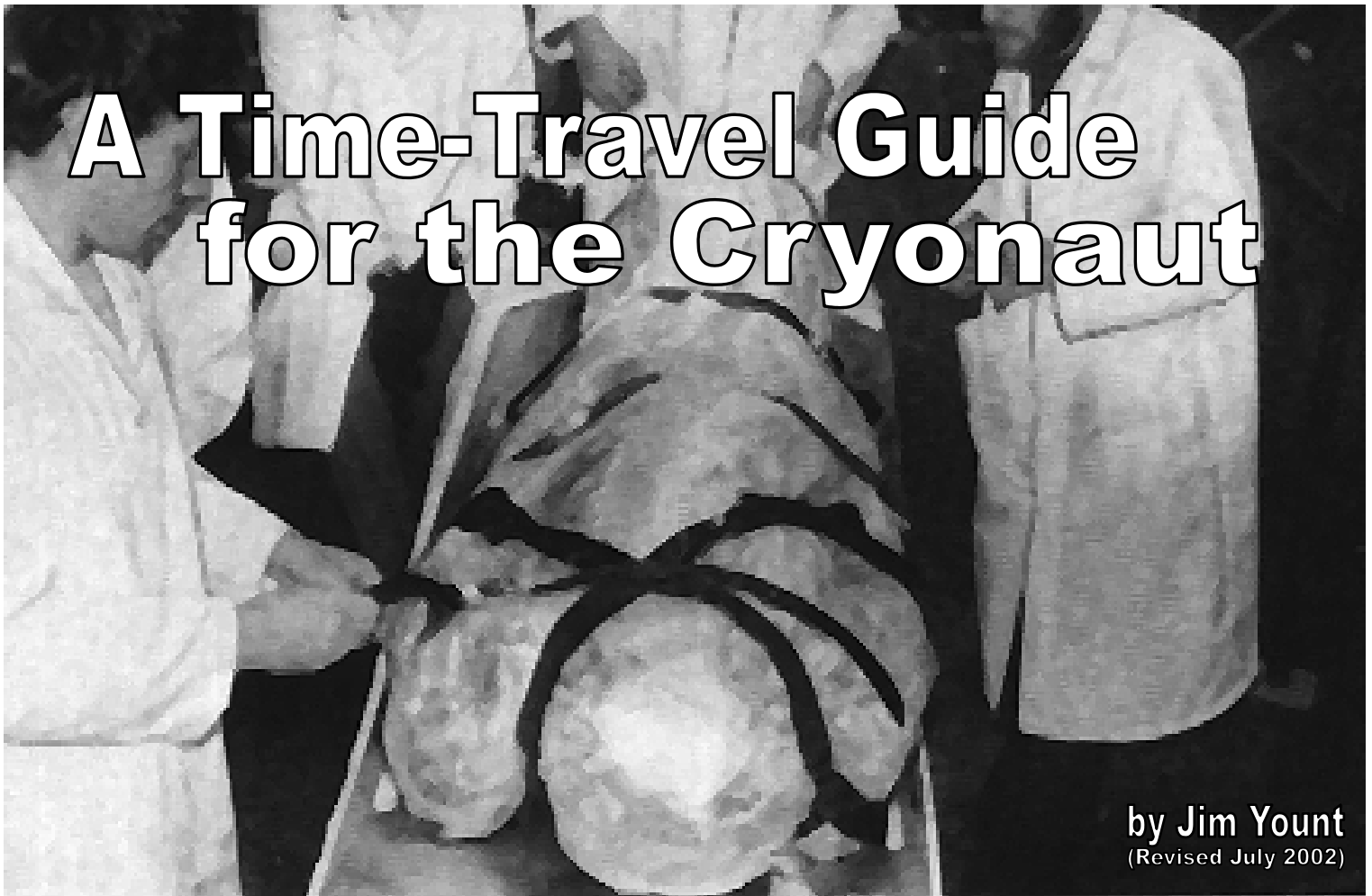


A Time-Travel Guide for the Cryonaut



by **Jim Yount**
(Revised July 2002)

This was the first cryonic suspension sponsored by the American Cryonics Society (February, 1974).

How do people go about making arrangements to be frozen? After they are frozen, what happens next? What does the American Cryonics Society do to make sure frozen people don't accidentally thaw? If revival or reanimation of frozen patients proves possible, what kind of future awaits the cryonauts?

Before You Are Frozen

The American Cryonics Society (ACS) is a member run non-profit organization that promotes research and education into cryobiology and cryonic suspension. One of the ways we fulfill these functions is by sponsoring a suspension program where members make arrangements for their own cryonic suspension.

For a person to participate in this suspension program we need him to do three things:

1. Become a member of the American Cryonics Society.
2. Give us the legal authority to perform a suspension.
3. Provide funding.

Let's discuss these three requirements in a little more detail:

1. Become a member of the American Cryonic Society by filling out our enrollment form and paying membership dues. For our full membership ("four-year") program dues are \$376 per year for the first four years after which the dues become \$300 per year. There are substantial discounts for additional family members which enables family participation.

2. Give us the legal authority to perform a suspension. Individuals make use of legal provisions of the Uniform Anatomical Gift Act to "gift" their bodies to ACS for the purpose of cryonics research. Other supporting forms make sure that individuals understand the limitations of current freezing methods and provides for various choices in suspension technology and storage.

3. Provide his own individual funding for his suspension, storage, and future revival (if that proves possible). Although the costs of suspension and long-term storage are relatively high, most people simply purchase a life insurance policy for this purpose. For

young to middle-aged people in good health, this insurance is usually readily affordable. Alternatively, individuals sometimes set up trust funds with real estate, stocks and bonds, or other assets. Such funds are normally under the control of the member during his or her lifetime but revert to ACS upon the member's death.

Currently ACS recommends minimum funding of \$45,000 to \$135,000 for full body suspension. The variation in funding recommendations is to account for different initial treatments soon after death. Some suspensions have involved a complete surgical team and employed procedures of the same sophistication and complexity as open-heart surgery (case studies are available through ACS). For individuals who cannot afford such treatment or where the conditions of death don't warrant such surgical procedures, a less complex freezing technique is used which is far less costly.

Once a person is enrolled in the ACS suspension program a Medic Alert bracelet or necklace and wallet card are issued which has emergency information and our emergency response phone numbers.

Most of our members are neither old nor sickly. They are people of various ages who recognize the importance of being pre-enrolled in a suspension program.



A cryonaut arrives at a suspension facility for further cool down.

Through the Time Tunnel (the suspension procedure)

Our Mission: to deliver the subject to the future...

There has been considerable research, much of it sponsored all or in part by the American Cryonics Society to minimize the expected damage from the freezing process itself. Some of this research has been well publicized with ACS researchers appearing on the Phil Donahue Show, Sally Jesse Raphael, and Good Morning America. There have also been reports of

"suspended animation" (with techniques used similar to those we helped pioneer) in various scientific publications.

The suspension team is charged with delivering the subject to future medical people in as good a shape as is possible. We must, however, emphasize the current limits on freezing or suspension technology. No animal with a backbone can now be frozen to liquid nitrogen temperature and revived. What our procedure seeks to do is to reduce the damage which would otherwise occur. That is, if an organism is frozen with no preparation at all, there are often some cells in some organs which will survive freezing and thawing. With various procedures we can increase this survival rate considerably.

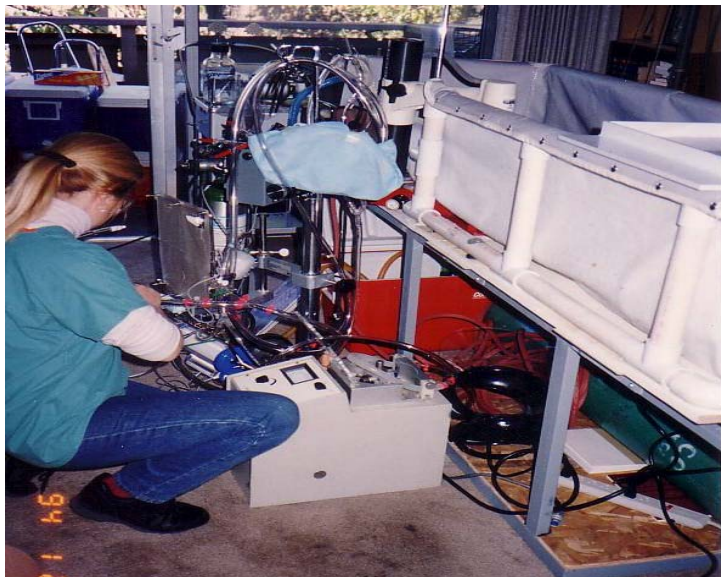
Also keep in mind that the experiments aimed at reducing freezing damage and to perfect suspended animation techniques have largely been done on healthy animal subjects. Cryonics must deal with clinically dead human beings. One researcher estimates that only about 30% of signed-up members will die under circumstances where their freezing may be improved by the interventive procedures which have come from this research. For the remaining 70% we simply do the best we can.

There are no guarantees that anyone frozen by current techniques will ever be reanimated. Obviously the people seeking such service are hopeful, and point out that there can be no assurances that reanimation will *not* occur. We'll have more to say on this subject when we take up our third topic: "Reanimation Day".

When "Deanimation" is Near

Although there are concentrations of ACS members in several metropolitan areas of the US, there are also ACS members scattered across the US and in several other countries. ACS makes use of both its own equipment and personnel, and contract companies (when available). The more warning of an impending suspension that we get, the better. Under some circumstances we may bring a preparation team and equipment to the location of the member. Other times it is only possible, or practical, to give instructions by phone to cooperating funeral directors. When a member knows that he or she is nearing death it may be preferable for the member to relocate so he or she is closer to an area where prompt preparation and freezings are more readily available.

When ACS knows that a member is likely to need our services soon, we maintain frequent contact with the member, his family, and medical support team.



When deanimation is near, suspension equipment is set up at hospitals, nursing homes or, as pictured, in the member's home.

Of course there are frequently circumstances where death occurs suddenly and unexpectedly. When this happens we have found that often our initial efforts must concentrate on getting a prompt release of "the remains" from the local medical examiner and to doing what we can to prevent or minimize autopsy.

Keep in mind that cryonics is still, very much, in its "pioneering" stage. There have been less than 100 people frozen, in all countries, from all cryonics organizations. With so few suspensions taking place, there is simply not the "market" to support the host of suspension personnel that we would like to have. It is most important that members who are in poor health and likely to need suspension services soon, work closely with us and keep us well informed of their situations.

A Pretty good Freezing

We have a detailed clinical case study of the preparation and freezing of Jerry White, a long-time ACS member and former President. This study can be accessed through our web page or we can provide it in printed form. There is a charge for the printed copy. This is a good example of how the procedure is applied when there is plenty of warning that death is imminent and where we have complete cooperation from the patient, his family, and friends. Please refer to the case study for all pertinent clinical details involving this patient, and the procedure. The following discussion is intended to give just the broad general outline as a guide for people who are entirely unfamiliar with cryonics procedures.

The patient, Jerry White, was a middle-aged man who was living in Northern California. He had been diagnosed with AIDS some years prior to death and had various complications of the immune system which had led to severe loss of weight, pulmonary complications,

and a general weakened condition. The initial preparations (following death) took place in the patient's home where he was undergoing home hospice care.

An Emergency Response (ER) team had spent many hours with Jerry just prior to his death. An ER team is made up of people prepared to start CPR and ice water cooling as soon after clinical death as is possible. Under the best of circumstances (as in this case) people are stationed at the patient's bedside. Jerry's good friend Margaret Bradshaw (also a cryonicist) had been designated by the patient as his Health Care Agent. Margaret also administered care and comfort to the patient during his home hospice period.

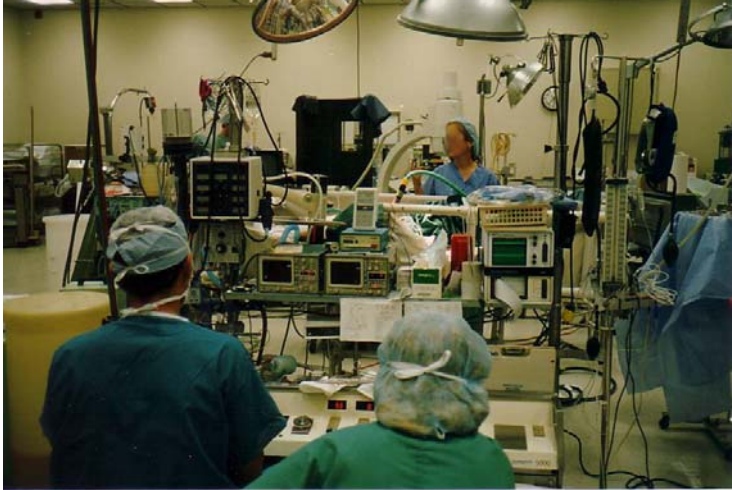


A procedure similar to bypass heart surgery is used to replace the patient's blood with a cryoprotective solution.

When the patient died, a physician was immediately summonsed to the home who then pronounced the patient dead. CPR with a "thumper" CPR machine and pure oxygen were administered in an attempt to maintain oxygen to the tissues (especially the brain). The patient was placed into an ice water bath in a specially constructed "bassinnet". Ice was packed around the patient's head. The ice water and ice were used to cool the patient. Heparin was injected into the circulatory system to retard the formation of blood clots.

As the patient was thus being cooled and oxygenated, cannulas were placed in his femoral artery and vein and a circulatory system "by-pass loop" established so an electrical pump could be used to replace the CPR machine. Thus the patient's blood could be pumped, oxygenated, and cooled, then sent back into the body to pick up another "load of heat". In this way the patient's body temperature was brought down very quickly.

As the patient was quickly cooled by the "extra corporeal" circuit the blood soon had to be replaced by a balanced salt solution (a physiological imitation of blood without the clotting properties of blood).



Suspension is a complex procedure that makes use of medical equipment similar to that employed at large city hospitals.

This particular patient was then packed in ice and quickly transported to a suspension facility for further treatment. In some applications the team might choose to do all procedures "in the field". Such decisions would depend upon factors such as the distance of the patient from a suspension facility.

At the suspension facility an operation similar to open-heart surgery was performed to enable the team to "perfuse" the patient by inserting cannulas where the circulatory system connects with the heart and then pumping increased concentrations of cryoprotective solution through the circulatory system. This is an attempt to get chemicals which have been found to help prevent freezing damage both around the cells (in all tissues) and through the cell walls.

When perfusion and cooling are completed, the patient then goes into a large insulated tub where a special oil (cooled with dry ice) is used to slowly cool the patient down to dry ice temperature (-79 degrees C.). Alternatively, an "air cooling" system may be employed for this phase. Either way, the patient is next placed into an insulated bag and secured in a metal "cocoon". Liquid nitrogen vapors are used to slowly cool the subject down to liquid nitrogen temperature (-186 degrees C.). After the cooling is completed, the patient is transferred to a large (nine feet tall) dewar (a dewar is an insulated tank) which is then filled with liquid nitrogen. There he will remain indefinitely with liquid nitrogen added on a weekly basis as it slowly "boils off".

In Jerry's case, since Jerry had decided upon a "neuro" suspension, just the head was cooled to liquid nitrogen temperature. About 5% of ACS members have chosen

this option for various reasons including economic ones. Such people believe that the "self" resides in the brain and the preservation of the brain alone should be sufficient. Future scientists causing a new body to grow around the old brain is one of the scenarios presented to support the "neuro" option. Please note that this option is not now available, except by special arrangement.

While we have had a number of suspensions where a very prompt response was possible which resulted in rapid cooling there are many examples where long delays and medical examiner intervention prevented perfusion and quick cooling. In many of these cases the patient had not been a member of ACS prior to death. Being enrolled in our suspension program is a good first step to increase the chances for a prompt suspension.

Since Jerry's suspension there has been research into a number of possible techniques that might provide a better suspension or long-term storage such as use of "ice blockers", nitrifications, storage at -130 degrees C., and various techniques to achieve quicker initial cooling. When and how these techniques can and should be applied, when the means to use such techniques are available at all, are complex questions for which there are no sure answers. Cryonic suspension subjects are research subjects* where the procedures used are NOT proven techniques, and where ACS must use its own best judgment to determine what treatments are most appropriate for any given subject.



Liquid nitrogen vapors are used to slowly cool the cryonaut who plays the waiting game in the fiberglass or stainless steel "cryostat".

The Waiting Game

There are no guarantees that anyone frozen by today's technology will ever be "reanimated." We cannot demonstrate that our procedures will lead to anything except frozen bodies. Even if the technological breakthroughs come about that would enable a

reanimation to take place, there are a host of possible problems which could prevent the application of that technology. For example, massive civil unrest or atomic warfare might make liquid nitrogen unavailable for a long period of time which would lead to patients being thawed.

A lot of thought and planning has gone into the system used to prevent accidental thawing. Procedures include periodic inspections and reporting on facility maintenance. We also rely upon the strict keeping of various filling and maintenance logs, and installation of electronic monitoring devices.



The safest place for cryostats may be underground. Underground vaults from reinforced concrete provide protection against many hazards.



Stainless steel high-vacuum cryostats may hold one cryonaut or as many as four. Liquid nitrogen fills up the cryostats.

There is also a lot of care taken to ensure that funds set aside to maintain patients indefinitely are not mismanaged or embezzled. ACS uses a number of internal safeguards, including designating a live member as the "sponsor" for each of our frozen members. The sponsor has the power to inspect any facility housing his charge and to review and monitor the investments made on behalf of the patients.

As a corporation with indefinite life, ACS may continue in existence for whatever time it takes to complete this grand experiment. However, we have also engaged in a fair amount of "fail-safe" planning so even if ACS should go out of business, our patients will remain frozen (with custody transferred to a new organization or company, and the trust funds and maintenance funds transferred). We also have a program in cooperation with the Cryonics Institute ("CI," an associated company) which allocates long-term maintenance resources between the two companies in such a way that both CI and ACS would have to go out of business before it was necessary to transfer care of patients to a third organization.

Reanimation Day

It could be that present research efforts will result in a procedure where reversible suspended animation is possible. Should that come about, then it will be possible to place a subject into suspended animation on one day, and to revive him the next day, next week, or next century. However, such procures would likely not help the people who had been frozen prior to those techniques being developed.

Some people with an optimistic viewpoint believe that disease and aging will be understood and eliminated before even the first cryonic reanimation. If so, then if our grand experiment works at all, we may look forward to indefinitely extended life in a healthy, young-looking body.

There is a great deal of discussion and speculation among cryonics advocates as to just what procedures will be found (if at all) to treat people frozen by today's techniques. It may be that future reanimation technicians will rely heavily on rebuilding and regrowing. By using the genetic code present in each cell it may be possible to re-grow or duplicate whole organ systems up to and including most of an entire new body. Cloning techniques, organ regeneration, and nanotechnology may interface in the reanimation process.

A key question which may decide how soon, if at all, patients can be reanimated goes to the nature of the "self" itself. Most informed people would agree that it may someday be possible to replace most of the organic material in a badly damaged "cryonaut". But how far can that replacement go before you have gone beyond repair or the person frozen and instead have created an entirely new person? It seems reasonable that everything except

the brain could be replaced with new organs and the person's identity would remain the same. Even most of the brain might go (excepting parts of the cerebral cortex and the cerebellum).

If the "self" is simply information (our memories) then the task becomes a good deal simpler. We need only devise devices to scan our brains and read memories (which are perhaps encoded in the positioning of neurons in relationship to each other), then reprogram a new brain with the old memories. Other cryonicists are uncomfortable with this "information" definition of self and think there must be more continuity of material.

Could such reanimation technology be so very expensive that we just can't afford it? Since we don't know what these techniques may be, we can't answer that question. Some people, who have given this subject a great deal of thought, have concluded that this technology will be very cheap. They point out that its first application will likely be to various medical problems of the living and the cost of development will be divided among many millions of "product units".



Here is what the cryostat vault looks like up close; a good neighborhood to wait for Valhalla.

Life among the Gods

Major retraining programs could well be needed before any of the "frozen-fogies" can adjust to life 100 or 200 years hence. However, there are some grounds for optimism here. Surely the techniques for re-educating will also advance considerably before that day.

Social isolation can have a negative impact upon the unfrozen, but we will always have each other!

Funds for such retraining will likely come from the fortunes of some of our more wealthy members who are endowing cryonics trusts or reanimation funds.

Finding Out More

"The Prospect of Immortality" and "Man Into Superman", both by R.C.W. Ettinger give the rationale behind the cryonics movement and speculate on what the future will be like. These are available through the American Cryonics Society and the Cryonics Institute.

Current Research on the Brain, as it pertains to cryonic reanimation, is featured in PERIASTRON, a publication by Dr. Thomas Donaldson. Subscription information as well as reprints of a number of recent articles are carried on the ACS web page.

An article by this author on how Funeral Directors can assist in the cryonic procedure is featured in the 1999 February issue of "The Director" a trade publication for funeral directors.

A good introductory paper with an excellent bibliography is: INTERVENTIVE GERONTOLOGY, CLONING, AND CRYONICS; RELEVANCE TO LIFE EXTENSION by Drs. Sternberg, Segall, Waitz, and Ben-Abraham as submitted to: Proceedings of the Conference on Biomedical Advances in Aging, Washington D.C., May 1988 (available through ACS)

A paper on the ethics of cryonics by Dr. Charles Tandy is available through ACS.

Nanotechnology as a method for reanimation is discussed in one chapter of "Engines of Creation" by K. Eric Drexler, Anchor Books, Doubleday, copyright 1986.

Nanotechnology as a technique for reanimation is also featured in articles on cryonics by Ralph Merkle, available on the ACS web page.

Alternative reanimation techniques, including "the Sherlock Holmes Computer" are presented in an article by this author published in the book "Being Human".

The Case Study on the suspension of Jerry White can be accessed through the ACS web page or a printed copy for \$25.00 from the American Cryonics Society.

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