



## Independent Cryonics Educators Program

### 2.2: Cryonics cryopreservation, cryobiology, and cryogenics

Many people confuse and conflate various cryo- terms. The media frequently uses the term “cryogenics” when it means “cryonics”. The editor of the journal *Cryogenics* has also noted this confusion. The root term stems from Greek κρύος (cryos) – “cold”.

In physics, **cryogenics** is the production and behavior of materials at very low temperatures. The word cryogenics stems from Greek κρύος (cryos) – “cold” + γενής (genis) – “generating”. In physics, cryogenics is defined as the production and behavior of materials at very low temperatures. How low is “very low”? Universal agreement is lacking.

- The National Institute of Standards and Technology considers the field of cryogenics as that involving temperatures below  $-180\text{ }^{\circ}\text{C}$  ( $93\text{ K}$ ;  $-292\text{ }^{\circ}\text{F}$ ).
- In 1971, the 13th IIR International Congress of Refrigeration endorsed a universal definition of “cryogenics” and “cryogenic” by accepting a threshold of  $120\text{ K}$  (or  $-153\text{ }^{\circ}\text{C}$ ) to distinguish these terms from conventional refrigeration.

The latter is a practical definition in that the normal boiling points of the “permanent gases” (such as helium, hydrogen, neon, nitrogen, oxygen, and normal air) lie below  $-120\text{ }^{\circ}\text{C}$  while the Freon refrigerants, hydrocarbons, and other common refrigerants have boiling points above  $-120\text{ }^{\circ}\text{C}$ .

**Cryogenic temperature**, in biology, means a temperature low enough for stability of biological materials for periods of years or more, typically below  $-100^{\circ}\text{C}$ .

**Cryobiology**: The branch of biology involving the study of the effects of low temperatures on organisms (most often for the purpose of achieving cryopreservation).

**Cryopreservation** means the preparation, cooling, and storage of biological cells and tissues at temperatures low enough for stability for periods of years or more, typically below  $-100$  degrees Celsius.

**Cryonics** means the study and practice of cryopreserving human bodies, human brains, or other human tissue with the intention of future revival of a person.

[Updated 07/30/22]

**Next: 2.3: The justification of cryonics**

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## **ICE Program**

Part 1: ICE: Why is it important.

Part 2: Introduction to cryonics

Part 3: Procedural aspects

Part 4: Technical aspects

Part 5: Science

Part 6: Membership

Part 7: Concerns about cryonics

Part 8: Philosophical and ethical issues

Part 9: Cultural, religious, and social issues

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