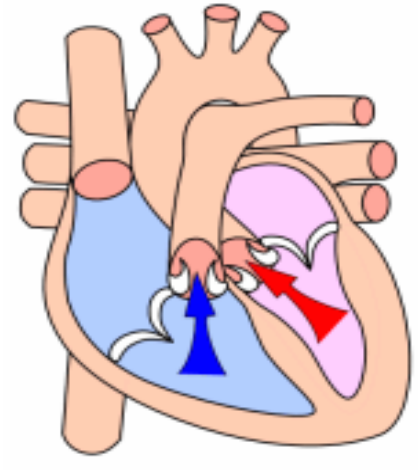
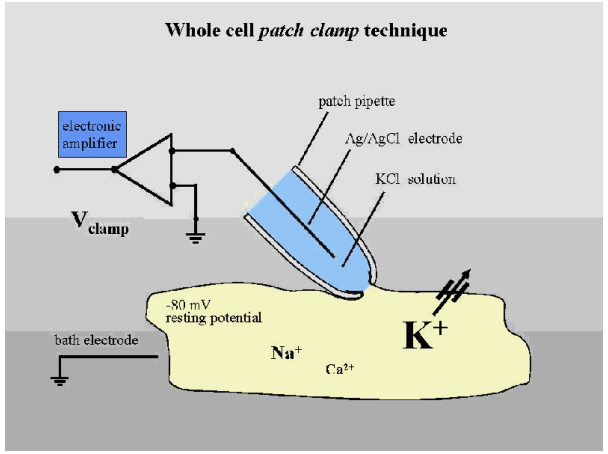
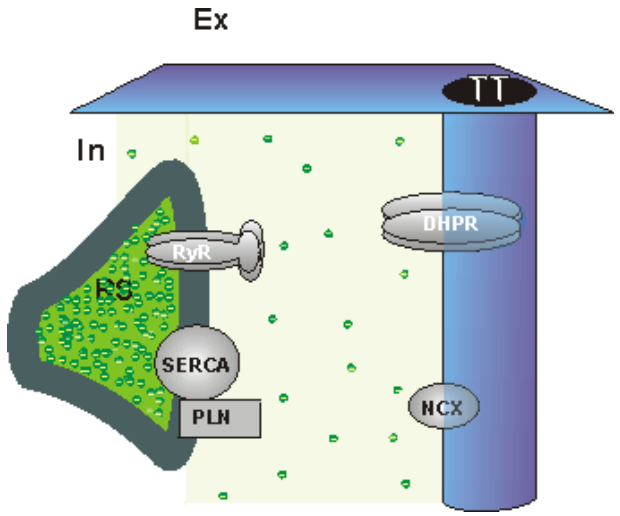






Introduction to Biophysics

Assoc. Prof. Erkan Tuncay
Department of Biophysics

Lecture Outline

- What is Biophysics?
- Systems
- Thermodynamics
- Why is there a membrane potential?
- Permeability and membrane potential
- Action potential
- Action potential in different cell types

Kenneth Stewart Cole (1900-1984)

Biophysics includes everything that is interesting and excludes everything that is not.

Nakleden: Sybesma, C. (1977). An Introduction to Biophysics . New York: Academic Press.

Bu resmi görmek için, QuickTime™ ve bir GIF aç›c› gerekir.

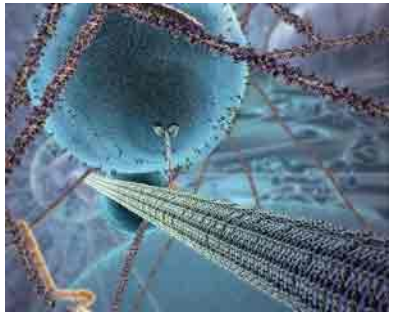
BIOPHYSICS

- **Biophysics is a bridge between biology and physics.**

Subject: **Biology**

Methodology **: Physical**

What do biophysicists study?



- Biophysicists study life at every level, from atoms and molecules to cells, organisms, and environments. As innovations come out of physics and biology labs, biophysicists find new areas to explore where they can apply their expertise, create new tools, and learn new things. The work always aims to find out how biological systems work.

Biophysicists ask questions, such as:

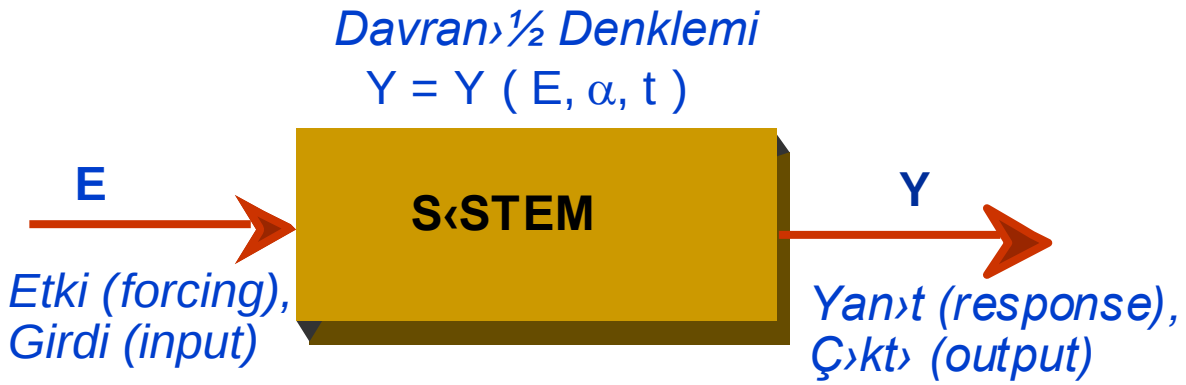
- **How do protein machines work?**
- **How do systems of nerve cells communicate?**
- **How do proteins pack DNA into viruses? How do viruses invade cells?**
- **How do plants harness sunlight to make food?**

What are the applications?

- Biophysics is a wellspring of innovation for the high-tech economy. The applications of biophysics depend on society's needs**.**
- **In the 20th century, great progress was made in treating disease**.
- **Biophysics gives us medical imaging technologies including MRI, CAT scans, PET scans, and sonograms for diagnosing diseases.**
- **It provides the life-saving treatment methods of kidney dialysis, radiation therapy, cardiac defibrillators, and pacemakers.**

Definition of System

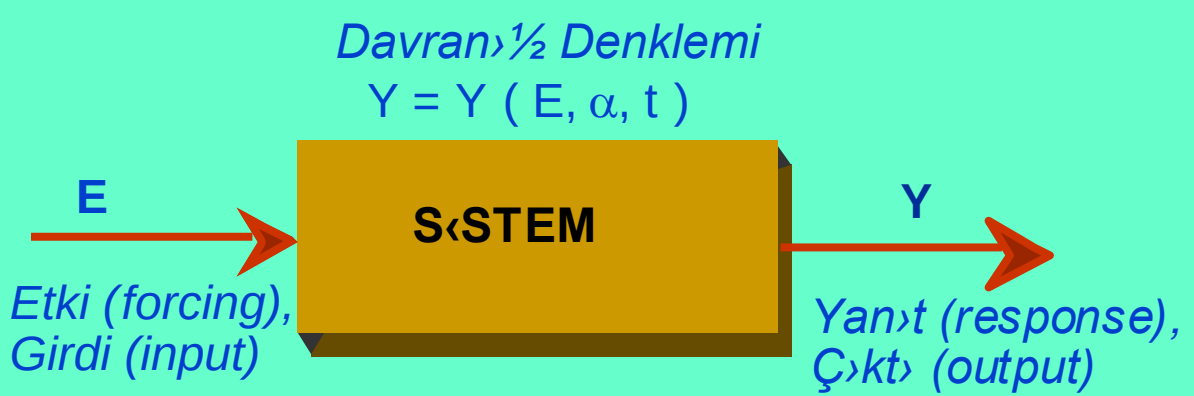
A **system** is a set of interacting or interdependent component parts forming a complex or intricate whole.



Properties of Systems:

- **Type of item**
- **Amount of item**
- **Type of interaction**

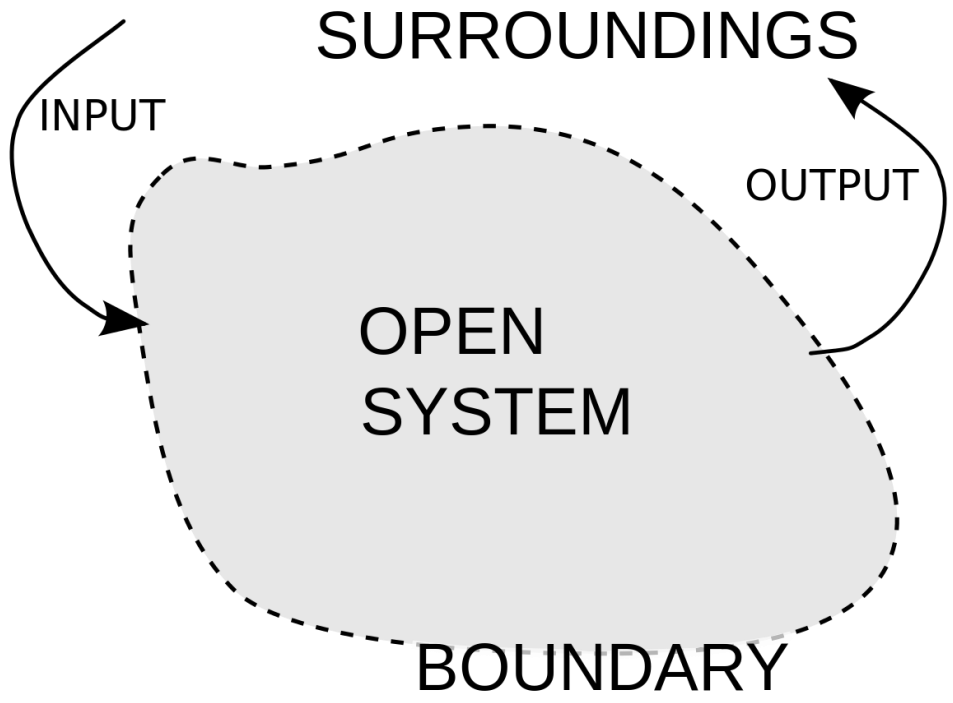
Type of systems



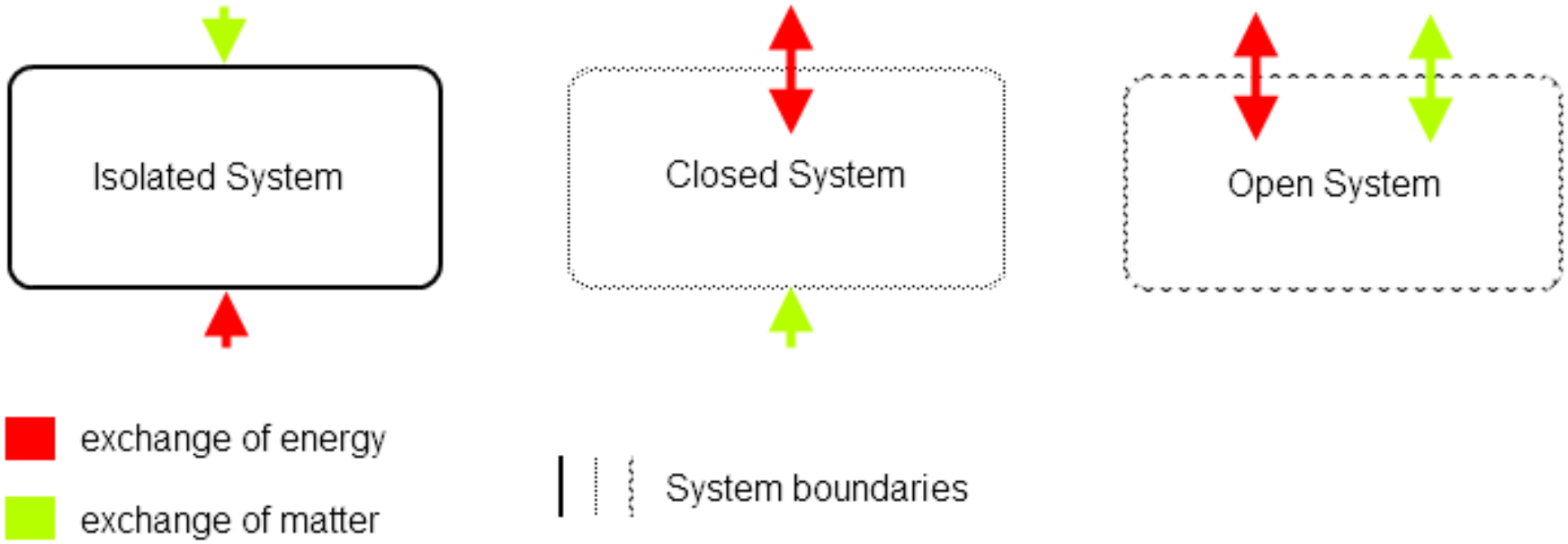
Isolated systems
Close systems
Open systems

BIOLOGICAL SYSTEMS

- A system is an amount of matter contained by real or imaginary limits.

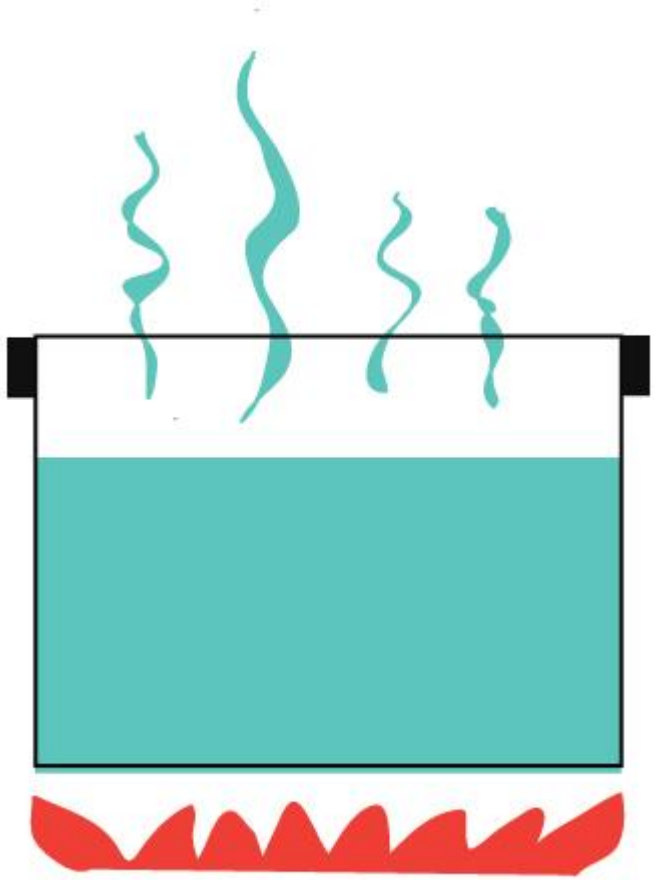


Isolated Closed and Open Systems



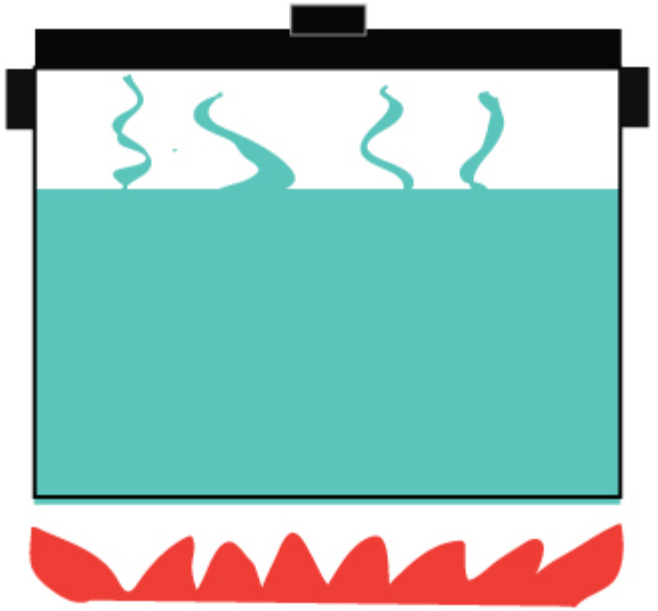
Open Systems

- An open system is one that freely allows both energy and matter to be transferred in an out of a system.



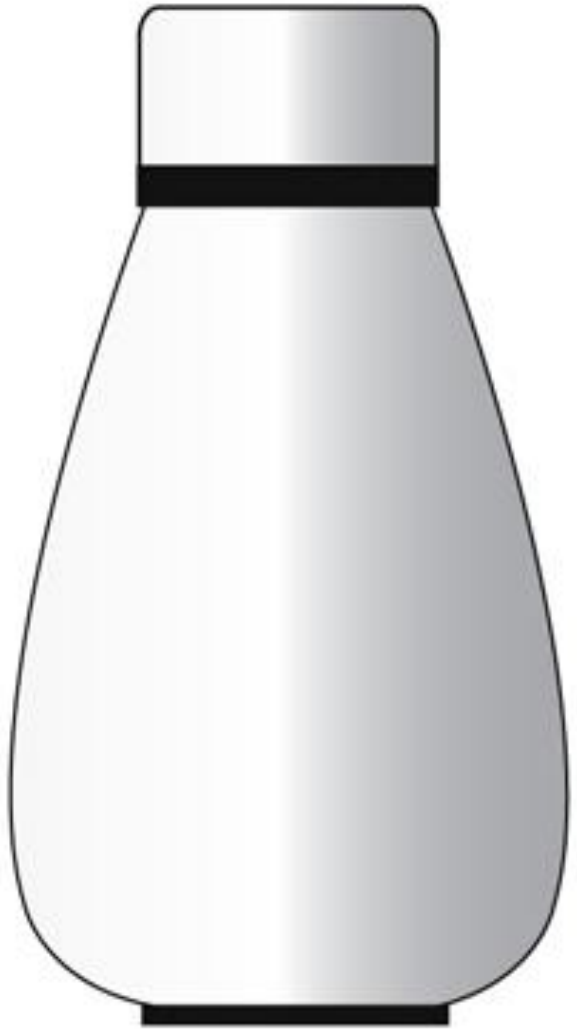
Closed Systems

- A closed system, on the other hand, does not allow the exchange of matter but allows energy to be transferred.



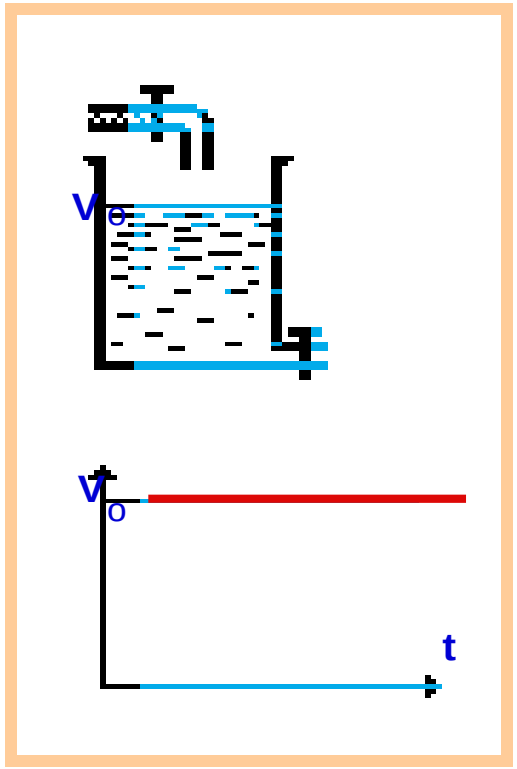
Isolated Systems

- This system is completely sealed. Neither matter nor heat can transfer to or from the surroundings

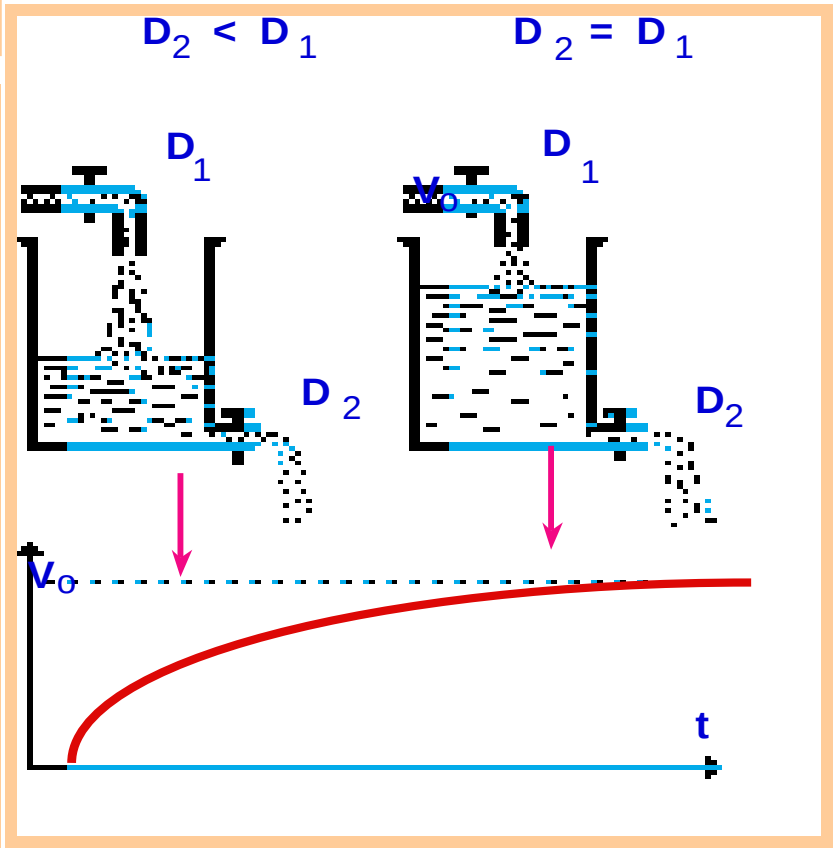


Equilibrium and Stable state

Close system and equilibrium



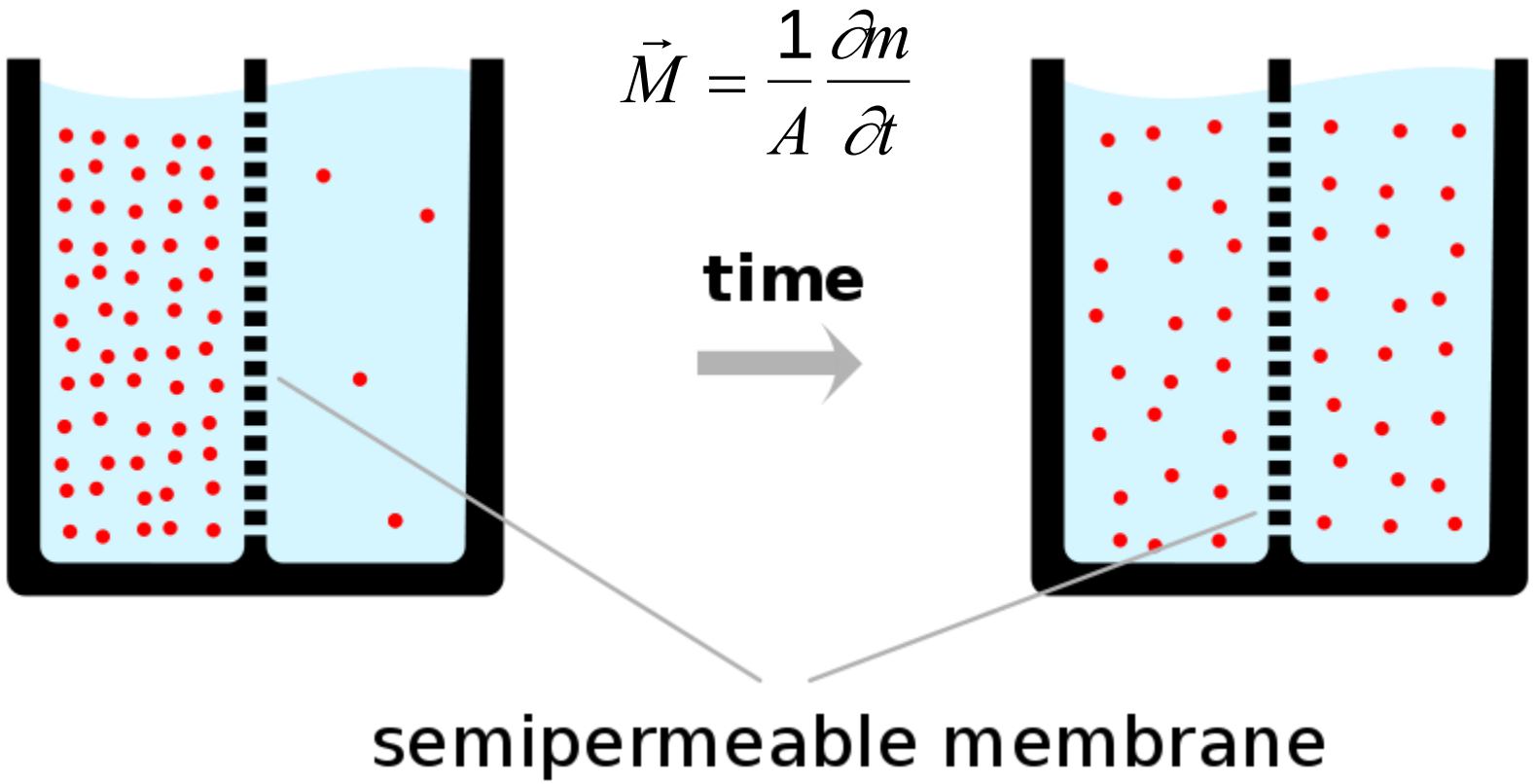
Open system and equilibrium



Diffusion Flux

Diffusion refers to the process by which molecules intermingle as a result of their kinetic energy of random motion. When two species diffuse into each other, it is necessary to know the rate of mass transfer. This is known as diffusion flux . When differentiated to take the rate of diffusion into account, this equation becomes.

$$\vec{M} = \frac{1}{A}\frac{\partial m}{\partial t}$$



Gradient

The gradient is a vector operation which operates on a scalar function to produce a vector whose magnitude is the maximum rate of change of the function at the point of the gradient and which is pointed in the direction of that maximum rate of change.

Gradient in 3D space:

$$\nabla \varphi = \frac{\partial \varphi}{\partial x}\vec{i} + \frac{\partial \varphi}{\partial y}\vec{j} + \frac{\partial \varphi}{\partial z}\vec{k}$$