CRYONICS

ISSUE #18 Maat JANUARY 1982

Selected Contents:

CRYONICS is the newsletter of the Institute for Advanced Biological Studies, Inc. Published monthly. Free to members of IABS, the Alcor Life Extension Foundation and the Bay Area Cryonics Society. Individual subscriptions $15.00 per year. Group rates available on request. Please address all editorial correspondence to IABS, Inc., 4030 North Palm #304, Fullerton, CA 92635, or phone (714) 990-6551.

EDITORIAL MATTERS

We have received a few calls about the December issue of CRYONICS failing

to arrive or arriving late. The reasons for this are two-fold. First, due to the holiday season and the backlog from the double length November issue, we were somewhat delayed in going to print. Secondly, the Postal Service was faced with its usual deluge of cards and letters and is unlikely to accord CRYONICS any special consideration. We hope all of our readers have received the December issue of CRYONICS by now. If any of you failed to get the December issue, please, drop us a line and we'll send you another copy immediately.

The review of Arlene Sheskin's book "Cryonics: A Sociology of Death and Bereavement" which appeared in the December issue of CRYONICS was by Thomas Donaldson, Ph.D. A response to Dr. Donaldson's commentary appears elsewhere in this issue.

LETTERS TO THE EDITORS

Dear Sir,

With reference to your bit on Carl Sagan, I wrote to him on September 21 this year. Dr. Sagan is president of the Planetary Society, 116 South Euclid Avenue, Pasadena, CA 91101 and may reportedly be reached at this address.

In my letter I suggested it would be impossible to understand the universe fully during a lifetime that was so small in relation to its age. I gave the address of a number of cryonics societies. I have yet to receive a reply. I do, of course, have no way of knowing whether he ever saw the letter, or whether it was destroyed by a secretary or other subordinate.

Therefore you may care to use the address given and write again. A different secretary may pass you letter on!

Cryonics certainly needs someone with Dr. Sagan's communicating abilities. He is interested in using private funds and political pressure to accelerate the space program so more can be done in his lifetime. An alternative or adjunct to this process would be to extend, possibly indefinitely, this lifetime. He is unlikely to be able to do this without the help of others. Therefore it would seem logical for him to support the cryonics societies, and possibly be a welding force to provide a cohesive worldwide cryonics movement.

When they get older, many scientists (and an astronaut I've heard about!) start to contemplate their ultimate destination, and become "God botherers" in one way or another, possibly with an interest in ESP. This is a pity when they could join the life extension and cryonics movements to some useful end.

Sincerely,
J. de Rivas
Cornwall, England

---

(2)

Dear Editors,

As I enter into my earliest stages as a cryonicist one thing becomes immediately clear. There have been a lot of hard feelings in the past. Some cryonicists don't like other cryonicists because one didn't support the others views or was even critical of them.

The cryonicists and the cryobiologists are at each other for various similar reasons. The cryonicists are mad at the media for not enough favorable publicity. We cryonicists also seem to fly off at everyone who doesn't adhere to our every notion, even though we are the first to admit that our whole Cryonics Theory is a roll of the dice and the best we can claim is that it is better than the alternative.

When I read the frustrations and contempt from brilliant people like Donaldson and Kent, as in your November issue, it is disheartening to see such gifted people so far off on the wrong track.

We need to work together to be tolerant of other people's views if we are ever going to be successful. Let's all swallow our pride and try to work with others. After all, it isn't who has the last word in 1981 or 1982 or even in this century, but rather who has the last word 500 years from now, who will be judged the winner of the debate (and God do cryonicists love to debate). If these unreconciled differences become the trend none of us will be winners of anything. So, come on cryonicists, Cool It.

Respectfully Submitted,
David S. Pizer

Phoenix, Arizona

Dear Mr. Pizer,

It was with a sense of deja vu that I read your commentary on the recent pieces by Kent and Donaldson. In 1969 when Saul Kent was seriously questioning the propriety and integrity of Robert Nelson numerous letters and comments such as yours passed through my hands. How sad it was that no one took those seemingly academic matters of "approach and procedure" very seriously. True, pursuit of the issues Mr. Kent raised would have made for much hard feeling within the cryonics community. Now, the hard feelings are universal. The damage that has been done is almost incalculable.

One thing a little "hands on" experience in cryonics quickly teaches: what will happen 500 years, 50 years, or 5 years from now is dependant on what happens TODAY. It's strange how "academic" debates about levels of care, quality of services, or financing suddenly take on very human proportions when someone we love or car about is lying on the operating table during perfusion.

I think it is important to point out that we are not involved in cryonics to make everyone feel good about themselves. We are in it to survive. Tolerance is on thing, complicity or silence in the face of firm moral and intellectual conviction to the contrary is quite another. We can only act as reason and conscience dictate. Sometimes that's not the way to win a popularity contest. Perhaps the question you should ask yourself is why people as "brilliant" and "gifted" as Kent and Donaldson need to say the things they do.

M.D.

****

FREEZE - WAIT - REANIMATE -- Ev Cooper, 1966

FREEZE - WAIT - LITIGATE -- Curtis Henderson
circa 1974

DONALDSON IN THE UNITED STATES

In December Dr. Thomas Donaldson, a frequent contributor to CRYONICS and winner of our unofficial Most Prolific Correspondent in Cryonics Award, visited Cryovita Labs at Fullerton. Dr. Donaldson is touring the United States to gather information about the state of cryonics here, and to complete negotiations to extend remote standby and provide for rapid acquisition of a complete physical suspension capability in Australia.

As has been previously noted in the July issue of CRYONICS Dr. Donaldson has succeeded in negotiating for remote standby insurance with Lloyds of London. Such insurance would allow someone who was living a great distance from a cryonics facility to have a team of cryonics personnel flown to their bedside in the vent of a "terminal" crisis. Obviously this kind of insurance would be of benefit not only to members living in Australia, but to those in Topeka or St. Louis or any location without a capable cryonics organization. Dr. Donaldson is continuing negotiations with Lloyds and with individuals stateside to extend the availability of this insurance to everyone who needs it.

Negotiations were also basically completed on supplying the Australian group with the necessary equipment, chemicals, and other major supplies required to carry out a cryonics suspension under field conditions in Australia. It is very reassuring to see cryonics capability taking shape outside the continental United States. It is even more reassuring to see

it being managed by a man as capable and dynamic as Thomas Donaldson. Donaldson is to be congratulated on his awareness that starting a cryonics organization consists of doing more than giving an interview to the local press announcing that you've started a cryonics society.

OMINOUS

The December issue of OMNI magazine contains yet another example of sloppy reporting and ugly sensationalism of the Nelson Scandal. The piece in question appeared in the Antimatter section, neck and jowl with such other unlikely and enlightening stories as the one of the man who is building a flying saucer in his back yard on the instructions of friendly extraterrestrials, or another about a man who recovered after spontaneously bursting into fire and losing an arm and a vertebra in the process. As if the company isn't bad enough, the article is riddled with more errors, misconceptions, and simple untruths per sentence than I have ever seen in any piece written about cryonics.

The principle errors are: a) The Cryonics Society of California had offices (and still does) in Berkeley. Apparently OMNI confused CSC with Trans Time. 2) Cryonics was a booming business which has the "brakes" put on it because of the failure at Chatsworth. 3) The death of CSC is probably equal to the death of the entire cryonics movement.

Beyond the errors there was an observation attributed to Bob Ettinger, which as usual offers some equivocating defense of Bob Nelson. Based on many statements Ettinger has set his initials to in his own monthly newsletter, we are open to the possibility that this embarrassing remark is one of the few things in the article that is accurate.

CONSTRUCTION AT CRYOVITA COMPLETE

The construction efforts which have been underway for the last several months at Cryovita Labs are now complete. Cryovita is back in operation and capable of handling suspensions in Los Angeles. The new operating room features a four-cluster overhead surgical light, 16 feet of glass-fronted supply cabinets and a massive and much needed increase in available electrical outlets. The loft over the new O.R. is already supporting tons of backup supplies, occasionally used equipment, and spare parts. Jerry Leaf and Mike Darwin wish to extend thanks to all who helped in various ways. Special thanks go to Hugh Hixon and Laurence Gale, who put in several weekends of labor to help things take shape as quickly as they did and whose other contributions, both financial and intellectual, were very helpful; to Betty Leaf, who brought food for the troops, supplied cleaning help and an ear to be bent upon occasion; to Al Lopp for financial and woodworking assistance; and to Herman Earl for generous financial support of the project. To one and all, our sincere gratitude.

A GIFT FOR THE COLONEL
by Mike Darwin

It is Christmas in Los Angeles. Christmas is always a reflective time for me. More so this year, since I find myself in new surroundings, separated by thousands of miles from friends and family with whom I have shared a lifetime of tradition and warmth. And yet, it is still a very special Christmas for me and a very satisfying one.

This is not my first Christmas in Los Angeles. Years ago I spent Christmas Day in what was then to me a very stranger and perplexing new

city. I spent part of that Christmas Day with a man I have since grown to love, and to consider a grandfather to replace the one I loved and lost in youth. It is not easy for me to speak of these feelings. The words come slowly, awkwardly, and with much consideration. Indeed, it was not easy for those feelings to develop. There were many barriers to their occurrence.

I can recall vividly when I first met the Colonel. It was in July of 1974; a typical blue crystal, dusty bright Southern California day. I had come to Los Angeles to work with his son and daughter-in-law on cryonics. I was eighteen, full of wild temperament, incredible certainty and the total optimism that only youth and relative good health can give. By contrast, the Colonel's existence was an exercise in uncertainty. He was paralyzed on one side from a stroke, and suffering the many complications of having been long confined to bed. I thought I had little in common with the Colonel when I was introduced to him on that summer day almost eight years ago.

Even when they are at their best, nursing homes are terrible places. While the Colonel was in a very good one, it still had that inevitable effect of overwhelming the senses with sights and sounds and smells of old age. And let's not use the euphemism of "old age;" it is a place of death and decay and despair. It is a place where human impotence is concentrated

and hidden away from view. It is not a pleasant place for anyone to be, as a patient or as a visitor. Few are attracted to a charnel house. And yet, this is where the Colonel was, where I came to know and love him, despite the barriers of age, disparate interests, and the

---

atmosphere of inescapable doom. We spent many hours talking, and in the course of that time I grew to know him well. I regret that I did not give him more of myself. But given youth and the terrible feelings of anxiety and discomfort the place produced in me, that was not possible. I wish I could have been then as I am now. The last five years of my life have removed the barriers and uncertainties which kept me from spontaneity and easy self-assuredness with the Colonel. Since that time I have handled the dying daily, dressed their wounds and ulcers, listened to their doubts, held their hands during the last moments. No mutilation or disfigurement surprises me. I have seen just about everything that disease and medicine working in concert can do to a human being. Nor have I become simply hardened to these realities. I have learned not to let the anxiety they produce cut me off from the people who are inside these disfigured bodies. It is a most important lesson for survival as well; for I have learned that these people are just the same as me, and someday I will join their ranks and make the passage they are making.

Oddly that one great piece of continuity is the thing I denied myself a realization of in my dealing with the Colonel. Despite all the trips I made to visit him; despite the boxes of candy or occasional gifts I brought him, including conversation, I never really understood that the one thing we shared was the heritage of the journey he was making. I know that now, with both mind and heart, and there are no barriers left in me to touching a dying hand with ease to give real comfort without the first corrupting taint of anxiety or forced emotion. And though I have come to a point where I can say I look beyond these realities, I do NOT ACCEPT THEM. I do not feel them just or good. I have simply learned to defuse another of their weapons against me: the weapon of denial.

I did not stay in Los Angeles long enough to participate in the suspension of the Colonel. It was almost a year later when word reached me that he had deanimated and been suspended by his son and daughter-in-law.

I was deeply saddened at his passing. Indeed, my first thought was of that Christmas, years before, when he had presented me with a gift I have treasured ever since: a beautiful duck down sleeping bag, something that Mike Darwin wanted rather badly in the winder of 1975. In some ways this Christmas in Los Angeles is no different. For, when I met with his son and daughter-in-law recently, they paused as we were saying our goodbye's and handed me a gift they said the Colonel would have wanted me to keep. It was a watch he'd won when he was young and strong and full of life 75 years ago.

And I, in my turn, have not stopped caring for him either. And I will make my Christmas gift to him today, knowing this time with certainty that I will someday join him. And hoping that we will both step through the carnage and horror of death unscathed, young and healthy. Then I will return the watch to him and it will be given as it once was, as an award to youth and strength and victory.

CRYONICS TRAGEDY AVERTED -- FOR NOW

Art Quaife, President
Trans Time, Inc.

We have previously reported on the case of two patients we are maintaining in suspension, whose son was killed in an automobile accident without leaving any funding to maintain his parents. Trans Time had informed the Bay Area Cryonics Society (BACS) of its intention to remove these two patients from suspension as of November 1, 1981, unless payment of past storage bills owed, and some assurance of future storage bills being paid, was forthcoming. BACS had provisionally decided to accept the generous offer made by Michael Darwin and Jerry Leaf, to convert and maintain these two patients in neuropreservation. But shortly before the time for this conversion, Attorney James Bianchi rendered BACS a formal opinion that we should not proceed with conversion to neuropreservation without written consent from the surviving relatives. Mr. Bianchi opined that we would be assuming too great a risk, both civilly and criminally, of being charged with mutilation of a corpse.

At that point Jerry Leaf and Mike Darwin made a new offer, to maintain these two patients in dry ice storage for at least six months while BACS pursued a lawsuit against the estate for the full amount necessary to maintain these two patients indefinitely in liquid nitrogen storage. On the weekend of November 7, Jerry and Mike drove up to our Emeryville facility to take physical custody of the two patients. An agreement was signed between BACS and the Institute for Advanced Biological Studies (IABS) detailing the terms of transfer of physical custody.

Since the cryogenic storage capsules Trans Time uses for maintaining whole body patients are vertical units, the removal or transfer of a patient requires use of our crane which was constructed especially for that purpose. This crane has a cable winch to raise its mast to the 16 foot height needed to remove patients, who are held on aluminum stretchers. During the removal of the father, we placed too much strain upon the cable, causing it to snap. We then had to manually lower the patient down and into the waiting dry ice temperature chest.

The patient had been wrapped in numerous layers of aluminum foil and fiberglass for insulation, and reading of a thermocouple probe wrapped around his ankles showed that his external temperature did not rise above -

114øC. The transfer to dry ice storage at -79øC was completed, but due to the breakdown of the crane, transfer of the patient's wife to dry ice storage was tentatively deferred until the following weekend.

On the next Monday, I was most pleasantly surprised by a phone call from Richard Clair Jones, who offered $12,000 to pay all of the back storage bills owed by the estate, plus one more year of liquid nitrogen storage. After further discussion, BACS accepted Dick's benevolent donation, using the amount to guarantee payment of past due LN2 bills and for the next year's storage bills if we are unable to recover such payment from the estate. Many readers know of Dick Jones for his involvement in cryonics dating back to about 1965, and as a television writer who has been awarded three Emmies for his participation in writing the Carol Burnett show. Dick has intentions of writing a producible television script depicting the saga of these two patients, and the ongoing efforts to maintain them in suspension. If this writing and production effort is successful, it may generate further donations to maintain the two patients in suspension for much longer than the upcoming year.

WIth our utmost gratitude to Dick Jones, we proceeded with plans to re-encapsule the father. On the weekend of November 28, Jerry Leaf and Mike Darwin and Hugh Hixon returned north with this patient. He was removed from the dry ice chest, surrounded with additional insulation in the form of a "mummy" type polyester filled sleeping bag, and transferred into our reserve cryogenic capsule. We proceeded with a protocol of adding liquid nitrogen to his capsule in such a way as to permit no more than a 20øC gradient between external and body core temperature. Since no thermocouple probes (rectal or esophageal, as we normally place them) had been inserted within the patient at the time of his 1974 suspension to permit direct monitoring of this temperature gradient, we followed the liquid nitrogen filling schedule used for another patient, with whom such cooling required one week while staying below a measurable 20øC gradient.

We also replaced the broken crane cable with a thicker one, and for additional safety installed a locking collar to the mast to support it even if the cable snapped. On December 6, the patients's wife was raised from her current capsule, surrounded with a sleeping bag, adding to her previous thin Ensolite insulation, and transferred into the capsule with her husband.

At the present time, the only assurance is that these patients will be maintained in LN2 storage for one more year. We still have no solution to the long term funding problem, which will again become critical within a year.

One lesson from this experience which has always been clear, but continues to become clearer is: IF YOU WANT TO BE PLACED AND MAINTAINED IN SUSPENSION, YOU MUST MAKE ALL OF THE LEGAL AND FINANCIAL ARRANGEMENTS YOURSELF! Saving angels such as Dick Jones will not always be there, and counting upon relatives to do so is usually and literally a dead end.

Reply to Mae Junod and Bob Ettinger Regarding Perspective

In the September 1981 issue of The Immortalist, I was gently called to task for portraying a "needlessly alarming" view of freezing in my article,

"A Possible Alternative to Freezing." The issues, as I see them, are as follows.

First of all, Mae and Bob are right: I agree that negative news should be placed in perspective, and I would recommend that all authors writing about negative subjects explain why the cryonics position seems sound despite the negative aspects being discussed. In my case, I was using the negative aspects of brain freezing as perspective for the positive possibilities of vitrification, but the third perspective (that freezing, despite its problems, if far better than rotting), could have been briefly mentioned.

At the same time, it is very important for us to realize that we should not be happy with things the way they are. Although it may be possible for a man to live with a crowbar rammed through his brain (Mae and Bob's analogy to be frozen with techniques currently used), only an idiot would be happy to place his head in the path of a flying crowbar deliberately. Furthermore, there is far less likelihood of our crowbar man surviving than a crowbar-free man surviving. I am glad that Mae found the prospect of brain cracking to be "alarming" and "horrifying" because it is alarming and horrifying and should be recognized as such. That does not mean that we should not be frozen, but it emphatically does mean that we should be frozen with better methods than we are currently using, and the only way to create better methods is to do the research which will both define what our problems are (you can bet your life that there are other problems, equally horrifying, that we don't even know about yet) and help to solve them. Right now the issue of brain cracking is up in the air.

(Continued on page 26)

SCIENCE UPDATES by Thomas Donaldson, Ph.D.

MEMORY LOSS

All cryonicists will know of several conditions which cause an inability to remember even in living subjects. Destruction of some brain areas such as the hippocampus will cause almost total loss of the ability to learn new facts; Korsakoff's syndrome, which occurs in alcoholics, causes a loss of the ability to recall past events. Brain injuries can cause amnesia for many months or years into the past, and electroshock treatments will cause a loss of memory for as much as 3 years into the past.

As yet, unfortunately, we don't know whether any such cases of memory loss come from a loss of the actual substrate of stored memory or a loss of the ability to process and retrieve the memory. We have good reason to believe that in at least some of these cases the loss is a loss of the ability to retrieve, since for instance amnesias due to brain injury can sometimes disappear as the brain recovers from its injury. However some conditions leading to memory loss, such as senile dementia, progress until the person loses all recollection of their past. Since such people never recover, we still have no idea have no idea whether their memories have actually been destroyed or whether as in the case of brain injury or electroshock, their memories and persons still survive, even though they cannot recall them.

So far nothing has happened to improve our knowledge on this heading. However two recent papers present some interesting new data on different kinds of memory loss, worth the attention of anyone interested in this problem.

A rather interesting paper in SCIENCE (213 (1981) 1392-1394) gives a case report of someone who actually lost 20 years of memory due to accidental injury. E. Goldberg et al report the story of a 36 year old man who sustained a skull fracture. This was surgically repaired; when he recovered consciousness he had lost the ability to remember new facts, and in addition could recall only the first 16 years of his life: on awakening, he thought he was 16 years old. After two years of recovery, his ability to remember new facts had improved a lot. He could, for instance, remember what he had read in newspapers or seen on TV. He was told about the major incidents in his life after age 16: his marriage, his children, his jobs, but remembered them not as things which had happened but as things which others had told him he had done. His IQ and memory recovered to average normal, i.e., IQ 100 (it would be interesting to know what his IQ had been before the injury). He still could not answer questions of longterm general knowledge such as "What is the capital of France?"

Loss of memory for the past combined with no loss of ability to learn new facts is a quite unusual combination of conditions. The authors therefore used a CAT scanner to study the exact areas of this man's brain which had been injured. At first their scan showed nothing which provided any obvious clues to his condition; however when they made a second scan they found a very small injury in the front part of the tegmentum. The region injured contained nervous projections from the reticular formation to the hippocampus; the reticular formation is involved in activations of all the different brain regions, and injury to it will usually cause loss of consciousness. The authors surmise that activation of the hippocampus is needed for longterm memory, and that this man had escaped loss of consciousness because his injury happened to be precise enough not to involve a larger area. the fact that only a very small injury to only a very small area will cause this particular pattern of memory loss would also explain why it is so rare.

A second paper by M.S. Albert et al in ARCHIVES NEUROLOGY (38 (1981) 495-500) gives us additional interesting information about memory loss. The author and her colleagues report the results from their study of two different kinds of pathological conditions and the loss of memory for the past which they cause. The first set of subjects were former alcoholics suffering from Korsakoff's syndrome; the second set of subjects suffered

from Huntingdon's disease, which also causes a loss of memory for the past. They used a test of memory loss developed by Albert herself, involving a graded series of questions about incidents and events of the past extending back to the 1920's, and so designed that normal subjects who had lived long enough to do so would get about 85% right in all the different periods. Goldberg et al, in evaluating their own patient, had used this same memory test.

Albert et al report a striking difference in the remote memory of the two different classes of subjects. Korsakoff's syndrome patients showed a significantly better memory for events in the remote past than for events of only a few years preceding; their memory seemed to become worse the closer their questions came to the present. On the other hand, the Huntingdon's disease patients showed no such improvement as questions proceeded into the past: they seem to have lost recollection equally for all their past history.

Albert et al suggest that this difference in the pattern of memory loss may suggest that the two conditions have quite different causes, although the cause of each is as yet unknown. As it turns out, Korsakoff's disease patients do lose memory for events which preceded their alcoholism, so that their pattern of memory loss cannot be explained as the result of an inability to learn new facts which has persisted for several years. Study of Huntingdon's disease patients suggests that they have an inability to store new information, while Korsakoff's patients seem to be able to store the information but not to recall it. Both types of patients, therefore, show different kinds of losses both in the ability to remember past events previous to their disease and in their ability to learn new facts.

For cryonics the main implication of this information is simply that memory for the past, first, seems linked to activation by the reticular formation. We can therefore imagine at least one way in which total loss of memory can happen without destroying the actual stored records. Secondly loss of memory for the past can show at least two different kinds of defect. Whether this past memory still exists inside the patient, in general, remains a hard question answerable only by indirect means (for instance, it is hopeful that in both types of patient, hints and cues seemed o help memory). Optimistically, most people don't develop these conditions in any severe form before their death, so that even with no advances in treatment we will probably survive our senescence with little loss of memory. Treatments for memory loss in senility have also advanced (cf. other articles in this journal). Fundamentally, of course, whether or not our memories will survive remains unknown, and we may have to accept some degree of memory and personality loss, although quite far from a total loss.

A FUNCTION FOR THE S-100 PROTEIN?

One chemical apparently involved in memory in a critical way is the S-100 protein, which Holger Hyden at the University of Lund has studied intensively. Its synthesis increases when animals learn something new, deranging its synthesis by several different means will derange the ability of the treated animals to remember what they have learned. However no one yet has a good idea exactly what the S-100 protein may actually be doing in the brain (cf. Bock, E. J of NEUROCHEMISTRY 30 (1978) 7-14).

Several scientists have shown that the S-100 protein occurs in a large number of different forms, which behave differently on various tests. For instance, polyacrilamide gel electrophoresis will separate this protein into different fractions, all of which when tested immunologically will seem the same. A recent article from the Department of Cytology and Genetics of the USSR Academy of Sciences, appearing in JOURNAL OF NEUROCHEMISTRY (36 (6) (1981) 1904) presents some very interesting evidence that these different fractions of S-100 protein differ quite specifically in their binding of calcium ions; how many, and where, these ions are bound to the S-100 protein differs with its type. M.V. Starostina et al used spectroscopy and binding of calcium by dialysis to detect these different fractions.

These results become particularly interesting when we reflect that the level of calcium ions in the cell regulates the permeability of the cell membrane. The S-100 protein may therefore play a role in regulating this permeability, in particular a role closely connected with memory itself. Even though a lot of indirect evidence suggests that memory is very durable

even against treatments such as dismemberment of the brain, we can't settle this issue once and for all until we know how memories are stored in our brains. The information about S-100 may give us a very useful close to that problem.

BRAIN PROTEINS IN LEARNING: A VERY SENSITIVE ASSAY

V.E. Shashoua, at Harvard Medical School, is one of the small number of scientists actively working to discover how memory is stored in the brain. In earlier work, Shashoua discovered three different brain proteins, which he has named the alpha, beta, and gamma ependymins. Beta and gamma ependymins appear to exist normally in goldfish brains; after goldfish acquire new information, the beta and gamma ependymins will appear in the fluid surrounding the goldfish's brain cells. Antiserum to these proteins will also inhibit consolidation of learning by the fish: even though experimental goldfish will show a short-term memory for what they have learned, they will fail to retain it. All of these observation suggest that in goldfish at least, the ependymins must play a role in the process by which the goldfish acquires new information, even though they are clearly not the coding molecules themselves.

In a recent paper, V.E. Shahoua and Rupet Schmidt report (JOUR OF NEUROCHEMISTRY 36 (4) 1368-1377) first finding developing a very sensitive assay for these ependymins and secondly some of the results they have found by using their assay. The assay uses the radioimmunoassay technique for which Yalow recently received a Nobel Prize. Shashoua and Schmidt found that ependymins constituted 14% of the total protein content of the fluid taken from the brain fluid outside the brain cells. Ependymins in the internal cellular fluid (the cytoplasm) was about 4.6% of the total protein.

At one time experiments of Agranoff and others only allowed us to conclude that some protein, of undefined nature, was involved in learning; these newer results begin to tell us some of the specific proteins involved in learning. Eventually their exact role should become clear. The relevance of memory processes and memory storage to cryonics of course consists of the fact that the chemical and/or physical stability of our memories against damage will determine the degree to which we are recoverable after this damage IN PRINCIPLE as distinguished from the transitory practice of present days. Of course in all sanity the degree to which subcellular structures and biochemicals survive even extensive neglect for up to days in refrigeration after cessation of heartbeat and freezing should lead us to think it unreasonable that our memories and identity will not survive. However we would still want to know the exact limits to this survivability, both with a view to discovering our own future and with a view to finding ways to improve this survivability perhaps by treatments which do not improve "viability" at all.

Waiting

by Michael Darwin

They are waiting
Gray and silent now
Like soapstone figures
My Grandfather once carved.

They do not speak of past
Or present
Mute tongues lie frozen
And when a sound escapes
It is only a whisper of
Tomorrow.

Like blocks of ice they stand
While rushing water
Flows around them.

We run and dance in catastrophic motion
A billion molecules a second
Breaking up
While they stand
In silence
And quiet
Waiting---

Waiting on us
To wind them up
And send them running
Full of love and laughter.

But they cannot speak to us
Of that-
Only what they have been
Can speak to us
Only what we will do will
Speak to them.

They are waiting on us.

MORE ON THE SHESKIN BOOK

-- A Reply to Thomas Donaldson by Stephen Bridge

Readers of CRYONICS will be aware of a great difference in opinion between Dr. Donaldson and myself concerning "Cryonics: A Sociology of Death and Bereavement" by Arlene Sheskin. My opinion was expressed in the November issue and Donaldson's opinion is in the December issue. Whatever the reader's feelings about the relative merits and flaws of the book, it must be strongly point out that this book is politically a very important one for cryonics. A professional sociologist has spent a lot of time interviewing cryonicists (true, some were marginal) and has concluded that, in general, they did not appear to be frauds of death-deniers. On the contrary, they appeared to have a most healthy attitude about death, accepting its reality but working to overcome it. Indeed, Sheskin maintains that this sort of activity is normal and positive. Whether or not she herself was convinced or whether she fully understood all of the implications of cryonics is quite beside the point.

Finally, Donaldson's statement that Sheskin "never managed to grasp the essential point that cryonicists don't believe that their frozen relatives are dead anyway, so therefore they cannot be said to grieve for them or to be bereaved," is nearly as "DENSE" as he claims Sheskin is. Unless Donaldson is proposing we all have some religious-like faith in the healing power of ice, I think it is clear that most cryonicists have considerable

doubt that the frozen are still alive. Even if I did believe that cryonic suspension was 100% infallible, I would grieve if my best friend were declared legally dead and then was frozen. He would be taken from me for many years and would be as if dead. I won't be sending him any birthday cards. In the present state of cryonics, suspension is strictly a last-ditch effort because we don't know what else to do to save our lives. With our current low level of understanding, my friend's death today would seem much more likely to be permanent; and I would grieve deeply for him, even while I hoped to be proven wrong and even while I helped on the suspension which give him his last chance. Cryonics still has much to do with bereavement and will have for many years to come.

AN INTRODUCTORY NOTE

In this issue, we are at last publishing the first half of "The High Cost of Cryonics." Many months of work have gone into the article. It has been previewed by Art Quaife, Bob Ettinger, Jerry Leaf, and Thomas Donaldson to correct problems of fact, although none of these gentlemen completely agree with our conclusions. In February we will publish Part II: "Cryonics Prices Today and in the Future," in which we will compare the price structures of Cryonics Institute and Trans Time.

Our intentions in this article are both to provide our readers with background on suspension prices and to stir up discussion and controversy about them. Most cryonicists seem to spend a lot of time complaining about prices, but comparatively less work has been done in seriously evaluation those prices. We hope that this article will provide the first step in such an evaluation and will persuade members of all cryonics organizations to take a deeper interest in the financial affairs of their companies. After the second part if published next month, we will welcome both formal responses to and questions about the article. We will publish as many responses as we have room.

THE HIGH COST OF CRYONICS

by Stephen Bridge and Michael Darwin (Federowicz)

"Well organized public facilities on a substantial scale will probably exist fairly early in 1966, by present indications. The cost of cryostasis -- ed. according to several independent estimates will be well within the $8,500 figure I mentioned for preparation and perpetual storage, with easy financing through group insurance or similar plans."

Robert C.W. Ettinger in his
"The Prospect of Immortality,"
paperback edition, postscript
dated October 29, 1965

"We all know how much the actual costs of doing a perfusion amount to. We also well know the difference between reasonable and unreasonable profit. No one likes to be made to feel worthy of being taken advantage of."

Mae Junod, editor of "The
Immortalist," commenting on the
fee schedules of Soma, Inc.,
November 23, 1979

"Just who the hell do you think you're trying to kid? When we got started on this thing nobody was talking about $60,000. Now you're trying to tell me that in ten years the cost of cryonic suspension has gone up from $8,500

to $60,000!"

Husband of former cryonic suspension patient commenting on the fee schedules of Trans Time and Soma, Inc., September, 1979.

We live in a time of great uncertainty about the honesty and credibility of virtually every productive segment of our society. There is no producer of goods and services who is exempt from accusations of profiteering or price gouging. It is a time of shortages and of rapidly increasing prices, and there seems to be little consensus about the reasons for this economic instability. In cryonics in the late '60's, several groups offered suspension for the $8,500 suggested by Bob Ettinger. Today's prices range from the $28,000 minimum of Cryonics Institute (Ettinger's organization) to the $60,000 minimum suggested by Trans Time. Considering the fact that Trans Time's prices represent an increase of 600% in about 15 years, it is not surprising that charges of excessive profits have been leveled at that company and at others which have listed similar prices.

Why has the cost of cryonics risen so sharply since 1965? What is the basis for today's prices, as charged by Cryonics Institute and Trans Time? Are the commercial firms like Trans Time making "unreasonable" profits from cryostasis? What additional price increases can we expect in the future? These are some of the questions we will attempt

to answer.

At first glance, the price increase of 600% alone may seem to justify charges of price fixing. If we examine cost increases in other essential goods and services over the same period of time (1965-1980), it is apparent that the cost of suspension has risen at a disproportionate rate. Appendix A shows that the consumer prices of steel, energy, and medical care rose no more than 250% during this time. However, because of the peculiarities of the Consumer Price Index, these figures are not the whole story. The C.P.I. and its related indexes are figures on a "market basket" basis, i.e., they compare the prices of a fixed group of items at fixed quantities in "the basket" with the same group's prices in later years. But how does one easily compare a car of 1965 with a car of 1980?> How much of the cost change is due to inflation, how much to technical or safety improvements, and how much to added luxuries? The figures for medical care show this problem clearly. The C.P.I. for Medical Services increased 180% from 1965 to 1979. Yet the average annual cost per person rose 365%. Medical treatment is not just more expensive today -- more treatment is actually given, at a greater total cost. The relationship of this fact with the situation in cryonics will be apparent later. The Energy Price Indexes show similar inconsistencies. The C.P.I. for Fuel and Utilities increased 180% through 1980. Yet the retail price of gasoline increased 495% and the Producer Price Index for all Fuels and Power increased 472%. Comparing these figures with prices in cryonics is not a simple matter.

In order to assess the real magnitude of the price rise for cryonic suspension, it is first necessary to determine how realistic the $8,500 recommended price was in 1965. In considering this estimate, it is essential that the reader keep in mind several points. First, in 1965 the annual inflation rate was only 1.7%, as contrasted with 14.4% for 1980 (see Appendix A). The early '60's were a time of tremendous economic growth and a parallel degree of optimism about the future of the economy -- a situation which no longer exists. Secondly, this 1965 estimate was made two years before the first man was frozen under "controlled" conditions.

Anyone familiar with budgeting in new and previously untried ventures will immediately appreciate that estimates made with no previous working experience are notoriously unreliable. Vast overruns are the rule rather than the exception. Undoubtedly, there are a number of NASA Shuttle Project engineers who will unhappily verify this observation. Finally, and most importantly, there is the question of the purposes of "The Prospect of Immortality" -- purposes which readers may have forgotten if they have not re-read that entire book in the past few years.

Ettinger made no claim that his book was the last word on how to organize the freezer program or on the technical aspects of freezing, although some readers apparently took it that way. The basic purposes of "The Prospect of Immortality" were to show why immortality was desirable and even necessary and to suggest a possibly practical method for its attainment. The book's emphasis was philosophical, not technical, and Ettinger obviously expected that experts in science and business would take over the program as part of a mass movement toward immortality.

Let us emphasize that this article is not intended as an attack on Bob Ettinger. I'm sure Bob is not surprised that he did not completely predict the future nor that his book had technical flaws in it.

If the first book on any subject were 100% correct, it would be a miracle indeed. Since the book did create a movement, it is appropriate and necessary that its premises be periodically examined to see how they have held up.

Bob Ettinger may be the most optimistic and positive-thinking man alive, a characteristic well displayed in these quotes from "The Prospect of Immortality" (Doubleday, 1965. Page numbers are from the 1965 British edition, published by Sidgwick and Jackson).

"Large numbers of Americans and Europeans will soon come not only to perceive but to feel the vastness and grandeur of the prize, and to understand that all other prizes, all previous goals, are secondary. Their demand cannot long be ignored." (p.180)

"It seems nearly certain that most of us will either see the point or will be initially in doubt. At first a few, and then mounting numbers will choose freezing, and before long only a few eccentrics will insist on their right to rot. Most people will not dare be left behind. There will be no generation of martyrs." (p.174)

It is clear that the book was not a technical manual for freezing. It was intended to persuade a mass audience that the idea is acceptable and that every passing day is lost time. In fact, the forcefully positive tone of the book leads us to understand that it was written in an attempt to create a self-fulfilling prophecy. Ettinger assumed that, once proposed, such an obviously sensible idea would take society by storm. Unfortunately, today the "mounting numbers" have failed to materialize, and it is the cryonicists who are looked upon as the "few eccentrics." With these points in mind, let us go on to examine the basis for Ettinger's estimate of $8,500 for suspension costs.

For clarity and to avoid the possibility of quoting out of context, we first reproduce most of the section "The Cost of Commercial Freezers" (p.118-121) in which the cost is proposed. (Reprinted by permission of the author.)

"Now let us try to guess the cost of freezing in the near future, when commercial facilities become available.

"The preparation of the body may correspond roughly to a major operation by a team of surgeons using expensive cryogenic equipment, and can therefore perhaps be expected to cost several hundred dollars at

least. This might be reduced if mortuary technicians can be trained to replace surgeons.

"Even more difficult to asses is the cost of the Dormantory and its maintenance. But there are some suggestive known costs."

"In Detroit in 1963, a mausoleum crypt could reportedly be had for $1,250. The mausoleum itself cost about $3,000,000 to build and holds 6,500 bodies.

"Can we make a first crude estimate of the cost of the Dormantory by regarding it as a refrigerated mausoleum? Perhaps we can at least as regards first cost and not maintenance. In fact, since the freezer need not be as fancy nor as spacious as a mausoleum, and need not provide for routine access once it is filled up, possibly its initial cost will be no greater than that of the mausoleum, especially if the refrigeration scheme is the very simple one now to be considered.

"To fix a rough upper limit on the cost of maintaining the refrigerating equipment, let us think of the simplest scheme possible; besides being the simplest, it will probably be the cheapest to install and the most expensive to maintain.

"This involves merely surrounding the storage space with liquid helium and insulating layers, and replacing the liquid helium as it evaporates.

"Now, liquid helium in a 4,000 liter spherical container 2 meters in diameter, shielded by liquid nitrogen, evaporates at about 0.2 per cent per day. (103) If we consider a cubical storage space 30 meters on edge, this will hold 18,000 bodies at 1.5 cubic meters per body. If we assume the evaporation rate is proportional to the area of the exposed surface, as it ought to be, then the liquid helium evaporating per day would be roughly 3,400 liters.

"Liquid helium was quoted in Detroit in 1962 at $7 per liter in 100-liter lots. If we used this figure, the evaporation loss cost comes to about $1.32 per day per body, or roughly $480 per body per year. Actually, the price for large amounts will surely be lower. Helium is available in large quantities, occurring as 1 per cent to 8 per cent of natural gas at various wells. (103) On the other hand, we have ignored the cost of replenishing the liquid nitrogen shield; but liquid nitrogen is quoted at only 50 cents per liter in 100-liter lots, and its latent heat of vaporization per dollar's worth is much larger than that of helium, and sufficient insulation could make the heat leak very small, minimizing this cost.

"In fact, with very thick insulation, the liquid nitrogen shield could be dispensed with altogether, and the evaporation rate of the helium still reduced, no doubt. In any case, the cost of cooling and recycling the helium will surely be much lower than the cost of simply replacing it, especially after large-scale study and investment. Also, the allotment of 1.5 cubic meters per body may be too liberal; this is more than 51 cubic feet. All in all, perhaps it is not unreasonable to guess at a figure of $200 per body per year for maintenance as a first approximation.

"To produce $200 per year would require capital of $6,667 invested at 3 per cent. (There are always plenty of good bonds for sale which yield this much.) Then adding together the $1,250 storage space cost, the $6,667 capital investment for refrigerating cost, and a few hundred dollars for preparation of the body yields a rough total of $8,500 per body. This is the tentative cost of a private freezer program on a group basis."

Ettinger then writes "Needless to say, countless refinements and improved safety factors could increase the cost," and "On the other hand, any of many possible developments might reduce the total cost, and tax subsidy might reduce the direct cost." (This hope for tax relief is also mentioned on page 73.) Ettinger goes on to discuss mutual aid societies who may want to provide emergency freezing and temporary storage; but the implication is clear that he believes this will not be necessary for long.

One problem with evaluating Ettinger's conclusions is that he has not been very clear about how he got his figures. This is not necessarily a criticism, since a fully documented book would have been too dull to attract much attention. (In fact, Ettinger has 130 references, far more than the average work of popular non-fiction.) Still, some of the conclusions and figures are disturbingly vague ("a first crude estimate," "several hundred dollars at least," and "perhaps it is not unreasonable to guess at"), and it is a bit confusing when he switches from 6,500 bodies in one type of building to 18,000 bodies in another type. Ettinger himself does not seem very confident about the $8,500 total, since he calls it tentative. Certainly this does not sound like a hard figure that should be used for initial budgeting without being questioned.

In reading Ettinger's description of the giant storage unit, you should have become aware that it was a speculation based on mass acceptance of cryonics. Only an active and influential movement could support the staggering complexity of a program designed to perfuse, freeze, and store 18,000 individuals. If we assume that the building is intended to be filled in a five year period, that means nearly ten perfusions per day. Although Ettinger suggests that hospitals or mortuaries might do the perfusions, it would seem that this level of activity would be beyond the ability of either institution to provide. A separate perfusion building (or series of buildings in various locations) would be needed. (The building Ettinger describes is for storage only.) Ten perfusions per day could be handled by a non-profit corporation, but it would have to have paid full-time employees, including perfusionists, biologists, cryo-technicians, administrators, secretaries, clerks, accountants, lawyers, custodians, truck drives, maintenance men, and public relations and sales personnel. Even with a well-organized system, it would not have been likely that a perfusion could have been completed in less than twenty-four hours, with an additional forty-eight hours needed for the descent to liquid nitrogen temperature (-196øC). The technical staff, among others, would have to be on duty twenty-four hours a day, presumably in eight-hour shifts. The writers of this article have figured that if all the perfusions were done at one location, the company would require at least 200 full-time employees (not counting extras to cover for vacations and illness) and ten sets of perfusion equipment. In reality, much more equipment would be purchased to cover breakdowns, set-up time, and days in which 13 perfusions are required instead of the average ten. If the perfusions are done at more than one location, more people and equipment will be needed.

Our point in this is to indicate the complexity, not to detail the cost. Many months of figuring have still not allowed us to come up with a figure which reflects the real 1965 cost of such an operation. Although we feel we can state a definite minimum of fifteen million dollars over a five year period (not counting any building or

property cost), we estimate that the actual costs could have been in excess of twenty-five million dollars. We have no way to confirm that; but in any case, we will soon show that the details are not very important. A critic could counter that the building more likely would have been filled

over a period of time longer than five years, reducing the annual costs; however, this would increase the total costs. But the ongoing costa are not the real problem. Before any of these system became a reality, the perfusion and storage buildings would first have had to be in place and operating. This means an immense amount of capital would have been needed in advance.

As to the storage building itself, Ettinger gives no firm figure of cost. The $3 million mentioned is for a mausoleum holding 6,500 persons, not for a significantly larger structure for 18,000 persons, a structure with a complex and untried cooling system. When a cryogenic engineer from Linde Division of Union Carbide was recently asked about the cost and feasibility of constructing such a unit, he replied that he couldn't begin to provide such an estimate without contracting for a formal feasibility study. When pressed, the engineer did indicate that such a project would be a massive undertaking of a more or less unprecedented nature and that the cost for the prototype would probably run in excess of $40 million (approximately $14 million in 1965 dollars). He also felt that the proposed refrigeration scheme was far from being "very simple."

Ettinger also suggested that the storage building could be of comparatively simple design because it would not need "routine access once it is filled up." Well, the access points certainly have to be provided while it is being filled up, since 18,000 individuals will not be perfused and frozen simultaneously. In fact, the building will have to be carefully compartmentalized to prevent heat transfer to stored patients as new ones are added. This will require a fairly elaborate system of access which will have to remain in place so that future technicians can remove patients for re-animation. Complete access will be essential since, unless all 18,000 patients were of the same age, died of the same disease, and were frozen in the same condition, future re-animators are likely to find it possible and necessary to revive some patients before they are able to revive others.

A local architect has pointed out to us that floors, hallways, and stairwells not only provide access but are also an integral part of the support structure of a building. This giant cube would certainly require floors, or the bottom-most bodies would be crushed by the tons of bodies above them. Stairwells and other vertical supports are necessary to transport the force of all that weight to the ground. We were told that it would be impossible to build such a structure without a great deal of expensive support framework and much detailed research.

It is useless to spend further time in contemplation of this building or of the immense perfusion system required to fill it with suspendees. The building was only a speculation designed to fire the imagination and to show one possible route to solving the storage problem. Using this speculation as a basis to figure actual costs was an exercise in fantasy. The need in 1965 was not to figure what costs would be after the entire society became involved and began building huge storage units. The need was to determine what the cost would be for the first people to be frozen.

As we are all sadly aware, today's truth has fallen far short of

---

yesterday's dream. Today, less than 200 people have made the financial and legal arrangements to be suspended. Only two companies, Trans Time and Cryonics Institute, offer suspension services. (*) The idea of huge storage corporations or the government providing cryonic suspension and storage died long ago. There is no way to know what the cost really would have been had the freezer program caught on in 1965. It is fruitless to try to compare today's prices with that $8,500 "mass market" estimate.

A major factor in today's prices (and the one most crippling oversight

in the estimates of early cryonics companies) is the start-up cost, which someone -- Donor or Member -- has to pay. It can cost over $150,000 to purchase the new equipment necessary to begin doing perfusions and freezings. True, today's cryonics companies have frequently purchased used equipment for less than 20% of new cost, but it has generally taken them several years to find the used pieces they needed. Even this amount of equipment only gives a company the capability to suspend one person at a time, with no back-up for repair or for that ill-timed and inevitable second suspension. Other start-up costs include building rent or purchase, legal costs, promotion, utilities, supplies, and time. The company must have the time to equip and organize its facilities and to trains its perfusion team. All of this must be in place before the first suspension case is accepted. And the company must then be able to afford to sit and wait for months if necessary before an acceptable patient is available. Shortly after that first patient is perfused and frozen to dry ice temperature (-79øC), the company must come up with a tank or other system to suspend the patient in liquid nitrogen. Today a whole-body vacuum tank for two patients will cost at least $7,000 and more likely $15,000 -- if a company can be found which will build a good one at all. MVE and Linde, the major manufacturers of cryogenic dewars, now refuse to build tanks for cryonic suspension, and other suppliers have been found to be unreliable, uncooperative, or impossibly high priced. All of the present cryonics groups combined could not provide the money to build Ettinger's 18,000 patient unit; and if the building did exist, at the current rate of freezings it would have space available for 2,600 years.

Except for the precise figures, the above considerations were just as necessary for the early cryonics organizations as they are for modern groups. Yet, even though the figure of $8,500 was based on an unreal or at least far-future situation, that figure was widely quoted in magazines and television programs at the time and was used as a base cost by several companies. It is ironic, but in a way, perhaps that $8,500 estimate (and to some extent, the book itself) was a contributing factor in the failure of the early cryonics movement. The problem was not primarily with Ettinger, but was more a misunderstanding of the book's purpose by some of the early cryonics enthusiasts. These first groups were run mainly by unknowledgeable amateurs, instead of the financial and scientific professionals Ettinger expected. Against all logic, "The Prospect of Immortality" was taken as a guidebook,

---

* BACS, Alcor, and IABS do not directly provide suspension services, but instead contract with Trans Time. Cryovita offers its suspension services through Trans Time.

instead of an inspiration for new idea and solutions. Ettinger's book answered more psychological and sociological problems than it did technical or financial ones. Perhaps it answered the psychological and sociological problems so well, that these enthusiasts just assumed everything else was as easily solved.

For whatever reasons, the early cryonics organizers got in over their heads. They had little idea how to go about doing perfusion, freezing, and storage. Many were put off by the idea of working with dead bodies. They failed to take on their own responsibility for estimating costs and physical requirements. No realistic provisions were made for start-up costs. Charges for suspension and storage were far too low. Little judgement was used in deciding which patients to accept for suspension. The idea that "everyone deserves a chance" quickly bankrupted companies.

And most fatally, buoyed by the movement's optimism, these leaders assumed that help would soon come from other sources (the government, foundations, millionaires, or merely increased cash flow from new recruits), and so they failed to take the personal responsibility necessary to correct the problems.

Though it is not possible for us to further evaluate the building and storage portions of the $8,500 estimate, there is one portion we can be more detailed on. Let us consider the "several hundred dollars" (to be specific: $583) for the preparation of the patient, including perfusion and cool-down to liquid nitrogen temperature.

In 1965 a hysterectomy with a typical five-day hospital stay cost about $1,000 (1981 -- $3,100). A hysterectomy is in no way comparable in complexity or labor intensiveness to perfusion and cool-down (a process which currently takes three to five days). More comparable would be open heart surgery for valve replacement or septal defect repair, operations which require perfusion procedures similar to those required for cryoprotective perfusion. Such heart operations cost between $3,000 and $6,000 in 1965 (1981 -- $18,000), including post-operative care to five days. It would be reasonable to assume that a full-scale perfusion performed by hospital personnel plus a cool-down performed by a cryonics team would have been similarly priced. Not included in this price would be the added costs of extended resuscitation and transportation if death occurred at some distance from the perfusion facilities.

As we have previously mentioned, Ettinger at many points in his book assumes that hospitals would at least perform the perfusions. He also hints that the use of trained mortuary technicians could reduce the price. The use of mortuary technicians, at least is easier said than accomplished. Most of the morticians these writers have met had training and attitudes suitable only for the treating of dead bodies, not for the preservation of life -- an important distinction when time is critical and commitment is required. Even the physicians supposedly pledged to the preservation of life have generally refused to view the most basic pre-perfusion procedures as a reasonable use of medical facilities. In any case, in the succeeding years dependence on either hospitals or mortuaries was shown to be unwise, and cryonics groups were forced to develop their own methods. While less sophisticated than hospital procedures would have been, these methods were still costly. Then, as now, a small group of amateurs had to suffer the higher prices for supplies not purchased in bulk, the initial cost of

purchasing equipment and facilities, and the dozens of other inefficiencies of running a twice-a-year operation.

An even more important element in today's higher prices is that, though Ettinger tried to make some concession in this direction, cryoprotective perfusion of clinically dead human beings has turned out to be a much more complex and difficult procedure than anyone in 1965 imagined. Fifteen years of experimentation have not yet brought us a perfusate which is completely reliable and which does not cause its own damage. Even the controversy over which cryoprotectant to use has not entirely ceased. The early techniques of perfusion through the carotid or femoral arteries are being judged inadequate and are being replaced with more elaborate thoracic surgical methods. Difficulties with cooling rates, clotting, edema, and dehydration have each added complexities to the procedure. In addition, social complications have developed with transportation, legal paperwork, unreliable operators, and with the lack of co-operation from physicians,

hospitals, mortuaries, and builders of cryogenic containers. The few suspension facilities currently available have made transportation an especially costly item. Because of the need for prompt cardiopulmonary support, medication, and cooling after the patient has been declared dead, a perfusion team must be prepared to wait by the patient's bedside, perhaps for several days. If maximum protection is desired, jet air transportation must be used to take the patient to the suspension facility ($6,500 from Indianapolis to Los Angeles). Shipping the patient via air freight, while cheaper, creates a number of technical problems.

In the early days of cryonics, such elaborate procedures were not even contemplated, much less applied. The biological and medical sophistication of most of the early cryonics activists was slight. Indeed, as one of the early leaders, Curtis Henderson, has stated, "Cryonic suspension in the '60's and early '70's was little more than guerrilla theatre as far as the cryobiology was concerned. You got the body, you ran a few gallons of chemicals through it in a funeral parlor, and then you iced it." This view is substantiated both by popular press articles and technical reports, as well as by Michael Darwin's personal experience with perfusions during this period. Appendix B-I shows a list of equipment, chemicals, and supplies used in conducting a perfusion and cooling to dry ice temperature as it was typically carried out between 1967 and 1972. During this time there were about 11 major items or classes of items used. Some groups may have even used less. Additionally, most of these items were not owned by the cryonics society but were made available by a mortuary as part of its service. Between 1973 and 1978, cryonics groups attracted more members with biological backgrounds, who insisted on refinement of the procedures. This, coupled with the realization that morticians were not always dependable sources, resulted in the cryonics societies becoming responsible for the equipment, chemicals, and space. The increase in cost and number of materials and equipment is shown in Appendix B-II. From 1978 to the present, there has been a rapid increase in the sophistication of the suspension operation, in an attempt to provide a level of quality consistent with contemporary medical procedures. This was coupled with a growing understanding of the chemical and structural complexities involved in perfusion and freezing. These two factors led to the explosion of added equipment and supplies

---

listed in Appendix B-III, including a heart-lung machine, more sophisticated cooling and pumping apparatus, monitoring equipment for assessing perfusate distribution and cryoprotective equilibration, and quality control for dangers such as air bubbles, microemboli production, bacterial contamination, and water impurities. The rise in suspension costs created by this greater sophistication is similar to the rise in medical costs over the same period (see p.14). In both cases, not only have basic cost risen with inflation, but more care is actually given, at a greater total cost.

The need for all of the improvements mentioned above has been questioned by some individuals and groups involved in delivering cryonics services. One recent controversy has concerned the uses of sterile technique and of pyrogen-free water, which some officers of the Cryonics Institute have suggested are expensive frills. Certainly the use of sterile technique has added to the cost of suspension, in comparison with the early '70's. However, experiences with unclean equipment and potentially infectious patients have convinced many cryonics researchers that most such procedures are unavoidable. At the very minimum, the perfusate has to be filtered and the operating room kept clean to prevent particulate obstruction of the perfusion circuit and of the patient's

circulatory system. Since particulate contamination is also possible through an overgrowth of micro-organisms or an infestation of insects, sterilization of stored materials is also desirable. In addition, most of the drugs, tubing, and other supplies required for perfusion are by definition medical devices and are largely supplied only in pre-sterilized form. Many of these supplies cannot be re-used, because they are difficult or impossible to re-sterilize.

While this is not the place for a full discussion of sterile technique, it should be pointed out that its use is not only for the protection of the patient. Equally important is protecting the surgical and perfusion teams from the germs of the patient, who may have had an infectious disease (possibly undiagnosed). Cryonicists do no have the mortician's advantage of perfusing with a potent germicide such as formaldehyde or glutaraldehyde. A further consideration for the suspension team is the hazard of cuts and infection from unsterilized medical equipment.

It appears certain that the $583 allowed for patient preparation was far below what would have been necessary, except in the most primitive perfusion and freezing. It also seems certain that $8,500 would never have been a practical figure for suspension and maintenance. In 1965, an estimate of $12,000-$15,000 would have been more realistic and might have made it possible for more companies to have survived. Of course, a company would still have had to hold that as a firm figure and not have taken any charity cases. That kind of charity did no one any good. With a 1965 base of $12,000, today's price of $60,000 represents only a 400% increase, nearly in line with the increases in medical care. A base of $15,000 results in only a 300% increase, more nearly fitting into the general inflation rate.

There will continue to be debate over increased cost and over the question of how much technology is cost-effective. This is true in any type of business, as demonstrated by the current arguments over the use of low-pollution fuels and devices in industry and by the medical debates on the value of heart by-pass operations. Cost increase is

inherent in any growing technology. It is natural for people to strive for improvements in method and equipment. Not to use appropriate new developments would be bad public relations, and sometimes unethical. Since few people ever agree on the definition of what is "appropriate," we may as well get used to the debate continuing.

END OF PART ONE.

- -

APPENDIX A -- ECONOMICS

I. Consumer Price Index

1965	1979	%incr.	1980	%incr.
94.5	229.9	143%	258	173%

II. Change in the C.P.I. by year (the inflation rate).

1965	1.7%	1973	6.2%
1966	2.9	1974	11.0
1967	2.9	1975	9.1
1968	4.2	1976	5.8
1969	5.4	1977	6.5

1970	5.9	1978	7.7
1971	4.3	1979	11.3
1972	3.3	1980	14.4

III. Price of finished Steel	1965	1979	%incr.	1980	%incr.
	6.37cents/lb	20.01	214%	21.73	241%
IV. Fuel and Utilities (C.P.I.)	98.3	239.3	143%	275.9	180%
Producer Price Index for Fuels and Power	95.5	408	327%	547	472%
Retail Gasoline Price (excluding taxes)	20.7cents/lb	101.1	388%	123.3	495%
V. Medical Services (C.P.I.)	89.5	250.7	180%	276	208%
Per Capita Annual Cost.	$198	$920	365%	not yet available	

APPENDIX B --

MAJOR ITEMS REQUIRED FOR A PERFUSION AND COOL-DOWN TO -79øC

NOTE: These figures do not represent the cost per perfusion; they represent the cost of the first perfusion, i.e., the set-up costs. Not included are the cost of long-distance transportation, rental or purchase of property, payment and training of personnel, and legal and administrative costs, all of which are too variable to be easily estimated. Most of the items on the following lists could be used in subsequent perfusions, including consumables, many of which can only be purchased in amounts larger than needed for one perfusion.

The definition of "required" has some flexibility in cases where an older or cheaper model or method may be adequate. So far, a large part of the equipment actually in use in perfusions has been purchased at used prices. Bargains in medical equipment are difficult to find, however, unless the group has a member on a hospital staff. Even with this advantage, it takes as long as three or four years to locate the necessary items, time which newer organizations may not have.

I. 1967-1973.

	Cost in 1968
Porta Boy embalming pump	$ 250
Embalming table	175
Surgical instruments	125
Two mercury thermometers	25
Two graduated cylinders (1 liter)	30
Ringer's lactate solution	120
Glycerol	65
Drugs	15
Chrome and brass cannula	15
Dry ice chest	300

Dry ice and ice	85
Body Pouch	15
	$1220

II. 1973-1978

	Cost in 1974
Ambulance and cot	$ 2500
Perfusion machine (Manrise)	700
Resuscitation equipment	2800
Safety equip (eyewash station, etc.)	150
Filtration pump and filters	150
Hypodermic equip and IV supplies	225
Centrifuge	125
Surgical instruments	1000
Telethermometer with probes	400
pH meter	125
Balance	75
Embalming table	200
Reservoirs	50

1973-1978

Glassware and graduated cylinders	$ 250
Stainless steel heat exchanger	250
Refrigerator	100
Hydrometric equip.	45
Custom glass cannula	75
Drugs	300
Water for injection (100 liters)	200
DMSO (15 liters)	175
Dry perfusate chemicals	150
Propyl alcohol (55 gal.)	117
Plastic bags	21
Body Bag	45
Dry ice chest	350
Dry ice and ice	125
	$10,703

III. 1978-1981

	Cost in 1980
Ambulance and cot	$ 3200
Heart-lung machine	18,000
Resuscitation equip.	2800
Safety equip.	200
Filtration equip. and filter	450
Stirring and mixing equip.	75
Hypodermic and IV supplies	275
Physician's compact centrifuge	375
Adams Redicrit centrifuge	325
Surgical instruments	4000
Two telethermometers and probes	1185

Thermocouple thermometer and probes	1600
Wall sphygmomanometer	125
Blood gas equip.	6000
Renal systems airbubble detector	580
Suction equip.	275
Bos-10 oxygenator	185
Sarns Torpedo heat exchanger	1000
Sarns heater-cooler	3000
Speed autoclave	1500
Cidex and tub for cold sterilization	95
Refractometer (A O)	375
pH meters (2)	850
Spectrophotometer	750
Pressure transducers (2)	1500
Pressure monitor	6000
Opthalmoscope	175
Cautery and R-F knife	2600
Stryker bone saw	225

1978-1981 (continued)

Balance	$ 125
Operating room table	4800
Operating room lamps (2)	1600
Mayo stand	325
Reservoirs	200
Glassware and graduated cylinders	800
Carts, cabinetry, tables	7000
Refrigerator-freezer	700
Electric clippers	75
Tape recorders and tapes	100
Sterile supplies	800
Gloves gowns, masks	300
Tubing packs	70
Cannula	25
Disposable surgical patient prep kit	35
Emergency drugs	325
Dry chemical for perfusate	375
Glycerol (5 gal.)	260
Water for injection (200 liters)	450
Propyl alcohol (55 gal.)	150
Body bag and wrapping	65
Dry ice chest	550
Dry ice and ice	300
	$77,150

****

(Continued from page 7)

I am pretty certain we can avoid it. I am equally certain that we will blunder into it if we ignore it and fail to understand its causes. It is suicidal to hide from the truth because the truth is frightening: that only condemns us, without a figth, to suffer from all the frightening things that we would prefer to avoid. If not for our willingness to face the prospect of death, for example, we would not have developed cryonics as an interim solution for it.

We must similarly face the deficiencies of current methods so that our solution will have a better chance of success.

The final issue is fraud. If we go on record as supressing bad news about what happens to people when they are frozen, we are wide open for charges of fraud, and believe me, there are plenty of people out there who would like to see such charges stick. We have no choice: we have to tell the truth, even about things which we consider unpleasant or damaging. If cryonics cannot survive in the clear light of day, we might as well forget it. It's as simple as that.

Incidentally, in my later article, "The Future of Cryonics", I made several inflammatory remarks which were inteneded to challenge the complacent to take the problems of cryonics more seriously and do something about improving the overall situation. In the course of the article I mentioned the "CSC/CI" disaster. I did not, however, mention that CI referred to Cryonic Interment, not to Cryonics Institute. I apologize for this ambiguity. Most readers, hopefully, are aware of the fact the Cryonics Institute was not involved.

Corey Noble
IABS DIRECTOR OF RESEARCH
December 11, 1981