Desiccation Encyclopedia Article

Desiccation

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Desiccation

Desiccation is the removal of water from a biological system. Usually this is accomplished by exposure to dry heat. Most biological systems are adversely affected by the loss of water. **Microorganisms** are no exception to this, except for those that have evolved defensive measures to escape the loss of viability typically associated with water loss.

Desiccation also results from the freezing of water, such as in the polar regions on Earth. Water is present at these regions, but is unavailable.

Microorganisms depend on water for their structure and function. Cell membranes are organized with the water-loving portions of the membrane lipids positioned towards the exterior and the water-hating portions pointing inward. The loss of water can throw this structure into disarray. Furthermore, the interior of microorganisms such as **bacteria** is almost entirely comprised of water. Extremely rapid freezing of the water can be a useful means of preserving bacteria and other microorganisms. However, the gradual loss of water will produce lethal changes in the chemistry of the interior **cytoplasm** of cells, collapse of the interior structure, and an alteration in the three-dimensional structure of **enzymes**. These drastic changes caused by desiccation are irreversible.

In the laboratory, desiccation techniques are used to help ensure that glassware is free of viable microbes. Typically, the glassware is placed in a large dry-heat oven and heated at 160° to 170° C (320° to 338° F) for up to two hours. The effectiveness of **sterilization** depends on the penetration of heat into a biological sample.

Some microorganisms have evolved means of coping with desiccation. The formation of a spore by bacteria such as Bacillus and Clostridium allows the genetic material to survive the removal of water. Cysts produced by some protozoans can also resist the destruction of desiccation for long periods of time. Bacterial biofilms might not be totally dehydrated if they are thick enough. Bacteria buried deep within the biofilm might still be capable of growth.

The fact that some microbes on Earth can resist desiccation and then resuscitate when moisture becomes available holds out the possibility of life on other bodies in our solar system, particularly Mars. The snow at the poles of Mars is proof that water is present. If liquid water becomes transiently available, then similar resuscitation of dormant Martian microorganisms could likewise occur.