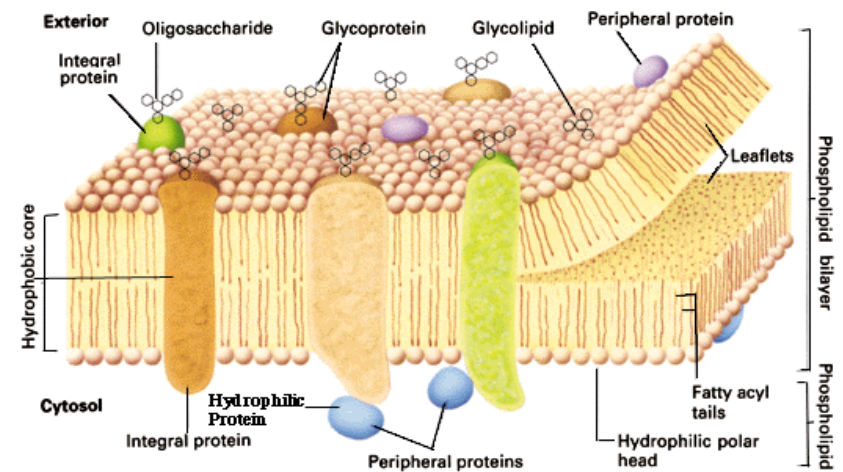
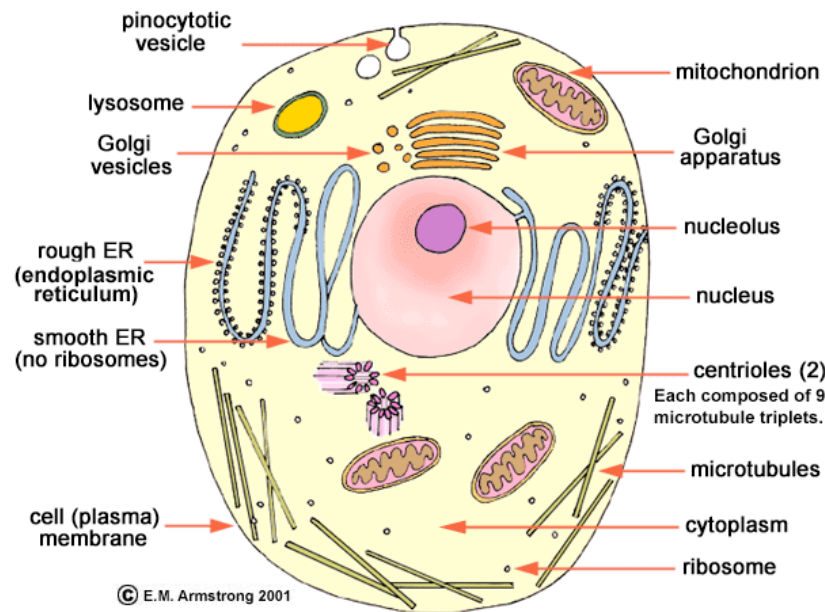


Dimensionality

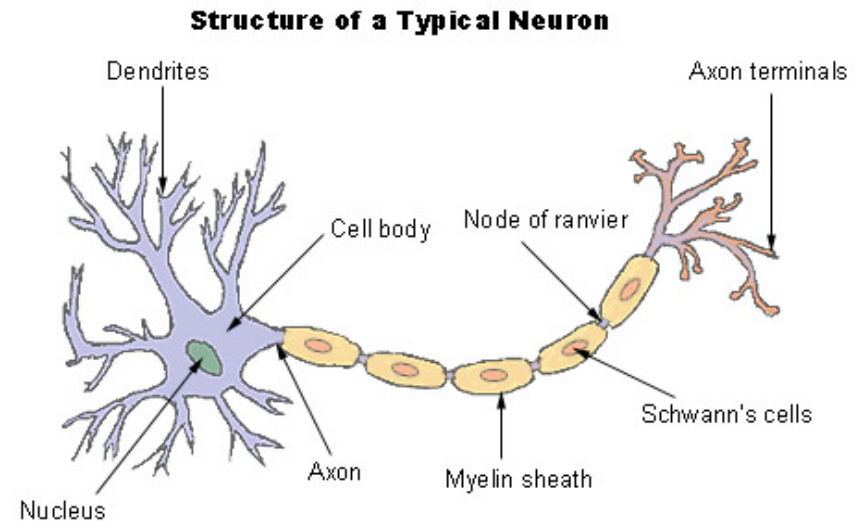
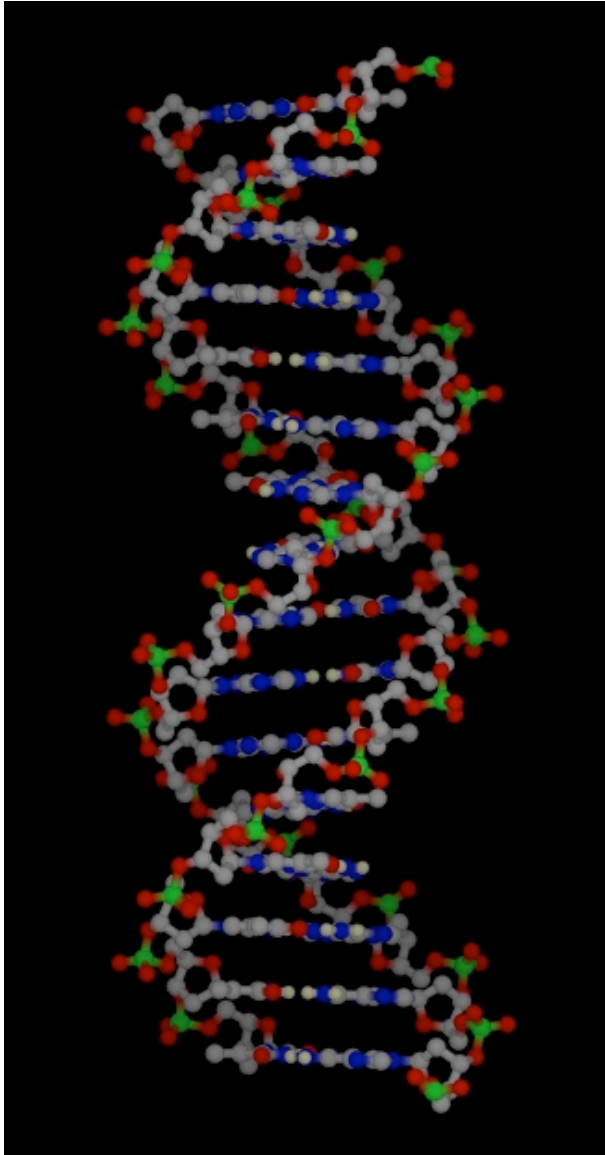
Cell and Cell Membrane



What is the effective dimensionality of a physical system?

DNA double helix

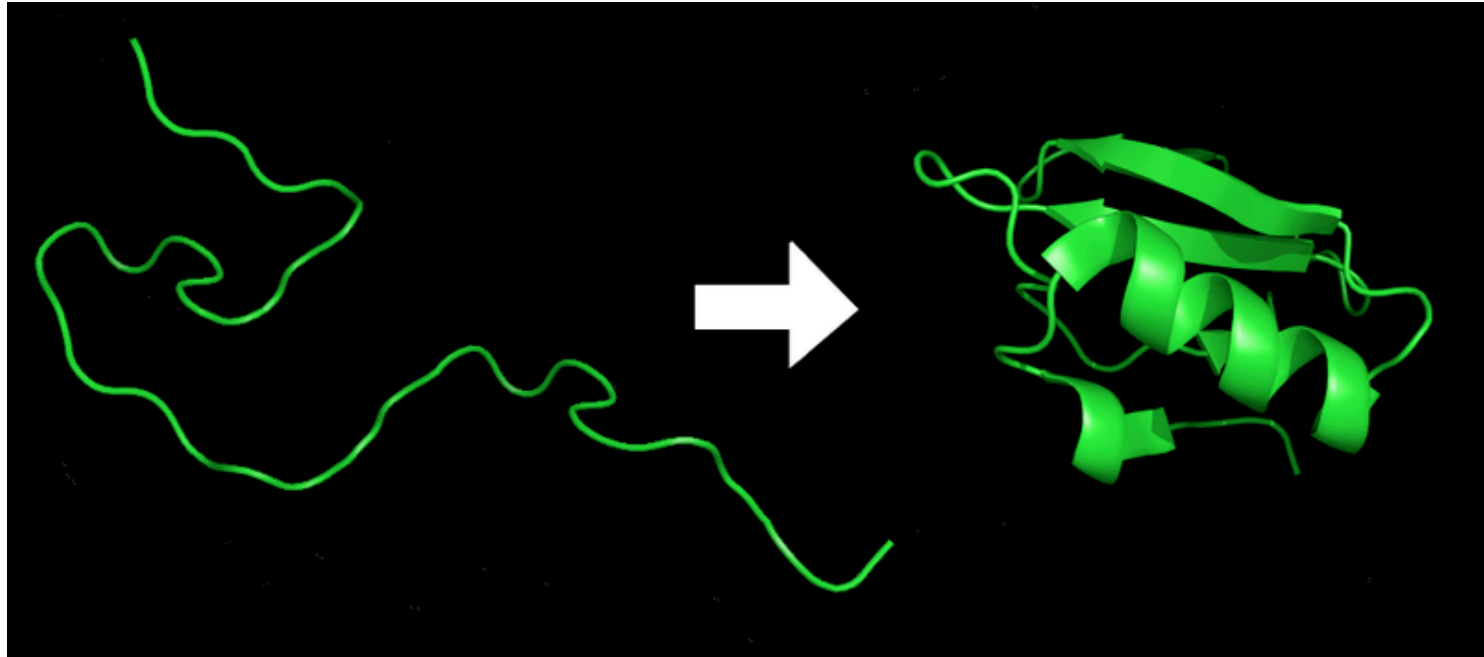
Dimensionality



What is the effective dimensionality of a physical system?

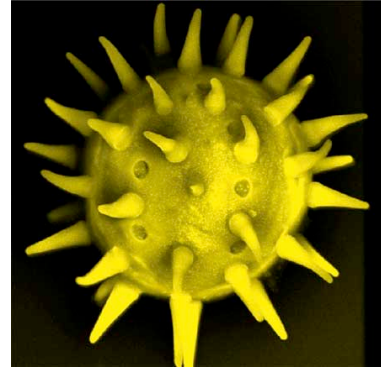
Dimensionality

Protein Folding

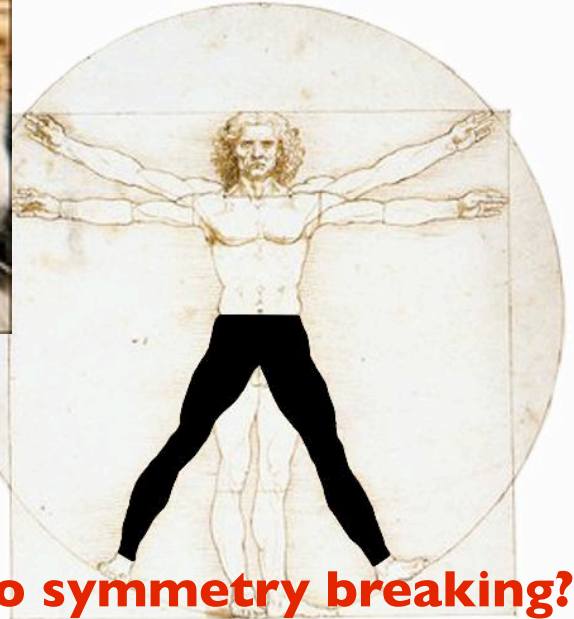


What is the effective dimensionality of a physical system?

Symmetry and Symmetry Breaking



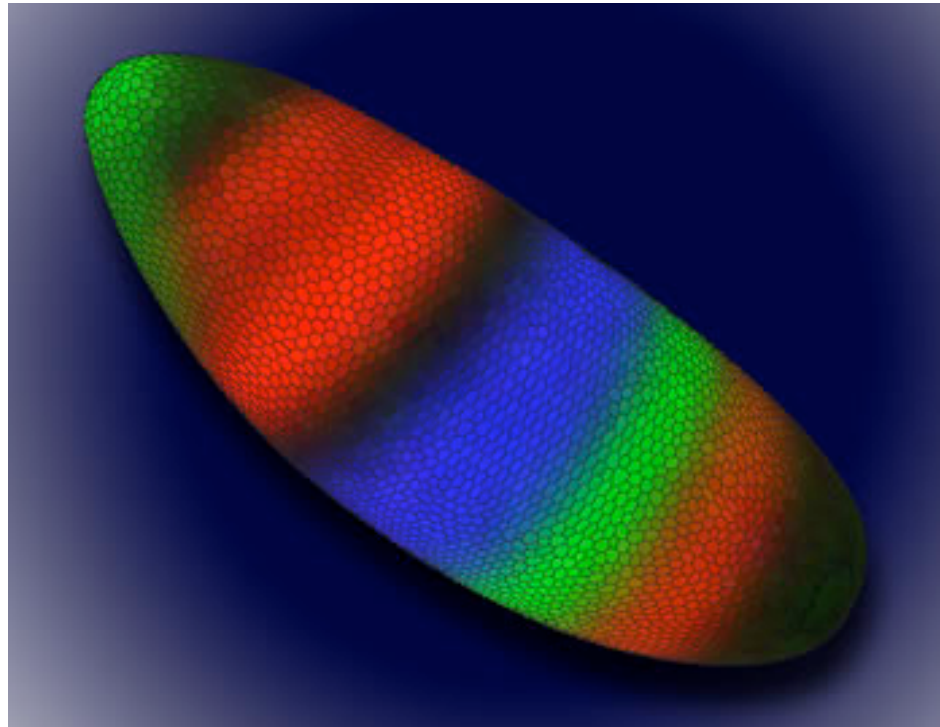
If Da Vinci Had UnJeans...



What are the physical mechanisms which lead to symmetry breaking?

Symmetry and Symmetry Breaking

Drosophila embryo: Gene regulator expression



What are the physical mechanisms which lead to symmetry breaking?

Scaling in biological systems

Metabolic Rate scaling in mammals

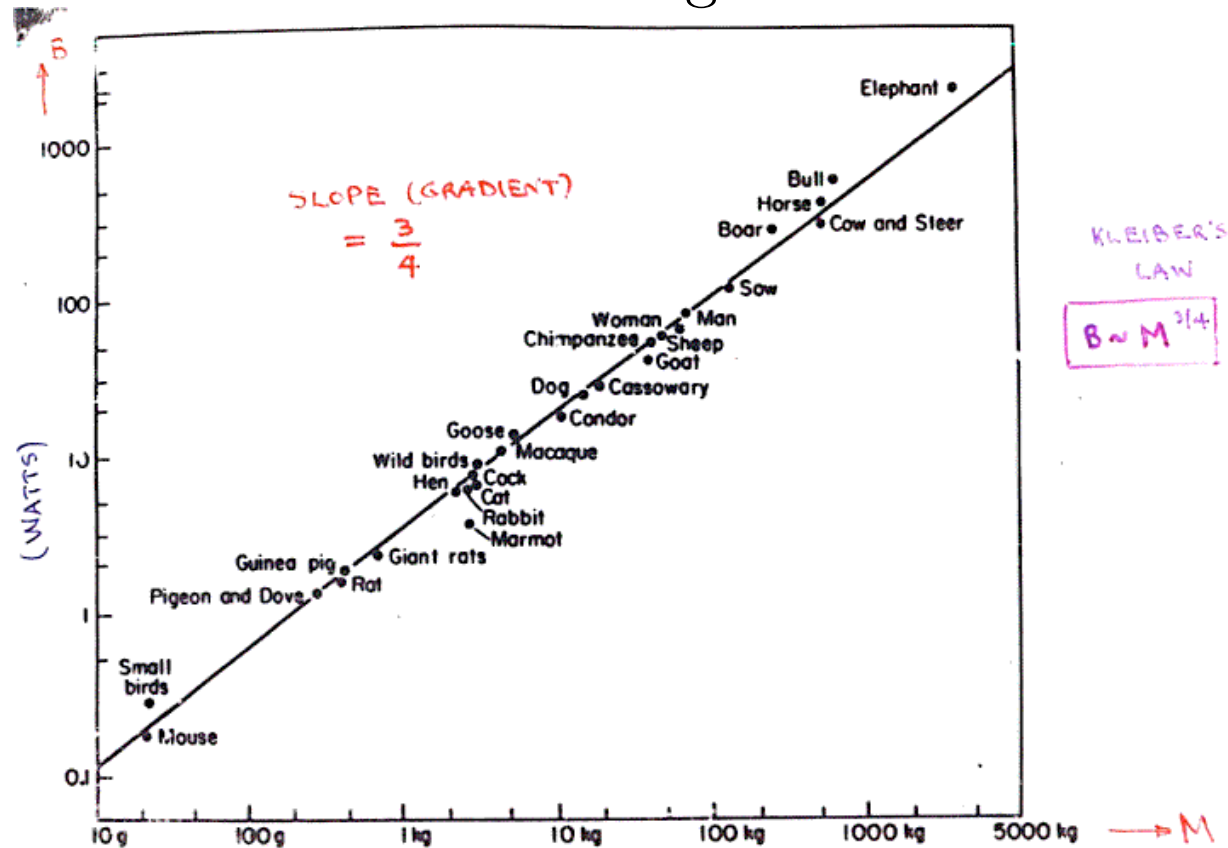


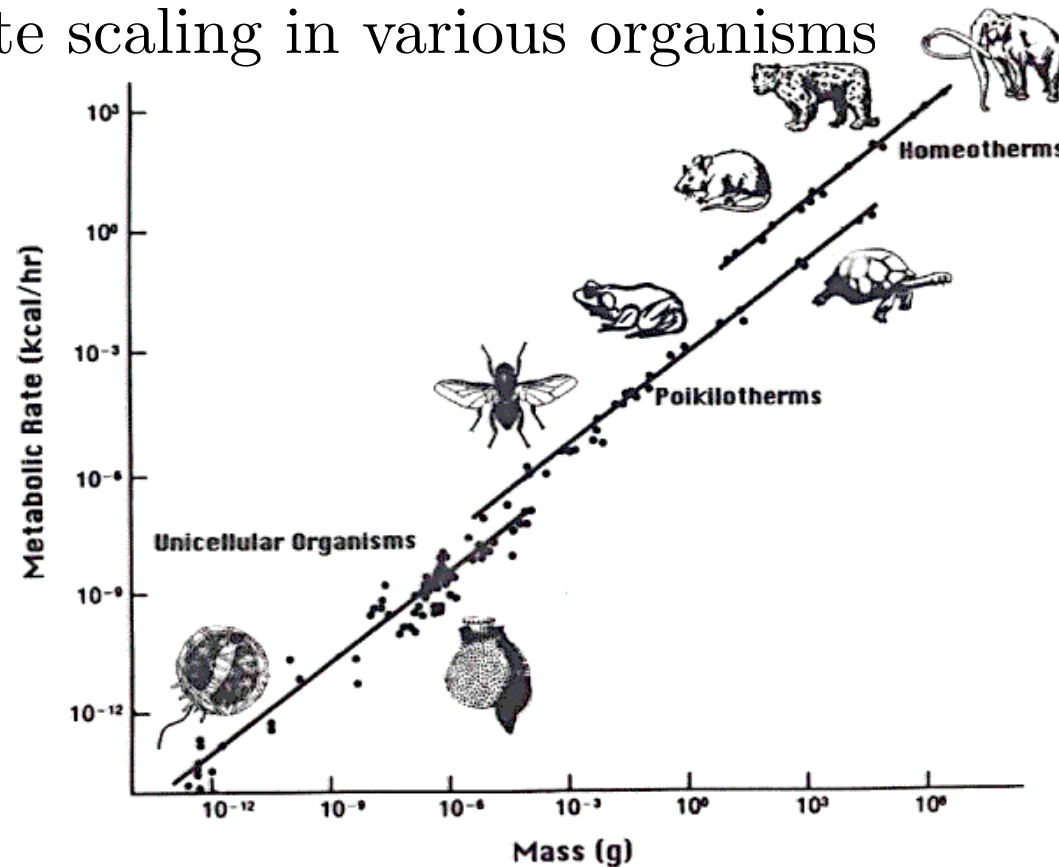
FIG. 4. Metabolic rates (in watts) of mammals and birds plotted on logarithmic coordinates against body mass (in kilograms).

What is the physical mechanism or physical constraint which leads to such scaling?

Scaling in biological systems

HEMMINGSEN ~1950's

Metabolic Rate scaling in various organisms

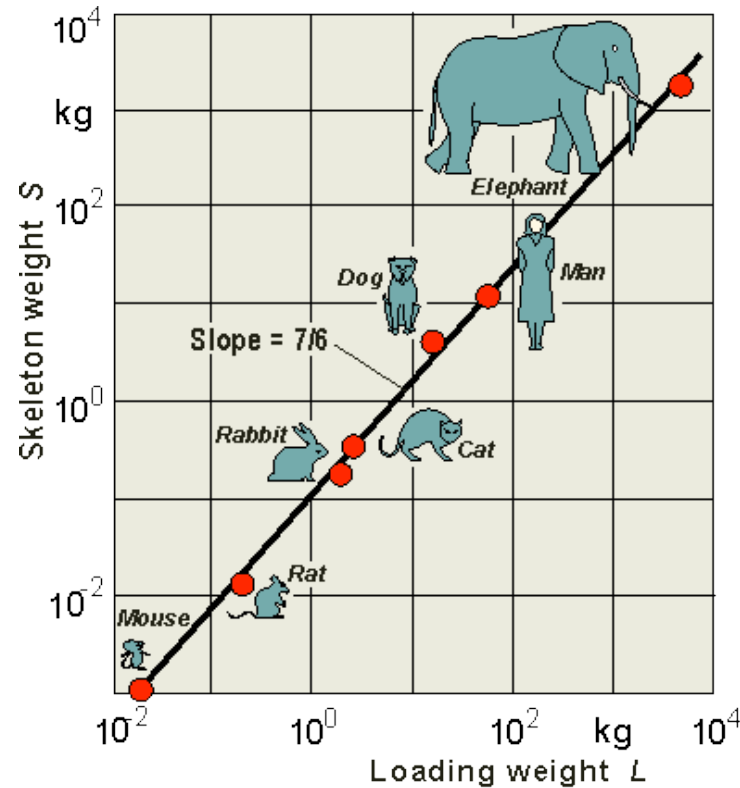


Allometric scaling of metabolic rate for a selection of homeotherms (birds and mammals), poikilotherms (fish, reptiles, amphibians, and invertebrates), and unicellular organisms. The solid lines all have a slope of .75. Modified from Hemmingen, 1960.

What is the physical mechanism or physical constraint which leads to such scaling?

Scaling in biological systems

Skeletal Mass Scaling



What is the physical mechanism or physical constraint which leads to such scaling?