11: Functional morphology and variability of the auditory system - frameworks in the search for human speech evolution

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Involved subjects: Physical anthropology, Zoology, Audiology, Hearing Physiology, Cognitive neuroscience, Linguistics, Radiology

Number of positions requested: 1

Abstract:

The capacity for vocal communication using speech is a unique characteristic of modern humans and its origin during human evolution remains obscure. While the anatomy of the sound producing organs and the neural organization relevant for speech production are well analyzed, no studies exist investigating if the human auditory periphery is morphologically tuned to perceiving sound with speech related acoustic properties. This is surprising, given that humans strikingly differ in ear anatomy when compared with other primates. In many animal species, morphological co-variation exists between sound emitting and perceiving structures. We thus hypothesize that the human auditory periphery has co-evolved with the sound producing organs showing anatomical features adapted to speech perception.

To test our hypothesis, we will study the influence of morphological allometry and genotype on hearing capacities in humans and mice. In the first part of the project, the doctoral student will measure

hearing capacities and analyze the anatomy of the auditory periphery (from outer to inner ear), of a large number of human individuals, being young adults and covering the full range of body sizes representing sexes at equal proportions. This analysis will show how the hearing bandwidth relevant for speech is reflected in the ear anatomy.

In the second part of the project, the student will use three different groups of mice (I. genetically identical, II. closely related, III. close to wild type) to test if and when positive how hearing variability depends on genetic variation and ear morphology.

These analyses in humans and mice will reveal the heritability of auditory capacities and morphology and help us to assess the relationship between bony ear structures, which remain in the fossil record, hearing ability, and potentially also speech. Applicants for the offered PhD position should have a scientific background in zoology, physical anthropology or medical sciences, preferable with background knowledge in 3D imaging and 3D morphometric analyses and conduction of experimental approaches to studying auditory function.