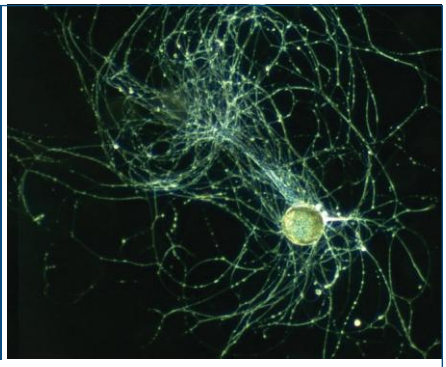
The Future of Biomedical Research

Why Animal Models Still Matter



Introduction

The use of animal models in biomedical research has been essential to nearly every major scientific breakthrough in neuroscience and to nearly every medical discovery that has improved human health and well-being. The Society for Neuroscience (SfN) is committed to advancing biomedical research that drives innovation, improves public health, and maintains the United States' global leadership in scientific discovery. At this time, the responsible use of animal models in research remains essential and irreplaceable in science's search for a better understanding of the brain and for improved treatments and cures for the many brain and central nervous system diseases and conditions that impact our society.

Research with animal models is well-regulated and irreplaceable in neuroscience. Neuroscience uniquely requires multi-level research—from the molecular level to behavior and cognition, and no single new approach methodology (NAM) can yet capture the full complexity of these interactions. Thus, animal models are vital and irreplaceable for scientific progress and in combating the devastation of human brain disorders, such as Parkinson's disease, Alzheimer's disease, and related dementias, Amyotrophic Lateral Sclerosis (ALS), addiction, vision and hearing loss, depression, autism spectrum disorders, and other conditions that affect more than one billion people worldwide. Using animal models provides the basis for the understanding of nervous system function and the general physiology and biology of both humans and animals.

Limitation of NAMs

There are currently no viable alternatives available for studying core neuroscience questions and biomedical systems that advance our understanding of the brain and nervous system; or when seeking treatments for diseases and disorders like depression, addiction, post-traumatic stress disorders, and neurodegenerative disorders. NAMs hold significant promises, however, many are still in developmental stages and limited in their ability to answer critical scientific questions central to neuroscience. While NAMs are rapidly emerging, often with the potential to complement or enhance existing approaches, they are not yet ready to replace animal-based approaches. Premature adoption of NAMs over proven animal models will undermine progress in neuroscience research and delay development of effective treatments.

Recent Breakthroughs

Alzheimer's Disease

A recent study found a new drug strategy that could help reverse advanced Alzheimer's disease. Scientists used specially bred mice carrying human genes that cause Alzheimer's-like brain changes to test a treatment that restores healthy NAD+, a coenzyme necessary for cellular function. NAD+ levels naturally decline as people age, and the decline is more severe for individuals with Alzheimer's disease. The treatment not only stopped the disease from getting worse, but also reduced harmful brain plaques and tangles, brought a key blood marker back to normal, and improved the mice's memory and thinking skills. The use of animal models was essential, as the complex nature of Alzheimer's disease involves chronic interactions among neural, vascular, metabolic, and immune systems that cannot currently be replicated in NAMs. Moreover, demonstrating recovery of cognitive function and assessing drug interactions required an intact, living organism – conditions that non-animal approaches cannot reproduce.[1]

Spinal Cord Injury

Present-day regeneration research in zebrafish builds on earlier observations that certain fish and amphibians can regrow fins, retina, and spinal cords, pointing towards biological mechanisms that could one day guide regenerative therapies for human neurological injuries. Using that historical base, recent work in zebrafish has systematically identified specific pathways, cell types, and gene networks that enable functional recovery after brain and spinal cord injuries. This progress depends on live zebrafish because it extends previous developmental and injury models into long-term studies of repair, behavior, and physiology that NAMs cannot replicate. These cumulative findings are now being evaluated in mammalian models and early translational pipelines for spinal cord and other central nervous system injuries, providing essential groundwork for future human trials.[2]

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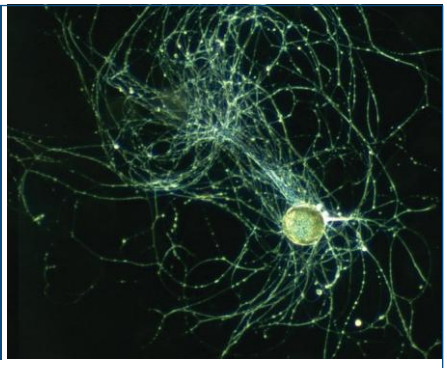

In Conclusion

SfN embraces the goal of the 3Rs (replacement, reduction, and refinement) of animal models in biomedical research. Much more research and time is needed before this goal is attainable. Premature replacement of animal models may delay or prevent the discovery of treatments and cures, not only for neurological diseases, but also for communicable diseases and countless other conditions. It may also increase the risk to patients due to premature approval without adequate testing in appropriate animal models to understand the potential risks. There are currently no viable alternatives available for studying core neuroscience questions and biomedical systems that advance our understanding of the brain and nervous system; or when seeking treatments for diseases and disorders like depression, addiction, post-traumatic stress disorders, and neurodegenerative disorders.

[1]Chaubey, K., Vázquez-Rosa, E., Tripathi, S. J., Shin, M.-K., Yu, Y., Dhar, M., Chakraborty, S., Yamakawa, M., Wang, X., Sridharan, P. S., Miller, E., Bud, Z., Corella, S. G., Barker, S., Caradonna, S. G., Koh, Y., Franke, K., Cintrón-Pérez, C. J., Rose, S., … Pieper, A. A. (2026). Pharmacologic reversal of advanced alzheimer's disease in mice and identification of potential therapeutic nodes in human brain. Cell Reports Medicine, 7(1), 102535. https://doi.org/10.1016/j.xcrm.2025.102535

[2]Pradhan, L. K., & Das, S. K. (2026). Zebrafish neural regeneration: Mechanistic insights into human nervous system repair. Neuroscience, 596, 1–15. https://doi.org/10.1016/j.neuroscience.2026.01.009

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