Genetics of Brain and Cognitive Aging and its Review

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Abstract

Ever since Sir Francis Galton expounded on the role of heredity in human variation, from mental abilities to physical characteristics, psychologists, biologists, and geneticists have pursued scholarly exploration into the role of nature and nurture for human traits. Some traits that are more somatically defined, such as morphological characteristics (height) were assumed to be more heritable than other traits, such as human behavior, for which the role of genetic influences has at times been fiercely debated. During the last 35 years, there has been a growing appreciation that genetic variation is relevant for understanding individual differences in human traits, from morphological characteristics to behavioral traits. Indeed, the focus has moved from quantifying the relative contribution of genetic influences, i.e. estimating heritability, to identifying which genes are involved in pathways that impinge on human traits in order to understand the genetic architecture. This issue of Neuropsychology Review is a timely sequel to the previous special issues on Aging and Dementia and on Development of Human Brain Structure and Function. The papers in the current issue review the role of genes on the full range of brain development, morphology and function from childhood through late life, human communication, cognitive abilities, and dementia. The current issue of the journal touches on a variety of methodologies available to understand the genetics of brain and cognitive aging. The utility of comparative genomics for understanding the "ancient genetic foundations" of human communicative abilities is elucidated by Graham, Derizoitis, and Fisher. Moving beyond an evolutionary perspective, they also describe a number of other strategies that have been fruitful for understanding genetic factors in communicative abilities, such as taking a developmental perspective and studying developmental communication disorders and linkage studies to identify specific candidate genes followed by karyotyping to identify chromosomal aberrations in rare disorders. As in several of the other reviews in this issue, they also describe the utility of twin studies for evaluating heritability, endophenotypes through neuroimaging, experimental paradigms and animal models to understand the function of specific genes, and the role of genome wide association studies (GWAS). The following three reviews—by Jansen et al, Papenberg et al., and Strike et al.— all have in common a focus on genetics of brain structure and function. Jansen et al. summarize what twin studies tell about the heritability of brain development, morphology and function, contrasting findings from children, adults and the elderly. Heritabilities of brain structure are generally substantial, and crosssectional comparisons suggest slight increases from childhood to adulthood. Longitudinal studies are needed to understand better the heritability of changes in measurements of structure or function.

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