**Chapter 18**

**Adaptations to bipedalism**

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| **Structure** | **Adaptation** | **Advantage** |
| Foramen magnum | Located centrally in the base of the cranium, allows for the skull the balance over the vertebral canal | Skull is better balanced/less neck muscles  Brings centre of gravity over feet/upright posture |
| Jawbone | Small and non-protruding | Enables skull to balance on vertebral column |
| Vertebral column | Lumbar vertebrae is wedge shaped, producing an ‘S’ shaped curve | Brings the vertebral column directly under the centre of the skull |
| Pelvis | Broad/wide and shallow from top to bottom. Attachment of femur is wide apart | Provides support for abdominal organs  Supports developing foetus during pregnancy  Carrying angle increases due to the attachment of femur being wide apart, better for bipedal locomotion |
| Femur | Large head of femur | Contributes to carrying angle |
| Knee joint | Outer ‘hinge’ is larger and stronger | Takes weight off the body  Knee is able to be straightened |
| Legs | Legs are longer than arms | Contributes to a low centre of gravity  Carrying angle allows the weight of the body to be kept close to the central axis |
| Foot | Large heel bone and big toe supports the body. Has longitudinal and transverse arches | Increased weight bearing  Weight distribution  Forward movement |

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|  | **Structure** | **Quadrupeds** | **Bipedal** | **Advantage** |
| **Skull** | Foramen Magnum | Located at back of skull | Central at base of skull | Skull better balance  Brings centre of gravity over feet |
| Prognathism | Large prognathic jaw | Flat face | Skull better balance |
| Neck muscles | Large neck muscles | Smaller muscles | Skull better balance so no need for large muscles |
| **Vertebral column and pelvis** | Lumber curve | ‘C’ shaped | ‘S’ shaped | Straightens to bring centre of gravity over feet  Carry weight of upper body |
| Pelvis | Longer and narrower for arborealism | Shorter, broader and more bowl shaped | for support of upper body and abdominal organs and supports foetus in development |
| **Legs** | Femur | No carrying angle so the weight is distributed inside femurs and there is side swaying | Carrying angle  Enlarged femur head and hip socket | Distribute weight and bring to midline of body over feet  Greater stability to carry weight of upper body, rotating when walking, and a striding gate instead of swaying |
| Knee joints | Large strong inner hinge | Strong large outer hinge | Supports weight due to carrying angle |
| **Feet** | Arches | Longitudinal | Transvers and Longitudinal | Shock absorber  Transfers weight from heel to big toe |
|  | Big toe | Opposable with grasping ability | Non-opposable and robust | Carries weight and creates thrust when walking |
| **CoG** |  | High | Low | Greater stability |
| **Other Features** | | | | |
|  | | **Quadruped** | | **Bipedal** |
| **Hand** | | Long fingers short thumb for power grip | | Short fingers long thumb for precision grip |
| **Brain** | | 400-500cm^3 with a smaller cranium and space for a larger brow ridge | | 1350cm^3 with an increased cerebral cortex and cranium leading to decrease brow ridge and flatter face |
| **Dentation** | | In a ‘U’ shape  Large incisors and canines  Diastema  Chin not developed | | Dental arcade shorter and parabolic  Smaller canines and incisors  No diastema  Chin present |
| **Skull** | | Rugged  Prominent brow ridge  Prognathic face  Large zygomatic arches | | Smooth and rounded  Brow ridge reduced  Flatter face  Smaller zygomatic arches |

**Chapter 19**

Robust: big and heavy

Gracile: small and has a slender body shape

**Australopithecines**

* Paranthropus robustus, Australopithecus afarensis and Australopithecus africanus

**Australopithecus afarensis**

* Lucy
* 40% skeletal muscle remains discovered which suggest bipedalism
* Gracile form
* **Flat nose, strongly projecting lower jaw and small canine teeth**
* Cranial capacity = 500cc – 1/3 size of modern human brain
* Long and strong arms with curved fingers adapted for climbing trees

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| **Other Name** | None |
| **Time period** | 3.9 – 1.5 mya |
| **Height** | 1 – 1.5 m |
| **Where found** | Eastern Africa |
| **Skull** | No chin  No sagittal crest  Low forehead  Large, prominent brow ridge  Prognathic  Large zygomatic arch  Jaw is half way between an ape and a human |
| **Brain** | 500 cc |
| **Dentition** | ‘U’ shaped dental arcade  Smaller canines than apes  Smaller incisors  Thick enamel  Diastema present |
| **Skeleton** | Sexual dimorphism  Long arms, curved fingers, short thumb  Toes - slightly curved bones |

**Australopithecus africanus**

* Taung child
* **Rounder cranium, larger brain and smaller teeth** compared to Australopithecus afarensis
* Pelvis, femur and foot bones indicate bipedalism
* Shoulder and hand bones indicate they were adapted for climbing

**Paranthropus robustus**

* 1.8-1.2 million years ago
* Large megadont cheek teeth with thick enamel
* Focused their chewing in the back of the jaw
* **Large zygomatic arches** (cheek bones) which allow the passage of large chewing muscles to attach to the jaw
* **Sagittal crest** which provided a large area to anchor chewing muscle to the skull

**Homo habilis**

* First species to make tools (handy man)
* **Taller with longer femurs and larger brain** in comparison to Australopithecines
* **Smaller teeth** = change in diet (meat) which increased brain size
* Bulge in speech producing area of brain = development of language
* May have existed alongside Paranthropus Robustus
* Hands were more robust compared to Homosapiens which suggest tree climbing is still prominent

**Homo erectus or (Homo ergaster)**

* Larger brain than Homo Habilis
* Footprints in Africa = big tie was parallel to other toes
* Evidence of fire use – **advantages**

-light

-kept predators away

-cooking became more important = softened meat, killed parasites, detoxify plant foods

* Increased group hunting
* They modified the environment (environment is no longer a selective agent)

-expansion of areas occupied

-building shelters

-tool and fire use

**Homo neanderthalensis**

* Cranial capacity = 1485cm^3
* Heavy brow ridge remain
* Probable that Neanderthals and Sapiens lived alongside each other
* Extinct = Homosapiens outcompeted directly in contact and indirectly in hunting and gathering resources

**Homosapiens**

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| --- | --- |
| **Feature** | **Description** |
| Prognathism | * Flatter face |
| Brow ridge | * No brow ridge present |
| Sagittal crest | * No sagittal crest present |
| Dentition | * Smaller teeth |
| Legs | * Longer femurs which slope towards knee |

* “Cro-Magnon”
* Cranial capacity = 1350 cm^3
* Flatter faces
* No brow ridges
* No sagittal crest
* Smaller teeth
* Broader hips
* Longer femurs which slope towards knee

**Cultural Evolution**

**Evolution of behaviour**

* Natural History intelligence
* Social Intelligence
* Technical Intelligence
* Creating artefacts and images with symbolic meanings
* Advanced planning and communication

**Homo Habilis/Australopithecines**

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| **Culture** | | |
| Food | Generalised diet – maybe some meat – lead to increased brain size | |
| Tools | Oldowan stone tool kit (2.6 – 1.7 mya)   * Cores, flakes, hammers, choppers, scrapers, spheroids, polyhedrons * Pebble stone tools | Uses – cutting and scraping meat of prey |

**Homo Erectus**

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| **Culture** | | |
| Food | Generalised Diet – some meat; **first hunters** (possible cannibalism) | |
| Fire | Harden spears and burning animal bones | |
| Speech | First form of speech production due to Broca’s and Wernicke’s area | |
| Cognition | Development in hunting technique which indicates **thinking** and **communication** | |
| Shelter | Control fire so could move to colder climates | |
| Art | Possible rituals and sculpting | |
| Tools | Acheulian (1.7 mya – 200 000 ya)   * Hand axes = **tear drop shape**, cleavers, picks and cores * Cattleman – increased dispersal of species * Use of fire   -remain active at night  -cooking with fire  -make better weapons and tools  -protection from predators  -warmth for themslves | Uses – cooking, warmth, protection, constructing shelter, hunting, killing animals |

**Homo Neanderthalensis**

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| --- | --- | --- |
| **Culture** | | |
| Food | Generalised diet – reliance on meat (some evidence of cannibalism) | |
| Fire | Extensive use – heaths common | |
| Shelter | Extensive use of caves; clothing inferred | |
| Art | Clothing and needles; buttons; ivory beads, evidence of bone flute and necklace, cave paintings (pass on knowledge or invoke animal spirits for luck during hunting) | |
| Religion | Death awareness: Buried the dead:   * Bodies with flowers, food, tools, medicinal plants, ochre pigment, animal bones, complex rituals and beliefs * Buried with body aligned east-west with head facing south (creates closer spiritual bonds within the group, leading to better cooperation and group cohesion) * **First species that buried their dead, therefore they believe in an after life**   Looked after sick and injured; able to offer things for/to the clan other than physical work | |
| Tools | Mousterian Tools (200000 – 35 000 ya)   * **Stone flakes** = enabled those living in colder climates to make clothes * **Axes** = with wooden handles * **Scraping tools** = for preparing animal hides have been found at Neanderthal sites * **Flint** became a preferred material to produce stone stools * **Levallois** method involved core and striking off a large oval flake | Uses - Hunting, protection, making clothing, carvings.  Cutting, scraping, piercing and gouging |

**Homo sapiens**

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| Culture | | |
| Food | Generalised diet – omnivorous | |
| Shelter | Extensive use of caves with development of tents/huts   * caves with hearths, limestone, mammoth bones * tents made of mammoth bones with skins | |
| Art | Modern language (6000 ya) – finger painting in limestone (24 000 ya)  Figurines, pendants, shells, needles  Symbols, flutes and paintings in caves (30 000ya) | |
| Agricultural evolution/Neolithic revolution | **Fertile crescent** running from Egypt to the Persian Gulf (10000 ya)   * cattle, goats, sheep and pigs all have their origins as farmed animals here * **7000** years ago, agriculture became established in China | |
| Religion | Burials, cremations (with tools, weapons, organs; idols worships) – last 10 000 yrs | |
| Cognition | * Can create artefacts and images with symbolic meanings as a means of communication | |
| Tools | Aurignacian (40 000 – 26 000 ya) – upper paleolithic   * Scrapers, blades, points, knives, burins, bone points, ivory pendants * **Blade tools** | Uses - Fishing, hunting, protection, building shelters, making clothing, harvesting |
| Solutrean (22 000 – 19 000 ya)   * Innovations in design of blades and points * **Laurel leaf points blade** |
| Magdalenian (18 000 – 12 000 ya)   * Increase in needles, fishhooks, harpoons, snow shoes, nets, weights, bows and arrows and atlas (spear throwers) * **Bone and antler tools** * **Use of burin to shape bone, antler and ivory into tools** |