DEVLOPING AN ASTROCYTE SIGNALING MODEL TO INFORM AND IMPROVE STROKE TREATMENT

ETHICAL CONERNS OF BIOMEDICAL RESEARCH FUNDING

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SOCIOTECHNICAL SYNTHESIS

Biomedical research is funded with billions of dollars each year, and greatly impacts American public health, as well as our standing in the global medical field. The technical research topic aims to inform and improve stroke treatment research, through the development of a computational model. The creation of a complete signaling network model will aid researchers in investigating possible stroke therapy targets by outlining the processes that are underwent during an ischemic stroke. The science, technology, and society (STS) research topic explores the process of biomedical research funding as a whole in the United States, and analyzes the relevant social groups that impact the process of allocating funds to different research labs. The STS topic specifically investigates the ethical concerns involved in biomedical research funding, with a focus on the federal level of funding. Stroke is one of the world's leading causes of death, and impact hundreds of thousands of Americans each year. Research for stroke therapy is significant, and therefore great focus should be put on removing unnecessary unethical concerns within the research field.

The problem that the technical project addresses is the lack of a complete computational signaling model that describes what is happening on a subcellular level during an ischemic stroke. The technical report outlines the development of an astrocyte signaling model in both normal and stroke conditions. Astrocytes are specialized glial cells in the central nervous system that play an essential role in normal brain function. The goal in outlining the signaling network within astrocytes involves identifying possible therapeutic targets that could exist for potential stroke therapy. The signaling model was constructed in Matlab's Netflux software using known signaling pathways that were identified in published literature and then combined to form one complete model.

The model was then applied in order to investigate the effects of delivering mitochondria as a therapy to damaged astrocytes in order to help cells recover following stroke. Results from the novel model were then compared to published data, as well as data obtained from *in vitro* experiments carried out in the lab. Data showed that the model accurately predicted outcomes and was comprehensive. According to the results, the model can be used to identify possible therapeutic targets for stroke, as well as investigate the effects of certain inputs, with some constraints and assumptions in mind.

The motivation for the STS research topic involved the curiosity to understand how biomedical research funding is allocated, and who is responsible for ensuring it is carried out ethically and efficiently. The research uncovered many issues that plague the National Institutes of Health (NIH), which funds a great portion of biomedical research. The question the report set out to answer is how can the issues plaguing the NIH be addressed, and what solutions can be implemented to erase ethical concerns within the field. Pinch and Bijker's Social Construction of Technology theory was used in order to analyze the significant social groups contributing to the NIH allocation system. The analysis was carried out following a review of articles, informational sites describing the NIH system, and opinion editorials exposing the many issues within the federal system.

The research helped to identify areas of weakness within the system, and possible solutions. Ethical frameworks were used to analyze proposed solutions in order to identify the effect of their implementation on the system as a whole. While the implementation of the solutions may take time, the report succeeded in raising awareness to certain issues within the federal funding of the biomedical research field. Additionally, a greater understanding the relevant social factors that directly impact the system were identified and analyzed.

Ethical and economic problems must be addressed in order to improve the NIH's system of allocating research funds in biomedical research labs across the country. This, in turn, will improve researchers' ability to produce biomedical breakthroughs in leading diseases, such as stroke.

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