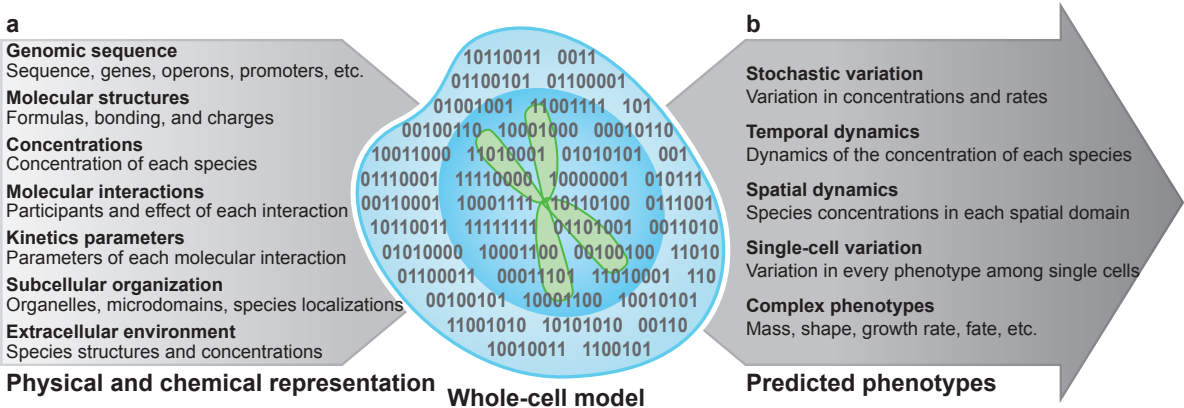
a
Genomic sequence
Sequence, genes, operons, promoters, etc.
Molecular structures
Formulas, bonding, and charges
Concentrations
Concentration of each species
Molecular interactions
Participants and effect of each interaction
Kinetics parameters
Parameters of each molecular interaction
Subcellular organization
Organelles, microdomains, species localizations
Extracellular environment
Species structures and concentrations
Physical and chemical representation
10110011 0011
01100101 01100001
01001001 11001111 101
00100110 10001000 00010110
10011000 11010001 01010101 001
01110001 11110000 10000001 010111
00110001 10001111 10110100 0111001
10110011 11111111 01101001 0011010
01010000 10001100 00100100 11010
01100011 00011101 11010001 110
00100101 10001100 10010101
11001010 10101010 00110
10010011 1100101
Whole-cell model
b
Stochastic variation
Variation in concentrations and rates
Temporal dynamics
Dynamics of the concentration of each species
Spatial dynamics
Species concentrations in each spatial domain
Single-cell variation
Variation in every phenotype among single cells
Complex phenotypes
Mass, shape, growth rate, fate, etc.
Predicted phenotypes