Animal model

Is a living, non-human animal used during the research and investigation of human disease, for the purpose of better understanding the disease process without the added risk of harming an actual human. The animal chosen will usually meet a determined taxonomic equivalency to humans, so as to react to disease or its treatment in a way that resembles human physiology as needed. Many drugs, treatments and cures for human diseases have been developed with the use of animal models.

Animal models representing specific taxonomic groups in the research and study of developmental processes are also referred to as model organisms.

There are three main types of animal models: Homologous, Isomorphic and Predictive. Homologous animals have the same causes, symptoms and treatment options as would humans who have the same disease. Isomorphic animals share the same symptoms and treatments, only. Predictive models are similar to a particular human disease in only a couple of aspects. However, these are useful in isolating and making predictions about mechanisms of a set of disease features.

Animal Model for microvascular anastomosis

Animal Model for microvascular anastomosis.

Spinal Cord Injury animal models

Spinal Cord Injury animal models

Animal models for central poststroke pain

Dejerine Roussy syndrome or thalamic pain syndrome is a condition developed after a thalamic stroke, a stroke causing damage to the thalamus. Ischemic strokes and hemorrhagic strokes can cause lesioning in the thalamus. The lesions, usually present in one hemisphere of the brain, most often cause an initial lack of sensation and tingling in the opposite side of the body. Weeks to months later, numbness can develop into severe and chronic pain that is not proportional to an environmental stimulus, called dysaesthesia or allodynia. As initial stroke symptoms, numbness and tingling, dissipate, an imbalance in sensation causes these later syndromes, characterizing Dejerine–Roussy syndrome. Although some treatments exist, they are often expensive, chemically based, invasive, and only treat patients for some time before they need more treatment, called “refractory treatment.” Thalamic pain syndrome is a condition developed after a thalamic stroke. Research into its underlying mechanisms and treatment options could benefit from a valid animal model. Nine different animal models have been published, but there are relatively few reports on successful reproductions of these models and so far only little advances in the understanding or the management have been made relying on these models. In general, the construct validity (similarity in underlying mechanisms) of these animal models is relatively high, although this cannot be evaluated into depth because of lack of understanding the mechanisms through which thalamic stroke can lead to thalamic pain syndrome. The face validity (symptom similarity) is relatively low, mainly because pain in these models is tested

almost exclusively through evoked mechanical/thermal hypersensitivity assessed by reflexive measures and given the conflicting results with similar tests in patients with thalamic pain syndrome. The predictive validity (similarity in treatment efficacy) has not been evaluated in most models and incorporates difficulties that are specific to thalamic pain syndrome. De Vloo et al., compare the different models regarding these types of validity and discuss the robustness, reproducibility, and problems regarding the design and reporting of the articles establishing these models. They conclude with various proposals on how to improve the validity and reproducibility of thalamic pain syndrome animal models. Until further improvements are achieved, prudence is called for in interpreting results obtained through these models [1].

Animal model for multiple sclerosis

Kalkowski et al. combined the advantages of the demyelination model with experimental autoimmune encephalomyelitis (EAE) to provide a local autoimmune encephalomyelitis (LAE) inside the rat brain. They induced a demyelinating lesion by immunizing male Wistar rats, followed by blood-brain barrier opening protein (vascular endothelial growth factor) by stereotactic injection. They confirmed the immunization against myelin epitopes and minor neurological impairment. The histological assessment confirmed the lesion development after both 3- and 7 days post-injection. This approach was sufficient to develop a demyelinating lesion with high reproducibility and low morbidity [2].

Books

Experimental Neurosurgery in Animal Models (Neuromethods) From Humana Press

This volume provides a full explanation and technical details to perform surgical techniques properly on small and large animal models. The first six chapters of Experimental Neurosurgery in Animal Models focus primarily on the brain, while the next six chapters concern the spinal cord in rodents. The last four chapters provide a description of operative procedures in large animals. Written for the popular Neuromethods series, chapters include the kind of detail and key implementation advice that ensures successful results in the laboratory.

Authoritative and practical, Experimental Neurosurgery in Animal Models aims to ensure successful results in the further study of this vital field.

Murine model

Murine model

1)
De Vloo P, Morlion B, van Loon J, Nuttin B. Animal models for central poststroke pain: a critical comprehensive review. Pain. 2017 Jan;158(1):17-29. PubMed PMID: 27992392.
2)
Kalkowski L, Golubczyk D, Kwiatkowska J, Domzalska M, Walczak P, Malysz-Cymborska I. Local autoimmune encephalomyelitis model in a rat brain with precise control over lesion placement. PLoS One. 2022 Jan 21;17(1):e0262677. doi: 10.1371/journal.pone.0262677. PMID: 35061807.