CRYONICS

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EDITORIAL MATTERS

Frosty Thermometer

As you can clearly see, Frosty Thermometer is continuing his recovery from suspended animation. Due to the generous contributions which continue to come in, we are now at $2,037! We are rapidly nearing the half way mark! We hope to place our order for the concrete vault

and the trailer sometime in the next two weeks or so. We'll keep you posted on further developments.

Drexler Error

One of the amazing changes we've experienced is a big improvement in our efficiency as a result of entering the computer age. While the computer has almost eliminated many of the production gaffes we've experienced in the past, there are still humans around, and consequently still plenty of room for error. We can blame the footnote error which occurred on page 25 of the August issue on humans and not on the machine. The footnote which should have appeared at the end of "Transitions" by Mike Darwin was covered over in a last minute paste up. Our apologies to Eric Drexler since it referenced his very excellent manuscript The Future By Design. We understand that Eric still has not found a publisher and we wish to point out that copies of his manuscript will be unavailable until he does so.

Meeting Schedule Error

The meeting schedule printed in the August issue contains an error for the September meeting. The September meeting will be held on the second Sunday, the 9th of September, not on the 2nd of September, which happens to be on Labor Day Weekend!

Postmortem Results: Some Perspectives

Elsewhere in this issue we present a technical paper documenting observations made on the bodies of frozen-thawed suspension patients who were converted to neuropreservation. First, we should point out that long-term care for all three of these patients is continuing and will continue as long as we're around. Second, we should point out that while the discovery of fractures in the bodies of all three patients is not good news, it is the kind of "bad" news we've been prepared for all along.

While the fracturing problem is a serious one (many vital organs were disrupted by one or more fractures) it is not overwhelming in the sense of the bodies being heavily or minutely fractured. While the fractures we observed would certainly disrupt gross functioning, they have little, if any, impact on the stability and integrity of the fine structure and thus the information

content of the tissues. A good analogy to this kind of injury would be to envision a phonograph record which someone has scored with a screwdriver. The fidelity of the recording would appear to be hopelessly compromised if it was placed on a standard stereo and played. Yet, the same record with advanced Dolby (TM) noise removal would be virtually indistinguishable from the original. The information is there; the breaks and glitches simply need to be removed.

What these results DO point up is that it is time for those (hopefully few) of us who have been thinking of cryonic suspension in terms of simple

viability and traditional surgical repair techniques to wake up and face reality. Contemporary freezing techniques are disruptive and they will require the development of very sophisticated repair techniques. Undoubtedly we will discover damage on the molecular level which is equivalent to or even worse than the fracturing problem we have encountered on a gross level. Repairing such injury will require that we be able to move atoms around almost on a one by one level. It will require that we have tools and engineering capability on a molecular level and that we be able to build molecular repair and fabrication machines--basically our own version of enzymes.

While we may not be able today to design such tools, it is possible for us to set the parameters for repair and to know what such tools will have to do, as well as what their physical and design requirements will have to be. Just because we don't yet have the capability to build something doesn't mean we don't know if it can or cannot in fact be built. In this respect we are in much the same position as Leonardo da Vinci in the 15th Century. Leonardo could envision many, many mechanical devices (indeed he envisioned ALL of them now known but two!) but the levels of engineering and materials science available in his time were just not good enough to build them. Leonardo lived in a time when ball bearings could be thought of but the existing craftsmen were unable to cast and machine metals to that quality and degree of precision. Indeed, it was to be hundreds of years before metallurgy evolved to the point that metals hard enough to withstand the loads required were even developed!

We are in much the same position today. We can see quite clearly the kinds of repair techniques that will generally be required to recover patients from suspension, and yet they are beyond our grasp today! But not tomorrow! That is the beauty of cryonics: we, unlike da Vinci, can afford to wait. It behooves all of us to realize that subtle and powerful techniques will have to be developed to recover those of us frozen with existing techniques. This is one reason why so many of us have elected for neuropreservation as opposed to whole body storage: the kind of repair technology which will likely have to be available to repair our brains will make regrowth of a new body a trivial exercise by comparison. Indeed, new bodies are grown every day in nature right now, while freeze-injured and cryofractured brains are not repaired in nature at all. We urge everyone who is whole-body to rethink the basis of their choice. If the basis of choice is concern over a severed spinal cord or emotional concerns not related to the hard facts, we urge you to reconsider.

On the other hand, we should point out that we intend to try and solve the fracturing problem. At this point it is hard to know how easy this will be to do, or even if we can do it in a fashion consistent with existing resources and realities. Rest assured we are going to be looking for solutions and we have some reasonable amount of optimism that we will find them!

In the meantime, keep the issue of fracturing in perspective. While it isn't the most pleasant thing to discover, it's far from the end of the world and in fact just confirms what we were reasonably sure was happening all along: existing freezing techniques cause injury on gross and microscopic levels.

On a more optimistic note, histological studies done on tissues from one of these patients demonstrated excellent cellular preservation on a light

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microscopy level. Cell to cell relationships were well preserved and other visible structures appeared intact as well. This work gives us much reason for optimism. We hope to bring you the paper documenting the histological

findings in a month or two (it's written already but needs to be circulated for review).

A word or two needs to be said about why it took well over a decade to find out such a problem was happening! It cannot be emphasized too much that many cryonicists don't take the need to do research seriously. They are content to sit on their ----- and let "our friends in the future" fix us up. Well, friendship is a two-way street. Our "friends" of the future had better have some debt of gratitude to owe us or they're not likely to have our reanimation as a high priority. Research work successfully completed now helps everyone and is the foundation upon which future capabilities will rest. Technical problems are solved a little bit at a time. If we allow ourselves to be demoralized by the magnitude of the task required, or worse if we sit back and wait for others to solve problems we wouldn't tackle ourselves, we've failed before we've begun. By and large no one is going to do the kind of work necessary to perfect cryonics except cryonicists. In a very real sense the amount of injury YOU suffer and the degree of recovery YOU experience IF you are revived depend upon your actions NOW. The fracturing problem is just one example of the kinds of problems which need to be and CAN be identified early and solved early.

Finally, a deep debt of gratitude needs to be acknowledged to the husband of one of the suspension patients whose body we examined. All of us owe him our thanks for his generosity in allowing such an examination. That kind of courage and depth of commitment are rare. All of us will benefit from his generosity. Reflecting on the stupidity and short-sightedness of other relatives in similar situations, it is especially apparent that this cryonicist made a major contribution. Our sincere thanks to him, and to the patients themselves, two of whom I know were strongly motivated to participate because of what could be learned by their doing so. Our thanks to all of you.

THE FRENCH RELUCTANTLY ENTER THE CRYONICS ERA?

In late July we received a call from a reporter from the French equivalent of a combination of Life and People magazines, Paris Match. The reporter spoke very poor English and communication was difficult but several things seemed to emerge from the conversation: something having to do with cryonics was happening or about to happen in France, and the reporter was not about to give us any information. A few days later the July 28th issue of the San Francisco Examiner contained a story about a French gynecologist, 62-year-old Dr. Raymond Martinot, who had frozen his 49-year-old wife Monique after her death in an automobile accident. Martinot is described not only as a gynecologist but as a scientist "who has also studied hibernation and body conservation at low temperatures." According to the UPI story Martinot is maintaining his wife at -130 degrees (it doesn't say whether Fahrenheit or Centigrade), presumably in a standard "dry ice" temperature range mechanical freezer. The press got wind of the story when the freezer malfunctioned and Martinot called in a repairman--who promptly reported him to the authorities.

One of the major stumbling blocks to the development of cryonics in France has been that country's bizarre and archaic burial laws. According to French

law no embalming may be carried out until the body has been held for 24 hours. The law regarding where and how bodies shall be disposed of is equally strict and Draconian and can best be described as the nearly unmodified leftovers of the Black Plague and the Middle Ages. It probably also counts to mention that the French are rather conservative people who do not take well to "alien or radically different" outside ideas. The French have made national efforts in the past to prevent "contamination" of their culture with "foreign" words and ideas and their initial reaction to cryonics in the 1960's and '70's was even more hostile and conservative than was the case in the U.S.

With that background, the French authorities quite understandably are trying to pressure Dr. Martinot into burying his wife. According to the UPI, French police inspected the freezer containing Mrs. Martinot and "took pictures and strung new locks around the casket."

Martinot's motivation in freezing his wife seems to be rational enough. He has commented to the press that "he put his wife's body into the deep freeze hoping medicine could bring her back to life by the year 2030." While we may disagree with the doctor's optimism, as far as the timescale is concerned, we can certainly admire his spirit.

As a final note, we understand that Martinot has appealed to other countries to take over care of his wife's remains should the French force him to bury her.

The Question of Prepayment For Suspensions: An Editorial

by Mike Darwin

In the past it has been almost impossible to get cryonics services paid for even after the patients has been frozen. It's a sign that times are changing in that we are now receiving requests to prepay for suspensions. In Northern California we understand that Trans Time has already been prepaid by at least one person.

Prepayment raises a number of sticky ethical and legal questions. First of all, if someone prepays, are they being guaranteed a service at that rate? In other words, if an individual prepays and then doesn't die for ten years do they owe more if the cost of cryonics services has risen in the interim? How should prepayment monies be managed? What kinds of investments and use of prepaid funds constitutes good ethical behavior and good common sense?

There has a been a lot of debate about these issues in the cryonics community over the past six months or so. ALCOR has already received one offer of prepayment and inquiries from several other members who are interested in this option as a way of safeguarding noninsurance funds which have been set aside for suspension.

As an aside, it is worth mentioning that personal assets which have not been transferred to a cryonics organization via an irrevocable trust or prepayment are subject to attack by health care providers, landlords and/or other creditors. What this means is that if you become catastrophically ill and require extended (or even very expensive short-term) medical or other care then all of your assets, excluding $1,500 which the state allows you to retain to pay for burial expenses, is subject to attack by your creditors. If you have a stroke, become suddenly incompetent or otherwise unable to act and require extended care, then funds provided for cryonic suspension could be rapidly depleted. Life insurance, prepayment, escrow and irrevocable inter vivos trust funds are immune from depletion in this way.

While prepayment will safeguard against such a resource drain, it carries other risks. Principally, the solidity and good judgment of the organization the prepayment is going to should be considered. Recently in Northern California this issue has been brought into sharp focus. BACS/Trans Time has been casting about for some months for capital to purchase a facility. Despite vigorous efforts, the building fund has remained at $25,000 for many months. Early this year it was proposed that some of the prepayment money (perhaps as much as half) which Trans Time has received be used to supplement the building fund and move BACS/TT closer to a purchase.

Some BACS members, such as Thomas Donaldson, have vigorously opposed this use of prepayment monies. Donaldson and others, including ALCOR, have argued that prepayment monies should be managed very conservatively. A conservative approach is doubly recommended when the individual for whom prepayment is made is elderly or otherwise at increased risk of dying. Loss of the principal through mismanagement or error in such a case could mean the difference between being suspended and not being suspended.

ALL the directors of ALCOR feel quite strongly that regardless of the particulars, prepayment funds should be very conservatively handled, even if it means getting a lower interest rate or otherwise passing up attractive investments. It cannot be emphasized too much that cryonics organizations including ALCOR do not have exactly rosy Dunn and Bradstreet ratings. Trans Time has been recording heavy losses over the last two years and, judging from their 1983 Annual Report, cash flow is becoming an increasingly severe problem. It may be tempting to use prepayment money to "keep the doors open." However, in our opinion any realistic analysis of the situation will show this to be a short-term answer to what is a long-term problem, a problem which will ultimately destroy any cryonics enterprise unless it is solved in a long-term fashion by realistically spreading the cost for services around and/or attracting more clients.

To this end, ALCOR recently adopted standards and incorporated them into our bylaws which govern handling and investment of prepayment funds. Basically, we have stated that such funds (if they are liquid) shall be maintained in a liquid state. This will probably also act to restrict prepayment (as we feel it should be) to situations where individuals are unlikely to live long and desire the security of having paid in advance. In most situations the best solution to the "prepayment" dilemma will be the creation of trusts or escrow accounts which place full responsibility for management of the money on the person while he or she is alive and removes from the money management picture questions of proper conduct by cryonics groups. We believe such stringent and conservative standards are a must at this point when the credibility and durability of any cryonics organization are so much at question.

This issue points up yet again the urgent need for industry-wide ethical standards. Certainly it has sensitized all of us at ALCOR to the need for an ethical manifesto to guide and govern our own decisions. For some time now we have needed guidelines on what constitutes informed consent, reasonable and prudent investment practices for suspension fund monies, rights to privacy of suspension patients and their families and under what circumstances and conditions we should accept "research" cases (i.e., people with inadequate or no funding whom we may wish to suspend in order to do testing or take tissue samples which we would be unable to do under normal circumstances in a suspension). Now, before these issues are forced upon us, we should begin to think about how we handle them. It is long overdue for us to begin drafting an internal set of ethical guidelines and regulations. If we fail to do this, then in the long-run someone else will. In any event, it is wise to note that when the state gets around to

base such regulations on whatever industry standards are already in place. The question is, just exactly what kind of regulation will we get if there are no standards? Unless we act and act in the near future, that may be one of many questions we find abruptly answered for us. Until such time as we have standards for ethical conduct to guide us, it behooves all of us to be careful and conservative, particularly in the areas of prepayment and suspension fund management.

THE QUESTION COLUMN

A question we have been asked by several people over the last few months is why ALCOR doesn't charge a $1,000 or so "initiation" or "entrance" fee like virtually every other cryonics organization?

As far as we know the practice of charging a $1,000 entrance fee was begun by the Bay Area Cryonics Society (BACS) and Trans Time in Northern California. The purpose of the fee was, among other things, to help capitalize cryonics, encourage new suspension memberships by allowing for payment of a finder's fee or commission, and compensate for the administrative expenses involved in signing up a new person. A significant fraction of the "up-front" money went into commissions as an incentive for those already committed to go out and get others signed up. When ALCOR contracted with Trans Time for suspension arrangements in 1977, part of the agreement was that we too would charge an up-front fee in order to pay TT's commission and prevent "unfair" advantage over BACS (obviously few would sign up with BACS if they could get the same coverage for $1,000 less with ALCOR). The Cryonics Institute in Michigan has a similar policy, although they do not pay commissions for new suspension members.

Shortly before it was initiated, the up-front fee resulted in a mini-surge of people signing up. Most people who had been "putting it off until tomorrow" quickly decided to save $1,000 and make arrangements today. Beyond that, there was also an increased number of sign-ups due to marketing zeal inspired by the promise of commissions. But after a year or two, the number of new members declined to previous low levels. Additionally, the $1,000 fee was applied somewhat capriciously. If you were part of a group or had a useful skill to barter you might cut a deal and end up paying far less than $1,000.

Several years ago, when ALCOR decided to begin offering its services directly to members, ending our contract with Trans Time, we began to reassess the utility of the $1,000 fee. Was it really acting as an incentive to attract new members or was it turning them away? Would we have a better chance of recouping administrative expenses involved in signing someone up by spreading such costs out over time rather than by asking for them up front in one big chunk? If someone doesn't think enough of cryonics and of ALCOR to try to convince others around them to sign up, should we encourage such people by offering to pay them? Of course, we realized that the initial intent of Trans Time in organizing the finder's fee program was to encourage "impersonal" sales (by a staff of TT sales agents) much like insurance is sold (and indeed this may be a valid way to market cryonics in the future). Unfortunately, no such sales force materialized and few, if any, suspension memberships were sold in this way.

Perhaps most importantly, we realized that there were a number of hardworking people who were interested in signing up with us who were being

excluded because they found it difficult or impossible to get $2,000 to $3,000 in one place (for a whole family) in order to sign up. Lastly, the question of just how important the $1,000 was had to be considered. How many thousands of dollars would we be losing if we gave it up? The answer there was clear: fewer than one per year! On the other hand we stood to gain a number of people if we dropped the entry fee--people who we could probably count on to pay in far more through dues and contributions over the long haul than the $1,000 we stood to "lose" in the short run.

We are pleased to note that we appear to have made a good decision. We are now signing up people at a steady rate (over eight people in the last two years alone) and we see no sign of that slacking off. Most of these people would not be signed up now if we still had our $1,000 up-front fee.

Because the up-front fee was applied so capriciously, we have refunded our share of it to all of our members who paid it.

We have found that there are other advantages to not having the $1,000 initiation fee. For one thing the absence of an entry fee keeps us on our toes. We know that our members have no incentive to stick with us if our service is bad. A fair number of our members have switched from other cryonics groups after paying an entrance fee--and they can just as easily switch back again. The fact that we have such members is also proof that in the long run even the psychological ball and chain of having paid a high-priced entry fee won't hold people to an organization they feel is not meeting their needs or offering services they want.

We want to see cryonics grow more rapidly in the future and most of all we want it to be affordable. So, we have avoided and will continue to avoid the high priced entry fee approach. In the near future we hope to offer a wider range of services and increase the number of low cost options available to make cryonics even more affordable.

BACS BEGINS NEWSLETTER

We have received the first issue of BACS NOTEBOOK edited by Dr. Paul Segall, Secretary-Treasurer of the Bay Area Cryonics Society. The first issue is a hefty 10 pages long and contains news items and research progress made by the Northern California group. According to Dr. Segall the newsletter will be published bi-monthly after BACS meetings (and will accompany the BACS Minutes). BACS NOTEBOOK is reportedly a joint project between BACS and Trans Time with Trans Time "providing duplicating, clerical and editorial assistance." We understand that the newsletter will be available only with membership in BACS: $150.00 per year for full members and $20.00 per year for domestic Associate Members ($25.00 per year for foreign). Anyone who wishes to receive the newsletter should send their remittance to:

Bay Area Cryonics Society
1098 Euclid Avenue
Berkeley, CA 94708

It is in the half fools and the half wise
that the greatest danger lies.

--Goethe

EVOLUTION AND IDENTITY

by Mike Darwin

> "Dear, Dear! How queer everything is today! I wonder if I've been changed in the night? Let me think: was I the same when I got up this morning? I almost think I can remember feeling a little different. But if I'm not the same, the next question is, Who in the world am I? Ah, that's the great puzzle!"
>
> --Alice
> Alice in Wonderland
> by Lewis Carroll

Cryonicists are more concerned with the questions of identity and of our future evolution than just about anyone else because we and we alone are confronted with the personal prospect of losing some part of our identity or finding ourselves in a position like Alice, wondering if we've been changed in the night. If we are to wonder what we will be like when and if we are revived we must first ask into the nature of what we are. What constitutes personal identity? If we can answer that question, what can it tell us about what we are likely to become or evolve into?

All cryonicists should be aware of the possibility they will not come back exactly as they were. The vagaries of illness, postmortem delay and damage done by the freezing process itself will almost certainly result in the loss of some information. The extent to which memories or behavioral repertoires or skills will survive freezing remains a total unknown. Some less self-satisfied cryonicists do not want to come back as they are right now. Some have made it quite clear that the reason they are involved in cryonics is precisely because of the possibility of reworking their "identities." Indeed, the question might well be asked: who is it that will get suspended? It certainly isn't the "you" or "I" that exists here and now. With luck, all of us will live many more years. We will develop new skills, lose old ones. Memories will come and go, information will be added and lost. As we age, a large fraction of the cells which make up our brains and bodies will die and disappear. Not only will physical strength diminish, but mental skill as well. If we live long enough we will be but shadows of our youthful selves.

If we look at ourselves in that way, as rivers of information in flux, we begin to bound the problem of identity. Am I still me if can't walk? Am I still me if I've lost 10% of my memory? 30%, 50% or 90%? Am I still me if I forget how to play the piano or work an equation? At what point do I stop being me?

Not surprisingly, a fair amount has been written on the question of identity. Locke (1), Butler (2), Hume (3), Shoemaker (4) and Parfit (5) have all made statements on the concept of personal identity. For Hume, identity might be best described as an "invariableness and uninterruptedness of any object, thro a suppos'd variation of time, without

any break of the view, and without being oblig'd to form the idea of multiplicity or number." The fact

that an individual consciousness was continuous and bounded by the mind of one person was reason enough to believe in identity. However, are we conscious when we sleep? Are we the same person when we wake? What about anesthesia where even dreaming stops? Or, perhaps more to the point, what of the consciousness and continuity of someone who has been frozen? What happens to continuity if the person's mind is duplicated several times during the repair process to provide backup in case the original is lost or damaged during reconstitution after thawing? Is continuity a valid criterion for identity? Then there is Locke's notion of memory as a boundary to identity. What happens if some memories are lost? If all memories are lost? Where does one draw the line?

In his book "The Prospect of Immortality" (6) Robert Ettinger raises many of these issues and through clever scenarios draws the reader out onto the thin ice of the question of identity. Ettinger's conclusion is quite startling, quite at odds with that of the conventional philosophers: "Let us then cut the Gordian knot by recognizing that identity, like morality, is man-made and relative, rather than natural and absolute. Identity, like beauty, is partly in the eye of the beholder. It is only partly existent, and partly invented. Instead of having identity, we have degrees of identity, measured by some criteria suitable to the purpose." In 1962 Ettinger arrived at a conclusion similar to that arrived at by the philosopher Derek Parfit (5) nearly a decade later in 1971. I have long found it a paradox that a book which is ostensibly about the preservation of identity should contain so persuasive an argument that it doesn't really exist. Perhaps it was these musings which prompted Ettinger to conclude his Afterword to "The Prospect of Immortality" with a salutation and a prophecy equally out of keeping with the tone of the rest of the book: "To the hosts of the past, our gallant forebears, whom one day -- however long deferred -- we can expect to join."

What of our forebears? What of the men and women and protohuman creatures who came before us? What of the first "living" organism and its fate? The world is a hostile place to us. It is hostile because of the many states that exist in nature, only a few allow for life in general and our lives in particular. The complex structure and highly ordered interaction of molecules which living things represent require very specific conditions to continue existing. In a world of rapid change and nearly endlessly variable conditions, life's requirements limit it severely. No doubt the first protocells formed and disintegrated countless times as conditions became "right" and then shifted to "wrong." In a world of chance, strategies were developed early on to cope with change, to cope with alteration of the environment. Pumps, membranes, skins, spines, poisons, shells, camouflage, and temperature regulating hypothalamuses all attest to the diversity of living systems' approaches to minimizing the impact of a capricious environment. But most important of all, the ability to copy, to duplicate oneself, provided a path to survival. No matter how good the defenses, no matter how careful the concealment, in the long run the only route to continued existence in a capricious and unpredictable world is to provide backup. All successful living things produce copies of themselves. Some organisms produce copies with very high degrees of fidelity, virtually duplicating themselves down to the molecular level. Others have traded off near complete fidelity for variation which allows for wider ranges of adaptation and the possibility of creating new advantages to meet the challenge of survival where none existed before.

Living things made multiple copies of themselves because in the long

run it was the only strategy which allowed them to persist over time. Thomas Donaldson has argued in The Genetic Evolution (CRYONICS, August 1984) that human beings in the future will be much as they are now because they are well adapted to being human beings now. This kind of circular reasoning in and of itself should make

one wonder. It is all too easy to imagine a similar pontificator before the age of chariots or automobiles arguing with equal force that when automobiles are invented they will look just like horses, since horses are so perfectly adapted to carrying men around. We can see our would-be visionary carrying on endlessly and with pompous certainty about why nothing with wheels will ever catch on because we would need to build roads! The problem with such a "visionary's" "insight" is that it fails to strip the idea of transportation down to its essentials and then proceed imaginatively from there in speculating on the possibilities. If we accept Ettinger's answer to the puzzle of identity, then the rules of the game change radically. If the very root of our perception of ourselves lies in false limitations, then what is to follow? Who will we be? What will we become if we change the very yardstick by which we measure ourselves? Unlike Donaldson, I cannot hope to guess that we would "actually LOOK very much like people do now." All I can do is to venture a few general speculations on the future of our evolution as survivors.

If we are to survive as individuals in the really long-term then we must protect ourselves against catastrophe. Donaldson argues that our bodies will be much as they are now, that we will be individual self-contained units and that we will add to them or subtract from them with tools. In so speculating he fails to ask the relevant question: what is the purpose of a body? Is a body just a tool? If the answer to that question is yes, then we will have many bodies. We may not use them all at once, but we may well use more than one at once. And if our bodies are just tools then what of our minds? Where shall we keep our minds if we conclude that minds are the stuff we're made of? In a universe of uncertainties are we always constrained to keep our bodies and our souls together? In a world of "telepresence" is it safe or sane to always keep the worker with the tool? In a world already reaching hazardous environments by "remote control" will we choose to locate our minds in our bodies? Indeed, will we choose to locate our minds in any one place at all?

If we look around us we can see that one all-pervasive survival strategy is the strategy of duplication and backup. Will we be any different? Won't it make sense to copy ourselves and separate and protect the copies just as every other living thing does? I think the answer to that question will be yes and I think the consequences for human identity and human evolution are profound. In the short run, as Donaldson rightly points out, when the death rate falls our interest in traditional reproduction will dwindle. But the death rate will NOT go to zero. In a vast and largely uncontrolled universe there will still be plenty of room for mistakes and catastrophes. Some mistakes will be internal: bad ways of structural organization, bankrupt models or ideas about the way the world "really" works. Others will be external: the sudden death of a star, a terrible "industrial" accident. All life, by definition, is at risk.

With time we will emerge from our complacency. If we wish to survive for the really long-term, then we will be forced to provide backups. Anyone who has ever lost a computer file will appreciate the safety which comes from duplication. It will be no different with the information which composes our identities.

Perhaps at first copying will be complicated. It will cost money and it will take time. Emerging technology may not allow for continuous updating. Copies may be updated only yearly or monthly or as often as can be afforded, because as Donaldson rightly points out, every adaptation costs something. But one thing seems clear, we will make copies.

The issue of memory loss due to freezing, old age and disease, as well as the issue of copying, raise the question again of what comprises our identity. A convenient way to look at the question of identity is to view it in terms of a fidelity curve. If 100% of the information which composes us is recovered and

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reconstituted into a working, functioning organism, then we have 100% fidelity, or 100% identity. As less and less information is recovered we have less and less identity. It is never correct to speak of identity as lost until all the information is gone, though for practical purposes individuals will be less and less satisfied with their degree of identity down to the point where self awareness ceases and such debates become personally meaningless.

Some copies of ourselves may be sent outside of the solar system as packets of information, safeguarding against sudden explosion of our sun. If they are awakened someday, they may bear little relationship to what we became before our sun exploded and annihilated us. And yet, they will have some fidelity, and like children, they will be a part of us that goes on.

If that seems strange and alien it is because it is. Like the world of relativity or quantum mechanics, if you take the survival game to extremes and try to play it for very long periods of time (relative to our current experience) all kinds of commonplace assumptions don't apply. You end up taking what you can get along the way to reaching the 100% mark on the fidelity curve. Indeed, in a universe of uncertainty there will always be information loss and we will always be dynamic rivers of information (however slowly flowing) gaining and losing information as time passes. It is a deep and basic instinct of living things to gain as much as possible while losing as little as possible. It would seem that in the broadest sense the goal of life is to eliminate uncertainty from the universe, to control all of the variables, to know all of the answers. Until, and if, that day ever arrives we will use many strategies for survival. These strategies will make all such questions about what we will look like or what vitamins we will or will not need seem trivial by comparison.

In the midst of this uncertainty some things seem clear, we will be intensely protected creatures, duplicating and updating our identities whenever and wherever we can afford to. We will wear many bodies and we will strip "ourselves" down to whatever the minimum is. That minimum will vary from individual to individual as much as night varies from day. For some, identity will consist of flesh and blood, arms and legs, penises, vaginas and eyes all linked by a continuity most of us now living would find very familiar and reassuring. In the long run it seems likely that individuals who choose this kind of identity will perish. For others there will be changes, changes we can see only dimly now, like a faint smear of light in the darkness of a long tunnel. For many of us, perhaps for most, the light will never appear and the tunnel will be forever in darkness. But for a few of us the darkness will end and we will emerge into the light and revel in its abundance, for we will have found our identities at last and we may well be quite surprised to discover who we are. As H.G. Wells said so eloquently and well (7) "It is possible to believe that all that the human mind has ever achieved is but a dream before the awakening... We are creatures of the twilight... All this world is heavy with the promise of greater things, and a day will come, one day in an unending succession

of days, when beings, who are now latent in our thoughts and hidden in our loins, shall stand upon this earth as one stands upon a footstool, and shall laugh and reach out their hands amidst the stars."

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5) Derek Parfit, "Personal Identity", The Philosophical Review, 80, (January, 1971).
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7) H. G. Wells, "The Discovery of the Future", Nature, 65 (February, 1902), p. 331.

A BRIEF OVERVIEW OF RECENT ALCOR RESEARCH

Over the past year ALCOR has been steadily gaining expertise and experience in subjecting dogs to extracorporeal circulation and deep cooling. As far back as 1979, ALCOR and Cryovita have been interested in evaluating extended bloodless support of dogs in deep hypothermia. This kind of work is crucial to being able to assess viability after cryoprotective perfusion and freezing or vitrification in the brain. Until we know we have a pretreatment, cooling and surgical protocol, as well as a perfusate formulation which is compatible with viability, we cannot begin to move on to introduction and removal of cryoprotective agents.

ALCOR, in cooperation with Cryovita, has also had the unexpected and welcomed opportunity to examine human remains which had been cryopreserved for a number of years. Within the next few months we will conclude our presentation of findings generated as a result of these studies.

On the weekend of July 21-22, we undertook another total body washout experiment, this one designed to complete evaluation of the new perfusate formulation developed for human suspensions published in the July issue of CRYONICS. This perfusate is designed to allow for extending storage (1 to 3 days) at temperatures just above the freezing point of water. Since one of our major research objectives for next few years is to develop reversible techniques of suspended animation for the central nervous system, we were anxious to find out if this perfusate would be compatible with complete recovery of the brain following blood washout and deep hypothermia.

We are pleased and proud to report that the ALCOR suspension team again delivered and we had recovery of an animal from total body washout (hematocrit between 4 and 5) and cooling to a temperature of 4.2 degrees centigrade. We are especially pleased with this success because the procedure was so technically demanding and this was our first time using this approach.

Because the perfusate employed has a composition very different from normal body fluids with respect to salt and other electrolyte content, we had to connect the animal to an artificial kidney machine and "dialyze" him

as we rewarmed. This allowed for normalization of blood glucose and electrolytes. Since the animal was intended to recover in order to allow for extended evaluation of general health and mental status, we employed sterile technique. In the future, when we are working with isolated head preparations to establish brain viability, simpler and far less costly protocols can be used. Even with the use of sterile technique the total cost for the experiment was only around $1,000.

At this time the dog, whose name is "Star" (courtesy of Anna Tyeb) is fully recovered and shows no neurological or other deficits. As far as we know this is the first time anyone has succeeded in cooling a large, nonhibernating animal to a such low temperature, carrying out blood washout with a very "alien,"

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* The photos which accompany this article appear in the center of the magazine.

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nonphysiologic perfusate, perfusing for one hour, and then successfully rewarming. We are quite surprised at our success as we had expected many complications and failures before the first long-term recovery.

Our success with Star, and with the other dogs we have surface cooled and perfused recently has led to increased funding support for this area of research. Over the next six months or so (time more than money permitting) we hope to complete a series of five or six animals who have been similarly treated. We will delay a full technical presentation until this work is completed, but we will keep everyone posted on the general nature and pace of our progress, as well as reporting on any unforeseen developments which may impact suspension patient care.

NEW ALCOR BYLAWS

On Sunday, August 5th, the ALCOR Board of Directors voted to adopt new bylaws. The new bylaws basically reflect major changes in the California Nonprofit Public Benefit Corporations Law which went into effect in 1980. The new bylaws are much more comprehensive than our old ones (17 pages single-spaced versus 6 pages double-spaced) and provide guidelines for basic administration. One change of importance is that the new Bylaws provide a detailed summary of our purpose for existence. We would like to share those purposes with you:

"The primary objectives and purposes of this corporation shall be:

(a) to promote, foster and conduct basic and applied research in all areas of the life extension sciences including but not limited to cryonics, cryobiology, gerontology, molecular engineering, and cell repair technology;

(b) to engage in the application of whole-body cryonic suspension, neuropreservation, morphostasis and other postmortem and premortem biopreservation techniques as allowed by law and to provide these services to the general public;

(c) to promote, encourage, further and carry out research to develop techniques for short-term and long-term fully reversible arrest of metabolism in man and other mammals, i.e., the development of suspended

animation;

(d) to promote, encourage, further and conduct research to allow for repair, recovery, and rehabilitation of humans placed into cryonic suspension, neuropreservation, morphostasis or other biopreservation techniques;

(e) to protect the legal rights, including the right to life, of humans in cryonic suspension or suspended animation and to encourage and promote legislation to facilitate continued care for and revival and rehabilitation of humans placed into cryonic suspension, neuropreservation, morphostasis, suspended animation or other biopreservation techniques;

(f) to act as a bank or storage facility under the California Uniform Anatomical Gift Act (Section 7153.5(a) of the California Health and Safety Code) for tissues, organs, and all other human remains as may be required to further the purposes of (a) through (e) above;

(g) to engage in the dissemination and administration of techniques and information for extending human life span, health and quality of life;

(h) to act as a trustee, conservator, guardian, executor, power of attorney or medical surrogate as may be required to further the purposes above;

(i) to sponsor seminars, exhibits, workshops, displays, and other activities to educate the general public about the life extension sciences in general and cryonics in particular;

(j) to provide financial support, research facilities and equipment and supplies required to carry out all of the above objectives."

We feel this statement of objectives in our Bylaws goes a long way to establish on record what we have had as our guiding philosophy and purpose for some time now.

OCTOBER-NOVEMBER 1984 MEETING CALENDAR

ALCOR meetings are usually held on
the first Sunday of the month.
Guests are welcome. Unless otherwise
noted, meetings start at 1:00 PM.

The OCTOBER meeting will be at the home of:

(SUN, 7 OCT 1984) Paul Genteman
535 S. Alexandria, #325
Los Angeles, CA 90020
Tel: (213) 386-2265

DIRECTIONS: From Santa Monica Freeway (Interstate 10), exit at Vermont Ave. and go north to 6th St.
From Hollywood Freeway (US 101), exit at Vermont Ave. and go south to 6th St.
Go west on 6th 4 blocks to Alexandria and turn right. 535 is

the first apartment building on the west side of the street.

The NOVEMBER meeting will be at the home of:

(SUN, 4 NOV 1984) Jerry and Kathy Leaf
13152 S. Blodgett
Downey, CA 90242
Tel: (213) 531-2708

DIRECTIONS: From the Long Beach Freeway (Hwy 7), get off on Imperial Highway and go east to Lakewood Blvd.
From the San Gabriel Freeway (605), get off on Imperial Highway and go west to Lakewood Blvd.
Go south on Lakewood to Gardendale (1st light) and turn west (right) on Gardendale. Blodgett is the 2nd street on the left. Turn left on Blodgett. 13152 is on the left (east) side of the street about midway down the block.

*** TYPIST'S NOTE: THE CENTER TWELVE PAGES OF THIS ISSUE CONTAINED PHOTOGRAPHS. THE FOLLOWING TEXT IS REPRODUCED FROM THESE PAGES. ***

PAGE ONE:

THESE PHOTOS ACCOMPANY THE ARTICLE "A BRIEF OVERVIEW OF RECENT ALCOR RESEARCH," WHICH BEGINS ON PAGE 13.

We thought it might help our readers better understand "what goes on" at ALCOR if we published a few pictures of a "typical" research/training weekend. For the first time we're able to give you a panoramic view of the operating room thanks to Saul Kent's skillful photography and wide angle lens. For those of our members who've never seen the facilities available to us -- here they are!

*** PHOTO LEFT ***
Paul Genteman (foreground) and Mike Darwin (background) begin external cooling of the animal as Bill Jameson looks on following the anesthetization and pretreatment with the same medications used during initial transport and cool down of suspension patients. (Photo by Saul Kent.)

*** PHOTO ABOVE ***
As external cooling proceeds surgery begins to raise both femoral arteries and veins so they can be cannulated (a tube inserted) and the animal can be connected to a heart-lung machine for further cooling and blood washout. Al Lopp (foreground) provides manual ventilation for the animal with an "ambu" bag. (Photo by Saul Kent.)

PAGE TWO:

*** PHOTO ABOVE ***
Once cannulation is completed the animal is further cooled from 26 degrees centigrade to 12 degrees centigrade at which time blood washout takes place. The heart-lung machine is the somewhat cluttered looking device in the bottom left of the photo. Carlos Mondragon, Brenda Peters, and Erin Connoughton (left to right) look on as Paul Genteman and Jerry Leaf prepare to give the go-ahead for blood washout. (Photo by Saul Kent.)

*** PHOTO LEFT ***
Mike Darwin reaches over to open up the flowmeter on an RSP kidney machine. This allows premixed dialysate (blood washing solution) to begin

flowing to the artificial kidney (which can be seen pressed against Mike's chest protruding from a pole on the machine). (Photo by Hugh Hixon.)

PAGE THREE:

*** PHOTO LEFT ***
Old Faithful. This is a Travenol RSP artificial kidney machine. These machines were the first widely marketed "workhorse" dialysis machines ever built. They were the standard of the industry up until a decade ago. In Mike Darwin's opinion they're still the best machine around! Dialysate is mixed in a 120 liter quantities in the bottom tank and then pumped up to the top (stainless steel bucket) tank where it is heated and then delivered to the artificial kidney. The artificial kidney is the dark (blood filled) cylinder on the right (see arrow). (Photo by Saul Kent.)

*** PHOTO ABOVE ***

Seventeen hours after the start of the session two stalwarts (Al Lopp and Erin Connoughton) grab a bit of shut-eye. The excellent cuisine on the table was courtesy of Pizza Hut and Al Lopp. We ordered three large pizzas and and then found we were too tired to eat them. There is still pizza in the freezer! (Photo by Hugh Hixon.)

PAGE FOUR:

*** PHOTO ABOVE ***
Yum Yum doughnuts (yes, we know the picture is "backwards" but that the halftone man's fault not our) provided that low fat, high nutrition energy so essential to good performance. They were so delicious even Mike (Pritikin) Darwin broke down and ate a few. We'll have you know we do stop short of Twinkies. (Photo by Hugh Hixon.)

*** PHOTO ABOVE ***
Having one's tail washed by Mike Darwin following a "little accident" can be an embarrassing thing. Here we see Star's revenge (as Hugh Hixon looks on with glee) a few days after his revival from 4.2 degrees centigrade. Ahh the indignities of a life in research! (Photo by Saul Kent.)

PAGE FIVE:

Plate 1. Arrows A and B indicate massive fractures of abdominal skin and subcutaneous fat observed in P2. These fractures penetrated to the body wall. A thorough external examination at -40 degrees centigrade failed to disclose these fractures.

Plate 2. Arrow A indicates fracture of skin and subcutaneous fat observed in P1. The fracture penetrated almost to the body wall. This fracture as well most of the others observed in P1 were clearly visible at -40 degrees centigrade.

Arrow B points to areas of lividity which outlined the course of veins in the legs. Much of this network of lividity is not visible in the printed photograph owing to loss of fidelity during printing. The discoloration of the left hand and forearm is lividity apparently secondary to a venous infiltration probably sustained during the patient's hospitalization.

PAGE SIX:

Plate 3. All of the great vessels in P2 were seriously fractured adjacent to the heart. Arrows indicate where the pulmonary artery and aorta were

almost completely severed by fractures. Numerous small longitudinal fractures were noted elsewhere in the great vessels such as in the descending aorta and inferior vena cava.

Plate 4. Arrows indicate small circumferential fractures observed in numerous locations in both arteries and veins. This photo is of the pulmonary artery of P2.

PAGE SEVEN:

Plate 5. Large fracture almost completely severing the right lung of P3. The arrow point out the small band of tissue which uniting the nearly severed tip of the lower right lobe with the rest of the lung.

Plate 6. Fractures in the mesentery and mesenteric fat adjacent to the ileum. The ileum was also fractured in numerous locations.

PAGE EIGHT:

Plate 7. Cutaneous fractures of the hands and wrist of P3. These fractures penetrated only a millimeter or two below the skin surface.

Plate 8. Two small fractures 2 to 3 mm wide in the wall of the left ventricle. The myocardium was riddled with fractures of this kind.

PAGE NINE:

Plate 9. The liver was separated by a large, sinuous fracture which penetrated the full thickness of the anterior lobe. Several other lobes of the liver were similarly disrupted by fractures.

Plate 10. The arrow indicates a fracture of the serous coat of the lung in P3.

PAGE TEN:

Plate 11. Fracture of the renal cortex (arrow) observed in P2. The fracture did not quite penetrate the cortex to the medulla. Note the excellent blood washout as evidenced by the solid white appearance of the renal cortex.

Plate 12. The right kidney of P3 showed very poor blood washout with one pole of the kidney being very dark and the other 2/3rds of the organ showing extensive red mottling. The flap of membranous tissue at the top of the photo is the renal capsule which has been removed to facilitate examination of the cortex.

PAGE ELEVEN:

Plate 13. A 12 g angiocath has been positioned in the axial artery to allow for reperfusion of the left arm of P3. Drainage was via the axial vein which was opened at the point of the incision. The arrow indicates a fracture which is leaking perfusate containing dye. The skin of the arm is mottled with dye.

PAGE TWELVE:

Plate 14. Deeply dye-stained brachial muscle of the upper left arm following reperfusion. Note the mottled appearance of the subcutaneous fat which failed to perfuse well with dye.

POSTMORTEM EXAMINATION OF THREE CRYONIC SUSPENSION PATIENTS*

by Michael Federowicz, Hugh Hixon and Jerry Leaf

INTRODUCTION

Since the first person was placed into cryonic suspension in l967, well over 30 intact (whole-body) humans have been cooled to liquid nitrogen temperature (1). At the time of this writing, only 3 whole-body patients remain in liquid nitrogen storage (2). Despite the fact that the majority of patients treated by cryonic suspension have been removed from liquid nitrogen storage and interred conventionally, to our knowledge, no previous efforts have been made to subject these individuals to a postmortem examination in order to determine the efficacy of the cryonic suspension protocol used to prepare them.

Postmortem examination of cryonic suspension patients being removed from long-term storage could serve to answer many important questions and could facilitate quality control just as it does in medical practice (3). Key questions of concern to cryonicists are:

1) How effective are various approaches to perfusion in achieving blood washout and cryoprotective agent (CPA) equilibration?
2) How is CPA distributed during "optimum" perfusion vs. post-ischemic or "suboptimum" perfusions?
3) What are the gross and microscopic effects of CPA perfusion and freezing and cooling to liquid nitrogen temperatures?
4) What is the impact of transport or other handling techniques on the gross integrity of the body?

While answers to many of these questions may be approximated by the use of small animal models (4), many problems and complications introduced by the advanced age of many suspension patients and the large mass of adult humans cannot be easily answered in this fashion.

Due largely to the unfortunate circumstances which usually surround removal of patients from cryonic suspension (5), it has not been possible until very recently to subject patients being removed from cryonic suspension to autopsy. During November and December of l983 the authors were afforded the opportunity to conduct a postmortem examination on the remains of three whole-body cryonic suspension patients who had been converted to neuropreservation.

PATIENT HISTORIES

On November 2, 1983 two whole-body cryonic suspension patients who had been maintained in liquid nitrogen storage for 5 and 9 years respectively, were removed from storage and converted to neuropreservation. PATIENT 1 (P1) was a male, caucasian, 65 years of age who suffered a lethal cerebrovascular accident in 1974. The patient was not near a cryonics facility when he deanimated and it was necessary for a team to be flown a considerable distance to perform perfusion, resulting in a delay of almost 24 hours after declaration of legal death. Perfusion was complicated by a number of technical difficulties and equipment failures as well as by severe edema, secondary to the use of a

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* Photographic plates which accompany this article appear in the center of the magazine.

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colloid-free DMSO-based perfusate (6). Vascular access for perfusion was via the left common carotid artery and was achieved by a local mortician who assisted with the case. Perfusion was open circuit and drainage was via both the left and right internal jugular veins. Perfusion consisted of initial blood washout with 32 liters of bicarbonate-buffered Ringer's solution and cryoprotective perfusion (also open circuit) with 32 liters of a glycerophosphate-based perfusate containing 15% DMSO (v/v). Standard embalming equipment (Porta-Boy embalming pump) was used for perfusate delivery. A total of 64 liters of perfusate was employed. Effluent samples collected at the time of perfusion were lost late in 1983 when they exploded (as a consequence of rapid boiloff of liquid nitrogen which had leaked into the vials) during a transfer of the patient from one storage dewar to another.

The protocol for cooling the patient to dry ice temperature consisted of wrapping in a thin insulating blanket and packing in crushed dry ice. The patient was prepared for cooling to liquid nitrogen temperature by being wrapped in multiple layers of fiberglass cloth, polyethylene, and aluminum foil. Following wrapping, the patient was placed on a heavy gauge aluminum stretcher and cooled to liquid nitrogen temperature by placement in a cryogenic dewar which was gradually filled with liquid nitrogen over a period of 5 days (Figure 1).

*** TYPIST'S NOTE: ORIGINALLY THIS SPOT CONTAINED A GRAPH OF TEMPERATURE IN DEGREES CENTIGRADE VERSUS TIME IN DAYS, FOR COOLDOWN OF THE PATIENT'S HEAD. ***

Figure 1. First Cooldown of P1.
Thermocouple probe placed externally on head. Vertical marks on horizontal axis indicate midnight. "Start" indicates beginning of cooldown.

PATIENT 2 (P2) was a female caucasian 68 years of age who was pronounced legally dead in 1978 in a location remote from cryonics facilities. Deanimation

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was sudden and reportedly due to an acute myocardial infarction. There was approximately a 72-hour delay between the time of death and the time perfusion was begun (all of this delay period was in the presence of either air or ice cooling). Vascular access for perfusion was via the aortic root and the right atrium following median sternotomy (7). Perfusion was accomplished utilizing a heart-lung machine with appropriate 40 micron in-line filters and a Bentley Q-100 "bubbler" oxygenator. The perfusate was a glycerophosphate type with PVP-40 as the colloid. Perfusate was filter-sterilized by passing through a 0.2 micron filter. The patient was exposed to three open circuit passes of perfusate consisting of 10 liters of 5% DMSO (v/v), 10 liters of 10% DMSO (v/v) and 40 liters of 15% DMSO (v/v). Following completion of perfusion the patient was cooled in an isopropyl alcohol bath at an average rate of of 2.27 degrees centigrade per hour. Following cooling to dry ice temperature, the patient was removed from the cooling bath, wrapped in two layers of 1/4" closed cell nitric rubber (ensofoam) and placed in a mylar bag. Via a lifting block attached to the feet the patient was then lowered into a cryogenic dewar and cooled to

liquid nitrogen temperature very rapidly by partial submersion. The temperature descent curve to -196 degrees centigrade are not available on this patient as a result of loss of records by the contract company which prepared this patient for long-term storage.

In 1982 P1 was removed from liquid nitrogen storage due to inadequate maintenance funds, placed in a sleeping bag and immediately transferred to a dry ice storage chest which had been filled with dry ice previously cooled to near liquid nitrogen temperature. The patient was stored on dry ice for 19 days and was then transferred to a cryogenic dewar and again gradually cooled to liquid nitrogen temperature over a period of 8 days at a rate of 0.9 degrees centigrade per hour (Fig. 2).

*** TYPIST'S NOTE: ORIGINALLY THIS SPOT CONTAINED GRAPHS OF TEMPERATURE IN DEGREES CENTIGRADE VERSUS TIME IN DAYS, FOR COOLDOWN OF THE PATIENT'S HEAD AND ANKLE. ***

Figure 2. Second Cooldown of P1.
Thermocouple probes placed externally on head and ankle. Vertical marks on horizontal axis indicate midnight. "Start" indicates beginning of cooldown.

Both patients were maintained in the storage dewar in a head-down position in order to minimize any thermal cycling of the central nervous system which might result from fluctuating liquid nitrogen levels. The distal 1 to 1.5 meters (i.e.-knees to feet) of the patients bodies were alternately exposed to vapor and liquid nitrogen as a result of normal boil-off/fill cycles. Both patients were maintained in the same cryogenic dewar during the last year of their liquid nitrogen storage. Prior to this both patients had been maintained in separate storage dewars and both had been transferred on two occasions owing to logistic needs or vacuum failure of the storage vessels.

PATIENT 3 (P3) was a 36-year-old caucasian female who deanimated suddenly in 1980 following numerous chronic illnesses including profound immune deficiency, multiple opportunistic infections, adenocarcinoma of the throat, therapeutic radiation overdose, idiopathic liver disease, and an unclassified central nervous system myelopathy. Since deanimation was sudden and remote from cryonics facilities there was approximately a 24-hour delay before the start of perfusion during which time thorough external cooling with ice was carried out.

Perfusion consisted of blood washout and extracorporeal circulation with a heart-lung machine, employing the aortic root and right atrium for vascular access (8). Perfusion was closed-circuit, employing a glycerophosphate-based perfusate using PVP-40 as the colloid glycerol as the cryoprotective agent. The concentration of glycerol was gradually increased in the recirculating system until the venous concentration reached 2.85M. Following perfusion the patient was cooled to dry ice temperature at a rate of approximately 2 degrees

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*** TYPIST'S NOTE: THIS SPACE ORIGINALLY CONTAINED GRAPHS OF TEMPERATURE (DEGREES C) VS. TIME (DAYS), FOR COOLDOWN OF THE PATIENT'S HEAD, ESOPHAGUS, RECTAL, ANKLE. ***

Figure 3. Cooldown of P3
Thermocouple probes at head and ankle placed externally on skin.

Esophageal and rectal probes placed internally. Vertical marks on horizontal axis indicate midnight. "Start" indicates beginning of cooldown, with LN liquid level below head of patient in upside down position. "Add LN " indicates addition of more liquid.

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centigrade per hour by submersion in an isopropanol bath and gradual addition of dry ice.

Five days following cooling to dry ice temperature the patient was placed in a urethane (open cell) foam insulated aluminum cassette, positioned in a storage dewar and gradually cooled over a two-week period to liquid nitrogen temperature (Figure 3).

REMOVAL PROTOCOL

P1 and P2 were removed from the storage dewar using a high-reach forklift and lowered to the ground on their supporting stretchers in a supine position. The head and upper torso of each patient was unwrapped and conversion to neuropreservation was achieved using a high speed electric chain saw while the patient's head was lavaged with liquid nitrogen. A block of tissue approximately 12 by 16 cm. was cut from the decapitation site on the body and banked with the heads as a reference sample. Following conversion to neuropreservation the bodies were wrapped in several layers of 4 mil plastic tarpaulin and allowed to rewarm for 21 hours on a concrete floor. All insulating wrappings (sleeping bags, foil-fiberglass, Ensofoam) were allowed to remain in place. After 21 hours of rewarming, the insulating materials were removed, the patients were examined externally, samples were taken, and surface and "core" temperature measurements were made. After 21 hours, "core" temperature was -47 degrees centigrade and surface temperature was -46. (Core temperature was approximated by inserting the thermistor probe into deep cuts made as a consequence of sample taking.) At the time of unwrapping, numerous samples were removed by chiseling with a precooled steel chisel and were thawed in fixative at 22 degrees centigrade for possible light/electron microscopy at a later date.

Samples of tissue were also allowed to thaw out at room temperature and fluid collected from them for examination by light microscopy.

P3 had been placed into long-term liquid nitrogen storage in an aluminum cassette which was lined and heavily packed in open cell urethane foam to act as a thermal barrier. Inside the cassette P3 was wrapped in a 1/2-inch thick layer of Ensofoam and two ethylene vinyl acetate (EVA) bags.

The cassette containing the patient was removed from the storage dewar using an overhead crane and lowered to the ground with the patient in a supine position within the cassette. The cassette was then opened and sufficient urethane foam was cleared away to facilitate removal of the patient. The patient was removed to an isolation tent with specially constructed supports, where a rapid conversion to neuropreservation was done using a high speed electric chain saw.

After conversion to neuropreservation, the body of P3 (still enclosed in a 1/2-inch Ensofoam wrap and EVA bags) was transferred to an insulated rewarming chest for attempted controlled rewarming to 0 degrees centigrade. This was done in an effort to minimize the possible effects of large thermal gradients during warming.

The rewarming box consisted of a cavity 24" in width and 74" in length. The container was insulated with 2" of Styrofoam and 2" of urethane foam on the bottom and sides. The body was placed in the box, which had been precooled with dry ice and liquid nitrogen, on two

thicknesses of R-19 fiberglass insulation with a wooden support block across the shoulders and buttocks to prevent crushing of the insulation. Following placement of the body in the rewarming box, the body was covered over with three layers of R-19 fiberglass insulation and the box was closed.

The temperature of P3 was monitored via copper-constantan thermocouple

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probes placed rectally, on the external abdomen and on the ankle. Another probe was placed midway in the covering R-19 insulation to monitor the box temperature. P3 was allowed to gradually rewarm over 19 days following removal from liquid nitrogen storage. The course of rewarming is shown in Figure 4.

*** TYPIST'S NOTE: THIS SPACE ORIGINALLY CONTAINED GRAPHS OF TEMPERATURE (DEGREES C) VS. TIME (DAYS), FOR REWARMING OF THE PATIENT'S CONTAINER (BOX), EXTERNAL ABDOMEN, RECTAL AREA, AND ANKLE. ***

Figure 5. Rewarming of P3.
Thermocouple probes for ankle and abdomen were placed on the skin. Rectal probe was internal. Box probe was next to inside wall of box. Vertical marks on horizontal axis indicate midnight. Vertical (temperature) scale changes at -80 C. Arrow at -145 C indicates addition of LN .

POSTMORTEM EXAMINATION

During examination of P1 following unwrapping, it was noted that full thickness fractures of the skin had occurred. These fractures were most unusual in appearance and can best be described as resembling the type of cracking observed in deteriorating coatings, such as is seen in paint peeling away from a wall. The skin adjoining the fracture fissure was somewhat raised from the underlying fat and gave the appearance of having "peeled away" slightly. Another striking feature about these fractures was their symmetry. Fractures were observed in either identical or nearly identical locations bilaterally. (Figure 5) Fractures were observed in the skin along the inner aspect of each upper arm and lower arm, in the skin of the hand just below the wrist in the fleshy area between thumb and forefinger, on the inner aspects of the upper thigh and on the upper aspect of the feet. Many of these fractures were 2 to 3 inches in length. External examination of P2 revealed only one similar fracture, which measured only a few millimeters in length and was at the edge of what appeared to be a diabetic ulcer. Several other areas on the lower extremities which looked slightly "crazed" were noted, but no gross fractures

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were observed with separation from subcutaneous fat comparable to the ones

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*** TYPIST'S NOTE: THIS SPACE ORIGINALLY CONTAINED LINE DRAWINGS OF A MALE BODY AND TWO FEMALE BODIES, WITH ARROWS POINTING TO EXTERNAL FRACTURE LOCATIONS. ***

Figure 5 Figure 6 Figure 7

External Fracture Locations

observed in the remains of P1. At the time of initial examination we attributed the presence of visible fractures on P1 to be due to an episode of thermal cycling (up to dry ice temperature and then down to liquid nitrogen temperature again) which had occurred a year before when funding for this patient became exhausted and the contract company caring for him removed him from liquid nitrogen storage.

Following thawing, numerous large fractures were observed on the surface of P2's remains (Figure 6) and additional fractures were noted on P1's remains. These fractures were also often bilaterally symmetrical. In some instances these fractures penetrated more than 4 cm into the subcutaneous fat, usually ending at the body wall or at the next underlying tissue plane (such as the fascia covering the musculature) (Plate 1). Both patients' remains exhibited massive cutaneous fractures over the pubis (Plate 2(A)). In the remains of P1 a fracture separated a large flap of skin and subcutaneous fat over the pubis and in P2 these fractures penetrated the mons and labia majora to the underlying musculature.

External examination of P1 following thawing revealed much more extensive surface fracturing than was visible at first examination in the subzero state. In the limbs of P1, particularly in the lower limbs, a tracery of veins was etched in bright red on the skin surface, apparently as a result of the release of hemoglobin into the tissue adjacent to the vessels (Plate 2(B)). The skin of P1 also exhibited an overall pink cast which was absent from P2 and P3.

Internal examination of these patients' remains disclosed multiple fractures in almost every organ system with only the livers being completely spared and the kidneys only slightly affected. In the remains of P2 fracturing was so severe that numerous organs were often completely, or almost completely transected by fractures. The pulmonary artery had fractured and completely

separated from the heart (Plate 3). A large fracture had almost completely severed the aorta. Numerous small fractures were observed in other great vessels of the chest (Plate 4). The lungs (Plate 5) and spleen were at one point in each organ virtually severed by fractures. The intestine, mesentery, mesenteric fat (Plate 6), peritoneum, abdominal wall, and pancreas were riddled with fractures too numerous to count. P1 was similarly fractured, although not as extensively.

In sharp contrast to P1, P2 exhibited excellent blood washout with small blood-filled vessels being exceptional rather than the rule, as was the case with P1. The circulatory system of P1 was filled with blood or perfusate containing large amounts of blood. The partially frozen contents of the pulmonary artery and aorta were collected from both patients, thawed and subjected to osmometry. Additionally, a fluid sample from the femoral artery of P2 and a sample of interstitial fluid draining from a right thigh muscle fracture were also subjected to osmometry. Osmolalities for these body fluids are shown in Table I. These osmolalities must be regarded as only approximate at best due to the fact that the samples were collected in the partially frozen state. Nevertheless, the data does at least provide a basis for comparison of the two perfusion techniques employed and unequivocally supports the use of great vessel perfusion utilizing large quantities of perfusate if the open circuit approach is used.

Table I. BODY FLUID OSMOLALITIES

Other findings of interest were that both patients apparently suffered from pathologies which contributed to or caused their deaths

Patient	Collection Site	mM Me2SO
P1	Pulmonary Artery	20
"	Aorta	40
"	Pericardial Fluid	0
P2	Pulmonary Artery	900
"	Aorta	760
"	Femoral Artery	800
"	R. Adductor Muscle (fluid drainage)	250

which were not listed on the death certificates. In addition to having suffered a cerebrovascular accident P1 was also found to have suffered a large, "recent" infarct of the posterior wall of the left ventricle.

The heart was also hypertrophied secondary to chronic heart failure. P2 apparently died as a result of a massive intra-abdominal hemorrhage, not of an acute myocardial infarction as listed on the death certificate. Examination of the liver of P2 revealed it to be severely fibrosed and shrunken, having a knobby, scarred appearance.

The autopsy results of P1 and P2 prompted us to attempt to remove too rapid rewarming as a possible cause of fracturing in P3. To this end a mathematical model of rewarming was generated by Art Quaife of Trans Time (9) which indicated that the rewarming scheme which was eventually employed with P3 would yield a rate of temperature rise between -196 and -120 degrees centigrade in the range of 2 to 3 degrees centigrade per hour. It was also hoped that the surface-to-core temperature gradient could be held to a maximum of 10 degrees centigrade. As can be seen in Figure 4 neither of these objectives was met. However, rewarming was still much slower than in P1 and P2. Results of the postmortem examination lead us to believe that rewarming is not the primary event responsible for massive internal fracturing observed in these patients.

When the rectal temperature of P3 reached 0 degrees centigrade the body was removed from the rewarming box and subjected to a thorough external examination.

The initial examination gave us considerable cause for optimism concerning the prospect for minimal internal fracturing. P3 had only a few external fractures: one of the skin on the dorsum of each hand approximately 3 cm in length (Plate 7); one between the thumb and forefinger of the right hand; and bilateral fractures of the skin and subcutaneous fat in the brachial area (Figure 7). The rest of the body was free of fractures. Careful external examination also failed to disclose the livid tracery of veins under the skin which was observed on P1.

Of particular interest was the fact that no fractures were observed adjacent to the decapitation wound. This seems especially remarkable considering the amount of mechanical and thermal stress introduced by application of a chain saw at liquid nitrogen temperature. The absence of fractures associated with sawing at liquid nitrogen temperature confirms for humans what had been found in earlier, unpublished animal work conducted by the ALCOR Foundation at Cryovita Laboratories in Fullerton, California.

Examination of the internal organs of P3 revealed fractures present in almost every organ. The spinal cord, aorta, thoracic inferior vena cava, pulmonary artery, myocardium (Plate 8), right lung, liver, pericardium, stomach, ileum, colon, mesentery, spleen, skeletal muscle, and pancreas, were all seriously fractured. In some organs, such as the spleen, lung, liver (Plate 9) and great vessels, fractures penetrated the organ to the point of completely or almost completely severing them. In other instances the fractures were confined to the capsule, serous coat, or first two or

three millimeters of the organ (Plate 10). The only organ which was consistently spared gross fracturing in all three patients was the kidney: in P1 and P3 the kidneys were free of visible fractures and in P2 the left kidney suffered only one small fracture of the cortex (Plate 11). The kidneys of P1 were free of any fractures and were somewhat fibrotic and shrunken showing evidence of renal disease.

A length of spinal cord approximately 20 cm in length was exposed in P3 and was collected for later evaluation by light and electron microscopy. When the dura was opened it was noted that the cord had fractured into three pieces, each approximately 6 cm long. These fractures completely transected the cord giving the impression of a broken glass rod.

TableII.BODY FLUID OSMOLALITIES,P3

Sample Source	Glycerol M
Abdominal fluid	.729
Pericardial fluid	1.367
Femoral Artery	1.967
Hepatic Artery B	.690

During the course of the autopsy on P3 two sets of tissue samples were collected from the left ventricle, lung, liver, kidney, spleen, diaphragm, spinal cord, skin and fat. One sample of each set was fixed in Karnovsky's solution (10) and the other sample of the set was fixed in buffered formalin (11) for later evaluation by light and electron microscopy. Fluid was also collected from the femoral artery, hepatic artery, abdomen and pericardium and subjected to light microscopy and osmometry. Light microscopy revealed numerous intact red cells in the femoral artery and pericardial fluid with few ghosts and little debris present. Many of these cells were noted to be agglutinated upon initial examination, and progressive clumping and agglutination of the red cells was noted with continued exposure to ambient temperature on the stage of the microscope. Osmometric determinations are shown in Table II.

The abdominal and thoracic viscera of P3 showed numerous areas where blood washout was incomplete. The distal two-thirds of the right kidney appeared very dark and infarcted and the upper pole of the left kidney also appeared to have

been poorly perfused (Plate 12). There were numerous areas in both lungs which were atelectic and unperfused. The liver, mesentery and gastrointestinal tract appeared well perfused and free of any obvious blood. The spleen was very bloody on sectioning and demonstrated many intact red cells on microscopic examination.

In 1980, when cryoprotective perfusion of this patient was carried out by the authors, a large, firm abdominal mass was noted both on external examination and during median sternotomy. At that time we elected not to perform a laparotomy to investigate the nature of the mass because of both time constraints and concern over our ability to close the abdomen should edema develop. This mass, which was severely compressing the diaphragm was found to be the massively hypertrophied anterior lobe of the liver. The liver was sectioned and it was demonstrated that the lobe was indeed hepatic parenchyma and not tumor or cystic material. Histological examination of liver sections taken from this lobe later demonstrated severe liver disease with massive areas of necrosis interspersed with small islands of apparently histologically normal tissue. The other lobes of the liver were similarly enlarged, and the liver was noted to have a dusky brownish-yellow color rather different from that normally seen following blood washout.

Prior to the discovery of massive internal fracturing in P3 we had hoped to reperfuse the remains with a high molecular weight dye solution

with a glycerol concentration comparable to what the glycerol concentration in the patient's venous return had been at the conclusion of cryoprotective perfusion. We hoped to determine if reperfusion was possible and if any small fractures were present in organs which might not be readily apparent on gross inspection. Due to the disruption of the great vessels and cracks in the abdominal and thoracic viscera, complete reperfusion of the remains was not possible. Instead, we elected to reperfuse the left arm by cannulating the axial artery and vein. Unfortunately, the dye used (2,000,000 molecular weight blue dextran) did not impart enough stain to adequately determine distribution of perfusate into the limb. Consequently we continuously added methylene blue to the perfusate as it was delivered. Distribution of the dye was quite striking. Dye penetration was first noted in the hand and a few small patches of skin on the brachial and dorsal aspects of the arm. Perfusate began leaking from the brachial fracture almost immediately (Plate 13).

Within 1 minute following the start of perfusion massive edema was noted in the limb. Little venous return was noted at any time during the perfusion. Due to edema, perfusion was stopped after 5 minutes, 21 seconds and the limb was dissected in order to evaluate dye distribution.

There was very poor distribution of dye in the skin and subcutaneous fat with the exception of the hand and distal portion of the forearm, which showed moderate staining with patchy distribution. The deep musculature of the upper arm showed staining with dye with very even distribution (Plate 14). Virtually all of the extensor and flexor muscles of the forearm perfused very poorly if at all. In the case of the brachioradialis and the flexor pollicis, perfusion was confined to an area approximately 2 cm in diameter in the center of the muscle.

During dissection of the arm immediately following perfusion several highly pressurized blebs of perfusate were encountered, apparently the result of fractured vessels within the limb.

DISCUSSION

The most unexpected finding as a result of these autopsies is the discovery of serious fracturing in all of the suspension patients. While the cause of these fractures has yet to be established, two explanations may be put forth.

The first, and most obvious cause would be shell deformation effects resulting from expansion of water in the core of the body following phase change on the outside of the body (12). Unfortunately, this fails to explain the presence of many internal fractures in tissues which should have frozen more or less simultaneously and at high enough temperatures to have accommodated any expansion of ice. A more likely explanation is that fracturing occurred long after freezing was complete and the patient was being cooled to below dry ice temperature. As cooling proceeds below the glass transition phase of water (TG), different organs and tissues within the patient's body will begin to contract at different rates. However, because the system is now in a solid state, these materials, bonded to each other by ice/cryoprotective agent mixtures, will be unable to contract independently. A logical consequence of this would be the development of tremendous mechanical stress in tissues contracting at differential rates. As a result of the inflexibility and low tensile strength of frozen tissues at or below TG, fracturing occurs.

If the latter explanation is indeed the correct one, then cooling to very low temperatures in the absence of serious fracturing may be extremely

difficult in large biomasses. Perhaps the solution to this problem may be to anneal the patient for a prolonged period of time at or near TG prior to completing the descent to -196 degrees centigrade. Alternatively, it may be determined to be both safe and feasible to pursue storage at higher temperatures, perhaps in the region of TG, where there will be no available liquid water/cryoprotective agent to allow for appreciable propagation of chemical reactions.

It should also be noted that in the case of P3 there were surface to core temperature gradients of 20 degrees centigrade or greater during descent from -100 to -196 degrees centigrade (Figure 4). Head to foot gradients during cooling below - 100 degrees centigrade were consistently in the range of 40 to 60 degrees centigrade. It should be emphasized that these gradients were probably not as extreme in P3 as in P1 and P2 due to the fact that P3 was surrounded by multiple layers of insulation and a metal cassette. Large head to foot gradients, as well as surface to core gradients should be carefully examined as a possible cause of fracturing. It may be that simply by eliminating large temperature gradients during cooling much of the fracturing observed might be avoided. Clearly, much additional research is needed in this area.

One puzzling observation for which we have no explanation as yet is why none of these patients experienced any fracturing on the dorsum of the body. The entire back side of the bodies was completely free from fractures, including fatty areas such as the buttocks which would seem prime candidates for fracturing. Additional areas which were consistently free of fractures were the palms of the hands, soles of the feet, and genitals in the male patient. A cursory examination of the patient's severed heads under liquid nitrogen revealed no sign of fracturing (such as was observed in the subzero state in the case of P1), however it seems unlikely that the head would occupy a privileged position in this respect. Since these patients have been converted to neuropreservation and their care continues it was not possible to examine the brain and head for post-thaw fracturing.

The first two patients were cooled to liquid nitrogen temperature while strapped to heavy aluminum stretchers which completely covered the dorsum of the body. P3, who experienced far less external fracturing than P1 and P2, was enclosed in an insulating container which, as shown in Figure 3, resulted in a much slower rate of temperature descent. It remains a possibility that the stretchers may have acted in some way to mitigate fracturing on the dorsum of P1 and P2.

On gross external and internal observation, all of the remains appeared well preserved post-thaw. The skeletal muscles in both P1 and P2 had a softened, somewhat "mushy" feel which was not present prior to freezing and which was noted only to a slight extent in P3. The remains of all three patients exhibited considerably less rigor post thaw than was observed at the conclusion of perfusion. The change in tissue texture and reduction in rigor suggest the possibility of autolytic degradation of skeletal muscle. The texture and appearance of the heart and the other abdominal and thoracic viscera were for the most part unremarkable. The pancreas of P3 appeared edematous with separation of the parenchyma into rosette-like islands imbedded in a clear, gelatinous matrix. This type of edema has been observed during ischemic glycerol perfusion of animals (4) and during failed total body washout experiments. In contrast to the experimental situations where such edema has been observed, it appeared confined to the pancreas in P2. All three patients exhibited some degree of pulmonary edema.

It was difficult to find free fluid available for sampling in any of

the peripheral vessels of any of the three patients. Cut tissues exhibited very little weeping of fluid and even with the application of pressure, oozing was negligible. This observation suggests absorption of extracellular fluid by the tissues. Transcellular water in the form of intestinal chyme was noted in all three patients. The bladder of P3 was noted to contain a small amount of urine which was still partially frozen at the time of autopsy suggesting absence of cryoprotective equilibration. The spinal canal of P3 contained only a small amount of very viscous fluid (too small for sampling) and the cord was shrunken to approximately 1/2 of normal diameter. The dura of P3 had a dark, abnormal reddish cast and areas adjacent to fractures in the cord were similarly discolored. The virtual absence of significant amounts of CPA in P1 are very disappointing in view of the amount of perfusate used. It seems likely that failure to introduce meaningful amounts of CPA in this patient are a result of both the postmortem delay and the mode of vascular access used: the internal carotid artery. The absence of adequate blood washout and significant levels of cryoprotective agent point out the inadequacy of embalming equipment and techniques in human cryoprotective perfusions.

Both P2 and P3 showed good blood washout when contrasted with P1. However, in both of these patients numerous infarcted and nonperfused areas were noted. In P2 the CPA concentration was, not surprisingly, very low, no doubt as a consequence of the low volume of DMSO perfusate which could be delivered prior to the development of obstructive edema. A greater disappointment is the low levels of glycerol observed in the body fluids from P3. Despite four hours of closed circuit perfusion, the highest concentration of glycerol observed was still under 2M. These preliminary indications of poor CPA distribution should serve to again point out the devastating effects of long postmortem time delays to perfusion in the absence of adequate cardiopulmonary support. It is unfortunate, but not surprising that these results with humans bear out work conducted earlier with animals subjected to long ischemic times prior to glycerol perfusion (4). In the future, greater efforts should be made, where possible, to provide good postmortem cardiopulmonary and metabolic support in order to avoid the complications of inadequate perfusion and CPA distribution observed in all three of these patients.

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SCIENCE UPDATES by Thomas Donaldson

Barney Clark

Readers of CRYONICS cannot have escaped noticing the recent experiments in which deVries, Jarvik, et al implanted a mechanical heart into a retired dentist, Barney Clark. Many cryonicists and even many immortalists will have strong reservations about this research. An interesting editorial by Pierre M. Galleti of Brown University in the NEW ENGLAND JOURNAL OF MEDICINE (310 (1984) 312) gives us a mainstream view of the significance of Barney Clark's artificial heart.

Galleti points out that the experiment demonstrates only the feasibility of an artificial heart, not its usefulness. He argues that artificial hearts could only become common after the year 2000, so that this discovery will probably not have any immediate influence on medical costs. And he addresses the ethical problems which doctors and review boards (why not PATIENTS?) have had to face. Of course he has little to say about that problem. Doctors felt uneasy about allowing Barney Clark to turn off his heart, and Galleti draws a comparison with kidney transplants and dialysis, in that doctors were really not willing to undertake transplants unless the consequence

of failure was not death, but a return to dialysis.

As a cryonicist, these moral struggles seem to me very much like watching people through the wrong end of a telescope. Barney Clark chose to have an artificial heart implanted, in the full knowledge that he was not a candidate for transplant (the FDA would not permit implantation of artificial hearts in people who were candidates for transplantation) and that when this heart failed he would die. He furthermore knew that in no way could this artificial heart replace his own heart. It wasn't even portable, and he would probably not have even a full year left to him on the artificial heart. To do such experiments on dogs is one thing: much could be learned and someday artificial hearts may have a very useful role as a form of temporary support. A fully functioning implantable mechanical heart would be extremely useful, but of course that's not what was proposed. Instead, it was proposed to do on a person what really should have been done on dogs. By choosing to do this experiment, I feel that the doctors who treated Clark, and Clark, himself suffered from a gross perversion of values.

Of course I'm not questioning, here, that doctors had the right to do

what they have done, nor am I questioning that Barney Clark gave his informed consent, nor am I questioning the idea of experimenting upon human beings. Not all experiments, however, are equal.

The story of Barney Clark's artificial heart shows a totally shortsighted view of life, death, and the options available. If life is so valuable, why don't they consider suspension? Suspension is not acceptable, but it IS acceptable to engage in a costly attempt to postpone death for three months, an attempt which will guarantee death after that time elapses. The proponents of these experiments might defend themselves by saying that Barney Clark had the alternatives of death or the artificial heart. WE know that is not true, and therein hangs the tale. Defenders of this experiment lie in much the same position as a witch doctor who refuses penicillin out of hand, and then argues that his patient requires trephination because the only alternative is death.

We have all faced this problem of death and choices. We've come to our resolution of it, which is cryonics. It is a superior resolution. This superiority comes not because we can solve problems which doctors want to solve now, far from it. Rather, it comes about because we have come to understand that these problems, which seem so central to doctors and thinkers of the 20th Century, are the wrong problems, that their resolution is merely a side issue or perhaps even that they should not be solved at all.

Research on artificial mechanical hearts compares to research on iron lungs. Not long ago, many polio victims ended up in iron lungs; they cost a lot to maintain, and the patients had nothing like a normal quality of life. IN THEORY a fully artificial diaphragm could make it possible to lead a more normal life; but that wasn't what was actually produced. Salk discovered a polio vaccine; iron lungs became not totally obsolete, but certainly a side issue in medicine. We did not find a vaccine for polio by researching improved, high technology iron lungs. Artificial hearts aren't really a triumph of technology at all; they are a debacle, a rout, an ignominious defeat. Why not a cure for heart disease? Why not a cure for aging? Why not transplants with fully controlled rejection?

In terms of the problems which they've considered as crucial and important, the whole of the medical establishment has spent 30 years barking up the wrong tree, and all their papers on cancer and heart disease will one day lie neglected in libraries. One more forgotten fatuity of our ignorant predecessors!

The 20th Annual Meeting of the Society for Cryobiology: An Outsider's View

Recently, CRYONICS presented a thorough report by a cryobiologist of the 20th Annual Meeting of the Society for Cryobiology. I am an outsider and could only read the Abstracts of this meeting. Of course this is a very different and truncated view of the meeting. However from reading the Abstracts, which have just appeared in CRYOBIOLOGY (20 (1983) 698-752) some points stood out to me very strongly.

I would like it understood that this report is in the spirit of Ithiel deSola Pool or Eugene Garfield, who do such things as count the number of papers in a particular subject and draw conclusions about what's happening on the basis of statistics. In this light, the most outstanding thing about the meeting was not any individual research result presented (the very important work of Fahy at the Red Cross Blood Center on vitrification seemed represented more by a review than by an actual presentation of new work; I use the term "freezing" in the loose sense in this report and therefore include vitrification as a special case) but by quite a considerable increase in the number of papers devoted to organ freezing and

preservation. In fact, I've read these conference reports avidly for years and furthermore looked through the back issues of CRYOBIOLOGY for the older reports, and I cannot recall ever seeing so many papers on the problems of kidney and organ preservation by freezing and other methods.

It seems to me that this increase in organ preservation work is very significant in and of itself and would remain very significant even if each individual paper were utterly trivial. A lot of people are finally starting to get interested in organ preservation. Even people from New Zealand and Australia, countries not previously noted for cryobiological research, came to the conference to present their ideas. A large contingent of Germans also came, again unlike previous years.

Again, speaking as an outsider, I can suggest some underlying reasons for this (which reasons may have nothing to do with the conscious intentions of the scientists participating). I believe that cyclosporin and other recent advances in immunology coupled with the constant growth in kidney and heart transplants is driving this current interest in organ preservation, even AGAINST THE WILL of some of the participants.

It also seems to me (despite a comment in the earlier CRYONICS report) that there is essentially no way to meet the desire for long-term storage of organs other than by freezing them. I don't mean that other means of preservation are not possible, but rather that economic preservation is unlikely to be attainable except by freezing.

If cryobiologists can freeze kidneys, brains will not be far behind.

A further point of interest to cryonicists, although it doesn't tell us anything unexpected, is a report by Arthur Rowe and Leslie Lenny of the New york Blood Center on the long term viability of red blood cells. They tested a sample preserved for 15 years and found that at -196C their sample remained unchanged for that long. However, at -20C red blood cells tended to break up 24 hours after thawing. At -80C, glycerol frozen-cells could last for less than a week. This fact may suggest caution in carrying out temporary storage of suspension patients on dry ice.

"Even the lion has to defend himself against flies."

-- German Proverb