

Rethinking Animal Research in the Age of Consciousness

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Neuroscience stands at a historic ethical inflection point. Advances in comparative neurobiology, cognitive ethology, and affective neuroscience continue to reveal sophisticated forms of consciousness, subjective experience, and agency across diverse taxa, from octopuses and corvids to rodents and non-human primates.^{1–3} These findings are increasingly supported by contemporary neuroscience frameworks that conceptualise consciousness as an embodied and predictive process grounded in brain–body dynamics.⁴ Yet the field remains heavily dependent on animal models to uncover the mechanisms of brain function and to develop therapies for devastating neurological and psychiatric conditions. With the FDA's 2025–2026 guidance on New Approach Methodologies (NAMs) and growing NIH investment in human-relevant platforms, the moment is ripe for a deeper ethical reorientation.^{1,5}

In a recent narrative review, we proposed the **Stratified Relational Responsibility Model (SRRM)** as a framework capable of addressing this longstanding tension.^{6,12} SRRM affirms robust ontological continuity: consciousness and sentience are graded, multidimensional phenomena emerging from shared evolutionary conditions, not binary properties unique to humans. At the same time, the model recognises normative asymmetry. Humans possess distinctive capacities for reflexive normativity, symbolic articulation, institutional coordination, and large-scale technological power. This asymmetry does not licence domination or metaphysical superiority; rather, it generates intensified moral responsibility. Greater power to anticipate, innovate, and reshape systems of harm entails greater obligation toward sentient beings with whom we share evolutionary kinship and ecological interdependence.^{7,8}

Applied to animal research, SRRM transcends polarised debates. It rejects both residual Cartesian underestimation of animal minds and forms of moral egalitarianism that would render most current neuroscience ethically unsustainable. Instead, it demands heightened justificatory standards: every protocol involving sentient animals should be assessed not only through conventional harm–benefit analysis and the 3Rs (that is Replacement, Reduction, and Refinement which constitute the cornerstone of humane experimental technique in animal research as describe by Russell and Burch (1959) in their book *The principles of humane experimental technique*, with Replacement involving the use of non-animal alternatives (such as organoids, brain-on-a-chip technologies, or computational models) whenever possible. Reduction referring to minimising the number of animals used to the minimum necessary for valid scientific results, and Refinement concerning the modification of procedures and husbandry to minimise pain, suffering, and distress while improving animal welfare), but through the lens of stratified relational responsibility.

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This perspective yields concrete implications. First, the 3Rs must evolve from regulatory compliance into expressions of moral agency. Replacement should increasingly be treated as a primary scientific imperative, supported by accelerated validation of cerebral organoids, brain-on-chip technologies, human Induced Pluripotent Stem Cells (iPSC)-derived systems, and advanced computational models.⁹ Refinement requires genuine integration of cutting-edge ethological and phenomenological knowledge about species-specific affective states and forms of agency, particularly in cephalopods and other invertebrates now afforded legal protection in several jurisdictions.^{10,11}

Second, SRRM supports tiered ethical review. Neuroscience has led efforts to identify neural correlates of consciousness across species. This expertise should now inform more sophisticated, species-sensitive harm–benefit analyses, with proportionally higher justificatory thresholds, continuous multimodal welfare monitoring, and mandatory pursuit of alternatives for animals with richer cognitive and affective capacities.^{1–3}

Third, the neuroscience community must lead the transition. The same institutional and cognitive resources that sustain animal-based research should be strategically redirected to validate and scale non-animal or minimally sentient platforms, thereby enhancing both the predictive validity and the societal legitimacy of our work.

Critics will object from opposite directions. Some will claim that stressing continuity threatens essential research; others will argue that any asymmetry revives human exceptionalism. SRRM rebuts both simplifications. Evolutionary continuity grounds broad moral considerability through shared capacity for suffering and experience. Normative asymmetry grounds differentiated duties through differences in reflexive power and institutional reach. Ethical maturity lies not in denying difference, but in refusing to convert it into domination.^{7,8}

As regulatory expectations and public scrutiny intensify, the neuroscience community faces both a unique opportunity and a profound responsibility. By adopting a stratified relational perspective, we can demonstrate that rigorous

science and serious ethical reflection are not opposing forces, but mutually reinforcing ones.¹³ Neuroscience, with its privileged access to the mechanisms of mind across species, is ideally positioned to model what responsible multispecies research looks like in the 21st century.

The coming decade will determine whether we successfully integrate advancing knowledge of animal consciousness with genuine methodological and ethical progress. The Stratified Relational Responsibility Model does not eliminate difficult trade-offs, but it clarifies what is at stake, and who is responsible, when they are made.

References

1. Birch, J., Schnell, A. K., & Clayton, N. S. (2020). Dimensions of animal consciousness. *Trends in Cognitive Sciences*, 24(10), 789-801. <https://doi.org/10.1016/j.tics.2020.07.007>
2. Godfrey-Smith, P. *Other Minds: The Octopus, the Sea, and the Deep Origins of Consciousness* (Farrar, Straus and Giroux, 2016). https://scholar.google.com/scholar_lookup?title=Other%20minds:%20the%20octopus,%20the%20sea,%20and%20the%20deep%20origins%20of%20consciousness&author=P%20Godfrey-Smith&publication_year=2016&
3. Mather, J. A., & Dickel, L. (2017). Cephalopod complex cognition. *Current Opinion in Behavioral Sciences*, 16, 131-137. <https://doi.org/10.1016/j.cobeha.2017.06.008>
4. Seth, A. K. *Being You: A New Science of Consciousness*. Faber & Faber (2021). https://books.google.pt/books?id=g0-4DwAAQBAJ&hl=pt-PT&source=gbs_book_other_versions
5. Food and Drug Administration. Draft guidance: general considerations for the use of new approach methodologies in drug development (2026). <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/general-considerations-use-new-approach-methodologies-drug-development>
6. Alves Ferreira, J. M. (2026). Consciousness, Continuity and Responsibility: Toward a Stratified Relational Model of Human–Animal Difference. *Philosophies*, 11(2), 44. <https://doi.org/10.3390/philosophies11020044>
7. Korsgaard, C. M. *Fellow Creatures: Our Obligations to the Other Animals* (Oxford University Press, 2018). https://notebook.colinmclear.net/ox-hugo/korsgaard2018_Fellow_Creatures.pdf
8. McDowell, J. *Mind and World* (Harvard Univ. Press, 1994). <https://teoriadelconocimientocontemporanea.wordpress.com/wp-content/uploads/2014/06/mcdowell-mind-and-world.pdf>
9. National Institutes of Health. Complement animal research in experimentation (Complement-ARIE) program (2026). <https://commonfund.nih.gov/complementarie>
10. Schnell, A. K., Browning, H., Crump, A., Burn, C. C., & Birch, J. (2026). Sentience in cephalopod molluscs: an updated assessment. *Biological Reviews*. <https://doi.org/10.1002/brv.70125>
11. European Parliament and Council. Directive 2010/63/EU of 22 September 2010 on the protection of animals used for scientific purposes (2010). <http://data.europa.eu/eli/dir/2010/63/oj>
12. Alves Ferreira, J. M., & Tukaiev, S. (2026). Multispecies Responsibility and Planetary Health Education: Integrating Indigenous Relational Ontologies and Behavioral Transformation. *Challenges*, 17(2), 16. <https://doi.org/10.3390/challe17020016>
13. Giannouli, V. (2020). Et in Arcadia ego. *Philosophy Now*, 138, 32-33.