Chapter 11

The Origins and Evolution of Early *Homo*
In 1891, no fossils of *Australopithecus* had yet been found. The only fossil humans that had been discovered were Neandertals, dismissed by many simply as pathological modern humans. Just 20 years earlier, Charles Darwin had published the *Descent of Man*, in which he formulated many of his ideas about human evolution. If Darwin was right, then scientists should eventually discover fossils of creatures that are not quite human and not quite ape, in Africa. Other scholars, like Ernst Haeckel, argued that they would reside in Asia, given the close similarities between humans and orangutans.

Remember, DNA had also not been discovered yet, so there was no way of knowing which of the apes was most closely related to humans. Haeckel not only hypothesized the existence of this half-man, half-ape, he even gave it a name: *Pithecanthropus erectus*. The writings of Darwin and Haeckel attracted the attention of a young Dutch anatomist named Eugène Dubois.

Dubois became obsessed with finding fossils of these early humans and, in 1887, he moved to Indonesia, which was, at the time, a Dutch colony. On the banks of the Solo River near a village called Trinil, Dubois found a tooth, partial skull, and a femur. The femur indicated that this creature walked on two legs, but the brain measured only about 1,000 cm\(^3\). It was too small to be a human brain and too large to be from an ape. It was exactly what he was hoping to find, and Dubois named it *P. erectus*. We now know these fossils by a different name: *Homo erectus*. 
**Homo habilis**

- Although we find stone-tool technology in the smaller-brained *Australopithecus* genus, it is a combination of stone-tool culture, larger brain size, and smaller tooth anatomy that can be used to identify fossils from our own genus.
- The geologically oldest fossils that fit the criteria for inclusion within the genus *Homo* were initially discovered by Louis Leakey in Olduvai Gorge, Tanzania, in the 1960s.
- Lived in Africa between at least 1.9 and 1.44 mya (may be as early as 2.33 mya, but not yet verified)
  - The brain was larger than that of an *Australopithecus* (~600 cc), the teeth were smaller, and the landscape was littered with Oldowan stone tools.
    - Tools were made from flint, obsidian, or quartz.
    - Flakes were made by striking two stones together and were used for many purposes.
  - Stone tools were important for expanding the dietary base. This dietary change would have selected for smaller, rather than larger, teeth.
    - We know they helped with scavenging.
    - Did they hunt? Unclear, but data leans to scavenging only.
    - This dietary shift may have been critical in providing the energy necessary to grow a large brain, as well.
  - These features are probably linked to one another. Leakey and his colleagues named this new creature *H. habilis*, which means “handy man.”
    - It was about 4 feet tall. This has led some to suggest *Homo habilis* is an australopithecine.
    - Additional finds of *H. habilis* have revealed that this species probably had an *Australopithecus*-like body, with relatively long arms and short legs.
- We are not sure which species was ancestral.
Oldowan Tools and Human Thumb

**HUMAN THUMB**
- Abductor pollicis brevis
- Adductor pollicis
- Thumb metacarpal
- Flexor pollicis brevis (superficial head)
- Flexor pollicis longus
- Flexor pollicis brevis (deep head)
- 1st volar interosseous of Henle

**CHIMPANZEE THUMB**
- Adductor pollicis brevis
- Adductor pollicis
- Thumb metacarpal
- Flexor pollicis brevis
- Tendon only (flexor digitorum profundus)
Homo rudolfensis

- More than one species? There is intriguing evidence that *H. habilis* was not the only species of early *Homo* existing at this time.
  - At Lake Turkana, about 1.9 mya.
  - Larger cranial capacity (775 cm³), more gracile bone structure and a survival date to about 1.44 mya.
  - An endocast of the interior of the skull shows that this specimen has fissures and other features that resemble *Homo* line.
  - There is a debate
- Lumpers versus splitters (again)
  - There are many researchers who regard this as a different species and call it *H. rudolfensis*.
    - Some *H. habilis* fossils should be classified as *Homo rudolfensis*.
    - Those that advocate for two species suggest that *Homo habilis* is more human than *Homo rudolfensis*.
    - A recent discovery of additional fossils in Kenya support this idea that there may have been two different kinds of early *Homo* coexisting.
  - Others regard these differences as normal variation one would find in a population of hominins. Figuring out which of these hypotheses is correct is not as easy at it sounds.
- Some differences between the “two species”:
  - *Homo rudolfensis* has, on average, a larger braincase than *Homo habilis* (~750 versus ~600).
  - *Homo rudolfensis* has later *Homo* hindfoot and femur, *Homo habilis* is more *A. afarensis*.
  - Body size of *Homo rudolfensis* is larger.
Homo erectus 1

- Sometime after 1.8 million years ago, *Homo habilis* was replaced by a new hominin species, *Homo erectus*.
  - This date is attached to specimen ER 3733, Koobi Fora, Turkana Lake. It dates to about 1.78 mya.
  - It is both human, and yet different.
    - *H. erectus* possessed a larger brain than *habilis*; its **mean brain size** of just under 1,000 cc is two-thirds the modern human mean.
    - With its larger brain and attendant greater intelligence, *Homo erectus* was able to adapt to the changing environmental conditions posed by the Pleistocene epoch.

**Body size**
- Anthropologists estimate that some *Homo erectus* adults weighed well over 100 pounds, with an average adult height of about 5 feet 6 inches.
- *Homo erectus* was quite **sexually dimorphic** (so males may be larger than the 100 pounds)
- Increased height and weight in *H. erectus* are associated with a dramatic increase in **robusticity**. Robusticity remains common going forward until the advent of modern humans.

**Brain size and shape**
- Early *Homo* had **cranial capacities** ranging from as small as 500 cm$^3$ to as large as 8,810 cm$^3$, but *Homo erectus* had a cranial capacity of 800 to 1,250 cm$^3$, the mean was 960 cm$^3$.
  - Using the mean, this change represents an increase of 37%
  - Endocasts suggest the brain was organized with **bilateral assymmetry**.
  - At the same time, *Homo erectus* sample actually had less **encephalization** than later *Homo*. 
An important specimen from Nariokotome, Kenya is called WT15000 and also Turkana Boy (1.55 mya):
- Nearly complete skeleton; young male was found in 1984.
  - The development of his teeth were used to estimate his age at 12 years
  - Others suggest he is younger, 8 years, if one accepts a faster rate of maturation.
  - Height was 5’ 3”, but some researchers suggest it would have been more than 6 feet tall if it had survived.
- He has a relatively large brain, about 900 cc.
- Post-cranial bones look very modern, but not exact.
- Some researchers see enough differences in the African forms of Homo erectus to place them into a separate species from the European and Asian fossils.
  1. They suggest Homo erectus is found only in central and eastern Asia.
  2. In southern Europe at Ceprano, central Italy is a find that dates to 900-800,000 years ago.
    - Cranial morphology is very close to Homo erectus.
    - Researchers suggest a new species for the Italian finds. The discoverers are calling it Homo antecessor.
  3. According to the splitters, the proposed name for the African form is Homo ergaster.
- Probably, we should lump Homo antecessor and Homo ergaster in with Homo erectus for now, at least.
- Lordkipanize et al. found the variation between specimens to be within the range found in modern apes. They can be considered geographic variants of a single species.
**Homo erectus 3**

- **Brain**
  - Has a larger brain than earlier hominins, and there was increase in size over time.
  - The overall brain case is still smaller than modern humans (50% than *Homo habilis*), and the face still protrudes.
- **Facial features**
  - A bony ridge (nuchal torus) developed along the back of the skull for powerful neck muscles (strong neck muscles)
  - **Brow ridges** also developed over the eyes, possibly for support for chewing forces, or as facial or eye protection.
  - Jaws were still large but smaller than those of earlier hominin.
  - A postorbital constriction is created by a narrowing of the skull behind the eye sockets, broadening of the base of the skull. This means the cranium wider at base, compared with earlier and later species
  - **Sagittal keel**, a small ridge from front to back along the sagittal suture, reflects bone buttressing in a very robust skull.
- **Postcranial anatomy**
  - Body proportions are similar to modern humans.
  - Limb proportions reflect a modern bipedal form, and suggest endurance running.
  - Narrow pelvic proportions indicate rapid brain growth continuing after birth.
Was there more than one species?
- Expect and see, some geographic differences in the African, Eastern European and Asian populations.
  - Early African and European crania have smaller cranial capacities and less rugged brow ridges
  - There are also some differences in cranial shape by region also.
  - The post-cranial skeletons from Dmanisi are also shorter.
- What does this all mean? Think lumpersplitter debate.
  - Some call it regional variation.
  - Others are calling the populations different species.
- The splitters
  - Africa
    - Some suggest that another species should be named for specimens such as KNM-ER 3733 and other early African specimens: *H. ergaster*
    - They argue these are the ancestors of modern humans, not *H. erectus* (which they label the Asian specimens)
  - Europe
    - Others break off the Dmanisi population into yet another species.
      - *H. georgicus* is the name they use
    - Some researchers suggest a new species for the Italian finds.
      - The discoverers are calling it *Homo antecessor*
    - Update: *Homo antecessor* was likely a Neanderthal based on new DNA analysis. Also dates from 130-170 kya (2015).
- I use a single term: *Homo erectus*. This represents a conservative interpretation.
Homo erectus and modern Skulls

**Homo erectus**
- Low, flat forehead
- Prominent brow ridges
- Large facial skeleton with large orbits and large nasal opening
- Relatively large teeth
- Large mandible
- Pronounced postorbital constriction
- Sagittal keel
- Occipital torus
- Angular occipital

**Homo sapiens**
- Slight postorbital constriction
- No sagittal keel
- Vertical forehead
- Slight brow ridges
- Relatively small facial skeleton
- Relatively small teeth
- Rounded occipital
- Small mandible
Ileret Finds

- Not only can we use the skeletal anatomy of *H. erectus* fossils to infer how they walked but this species also left us fossilized footprints.
- At the 1.5 million-year-old site in Kenya, called Ileret, scientists have recently unearthed a large collection of footprints made by *H. erectus*.
  - These prints, shown to the right, are nearly indistinguishable from prints that a modern human would make, indicating that this species moved essentially like we do.
  - The feet are arched and the big toe is in line with the other toes, as is found in human feet.
- So, although the brain was still outside the range found in modern humans, the mode of locomotion was essentially identical.
  - There is also a skull from Ileret that is smaller and has smaller brow ridges than many other fossils attributed to *H. erectus*. This is skull KNM-ER 42700.
  - That means that this is the 42,700th fossil discovered at this locality in Kenya!
- Researchers have recently exceeded 60,000 fossils!
  - Of course, not all of these are hominins, but it indicates just how numerous fossils can be in some of these localities.
  - The anatomy of the Ileret skull indicates that *H. erectus* was quite variable, and may have maintained a high, *Australopithecus*-like level of sexual dimorphism.
Homo erectus in Africa

• East Turkana, Kenya (1.7 mya): Oldest well-dated H. erectus in Africa is labeled as ER 3733.
  • Has a cranial capacity of 848 cm$^3$
  • This is consistent with earlier specimens being smaller brained.
• East Turkana, Kenya (1.5 mya): Smallest cranium of any Homo erectus in Africa
  • There are a few smaller, but outside of Africa
  • Great amount of variation seen among individuals, possibly due to sexual dimorphism
• Gona, Ethiopia (1.3 mya): Specimen looks more like the Asian forms than African forms
  • First female pelvis found which is wide; this suggests large-brained newborn
  • Present data suggests that the growth curve of Homo erectus was faster than moderns
• Olduvai Gorge (~1.2 mya): Is called OH9.
  • Notice the enormous brow ridge (largest ever found) and a large area for muscle attachments on the back of the skull.
  • This specimen also has very thick bone comprising the skull. Brain size of 1065 cc.
• Daka, Ethiopia (1 mya) -- Critical find.
  • Complete cranium more like Asian H. erectus than most earlier East African remains discussed
  • Discounts argument that East African fossils are different species than Asian H. erectus
  • This explains why the textbook authors no longer discuss the species, Homo ergaster. Still many researchers continue to insist there are two species.
• Bodo, Ethiopia (600 kya):
  • Has a brain size that is within the range of what is found in humans today.
  • One neat thing about this skull was the discovery of deliberate cutmarks on it that indicates that Bodo was defleshed after his death, either ritually or because of cannibalistic activities by H. erectus.
Hominins Conquer the World 1

- Interestingly, almost immediately after *H. erectus* evolved, presumably in Africa, it spread east into Asia. Half a million years later, *H. erectus* expanded west into Europe.
- This expansion indicates that *H. erectus* was adaptable and had evolved the intelligence to use resources in its environment to make the tools necessary to survive.
  - **Stones first**
    - The earliest evidence of the migration out of Africa is found at Erk-el-Ahmar, Israel.
    - **Dated to 1.7-2.0 mya**, Oldowan choppers and flake tools were found.
  - **Then bones**
    - The Dmanisi hominins (dim’an esse’ ee) (1.77 mya)
      - The discovery of the Dmanisi materials in Republic of Georgia began in the early 1990s. The remains are the best-preserved hominins of this age found anywhere outside of Africa. Many suggest they were the first migrants out of Africa.
      - In both body and brain size, they look similar to early *Homo* in Africa.
        - They have the long, low braincase, wide base and a thickening along the sagittal midline (keel).
        - Estimated height ranging from 4 feet 9 inches to 5 feet 5 inches, smaller than full *H. erectus* specimens from East Africa or Asia. Body proportions, however, similar to *H. erectus* (and *H. sapiens*) and different from earlier hominins.
        - The cranial capacity is smaller – the most recent is 546 cm³, and the largest is only 730 cm³
    - The tool tradition resembles Oldowan.
    - This discovery was labeled as *Homo georgicus*, now *Homo erectus georgicus*. 
Dmanisi has turned out to be one of the most productive early Homo fossil sites ever found, with several skeletons and five skulls discovered, including the one shown here. The skulls have cranial capacities in the range of 600–750 cc, which incorporates the range of both *H. habilis* and *H. erectus*. Like *H. erectus*, the Dmanisi individuals also had long legs compared with their arms.

While human evolution was “bushy”, sometimes it was just not. What else should we lump?

• East Asia
  • Eugene Dubois was the first to organize a hunt for fossils in Indonesia. He first looked at Sangiran, Java.
  • In 1891 along the Solo River near Trinil, Java he found the famous skullcap. Cranial capacity of about 940 cm$^3$.
  • The Trinil site dates from 430-540 kya.
  • He called this find *Pithecanthropus erectus*. Renamed as *Homo erectus erectus*.
  • Major finding: Bipedalism preceded larger brain (big issue in the day).
  • Six sites in eastern Java have yielded all the *H. erectus* fossil remains found to date from 1.6 mya to 1 mya, during the Early to Middle Pleistocene.
  • Oldest Java fossils are close to 1.75 million years old. This date is from a juvenile found at Mojokerto, Java.
  • *Confirmed* to exist on Java as recently as 100 kya. But, some suggest a very late survival in Java, where the most recent *H. erectus* fossils (called the Ngandong individuals) may be as young as 53-27 kya (Would make it contemporary with modern humans; dating is controversial)
  • New finds, yet to be dated, may change these numbers (See this [2011 article that negates the recent date](#)).
  • Few artifacts and so behavioral data are sketchy here.
• FYI: [Sangiran Ealey Man Museum](#) is found on Java
Hominins Conquer the World 3

- **China**
  - In China, the oldest evidence are stone cores and flakes at Majuangou site. Located in north-central China, the site dates to 1.66 mya.
    - This date suggests that *Homo erectus pekinensis* (once *Sinanthropus pekinensis*) had migrated here within 200 ky of appearing in Africa.
    - This site would have been cold; cultural adaptations to the weather must have occurred.
  - **Zhoukoudian** (Zhoh’ koh dee’ en)
    - The fossil remains of *H. erectus* discovered in the 1920s and 1930s, as well as recent excavations at Zhoukoudian are the largest collection of *H. erectus* anywhere.
    - The hominin remains belong to approximately 45 adults and children.
      - The fossils have typical *H. erectus* features: a supraorbital torus in front and a nuchal torus in back, a protruding face, and the skull is broadest near the bottom.
      - Recent new date places the site at 770 kya at Locality 1 (where Peking Man was found).
      - Many of the bones have been lost as they were mistaken to be dragon bones and ground up for medicines. A young geologist, Pei Wenshong, brought some Zhoukoudian fossils to anatomist Davidson Black.
      - Later Franz Weidenreich took over for Black.
        - After WWII began, Weidenreich decided to move the fossils for safety.
        - He did take plaster casts before moving them.
        - They were handed over to the US Marines and have never been seen again, because the marines were captured by the Japanese.
Hominins Conquer the World 4

- **Europe**
  - In addition to the recent finds at Dmanisi, in northern Spain (Atapuerca regions) there are other important European finds
    - **Sima del Elefante** (dated to 1.2 mya)
      - Date makes this site the oldest in western Europe
      - Morphology appears to be similar to Dmanisi finds
      - Tools and animal bones found; some of the bones have indication of butchering
    - **Solana del Zamborino and Estrecho del Quipar** (760-900 kya)
      - No human remains, but evidence of handaxe production is apparent.
      - These tools are among the **oldest in Europe**.
    - **Gran Dolina** (>800 kya, maybe 1 mya)
      - At Gran Dolina, more sophisticated tool use, perhaps earliest in western Europe
      - [Click here](#) to read more.
      - **New paper** (2012) suggests that the Gran Dolina fossils exhibit morphological traits later linked to Neandertals (Neanderthals). This data suggest these traits developed earlier in Europe than first thought.
  - In southern Europe at **Ceprano**, central Italy is a find that dates to 900-800,000 years ago.
    - Cranial morphology is very close to *Homo erectus*.
    - Researchers suggest a new species for the Italian finds. The discoverers are calling it **Homo antecessor**.
  - After 400 kya, the fossil record fills up with fossils and interpretations get even more complex!
Cultural Behaviors

- **Stone tools**
  - Developed the *Acheulian tradition* as a new type of stone tool technology 1.5 mya.
  - Flakes were removed from a stone core using antler, bone, or wood pieces.
  - A soft hammer technique is used where the material used to strike is softer than the rock used for the new tool.
  - These new tools are also bifaces (worked on both sides).
  - The *hand axe* is the basic tool.
  - Other tool types were used, implying greater mental sophistication in design and manufacture.
  - There are regional differences in types of tools made and used. Once it was suggested one species = 1 tool type; completely wrong.
  - In Africa and Europe the hand axes are found, but not in Asia. In Asia, chopping tools are predominant

- **Hunters or scavengers?**
  - Ate meat and butchered animals.
  - The meat may have come from hunting or scavenging from predators.
  - One hypothesis is that they hunted small game, but not the large game we once thought they did.
  - Alternatively, evidence of fire and microscopic analysis of bones indicate scavenging is likely as the cut marks are over the bite marks.
  - Keep in mind that *H. erectus* was not a carnivore and *H. erectus* relied very heavily on food gathering of tubers, nuts, berries, and many other foods to survive, as well.
  - Most likely, *H. erectus* live in groups and shared the foods they gathered and hunted with one another.
  - This increase in food quality and available energy fueled the growth of an energetically expensive brain.
• We tend to have larger brains and smaller guts than our evolutionary heritage would suggest.
• Some suggest that the enlargement of the brain was expensive so that the gut had to reduce (both being so expensive metabolically)
  • The smaller gut would have been possible with a higher density, higher quality diet.
  • Our gut is midway between that of herbivores and of carnivores.
  • Cooking also changed us physiologically and culturally. So much so a new term was coined: cookivores
• The expensive tissue hypothesis
  • The human brain is seen as an expensive tissue because it requires 20% of the body’s energy.
  • Our brain size averages as 1400 cc (900-2000 cc range). This is 4-5 times larger than a chimpanzee’s or recent fossil ancestors.
  • Q: Why did the large brain evolve? A: Perhaps to facilitate social relations surrounding food sharing.
  • Q: How did the large brain evolve? A: Greater access to a higher density, higher quality diet.
    • Some argue the scavenger scenario: Eating the brain tissues of deserted kills.
    • Some argue for eating of red meat.
    • Breaking news: in 2015 announcement that 'Big brain' gene found in humans, not chimps reported that this gene prompted more neurons in the neocortex of humans and their direct ancestors.
• The evolution of larger brains
  • Disadvantages of larger brains: 1) metabolically expensive; 2) lose heat more quickly; 3) can complicate child birth
  • For brain size to increase, the advantages of larger brains must have outweighed the disadvantages: 1) intelligence; 2) toolmaking and tool use; 3) technological skill; 4) problem-solving ability; 5) language ability; and 6) social intelligence.
Why Study Fire?

- Answer: Because it helps to explain how humans came into existence and how we survived.
- We will use the biocultural approach to understand how important fire has been for humanity; we will look at environmental, biological and cultural factors.
- Before we do so, we need to discuss a few topics:
  - When we talk about the use of fire in this lecture we are talking about the control of fire, not opportunistic uses. So, using fire and controlling fire are two separate research questions.
  - A recent research paper outlined what level of intelligence our ancestors (Homo erectus) needed to control fire. The answer is a higher level than had previously been thought, because they needed to:
    - Plan ahead and gather the materials needed to keep the fire going.
    - Their capacity to cooperate, rather than compete, would be pivotal to the control of fire. This is what Twomey (2013) calls future-directed, self-regulation.
  - Personally, I have experienced how difficult it is to maintain a fire. I did my field research on the island of Guadalcanal, in the Solomon Islands.
    - While I was there, I consistently failed to bank my fire correctly.
    - At first, I simply “borrowed” from my neighbors, but this became embarrassing.
    - Next, I resorted to using “Girl Scout water”, a coconut shell, and a match.
    - When the villagers learned about this practice, I was scolded.
Twomey’s Inferential Structure

- Controlled fire use
  - Evidence
    - Archaeological
    - Fossil
    - Demographic
    - Palaeoenvironmental
  - Conditions
    - Social organization
    - Subsistence strategies
    - Habitat
    - Climate
    - Technology
  - Behaviour
    - Access fire
    - Transport fire
    - Provision fire
    - Protect fire
    - Use fire
  - Fire-related problems
    - Ecological constraints
    - Logistical constraints
    - Economic constraints
    - Free riding
    - Conflicts of interest
    - Delayed returns

- Behaviour
  - Anticipatory planning
  - Response inhibition
  - Future-directed cooperation

- Cognitive abilities
  - Extended working memory
  - Episodic memory
  - Decoupled representations
  - Collective intentionality
  - Protolanguage
When Was Fire First Controlled?

• There has been a series of sites suggested to the candidate for first control of fire.
  • Among the best documented, and least challenged, has been Gesher Benot Ya'qov, Israel, dating to 790 thousand years ago (kya).
    • Numerous hearths were identified.
    • Also found was burnt flint (more later on why this is important).
  • **Breaking news:** April 2012, a research paper reports a date of 1 million years age (mya) at Wonderwerk Cave, South Africa. Their evidence for the controlled use of fire included that:
    • Temperature of sediments measured using Fourier transform infrared microspectroscopy (FTIR). Found the sediments were heated to temperatures consistent with fire.
    • Burned grasses, leaves and bones were 30 meters back from cave entrance, which decreases the chance of blow-in as an explanation.
    • The burning was done repeatedly.
Advantages of Fire 1

- **Environmental advantages** include:
  - Along with clothing and shelter, fire has enabled humans to settle into a global environment.
  - This is in spite of our species being a K-selected species, reproductively.
  - K-selected species adapt to limited environments. Spreading into too many environments means placing your few offspring at risk.
  - Fire provides warmth, extends the activity period (light), and helps with predator control.
  - Every time it gets colder, my heating bill goes up.
  - The new PBS series, *How we go to now: Light*, discusses the importance of light in human history. Of personal interest to me was how the invention of the electric light shifted our sleep patterns.
  - We like to see ourselves as the top predator of the world, but for much of our history we were prey.
  - In fact, many of the hominin fossil finds have been found with tooth and claw marks from predation. FYI: Hominins are primates with large brains, who make tools, and have thicker tooth enamel. (In other words: us and our direct ancestors).
  - Fire also aids in pest control. Place some green vegetation on a fire and the resulting smoke will deter biting insects.
Advantages of Fire 2

- **Biological advantages** include:
  - Cooking of foods makes them more eatable.
  - Cooking “predigests” our food.
    - This means that previously hard to access calories are now available for less effort.
    - There is one hypothesis that suggests cooking our food was pivotal to the expansion of our brains (the **cooking hypothesis**).
    - Check out this TED talk about brain organization and the cooking of food: [What is so special about the human brain?](https://www.ted.com/talks/arik_novak_what_is_so_special_about_the_human_brain)
  - Another, related hypothesis, the **scavenger hypothesis**, is where early humans scavenged for brains using stone tools to crack open the skulls of discarded carnivore kills.
  - Yet a third hypothesis suggests our big brains are due the need for men to strategize when hunting (the **man the hunter hypothesis**). This idea lead to other proposals:
    - Woman the gatherer hypothesis as the explanation for our brains. Then, woman the hunter hypothesis was proposed.
    - Finally, man the hunted hypothesis (whose authors argued that hunting only began with control of fire).
  - Cooking kills parasites and other potentially dangerous organisms.
    - My late father urged everyone to cook beef until the “moo-ing stopped”.
    - I took him seriously; he worked night clean-up in a meat-packing plant.
  - There are several other biological responses to the cooking of food, besides brain size.
    - The decrease in the size of our molars as well as the decrease in the strength of our jaws.
    - The change in our digestive anatomy is apparent (our stomach surface area is 1/3 of what our body size would suggest; our large colon is 60% smaller). (Wrangham, 2009).
Advantages of Fire 3

- **Cultural advantages** include:
  - Fire makes the working of tools easier:
    - The oldest known evidence of tool use is about 3.4 million years ago (McPherron, 2010), hafted tools 500,000 (Bernaa et al., 2012).
    - Some stone flake better after heating.
      - Stone tools are created by taking advantage of the natural, small fissures found in rocks.
      - Some stones need heat to help create these imperfections.
      - If interested, this [link](#) provides a temperature guide for various types of stone.
    - Heated, wooden spear tips are stronger.
      - This process is often called “fire hardening” or “fire polishing”.
      - FYI: The evidence for the oldest wooden spears are 400.000 years ago, at Schöningen, Germany.
  - Fire allows for the firing of pottery.
    - Some cultures still place their pottery directly on the fire
    - Others now use kilns.
  - Allowed for the invention of metallurgy.
    - Early techniques appeared to be based on cold hammering
    - With fire the use of metals bounded.
  - Landscaping
    - Prehistoric groups often controlled the landscape by the use of fire
    - Today, swidden (slash-and-burn) farming remains a common practice in the tropics. In Oregon, the burning of the grass seed fields is an annual event.
  - The combustion engine.
The Social Connections

- One of the best known discussions concerning fire takes us back to the practice of cooking our food.
  - In 1969, Claude Leví-Strauss published his foundational work, *The raw and the cooked: Introduction to the science of mythology*.
  - In this work he makes numerous points for discussion. Here are a few:
    - Both the “savage”/”primitive” mind and the “civilized” mind are the same; one is not superior to another.
    - Humans often use binary oppositions to access more complex ideas.
      - His work draws from a cross-cultural comparative of mythologies.
      - He argued that the function of myths was to resolve the conflicts found between these binary oppositions, to explain the conflicts.

- So why would one cook food?
  - He argued that the act of cooking food moved from the natural state to a source of food appropriate for humans. We use fire/cooking to separate ourselves from the natural world.
  - Where he may have been wrong was the insistence that the cooking of food is unnecessary.
- Fireplaces as first form of social media.
  - Wiessner (2014) recently summarized decades of field site observations from her work with the Ju/”hoansi of southern Africa.
  - This researcher compared daytime and nighttime conversation content.
    - As can be seen, 34% of day conversations were about complaints and 31% were about economic issues.
    - In contrast, 81% of night conversations were story-based.
• Let’s wrap up this lecture with a final review of *H. erectus*.
• We begin to find fossils of this species at sites dated around 1.8 million years old in Africa and Asia.
• *H. erectus* spread throughout the Old World and populated remarkably diverse areas ranging from South Africa to Spain to Indonesia and everywhere in between.
• Their success was largely dependent on their ability to use material culture to survive in these diverse ecosystems.
  • They used more sophisticated tools, called Acheulean, and by 1 mya, had controlled fire for cooking and warmth.
  • These cultural innovations impacted the biology of *H. erectus*, leading to the evolution of larger brains, smaller teeth, and smaller jaws and chewing muscles. They evolved larger body size and limb proportions that were identical to humans today.
• One final thing to note is that the earliest *H. erectus* fossils from Africa and Dmanisi look very different from the later *H. erectus* fossils from Bodo and Zhoukoudian.
  • Some researchers feel these differences warrant the naming of different species.
  • But other researchers argue that all we are seeing is evolution *within* a species over time.
• Brains got gradually bigger, teeth got gradually smaller, skulls got gradually thicker and then thinner later.
• These changes mirror the technological advances made by *H. erectus* and illustrate the intertwined relationship of culture and biology on these hominins. Many of these changes we see in *H. erectus* foreshadow the evolution of our own species, *H. sapiens*, which will be the subject of the next lecture.
Remember Lee Berger finding of *Australopithecus sediba*?

• This was a once-in-a-lifetime event. Except it wasn’t.
  • He found a second species in 2013: *Homo naledi* at Rising Star Cave, South Africa.
    • The entry into the cave was so narrow, they advertised for petite spelunkers.
    • In total (to date) 15 partial skeletons were found (1,413 bones and 137 teeth).
  • In 2017, the date range was assigned: 236-335 kya.
• Differences in anatomy:
  • Most striking is the smaller brain size (~500 cm³, at the same time humans co-existed with large brains.
  • Pelvis and shoulders are primitive.
  • The hands were human-like, but the fingers are more curved (tree climbing adaptation).
• Similarities in anatomy:
  • Feet are adapted to bipedalism.
  • Teeth are smaller.
  • The shape of the skull is human-like.
• Mata Menge, Flores Island, Indonesia (700 kya) is as discovery found in 2014.
  • Gerrit van den Bergh et al, found a hominin mandible and six loose teeth,
    • They are very small. Suggests that the individual may have been ½ size of contemporary hominins.
    • Like the hobbit (Chapter 12) likely island dwarfism, but the mandible is smaller in the Mata Menge specimen.
    • Tools are similar to those used in the later hobbits; is Mata Menge ancestral to the hobbit?
  • Suggested not *H. erectus*, but derived from them.
  • Read more here: https://www.researchgate.net/blog/post/700000-year-old-hominin-remains-discovered-on-remote-island-of-flores


TED Blog Video (contributor). (2013). *Two monkeys were paid unequally: Excerpt from Frans de Waal’s TED Talk.* Retrieved from https://www.youtube.com/watch?v=meiU6TxysCg


