

SEMINAR SERIES

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Flex, Twist, and Swallow: Biomechanical and Cortical Control of Tongue Movements During Feeding

Featuring Dr. Arun Karumattu Mannatu
University of Nebraska at Omaha



Friday, Feb. 16 | 10:00 am – 11:00 am | BRB 167

PRESENTATION ABSTRACT

Tongue function is vital for chewing and swallowing and lingual dysfunction is often associated with dysphagia. Better treatment of dysphagia depends on a better understanding of hyolingual morphology, biomechanics, and neural control in humans and animal models. I will review recent research which has revealed significant variation among animal models in morphology of the hyoid chain and suprahyoid muscles which may be associated with variation in swallowing mechanisms. I will also review results of deployment of XROMM (X-ray Reconstruction of Moving Morphology) to quantify 3D hyolingual kinematics, which has revealed new details on flexion and roll of the tongue during chewing in animal models, movements similar to those used by humans. XROMM based studies of swallowing in macaques have falsified traditional hypotheses of mechanisms of tongue base retraction during swallowing, and literature review suggests that other animal models may employ a diversity of mechanisms of tongue base retraction. There is variation among animal models in distribution of hyolingual proprioceptors but how that might be related to lingual mechanics is unknown. In macaque monkeys, tongue kinematics—shape and movement—are strongly encoded in neural activity in orofacial primary motor cortex, giving optimism for development of brain-machine interfaces for assisting recovery of lingual function after stroke. However, more research on hyolingual biomechanics and control is needed for technologies interfacing the nervous system with the hyolingual apparatus to become a reality.

ABOUT DR. ROSS

Callum F. Ross is Professor of Organismal Biology and Anatomy and also heads the Anatomy Program at the University of Chicago. His research focuses on: mandible biomechanics in primates, with the aim of understanding form-function relationships in primate mandibles, and improving clinical treatment of disorders of the feeding system, including mandibular fractures and mandibular hypoplasia; the biomechanics of tongue movements during chewing and swallowing in primates with the aim of understanding the evolution of the primate hyolingual system and improving clinical treatments of dysphagia; and the role of the cerebral cortex in the control of chewing and swallowing in nonhuman primates with the aim of developing treatments and rehabilitation strategies for chewing disorders and dysphagia. Dr. Ross received his B.A. in Anthropology and Ancient History from the University of Auckland in New Zealand in 1987. He completed his PhD in Biological Anthropology and Anatomy at Duke University in 1993. Dr. Ross served two postdocs, one at the University of the Witwatersrand in Johannesburg and one at Stony Brook University in New York. He was on the faculty of The Department of Anatomical Sciences at Stony Brook University from 1995 until 2004, when he joined the University of Chicago.

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