

# TOPIC: HUMAN EVOLUTION

## Key Knowledge:

- The shared characteristics that define mammals, primates, hominoids and hominins
- Evidence for major trends in hominin evolution from the genus *Australopithecus* to the genus *Homo*
- Human fossil record as an example of a classification scheme that is open to differing interpretations that are contested, refined or replaced when challenged by new evidence, including evidence for interbreeding between *H. sapiens* and *H. neanderthalensis* and evidence of new *Homo* species
- Ways of using fossil and DNA evidence (mtDNA and whole genomes) to explain the migration of modern human populations around the world, including the migration of Aboriginal and Torres Strait Islander populations and their connection to Country and Place.

## PRIMATES

Humans belong to the order Primates, which has several key characteristics:

- **Prehensile digits** (they have an opposable thumb and opposable toe)
- **Reproductive features** (K-selected species with long gestation periods)
- **Intelligence** (they have larger brain sizes and complex social hierarchies)
- **Mobility** is geared towards bipedalism (either obligate or facultative)
- **Arm sockets** allow for significant rotation (in comparison to the legs)
- **Tactile pads** with nails instead of claws (allows for tool manipulation)
- **Eye sockets** are forward facing (their olfactory senses are reduced)
- **Stereoscopic vision** (allows for an improved perception of depth)

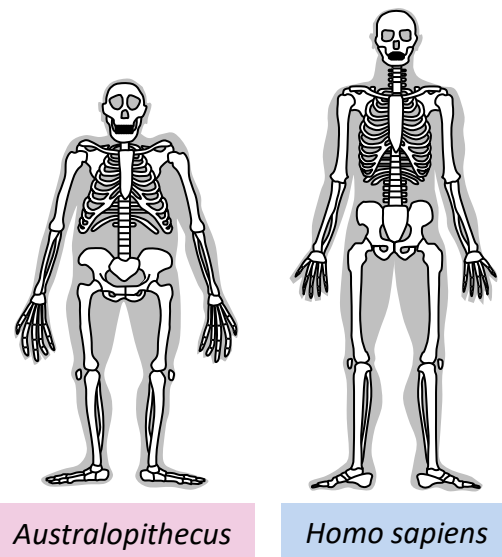


## HOMINOIDS VS HOMININS

Primates can be further subdivided into hominoids and hominins. **Hominoids** are a superfamily that include all greater and lesser apes and are commonly identified by the lack of a tail. **Hominins** are a subfamily that include all modern (and extinct) human species as well as their immediate ancestors. They are generally characterised by the presence of large brains and a tendency towards bipedalism.

## HOMININ EVOLUTION

Hominin evolution includes all the species that have evolved since the human lineage split off from the one that gave rise to the great apes. Around 8 million years ago, a global cooling and drying period changed the climate conditions in Africa. The population of hominoids that occupied the open and dry savannah habitats evolved many characteristics to suit these conditions, including a capacity to walk upright (**bipedalism**), which improved visual awareness and freed up the hands for tool manipulation. This led to dietary changes that improved brain development and resulted in more population mobility. The earliest hominins include the ape-like **Australopithecines** and were superseded by genus **Homo** (includes all humans).



## HOMININ TRENDS

By comparing different *Australopithecine* and *Homo* fossils, certain evolutionary trends become apparent.

STRUCTURAL CHANGE	EVOLUTIONARY ADVANTAGE
Larger cranial capacity with increased brain size	Allows for greater intellectual prowess
Reduced brow ridge and jaw protrusion	Head is no longer the most anterior part of body
Smaller teeth and narrower jaws (V-shaped)	New dietary patterns with less tough vegetation
More downward facing foramen magnum	Caused by a transition to bipedalism
S-shaped curvature of the spine	Supports an upright body posture
Lower and broader pelvis	Adapted to bipedalism and pregnancy positions
Longer leg bone length relative to arm bone	Change from brachiation to bipedalism
Larger heel bone and alignment of big toe	Feet becoming greater weight-bearing structures
Shift in muscle groups (gluteal and hamstring)	Supports a bipedal mode of locomotion
Marked reduction in body hair	Improved hunting practices led to use of clothing

## HOMININ FOSSIL RECORD

There is significant and continuous debate concerning the exact timeline for human evolution as the fossil record is **incomplete**. Very few hominin fossils have been discovered, so palaeoanthropology is an inductive science based on limited data. Additionally, individual fossils may not be representative of actual species – for instance, is *Homo floresiensis* (i.e. Hobbit man) a distinct species or an abnormal small member of a pre-existing species of hominin?



*Homo floresiensis* (left)

## HOMININ INTERBREEDING

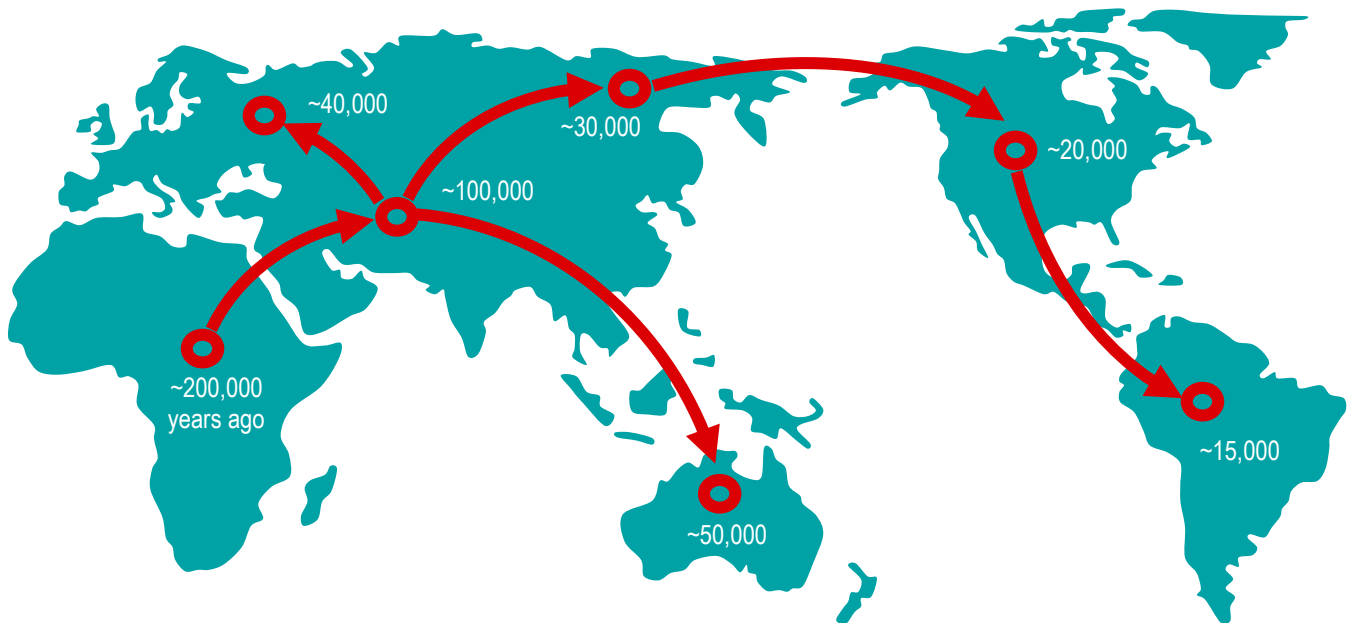
Current evidence supports the idea that certain *Homo* species may have co-existed at some point in time. Hence, the extinction of some species may have resulted from a gradual interbreeding with modern man (i.e. they were integrated rather than replaced). Excavations of the Denisova Cave (in Russia) uncovered the fossil remains of three distinct species – the Denisovans, Neanderthals (*Homo neanderthalensis*) and modern humans (*Homo sapiens*). While there is considerable debate as to whether the occupation of the cave by these three species was contemporaneous or sequential, DNA analysis on the uncovered bones indicates that interbreeding occurred between the populations (e.g. small amounts of Neanderthal DNA was found in the Denisovan fossil). This evidence is further supported by the analysis of modern human sequences, which shows that European and Asian populations share 1–4% of their DNA with Neanderthals while Polynesians (including Australian Aboriginals) carry roughly 3–5% of Denisovan DNA. This suggests that modern human ancestors interbred with these species as they migrated out of Africa.

## HOMININ MIGRATION

Roughly 1.7 million years ago, there was a rapid evolutionary divergence of the genus *Homo*, coupled with an explosive geographical expansion. This was consequently followed by a reduction in species richness (all except *Homo sapiens* are now extinct). Analysis of mitochondrial DNA suggests that modern humans first evolved in Africa and then migrated, replacing the hominin species in other regions ('**Out of Africa**' model).

## ABORIGINAL SETTLEMENT

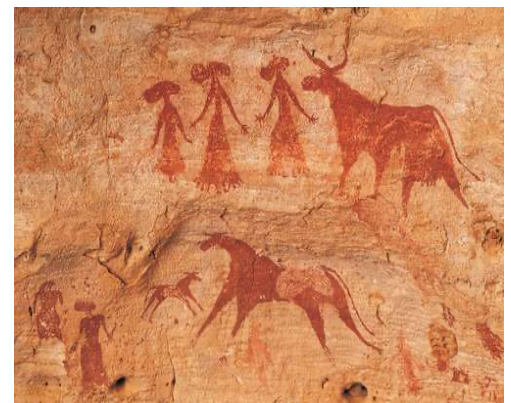
From mitochondrial DNA evidence, it is currently believed that ancestral Aboriginal and Torres Strait Islander populations migrated to Australia approximately 50 – 60,000 years ago. Further colonisation of Australia only occurred in the late 19<sup>th</sup> century with European settlement via the First Fleet. This period of uninterrupted occupancy explains the strong connection Indigenous peoples have to Country and Place.



## CULTURAL EVOLUTION

Cultural evolution describes the transmission of customs, skills and ideas between members of a society, similar to how many biological traits develop via evolutionary processes. Cultural evolution also includes the changes in technology that occur as humans gain increased control over the environment. Evidence for the presence of culture in ancestral hominins may include:

- Use of tools (e.g. Oldowan and Mousterian stone tools)
- Social hierarchies and division of labour (hunter–gatherer)
- Evidence of verbal communication and group hunting
- Use of fire and the domestication of wild animals
- Cave paintings, musical instruments and burial practices



Prehistoric Cave Painting

## BIOLOGICAL VS CULTURAL EVOLUTION

There are several key differences between the evolution of biological adaptations and cultural practices:

BIOLOGICAL EVOLUTION	CULTURAL EVOLUTION
Transmitted as <b>genes</b> via sexual reproduction	Transmitted as <b>ideas</b> (either written or spoken)
Traits can only be passed on from <b>parents</b>	Traits can be transmitted by <b>any individual</b>
Transmission is <b>slow</b> (occurs across generations)	Transmission is <b>fast</b> (may be immediate)
New traits <b>cannot</b> be acquired within a lifetime	New traits <b>can</b> be acquired via teaching
Cannot choose which traits are <b>inherited</b>	Can choose which traits are <b>adopted</b>