https://doi.org/10.1038/s41592-023-01983-z

Let's talk about diversity in human neuroscience

Diversity in human neuroscience studies is an important and recurring topic of discussion. Though slow, progress is being made.

Lack of diversity in academic research has traditionally been and still is widespread, be it the underrepresentation of people of color or those of a non-male gender in faculty positions or the overrepresentation of higher socioeconomic status in the student body. This bias may be one reason for the homogeneity of human populations under study — which can have dire consequences when the research in question is medically relevant. We have previously discussed[1] some issues around diversity in the context of genomic and immunological research. Here, we highlight recent opinion pieces as well as a Resource that help to pave a path forward for improving the diversity of participants in human neuroscience studies.

In the era of big data, large datasets that encompass neuroimaging, genomic, health, lifestyle and other information from hundreds of thousands of individuals are now available. However, these datasets were mostly acquired in the USA and UK, and are therefore skewed toward a WEIRD[2] (Western, educated, industrialized, rich and democratic) population.

A Comment in this issue from Kopal, Uddin and Bzdok debates some of the problems around the lack of population diversity in human neuroimaging studies. For instance, training predictive models with WEIRD data may invalidate them for predictions about those with a different background. Diversifying the recruitment strategies for large-scale studies is one way to overcome this situation. Accounting for confounding variables (such as socioeconomic status, age, education and others) can help, but such variables are numerous and may sometimes even lead to erroneous causal inferences. Kopal et al. furthermore discuss the consequences of limited diversity in the study population for the conclusions drawn from such research. For example, handedness can shape brain function, and omitting lefthanded individuals can lead to an incomplete picture of the involvement of brain areas in certain tasks.

The topic of racial bias is discussed in two Perspectives published in *Nature Neuroscience*. Webb, Ettner and Kwasa[3] discuss how methodological limitations can result in the exclusion of people on the basis of their skin or hair phenotype. Paradoxically, these limitations may have arisen from the adoption of colorblind thinking and an assumption of sameness. Yet, skin tone can influence measurements that use optical techniques such as functional near-infrared spectroscopy, and hair type can affect electrode placement in electroencephalography (EEG). Suboptimal data quality may lead to the systematic exclusion of data from Black individuals in particular. Webb et al. advocate for considering such methodological limitations in the design of research studies. Ricard et al.[4] argue that exclusionary approaches need to be confronted directly in human brain-mapping studies. They suggest reconsidering recruitment strategies and recommend efforts in science communication to increase trust as well as removing financial or language barriers. For some of the methodological limitations, they point out that solutions already exist (such as methods for obtaining EEG readings from individuals with curly hair) — but further efforts are needed in other methodological approaches, such as, for example, eye tracking, magnetic resonance imaging and pulse oximetry.

To counterbalance the WEIRDness of many neuroimaging datasets, Ge et al.[5] report in *Nature Neuroscience* the acquisition of a large-scale multimodal dataset from Han Chinese adults that includes structural, diffusion and functional MRI as well as behavioral, physiological and genetic data. In comparing their data to those from a large-scale study conducted in the USA, the researchers observed that brain activity during a motor task was similar between the two populations, but they observed large differences in brain activity during a language task. Hence, conclusions drawn from ethnically and culturally biased study populations may not be extrapolated to more diverse populations.

Although there is a growing consensus about embracing diversity, Müller et al.[6] caution in *Nature Neuroscience* that the concept of representativeness in neuroscience research is not well defined and may refer to a region, country or continent, or to the global population. Importantly, demographic information such as race and ethnicity may not be collected for legal reasons in some countries and therefore cannot be considered as variables in analyses. How to grapple with such realities requires a global conversation.

What kinds of data to store, how to make them accessible and how to protect people's privacy is also a matter of importance. Neuroimaging and associated data are typically stored and made available in an anonymized fashion, but linked genetic information could potentially be used to deanonymize the neuroimaging data if related genomic information is available in open-access databases. De Hemptinne and Posthuma[7] discuss this and other ethical challenges arising from genome-wide association studies in a *Nature Neuroscience* Perspective.

As a journal, we have a responsibility to promote diversity in human research. Although we typically do not have influence on study design (with the exception of Registered Reports[8]), we can do our part by enforcing policies and reporting standards. The *Nature* Portfolio journals have policies about research involving human participants in place. Our authors should describe their methods explicitly if they categorize human populations, define and justify these categories and discuss how they controlled for confounding variables. These policies also provide guidance on how to approach race, ethnicity, sex, gender and sexual orientation. To this effect, the *Nature* journals have recently updated the Reporting Summary document to encourage detailed reporting on the population characteristics of studies that involve human participants. We hope that such measures contribute toward a more-diverse research landscape.

Published online: 8 August 2023

References

1. *Nat. Methods* **18**, 577 (2021).
2. Henrich, J., Heine, S. J. & Norenzayan, A. *Nature* **466**, 29 (2010).
3. Webb, E. K., Etter, J. A. & Kwasa, J. A. *Nat. Neurosci.* **25**, 410–414 (2022).
4. Ricard, J. A. et al. *Nat. Neurosci.* **26**, 4–11 (2023).
5. Ge, J. et al. *Nat. Neurosci.* **26**, 163–172 (2023).
6. Müller, R. et al. *Nat. Neurosci.* **26**, 1132–1133 (2023).
7. de Hemptinne, M. C. & Posthuma, D. *Nat. Neurosci.* **26**, 932–941 (2023).
8. *Nat. Methods* **19**, 131 (2022).