Model

(Webster's ninth collegiate dictionary) from Latin *modulus* small measure 1: a set of plans for a building; 2: British dialect: copy, image 3: structural design 4: a miniature representation of something; also: a pattern of something to be made 5: an example for imitation and emulation 6: a person or thing that serves as a pattern for an artist: especially: one who poses for an artist 7: archetype 8: an organism whose appearance a mimic imitates 9: one who is employed to display clothes or other merchandise: mannequin 10: a type or design of clothing; a type or design of product (as a car or airplane) 11: a description or analogy used to help visualize something (as an atom) that cannot be directly observed 12: a system of postulates, data, and inferences presented as a mathematical description of an entity or state of affairs

Biological models - biological similarity

Model complexity – simplicity

Mathematical models

System of mathematical equations (algebraic, differential, partial differential, integral) allowing all the known experimental data to be taken into account (Y. Cherruault)

usefulness, practical results, justify (falsify) hypotheses (K. Popper)

Models of data

statistical models, empirical models

mathematical functions that do not necessarily have any physical basis

polynomial functions, sums-of-exponential functions

periodic data & time-series data: Fourier analysis models, moving average models, autoregressive moving average

model parameters obtained by optimization procedure

model cannot be used for with any degree of confidence for extrapolation or prediction purposes

(physical interpretation)

Models of systems

based on physical (biophysical) principles and hypotheses about how a system is structured and possibly also how it functions

Combined models of data and systems

Compartment models

class of dynamic, i.e., differential equation, models derived for mass balance considerations which are widely used for quantitative studies of the kinetics of materials in physiologic systems

Compartment

physical space (plasma, plasma glucose) more than one compartment in the same physical space, lumped

kinetically homogeneous (well mixed) space

Kinetics

„a branch of science that deals with the effects of forces upon the motions of material bodies or with changes in a physical or chemical system; the rate of change of such a system" ≠ kinematics „a branch of dynamics that deals with the aspects of motion apart from consideration of mass and force" (Webster's dictionary)

Non-compartment models

Difficulties in modeling

Forward problem

Inverse problem

Identifiability

Uniqueness Problem

Parameter Estimation

Optimal Experiment design

Validation