Plasticity Insights![1]

[1] The newsletter title has been changed from **Aphasia Insights** to **Plasticity Insights** to encompass brain function and plasticity as the foundation of all learning as well as recovery.

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"The bump is called Broca's area. It's named after Paul Broca, the doctor who put two and two together when he autopsied a man who had lost his ability to speak. Broca found tissue damage in the left front of the man's brain and determined that the bump had something to do with speech. It was clear that Turkana Boy's brain had Broca's area. Who would have thought a little bump could cause such a fuss? But when scholars started asking if Turkana Boy could talk, that little bump detonated explosive debates about the origins of language" (Rubalcaba et al., 2010, pp. 29).

Rubalcaba J, Robertshaw P. (2010). Every Bone Tells a Story: Hominin Discoveries, Deductions, and Debates. Charlesbridge Publishing, Inc. Watertown, Massachusetts.

Aphasia Nation, Inc. is committed to educating the wider public about stroke and aphasia and the "*Aim High for Aphasia!*" international Aphasia Awareness campaign.

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Turkana Boy: The Nariokotome *Homo Erectus* Skeleton from Turkana Lake, Kenya.

By Tom Broussard, Ph.D.

This is the LAST in a series of articles about the science and scientists behind the brain, stroke, aphasia, plasticity and recovery.

Turkana Boy is the name technically given to the fossil, **KNM-WT 15000**. He is also called Nariokotome Boy, and is a nearly complete skeleton of a *Homo ergaster* (meaning 'working man'). He is also referred to as *Homo erectus* (meaning 'upright man') youth who lived 1.5 to 1.6 million years ago.

Turkana Boy
b: ~1.6 million years

This specimen is the most complete early hominin skeleton ever found. It was discovered in 1984 by Kamoya Kimeu, the head of the Hominid Gang (fossil hunters), on the bank of the Nariokotome River near Lake Turkana in Kenya (Wikipedia). A cast of the KNM-WT 15000 skeleton is located at the American Museum of Natural History, NYC, NY.

Alan Walker and Richard Leakey, both anthropologists, estimated the boy to have been about 11–12 years old based on the rates of bone maturity (Walker and Leakey, 1993). The skeleton is comprised of 108 bones, is about 63 in. tall and was estimated to be about 106 lbs. when he died (Wikipedia).

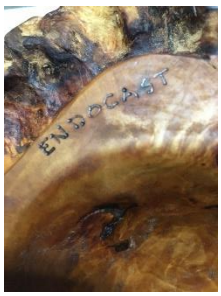
His pelvis is narrower than in *Homo sapiens*, which is most likely for more efficient upright walking. This indicates a fully terrestrial bipedalism, which is unlike older hominin species that show a combined feature of bipedalism and tree climbing. Turkana Boy was relatively tall, which increased his body surface area that helped with bodily heat dissipation under the hot sun (Wikipedia).

The KNM-WT 15000 skeleton features a low sloping forehead, strong brow ridges, and the absence of a chin, all of which had disappeared in *Homo sapiens*.

However, there are some significant characteristics; a bigger brain (880 cc), longer arms and legs indicating bipedality, and nose that projects like those of humans rather than the open flat nose seen in apes (Wikipedia).

The fossil skeleton and other fossil evidence, such as Acheulean stone tools, led the majority of scientists to conclude that *Homo ergaster* and *Homo erectus* – unlike their more primitive ancestors – became efficient hunters. The social structure also became more complex with a larger brain and its emerging Broca's area noted by a slight slant on the cranium (Wikipedia).

The Nariokotome Homo Erectus Skeleton (Walker & Leakey, 1993) provides an exhaustive description of the body plus dozens of detailed photographs and images of every part of the skeleton. The book itself is massive, 8.5 in. by 11 in., 497 pages and 3 lbs. (about the size of the brain!). It covers everything, not just the skeleton itself but the geology, dating, paleoenvironments, and the taphonomy (the process of fossilization) at the site.



It also includes Turkana boy's biology as compared to other *Homo erectus* skeletons. With other *Homo erectus* specimens in East Africa and Indonesia, "it can be concluded … that the endocranial volume of KNM-WT 15000 was fairly typical for *Homo erectus*" (Walker & Leakey, 1993, pp. 346)

One chapter of the book is entitled, Endocast. An endocast is the internal cast of a hollow object. It is often used to study the brain in humans and other organisms as well. An endocast cannot directly show how the structure of the brain works, but scientists can measure various parts of the brain that are close to the surface of the skull that form the features of the inside of the skull. As a result, there are some physical representations of the brain related to language, including Wernicke's and Broca's areas, responsible for receptive and expressive speech.

In the case of Turkana Boy's endocast, "[It] is particularly useful in this regard because it is relatively undistorted and provides clear evidence of the morphology of various cerebral and cerebellar components" (Walker & Leakey, 1993, pp. 327).

It appeared that, although Turkana Boy had the beginning of the Broca's area, it is likely that he, and other *Homo erectus* in the area, what hominids with "cerebral asymmetries and that these developed much earlier than the first appearance of well-developed Broca's caps … which are not clearly present any specimen until early *Homo [sapiens*]" (Walker & Leakey, 1993, pp. 354).

The authors went on to say that these 'cerebral asymmetries' (differences between the left and right sides of the brain) and the appearance of the Broca's area, "may be functionally similar to modern human asymmetries only at a very basic level, involving primary functions such as motor sequencing or task specialization, rather than at the level of specific behavior such as throwing or language production" (Walker & Leakey, 1993, pp. 354).

As Ian Tattersall, curator, Spitzer Hall of Human Origins, American Museum of Natural History, remarked, "Turkana Boy and his kin … were a long way from being simply junior-league versions of ourselves, and we should resist the temptation to view them that way" (Tattersall, 2012, pp. 101). It was clear that Turkana Boy had a Broca's area in his head but his species and his speech still had a long way to go before encountering Paul Broca down the evolutionary path to his Broca's area's namesake.

Signed: Johnny Appleseed of Aphasia Awareness

The author is a three-time stroke survivor and has aphasia as a result of the strokes. His language skills continue to improve. He is Founder and President, Aphasia Nation, Inc., a non-profit organization whose mission is educating the wider public, national and international, about aphasia and plasticity, the foundation of all learning.

1. Rubalcaba J, Robertshaw P. (2010). Every Bone Tells a Story: Hominin Discoveries, Deductions, and Debates. Charlesbridge Publishing, Inc. Watertown, Massachusetts.
2. Tattersall, Ian. Masters of the Planet, The Search for our Human Origins (2012). Palgrave Macmillan.
3. Walker, Alan & Leakey, Richard (Ed.). The Nariokotome Homo Erectus Skeleton. Harvard University Press, Cambridge Massachusetts, 1993.

Artist, Wayne Sanford
Guild of Artisans
Bowdoinham, Maine
Inside Firewood
"Endocast"

Helping firewood discover its inner beauty. My work varies from small to large and from useful to useless. Each piece is unique; carved in a free-form manner to be visually attractive from any perspective; many can be displayed in multiple orientations. I particularly enjoy exploring the lines, grain and texture hidden inside gnarly chunks, such as burls, crotches and gauls. I carve Maine hardwoods, such as apple, ash, beech, birch, cherry, lilac, locust and maple. Each piece is smoothed to be fondled, sealed with mineral oil and finished with beeswax to be food-safe.

"Send me your burls and I will set them free!"