Chapter 1
Introduction

The objective of cryonic suspension is the stabilizion of patients who have exhausted the resources and capabilities of contemporary medical skill, and who have been pronounced *legally* dead. This stabilization is carried out in order to allow the patient to be moved through *time* to a point where medical and biological understanding is sufficiently advanced to allow for resuscitation and treatment.

Clearly, the less damage inflicted as a consequence of legal death and the absence of blood circulation (*ischemia*) which accompanies it and the better the biopreservation technique used, the less injury will have to be reversed to achieve restoration of life.

General Principles

The objective of successful transport of a cryonic suspension patient is the complete elimination of any damage or injury associated with *ischemia* resulting from cardiac and respiratory arrest. When respiration and circulation cease, the delivery of oxygen and nutrients to the tissues is interrupted and injury begins. The cells which compose an organism are complicated structures, made of many molecular systems. Like any complex working machine, a cell requires energy to maintain its structural integrity and ability to function. Compared to the kinds of gross machines we are familiar with, cellular machinery requires an almost constant flow of energy to maintain its integrity. Whereas an automobile will fall apart over a period of years if it is not properly protected from the elements, lubricated, and maintained, a cell will begin to decompose in a matter of minutes if the energy flow for maintenance functions is interrupted.

One approach to delaying the disintegration of cellular structure is cooling. Every 10°C decrease in temperature reduces the level of cellular metabolic activity (i.e., energy requirement) by 50%. Deep cooling, with solidification of the system, completely arrests all biological and cellular change, though currently the price paid for entering this state of biological inactivity is the imposition of injury from the preservation technique. Unfortunately, due to the large mass and poor conductivity of the human body--or even the isolated human brain--and the rapid pace of metabolic activity and biological change, it is not possible to surface-cool a patient quickly enough to the point where stable storage may be carried out without also providing metabolic support.

Current thinking indicates that before deep cooling and freezing take place, it is helpful to infiltrate tissues with agents to protect against--or at least minimize--freezing injury. Once again, owing to the mass of tissue to be treated, the introduction of such protective agents (cryoprotectants) takes hours. In order to prevent tissue damage during cooling to a temperature where it is safe to begin introducing cryoprotective agents, it is necessary to provide the cells with metabolic support in the form of oxygen and nutrients. In transporting a patient from a hospital or nursing home where legal death occurs to a cryonics facility where the introduction of cryoprotective agents and final cooling is carried out, the objective is the minimization or elimination of injury that would normally occur as a result of ischemia.

Failure to provide such support will result not only in damage or loss of structure directly as a result of ischemia, but also in the development of injury which will seriously interfere with adequate introduction and distribution of cryoprotective agent(s). This will in turn result in increased damage from freezing.

Examples of ischemic damage which could interfere with cryoprotective treatment are:

1) *Blood clotting, which can obstruct vessels and prevent cryoprotectant-containing fluid (perfusate) from reaching the tissues.*

2) *Changes in the permeability of the capillaries (the small vessels through which oxygen, nutrients, and cryoprotectants are delivered to the tissues and wastes are removed), which can result in swelling of the tissue and blockage of flow, as well as changes in tissue structure which result in cell swelling.*

3) *Damage of cell components leading to decomposition of cell structure when cryoprotective compounds are introduced and oxygen and glucose are again made available.*

In order to prevent these undesirable changes, the objective of transport is the minimization or elimination of interrupted circulation and respiration after cardiac and respiratory arrest have occurred. Legal constraints require that a physician first must have pronounced *legal death*, i.e., signed or agreed to sign a death certificate. If the patient is hospitalized, agreement to sign a death certificate usually is evidenced by a note in the patient's chart. Therefore, the first objective in a successful transport is the minimization of the delay between the occurrence of *clinical death* (cardiac and respiratory arrest) and the pronouncement of legal death. One can accomplish this by making careful administrative arrangements well in advance of clinical death with the physician who is caring for the patient. This means that the physician must have a thorough understanding of the transport procedure, and that a mutually agreed upon plan must be established to meet the objectives of that procedure. Some of the details of such administrative and educational requirements are treated in the next chapter (General Instructions And Administrative Procedures).

Once a plan of action regarding access to the patient has been worked out with the physician and the institution providing the patient's care, the next objective is rapid intervention after the occurrence of clinical death and, where appropriate, recovery of circulation and respiration. In some situations, such as those where a condition of clinical death at normal body temperature has existed for an extended period of time, it may not be appropriate to restart circulation. A fuller discussion of when and how to make such a decision is contained in Chapter Three (Assessment, Planning, And Gaining Cooperation).