Abstract

Mandibular growth in *Australopithecus robustus*

by

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This dissertation tests the hypothesis that humans' unique pattern of growth was present in our fossil relative, *Australopithecus robustus*. Growth and development encompass the mechanisms and processes that bring about morphological variation and adaptation. Growth is also an important life history variable influencing both an animal's energy requirements and how it is treated by predators and conspecifics. Humans' unique pattern of growth, featuring long juvenile and childhood phases of slow growth followed by an adolescent growth spurt, is critical to the acquisition of language and culture. Unfortunately, the fragmentary and cross-sectional nature of fossil samples makes it difficult to ascertain the evolution of this pattern.

A novel randomization method, the ζ□□□□□□□ test, is developed to statistically test the null hypothesis that patterns of ontogenetic variation cannot be distinguished in the mandibles of humans and *A. robustus*. This species is not a direct human ancestor, but is closely related with a recent common ancestor and its mandible comprises the largest ontogenetic series of an early hominid. The ζ test compares age-related changes between pairs of specimens, and so maximizes information obtained from

fossil samples compared with traditional methods. This method can be extended to test other hypotheses with datasets do not meet assumptions of traditional statistics.

Results of the ζ test indicate *A*. *robustus* mandibular growth differs from humans' during two periods. First, prior to the eruption of the first permanent teeth, *A*. *robustus*' corpus breadth increases much more than humans'. Second, the *A*. *robustus* mandible increases in most dimensions in the time between the eruption of the first and second permanent molars, whereas human mandibular size tends to increase more after the second molar is occluded. These results suggest that the human pattern of growth was not shared with *A*. *robustus*, and provide the first statistical evidence for differences in skeletal size growth between humans and an early Pleistocene hominid. These findings are discussed in terms of life history and evolutionary developmental biology, including the possibility of early weaning, the influence of the developing dentition, and bone functional adaptation in *A*. *robustus*.