Mathematically modeling

A mathematical model is a description of a system using mathematical concepts and language. The process of developing a mathematical model is termed mathematical modeling. Mathematical models are used in the natural sciences (such as physics, biology, earth science, meteorology) and engineering disciplines (such as computer science, artificial intelligence), as well as in the social sciences (such as economics, psychology, sociology, political science). Physicists, engineers, statisticians, operations research analysts, and economists use mathematical models most extensively. A model may help to explain a system and to study the effects of different components, and to make predictions about behaviour.

Although mathematical modeling is a mainstay for industrial and many scientific studies, such approaches have found little application in neurosurgery. However, the fusion of biological studies and applied mathematics is rapidly changing this environment, especially for cancer research.

A review focuses on the exciting potential for mathematical models to provide new avenues for studying the growth of gliomas to practical use. In vitro studies are often used to simulate the effects of specific model parameters that would be difficult in a larger-scale model. With regard to glioma invasive properties, metabolic and vascular attributes can be modeled to gain insight into the infiltrative mechanisms that are attributable to the tumor's aggressive behavior. Morphologically, gliomas show different characteristics that may allow their growth stage and invasive properties to be predicted, and models continue to offer insight about how these attributes are manifested visually. Recent studies have attempted to predict the efficacy of certain treatment modalities and exactly how they should be administered relative to each other. Imaging is also a crucial component in simulating clinically relevant tumors and their influence on the surrounding anatomical structures in the brain [1)].

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Martirosyan NL, Rutter EM, Ramey WL, Kostelich EJ, Kuang Y, Preul MC. Mathematically modeling the biological properties of gliomas: A review. Math Biosci Eng. 2015 Aug 1;12(4):879-905. doi: 10.3934/mbe.2015.12.879. PubMed PMID: 25974347.