Mathematics Unlocks Precision Medicine

Precision medicine uses data about people and populations to help clinicians predict which therapeutic approaches will work best for an individual or groups of people.

This is made possible by mathematical and statistical methods that integrate data from diverse sources—such as a patient's lifestyle and medical history, physiological test results, and genetic information—with other knowledge of how the human body works.

These connections enable healthcare teams (including medical practitioners and researchers trained in mathematical, statistical, and computational techniques) to improve diagnoses, guide surgeries in realtime, and offer more precise treatments.

Population and personal data

Data specific to an individual (including blood tests, MRI scans, and genotype data) and groups (including gender, age, and race/ethnicity) shed light on important considerations for treatment.

Mathematical and statistical models
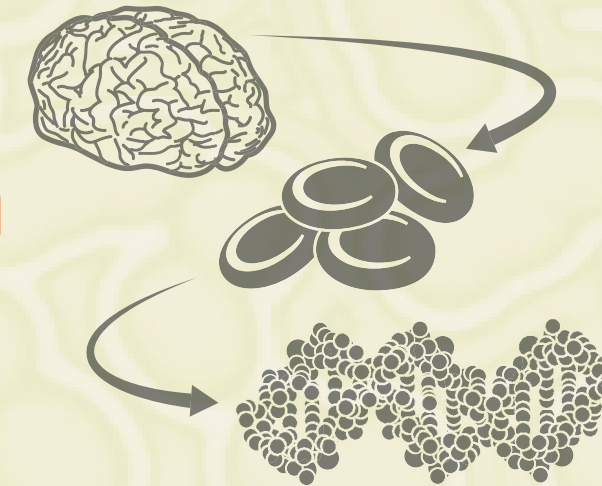
Multiscale mathematical models and statistical analyses integrate data and capture behavior of biological systems at various scales—such as organs, cells, and DNA. These models illuminate the progression of a disease in an individual.

Individualized treatment plans

Mathematical and statistical tools

Better outcomes

More precise diagnoses

More precise treatments
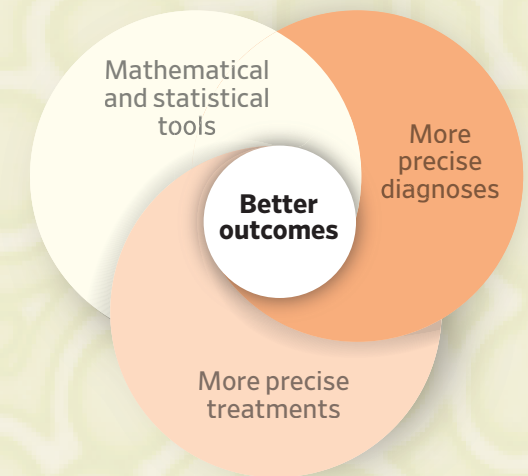
Mathematical and statistical tools have made their way into all corners of medicine and are improving patient care. Two exciting examples are precision cardiology and precision oncology.

Precision cardiology

An individual's heart and blood flow are represented mathematically using computational fluid dynamics simulations. Clinicians use this information to identify abnormalities and develop prognoses tailored to the specific patient.
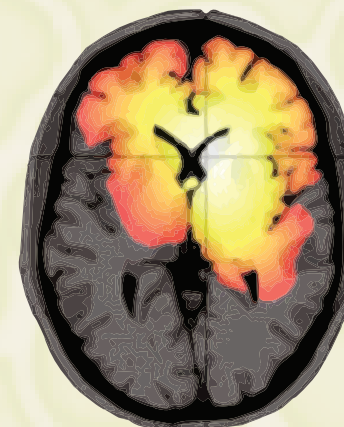
Precision oncology

Detailed multiscale mathematical models of tumor growth dynamics at the molecular, cellular, and tissue levels coupled with the dynamics of drug delivery and effectiveness enable specialized cancer treatment plans.

NATIONAL ACADEMIES
*Sciences
Engineering
Medicine*

[YOUR HEALTH, YOUR DATA, YOUR EQUATION, YOUR TREATMENT]