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## Socioeconomic status and its genetic basis are embodied in human brain anatomy

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ABSTRACT:

The brain is the major locus of integration for genetic and environmental influences on behavior, including those related to socio-economic status (SES). Current insights into the relationships between brain anatomy and SES are limited. Furthermore, little is known about whether such relationships are due to environmental or genetic effects. To address these questions, we conduct a genetically informed neuroscientific study on SES in a population sample of 23,714 adults from the UK. We find many small, positive associations (partial  $R^2 < 1.3\%$ ) between SES and voxel-level grey matter volume (GMV) across the entire brain. A brainwide GMV index predicts ~5% of the variance in SES out-of-sample. We show that SES and GMV structure have a partially shared common genetic architecture, in particular in regions of the insular and prefrontal cortex. Controlling for the genetic underpinnings of SES reduces the associations between SES and GMV on average by 38%. SES-GMV associations are most robust to genetic controls in the cerebellar, lateral-temporal, and lateral-parietal regions, suggesting that these regions are more prone to environmental influences. Furthermore, we find that SES-GMV associations can be partially attributed to individual differences in body mass index even after adjusting for genetic controls. This suggests that environmental factors that lead to obesity among low SES individuals also have negative consequences for brain health. Thus, the patterns we observe are both anatomical reflections of persisting socio-economic inequalities and a window into how unfavorable environments pose a risk to brain health and social mobility.

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