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Letters

Genes and domain specificity

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Kovas and Plomin's recent article on 'generalist genes' [1] purports to pose a strong challenge to the possibility of modular neural or cognitive structure. Pointing to the fact that 'there is substantial genetic overlap between such broad areas of cognition as language, reading, mathematics and general cognitive ability', Kovas and Plomin [1] argue that 'genetic input into brain structure and function is general not modular'.

The observation of genetic overlap in itself is not new. Our group made it recently in a more nativist account [2], while Karmiloff-Smith made it previously in the context of a less nativist proposal [3]. Given the extensive literature on a general factor (g) of intelligence, and the well-known correlation between verbal and nonverbal IQ, the overlap observation itself is unsurprising.

Kovas and Plomin's anti-modularity interpretation, however, goes far beyond the scope of these data. As researchers in other areas of biology recognize [4], modularity certainly does not require that all genes or even most of the genes involved in a given process be domain-specific; only that some genes (or even some portions thereof) be differentially expressed. Modularity can arise from the actions of a handful of 'upstream' regulatory genes, even if many or all downstream genes are broadly shared across domains.

Genes are in essence instructions for fabricating biological structure. In the construction of a house, one finds both some repeated motifs and some specializations for particular rooms. Every room has doors, electrical wiring, insulation and walls built upon a frame of wooden studs. However, the washroom and kitchen vary in the particulars of how they use plumbing array fixtures, and only a garage is likely to be equipped with electric doors (using a novel combination of electrical wiring and 'doorness'). Constructing a home requires both domain-general and domain-specific techniques. The specialization of a given room principally derives from the ways in which high-level directives guide the precise implementation of low-level domain-general techniques.

When it comes to neural function, the real question is how 'generalist genes' fit into the larger picture. Continuing the analogy, one might ask whether different 'rooms' of the brain are all built according to exactly the same plan, or whether they differ in important ways, while depending on common infrastructure. Kovas and Plomin [1] presume that the sheer preponderance of domain-general genes implies a single common blueprint for the mind, but it is possible that the generalist genes are responsible only for infrastructure (e.g. the construction of receptors, neurotransmitters, dendritic spines, synaptic vesicles and axonal filaments), with a smaller number of specialist genes supervising in a way that still yields a substantial amount of modular structure. Kovas and Plomin [1] offer no data to indicate otherwise.

References

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4 Schlosser, G. and Wagner, G.P., (eds) (2004) *Modularity in development and evolution*. University of Chicago Press

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