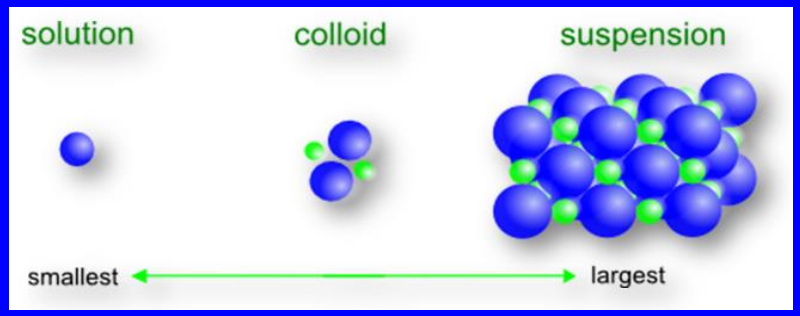
# Bioecology
# Module: Soil Science

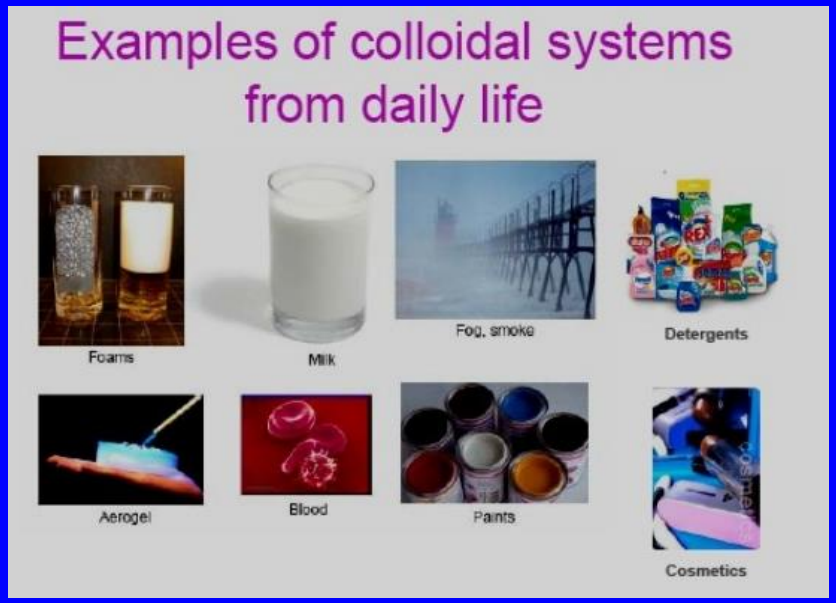
## Lecture 8.
## Soil colloids: Properties, nature, types and significance.

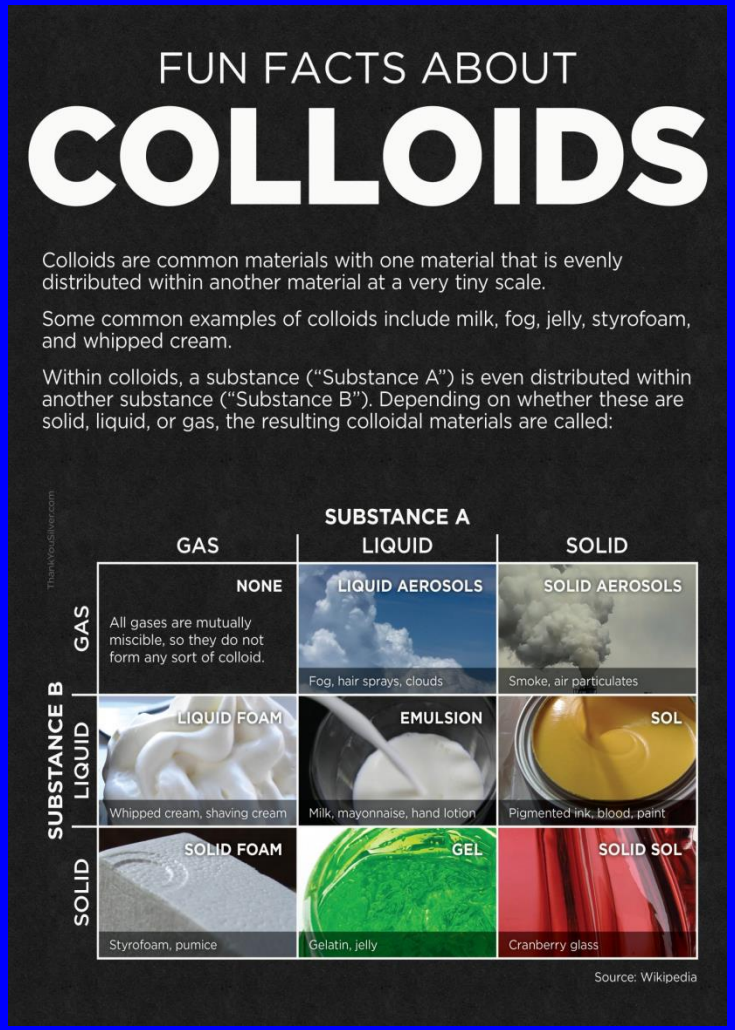
Lovinskaya Anna Vladimirovna
PhD, Senior lecturer
Department of molecular biology
and genetics

# SOIL COLLOIDS

The colloidal state refers to a two-phase system in which one material in a very finely divided state is dispersed through second phase. Particles less than 0.001 mm size possess colloidal properties and are known as ***soil colloids***.



# General Properties of Soil Colloids

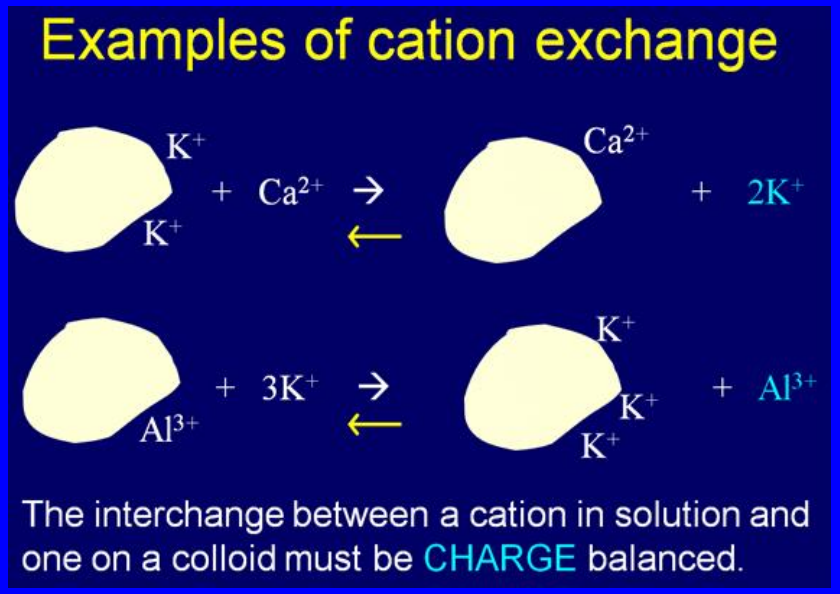
1. **Size**. The inorganic and organic colloids are extremely small size - smaller than 2 micrometers in diameter.

2. **Surface area**. Because of their small size, all soil colloids have a larger external surface area per unit mass. The external surface area of 1 g of colloidal clay is 1000 times that of 1 g of coarse sand. The colloid surface area in the upper 15 cm of a hectare of a clay soil could be as high as 700,000 $km^2/g$.

3. **Surface charges**. Most of the organic and inorganic soil colloids carry a negative charge. The magnitude of the charge is known as zeta potential. The presence and intensity of the particle charge influence the attraction and repulsion of the particles towards each other, there by influencing both physical and chemical properties.

# General Properties of Soil Colloids

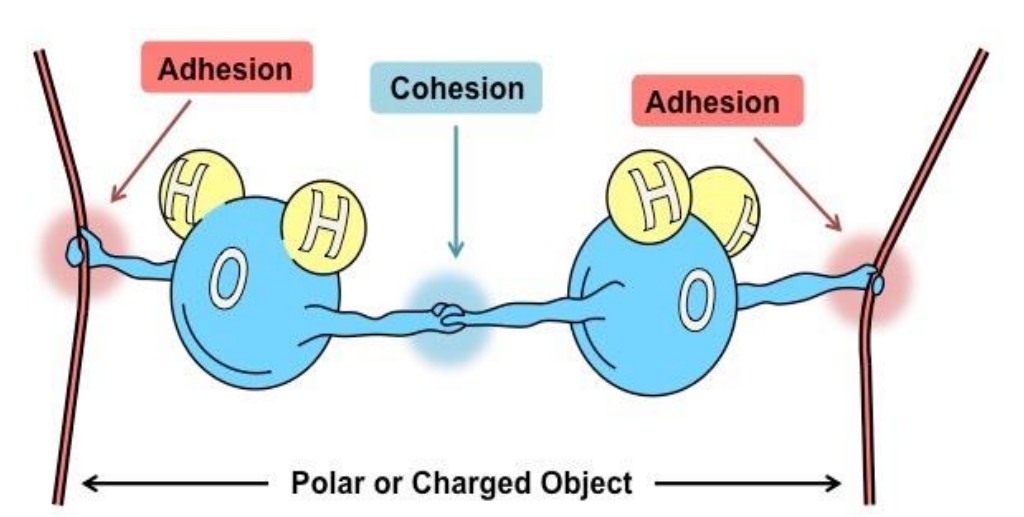
4. **Adsorption of cations**: As soil colloids possess negative charge they attract and attach the ions of positive charge on the colloidal surfaces. They attract cations like $H^+$, $Al^{3+}$, $Ca^{2+}$ and $Mg^{2+}$. This gives rise to an ionic double layer.

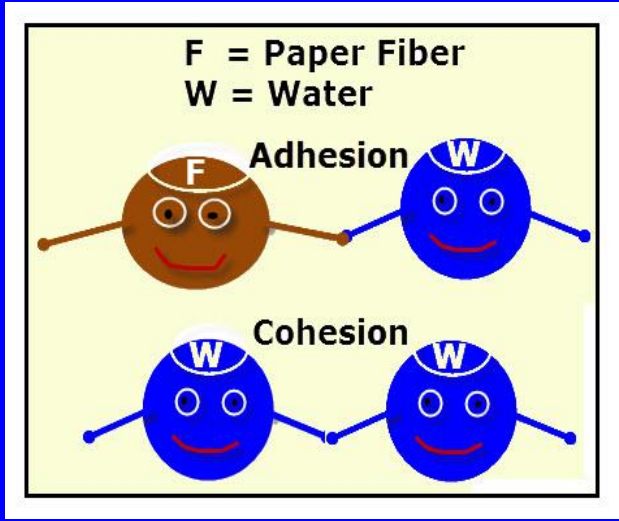



5. **Swelling and shrinkage**: Some soil clay colloids belonging to smectite group (Montmorillonite) swell when wet and shrink when dry. Soils dominated by kaolinite, chlorite, or fine grained micas do not swell or shrink. Vermiculite is intermediate in its swelling and shrinking characteristics.

6. **Cohesion** (Attractive force between similar molecules or materials) indicates the tendency of clay particles to stick together. This tendency is due to the attraction of clay particles for water molecules held between them. When colloidal substances are wetted, water first adheres to individual clay particles and then brings about cohesion between two or more adjacent colloidal particles.

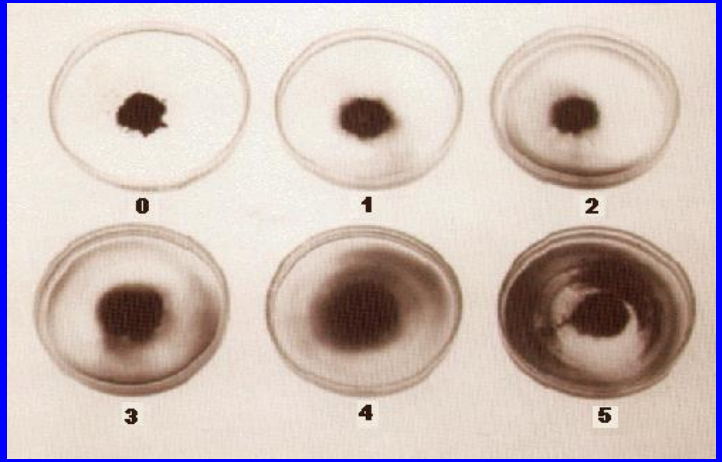
7. **Adhesion** (Attractive force between different molecules or materials) refers to the attraction of colloidal materials to the surface of any other body or substance with which it comes in contact.



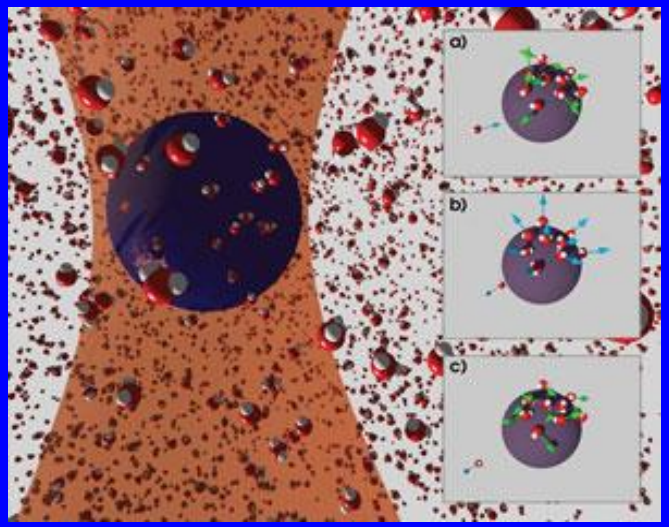



8. **Dispersion and flocculation**: As long as the colloidal particles remain negatively charged, they repel each other and the suspension remains stable. If on any account they loose their charge, or if the magnitude of the charge is reduced, the particles coalesce, form flock or loose aggregates, and settle down. This phenomenon of coalescence and formation of flocks is known as ***flocculation***.

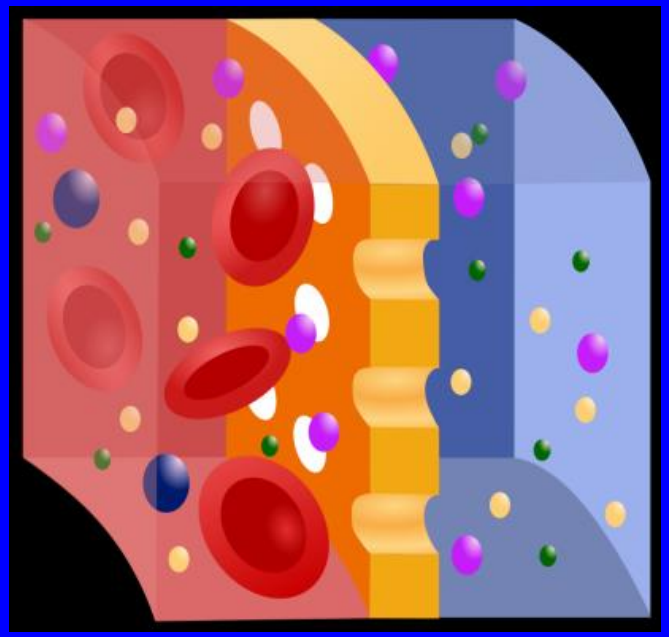
The reverse process of the breaking up of flocks into individual particles is known as ***de-flocculation*** or ***dispersion***.

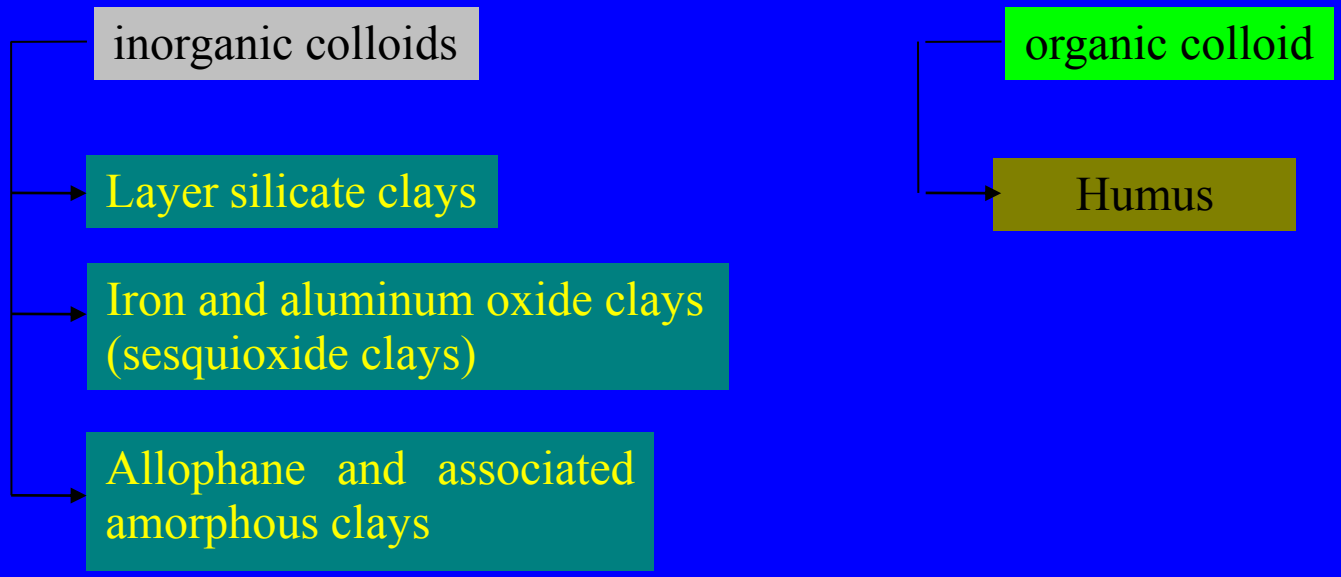
9. **Brownian movement**: Soil colloidal particles with those of water in which they are suspended are always in a constant state of motion. The smaller the particle, the more rapid is its movement.




10. **Non permeability**: Colloids are unable to pass through a semi-permeable membrane. The membrane allows the passage of water and of the dissolved substance through its pores, but retains the colloidal particles.



# TYPES OF SOIL COLLOIDS




| Clay | Humus |
|---|---|
| Made up of Si, Ai, O | Made up of C, H, O |
| Inorganic and crystalline | Complex amorphous organic colloid |
| Clays are stable relatively | More dynamic,formed and destroyed more rapidly |
| Clays have definite and well known structure | Complex structure not well known |

# Significance of soil colloids

- the organic and inorganic contaminats are often transported via colloidal particles;

- almost all surface controlled processes including adsorption reactions, nucleation and precipitation involve colloids;

- colloids are mobile in soils, and thus affect not only the chemical transport of otherwise immobile chemicals, but also exert a strong influence on soil hydraulic properties

*Thank you for  attention!*