Human Evolution

The story of human evolution begins at the origin of life
→ all life, at least all eucaryotic life, had the same ancestor

humans are **mammals**

mammals first appeared 200 MY ago
→ early Mesozoic
(same time as 1st dinosaurs)

1st mammal:
very closely resembled their reptile ancestors
about size of mouse (or ground shrew)
reptilian skeleton
had sharp teeth → ate insects, worms, fruits, vegetables
large eyes → probably nocturnal
warm blooded (many reptiles were warm blooded then)

for 160 MY they lived in the shadow of the dinosaurs

“suddenly” the dinosaurs disappeared ~65 MY ago
mass extinction correlated with
→ asteroid impact
→ drop in temperature and
→ more seasonal temperature fluctuations

→ Dawn of Cenozoic = “age of mammals”

early mammals quickly diverged:
1. **monotremes** = egg laying mammals
   eg. platypus
2. **marsupials** = young born in embryonic form
   and live in mothers pouch outside body
3. **placentals** = largest group, young go through
   embryonic and fetal development before birth

**Primates**

one of these placental groups were the **primates**

a. lived in trees = arboreal
b. 5 digits with opposable thumb
   → better gripping and dexterity
c. nails rather than claws
   → greater tactile sensitivity of fingertips
d. visual acuity
   could form sharp images
   had color vision
   decreasing reliance on chemical senses

e. greater maternal care
   longer, stronger mother-child relationships

f. tendency toward upright posture
   at least could sit upright

primates are divided into 2 groups:

1. **Prosimians**
   tropical & subtropical, small, furry, arboreal, nocturnal, vegetarian or omnivorous
   (tarsirs, lemurs, bush babys)

2. **Anthropoids**
   (monkeys, apes, humans)
   closely related groups
   \( \rightarrow \) chimps share >95% of our genes

a. **Monkeys**
   larger than prosimians
   more intelligent
   good vision
   diurnal
   move in bands (social groups)
   \( \rightarrow \) female care of young, male protects
   arose in eocene

b. **Apes**
   most are larger than monkeys
   larger brain in proportion to size
   long arms & short legs \( \rightarrow \) brachiation
   4 modern genera
   eg. gorillas, chimps
   arose 30 MY ago (miocene)

c. **Humans and Human Ancestors**
Human Ancestors

**uniquely human traits**

- not found in other primates:
  a. habitually erect posture → bipedal
  b. lower limbs longer than forelimbs
  c. non-opposable larger toes
  d. reduced canines
  e. bony chin
  f. prominent nose
  g. relatively hairless
  h. much larger brain:
      → abstract thinking
      → speech and language
      → use of complex implements
      → belief in supernatural and life after death
      → importance of cultural evolution

1. *Ramapithecus sp.*
   15 MY ago?
   1st known hominid
   smaller than a chimp
   tend toward bipedalism
   more use of hands and arms for manipulation
   may have moved to grasslands
     → seems to have eaten roots and seeds rather than soft vegetation of plants

   molecular evidence indicates that Gorillas diverged from human line
   ~10 MY ago (DNA is ~97% similar)

   chimps diverged ~7 MY ago (DNA is ~98% similar)

2. *Australopithecus sp.*
   3.2 –3.6 MY ago
   4’ tall, ~50 lbs
   no dramatic increase in brain size
   earliest bipedal primates still probably spent lots of times in trees
   several species known
     some not necessarily in direct line of descent to us
   lived in open grasslands
     eg. Lucy & footprints
   walked upright (bipedal), ground walker
     → better vision in grasslands;
     → frees hands for weapons and harvesting
relatively long arms

earliest evolution of humans 5-2.5 MY ago hominid family tree is represented by 1 lineage

= *Australopithecus africanus*

2.6-2.5MY split into 2-3 lines

→ one of these:

- *H. habilis* Africa, Asia
  - males probably had harems as do apes
  - females ~ 1/2 as large as males
  - was a tool user
  - first “human”

- *H. erectus* Africa, Asia, Europe

  → more delicately built

  → much more similar to *H. sapiens*; skeleton similar to ours

  → our size; males and females similar sizes

  → similar stride

  → more efficient than *Australopithecus*

  → dramatic increase in brain size

  → main difference between them and us is the skull

  → their skull is thick and massive

  → large jaws and teeth, no chin

  → brain case (700-1100cc) like us

  → wider ranging than *Australopithecus*

4. *Homo erectus* (eg. Peking Man)

1.5 MY – 300,000 yrs ago

by 1.5 MY a group of hominids had evolved that

→ are indisputably in our genus

→ distinctly different from *Australopithecus*

→ much more similar to us:

→ skeleton similar to ours

→ our size; males and females similar sizes

→ similar stride

→ more efficient than *Australopithecus*
eg. China, Germany, Hungary were hunters
plenty of game, more grasslands then
killed elephants, rhinos, antelopes, bears, hippos and
giant babboons
used simple stone implements
sometimes stampeded them into marshes or over cliffs
may have also used fire

brain size is correlated with intelligence
it evolved 100’s of x’s more quickly than most
traits evolve
occurred after bipedalism and tool use
→ strong selective pressure

≥1.2 MY ago: genetic evidence indicates ancestral
“fur” was shed; we became “naked apes”

5. Homo sapiens

400,000 yrs
earliest fossils from England and Germany
2 subspecies:
neanderthals & cro magnons
communication and culture became more important
than physical evolution

72,000 – 42,000 yrs ago: humans began wearing
clothes
→ indicted by genetic evidence for
 evolution of human body louse species that only lives in
clothing, not on skin or fur from human head louse

Neanderthals (150,000 – 35,000)
mainly in Europe and near east
more heavily built, very strong
= brain capacity
protruding face, low skull, heavy brow
used tools,
wore clothing of animal skins
cared for invalids
buried their dead → with weapons, food and flowers
→ belief in afterlife
language?
suddenly disappeared ~34,000 yrs ago
**Cro Magnons** (34,000 – present)
neanderthals disappeared abruptly about 34,000 yrs ago
replaced by Cro Magnon
physically indistinguishable from us
less massively built than neanderthals
made far better tools: knives, awls, chisels, engravers, etc
could make spears, harpoons, fishhooks, needles
cave paintings → ? more developed intellect?

at end of paleolithic
only a few places had not yet been settled by humans
population was ~ 600,000,000
groups in some areas became relatively
isolated as agriculture and village life caused our species to
become more settled
→ genetic differences between races
arose during this time
eg. black skin evolved as protection against UV
radiation of sun in warm tropical areas

6. Agricultural Revolution
7. Social Evolution

**The Scars of Human Evolution**

1. Bipedalism

various evolutionary changes, esp bipedalism, resulted
in a “terrific mechanical imbalance” in body

we are born with a backbone that has the ancestral
curve of a 4 legged creature

![Diagram of human backbone evolution]

old curve retained
as we become bipedal

1. stress points shifted from more evenly distributed 4 legged posture

2. vertebrae had to become more moveable to facilitate all these new curves
   → weakens the back → sore back

3. the whole pelvis was tilted upward
   → narrow birth canal

4. rather than viscera hanging evenly and weight distributed along all of vertebral column
   all organs are piled on top of each other
   → hernias

5. the weight of our upper body is borne by pelvis and its junction with vertebral column = sacroiliac
   → lower back pain

6. also, wider distance between rib cage and pelvis
   → less protection for lower abdominal organs

7. also, harder to pump blood from feet back up to the heart which is 4 ft off ground
   → varicose veins, hemorrhoids

8. much bigger burden on our feet
   → fallen arches
      bunion
      callouses

2. Brain

1. in skull, brain case has expanded greatly
   → larger face, smaller snout

2. while face bones have decreased in size our teeth have remained large
   → impacted wisdom teeth

3. big head, small birth canal
   → difficult births
Do Humans Continue to Evolve?

evolutionary changes in the past 100,000 yrs have been minor; eg jaws, teeth, size, toes, etc

the brain and other major things remain essentially unchanged

structurally, the human form is generalist = highly adaptable

humans are not dependent solely on physical structure for adaptability anymore → we are tool users and social animals

our tools have evolved greatly in the past few 1000 yrs → tools are an extension of us

“the speed of man’s development is equal to the speed with which new tools can be invented and made” -Lewis (Man & Evol)

also, our social structure is an outgrowth of technological development

language, knowledge, culture exist outside of the physical body

tools and society are subjected to different evolutionary processes

in terms of physical changes

→ those who say humans are no longer evolving sometimes confuse evolution with speciation

 evolution is a change in gene frequencies over time

 speciation occurs when there is so much change that members of the new gene pool can no longer interbreed with the original gene pool

the human gene pool is always changing → it will never “stagnate”

but there may never be a new human species → this would require isolation of a population

humans haven’t really changed the rules of Natural Selection → we are as much a product of evolution as any other organism

culture and technology might change the kinds of genes in the human gene pool but they cannot remove the force of evolution
Is Man becoming less well adapted to nature?

if anything: we may have the opposite problem

1. the physical environment has become far less severe a selective factor than in any other animal

2. behavior is a strong selective pressure in the animal kingdom
   - ability to learn
   - to overcome obstacles
   - parental care and protection

this behavioral shift initiates new selective pressures:

1. we are constantly finding more genetic links to behaviors and psychological factors

2. the conquest of disease and mitigation of the effects of aging have achieved spectacular results
   - new medical procedures may prevent weeding out of physically defective humans
     - eg. genetic diseases

such things actually counteract natural selection
   - may produce an increase in deleterious phenotypes

“are we sowing the seeds of our own species’ doom?”

while modern humans have largely mastered their environment

and communication and interactions are tending to normalize our gene pool

still ~50% of human race live in poor conditions, shortages of food & water,
  disease is common, poor health
   - still very subject to natural selection