

# CRYONICS

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# EDITORIAL MATTERS

The Institute for Advanced Biological Studies, Inc. has a new address: 4030 N. Palm Dr. #304, Fullerton, California 92631. Please use this address to correspond with CRYONICS. Phone co-editor Michael Darwin (Michael Federowicz) at (714) 990-6551. You may also correspond with co-editor Steve Bridge at 1720 N. Layman, Indianapolis, IN 46218. Phone (317) 359-7260.

The report on the K.V.M. suspension by Jerry Leaf in this issue was previously published in a much shortened form by Long Life Magazine. This is the first publication of the entire report.

Steve has recently had problems with Prudential Insurance Company in obtaining additional insurance for his suspension. If you have had similar difficulties with insurance companies or if you have found co-operative insurers for your suspension coverage, or if you just have opinions about life insurance and cryonics, we would like to hear about them, for possible use in a future CRYONICS article. Your experiences and knowledge may help others to avoid problems when they set up their suspension funding. We would also appreciate hearing from someone with insurance background and writing ability to help us prepare this article.

A correction from last issue: Michael Darwin's name was inadvertently left off as the interviewer of Curtis Henderson.

## A Response to our Readers:

Recently, the editors of CRYONICS have received criticism for publishing articles under pseudonyms. It is not our intention to deceive our readers; thus, these criticisms have caused us to re-evaluate our position on this matter and to make some changes.

First, let us state that we have published pseudonymous articles for what we thought were very good reasons. It is unfortunate that people within the cryobiological and medical communities are not more open-minded and tolerant of views that differ from their own. Apparently the standards of academic freedom and freedom of speech are preached more than they are practiced. Some of our contributors are working men and women in the medical/scientific community. In the past they have seen their colleagues censured or passed over for positions because of their involvement in cryonics. Some researchers have been forced to withdraw support for or participation in cryonics under pressure applied by the Society for Cryobiology or the medical community. So today, some of the people in cryonics who have important things to say cannot use their real names. They are compelled by threats to their continued employment to remain silent and to adopt positions of discretion which border on deceit.

Michael Federowicz: "I originally began using the name Michael Darwin in high school, when my parents received threats after my appearance on local television to speak about cryonics. I have since continued to use the name for my cryonics activities, partially to protect my job. As some one who has been informed that 'If your name becomes publicly associated with cryonics, this hospital will fire you. You are caring for dying patients and we want no conflict of interest,' I can attest to the fear and anxiety such a situation can produce. For me, the solution is to finally leave that job and find a place more tolerant. I have the option to do that. Some of the people who

have lent us generous support do not. Many of them have spent most of their adult lives preparing for a specialized career with limited employment opportunities. They have spent small fortunes for their educations and stand to make real contributions if they stay in their area of talent. For them, there is no simple way out."

In the past we have, when asked, published material under pseudonyms. We will continue to do so and will not provide the authors' real names; but from now on, all pseudonyms will be labeled as such, with an asterisk and a footnote. We will not use a pseudonym to cover the identity of a board member or business officer of any cryonics corporation. Michael Federowicz will continue to be referred to as Michael Darwin, out of several years' familiarity with the name, but his legal name will also be included.

The editors of CRYONICS are aware that our credibility is strongly dependent on our honesty. We have editorialized in the past that credibility is perhaps the major need of cryonics today. We apologize to our readers for any loss of our credibility which may have been caused by our use of pseudonyms or other material designed to protect someone's identity. We hope that a possible change in scientists' attitude toward cryonics will someday allow more of our colleagues to step forward.

Michael Federowicz  
a.k.a. Michael Darwin  
and Stephen Bridge,  
Co-Editors.

BOOK REVIEW by Thomas Donaldson, Ph.D.

Zeliser V.A.R., MORALS AND MARKETS, Columbia U. Press, N.Y., 1979.

This book is a history of life insurance in the United States written with a view towards discovery of exactly which factors changed so as to allow the practice of insuring lives to grow up to its present importance. Of course immortalists may not immediately see its relation to any of their concerns; let's discuss some of this history and perhaps we will see.

In 1977, the US had two trillion dollars worth of life insurance in force, and in 1977 alone Americans bought 360 billion dollars worth of insurance. The first life insurance company in the US was organized in 1759 by the Presbyterian Synods of New York and Philadelphia, but despite strenuous attempts by its founders failed to write any policies and was discontinued. Many other attempts were later made: a total of 29 life insurance companies were chartered between 1759 and 1799, but by 1800 there were not more than 100 policies in force in the whole of the United States. The Life Insurance Co. of North America, founded in 1794, only succeeded in writing 12 policies and dropped the business in favor of others by 1817. The Union Insurance Company, founded in 1818, never sold more than 12 policies, and these were to its own officers and directors. In 1815 US courts still were debating the legality of a life insurance contract. It was only in the 1840's, EIGHTY YEARS after the first attempt, that life insurance policies sold in any numbers, and when they did so the business boomed: from 1845 to 1850 life insurance grew more rapidly than any time since, marking a 571% increase in those five years.

By this time any immortalist reader even dimly concerned with cryonics will feel a very strong sense that they have seen all this before, somewhere. Let's pursue the matter still more. It seems that in 1800 "it was regarded by many good people as wicked to insure their lives". Even in 1853 the New York Times, true to its long tradition of reactionary policies (remember their attitude to Goddard?) was editorializing: "He who insures his own life or health must be the victim of his own folly or others knavery." In 1871 one of the early life insurance agents, writing about those days, reported, "It was exceedingly difficult to attract attention or excite interest in the minds of that class of persons for whom its benefits were intended." I hope that readers can now see the intimate connection there is!

If we really want to understand what happened, we can examine some of the books and pamphlets written against insurance. George Albree, *The Evils of Life Insurance* comes to mind. We can also examine the role of religious maniacs; the two are closely connected. It seems that in the 18th Century many good churchgoers vehemently opposed even the taking of censuses, on the grounds that human life was so sacred that to count it would be impious. Life insurance, of course, led these people to foam at the mouth. To take out life insurance which would be payable to one's family if one should die (of course the main purpose of life insurance) would usurp God's divine function of protection. Widows were told to dwell on the power of God. Religious people refused insurance, feeling that it was "an impious institution that they dared not countenance for fear of perpetrating some unpardonable sin". One religious is quoted: "We believe Satan never fitted so keen and sharp-pointed an instrument to pierce the soul of a saint as LIFE INSURANCE.". A prominent revivalist of the 1840's, Elder Swan, sermonized against life insurance. A German Lutheran pastor is quoted as boasting: "While I am a pastor in this church, none of my parishioners shall carry life insurance". In 1899 a Conference of Lutheran Ministers condemned life insurance.

If, of course, these gentlemen had matched their condemnation of life insurance with active provision for the widows and children of those parishioners who had followed their advice, their attitudes might have been comprehensible. No, there was no such activity. Instead it was argued that widows and children might derive a positive benefit by being deprived of their husband and livelihood: "In God's governance, the loss of the head of a family may be blessed to many of the members, may force them into habits of industry and economy, and may induce them to give up practices which were injurious to spirit, soul, and body". Anyone concerned with cryonics will recognize a lot of this; while it may be true that not all religious people oppose cryonics, we don't have to look far to find many religious people who do.

Even the emotional response to life insurance reminds us strongly of cryonics. An early trade publication, printed while life insurance was in its early stages but long after the initial period of 80 years of failure, *American Life Insurance Magazine*, reported that: "As a general thing parties having property to insure ... required little solicitation ... merchants, manufacturers, or storekeepers did not require to be hunted up, repeatedly visited, or earnestly importuned ... . In too many instances the life insurance agent had months and years of unremunerative toil to perform, before he could prevail upon the father of a family to insure his life." People to whom life insurance was suggested showed a strange belief that insuring their lives would cause their death shortly thereafter (this should really sound familiar! how many times have we met people who seem to believe that arranging for their cryonic suspension will cause their instant death?).



Why did life insurance take so long, and what had changed to make it possible? Zeliser really comes to no firm conclusion. She gives strong evidence that the change was not economic: life insurance caught on by 1800 in England, economically comparable to the US, and Trustee Companies flourished by that time even in the US. Life insurance publications suggest that it was the system of Agents which caused the increase: the life insurance agent acted as a paid missionary, and most of them showed real moral fervor in their cause. Yet life insurance *did* do better in England, even without agents. My own suggestion would be that people finally figured out that death was not something to be ignored as beyond control, but something which they could deal with, at least for its consequences to their families. To get people to understand that something about which they care deeply, and over which they have never exercised any control, can in fact be controlled is quite hard. They deal with the problem by ignoring it, and strenuously attempt to ignore the least attempt at discussion. Most of the stock objections to cryonics fit this pattern well: they ask about earthquakes, civil commotions, nuclear wars. Their underlying claim, of course, is: it's all beyond my control, I can do nothing to affect my fate. Allah will decide. Even today, long after life insurance has become widespread, people show much the same response as 100 years ago: a 1973 survey found that most people were relatively uninformed about life insurance and showed no interest in voluntarily acquiring further information; to admit a lack of understanding of life insurance in many circles is still today thought quite acceptable. Similar admissions of inability to understand real estate, or perhaps an inability to read, would evoke shame. Even in 1973 many people were complaining that life insurance contracts were incomprehensible: well, I've read mine and don't find it hard! The problem is that of a strenuous attempt NOT to learn about a subject, not just a problem of simple ignorance.

In some ways cryonics is better place now than insurance was then, and in some ways worse. An insurance company which fails to write enough policies cannot pay out to its customers on death; cryonicists have the benefit of life insurance companies, so that even a small cryonics group (the officers and directors of the company!) can arrange to pay for their own suspension. On the other hand, cryonics requires a good deal more investment by the companies and more care on the part of the customers if it is to be done well: equipment must be available, and the customer must be willing to ACTIVELY arrange to be near this equipment at the time of deanimation.

What Zeliser may do for a reader, most of all, is to give some historical perspective. Because a cryonics society can use insurance for funding, we can arrange for our own suspension; but if it took 80 years for life insurance to catch on, we cannot be surprised to see the same delay in cryonics. Of course life insurance did in the end prevail, fundamentally because it was a better way of dealing with the problem of death than going into a religious psychosis. In the same way, cryonics will prevail; but just like life insurance, cryonics will require prolonged and unremunerative toil on the part of many nameless people.

REPORTS BY THOMAS DONALDSON, PHD.A STUDY OF BEHAVIOR IN HEART ATTACK PATIENTS

All of us want to be cryonically suspended rather than buried. At the same time we can hardly fail to notice the really large numbers of people who may have expressed some passing interest in cryonics but who nevertheless made no preparations and ended up rotted or cremated. Exact reasons for this are hard to find; however a recent study of how patients behave when showing symptoms of heart attack will give a careful immortalist reader a lot to think about on behavior under this kind of stress.

AA Alonzo, a sociologist, writing in MEDICAL CARE (18 (1980) 297) reports his results in an extensive study through interviews of 1102 heart attack patients or their survivors of how they behaved when first experiencing their symptoms.

The average total time needed for a decision to seek medical care was 75 minutes. Patients made a large variety of decisions as to exactly which kind of medical care to seek, from consultation with a doctor to immediate calls for emergency cardiac care. Quite often, the relatives or bystanders intervened in this process and the final decision to seek help was made not by the patient but by these other parties.

A full discussion of Alonzo's results cannot be made briefly, since they were quite extensive. I believe that they will repay study by anyone who seeks to maximize their chances of suspension, especially since heart attacks or sudden cardiac arrest constitute by far the most significant cause of suspensions in poor conditions. In particular, our risk of dying from sudden cardiac arrest considerably exceeds our risk of dying by accident. One of the more interesting facts which Alonzo presents concerns the circumstances by which emergency cardiac care was required. Most often, this happened when bystanders, who were NOT relatives, took control of the patient and called for it at a time when the symptoms of heart attack both appeared suddenly and were incapacitating. The main reasons why relatives dealt with the problem less well appear to be not so much a deliberate attempt to do in someone who might leave then an estate, as rather that more than bystanders, who were less related to the victim, relatives were more likely to be too emotionally involved and unable to act effectively in a crisis. Among other points, relatives may be less able than bystanders to seek care despite requests by the patient not to do so.

Alonzo makes several recommendations about factors we might deal with by educating the patient and his or her associates. He suggests specifically that patients should be told to respond to symptoms of heart attack especially if they occur at "awkward" times, such as at work or in the middle of the night, and that a special hospital should be established to deal with enquiries and calls at such times, publicly known to be there precisely for that purpose. For cryonicists this latter suggestion may mean that a cryonics society may wish to be set up to take such calls from its members and summon appropriate help 24 hours a day. Trans Time, Inc, as part of its monitoring system, maintains a 24 hour telephone service; this might be publicized more vigorously and cryonics societies not served by Trans Time might seriously consider establishing their own service of the same kind.

Significant problems both with heart attacks specifically and with common responses to impending death still exist. For heart attacks, in particular, Alonzo's study corroborates many other studies (cf SL Tjoe CHEST 61 (1972) 617 and others) which show that patients with a previous history of heart attacks will actually respond more slowly and less effectively to cardiac emergencies than others who may experience a heart attack for the first time. More generally, the importance of bystanders in a situation in which someone must be suspended may help to explain why many cases arrive for suspension well after deanimation. Bystanders will be unable to take control in such a situation; the symptoms that the patient may soon die will be consistently ignored and minimized by the patient; the patient's relatives will prove unable to respond. Especially in the present situation of public apathy or even hostility to cryonics, such patients are likely to rot unless nearby cryonicists can take action and the patient has specifically authorized this long ago by means of documents such as Powers of Attorney. I believe also that this characteristic denial and ineffectuality when faced with a heart attack might give us a partial explanation for the very common nonimmortalist reaction to the problem of death in general.

#### A COURT CASE OF INTEREST FOR CRYONICS

Every cryonicist should understand clearly that the legal cases recently on the theme of the "definition of death" apply only to a very small percentage of cases, and traditional customs for ritual declaration of death are followed in almost all cases, even now. Nevertheless a recent case reported in the NEW ENGLAND JOURNAL OF MEDICINE (October 19, 1980, p876) does have some relevance for cryonicist, particularly in terms of provoking thought about countermeasures.

The story behind this case is simple. A religious brother, Brother Joseph Fox, from Chaminade High School in Mineola, NY, entered Nassau hospital for a routine hernia operation. He was 83 years old, and so might be expected to be in poor and frail condition; in the course of his operation, his heart stopped, and despite considerable efforts to revive him he had sustained so much brain damage that he had to be placed on a respirator if any other part of him were to survive. His guardian, the Superior at Chaminade, asked hospital officials to remove him from the respirator, but they refused, arguing that to do so would legally constitute murder.

Their argument lay not in the condition of Brother Fox, who quite clearly had sustained the so called "irreversible brain damage", but in the state of the law. Brother Fox's Superior, as his guardian, then sought a court order for them to remove him from the respirator. The Nassau County District Attorney, Denis Dillon, had previously stated that anyone who disconnected a respirator might be prosecuted for murder, so hospital officials were obviously playing safe.

The New York Supreme Court then ruled that Brother Fox, particularly as he had repeatedly stated that he did not want to be put on a respirator, was entitled to decline treatment and therefore that the respirator could be removed. But this turned out to be far from the end of the story. District Attorney Dillon then appealed this ruling; the Appellate Division of the NY

State Supreme Court (please bear with us while the legal system slowly grinds the remains of Brother Fox to dust!) then replied that Brother Fox was indeed entitled to decline treatment, but that a complex and expensive medical and legal procedure was needed for him to do so: this procedure required the certification of 4 to 6 doctors, 5 lawyers, and one judge, that the patient was indeed in an "irreversible permanent vegetative state".

The argument of the Court in favor of this procedure was that it was needed to protect the rights of the patient (the rights of the lawyer's wallets were not mentioned, though they may have played a crucial role!). The cost of this unsought protection of rights came to \$107,000.

Legal battles in the Fox case still continue and it remains unclear whether or not this judgement will bind anyone in New York in future. The interest of this case for cryonics consists of the fact that it highlights the need for us to make arrangements dealing precisely with those cases in which we become incapacitated. The Fox case is only a horrible example. Placement on a respirator is very rare, but \$100,000 is far from trivial, it may mean the difference between suspension and rotting. Our estates, including every penny which we have devoted to our suspension, might very easily vanish in the period of our incapacitation. Furthermore, even though rare, placement on a respirator in conditions in which recovery is unlikely is a disaster for preservation of the brain. The condition called "respirator brain" is well known to neurologists: the brain, receiving no blood flow even though the rest of the body may, necrotises and only thin layers of neural tissue survive.

The major countermeasure a cryonicist might take to the specifically FINANCIAL problems which such action may cause is to establish a trust in favor of his or her cryonics society containing all the money needed for suspension and set up so as to pass to the cryonics society in the event of his incapacitation rather than merely his death. Cryonicists might also, of course, arrange the trust so that control reverts to them in the event of their recovery, but the trustee must, by the nature of the situation, have power to obtain complete ownership of the money involved. Refusal to pay for any further maintenance on a respirator might help to bring officials to their senses, so long as it was effective. The legal problem, of how to get us off the respirator if we happen to be on, is harder, but would be considerably helped by explicit written statements by ourselves, with witnesses, that we don't want such treatment and our appointment of an Attorney who will act as our guardian.



CASE STUDY: K.V.M. SUSPENSION by Jerry D. Leaf

### INTRODUCTION

Every case encountered in medical practice has its stamp of uniqueness, and so it is to be expected that every case of cryonic suspension will also be unique. It is hoped that each reported suspension case will provide helpful information to others, but equally important, that these reports will stimulate thinking beyond actual experience to possible problems in future suspensions.

The suspension patient, Mrs. K.V.M., was a suspension member of the Bay Area Cryonics Society (BACS). Suspension arrangements were completed prior to clinical death. When I was advised of K.V.M.'s suspension status, she was in a community hospital being treated for chronic liver disease, etiology unknown. A nursing supervisor at the hospital agreed to co-operate in undertaking recommended emergency procedures in the event of her death. However, K.V.M.'s condition improved and she was discharged from the hospital as an outpatient.

K.V.M. lived alone, but was visited daily by a close relative. The relative had to leave town for a short business trip, and when he returned on November 3, 1978 he was informed that K.V.M. had just died. She died late at night, so that even if daily contact had been continued, it probably would have been hours before she would have been found. This points up the need for biomedical monitoring systems for suspension patients in similar situations. It is the weak link in an otherwise well designed emergency network. Fortunately, most people today are in a clinical setting when they have medical problems even when there is an unexpected problem, due to the paramedic services presently available.

The technology is available for physiologic monitoring of patients in the home environment. Pulse transducers with built-in transmitters for activating automatic telephone dialers are needed. If such a system can be purchased, it would be advisable that cryonics organizations purchase them for lease to suspension patients.

I was able to get an abbreviated medical history in a telephone conversation with K.V.M.'s relative prior to the suspension procedure. After the suspension, we requested the relative acquire the complete medical records, including x-ray films, for K.V.M.'s suspension file. We have not received these records to date. I would like to emphasize the importance of acquiring medical records for each person who has made arrangements for cryonic suspension. The medical history has a direct bearing on the choice of surgical sites for perfusion and can be an invaluable aid to interpreting problems that arise during the course of a suspension procedure. Every Suspension Member should insist that a copy of his medical records be kept on file by the cryonics organization responsible for his suspension. The importance of these records to a future medical team attempting reanimation can only be guessed at, but we can be sure that they will contain invaluable information.

MEDICAL HISTORY

K.V.M. was a female, caucasian, age 65, weight about 73 kg., height about 1.73 meters. Until 1963 her medical history was uneventful, at which time she underwent a laparotomy procedure for removal of an ovarian cyst. No other surgical procedures are known to have been performed. In 1973 she developed diabetes, possibly the lipoplethoric type, and was placed on regular insulin maintenance. The diabetes was easily controlled. In 1978 she was admitted to the hospital for evaluation and found to have a chronic liver disease, with probable hepatohemilia. Exploratory surgery was ruled out, due to a coagulopathy in which her clotting capacity was subnormal, making any kind of surgery dangerous. While in the hospital she developed phlebitis and swelling of her lower extremities, with secondary infection. Her condition was brought under control during her hospitalization and she was released to continue recovery at home. She was placed on a special diet, but was receiving no regular medication. She had prescriptions for Dalmane (insomnia) and Valium (tranquillizer), to be used as needed. She was psychologically depressed by her health problems. She seemed to be in a stable condition until the time of her death.

Mrs. K.V.M. fell unconscious, on her front porch late at night. She was not discovered for several hours. The ambient temperature was -1 degree C. She was transported to the hospital where she was pronounced D.O.A. (dead on arrival). The cause of death was given as coronary occlusion. She was kept in a refrigerated room at the hospital until arrangements were made for her transport to Los Angeles, California, packed in ice. She was picked up at the Los Angeles International Airport and brought to the suspension facility in Fullerton.

SURGICAL PROCEDURE

The operating table (1) was padded using an egg crate foam rubber pad (2) to eliminate pressure occlusion of peripheral circulation. The O.R. table was moved to a position adjacent to the Ziegler case and the patient lifted out and transferred to the O.R. table. The body was covered with ice bags, zip-lock type (3), which minimize the thickness and weight of the ice pack. Chipped ice was used to reduce the possibility of pressure points that would be created by cubed ice. The head was placed in a three sided plastic container (4), without a top, to insure the ice packs about the head were not displaced. Esophageal and rectal thermistor temperature probes (5) were placed and temperatures monitored on a Yellow-Springs meter (6). The O.R. table was moved into the operating theater.

Since no pre-treatment transport protocol had been used, the possibility of intravascular coagulation was considered in the choice of operative approach (7). A median sternotomy approach was used to maximize access to the major vessels. The chest and abdominal areas were prepped using a disposable surgical prep kit (8) with an iodine based prep solution. The surgical team scrubbed (9), gowned (10) and gloved (11). The sternal operative site was defined by draping with sterile towels (12) and an adhesive skin drape (13) was placed over the sternum. A cardiac drape (14) was placed over the patient, extending to the anaesthesia screen at the head, down over the feet and down over the sides at least 24 inches below the operative field.

The incision was made over the midline of the sternum with a #10 scalpel blade (15). Fascia and connective tissue were cleared down to the sternum. A median sternotomy was accomplished with a Stryker oscillating sternal saw (16). The edges of the sternotomy were padded with laparotomy sponges, a self-retaining retractor placed, and the sternotomy retracted open. Blunt and sharp dissection was used to expose the pericardium. The brachio-cephalic vein was so obscured by fat and connective tissue that it was inadvertently cut into. As a temporary repair we placed #2 silk ties (17) proximal and distal to the veinotomy. A 2 cm. long piece of 1/4" ID tubing was inserted into the vein. This temporary repair would allow venous flow through the brachio-cephalic vein during the course of the perfusion.

A ventral midline pericardiotomy was made using Metzenbaum scissors. Four stay sutures of 3-0 silk (18) were placed in the margins of the pericardiotomy. These sutures were tied to the sternal retractor, thereby reflecting the pericardium away and exposing the heart and aorta for cannulation. This technique creates a pericardial cradle that helps stabilize the heart. A Sarns cardiomy sucker (19) was used to suction away the pericardial fluid.

An aortic clamp was placed on the ascending aorta for partial occlusion. A 3-0 Ticron (20) purse string suture was placed in the aorta and a snare (21) applied. An aortotomy was made with a #11 scalpel blade (22). A 22 Fr. aortic perfusion cannula (23) was filled with Normosol (24) and a tubing clamp placed on the distal end. The aortic clamp was removed and the aortic cannula introduced into the aorta. The cannula was snared in place with a hemostat. A Satinsky partial occlusion clamp was placed on the right atrium, just below the apex. A purse string suture of 2-0 Ticron (25) was placed in the atrium and a snare tube applied. An atriotomy was made by removing the apex of the right atrium with Metzenbaum scissors. Single cannulation was used to save time, using a 40 Fr. venous return cannula (26). A tube clamp was placed on the distal end and the cannula introduced into the right atrium through the atriotomy, as the Satinsky clamp was removed. The venous cannula was snared in place with a hemostat and secured with umbilical tape (27). A third, small, purse string suture of 5-0 silk (28) was placed in the left lateral aspect of the ascending aorta and an aortotomy made with a #11 scalpel blade. A 3-way stopcock (29) was fitted to an Aloe arterial pressure monitoring catheter (30). A snare (31) was placed on the 5-0 suture, the Aloe catheter flushed with Normosol, then introduced into the aorta and snared in place.

The sterile perfusion tubing (32) was brought up to the surgical field and secured in the Travenol tubing holder towel clamped to the drapes. The arterial-venous loop (see circuit diagram) of the perfusion circuit was clamped and divided by cutting out the 1/2"-3/8" adapter with Mayo scissors. A connector with stopcock (33) was used to attach the 1/2" ID venous return line to the venous cannula. Air was cleared from the system with a 100 cc. glass syringe. A 3/8" ID connector was used to attach the arterial perfusion system with a syringe. An 8 ft. pressure monitoring line (34) was fitted to the arterial pressure catheter, flushed with Normosol, and handed off the field to be connected to the pressure transducer (35), (36). The perfusion process was now ready to begin.

No Phase 1 perfusate was used because the core body temperature was already low enough for introduction of cryoprotective agents and further delay was not warranted. All perfusates were prefiltered through a clean 0.2 micron Pall filter (37) and passed through a sterile 0.2 micron Pall filter in line from the clean perfusate reservoir to the sterile perfusate reservoir (38). Each pass of the perfusate was precirculated for cooling before perfusion. Arterial line perfusate and venous line effluent samples were taken at the end of each phase of perfusion for osmolality, onconicity and refractometer determinations (see data).

The perfusates were mixed as 5%, 10% and 15% DMSO v/v concentrations (see perfusate composition). Staged increase of DMSO concentration is used to prevent osmotic shock. Perfusion with the first reservoir of 5% DMSO perfusate was begun. Poor venous return was noted at this time and it soon became obvious that the abdomen was distending. Perfusion was temporarily terminated and an examination of the abdomen clearly indicated fluid in the peritoneal cavity. Examination of the diaphragm showed compression of the inferior vena cava at the point where it passes through the diaphragm. The compressive force was due to the weight of the fluid in the peritoneal cavity. The single venous cannula in the right atrium was removed. Venous cannulas (39) 26 Fr. and 32 Fr. were introduced into the superior and inferior vena cavae, respectively. This would allow separate monitoring of inferior and superior venacaval drainage. The superior cannula was introduced through an atriotomy in the atrial wall and snared in place, after placement of a second purse string suture. The inferior caval cannula was introduced through the original apical atriotomy and advanced to the diaphragm, but could not be advanced beyond. This demonstrated the complete occlusion of the inferior cava at that site.

At this time it became necessary to decompress the inferior vena cava by removing fluid from the peritoneal cavity. The cardiomy suction tip was introduced into the peritoneal cavity through a stab wound made in the upper right quadrant of the diaphragm with a #11 scalpel blade. A large volume of fluid, mostly blood, was suctioned from the peritoneal cavity. An estimated 2.0 to 3.0 liters of blood was removed. This blood volume represents 1/2 to 2/3 of the patient's total calculated blood volume. We can only speculate that either K.V.M.'s fall caused a massive intraperitoneal hemorrhage, or the hemorrhage precipitated the fall. The hemorrhage probably resulted in the expenditure of clotting factors at that site, which explains why we observed no sign of intravascular coagulation. The degree of hemorrhage was probably determined by her coagulopathy - as well as the severity of the lesion.

The inferior vena cava was successfully decompressed and the inferior venous cannula easily passed beyond the diaphragm and snared in place. The venous cannulas were connected to the venous return line with a Y-connector with stopcock (40), and air cleared with a syringe. Reinstitution of perfusion showed good venous return from both superior and inferior vena cava cannulas. However, continued accumulation of perfusate in the peritoneal cavity indicated we should keep it drained during the course of the perfusion. To accomplish the latter, without intermittent use of the cardiomy sucker, a 22 Fr. (41) venous cannula was introduced through the diaphragm and connected to the general venous return line by use of an additional Y-connector (see circuit diagram). Continued perfusion showed good venous return, and slow clearance of the peritoneal cannula indicated a hemorrhage site somewhere on the venous side of the vascular system. As stated previously, the probable site of the lesion was thought to be the hepatic system, from her medical history. I considered doing a laparotomy to identify the specific site of the lesion and do a repair, but decided the expenditure of time was not justified as long as we were able to provide adequate perfusion.

Perfusion continued with 5% DMSO concentration. A total of 10 liters of 5% DMSO perfusate was delivered with a peak arterial pressure of 65 mm. Hg and a peak pump flow rate of 1.7 liters/min. Ten liters of perfusate having 10% DMSO concentration followed, with a peak arterial pressure of 90 mm. Hg and peak pump flow of 2.5 liter/min. The final portions of the perfusion procedure consisted of 40 liters of perfusate with 15% DMSO concentration. A peak arterial pressure of 50 mm. Hg with an average pump flow of 1.5 liters/min. was used. The perfusate temperatures ranged from 4 degrees C to 8 degrees C with an average of 6 degrees C. Near the end of the perfusion it was evident that the tissues were taking up perfusate, as evidenced by a general appearance of edema. The degree of edema could not be quantified; however, it never reached the stage that it interfered with perfusion. Edema can be related to the condition of the vascular bed as a result of the circumstances of death. The skin had the typical coloration seen after DMSO perfusion. No problems with intravascular coagulation were encountered, and perfusion of a total of 60 liters of perfusate was completed.

The venous and arterial cannulas were clamped with tube occluding forceps. Snares were removed from the inferior and superior vena cava cannulas. As each cannula was removed, the corresponding atriotomy was closed with the purse string suture and tied. The same procedure was used to remove the arterial perfusion cannula and the diaphragm was closed with 2-0 Ticron. The tubing was removed from the brachio-cephalic vein, and distal and proximal ends were closed with Weck clips (42). Seven sternal wires (43) of 22 ga. stainless steel were used to close the median sternotomy. The skin was closed with 2-0 Ticron on a cutting needle (44). the suture line was protected by a spray-on plastic bandage (45) by Parke-Davis. The pump tubing was removed from the surgical field and the surgical drapes removed from the patient.

Two copper-constantan temperature probes were placed, one in the esophagus and a second at the feet. Temperature probes were secured with umbilical tape. An Ace bandage wrap served to keep the arms close to the torso. The ice packs were removed and the patient placed in double polyethylene bags (46). The temperature cables - esophageal and rectal thermistor, and esophageal and foot copper-constantan - were brought out of the opening of the bags and the bags sealed.

The patient was placed in a polyurethane insulated container with isopropyl alcohol pre-cooled to 2 degrees C. Dry ice and alcohol were gradually added to lower the bath temperature to -79 degrees C. When rectal temperature reached -72 degrees C. the alcohol was removed and the patient completely covered with dry ice and a layer of insulation. The insulated container was sealed and shipped by air to the Trans Time facility in Emeryville, California, where the patient was placed in LN2 capsule storage at -196 degrees C.



### RETROSPECTIVE

The KVM suspension presented us with some unique problems which we were fortunate to correctly analyze and solve. However, one can always see room for improvements, in retrospect. Anatomical variations can always lead to errors, such as accidentally cutting into the brachio-cephalic vein, which was obscured by a heavy layer of connective tissue. In the future I would be inclined to do a laparotomy if there is any perfusate leak in the peritoneal cavity. This would insure that no arterial lesions are present.

In the future I would like to take biopsy samples that would be representative of strongly and weakly circulated tissues, to determine the uptake of cryo-protective agent. I am also trying to acquire a fluoroscopy unit so we can use dye injection techniques to view the vascular distribution of perfusates during perfusion. This will allow us to select the minimum necessary arterial pressure required for good perfusion of the entire vascular bed, or determine if any areas are underperfused.

The samples of arterial perfusate were taken from the vent port of the arterial line filter. Unfortunately, an analysis of these samples indicated that significant quantities of 5% and 10% DMSO perfusate remained trapped in the filter. Therefore, our 10% and 15% DMSO perfusate samples represented mixed rather than discrete samples. Without definitive arterial samples to compare to our venous effluent samples, we are unable to make a reasonable estimate of DMSO uptake in the tissues. In the future we will collect arterial samples directly from the arterial line.

REFERENCES

1. Operating table, Scanlan, Type A4000.
2. Eggcrate pad, Bio-Clinic, Catalog No. 3574E.
3. Ziploc bags, plastic, Size 26.8 cm x 1.75 mil, Dow co.
4. Plastic box (3 sides), Rubbermaid, Catalog No. JDI 2969.
5. Esophageal and rectal thermistor temperature probes, Yellow Springs Instruments, Model 401.
6. Tele-Thermometer, Yellow Springs Instruments, Model 42SL.
7. "Cryonic Suspension of Sam Berkowitz: Technical Report", LONG LIFE MAGAZINE vol. 3, no. 2, March/April, 1979.
8. Disposable surgical prep kit, Desert Pharm. Co., Cat. No. 212.
9. Disposable scrub brush, E-Z Scrub, Desert Pharm. Co., Cat. No. 4103.
10. Disposable surgical sterile back gown, Tekna-Med, Cat. No. 4103.
11. Disposable surgical gloves, Triflex, Travenol Labs., Size 7 Cat. No. 2D7153, Size 7 1/2 Cat. No. 2D7154.
12. Disp. surgical towels, Tekna-Med, Texas Medical Products, Cat. No. 0035.
13. Plastic adhesive skin drape, Vi-Drape Surgical Film, 24" x 22", Parke-Davis, Cat. No. 30-1056-12.
14. Disp, cardiac pack, Tekna-Med, Texas Medical Products, Cat. No. 0001.
15. Scalpel blade #10, Bard-Parker, Cat. No. 1110.
16. Sternal saw blade, Stryker, Cat. No. 1101.
17. #2 silk ties, 2x60", Davis & Geck, Cat. No. 1037-81.
18. 3-0 silk, Deknatel, Cat. No. 743.
19. Cardiotomy suction tip, Sarns, Cat. No. 9999.
20. 3-0 Ticron, Davis & Geck, Cat. No. 3085-41.
21. Snare tube (5 cm long piece), All Purpose Catheter, 18-20 Fr., Davol, Cat. No. 9419.
22. Scalpel blade #11, Bard-Parker, Cat. No. 1111.

23. Aortic perfusion cannula, 22 Fr., Type 1966, USCI, Cat. No. 007195.
24. Normosol-R ph 7.4, Abbot Labs., Cat. No. 1570 (or use normal saline).
25. 2-0 Ticron, double armed, T-S needle, Davis & Geck, Cat. No. 3192-51.
26. Venous cannula, 40 Fr., Type 1967, USCI, Cat. No. 007215.
27. Umbilical Tape, 2x30", Davis & Geck, Cat. No. 731.
29. Pharmaseal 3-way stopcock K-75, American Hospital Supply, Cat. No. 17108-010.
30. Aloe arterial pressure catheter, 15" long, Argyle, Cat. No. 8888-153213.
31. Small snare tube (3 cm. piece), All-Purpose Cath., Davol, 10 Fr., Cat. No. 9140.
32. Tubing, all Tygon S-50-HL except pump shoes of Dow Corning Silastic.
33. Connector, straight 1/2" ID with Luer-lok port, Cobe Labs., No. 50-608.
34. Pressure monitoring line, 8 ft., Cobe Labs., Cat. No. 40-108.
35. Pressure transducer, Statham Instruments, Model P23db.
36. See pressure monitoring system diagram.
37. Pall filter, Ultipor DFA, 0.2 micron, Part No. DFA 3001 ARA.
38. Oxygenator, Temptrol, Bentley Labs., Model Q-100.
39. Venous cannula, 26 Fr., Type 1967, USCI, Cat. No. 007208; and 32 Fr., Type 1967, USCI, Cat. No. 007211.
40. Y-Connector with Luer-lok port, Bentley Labs., Cat. No. C345S, and a 3-way stopcock, Cobe labs., Cat. No. 41-210.
41. Venous cannula, 22 Fr. Type 1967, USCI, Cat. No. 007206.
42. Weck clips, Hemo-Clip, Weck Co., Cat. No. 523-170.
43. Sternal wires, 22 ga., Davis & Geck, Cat. No. 2420-09.
44. 2-0 Ticron, cutting needle, Davis & Geck, Cat. No. 3092-51.
45. Spray bandage, Aeroplast Dressing, Parke-Davis, Cat. No. 30-5268-1.
46. Plastic bags for suspension patient, 30" x 90" x .00125" and 38" x 90" x .003" polyethylene, More Plastic Bags, custom made (36" x 90" x .006" EVA bags are now used).

## KVM SUSPENSION

JERRY D. LEAF

### CREDITS

The members of the Trans Time Suspension Team deserve the highest praise for their efforts, which made this a successful perfusion. To my knowledge, there is no more capable suspension team anywhere in the world.

Paul Genteman	1st Assistant Surgeon
Betty Leaf, LVN	Scrub Technician
Fred Chamberlain	Perfusionist
Laurence Gale	Physiologic Monitoring
Reg Thatcher	Physiologic Monitoring
Hugh Hixon	Laboratory Technician
Virginia Jacobs	O.R./Lab Assistant / Circulator
Bill Jameson*	Perfusionist

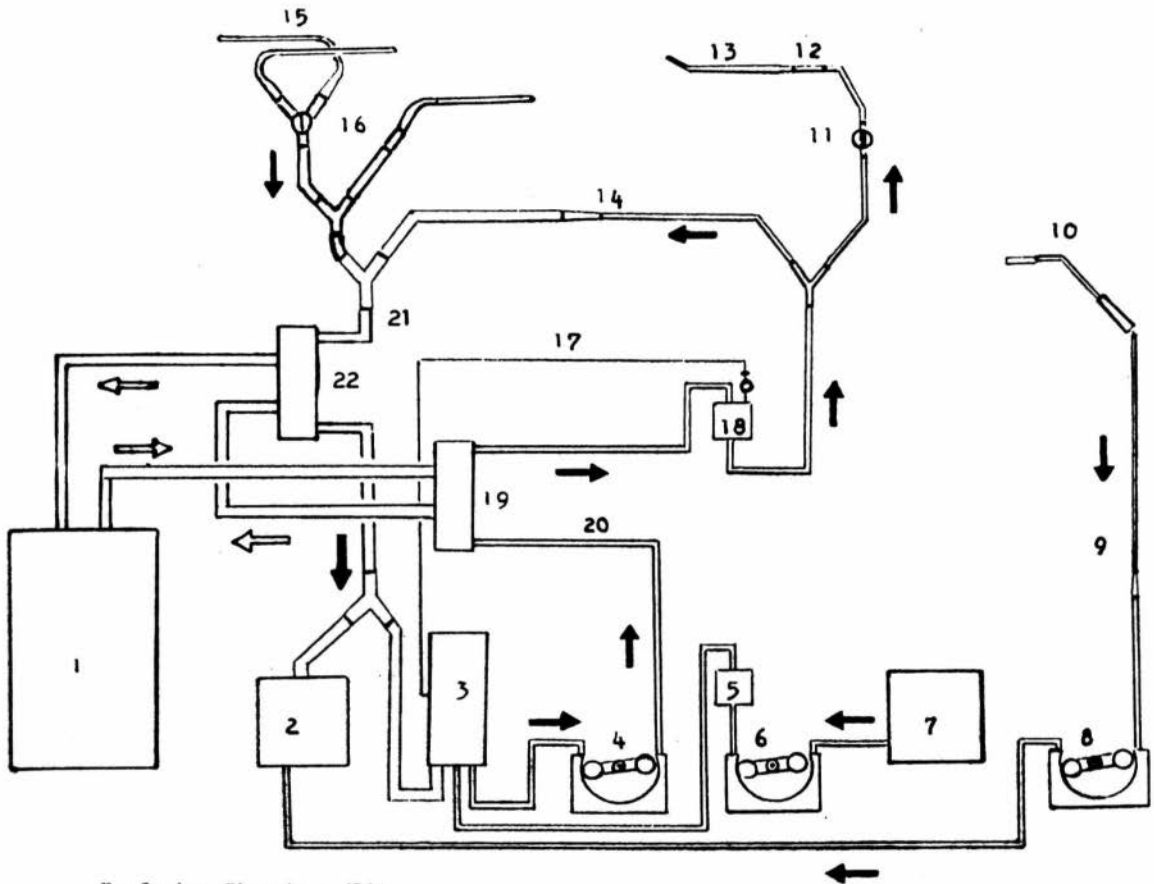
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\* Bill Jameson helped to prepare the perfusates, but was unable to stay for the suspension. My thanks to Bill for the help he was able to provide.

All of the pictures reproduced here, and many more, were taken by Patricia Kelley, who travelled from Northern California with her own film and equipment, at her own expense. Pat has covered this and other events in cryonics because of her personal interest. She is a professional photographer with considerable talent in the audio-visual arts and sciences. I am grateful for her contribution.

I am also grateful for the continued support of Trans Time, Inc. in its pursuit of excellence under the direction of Art Quaife.

### PERFUSION CIRCUIT (KVM Suspension)

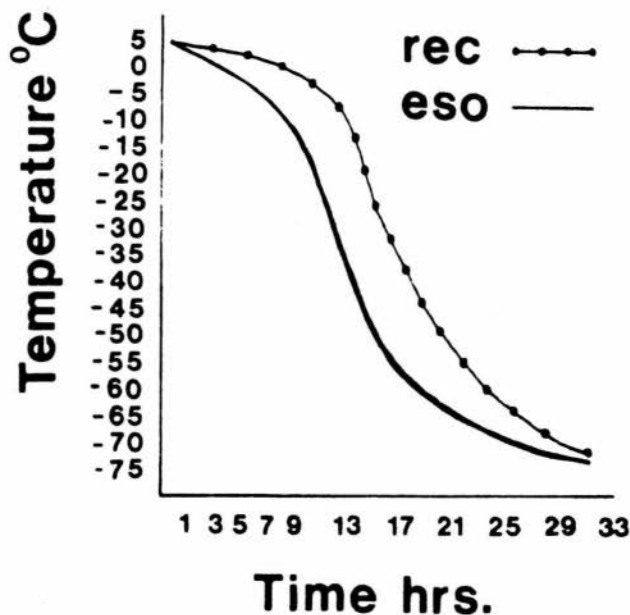


### Perfusion Circuit - KVM

1. Heater-cooler
2. Effluent reservoir
3. Sterile perfusate reservoir
4. Arterial roller pump
5. Pall filter, 0.2 micron
6. Roller pump to fill sterile reservoir
7. Clean perfusate reservoir
8. Roller pump for cariotomy sucker
9. Cariotomy suction line
10. Sams suction tip
11. Connector with stopcock
12. Connector, straight 3/8" I.D.
13. Arterial cannula
14. Arterial-venous shunt
15. Venous cannulas
16. Peritoneal drainage cannula
17. Filter air vent line
18. Pall filter, 40 micron
19. Heat exchanger, arterial line, Brown-Harrison
20. Arterial perfusion line
21. Venous return line
22. Heat exchanger, venous line, Brown-Harrison
23. Water lines



# kvm Suspension Cooling Rate



## Perfusate

<u>Agent</u>	<u>Grams/liter</u>
MgCl <sub>2</sub> · 6H <sub>2</sub> O	4.06
NaHCO <sub>3</sub>	1.26
Disodium glycerophosphate · H <sub>2</sub> O	12.59
Glucose	1.80
PVP-40	35.00
KCl	5.59
DMSO-sterile H <sub>2</sub> O	to one liter volume

## 15% v/v DMSO perfusate

Oncoicity, measured: 46.7 mm. Hg

(Measured on an IL OOP head)

Osmolarity, measured: 2656 mOsm/kg H<sub>2</sub>O

(Measured on a Wescor vapor pressure osmometer)

## pH of perfusates (37°C)

	<u>5%</u>	<u>10%</u>	<u>15%</u>
Arterial	8.01	8.09	8.22
Effluent	7.59	7.46	7.71

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