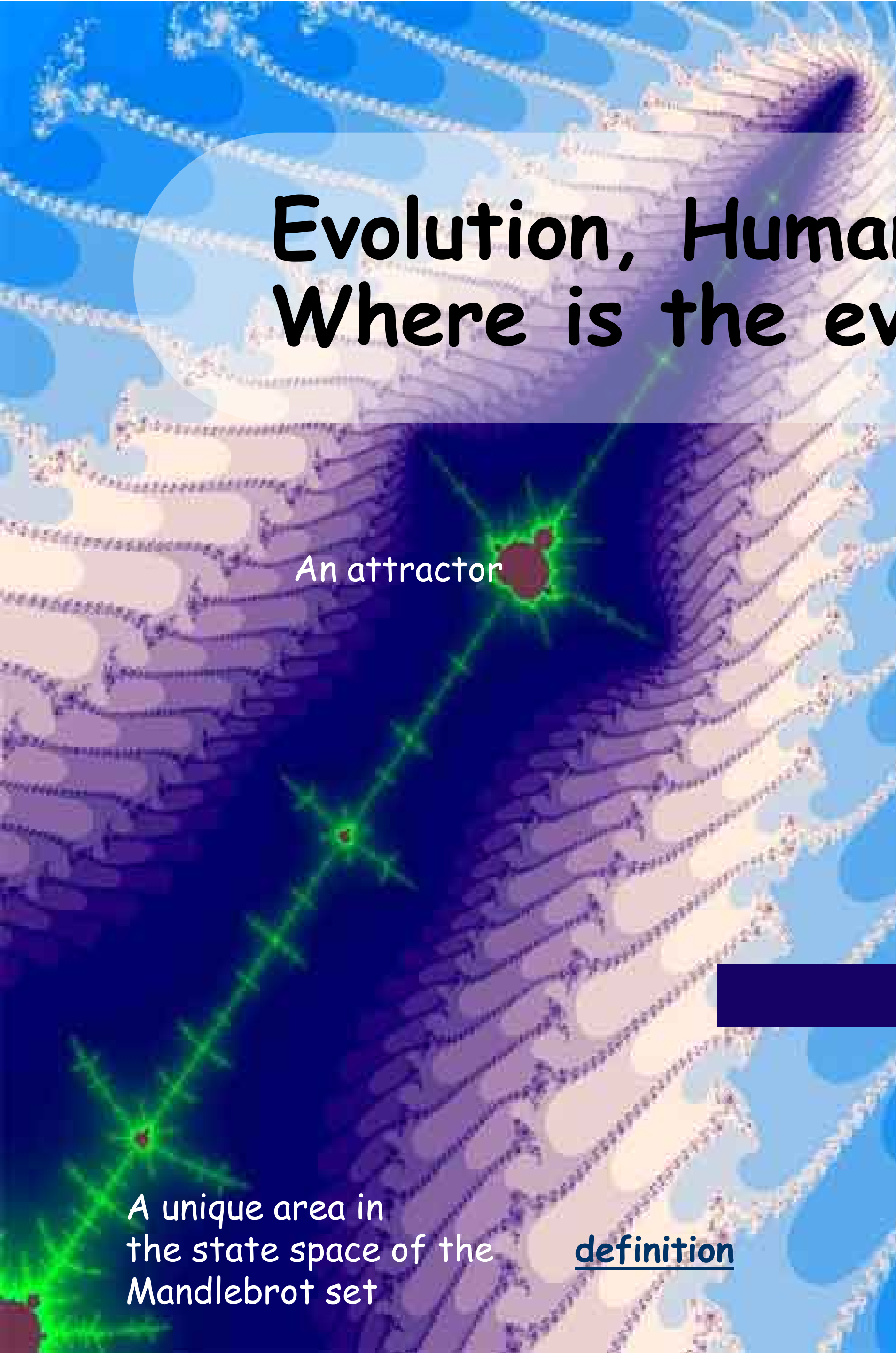
Evolution, Humanity and Religion
Where is the evidence for God?



William P. Hall

President
Kororoit Institute Proponents and Supporters Assoc., Inc. - http://kororoit.org

william-hall@bigpond.com
http://www.orgs-evolution-knowledge.net

Presentation for Central Victorian Atheists and Freethinkers, Albion Hotel, Kyneton, 20 Feb. 2013

Access my research papers from Google Citations

Note: this presentation is a hypertext: a revolutionary format for sharing knowledge

- Text displayed on a screen may include hyperlinks to other text or other objects that can be instantly accessed by a mouse click
  - may be located anywhere in the World Wide Web
- Hypertext is the underlying concept defining the structure of the World Wide Web.
- Underlined text and many graphics link to original source material, definitions or relevant discussions
- The result is knowledge built on and directly connected to knowledge and wisdom held in the World Wide Web

Introduction

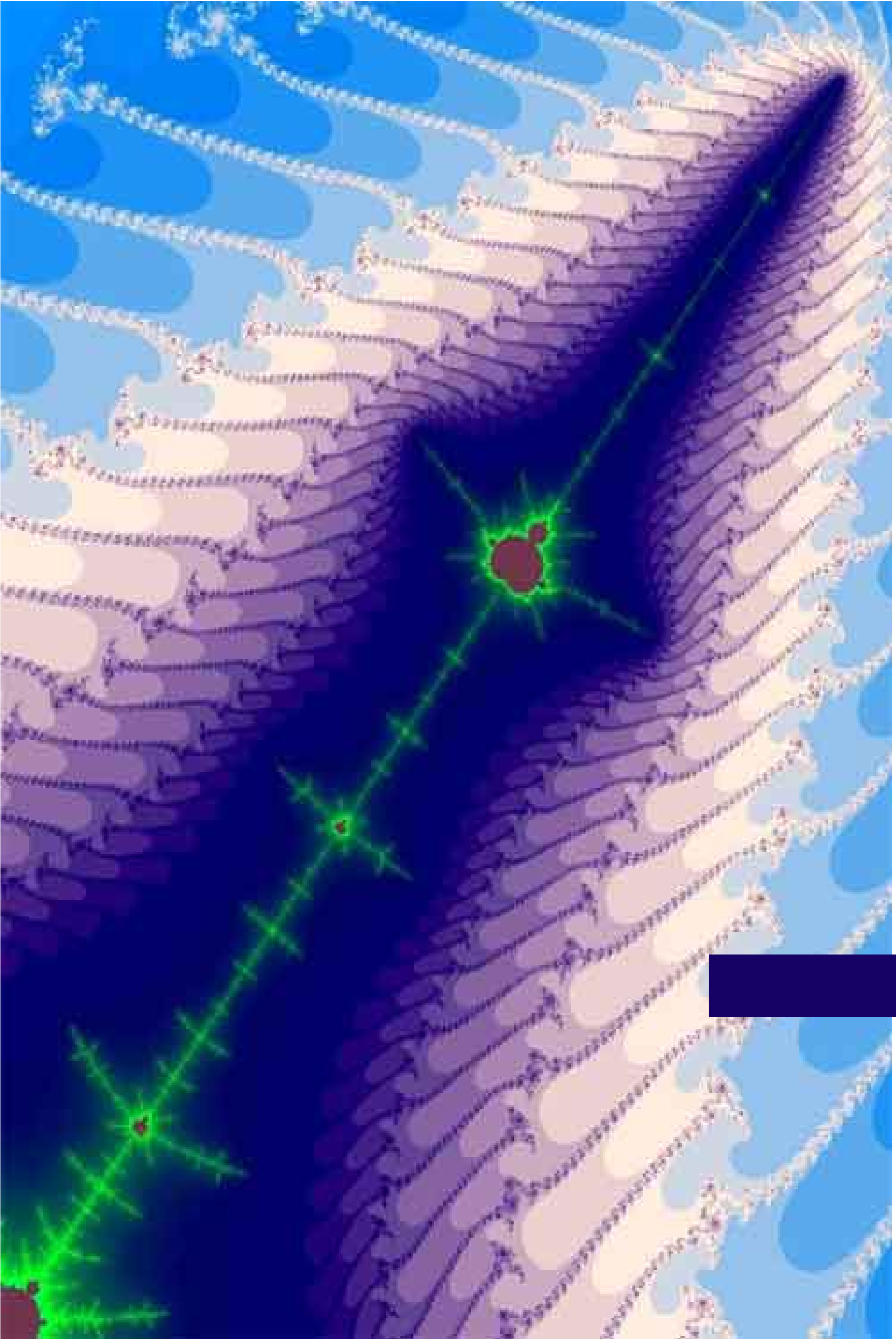
- I'm an evolutionary biologist by training
  - PhD Harvard, 1973; postdoc studies of evolutionary epistemology
- Worked in industry as a documentation and knowledge manager for the last 26 years before my retirement in 2007
- Since 2001 I have been working on a book project under the title *Application Holy Wars or a New Reformation – A Fugue on the Theory of Knowledge.*
  - Combines my interests in evolutionary biology and my practical experience with organizational behaviour and knowledge
  - story of the co-evolution and revolutions in human cognition and tools that extend human reach and cognition
  - provides the basis for this presentation
  - A draft and other extracts are available here (critical feedback welcome)

Clickable link

- **A scientific understanding the biological nature of human origins is incompatible with faith in an interfering god**
- **People may want god to exist, but science shows that we evolved without any need for a creator.**

Overview

- What it is to be human (individually and culturally) is determined by the nature of life, our heredity and our environments
- Two premises
  - **The nature of knowledge makes evolution inevitable**
  - **Given the universe, god is not needed to explain how life and humans evolved**
    - **How the universe came to exist is metaphysical**
- Two questions
  - Why did humans want to have god(s)?
  - Why do religions persist?
  - **These questions are answered by Durand's (2010) "*The rise of the human predator and the transcendence of consciousness*" [download: http://tinyurl.com/8ur7f8q]**
    - **Strongly recommended reading!**
- This presentation provides the philosophical and scientific foundation for Durand's argument and conclusions
  - Links to detailed arguments supporting assertions in the presentation are given on the last slide of this presentation



The first principle is evolution

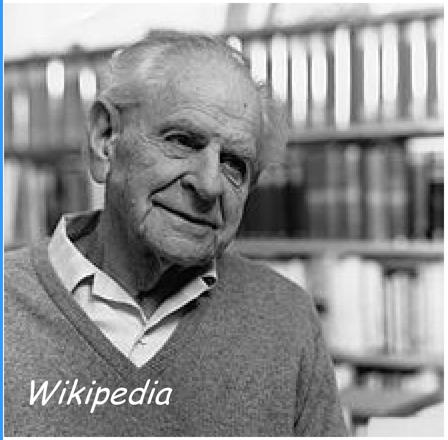
—

Life, Knowledge, Heredity and Environments

Life and evolution are physical processes
These can be understood scientifically

- The emergence and maintenance of life is driven by energy flowing from environmental sources to sinks through systems where entropic dissipation drives system dynamics and may make them more complex
- Living systems are *bounded*, *complex*, *mechanistic*, *self-referential*, *self-producing*, and *autonomous* (i.e. "autopoietic").
- Life is based on **solutions to problems of survival** (= "**knowledge**") embodied in the dynamic structure of the living system
- Knowledge is transmittable and shareable (i.e., "heritable")
  - **Life would not exist without the knowledge embodied in living systems**
- Three kinds of hereditary transmission
  - **Dynamic structure** (life begets life)
  - **Molecular** (DNA replication & transcription, RNA translation)
  - **Cultural** (apprenticeships, speech, writing)
- Given the existence of a physical universe like ours, heredity exists and evolution is inevitable
- The philosopher **Karl Popper** explained the generality and inevitability of evolution for science and living things

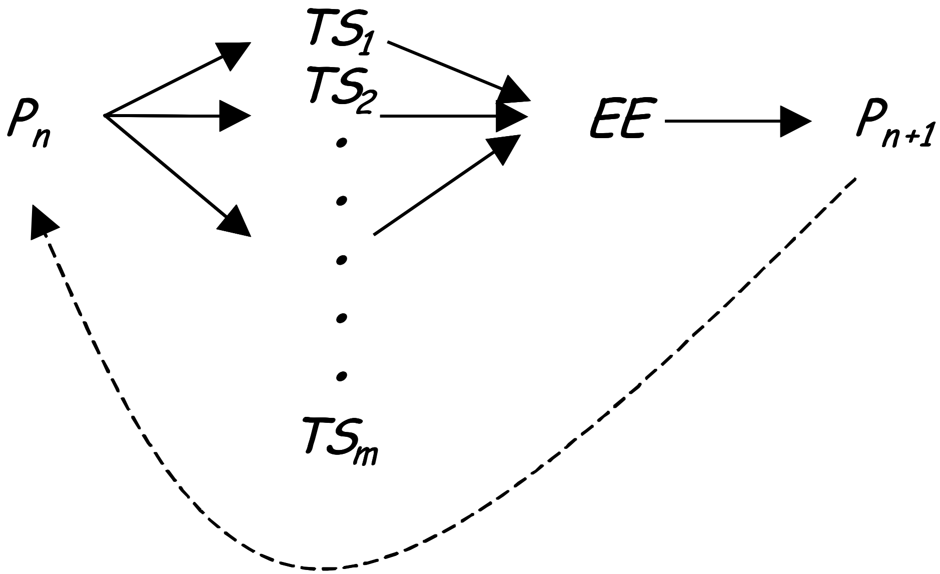
Popper on Evolution



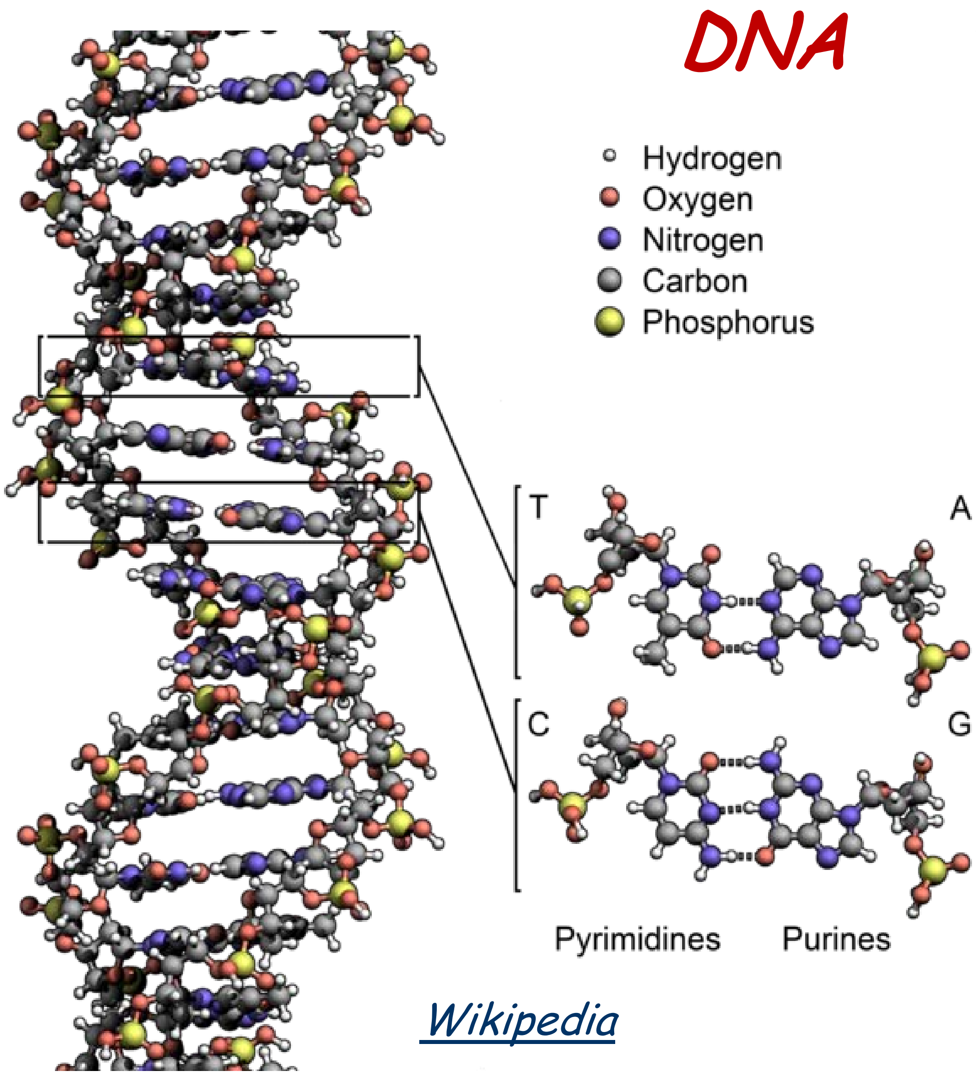
Karl Popper - b. 1902, d. 1994
"Objective Knowledge", 1972

- **Knowledge** = ***solutions to the problems of life***
  - 2 forms of knowledge:
    - "*subjective*" = capabilities to respond dynamically embodied in the living organism
    - "*objective*" = potential knowledge inertly codified in/on physical object
- "***General Theory of Evolution***"
  - A learning cycle

P = problem of life;
TS = tentative solution;
EE = eliminate errors;
P_{n+1} = changed problem after solving P_n
Cycle iterates to solve P_{n+1} etc.



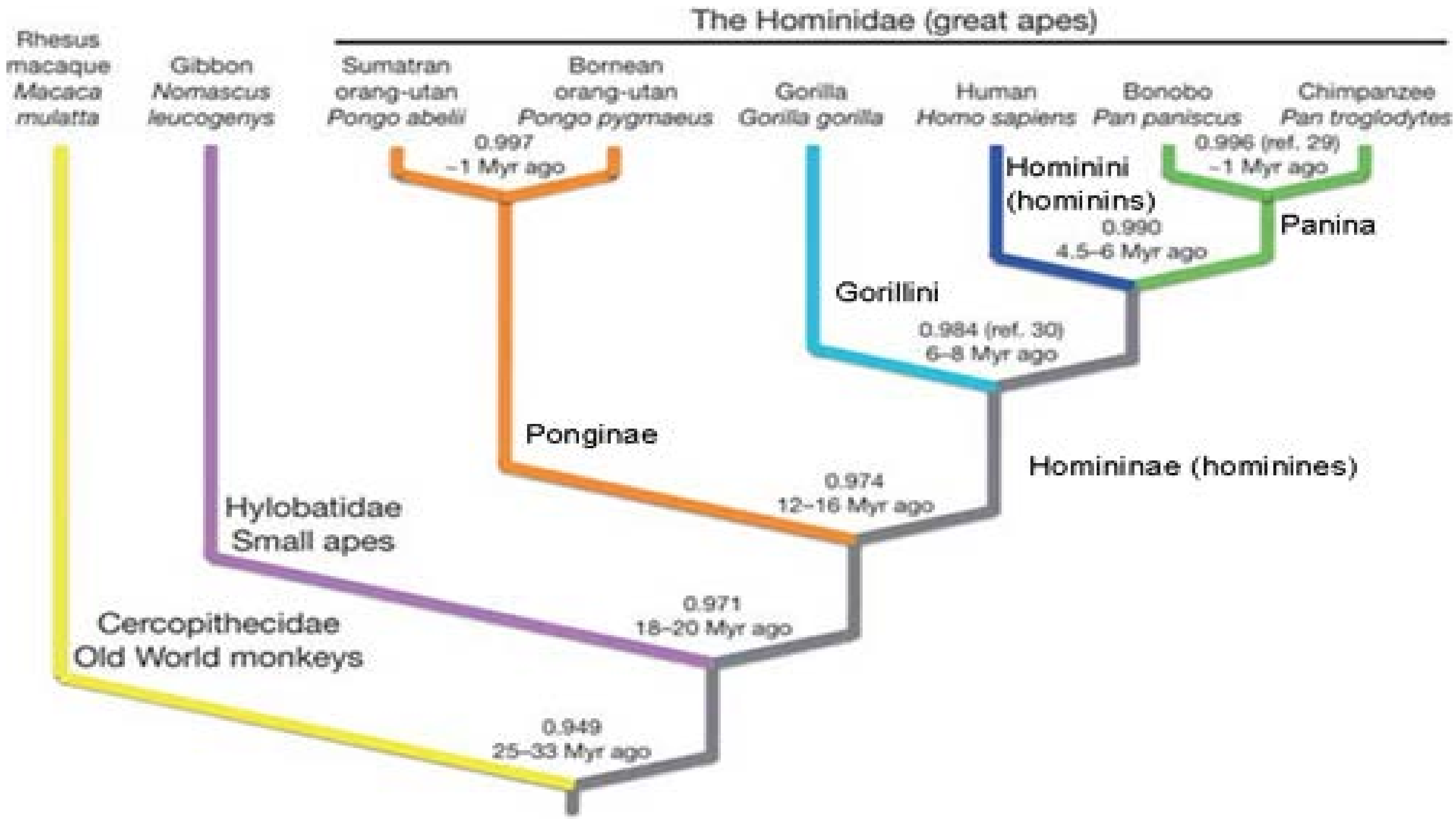
Genes and genomics
Watson & Crick (1953) DNA model



Wikipedia

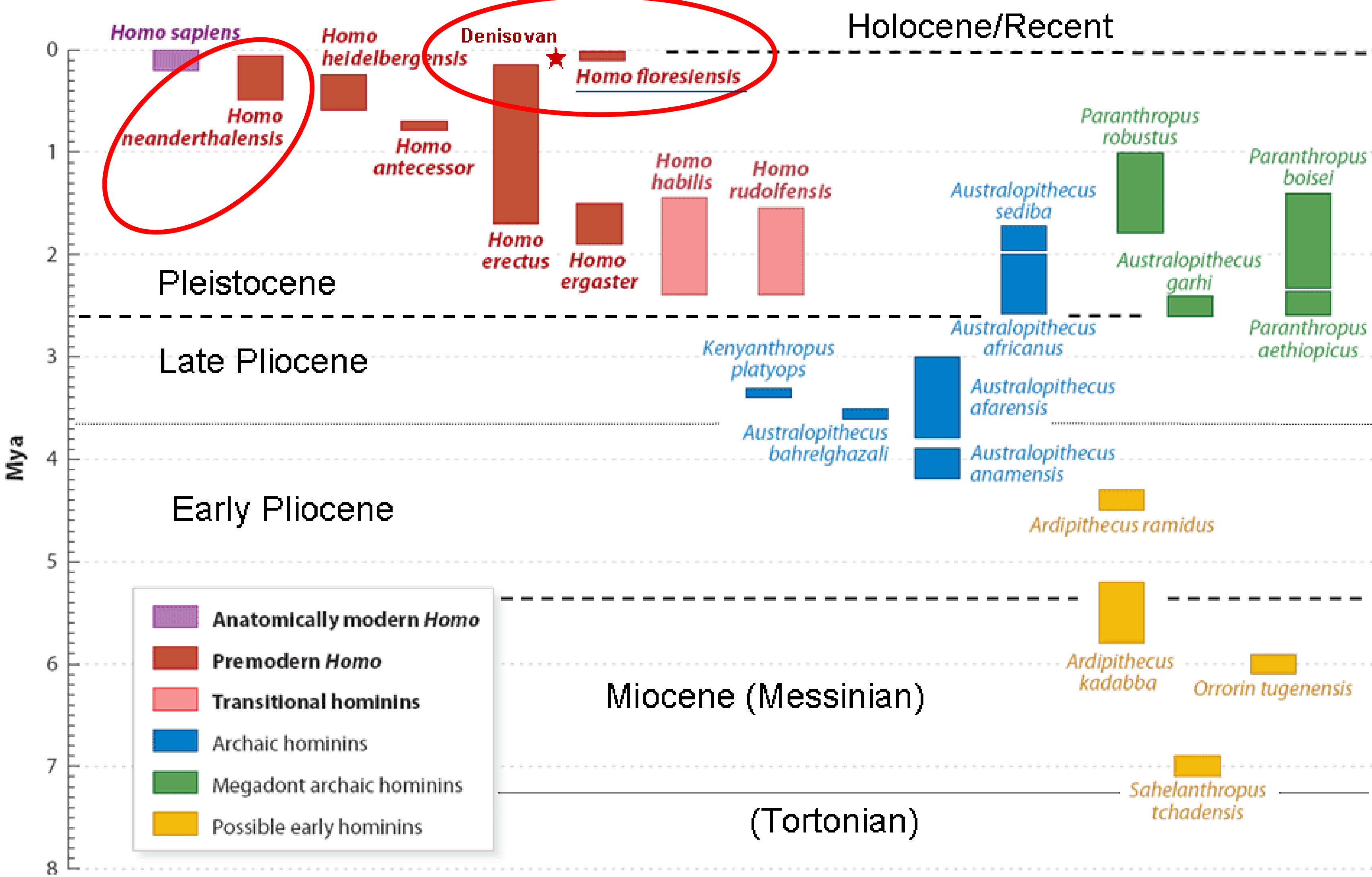
- Base pair = unit of information
- **Most higher vertebrates have around 3 billion base pairs** (= nucleotides)
  - Small percent code for proteins
  - Larger percentage function to control and regulate development
- **Genome sequence** maps the location of each base pair along the length of the DNA strand
- Genome sequencing identifies similarities and differences down to the single nucleotide difference

Comparative genomics provides detailed geneologies



From Locke et al. (2011)

Scrappy fossils provide some names and places



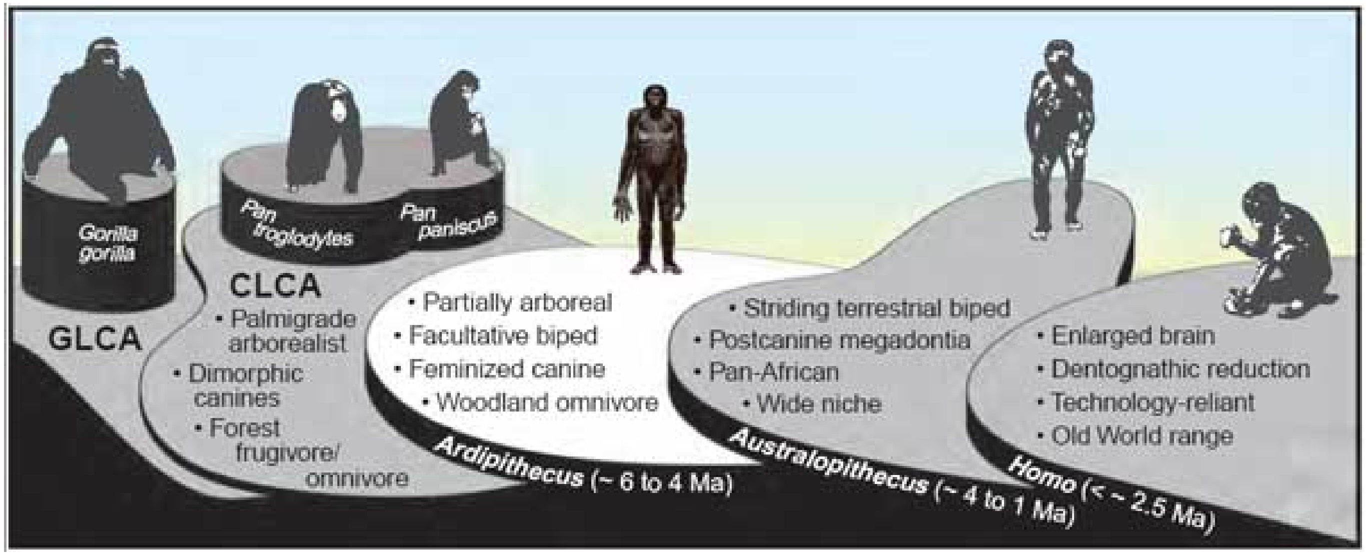
Comparative approach: Our relatives' genes tell us a lot about our ancestors

- Exponential growth in sequencing and computing technology
  - First human genome 2001; thousands sequenced by 2013
  - Chimpanzee genome 2005
  - Rhesus mcaque 2007
  - All our relatives sequenced by 2012, including two extinct species of *Homo*
- **99% of the ~3 bn nucleotides in chimps and bonobos are precisely identical to humans**, 98.4% with gorillas, 97.4% with orangutans (Locke et al. 2011)
  - Differences relate to speech, brain development, digestive capabilities & immunology.
- We have complete genomes from even closer extinct relatives
  - **Neanderthals** (2010) – dominated west Eurasia until mid ice-age
  - **Denisovans** (2011) – Central Asia – known only from extraordinarily well preserved DNA isolated from tip of little finger bone and two teeth
- **We share a "last" common ancestor with chimpanzees and bonobos that lived some 5 to 7 million years ago**

Fossils and paleoarcheological artifacts also help trace evolutionary history

- "Grade shifts" can occur in evolving & other chaotic systems
  - an initially small change may open new ecological opportunities
  - adaptation to the new opportunity may lead to large change (revolution) over short period of evolutionary time
  - **grade shift in the evolution of a species is a revolutionary shift in the species' ecological paradigm**
- Genomes, fossils, artefacts and comparative studies of our living relatives help us trace ancestry and history
  - YouTube videos show us how our ancestors may have first developed tool using cultures

Our family tree



White et al's (2009) depiction of the adaptive plateaus achieved by the different species grade shifts in the Pliocene radiation of hominins as our ancestors became more adapted to more open and arid environments. CLCA = chimpanzee-human last common ancestor.

- CLCA was a forest ape using simple natural and biodegradable tools to increase dietary range probably a lot like today's chimps and bonobos
- Changing climates broke up forest into grassy woodlands. *Ardipithecus* adapted by developing bipedal locomotion and use of tools for self-protection and to harvest wider dietary range.
- *Australopithecus* became a successful savannah dweller
- *Homo* became top carnivore in Africa and Eurasia

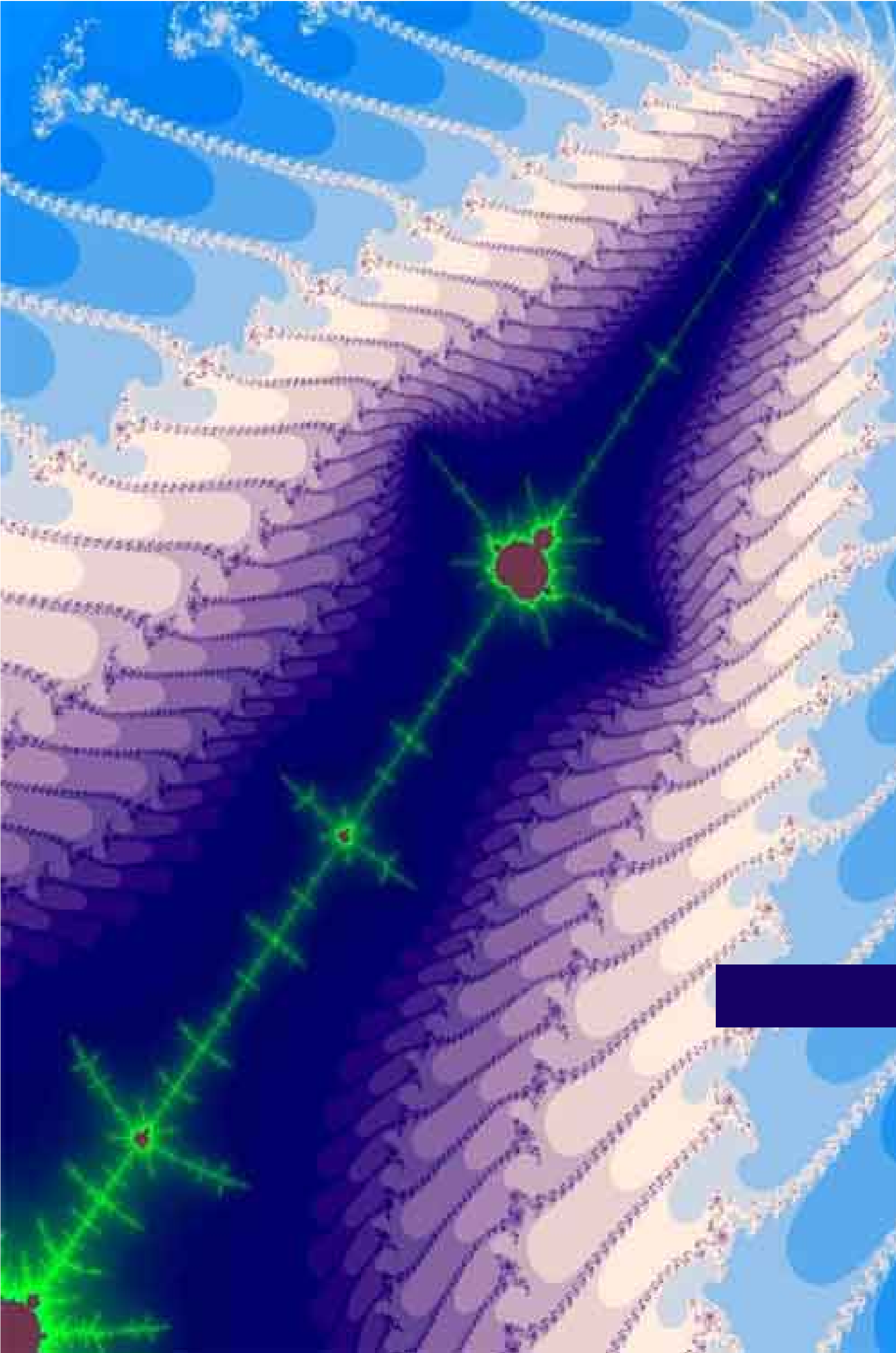
Apes & monkeys tell us our common ancestors made and used tools and transmitted knowledge culturally

Chimps using probes to collect ants. Probe is inserted almost to full length into earth.

Child watching mother crack otherwise inedible palm nuts using hammer & anvil.

(Note: click pictures for videos worth thousands of words)

Tool using cultures are not limited to apes. Capuchin monkey nut processing industry in Brazil deals with much more difficult nuts than chimpanzees work with. Process involves picking, husking, several days' drying, testing, transporting, and finally – cracking. They also make & use probes and shovels. Capuchins may be better models for early hominins than apes.



Tools helped forest apes survive as forest became savannah in late Pliocene

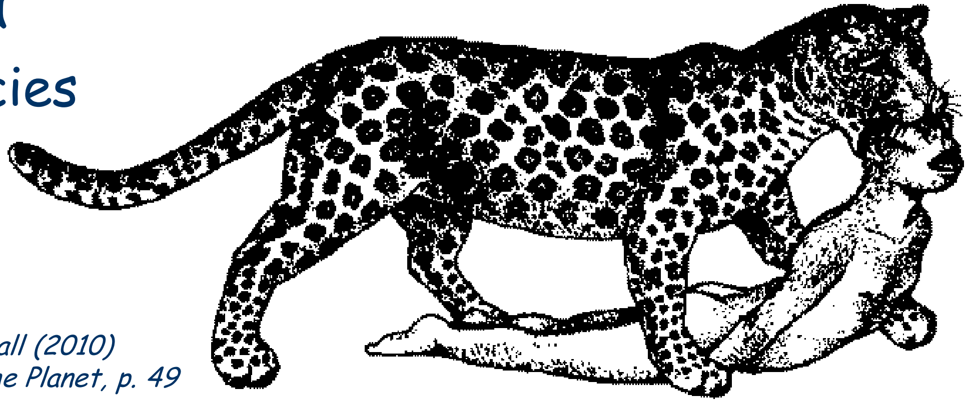
Durand (2010)

The reduction of the large canines to small eye teeth rendered apemen completely defenceless, especially since they had no manufactured tools to defend themselves effectively at this stage of their evolution. Apemen, as savannah dwellers, were often far away from a tree into which they could brachiate like their relatives in the forest. These adaptations made apemen the ideal prey of the big cats and hyenas because they were more defenceless than any other hominid or savannah dwelling mammal. The huge collection of apeman fossils in the Cradle of Humankind is the result of this detrimental twist in hominid evolution.

Rapid and continuous breeding was the only solution which saved hominids from extinction. Apemen survived only by outbreeding their predators, like many other organisms at the bottom of the food chain such as rodents and insects. ***Our ecological role, and therefore the whole reason for our existence, is to convert tubers, nuts, invertebrates, small vertebrates and leaves on the savannah into cat food. This strategy is only possible with an increase in fecundity, promiscuity and mating frequency.***

Pleiocene climate change forced some apes onto a savanna – a tough neighbourhood to survive in!

- Grave risk of predation by big cats & other carnivores on savanna
  - Lions, leopards, 3 species sabretooth cats
  - Bear-like wolverine
  - Large hyenids
  - Wild dogs

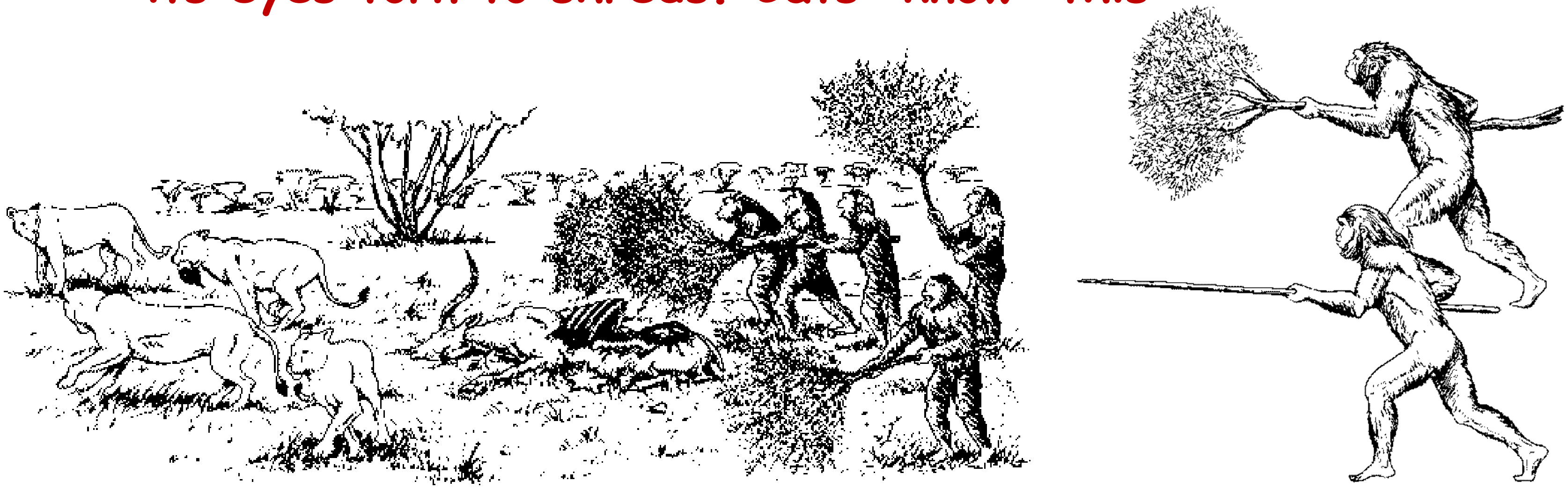


From Tattersall (2010) Masters of the Planet, p. 49

- **Gangs of chimps can be brave but not very dangerous**
  - As predominantly forest dwellers they can usually escape into a handy tree

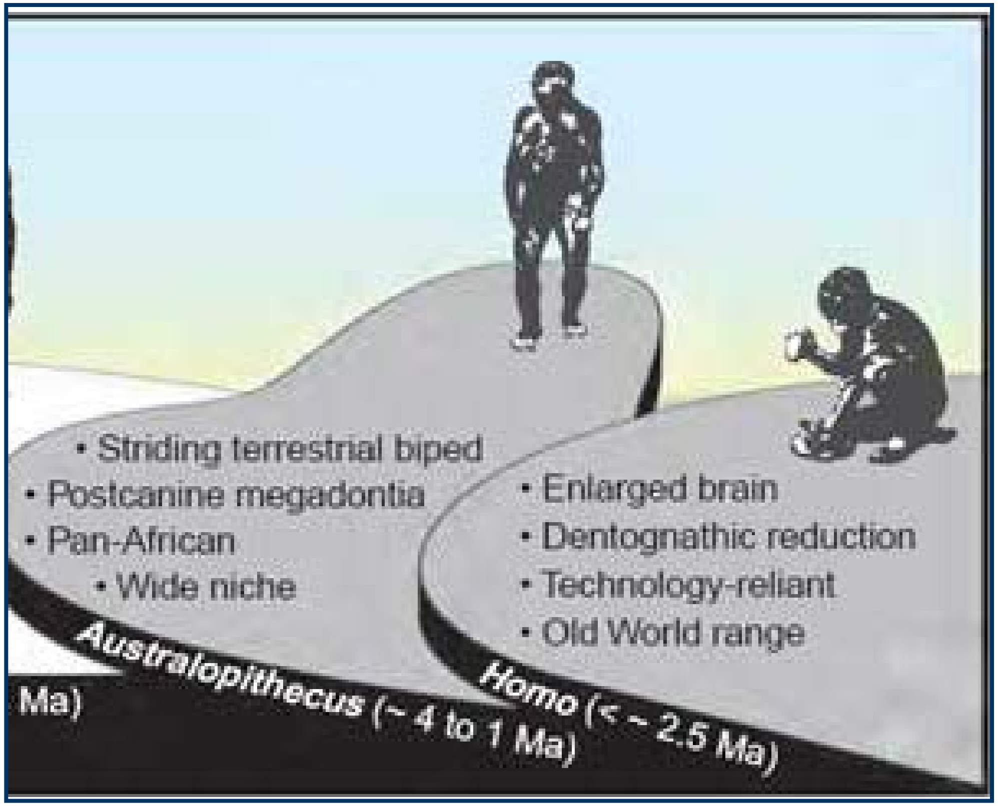
Pleiocene climate change forced some apes onto a savannah

- Guthrie (in Roebroeks 2007) speculated that a tiny technological improvement was all that was needed for a more effective defence than waving big sticks
  - Common "haak en steek" acacia tree is equipped with both sharp curved claws and dagger-like spines
  - **Any cat running head-long into a thorn branch will have its eyes torn to shreds. Cats "know" this**

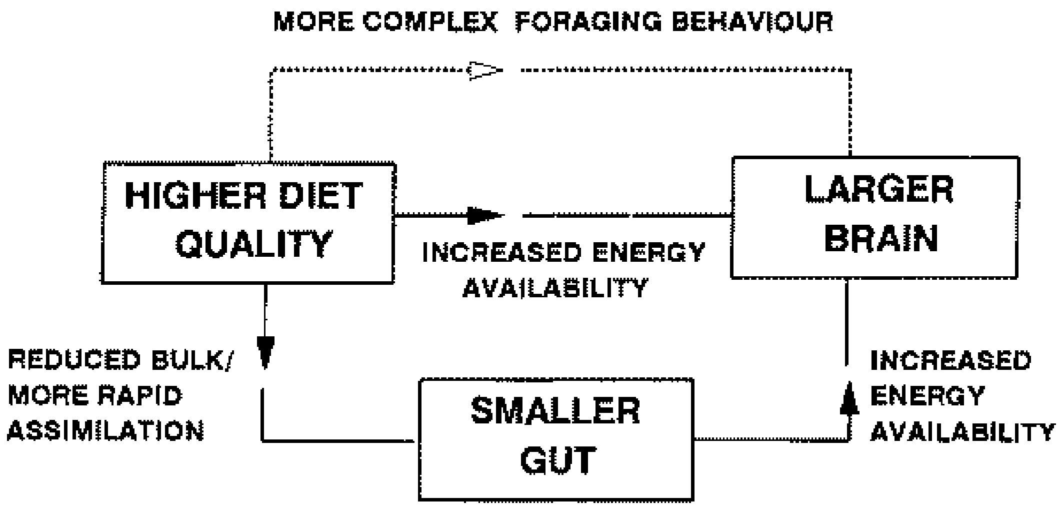


Hominins using *haak en steek* branches as tools (Guthrie 2007): **a**. for driving big cats away from their prey. **b**. for hunting - given the simple conversion of a thorn branch into a "megathorn" lance.

Our family tree (again)



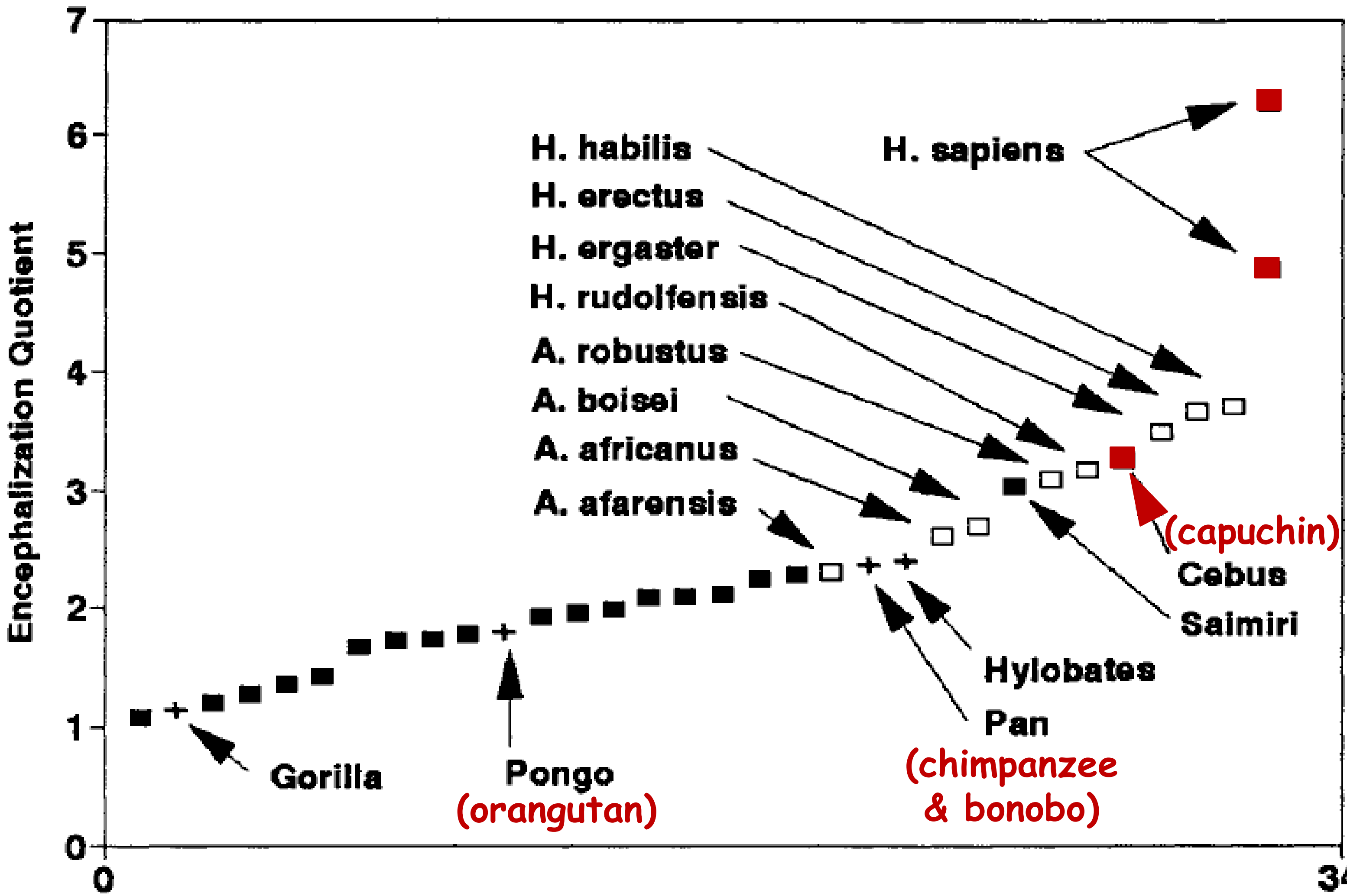
Brains, diets and guts



Tradeoff between brain size and digestive apparatus (Aiello & Wheeler 1995)

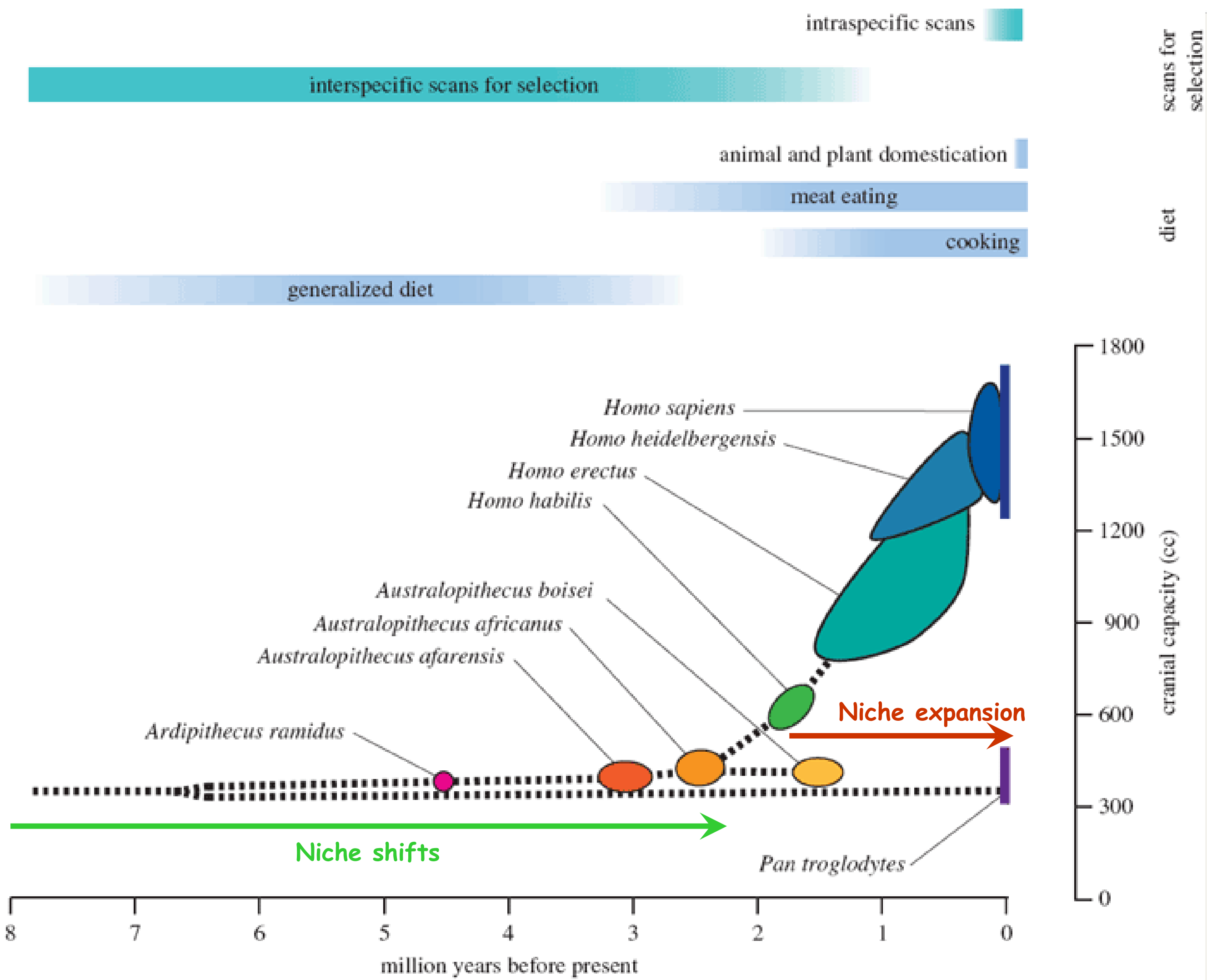
- Maximum energetic capacity of metabolism is anatomically limited
- Big brains are metabolically very expensive
  - human brains use 20% of total energy consumed
  - also depend on essential amino and fatty acids not provided by plant matter
  - gut tissue is as expensive as brain tissue
  - meat & fat easy to digest & have essentials needed for brain development & growth
- Broken stones with sharp edges enable fast butchery
- Cooking improves meat, root, and vegetable caloric & nutritional quality

More complex: tools, ecologies, cultures & brains

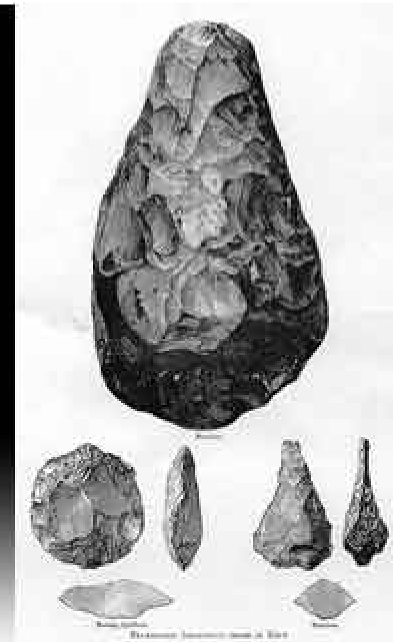


Encephalization quotients of 34 species of higher primates, including extinct hominins (Aiello & Wheeler 1995).

Possible dietary change and the evolution of hominin cranial capacity (Babbitt et al. 2011)



With stone butchering tools, hominins became top carnivores on the savanna



- <u>Oldowan</u> tools made & used from 2.6 to 1.7 mya
  - Hominin teeth not strong enough to tear skin and flesh of game animals.
  - Flaked rocks sharp enough to help dismember large prey before cats arrive
- More sophisticated <u>Acheulean</u> hand choppers & other tools made & used from 1.7 mya to 0.1 mya but required more knowledge & dexterity to make
- Note exceedingly slow rate of technological change
  - **Suggests limited neural/social capacity to accumulate knowledge of complex technologies**

Making a stone knife is within an ape-man's cognitive capacity

- Kanzi (a bonobo) knaps flint knife to cut rope to gain access to a banana
  - near Oldowan quality
  - socially facilitated learning from watching a human flint knapper
- Vulcan (a capuchin) makes flint knife to cut heavy plastic skin and makes a honey dipper from a branch to get honey
  - See Westergaard & Suomi (1995). The stone tools of capuchins *(Cebus apella).* International Journal of Primatology 16, 1017-1024.
- **Tools extend access to different niches: more kinds of tools → broader niche → better diet → opportunity for smaller guts & more brains → more capacity to make & use more different tools**

Fire users, keepers, & makers become top carnivore in Africa and Eurasia (Rolland 2004)

- Accumulating cognitive demands of a new technology
- Opportunistic users > 5 mya ?
  - savanna burns naturally every 2-5 years
  - Knowing that burnt savanna is a good source of high cuisine
    - roast meat much more digestible than raw
    - inedible/indigestible nuts, roots & tubers made edible
- Fire keepers > 1 mya
  - Requires high degree of social coordination
  - Knowing how to feed and keep a fire (process knowledge)
  - Keepers much better off than those without
  - Loss of fire potentially catastrophic to group
  - **Making tools, keeping the fire and coordinating the hunt are drivers to increase cognitive capacity**
- Fire makers ~ 0.5 – 0.4 mya
  - Knowing how to start a fire without a natural source
    - Striking a spark (what rocks, what tinder?)
    - Using a fire stick to create friction embers

Keeping fire is also not far beyond ape-men's mental capacities

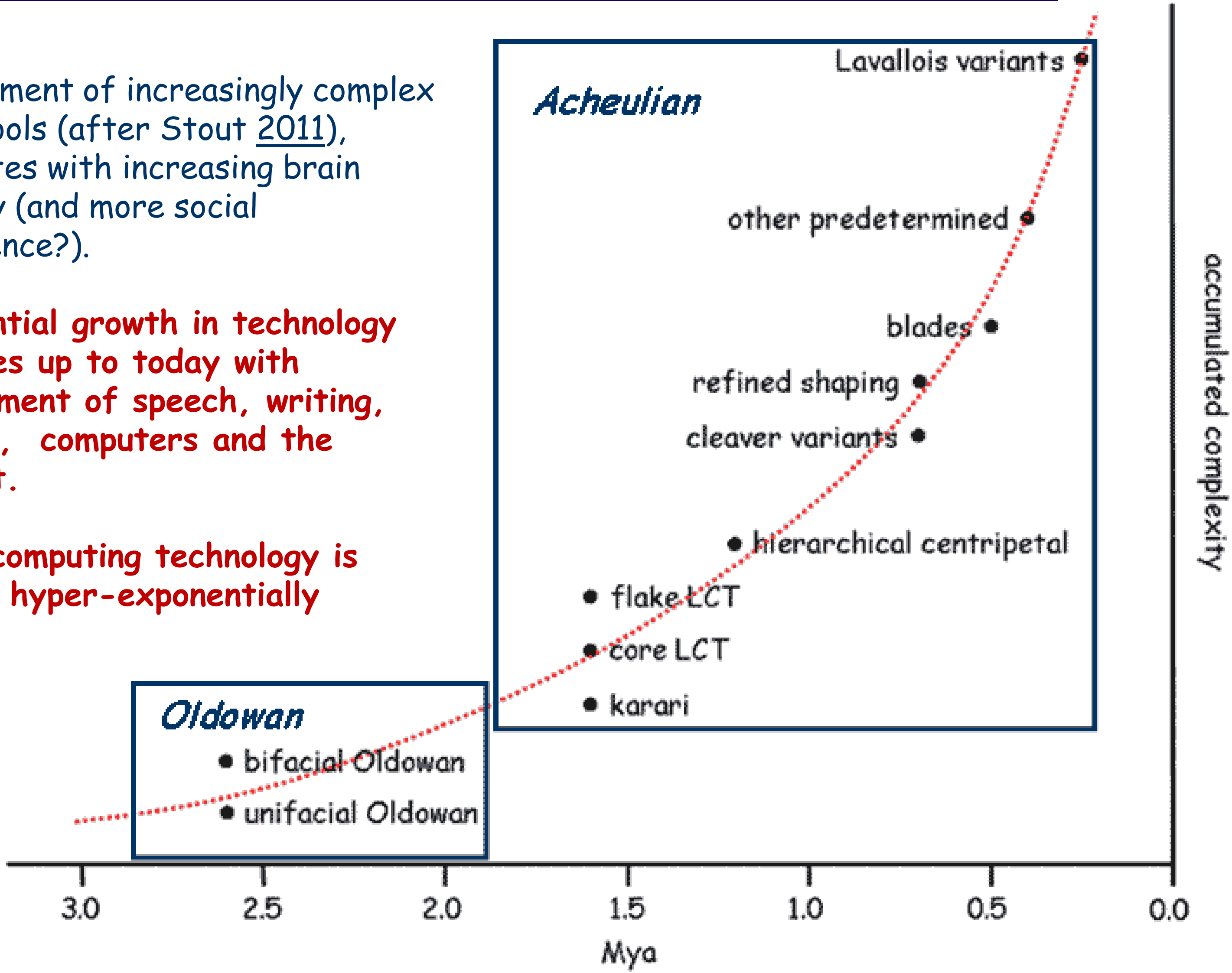
- Kanzi the bonobo can't start a fire without a lighter, but learned what fire is good for and how to keep it burning (Savage-Rumbaugh)
  - Cultural knowledge learned from his human "family"
  - Lighting the fire with stone-age technology is another matter
    - a bonobo's may have the neuro-muscular dexterity to <u>light a fire</u> using a hand-drill, fire-board and tinder – but even that is debatable
    - it probably is not within a bonobo's cognitive capacity to plan the fire, collect the necessary components to light a fire, and use them in the appropriate sequence to light the fire

Increasing tool complexity in archaeological record

Development of increasingly complex stone tools (after Stout 2011), correlates with increasing brain capacity (and more social intelligence?).

Exponential growth in technology continues up to today with development of speech, writing, printing, computers and the internet.

Today computing technology is growing hyper-exponentially

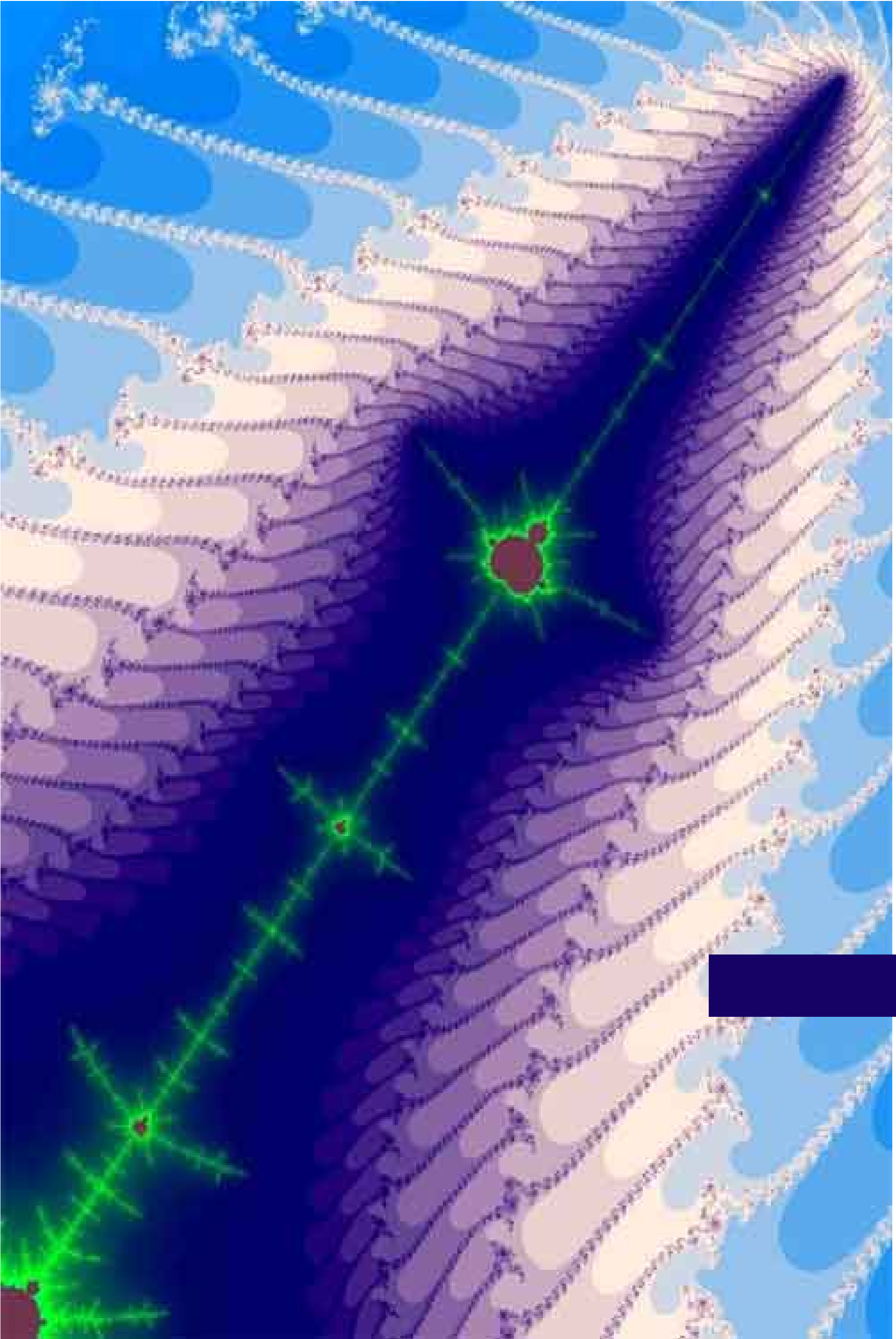


When did hominins learn to speak? (e.g., d'Errico et al. 2009)

- Language doesn't fossilize until it is written
- Paleoarcheological proxies for symbolic behavior
  - "masterpieces" (specially worked complex tools)
  - body and artifact painting (ochres & other pigments)
  - shell beads jewelry
  - ritual burials and "grave goods"
  - representational painting
  - musical instruments (i.e., bone flutes)
- Emergence of dateable genetic & fossilizable morphological/neurological prerequisites
  - FOXP2 etc (common to *H. sapiens* & *neanderthalensis*)
  - Larynx & hyoid bone (ditto)
  - Neuromuscular control of breathing (lack in *ergaster* & *erectus*
  - Broca's & Wernicke's areas of the cerebral cortex
- Last 150,000 - 200,000 years
  - Social coordination of cooperative hunthing
  - Last common ancestor *H. neanderthalensis* & *sapiens* was on the way (*H. heidelbergensis*)
  - Co-evolved with the development of complex technologies & social systems
  - Only fully developed with the emergence of domestication

Origins of religion (Durand)

- Male dominance hierarchy (i.e., alpha male – machismo) is typical of group living apes)
- Limbic system's survival urges: aggression, fear, feeding, sex
- Religion is obsessed with aggression, fear, feeding and sex and has many rituals involving these
- Shared belief contributes to the cohesion within a group while excluding others
- Fear of death; fear of unexplained
- Neolithic evidence for worship: Mother Earth and Sky Father
- Metal ploughs and swords to defend homeland dispensed with need for Mother Earth but Sky Father still needed for rain and lightning
- Weapons help the dominant male spread his seed; selection favours aggression & dominance
- Religions control sex & reproduction



For more detail and references

Detailed arguments and references can be found in my works linked here

- (draft) Application Holy Wars or a New Reformation: a fugue on the theory of knowledge [Dropbox public share folder]
  - Preview presentation
  - Complete draft as of early January
  - Evolutionary Origins of Homo sapiens extract
- (2011) Physical basis for the emergence of autopoiesis, cognition and knowledge
- (2011) Exploring the foundations of organizational knowledge
- (2011) Time-based frameworks for valuing knowledge: maintaining strategic knowledge
- (2006) Tools extending human and organizational cognition: revolutionary tools and cognitive revolutions
- (2005) Biological nature of knowledge in the learning organization