A CRITICAL PERIOD FOR THE EVOLUTION OF LANGUAGE-READINESS: CLARIFYING THE GLOBULARIZATION HYPOTHESIS

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If, as is often said, the mind is what the brain does, the evolution of our species' neuroanatomy ought to play an important role in accounting for the emergence of cognitive modernity and its most salient characteristic: our full-fledged language capacity. Traits like brain size or hemispheric lateralization have long figured prominently as factors that made the modern human brain special, but comparative research has cast doubt on explanations based exclusively or primarily on these traits. By contrast, the truly sapiens-specific brain growth trajectory that has been argued to give rise to a globular skull — the 'globularization phase' as per Hublin, Neubauer, and Gunz (2015) — remains understudied, though it constitutes a more robustly species-specific trait than better-studied neurological parameters (Boeckx, 2013). Indeed, according to the Globularization hypothesis (Boeckx, 2017), this specific brain growth trajectory played an important role in making the human brain fully language-ready.

Here I would like to clarify the content of the Globularization hypothesis, and in so doing adduce additional evidence in support of it. To begin with, and contrary to previous research on this topic, the emphasis should be on the growth curve, not the ultimate craniofacial shape. The latter is the result of several factors, early brain growth being one of them. It is, in fact, possible to identify situations where globular craniofacial shape is not accompanied by our species-brain growth trajectory (with cognitive deviance as outcome; e.g., Down syndrome). Accordingly, the search for the molecular basis of the globularization phase should not be focused on osteogenic factors (contra Boeckx and Benítez-Burraco (2014)), but rather on changes primarily affecting brain growth.

This talk will rely on a detailed analysis of the archaic human genomes currently available to characterize two sets of candidate genes harboring potentially relevant mutations. The first set consists of candidate genes for either microcephaly or macrocephaly. Based on their typical expression patterns, these genes

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may have been important for early brain growth trajectory changes. A second set of genes, implicated in synaptic plasticity, appears to reflect the need to accommodate brain growth changes at the connectivity level, postnatally. Thus, the globularization phase may be best understood as consisting of two stages: a first stage leading to accelerated brain growth around birth (thereby affecting primarily late developing regions like the cerebellum), and a second, postnatal stage affecting connectivity across brain regions. Interestingly, these two stages correspond to the two critical periods for the development of autism spectrum disorders (Parikshak et al., 2013), which suggests that a disregulation of changes underlying globularization may be at the heart of some autistic traits.

The globularization phase, once broken down into two stages, makes clear that some functional consequences of early brain growth trajectory changes may manifest themselves only much later in time. Thus, the distance across levels of analysis, from the molecular to the cognitive/behavioral, is not only to be measured in terms of space (Fisher, 2015), but also in terms of time. In addition, the functional consequences of globularization can only be understood in the context of other changes with which globularization stands in a 'feedback loop' relation: (i) the emergence of a cortical vocal learning circuit (Jarvis, 2004; Fitch, 2010), (ii) neurobiological changes leading to increased cooperation (perhaps best understood in terms of self-domestication (Theofanopoulou et al., 2017)), and (iii) contextual factors leading to increased cultural evolution.

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