

# Elasticity

- A physical property of solid materials or substances or bodies to return to their own original shape and size (volume, length) when the forces causing the deformation are removed
- A body / material / substance with this ability is said to behave or respond **elastically**
- Term relates to continuum mechanics

## Description and highlights

- To a greater or lesser size, most of solid materials exhibit elastic behavior. But there is a limit to the quantity of the force and deformation within which elastic recovery is possible
- This limit is called **elastic limit** which is maximum stress or force per unit area of a solid material that can arise before permanent deformation
- Stresses beyond the **elastic limit** of breakable materials cause "plastic behavior" which means that material deforms and does not return to the original shape
- For rubber-like materials stresses beyond the **elastic limit** means that they become more difficult to stretch
- The elasticity of materials is described by stress-strain curve, which is relationship between average restorative internal force per unit area and the relative deformation
- **Stress-strain curve** of various materials vary widely, different tensile tests conducted on the same material yield different results, depending upon firstly *temperature of specimen* and secondly *speed of loading*. It is possible to distinguish some common characteristics among the stress-strain curves of various groups of materials and, on this basis, to divide materials into two broad categories : *ductile materials* and *brittle materials*

## Elastic properties of biological tissues

Tissues may be *viscoelastic*, *poroelastic*, *anisotropic* or *contractile*, or any combination of these, quite apart from being normal or modified by disease. Other factors which may be relevant are the age of the tissue, its temperature, and whether it is in vivo, in vitro or fixed.

### Blood viscoelasticity

Blood viscoelasticity is a property of human blood that is primarily due to the elastic energy that is stored in the deformation of red blood cells as the heart pumps the blood through the body. The energy transferred to the blood by the heart is partially stored in the elastic structure, another part is dissipated by viscosity, and the remaining energy is stored in the kinetic motion of the blood. When the pulsation of the heart is taken into account, an elastic regime becomes clearly evident. It has been shown that the previous concept of blood as a *purely viscous fluid* was inadequate since *blood is not an ordinary fluid*. Blood can more accurately be described as a fluidized suspension of elastic cells.

### Elasticity of cell membrane

A cell membrane consists mostly of lipids, proteins and carbohydrates. The model of plasma (cell) membrane is called **fluid mosaic model** and it was proposed by Singer and Nicolson in 1972. In this model, the cell membrane is considered as a lipid bilayer where the lipid *molecules can move freely* in the membrane surface like fluid, what causes high elasticity of that cell component.

## Application

The main purpose of studying elastic properties of living tissues is to minimise invasive surgery

## Links

### Related articles

### External links

### Bibliography

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