DECOMPOSITION

BIOTIC AND ABIOTIC DECOMPOSITION OF PLANTS, ANIMALS AND FOOD

Last revision July 15, 2024

Decomposition

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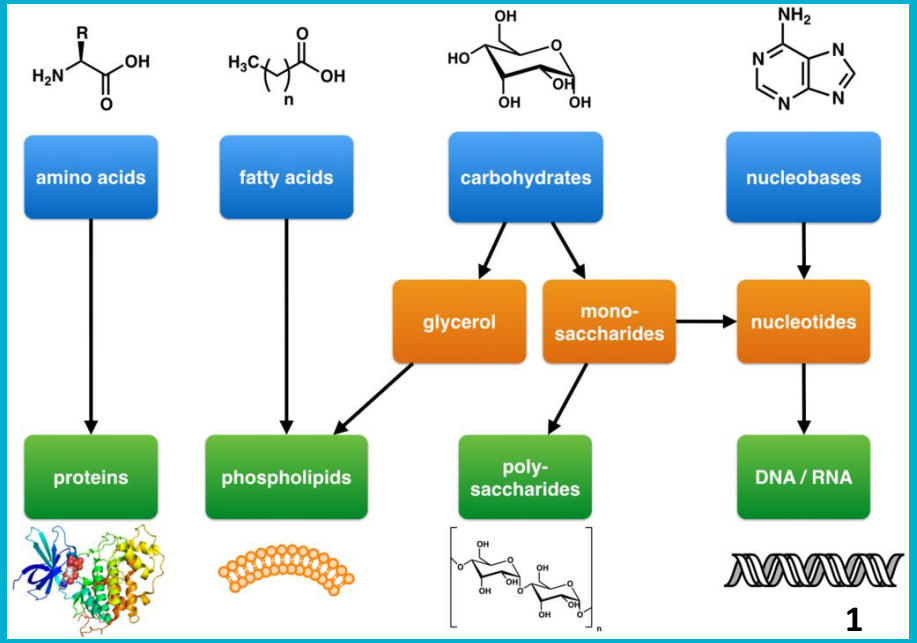
DEFINITION

DECOMPOSITION: definition

Decomposition is the set of processes that lead to the degradation of organic substances, transforming them into much simpler compounds.



Some of the biomolecules that build living things

DECOMPOSITION: definition

Decomposition is essential to give the possibility to recycle all that organic matter that takes up physical space in biomes. Without decomposition we would all be living on miles of garbage.

DECOMPOSITION: definition

When we talk about organic substances, the discussion is very large because they constitute not only large and small living organisms (microbes, animals, plants) but also food.

Side image:
a - Osmia rufa (hymenoptera); b - Boletus edulis;
c - Chlorococcales (green algae); d - Chimpanzee;
e - Ranunculus asiaticus; f - Isotricha intestinalis (protozoan)

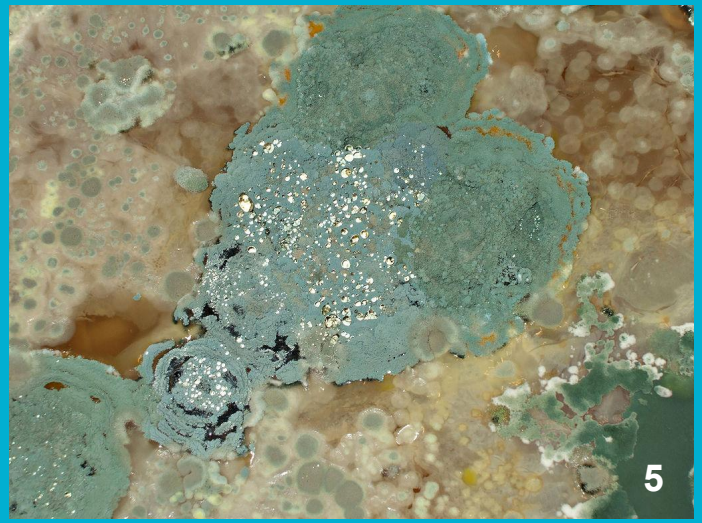
DECOMPOSITION: definition

Obviously, the decomposition process will affect living things after their death but food during its preservation.

Boar carcass in an advanced state of decomposition

DECOMPOSITION: definition

Essentially, decomposition is carried out by microorganisms that exploit the degraded molecules and the energy they obtain from them to reproduce themselves. What is the kingdom par excellence that exploits decomposition? Fungi, for that reason defined as saprophytes.



Molds on the surface of a starch solution (Ascomycetes)

DECOMPOSITION: definition

Bacteria are also present in large quantities.

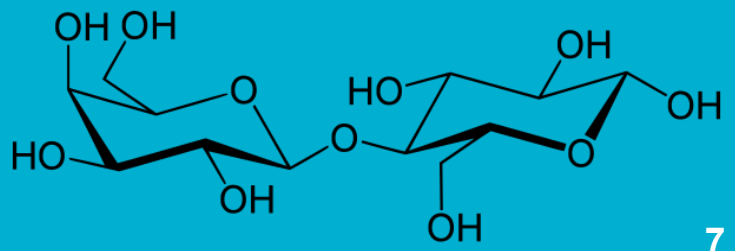
And we must not forget about the action of insects, worms... if food or any animal or vegetable remains is left in the open air.

Ants feed on a dead baby snake

DECOMPOSITION: definition

Decomposition can be abiotic or biotic.

Abiotic decomposition is mostly chemical in nature, i.e. carried out by enzymes without the intervention of cells. A typical example is hydrolysis. Think about the lactose molecule, present in milk and many of its derivatives; it is cleaved by lactase into its two components (glucose and galactose).



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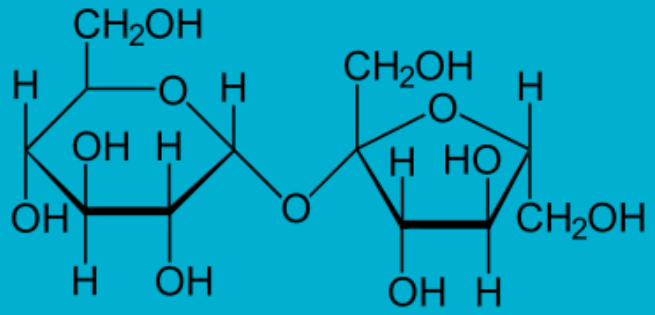
Lactose molecule

DECOMPOSITION: definition

Another example of hydrolysis is the cleavage of sucrose into its two components: glucose and fructose. In other words, hydrolysis is the cleavage of a complex molecule into two or more parts by the addition of water and with the intervention of enzymes.



Sucrose made up of glucose and fructose.

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DECOMPOSITION: definition

Biotic decomposition or biodegradation.

It is due to the enzymatic action with the direct presence of cells. Therefore, completely different from the previous one.

Yellow mucilaginous fungus growing on the outside of wet paper container

FACTORS INFLUENCING DECOMPOSITION

FACTORS INFLUENCING DECOMPOSITION

Let’s recall schematically which factors can influence the timing of decomposition.

- Physical factors: temperature, amount of oxygen, humidity, rain...
- Causes of death: trauma, possible wounds, food remains ...
- Possible embalming
- Burial and time since burial. In its absence the remains are at the mercy of necrophagous animals

DECOMPOSITION IN ANIMALS

DECOMPOSITION IN ANIMALS

Decomposition begins at the moment of death. This applies to all animals.
As regards humans, according to the Italian Law December 29, 1993 - n. 578 (Regulations for the assessment and certification of death) (Italian Official Gazette January 8, 1994 - n.5) death must be identified with the "*irreversible cessation of all functions of the brain*".

DECOMPOSITION IN ANIMALS

The definition of death as "*irreversible cessation of all functions of the brain*" is reported in the article 1 of the Italian law 578/1993. Furthermore, according to the D.M.S. April 11, 2008 (GU nº. 136 6 December, 2008), which regulates organ donation, the referring doctors for verifying the will proceed with the communication of the death to the family members and the subsequent donation proposal. Here a very delicate topic opens up (organ donation) which does not fall within this topic but which would be important to explore further in class.

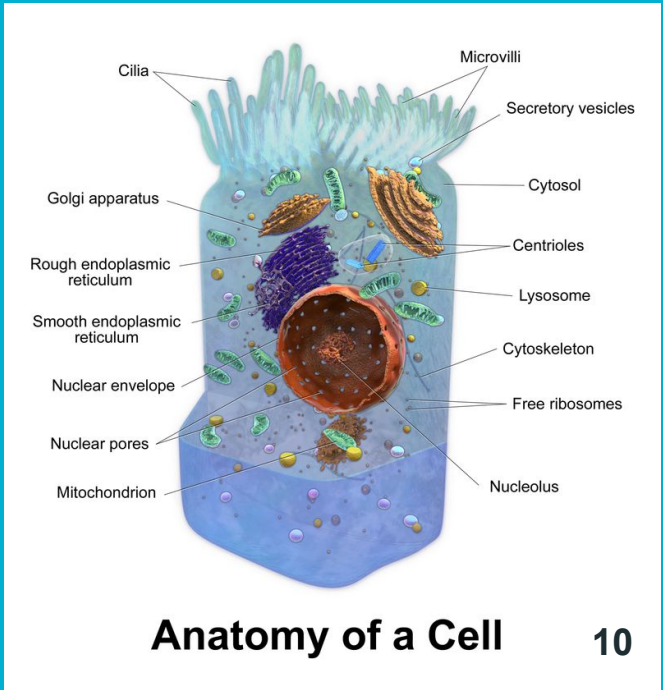
DECOMPOSITION IN ANIMALS

Decomposition is linked to biotic and abiotic factors. Among the biotic (destructive) factors are autolysis, autodigestion and putrefaction. But special phenomena such as saponification and mummification can also occur.

Statue realistically representing a decomposing corpse

DECOMPOSITION IN ANIMALS

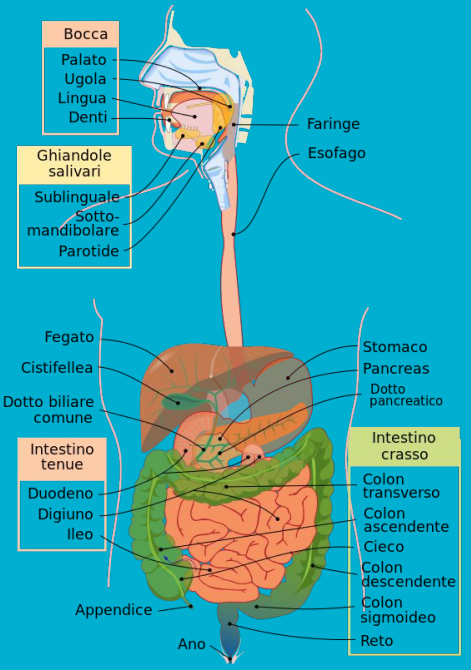
Autolysis: self-destruction of tissues due to the release of proteolytic enzymes from lysosomes. The process is the earliest and lasts a short time because it is replaced over time by putrefaction.



Animal eukaryotic cell

DECOMPOSITION IN ANIMALS

Autodigestion The lytic enzymes contained in the digestive system (mostly gastric and pancreatic juice) perforate its walls and thus manage to digest the spleen, diaphragm and lungs.



Human digestive system

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DECOMPOSITION IN ANIMALS

Putrefaction In this case, saprophytic microbes (especially bacteria and fungi), regular guests of our organism, come into action. Their job is to degrade all organic compounds in the body.

The first to intervene are the anaerobes present in the intestine which pass through its walls and reach the organs through the blood vessels.

DECOMPOSITION IN ANIMALS

The putrefaction process releases cadaverine (fetid diamine) and putrescine (polyamine) which are responsible for the characteristic odor of corpses.

Cadaverine 12

Putrescine 13

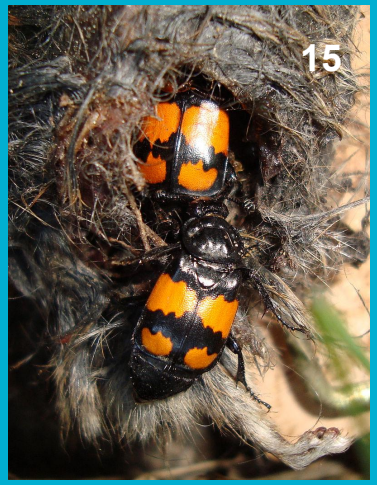
DECOMPOSITION IN ANIMALS

If the man or animal is not buried, it is attacked by necrophagous animals that normally feed on decaying meat or plant remains.

Sarcophaga nodosa

DECOMPOSITION IN ANIMALS

Among the necrophilic arthropods there are also sylphs (left) and calliphoridae (right).



Nicrophorus vespillones colonizing a dead rodent

Chrysomya megacephala (the green bottle fly) photographed in Tanzania

DECOMPOSITION IN ANIMALS

Among the large scavenger animals we should mention coyotes, wolves, foxes, rats, vultures...

Gyps fulvus (vultures) fleshing a deer in Spain

DECOMPOSITION IN PLANTS

DECOMPOSITION IN PLANTS

The decomposition of plant matter occurs in many stages. It starts with leaching thanks to the action of water; soluble carbon compounds are released in this process.
Another early process is the physical breakdown or fragmentation of plant material into smaller pieces that present greater surface area for microbial colonization and attachment.

DECOMPOSITION IN PLANTS

In smaller dead plants this process is largely carried out by soil invertebrate fauna. Instead, in large plants, mainly parasitic life forms such as insects and fungi play an important role in fragmentation. Subsequently, the plant debris (consisting of cellulose, hemicellulose, microbial products and lignin) undergoes chemical alteration by microbes.

DECOMPOSITION IN FOOD

DECOMPOSITION IN FOOD

The decomposition of food, both plant and animal, better called spoilage in this context, is an important field of study for food science.

Peach decomposition in 6 days

DECOMPOSITION IN FOOD

The decomposition of food can be slowed down by storage. For example, in untreated meat it occurs within hours or days and the meat becomes unappetizing, poisonous or infectious. The deterioration is caused by practically inevitable infection and subsequent decomposition due to the action of bacteria and fungi that are present in the animal itself or by manipulation by operators and their tools.

DECOMPOSITION IN FOOD

Meat can be kept edible for a much longer time - although not indefinitely - if proper hygiene is observed during production and processing and if appropriate food safety and food storage procedures are applied.

The topic is covered in greater detail in Food hygiene and quality and in Food conservation.

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