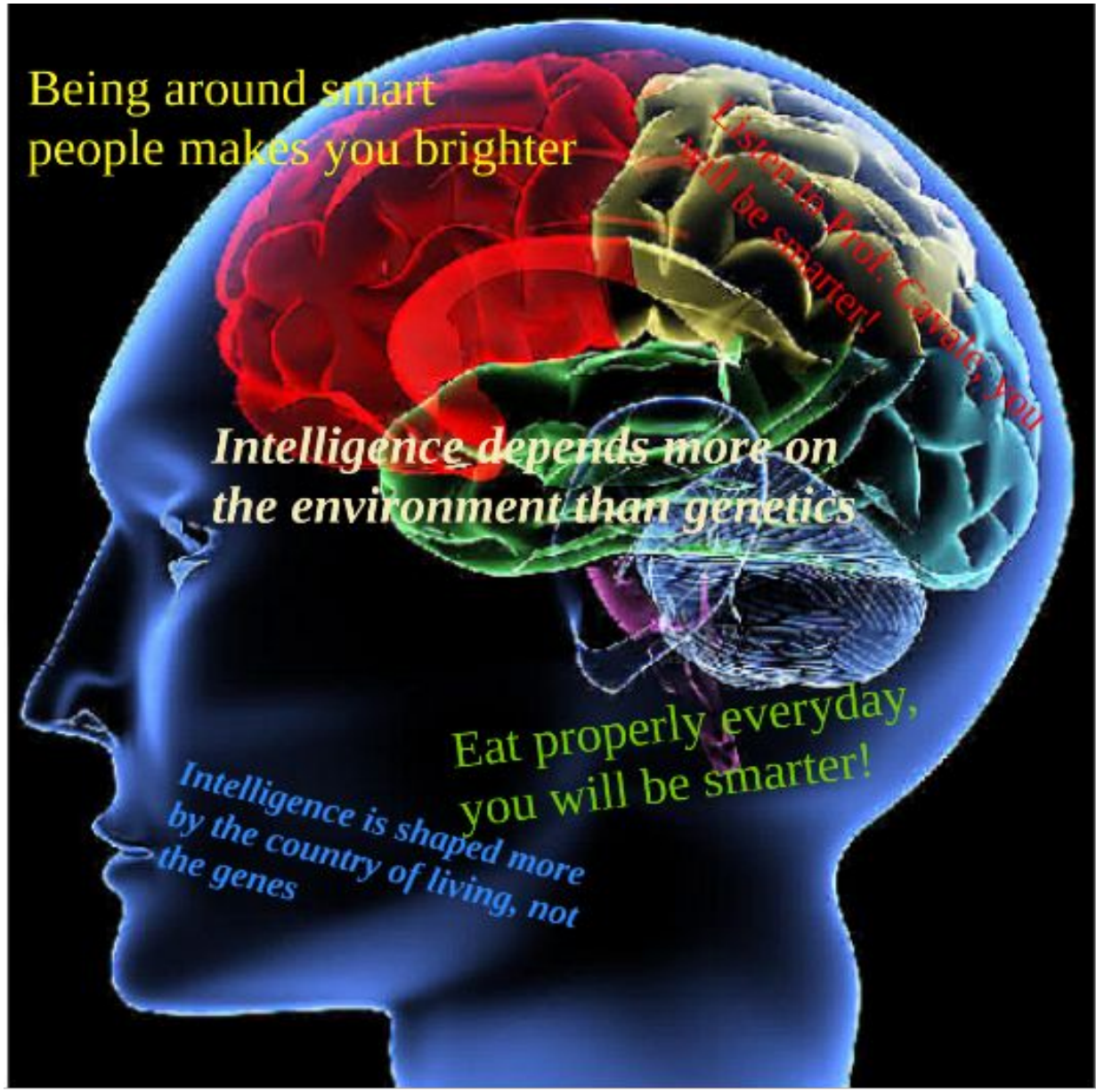
Data source: Intelligence and the Wealth and Poverty of Nations (2009) by Richard Lynn and Tatu Vanhanen




24000
22000
20000
18000
16000
14000
12000
10000
85
90
95
100
"Reddito procapite"
"Quoziente d'intelligenza"
NORD
SUD

E' nato prima
l'uovo
o
la gallina?

L'ambiente conta!



1. Togliamo un po’ di equivoci di mezzo

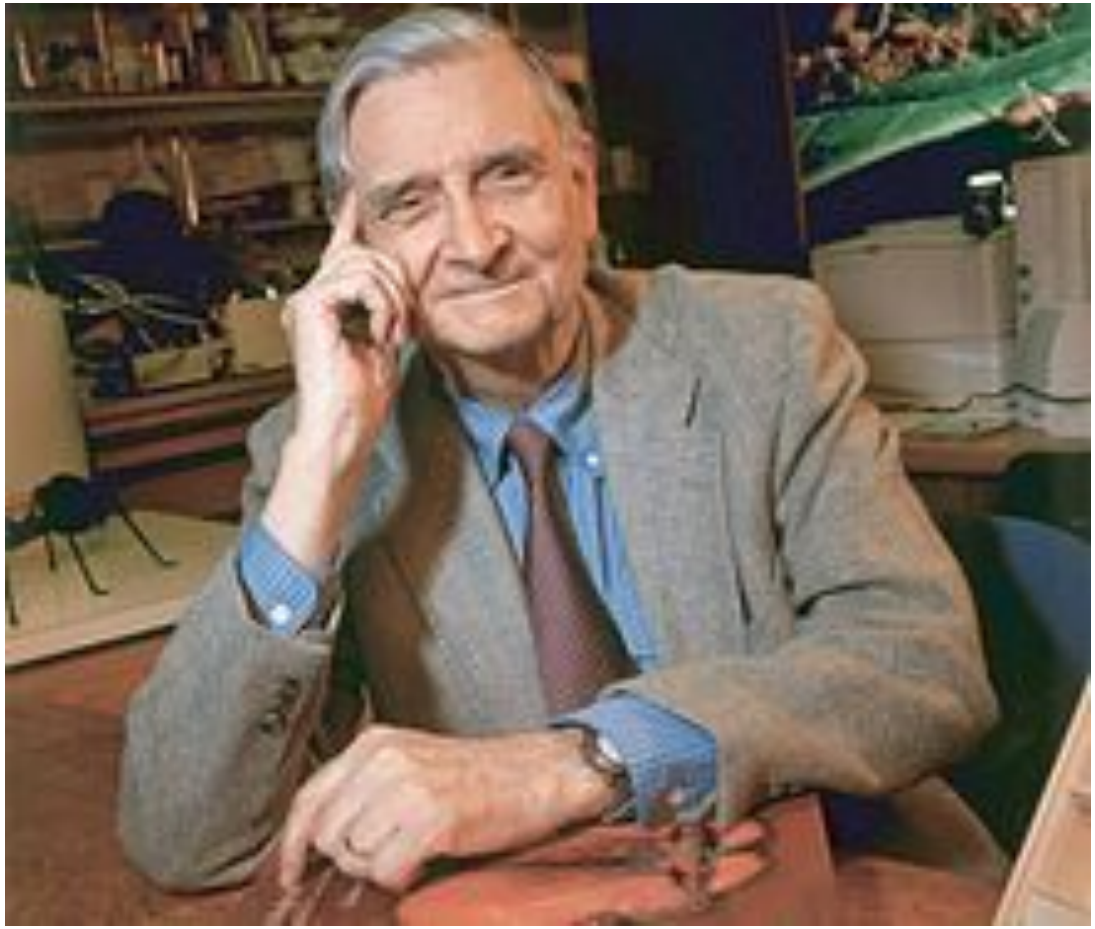
2. **La biodiversità (umana) è …**

3. Perchè mettiamo insieme biologia, evoluzione e cultura

4. Struttura e contenuti del corso

Biodiversity (1988)

National Research Council



Edward Osborne Wilson (1929)

Biodiversity (E Wilson, 1988)

…the variety of all forms of life, from genes to species, through to the broad scale of ecosystems

…a measure of the health of ecosystems

…a function of climate


What is biodiversity?

2010 International Year of Biodiversity

Biodiversity is life
Biodiversity is our life

1

Humans are part of nature's rich diversity and have the power to protect or destroy it.

Human activity is causing the diversity of life on Earth to be lost at a greatly accelerated rate. These losses are irreversible, impoverish us all and damage the life support systems we rely on everyday. But we can prevent them.

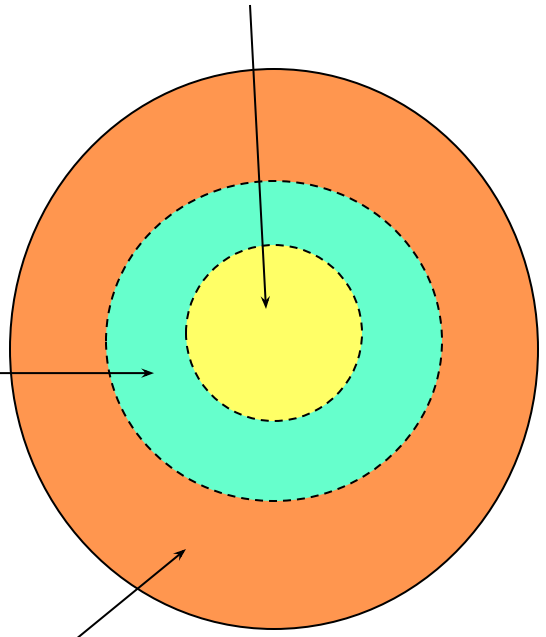
3

What's missing here ?

1. from Biodiversity to …Human Biodiversity

- ***intraspecific biodiversity***
  genetic variability among individuals and populations of a species

i tre livelli comunicano



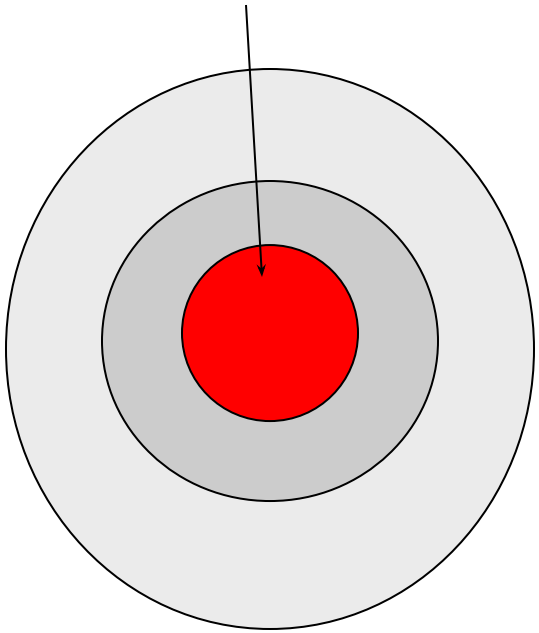
- ***specific biodiversity***
  Number and relative abundance of species in a given area

- ***Ecosystemic Biodiversity***
  Diversity among ecosystems and different types of interaction which can occur among their biotic and abiotic components.

1. from Biodiversity to …Human Biodiversity

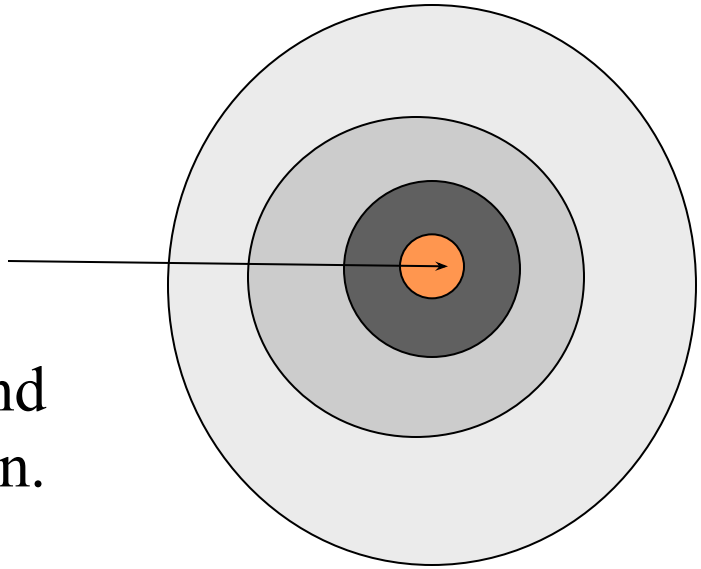
- ***intraspecific diversity***

  genetic variability among individuals and populations of a species



Molecular Biodiversity

… there is a FOURTH SOURCE OF BIODIVERSITY – MOLECULAR BIODIVERSITY – without which evolution cannot occur, either in the origin of a new species, its survival and development, or its eventual extinction.



non solo…

Campbell, J. Appl. Ecol. 2004

Molecular Biodiversity

- Molecular biodiversity is distinct from genetic diversity, though both ultimately on inheritable DNA.

- The consequences of molecular biodiversity for an individual or species are influenced in a major way by non-inheritable mechanisms. This is why molecular biodiversity is so important for ecology.

Campbell, J. Appl. Ecol. 2004

Molecular Biodiversity

- within one individual

isozymes (genetic and ontogenetic variation)
foetal antigens and HB

- between individuals of the same species

- bad molecular diversity

HBB, CFTR

- between related species

- within and between phyla and ecosystems

Molecular Biodiversity

1 the biological use of the same molecule in *different* (diverse) processes. … alternative splicing…retinitis pigmentosa

2 The multiple use of different molecules in the same biological process, function, or phenomenon; e.g. two enzymes catalysing the same reaction beta galactosidase in E. coli, lactase in humans

3 the molecular biodiversity of cells, whereby the same molecule is expressed at a different level in individual cells.

- Cellular individuality

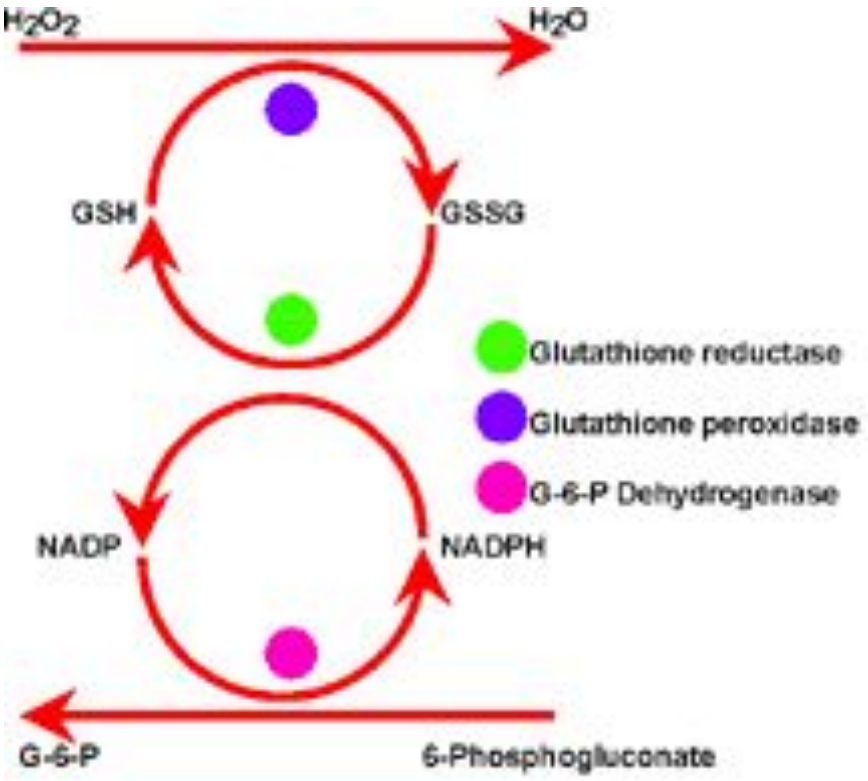
MOLECULAR BIODIVERSITY

Two or more different molecules can be considered partners in molecular biodiversity:

1. the molecules must have at least one structural difference between them.

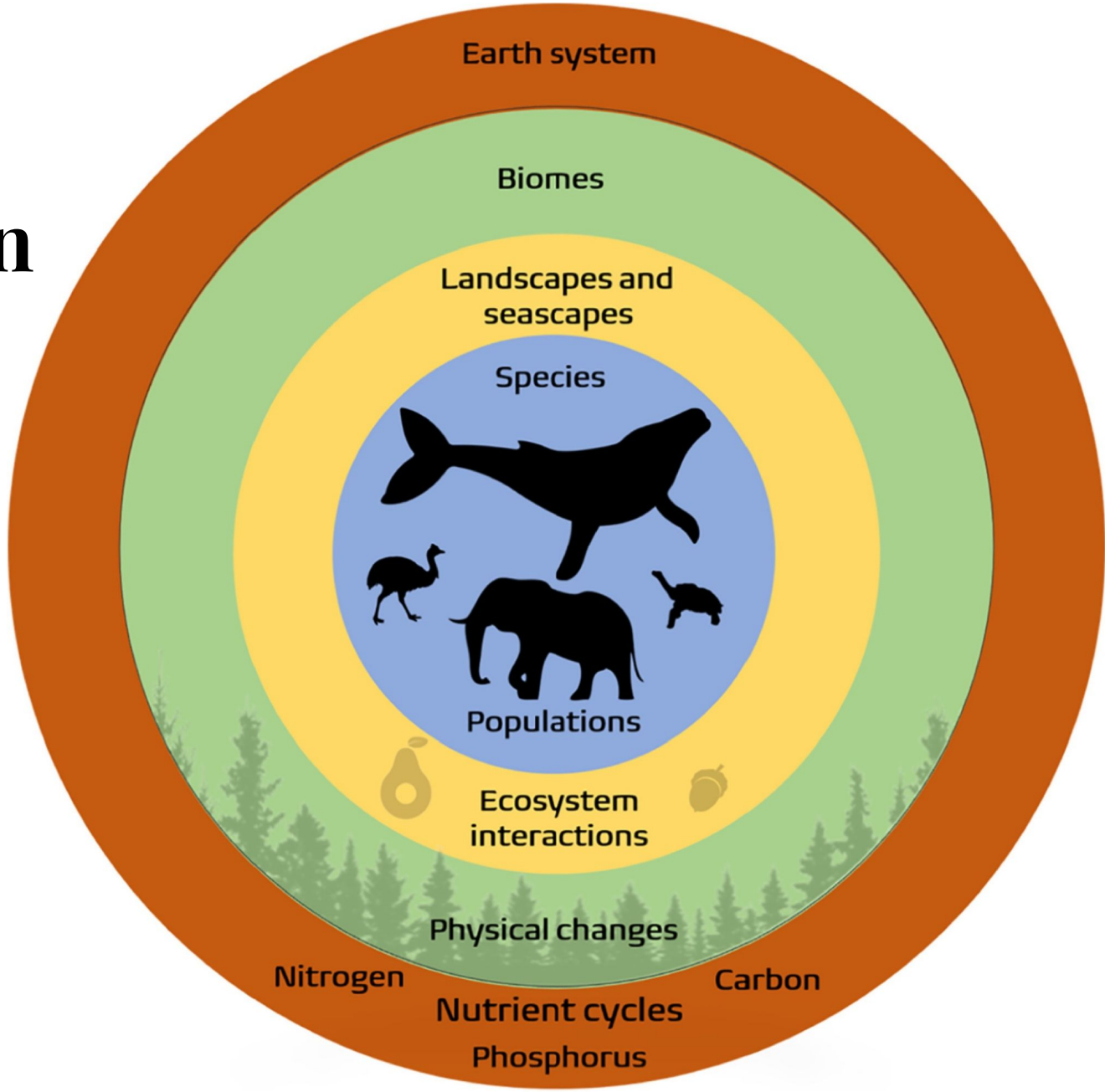
2. The molecules must play the same role in a biological process.

3. the molecules have to be susceptible to the same forces of natural selection when the organisms forced to adapt to environmental change



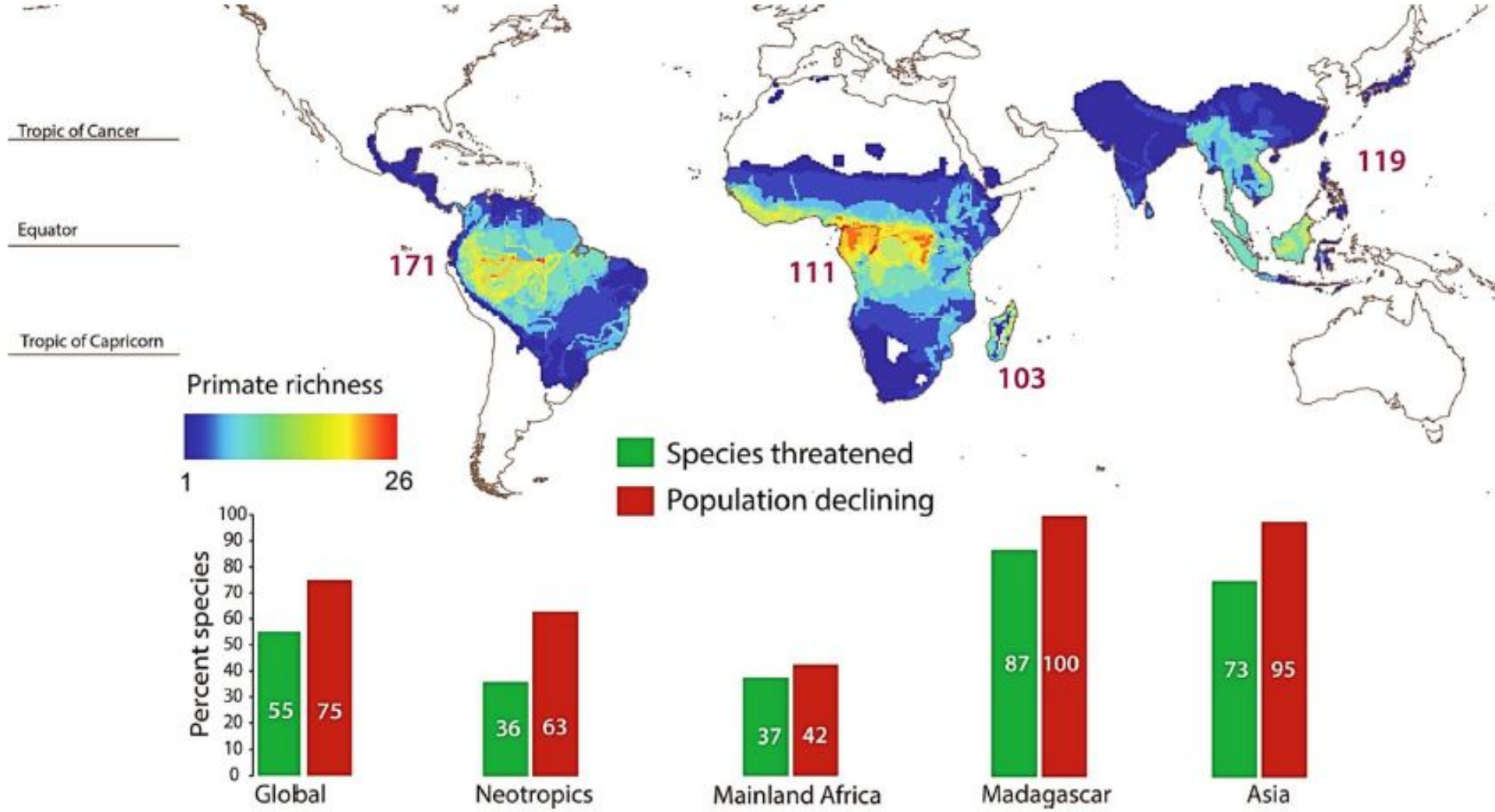
la natura non è “una mera cornice” della nostra vita e il mantenimento della biodiversità una **responsabilità** ma anche una **necessità** per la nostra specie e **tutto questo perché … la biodiversità è vita, la nostra vita.**

Biodiversity and Conservation



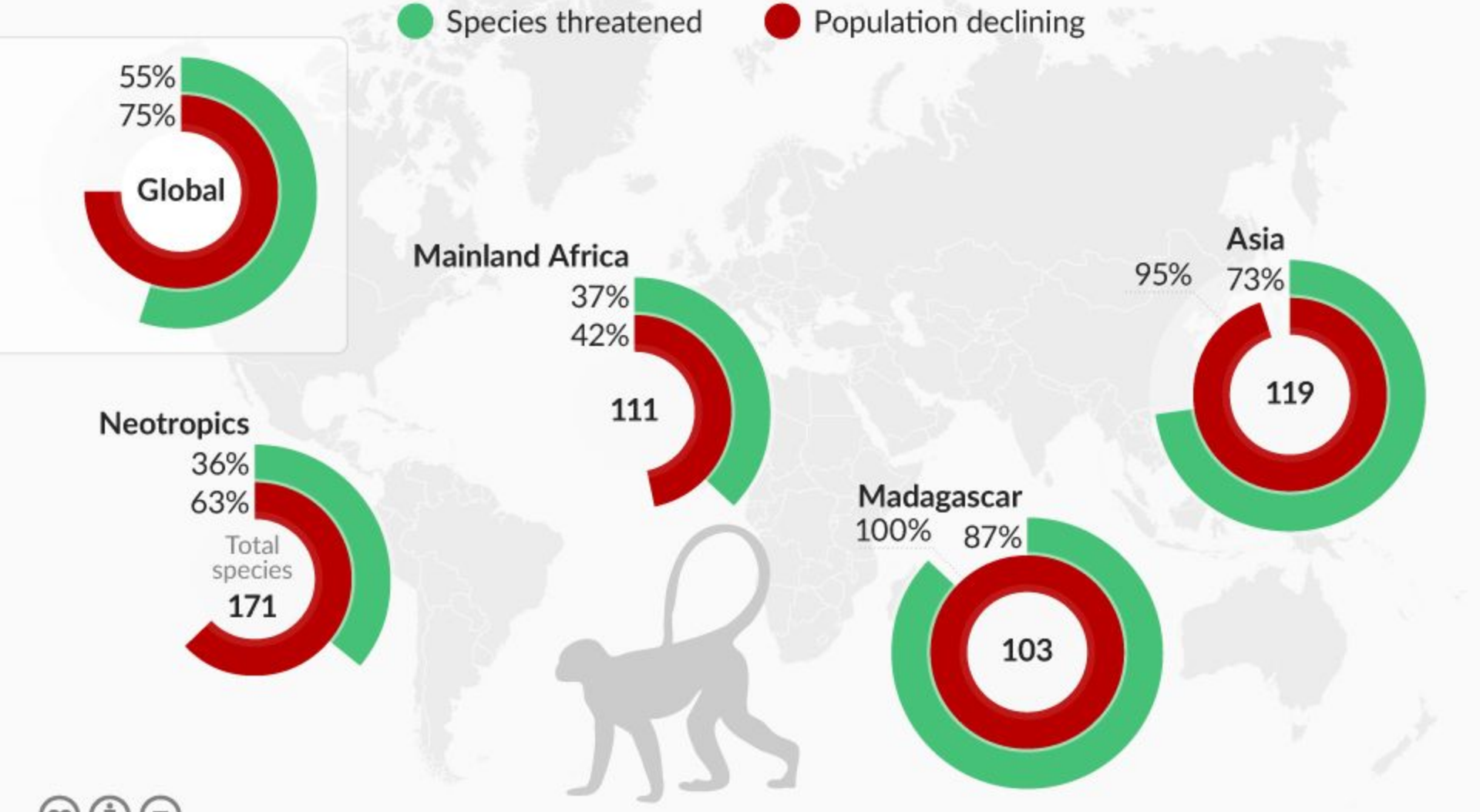
Trends in Ecology & Evolution

Primati non umani



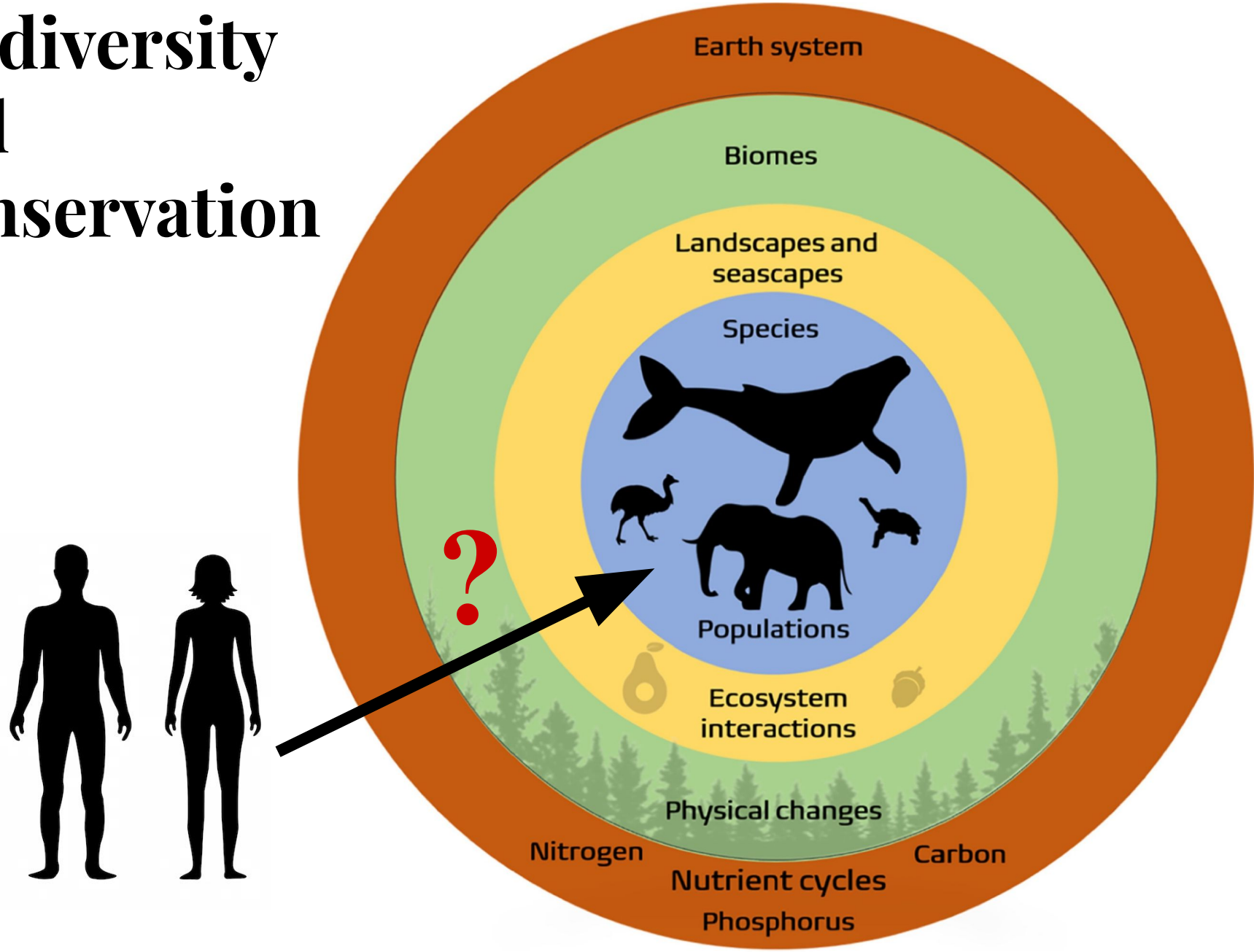
Over half the world's primates are facing extinction

% of global primate species threatened and with declining populations in 2017



Source: Science Advances

Biodiversity and Conservation



Trends in Ecology & Evolution

Gruppi umani in via d'estinzione?

Fuegini

L'ultimo Fuegino

è morto nel 1999

Genomic insights into the origin and diversification of late maritime hunter-gatherers from the Chilean Patagonia

2018

Patagonia was the last region of the Americas reached by humans who entered the continent from Siberia ~15,000–20,000 y ago. Here, we present genome data from four modern populations from Central Southern Chile and Patagonia (n = 61) and four ancient maritime individuals from Patagonia (~1,000 y old). **Both the modern and ancient individuals studied in this work have a greater genetic affinity with other modern Native Americans than to any non-American population, showing within South America a clear structure between major geographical regions**. Native Patagonian Kawéskar and Yámana showed the highest genetic affinity with the ancient individuals, indicating genetic continuity in the region during the past 1,000 y before present, together with an important agreement between the ethnic affiliation and historical distribution of both groups.

https://www.pnas.org/doi/pdf/10.1073/pnas.1715688115

ARTICLE

https://doi.org/10.1038/s41467-020-17656-w OPEN

Ancient genomes in South Patagonia reveal population movements associated with technological shifts and geography

2020

Archaeological research documents major technological shifts among people who have lived in the southern tip of South America (South Patagonia) during the last thirteen millennia, including the development of marine-based economies and changes in tools and raw materials. It has been proposed that movements of people spreading culture and technology propelled some of these shifts, but these hypotheses have not been tested with ancient DNA. Here we report **genome-wide data from 20 ancient individuals**, and co-analyze it with previously reported data. We reveal that immigration does not explain the appearance of marine adaptations in South Patagonia. We describe partial genetic continuity since ~6600 BP and
two later gene flows correlated with technological changes: one between 4700–2000 BP that affected primarily marine-based groups, and a later one impacting all <2000 BP groups. From ~2200–1200 BP, mixture among neighbors resulted in a cline correlated to geographic ordering along the coast.

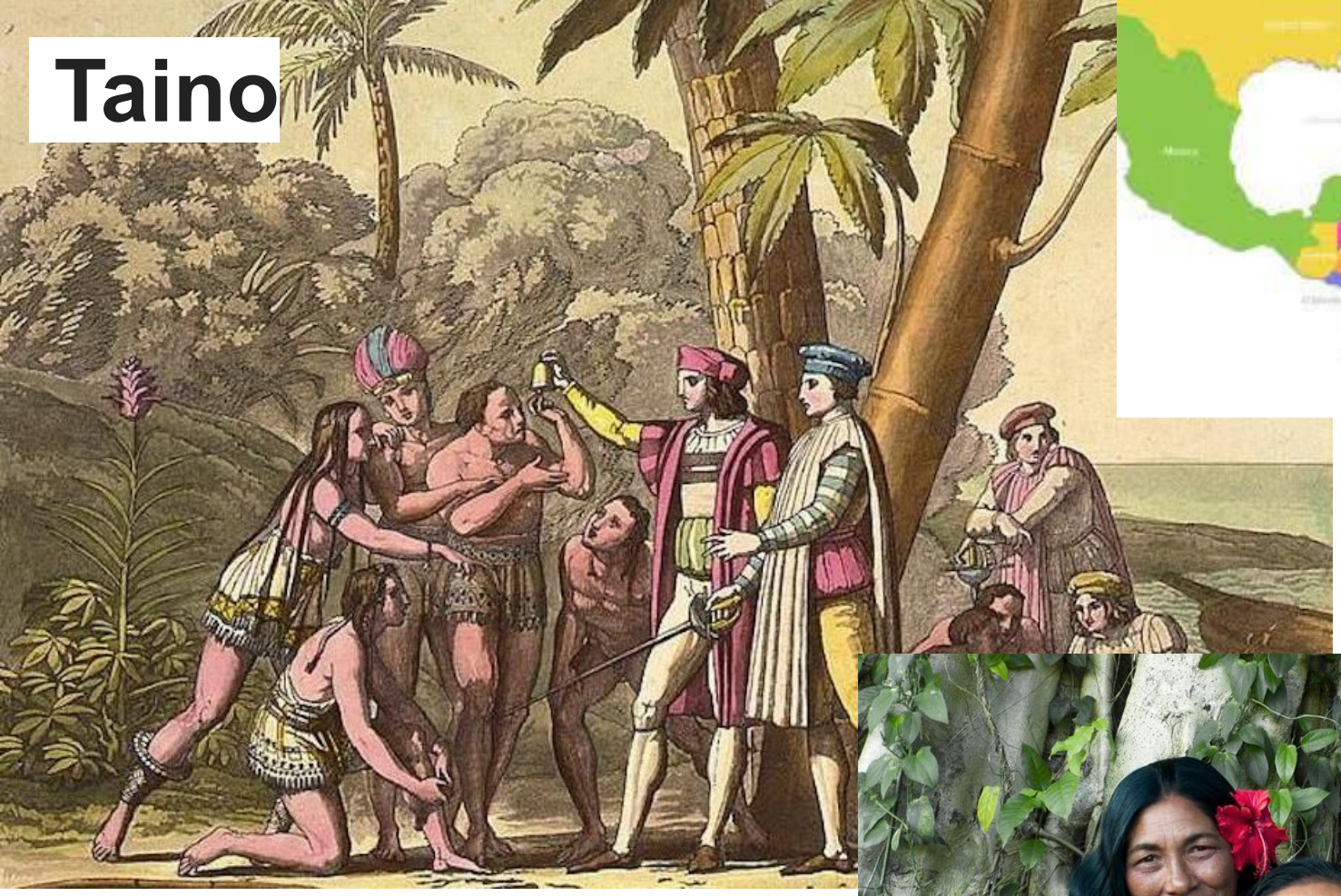
https://www.nature.com/articles/s41467-020-17656-w

Tasmaniani

nel 1803, il numero di **aborigeni in Tasmania** era stimato in 3.000-15.000 individui,

"ultimo aborigeno tasmaniano" venne riconosciuto a Fanny Cochrane Smith nel 1889

Taino



Taino

Cuba, Hispaniola, Jamaica, Puerto Rico, Bahamas e Lesser Antilles

Origins and genetic legacies of the Caribbean Taino

Hannes Schroeder[a,b,1], Martin Sikora[a], Shyam Gopalakrishnan[a], Lara M. Cassidy[c], Pierpaolo Maisano Delser[c,d], Marcela Sandoval Velasco[a], Joshua G. Schraiber[e], Simon Rasmussen[f], Julian R. Homburger[g], María C. Ávila-Arcos[h], Morten E. Allentoft[a], J. Víctor Moreno-Mayar[a], Gabriel Renaud[a], Alberto Gómez-Carballa[i,j], Jason E. Laffoon[b,k], Rachel J. A. Hopkins[l], Thomas F. G. Higham[l], Robert S. Carr[m], William C. Schaffer[n,o], Jane S. Day[p], Menno Hoogland[b], Antonio Salas[i,j], Carlos D. Bustamante[g], Rasmus Nielsen[a,q], Daniel G. Bradley[c], Corinne L. Hofman[b], and Eske Willerslev[a,d,r,1]

2018

The Caribbean was one of the last parts of the Americas to be settled by humans, but how and when the islands were first occupied remains a matter of debate. Ancient DNA can help answering these questions, but the work has been hampered by poor DNA preservation. **We report the genome sequence of a 1,000-year-old Lucayan Taino** individual recovered from the site of Preacher's Cave in the Bahamas. We sequenced her genome to 12.4-fold coverage and show that she is genetically most closely related to present-day Arawakan speakers from northern South America, suggesting that the ancestors of the Lucayans originated there. Further, we find no evidence for recent inbreeding or isolation in the ancient genome, suggesting that the Lucayans had a relatively large effective population size. Finally, we show that **the native American components in some present-day Caribbean genomes are closely related to the ancient Taino, demonstrating an element of continuity between precontact populations and present-day Latino populations in the Caribbean.**

https://www.pnas.org/content/pnas/115/10/2341.full.pdf

Article

A genetic history of the pre-contact Caribbean

https://www.nature.com/articles/s41586-020-03053-2

2020

Here we report **genome-wide data from 174 ancient individuals** from The Bahamas, Haiti and the Dominican Republic (collectively, Hispaniola), Puerto Rico, Curaçao and Venezuela, which we co-analysed with 89 previously published ancient individuals.

We find **no support for ancestry contributed by a population related to North American individuals**. Archaic-related lineages were >98% replaced by a genetically homogeneous ceramic-using population **related to speakers of languages in the Arawak family from northeast South America**.

Ancient Caribbean people **avoided close kin unions despite limited mate pools that reflect small effective population sizes**, which we estimate to be a minimum of 500–1,500 and a maximum of 1,530–8,150 individuals on the combined islands of Puerto Rico and Hispaniola in the dozens of generations before the individuals who we analysed lived.

Genetic continuity across transitions in pottery styles reveals that **cultural changes during the Ceramic Age were not driven by migration of genetically diferentiated groups from the mainland, but instead reflected interactions within an interconnected Caribbean world**