

# Cryogenics essay



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Cryogenics is a largely growing field, relatively innovative in the field of science and research. It deals with freezing temperatures below 150 degrees Celsius (-238 degrees Fahrenheit) using oxygen, helium I, helium II (which are both chemically identical), and nitrogen. These are cooled to the point of liquidation and used to freeze diverse materials and substances. At these extreme conditions, such properties of materials as strength, thermal conductivity, ductility and electrical resistance are altered. Materials at cryogenic temperatures are as close to a static and highly ordered state as possible. Cryogenics is more than the term for freezing, but more precisely for temperatures below 150 degrees Celsius. Cryogenic temperatures are achieved either by rapid evaporation of volatile liquids or by the expansion of gases confined initially at pressures of 150-200 atmospheres. This ability to freeze materials at such low temperature aids in the exploration of human research and development as well as freeze-dried foods, and aeronautics.

Among the different materials that can be cryogenically frozen, food is almost certainly the most familiar one. Liquid nitrogen is used in this process by being sprayed onto the food. This causes the heat to completely absorb from the food and the food is then preserved. This is most commonly known as astronaut food and is not only used in space, but also for people needing to carry light loads like extreme hikers or mountain bikers.

The human body can also be frozen in different ways and as a whole or in parts. Body parts such as a knee or elbow are frozen and can be later used for medical students or more recently in other people. Orthopedic tissue such as bone tendons like the quadriceps, Achilles and patellar tendons are transplanted after being cut and sized after being frozen to help better

match the recipient. New tendons are doubled up for more strength and are stiffer. After the replacement surgery, the tendon will be stronger than it was will heal better.

The meniscus is also being replaced in cryogenic surgery and becoming increasingly more popular. The pain a patient receives after the surgery was put into a scale called the Lysholm scale. Patients were asked to rate the overall severity of their pain on a scale of 0 to 10 with 0 representing no pain and 10 representing the worst pain imaginable. The average postoperative pain level was 2.7. Most patients were able to do most of the normal pivoting knee exercises that they were able to do prior to receiving the operation.

Veins and blood vessels are cultivated for transportation from either one body to another or from one body part to another on the same person. These veins are used in vascular reconstruction. This replacement can save a patients entire appendage. A vein, specifically the saphenous vein, from a patient can be taken out and cryogenically preserved and transplanted in to the same persons heart in coronary bypass surgery.

The human heart has recently been a major topic in cryogenic labs. In 1984, Cryolife (a corporation located in northeast Georgia) advanced cardiovascular medicine when it introduced and made commercially available cryopreserved human heart valves, providing cardiovascular surgeons with new, important and viable cardiac repair alternatives. This new heart works the same as a real valve does. Cryolife also preserves human aortic, pulmonary, and mitral heart valves that are all used as

replacement alternatives. These surgeries are completed with another new item, BioGlue. This surgical adhesive is used with sutures and staples to aid in the healing process, making it easier and faster for it to heal. Both of these huge medical advances have been considered significant, allowing people to lead normal lives over again.

Cryogenically preserved tissue that is cultivated is being used in new ways. This cryosurgery is being used for the treatment of Parkinson disease, the technique being based on the selective destruction of tissue by freezing it with a small cryogenic probe. A similar technique has also been employed to destroy brain tumors and to arrest cervical cancer. This can help a patient to recover quicker from surgery and there is a higher chance of a tumor not returning using this method.

In this field of research, donors are key for continuation. Without donors, there would be nothing to work with, no advances would be able to be made, and recipients would lack the heart, tissue, or vein that they need. These, however, are not the only type of donors needed. Sperm and eggs are also needed to aid in pregnancy for couples that cannot reproduce. These are also frozen for later use to be implanted in a woman or used in an unnatural environment (research). This implantation can cost over \$600 but is said to be worth it. But there are complications that can go along with this. The donated semen must be screened for infections and diseases.

Cytomegalovirus, AIDS, and Cystic fibrosis are among the top transmitted diseases in semen donors. Cystic fibrosis can put almost any couple at risk. The gene for CF can be carried in either the mother or father. Your ethnic background also has a lot to do with the possibility of a newborn to have CF.

When materials are frozen, the properties can drastically change. In paradigm, mercury solidifies and rubber becomes brittle. Helium-4 can change from a gas to a liquid to a super fluid, and when put in a container, forms a thin film on the surface. Oxygen can be produced from air that can be used in rocket engines, for cutting and welding torches, for supporting life in space and deep-sea vehicles, and for blast furnace operations. Nitrogen can also be produced from air for the making of ammonia for fertilizers, to prepare frozen foods, and to ship frozen foods.

Cryogenics is quickly becoming one of the most important fields in medicine and research. The vast number of uses for this technology continues to grow and draw more attention to it. More and more people are benefiting from this new technology whether from a single surgery or for someone flying in space. A lot has yet to be discovered about cryogenics and what other ways we will be able to benefit there are from it.

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