Novel Analysis of the Growth of the Fetus: A Much Needed Method in the Precise Diagnosis of Microcephaly and Other Growth Diseases

Ahamed, Tahmid (School: Bronx High School of Science)

The mathematical analysis of human growth, from the zygote to the adult, is key to determining long and short term health and longevity. Many studies prior have sought to develop a systematic approach to standardizing the measurement of growth, such as through MRI, autopsy results, or ultrasounding. Most, however, lack precision for use in a clinical environment. The purpose of the study was to develop a theoretical and intuitive framework through which human growth can be analyzed and implemented into usable technology. Practitioners and researchers would have a more precise and intuitive method through which they can analyze the growth of organs as well as make predictions in the case of diagnosing growth diseases such as microcephaly. Cellular allometry was used to analyze a dataset containing de-identified fetal autopsy data. Growth of the number of cells, weights/lengths, and geometries were analyzed by comparing log - log allometric graphs. Growth in terms of fetal geometry and organ growth were found to be allometrically linked, alongside finding particular parameters that (cellular allometric slope) that characterize growth for each given organ. Since geometry and the growth of the organs are allometrically linked, a set of equations that measure the geometry of the fetus can give information about the growth of the fetus as a whole. The next step would be to expand the dataset used and develop a probabilistic model on the future of the cell fate, such as through the use of monte carlo simulations, alongside expanding the dataset used.