**Information about the evolution of the Hominin**

As hominins walk more erect, the head is more centrally balanced over the spine. If the spine were centrally located in quadrupeds or knuckle walkers, their head angle would be slanted towards the ground instead of looking forward. Most importantly, the liberation of the hands adds potential for experimentation with tools and dietary habits.

An upright posture is more biomechanically efficient for long-distance marching and running. The disadvantages of bipedalism include having a slower sprint and having less mobility in trees. Even among contemporary hunting gathering societies (e.g. the San bushmen in Botswana), the endurance factor allows hunter-gatherers to track their prey until they are too exhausted to continue – a practice known as persistence hunting. Also, in tall grass, visibility improves.

A larger jaw opened up hominins to a specialized variety of nutrition. Foods such as grasses and tubers could be processed with specialized stronger jaws and larger teeth, best highlighted by the nutcracker man, A. boisei. Intimidation of predators is theorized in addition to a more formidable defense from physical attack. The protective buttressing hypothesis postulates that less damage occurred from blows to the face in prognathic species compared to orthognathic species. Maxillary prognathism and mandibular expansion was more costly in terms of energy efficiency during gestation and development. Nutcracker is a misnomer, recent research has shown that A. boisei subsisted on grasses and sedges and could thus digest cellulose.

Modern humans occasionally mimic the grazing habits of the Australopiths when eating celery, but we in fact do not obtain a net caloric gain from celery as our bodies can no longer break down the cellulose. The energy required to chew it and the energy needed to break it down in our stomachs is less than the energy it provides. Orthognathism reflects a trend towards efficient tissue development, and metabolic efficiency during active mastication.

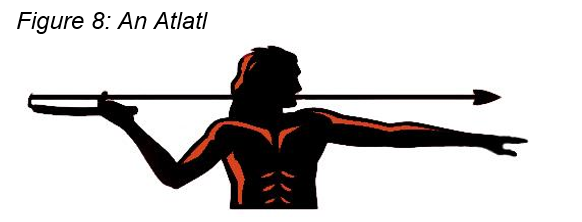
The larger the organism, the greater the metabolic cost of maintaining and utilizing its bone, muscle, brain and other tissues. There is thus a metabolic equilibrium that must be attained. The evolution of an orthognathic face (a jaw that does not protrude) in hominins is likely related to a reduction in the size of teeth, chewing muscles and jaw size, reflecting a reduced need for production of powerful grinding force. These changes reflect dietary shifts in human evolution away from tough skinned fruits and fibrous plant matter and towards greater consumption of meat and cooked foods. Students should be guided to consider what technological adaptations reduced the need for these large grinding jaws – fire and hunting in groups.

A larger brain meant a greater behavioral flexibility that led to a number of evolutionary advantages. The retention of complex tool traditions was an early distinction, followed by the investigation of fire, language, and shelters.

Higher logical, social cognition is rooted in the frontal lobe, in which hominins have a distinctly larger proportional capacity than other mammals and more distant hominin ancestors. Endocasts can be made of some skulls by molding the interior impression the brain makes, revealing further details of the complexity. One of Homo sapiens clear distinctions is the pronounced forehead, which accounts for the expansion of the frontal lobe. The difference can be clearly seen even in our closes relative, the Neanderthal.

The tool tradition is clearly correlated with increased brain size in the genus Homo, and H. erectus highlights hominins’ adaptive ability, as it thrived in a number of environments. Students should be posed with the question of what thought processes occur in the frontal lobe – logical reasoning, memory, and language – all integral parts of human culture. These adaptations enabled population expansion around the world and eventually lead to the rise of civilization marking the end of the Pleistocene and beginning of the Holocene, around 10,000 BCE.

As the measurements showed, the Neanderthal has a bigger brain, on average, than that of a modern human. Yet, a bigger brain does not automatically mean a better brain, and overall body mass is relevant as well. To help account for that variable, the encephalization quotient (EQ) is used, which, in the case of hominids, calculates a ratio of brain-mass to body-mass relative to the average of 27 other primates. The postcranial skeletal evidence showed that Neanderthals had larger bodies than early humans. So large, that even though their brain mass was larger, their EQ was smaller. Neanderthals were still a complex species that interacted with early Homo sapiens, adapting burials, art, and most likely language, and also innovating the atlatl, a very effective spear throwing device (see Figure 8).



A cost of a larger brain is an extended gestation period followed by a longer phase of dependence of the offspring. These demands on the mother required a high level of energy intake during and after the pregnancy. It is also metabolically expensive, estimated at 20-25% of metabolic consumption during rest. This is a common explanation for the increase of meat and quality of diet for the genus Homo.