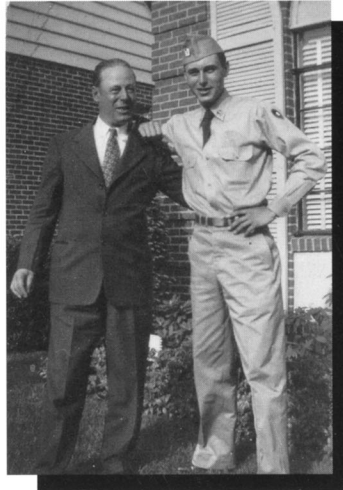


# CRYONICS

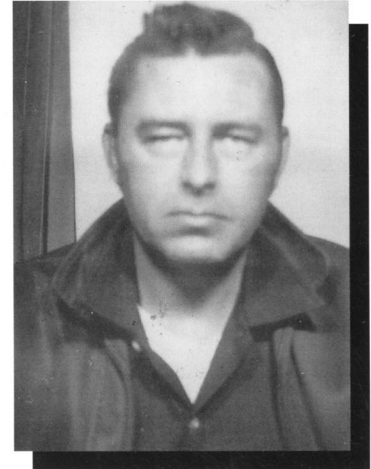
2nd Qtr. 1997 A PUBLICATION OF THE ALCOR LIFE EXTENSION FOUNDATION Volume



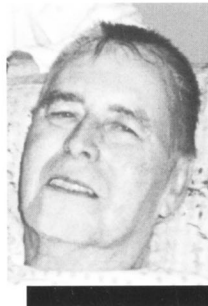
*Ed, 1952*



*Ed & his father*



*Ed Kuhrt, 4/10/71  
age 39*



*Ed Kuhrt, Jr., Ed's grandson, Ed Kuhrt, Sr.  
Three Generations*



*Ed & his grandchildren, Kristyn & Anthony*



*Anne & Ed Kuhrt, 1992*

## **CryoTransport Case Report: Edward W. Kuhrt, Patient A-1110**

BY BRIAN SHOCK, EDITOR

If you read this issue's masthead, you may have noticed a significant change: Ralph Whelan is no longer listed as the editor of *Cryonics Magazine*. For more than five years Ralph has doggedly, conscientiously performed his editorial chores while the entire cryonics community has roiled and mutated around him. When he began, *Cryonics* had just changed from an in-house cut-and-paste newsletter to a computer lay-out periodical arranged by two of our members (Eric Geislinger and Jane Jalisman, lest they suspect we have forgotten their efforts!). Ever the computer enthusiast, Ralph secured the hardware and software to handle lay-out chores back at Alcor. He guided the magazine through a shift to less expensive and less substantial "web press" format (which describes the printing process and has nothing to do with the World Wide Web), back to the previous format, into a brief bi-monthly phase, and at last into the current quarterly. Even during events surrounding the so-called "Cryo Wars," Ralph maintained fairness with the contents of *Cryonics*. Alcor owes Ralph Whelan a special thanks for his work throughout the years.

Unfortunately for us, Ralph had to wise up someday. Realizing that mere thanks do little to pay the bills, he has gone on to more lucrative work that makes greater use of his talents. Never

fear, though: Ralph Whelan is still a dedicated cryonicist and valued Alcor suspension member.

Enter yours truly. I'm Brian Shock, an Alcor suspension member since 1991 and Alcor Membership Administrator since August, 1995. I've studied a little medicine, dallied with computer programming, and dedicated most of my free time to writing. I love the written word. Elegant prose enthralls me and well-constructed thoughts elicit my deepest admiration. More than anything else, however, I enjoy gutsy, evocative storytelling.

Of course *Cryonics Magazine* will change to reflect my personal bias. As much as I like clever art and creative lay-outs, I am not preoccupied with either. If I have a choice between composing an article or arranging a title page, I'll probably compose the article. While I'm not threatening to convert *Cryonics* into a stark computer print-out, I also have no illusions about producing a rival to *Wired*.

### New Editorial Policy

Although *Cryonics Magazine* is a publication of the Alcor Foundation, back in 1994 Alcor's Board officially confined Alcor-only business to a sister publication, *The*

*Alcor Phoenix*. *Cryonics Magazine* has not been the Alcor "house organ" since that time, regardless of what it has subsequently published.

In my opinion, *Cryonics* should be neutral ground. It should report items from the entire cryonics community, without consideration for organizational lines or stale political conflict. As a meeting ground between cryonicists and non-cryonicists, it should reflect a spirit of cooperation, openness, and legitimacy.

I would like to invite all cryonicists to submit articles for *Cryonics Magazine*. Whether you're with Alcor, Cryonics Institute, CryoCare, ACS, Trans Time, ICS, or no organization at all, please feel free — please feel *encouraged* — to send me work of publishable quality. I recognize that the universe is larger than my personal thoughts and opinions; I will give serious consideration to any supportable fact or cogent argument, even I don't agree with it myself.

In general, the categories of items presented within *Cryonics Magazine* should remain similar to what you have come to expect. I'm looking for technical reporting, human interest stories, interviews, book reviews, practical ideas, supportable new hypotheses, and perhaps even

### PUBLICATION NOTES

*Cryonics* is the quarterly publication of the Alcor Life Extension Foundation

**Editor: Brian Shock**

**Volume 18:2 • Issue #173 • 2nd Qtr, 1997 • ISSN 1054-4305**

(Most of the first 160 issues—September, 1977 through December, 1993—were published on a monthly basis.)

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### About the Cover

Cover photos courtesy of Anne Kuhrt.

short fiction. Don't allow this list to limit your imagination, though; if you believe you have something important to say, by all means run it past me. Keep in mind that objective facts will always receive priority over personal opinion, though there should be room for both.

### The Future

Technically speaking, *Cryonics* has always been a "fanzine," a small periodical that accepted almost everything it received and paid nothing to its contributors (hence the need to accept anything it receives). While I don't necessarily believe the world is ready for a professional journal about cryonics, I have hopes

of making this a "semi-prozine," which pays its contributors a small honorarium for articles. Professionals expect pay, and even though *Cryonics* may never boast professional rates, I'm hoping that a token payment of \$40-50 will help professional writers look upon us more favorably.

Before the bills start arriving, however, let me beg everyone's patience and indulgence on this step. In particular, I hope that our regular contributors will continue with their written "donations." Any money for articles will come out of my own pocket, and so I'm determined to use it as carefully as possible. My goal is not just to draw more professionals — scientists, physicians, at-

torneys, financial advisers, insurance agents *as well as* professional writers — but also to guide the articles published toward more unified themes and more desirable topics.

Having said this, I hope I haven't discouraged potential contributors whose expertise I failed to mention. I need your input, whether that input is in the form of articles, correspondence, or simply ideas. *Cryonics* as a field of interest ranges from the technical heights of nanotechnology to the everyday facts of interpersonal relationships. *Cryonics* as a magazine should cover the same ground.



## Hello, Dolly! Goodbye, Reason?

by Brian Shock

In early March we heard the news that cell biologists at the Roslin Institute in Edinburgh, Scotland managed to clone the first mammal from an adult cell. The result of their labors, a female sheep named "Dolly" (in honor of entertainer Dolly Parton), occurred after 277 attempts at fusing nuclei from adult sheep-udder cells into denucleated ovi.

Mammals have been cloned before, but only with nuclei taken from embryos not yet beyond the eight-cell stage of development. The Roslin team accomplished their breakthrough by forcing nucleic DNA in donor cells to behave more like the inactive DNA of sperm or unfertilized ovi.

For the most part, however, the media seem to have ignored various technical difficulties of cloning in favor of more profitable nightmarish scenarios. They exuberantly remind us of the "X-

Files" episode with psychotic cloned children who murder their parents, or of "Jurassic Park" and its monstrous cloned carnivores.

"What does the cloning of Dolly mean to cryonics?" at least half a dozen bright reporters have asked me, practically salivating for some melodramatic link.

"Almost nothing," I must reply. "Cryonics is about preserving minds and memories, not just bodies. A suspension patient's clone would have the same relationship to him as his identical twin brother. When a *conventional* twin dies, no one suggests that *he* lives on simply because his brother survives."

A few of the better-informed journalists mention the use of cloning to restore the bodies of our neuro-patients. I always try to ignore this line of speculation; I don't want to see an article about how cryonicists plan to clone themselves and then lop off the poor clones'

heads to make room for a transplant.

None of this satisfies our friends in the media. If they can't announce "revival" of cryonics patients or "ghoulish intentions" of cryonics companies, they have no hook for their stories. "Doesn't cloning mean *anything* to cryonics?" they always whine in frustration.

"Certainly," I tell them. "It's a very general proof of principle: science continues to advance. Perhaps someday science will advance to where it can revive cryonics patients."

My callers usually groan and hang up on me.

Never hesitate to disappoint someone when that is the only reasonable course.



by Fred & Linda Chamberlain



## Questions & Answers About LifePact



*Most of the content below appeared in LifePact News Number 5, July 4, 1989  
It has been revised to reflect historical perspective.*

What lies beyond “being suspended?” Some will tell you “staying frozen,” and a few will say it’s all about “coming back.” But what does *that* mean?

Everyone has a slightly different slant. The biotechnologist will describe the repair methods that might be used, while the futurist will tell you about the wonders which might await us. The evolutionist will speak of it as an era beyond natural selection, and the psychologist may be fascinated with the challenge of adjustments to an extremely high speed future. Philosophers will be caught up with questions of preservation of identity and the matter of how memory losses are to be regarded. Financially aware individuals will be concerned with preservation of their assets and the economy of the future. But what does this mean to you right now? Can you do anything other than dream and speculate?

The two of us thought the answer to this was “yes,” back in the Spring of 1989. We spent a few days along the Northern California Coast and talked

of almost nothing but that.

Are we cryonicists blindly relying on our “friends of the future” to make everything happen for us? Are some of them among us already? Aren’t the younger cryonicists of today going to be members of the “welcome back” group? Might it make sense to get to know these people better?

Also, there are questions of how cryonicists who are suspended might back each other up, as to the reanimation process. If two present day cryonicists are in an automobile accident and one is easily rescued while the other is deeply compromised, would it be fair for them to promise each other, in advance, that the one less damaged would help get the other back on his/her feet? Since they could not know in advance which one would be the most badly damaged, such a pledge has a ring of fairness to it! It’s an “I’ll help you if you help me” principle, a “win-win” attitude, carried decades into the future, in a cryonics context.

The two of us made such a pact with each other, and (unilaterally) with

our parents, nearly a decade ago. We simply vowed that we would help them any way we could. But when we tried to broaden the idea to include large groups of people, the idea began to look very complex. There were lots of people in cryonics, of all different attitudes about what was valuable and what was not, or what would be an ideal future. How would the “mutual backup” idea work on that level? Did it even make sense?

We wrote some articles on this subject and put out a newsletter for awhile. We even went so far as to set up a non-profit corporation and obtain tax exempt status for it (later to form the foundation for the Extropy Institute), but the idea was too new and too undeveloped. Too many cryonicists feared it would be unworkable if their *own* cryonics society did not handle this on an internal basis. For the last ten years, the LifePact idea has lain dormant, in “suspension” as it were. Now, it will be reanimated within Alcor.

Rather than outline all aspects of the idea at once, we’ll take the subject

one step at a time, the way we did in one of the *LifePact News* issues, with a Q&A (Question-Answer) format. Hopefully, we'll have chosen the most central questions first, and left the detailed, nit-picking ones for later... but you never know. Later, we'll consolidate these ideas into a more integrated paper, then a booklet, and finally a handbook. But that is an evolutionary process, and those of you who are interested in this will play an important part.

The original Q&A LifePact treatment had it's own introduction. We'll start with that... and then proceed with the questions themselves. Once again, to clarify the purpose of what follows, the goal is to review LifePact ideas, as they were first developed in 1989, with minor updating to adjust for present context:

## **Introduction**

(content from the 1989 article):

With a view to being part of a future where old age and disease are no longer a problem, we arrange to be frozen if death should threaten us. We anticipate it may be 50 to 100 years, perhaps more, until technology advances to a point where those who arrange now for cryo-transport (an alternate term for cryonic suspension) may be reanimated.

Reentry into society (assuming reanimation is feasible) will take place at an undefined future time. Reanimations may vary in the degree of difficulty, in the extent of biological repair that is involved, and even in the repair technologies which are used. Each person will require an individualized program of assistance as to education and psychological adjustment. As a result of this, the "reentry" costs, the costs of reanimation and rehabilitation, cannot easily be predetermined and prepaid.

How, then, may these unknowns be accommodated?

LifePact is a way of improving the chances that we will awaken in a supportive environment, able to quickly resume our constructive roles in society. But what is LifePact, fundamentally? Is it an organization? Is it an agreement, a system, a methodology? In what follows, questions like these are answered.

### ***Q. What is a "LifePact?"***

**A.** A "LifePact" is an agreement (bilateral or unilateral) to help others be reanimated as soon as is possible and as well as is possible. In part, this may require a commitment to repay the costs of "reentry" (reanimation and rehabilitation). Members make LifePacts to repay their own reentry costs, and some may pledge to assist others (family members, loved ones, or fellow time travelers in general). By arrangements of a private kind, it is even possible one person might pledge to pay back another, for help with the costs of suspension. It is important that all such agreements state clearly that prospects for reanimation are unknown and it is possible such will never be achieved. A videotaped interview could well be the most convincing form of such a unilateral agreement.

### ***Q. Was there ever a LifePact organization?***

**A.** Yes! It was a project of the Lake Tahoe Life Extension Festival, a California nonprofit public benefit corporation. The scientific and educational objectives of LifePact were:

(1) To promote, support, and conduct research concerning the reanimation of those suspended by present methods. Non-ideal suspensions as well as those under ideal circumstances were to be

included, since there were sure to be cases where suspensions would be compromised.

(2) To carry out public education programs with regard to the limitations as well as the possible benefits of cryonic suspension. The purpose was to convey a realistic view of problems and difficulties to be faced at reanimation: the recovery of lost memories, regaining capacities for physical control necessitated by body regrowth/replacement, and the associated costs of both reanimation and rehabilitation.

### ***Q. Did LifePact have membership participation programs?***

**A.** Yes. LifePact developed agreement forms for its members and still archives those which were completed, for availability when they might be needed. Also, LifePact activities were to include development of systems supporting memory and identity restoration in suspendees with memory losses, along the lines of methods for use with stroke victims, and was envisioned to facilitate the archiving of personal artifacts which might help with this. LifePact had the objective of organizing support groups for relatives and friends of members who are suspended.

### ***Q. Was it intended that Lifepact become an organization in itself?***

**A.** Yes. Articles and Bylaws of the Lake Tahoe Life Extension Festival were amended so the organization would be renamed "LIFEPACT" and thereafter would be committed to the objectives of the LifePact Project as spelled out above. Annual conferences (Cryofests) were planned to promote new memberships in LifePact and (as a byproduct) in suspension organizations as well. Cryofests were also expected to help educate the public about the

current technologies of cryo-transport, as well as what future technologies might be necessary for reentry into future society. Research in both areas, as results developed, were to be presented. In 1990, at Asilomar, LifePact hosted a conference on "Biostasis and Reentry," which emphasized the LifePact theme. Perhaps such conferences can be resumed in the future, as interest in the LifePact idea develops, or perhaps this can become a part of the annual Alcor Cryonics Conferences which are already being developed.

**Q. How did LifePact plan to raise funds to carry out its programs?**

**A.** In the short term, LifePact expected to carry out a wide range of activities supported by membership dues. Over the longer term, LifePact anticipated support by way of income from revocable endowments. The principle of an endowment of this kind was that it would be revocable by the donor at any time while the donor was alive, and would retain an identity of its own, so it would not be a "donation" in the pure sense and would not be deductible from the donor's taxable income. Some significant portion of the income, however, would be dedicated to LifePact's research and educational activities, and would not be taxed so long as LifePact maintained its tax exempt status.

**Q. Was LifePact intended to be primarily comprised of cryonicists?**

**A.** LifePact was planned to have two classes of members. Associate members would not need to be cryonicists.

Full, voting members would have verified suspension arrangements through organizations adhering to certain minimum standards, and would have made

**"LifePact was conceived to focus exclusively on reentry problems, so that suspension organizations might put more energies toward urgent matters of getting their members suspended should they die."**

contingent agreements with LifePact relating to reentry.

**Q. Since LifePact objectives were to be heavily focused in the area of cryonics, how would LifePact have been different from other cryonics organizations?**

**A.** LifePact activities were expected to be in synergistic counterpoint with those of most of the suspension organizations. Its interests lay primarily in areas where suspension organizations had not yet developed programs, because of higher priorities in regard to cryonic suspension procedures and storage technologies. LifePact was conceived to focus exclusively on reentry problems, so that suspension organizations might put more energies toward urgent matters of getting their members suspended should they die. LifePact would not have engaged in suspension operations or storage services.

**Q. Don't suspension organizations take into account a need for reanimation and rehabilitation?**

**A.** Most suspension organizations promise a "good faith effort," but un-

knowns of cost prohibit budgeting and setting aside funds for it. To protect against implications they are promising reanimation, suspension groups cannot warrant that they have the capability or financial reserves to revive a member, much less provide for rehabilitation, reeducation, or psychological adjustment therapies. LifePact, since it did not plan to engage in suspension and storage, and since its eventual operational activi-

ties were contingent upon the feasibility of reanimation, had no such conflict of interest. To further protect against problems, some suspension organizations had specifically left it up to the member to determine how much funding was likely to be required for reentry and provide for this. LifePact would have been a way for such members to address this area of uncertainty, particularly if local groups develop independent LifePact programs of their own (discussed in more detail elsewhere).

**Q. How would LifePact help solve this dilemma?**

**A.** As stated earlier, members reanimated by LifePact (or by cooperation between LifePact and a cryo-transport organization) accept the responsibility to repay the costs of reentry, if such was required. They would make a contingent agreement, now, which would be anticipated to become retroactively binding in terms of future law. Not only would this have given members with "LifePacts" better chances of being reanimated, but it would have given cryo-transport organizations which worked with LifePact freedom to concentrate on immediate concerns, without divert-

ing energies from suspension and storage.

***Q. I've heard that the costs of reanimation may be trivial, and since most cryonicists are adaptable people, it appears that the process of rehabilitation may not be difficult. Can't reanimation and rehabilitation be provided by the cryo-transport organizations?***

**A.** Let's take the parts of this question one at a time:

(1) Will the cost be trivial? Current projections by those knowledgeable about nanotechnology are that the repair process could take months or years. If we awaken in a utopia where working space, power and materials are virtually free, with all processes entirely automated, the cost might be trivial. If conditions are other than that, the cost may not be so trivial. It is wiser to plan for a less ideal future, just in case.

(2) As to rehabilitation: Many involved with cryonics at this point are extremely "future minded," confident they will need no assistance. But some members, most particularly any whose suspensions are compromised by delays or problems of other kinds, may expect a period of adaptation to be needed. Also, we will not know, until technologies for reanimation are developed, what losses of memory and/or other capacities may result from being suspended by current methods. What if extensive neurophysical therapies are part of rehabilitation? These could be costly! Also, there will almost surely be educational gaps to be filled for complete "rehabilitation." We cannot count on public welfare programs to take care of this for reanimated suspendees, nor would it be prudent to cross our fingers and hope the original funds provided for suspension and storage will be adequate.

***Q. I'm very active in my suspension organization. The others in my group have stated they will go to any lengths to see that I am suspended and revived. I feel great confidence in these people. In that sense, don't I already have a "LifePact?"***

**A.** No. LifePacts are specific agreements. You say that you've made contributions to your suspension group, and, you hope you will be remembered and given consideration for this at the other end. That is valuable, but even the most actively involved participant in a suspension organization would be safer to also express a willingness to be responsible for the costs of reanimation and rehabilitation, if need be. Others, less active than yourself, are in even more need of LifePact to cover reentry costs, unless specific funding is being budgeted by the suspension organization to cover reanimation and rehabilitation, but then the question would be: "How can they know how much will be required?"

***Q. But aren't "people" the key? Why should I rely on the people in LifePact to reanimate and rehabilitate me if I can't rely on my suspension organization?***

**A.** Many "people" presently active in cryonics could be frozen well before the time when reanimation and rehabilitation were finally feasible. Reliance on principles and systems will offer greater safety and stability. An organization needs to have firm principles as to operation and systems which impell the people who run it to carry them out.

LifePact, during its first few years, expected to devote much of its energies to the development of such prin-

ciples and systems. Its members, a gathering of minds from all cryonics groups and a great pool of experience, were anticipated to participate in this. LifePact intended to build systems which fit in a complementary way with those of suspension organizations which specialized in suspension and storage, and LifePact expected to cooperate with suspension organizations which encompass both suspension and reentry, offering mutual members an even greater chance at successful and fulfilling reentry into society when means for their reanimation and rehabilitation were available.

***Q. Doesn't LifePact place itself into a state of conflict with cryonics groups whose members have confidence that the group, one way or another, will provide for reentry without outside participation of LifePact?***

**A.** No. If a member wishes, LifePact can serve solely as backup to the possibility that the cryo-transport organization might fail, with the cryo-transport organization having the primary responsibility for reanimation and rehabilitation. Or, it might be that the cryo-transport organization would possess the technology but not the funds, and an agreement with LifePact could serve as the means of providing the necessary finances. Also, one could affiliate with LifePact simply as an "associate" member, for purposes of idea exchange, without making a LifePact of any kind.

It is also important to remember that reentry may involve a wide spectrum of procedures. It would not be logical to hope that a cryo-transport organization would be a provider of every conceivable therapy one might need. It might develop, at a future time, that LifePact would be in a position to

handle reentry or contract out parts of this so effectively that suspension organizations which now hope to encompass all reentry procedures would prefer to have LifePact handle this. For patients who had joined LifePact and participated in its activities, this could be relatively straightforward. For those who did not, it could be more difficult.

***Q. Doesn't the LifePact concept rest on a working assumption that those in the future will have a way to pay? Suppose the future has such abundance there is no such thing as "money?"***

**A.** Yes, there is an assumption that those in the future will be in possession of productive capacities by means of which to repay what has been done for them. If we imagine that there will be tremendous productive capacity (which in the context of nanotechnology, we presume), and if we imagine the society of the day will not be totally collectivist (meaning individuals will have some rights to produce individually, retaining at least some right to dispose of what is produced), it follows that such individuals could accumulate values and fulfill their obligations. If the society of the future is such that those then living have no productive capacities or individual choices of disposition of resources, it is pure speculation as to

whether suspendees will be reanimated at all.

***Q. Isn't a LifePact agreement simply a means to provide those who need them with reassurances?***

**A.** No! Reassurances are for those who want to be told that a nominal cryo-transport fee will buy them a ticket to the stars, assuring their every need and want. LifePact agreements were intended to set a context that the people involved were willing to "pick up the tab" at the other end if necessary, willing to help out in exchange for being helped, willing to share the effort and costs, if need be. LifePact agreements were also expected to establish an understanding that there might be serious memory losses and tradeoffs as to the time and cost to effect a more perfect reanimation. These areas of concern may not be covered by the documentation of some suspension organizations.

LifePact agreements also were expected to provide members a more substantial means of expressing their desires to help other cryonicists reenter society. Mothers who wanted to help children frozen before they were old enough to understand their situations, relatives of loved ones who died and were suspended before LifePact came into being, or just one time trav-

eler reaching out his hand across time to help a fellow cryonicist, perhaps one she or he had never known, were among the possibilities of the sorts of individual pledges or commitments that might have been made. While none of these, at the time, were regarded as binding contracts, they establish states of mind which later could be very important to those involved.

The idea that a LifePact agreement "reassures" someone who wishes not to be responsible or face reality is mistaken. It is just the opposite that is the case. Those who execute LifePacts would have faced the difficulties and problems, and they would have been chosen to be responsible for their own destinies and perhaps for the destinies of others.

***Q. I'm not currently signed up for cryo-transport, but cryonics is an area of great interest for me, especially now that LifePact will be there to assist with reentry. Can I join LifePact before I make cryo-transport arrangements?***

**A.** Anyone was welcome to join LifePact. Unlike prearranging for suspension, which requires funding in the range of tens of thousands of dollars, LifePact membership only requires dues of a modest kind. An associate member of LifePact who went through the process of setting up a LifePact agreement would have been expected to be far more knowledgeable concerning options and limitations involved with cryonics, far better prepared to select among the existing suspension organizations, in making arrangements for suspension. For those who were interested in cryonics but who had not yet made arrangements, joining LifePact might have been the first, most logical step. And, as a member of LifePact, you would have had a better chance of

**"It is also important to remember that reentry may involve a wide spectrum of procedures. It would not be logical to hope that a cryo-transport organization would be a provider of every conceivable therapy one might need."**



convincing your loved ones to join you on this adventure!

***Now that LifePact is going to be “part” of Alcor, how will that work? Can we really keep LifePact separate from other activities?***

That question is the key to understanding the underlying LifePact ideas. With LifePact as an integral part of Alcor, it will develop only in those ways Alcor Members want to see it developed. Only to the extent that Alcor Members see this as an important principle will it grow and evolve. Since participation is the key, and since this is always voluntary, there should be no problems in LifePact fulfilling Alcor Members' expectations.

The purpose of this article, as indicated at the beginning, is to update LifePact ideas from 1989, leaving enough of the original content to show how LifePact would have operated as a totally independent organization.

If you have thoughts on LifePact and how its activities might best become part of Alcor's program, or (especially) if you would like to be a part of the volunteer group bringing such programs into existence, then please send email to us (fred@alcor.org or linda@alcor.org) mentioning LifePact, and we will send additional information to you within a short time and call you as well to get your viewpoints in a more direct way! Already, over fifty Alcor Members have completed a very short, introductory questionnaire, covering only “tip of the iceberg” issues. They are *already* in this information pipeline. You can easily join them!

There is one additional idea, and it has just begun developing during a trip

to Northern and Southern California during the period 4/11/97-4/15/97. This is the concept that local groups, as they grow and become autonomous non-profit, tax exempt corporations, will each become foci for LifePact activities, and serve as “backup” organizations for their Members. Since they can be distinct from Alcor, from a corporate standpoint, they could serve as Trustees for excess funding in Member's financial arrangements for CryoTransport (a new term for cryonic suspension). These groups could engage in all of the archiving activities which LifePact envisioned, and be the close-knit sorts of nexi (communication nodes) which could best evolve the LifePact concept.

With time, Alcor Members might find themselves affiliating with a number of “local groups,” each of which closely suited their preferences. An association or network of such groups might serve in a strong advisory capacity to Alcor, and help evolve reanimation strategies and standards, since it would represent a diversification of individual Trustee responsibilities, oriented toward a common goal on behalf of individuals suspended with a common organization (Alcor Central).

We are just at the beginning of making LifePact a reality. Those of you who are reading this, who find these ideas fascinating, will be the “heart and soul” of where we go from here!



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***Thanks for reading this “little piece of history,” and for thinking about how it might apply to Alcor's long range future!***

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# The Alcor Cryonics Technology Festival

*A Summary and Review*

By Thomas Donaldson

The Alcor Technology Festival took place on the weekend of February 1st and 2nd, with an initial party given by Dave and Trudy Pizer on January 31st. Although one of this conference's main features turned out to be disappointing for many there, some memorably positive things also happened.

Technically oriented people from all the major cryonics societies attended. This included Paul

Segall, Hal Sternberg, and Stephen Kehrer ("Tumbleweed") from Biotime, Inc; Paul Wakfer, Mike Darwin, Sandra Russell, Charles Platt, and Saul Kent from the CryoCare Foundation and Biopreservation (unfortunately Steve Harris could not attend, although his close friend, Sandra Russell, could and did); Bob Ettinger and Andy Zawacki from the Cryonics Insti-

tutes; and of course many Alcor members interested in the current and future state of cryonic technology: myself, Ralph Merkle, Wesley Du Charme, Tanya Jones, Mark Muhlestein, Mike Perry, Hugh Hixon, Russell Cheney, Brian Shock, Fred and Linda Chamberlain, and others. Steve Bridge, Carlos Mondragon, and other officers of Alcor also attended.

One event, specifically for Alcor members, took place at the banquet



on Saturday evening. Commemorative plaques were presented to Tanya Jones, Dave Pizer, and Steve Bridge. In a simple ceremony, Steve Bridge then handed the Presidency of Alcor over to Fred Chamberlain.

The major attraction of this Festival was Olga Visser, who has claimed successful freezing and revival of rat hearts with her cryoprotective perfusate (the composition of which she did not wish to reveal). From my own discussions with them, attendees from CryoCare particularly came because they wanted to see Olga Visser's

heart freezings on Sunday. Everyone there, I think, had lots of interest in seeing her experiment performed before an audience sophisticated in cryobiology and cryonic suspension.

The talks in this conference, given on Saturday, discussed both present and future work done by cryonicists to improve their methods.

In the morning Linda Chamberlain presented several improvements in dealing with important practical issues, such as transport and secure storage, including especially work

improving portability of our ice bath. Olga Visser described her own work, and the extensions of it now attempted in Russia, the Ukraine, and the United States. Fred Chamberlain described Alcor's future research plans, including development of several important technologies. One potentially important device consists of a system to tell Alcor if a member — particularly a member living alone — had died or become so seriously ill that he could not call Alcor on his own.

The afternoon session included a talk by Paul Segall and Hal

*Olga Visser (below, at rostrum) discusses her rat-heart experiments with ACT Festival attendees.*





*Dr. Thomas Donaldson*

Sternberg about their work with others at Biotime in repeating and extending the old experiments of Audrey Smith in the 1950's. Their talk also included reports of work with Hextend, their patented blood substitute. Hextend, soon to be marketed, demonstrably works better than other blood substitute now available.

*Dr. Ralph Merkle*



Paul Wakfer described the current state of his Prometheus Project, which aims at suspending and reviving brains within 10 years after it starts. His estimate (and that of others) for the total amount of funds needed over 10 years is \$1 million/year. At the time of this conference, he had raised about \$340,000 in pledges for future work (this sum has increased since then).

The other afternoon talks related more to theory than anything as yet done.

I discussed the criterion of *information survival* and how our knowledge of the brain's function bears on our experiments, particularly for members suspended under poor conditions. Basically, viability of cells or tissues in the classical sense means little. Since current studies indicate that permanent memories are stored within the connectivity of neurons, we should first test for how this connectivity survives the freezing process. Because cryonics remains emergency medicine and we may find ourselves unable to apply our best methods to all patients, such experiments will need doing.

Ralph Merkle discussed the latest developments in nanotechnology. His talk told of several recent simulations of nanomachine parts, including one gear contained in another. He also mentioned some work with DNA as a building material rather than for genetics.

Mark Muhlestein gave a very interesting talk on tissue engineering as a means of repairing tissues which would not normally grow together again. We may someday learn how to control growth and development itself, to the point of growing new arms (or bodies!) directly. Tissue engineering counts as a step towards



*Paul Wakfer*

that end.

That evening, after the banquet and the awards, Mary Margaret Glennie told of her own (much more empathetic than most) approach to convincing others to become suspension members. Michael Cloud, who has done similar things for other nonprofit associations (and was actually signing up with Alcor) then described further ideas on increasing membership, something all Alcor members and all cryonicists have tried to do for many years. He got, on the spot, significant contributions

*Mark Muhlestein*



to his efforts from most Alcor members present. From his own past accomplishments, he believed that he could double Alcor's suspension membership in less than a year. His methods involved some changes to Alcor's current methods, particularly in setting up a system with several levels of membership, the last being full suspension membership.

On Sunday, all the attendees came to watch Olga Visser freeze rat hearts. Because crowding in on the experiment itself could disturb the apparatus, most people watched on a TV viewer. Fred Chamberlain recorded this same video feed of the procedure on tape.

I had previously spoken with Olga, and found her quite different and much more friendly than the person sending messages to Cryonet in her name. No one in the audience wanted her experiment to fail, and we all felt quite sympathetic to her. Almost universally, though, we also wanted assurance that her experiment was indeed a valid test. That assurance came with the first experiment, in which the rat heart was placed in liquid nitrogen with a thermocouple nearby, specifically to verify that it remained for 20 minutes in the liquid nitrogen. Some questions arose because that thermocouple had been separated from the heart by a cottony vinyl tissue designed for mechanical protection rather than insulation. Olga answered those questions by also freezing a bit of rat liver, and showing how solid it had become.

Unfortunately, when this heart had been removed and warmed up, it completely failed to beat. Electrical signals came from the heart for a short time, as if it were trying to tell its muscles to beat, but no one saw any sign of beating. Olga then tried

a second test, which again failed, this time (perhaps) because one part of the heart had not been perfused. She then tried a third heart. By now many people in the audience had become discouraged and drifted away. Fred continued his taping. In each case, Fred and others insisted that the same procedure be followed: cooling down the heart, putting it into a dewar of liquid nitrogen, and timing its stay there.

As the audience number went down, we were allowed to enter the lab and watch the experiment more closely. Olga also dissected the failed hearts to see what may have happened. At this point, spectators started to express differing ideas as to why the experiments had failed. Mike Darwin (who, it turned out, Saul Kent had specifically set to testing cryoprotective solutions, which were designed by Steve Harris and Brian Wowk) believed the experiments failed because they destroyed the myoglobin in the heart muscle. Olga Visser gave a separate account, and believed she had detected movement of the heart ventricle in the

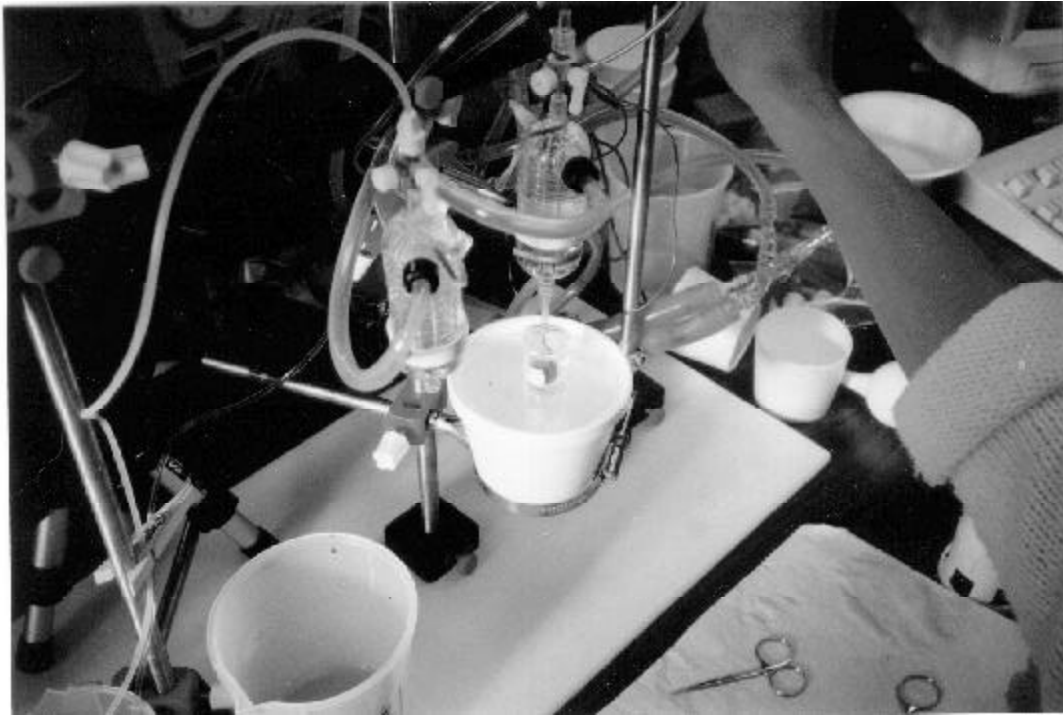
first experiment. One major cause for skepticism from Mike, Saul, and the others with CryoCare and BioPreservation came from their belief that they had already tested Olga Visser's cryoprotectant and found it too toxic. However, the cryoprotectant sample Ms. Visser used in her South African experiments did turn out to have a different conductivity\* from that used by Alcor in its attempts to duplicate her work. Possibly this was the case with the cryoprotectant sample used by BioPreservation as well.

Visser did a total of 5 tests that Sunday. None of them showed any revival other than, at best, weak electrical signals from the heart. Later events have confused the issue even more: apparently the solution used had not been recently brought up from South Africa for these experi-

\* *Conductivity*, although related, is *not* the same as pH. pH measures the number of hydrogen ions in a solution; conductivity measures the number of

*(Left to Right) Andy Zawacki, Hugh Hixon, and Olga Visser prepare the Langendorff apparatus for another rat-heart attempt.*





*The telltale rat heart (center, hanging above the styrofoam cup).*

ments. It was Visser's solution, but had been in storage since the last time she visited Alcor. Moreover, after Fred Chamberlain examined video tapes of earlier (successful?) experiments done by Olga Visser and Hugh Hixon on Friday, he (Fred) pointed out that none of the "successful" hearts had actually been immersed in liquid nitrogen.

In talking about her experiments, Ms. Visser stated that she had been able to revive about 6 out of 10 hearts. While these results might still be taken as cases of failure, her experiments also made several points very clear. First, she had not specified the exact solutions to be used, with some unknown additional (missing) ingredient possibly accounting for failure. Even for use in heart cryopreservation, a protective solution should give much more consistent results. Furthermore, on Friday she had tried several different procedures for freezing and reviving. All this needs to be made con-

sistent, with every step sufficiently specified that someone could reproduce it from her written account alone.

Some who attended the conference would apparently demand that Ms. Visser do all of these things before they would consider her solution at all interesting. I myself would simply insist that she verify, in every case, that the hearts she tested were immersed in liquid nitrogen, even if she revived only a small percentage of them. This would not necessarily make her solution good enough to use — much more work would be needed until then — but it *would* prove that her cryoprotectant deserved further consideration.

If Olga Visser has a useful cryoprotective solution, at minimum it still needs a great deal more development. Even then, it may ultimately fail to work. In one sense, the research needed is her responsibility, yet we all want *something*

that works. Before that Sunday, it seemed we might have that something already, or be very close to it. Now it does not.

However, in another way the Alcor Technology Festival was a roaring success. We all were united in wanting Visser to succeed, and sympathetic to her within the hard constraint that she demonstrate this success. Not only that, but for the first time *all* the major cryonics societies got together in the same room. I saw several arrangements between individual researchers to share facilities. Visser's failed experiments made very clear to everyone at the conference how much we were all in the same lifeboat, which will sink or save us through our own efforts. It brought a kind of unity. I hope that feeling continues.





## Visser Speaks

*Michelle Olga Visser's Presentation  
2nd Annual Alcor Cryonics Technology Festival  
February 1st, 1997*

**Steve Bridge (SB):** Since last September there's been a lot of curiosity, controversy, questions, and interest by some new ideas in cryobiology that were brought to the fore by an experiment done by our next speaker, Michelle Olga Visser, from South Africa, at the University of Pretoria.

Mrs. Visser froze a rat heart, thawed it out, and the heart resumed beating. This was repeated at Alcor's laboratory last September, and a lot of people have been waiting to hear what Mrs. Visser herself had to say about this research, to explain a little bit more, and answer questions about it.

So Mrs. Visser is going to talk for just a few minutes, and then she will answer questions.

This is Olga Visser. Thank you.

**Olga Visser (OV):** Hello. Good morning. I'm Olga Visser. I want to thank Alcor for my being her today, and I want to thank you for attending my presentation.

Some of you may have questions about my e-mail, and about my research. I'll try to address all your questions as we proceed.

To start, I'd like to tell you a bit more of myself. I am a cardiovascular perfusionist at the University of

Pretoria in South Africa. I started ten years ago in research on the preservation of dead tissue. I became the head of the autograft department, and started researching live tissue. On the subject of cryobiology, I read anything that was available and everything that was available, and about everyone's mistakes. My first heart was a pig's heart, and against all odds, it was brought back with a functional ECG. It could not be fully warmed up to 37 degrees because of technical problems.

We then passed on to rat hearts;

**"One thing I'm going to ask everyone is to work together. Your best hope of reaching your ultimate goal is to work together."**

they were less expensive, more available, and something I could try hundreds of times. After that, I did try hundreds of times; I've frozen well over two hundred rat hearts. Since the original pig heart, we haven't had a chance to use a bigger animal.

I only got my own research labs at the University around month ago.

That means now we have the opportunity to go for the first transplant, if approved by the ethical committee and by animal rights. We are hoping for full success.

We are all here for the same goal, to preserve life. The first, most direct way is to eat right, to not smoke, and to live in an impossibly perfect world. The second, more likely way for us, is to work together using what knowledge we have to prolong and enhance life.

Many here believe in cryonic suspension and revival into perfect health in a future time when knowledge will be so advanced that sickness and disease will forever be stopped.

I am a cryobiologist. I'm not a cryonicist. But we've all got the same goal. Everyone in the world, be they doctors, physicians, research scientists, cryobiologists, or cryonicists: that goal is to preserve life.

In preserving life, what we want to do, and what medical research wants to do, is to make life longer and healthier. You don't want to be ninety and an unhealthy invalid; you want the health and vigor of youth. That's the hope of humankind, to be young forever.

I believe in cryonics. One thing

I'm going to ask everyone is to work together. Your best hope of reaching your ultimate goal is to work together. You need physiologists, you need researchers, you need physicians, you need everyone, to reach the apex of eternal biological youth and health.

My studies are directed to achieving the best possible preservation of cells. The fruits of my research intersect the interests of cryonicists in supporting their dream of returning suspension patients as fully intact as possible. The more intact the patient, the easier the task of the revival.

Well, I hope I've communicated my opinion and made enough noise. I believe a lot of people think that I ride on a broom, but I don't. The purpose of the noise I make is to get everybody together, working toward a common goal. Because that's the only way we are going to be successful, by working together.

I'd like to accept questions from you now.

**SB:** Could you describe what we'll be seeing tomorrow?

**OV:** We're going to freeze a rat heart, thaw it, and cause it to resume beating.

There has been a bit of controversy about the length of time the hearts have been kept at liquid nitrogen temperature in my prior experiments. Scientifically, once the heart itself gets to -196 degrees Centigrade, it should make no difference if the heart remains at that temperature for one second or for a hundred years. Scientifically, there should be no biological change with either length of time.

Yes, it is true that I've not had any hearts longer than 45 minutes at

liquid nitrogen temperature. Maybe I should extend the time to reduce the controversy. In Pretoria, longer storage has not been possible to date because of the lack of proper storage facilities. We have had to use a small open bucket from which the liquid nitrogen constantly evaporates.

Now that I've got my own labs and a plentiful supply of liquid nitrogen, we can keep the hearts at -196 longer. Then I will be able to give you a definitive answer.

**Question by an audience member who does not wish to be identified**

**(Q):** Has your protocol been repeated or replicated elsewhere with success, or is the protocol proprietary?

**OV:** Yes, it has been repeated. I repeated it here at Alcor last September, and again last night. For training purposes, I did both hearts last night and brought them back.

**Robert Ettinger:** Also by two of your colleagues, I believe.

**OV:** Yes.

**Q:** By people independent to you, is my question.

**OV:** Yes, in New Zealand we've got a group working on livers. They brought a liver back that was stored for three days. It is noteworthy that the liver and the brain have a lot in common biologically, including the physiology and the type of cells.

We also have some people working in London as well.

**Q:** Is your next step to freeze and bring back a whole rat?

**OV:** No. The next step is to freeze a pig heart, leave it frozen for a few days, maybe a week or two, and then transplant it back into a live pig. Then, after the pig wakes up, hopefully he'll go ahead and walk!

**A well-known Research Scientist, requesting anonymity (RS):** Will you be putting the heart into liquid nitrogen for 45 minutes tomorrow?

**OV:** We can do that, yes. We've got enough time to do that.

**RS:** Nitrogen has its film boiling effect, so a heart in liquid nitrogen for just a few minutes might not completely freeze all the way through. But if the heart were there for ten or fifteen minutes, I think there would be very little doubt that it was very, very frozen.

**OV:** OK, we'll do that. We've got enough time.

**Dick Bergren (DB):** Without divulging proprietary information, can you give us an overview of your protocol and how it differs from prior attempts?

**OV:** OK. What is different about it is the cryoprotectant molecular size and the way the cryoprotectant actually penetrates the cell. The osmolarity pressure of the cryoprotectant is very near to the normal osmolarity of the cell. That is about the main thing.

**DB:** The cryoprotectant used in your protocol is the critical distinction?

**OV:** First, the cryoprotectant functions extremely well in protecting the tissue from freezing damage. Second, this cryoprotectant with its



smaller molecular size, as compared to glycerol and other cryoprotectants, results in its absorption into the cell much easier, without damage to the cell.

**DB:** Your protocol is performed entirely at atmospheric pressure; no hyperbaric pressures?

**OV:** That is right.

**DB:** Do you think augmenting this protocol with a hyperbaric system would be of interest?

**OV:** I'm open to every suggestion. It could be that a hyperbaric system could work much better. The major goal of my experiments to date has been to revive the heart, prove the concept, and move on to bigger organs. So anything that can expedite that process is welcome.

My research is not finished. There are so many things left to complete. We still get edema on hearts. We still get a lot of things we'd like to change.

The hearts beat well, the ECG is near perfection, the electron microscopy reveals no difference between the frozen and unfrozen cells. But there are certain dysfunctions, and we still have a lot of metabolism studies to do.

**RS:** How are you going to introduce cryoprotectant into the heart? Will you infuse it into the whole animal, or will you remove the heart and infuse the cryoprotectant solution into the heart, or will you just

allow the heart to sit in cryoprotectant?

**OV:** We now use the Langendorff system for the hearts. The Langendorff system provides simulated circulation for hearts, especially small hearts such as we've got here. So we introduce the cryoprotectant through the Langendorff system. We remove the heart from the rat, mount in on the Langendorff system, and start flowing.

**RS:** So you have a Langendorff system that you'll set up for tomorrow?

“I hope I've communicated my opinion and made enough noise. I believe a lot of people think that I ride on a broom, but I don't. The purpose of the noise I make is to get everybody together working toward a common goal.”

row?

**OV:** Yes.

**Matthew Gress (MG):** Do you have a project schedule for how this research will proceed? Do you believe that you will be perfecting your cardiac freezings before branching out into other organs? You mentioned the liver in New Zealand; are those colleagues of yours?

**OV:** Yes.

**MG:** So do you expect to branch out horizontally to other organs before perfecting the heart, or do you

believe the cryopreservation techniques will be more effective on the heart and you'll have to make some significant modifications for other organs?

**OV:** Because I belong to the thoracic surgery department at the University, I cannot work on any other organ but the heart. That is why we've got separate groups working on other organs.

And yes, we do want to expand to every organ.

**Linda Abrams (LA):** Will you explain, please, the process after the heart has been rewarmed, by which you determine that it remains viable? Also, what causes the heart to start beating again when it is not reattached inside an animal, and how long does the heart last?

**OV:** One of the hearts that we did yesterday lasted over an hour; we stopped it after it was revived. Some of the hearts last longer, some of them less time. We use the Langendorff system to provide a simulated circulatory system for the hearts. In the Langendorff system, we use a crystalloid solution which causes a lot of damage to the cells. So the heart will not beat for long on the Langendorff system after it has been abused by being frozen. That could be one of the things that we'll just have to learn more about after additional study. But we use this simulated system to work with the heart so the only thing we see is that the heart functions, is forceful, that the contractions are normal, and



the heart beats the same as it did before being frozen.

**Mike Darwin (MD):** You mentioned that your work is going on with livers, and that they've been recovered successfully. What are the end points by which that success is judged? In other words, how are you evaluating the liver for function, after it has been cryopreserved?

**OV:** There are ways of evaluating for function and cell damage. I think they used Trypan Blue (methyl blue) to evaluate the health of the cells. The liver experiments and evaluations are being performed by a team headed by Dr. Grant Knight, a well-known physiologist at the University of Otago (in Dunedin, South Island, New Zealand). Dr. Knight has outstanding credentials, and is the head of the physiology department at the University. We have quite a bit of trust in his work; he is

well known in the cryobiology field.

**Q:** So for instance, the enzyme levels released from cells have not been examined, and the liver's not been reimplanted, and...

**OV:** No, the liver hasn't been reimplanted. I do think the enzyme levels were studied and found to be in good, in perfect condition. I believe that's how the team concluded the liver was in working condition.

**LA:** The teams in New Zealand, and the other one you mentioned, are working on the same goal in

different organ system. Are they using the same cryoprotective agent that you are, and is this a proprietary solution, or are the contents public?

**OV:** The contents will be public knowledge very soon, with the publication of my paper. The current status of my paper is that it's currently back in my hand, having been returned to me by the editors for some updates.

**Q:** The paper was returned by whom?

**OV:** By *Cryobiology*. It wasn't rejected, but we just haven't had time to resubmit it to them. So it will be resubmitted, hopefully soon, and it will come out very shortly, we hope before June, and everybody will know what I'm using. Alcor has already got the specifics on the cryoprotectant.

**LA:** But my question was, are the other teams —?

**OV:** —Working with my same cryoprotectant and protocol? Yes, all of them.

**Q:** Do you expose the heart directly to liquid nitrogen, or do you package it in some way?

**OV:** We put cotton wool around the heart. And the cotton wool is dipped in cryoprotectant. The cotton wool is made into a thin shell.

**Q:** I see. So the heart has got some volume or space around it. And then the other question is, how long was the heart left in the liquid nitrogen yesterday?

**OV:** Almost a minute. We've got temperature graphs that show it was left at -196 for almost a minute.

**Q:** And there's a temperature probe in the heart?

**OV:** Yes.

**Charles Platt (CP):** Is this, in your expectations or imagination, scalable for the human brain?

**OV:** I do believe so, yes. I believe anyone who works hard enough will get there. There's a lot of research to be done, and you've got to work very, very hard and consistently. Like I said, work cooperatively with everyone, and you'll get the brain done.

**CP:** By using the same solution as yours?

**OV:** That's right, yes.

**CP:** You don't think it would be unacceptably toxic with a slower cooling rate?

**OV:** No. Glycerol is more toxic than my solution. Glycerol does not go through the blood-brain barrier, which my solution does. So my solution will go into the brain without damaging barriers.

**MD:** I understand that your cryoprotectant is proprietary. What sort of physiologic solution — carrier solution — are you using for the cryoprotectant? In other words, what's your crystalloid base? Is it like a heart solution, or Locke's, or Collin's, or...?

**OV:** I use a heart solution. I believe my colleagues in New Zealand, as used for livers, added to the heart solution a couple of other contents to work with the livers. So it differs from organ to organ at this moment.

**MD:** But what is the solution? Is it a Ringer solution, or...?

**OV:** It's like a Ringer solution. It's a crystalloid solution, yes. Would you like the name?

**Severall:** Yes!

**OV:** Tyrode's.

**Neil Freer (NF):** Would the criteria your colleagues used to evaluate the liver be equivalent to what the medical profession would use to evaluate a liver for transplant?

**OV:** That is right. Dr. Knight's team is in a medical university, and everything is evaluated scientifically under medical science. The evalua-

tion was not performed solely on microscopic grounds.

**RS:** I would like to say that our laboratory has been trying to revive frozen hearts *in situ* for over ten years. And we've done, I would say, probably on the order of hundreds if not a thousand cryoprotective perfusions. If you can show that this heart is in liquid nitrogen for 45 minutes, or even for half that amount of time, and you can get it beating again, I think that this would be a very, very significant advance, because I can tell you that we've never been able to revive hearts past -20.

Hamsters that have been partially frozen down to -10 I think we've gotten some heartbeats back, but that doesn't mean the heart temperature was that cold. So if you can actually keep this heart for 25 minutes, even 20 minutes, in nitrogen, enough time to make sure the film boiling effect has been overcome and the heart is entirely frozen...at two minutes there might be some film boiling problems, but I would have to say that 20 minutes would be extremely significant, more significant than anything I've ever heard of previously.

**OV:** OK, I'll do it. I've got four hours.

**RS:** Maybe 20 minutes would be a reasonable target. Would anybody disagree with that?

**MD:** I've actually measured temperatures using what I believe to be the agent that Mrs. Visser is using. The concentration I believe is 25%. I won't disclose the agent here; it's been disclosed on the Internet. And I've looked at rat hearts, not wrapped, but unwrapped, and measured several temperatures on immersion in liquid nitrogen. And I find the temperatures are about -130 within 90 seconds. The jacketing effect of what you call film boiling seems to collapse beyond that. However, I will point out that there's a great deal difference in the size of rat hearts; they can be almost twice the mass from animal to animal. In those cases were you run a larger heart, you do not reach very deep temperatures. I have no idea what the difference of the wrapping is, so that would be another variable.

**RS:** But we're talking about 20 minutes, Michael. You would be adequately impressed?

**MD:** Oh, absolutely. Ten minutes; I would say that if you immerse a heart for ten minutes, and it is solidly immersed in liquid nitrogen, you

“I believe anyone who works hard enough will get there; there's a lot of research to be done, and you've got to work very, very hard and consistently. Like I said, work cooperatively with everyone and you'll get the brain done.”

## **GLOSSARY:**

**Autograft:** Surgery; a tissue or organ that is grafted back onto the body of the individual from which it was removed.

**Crystalloid Solution:** An aerated perfusion solution designed to maintain the heart during an experiment (i.e., while on the Langendorff system).

**Cryoprotective Agent:** A chemical compound or a mixture of such compounds designed to both minimize freezing damage and have minimal side effects on the tissue to be preserved; a cryoprotectant.

**DMSO:** Dimethyl Sulfoxide; C<sub>2</sub>H<sub>6</sub>OS; A traditional cryoprotectant that permeates well through most cell membranes.

**ECG:** Electrocardiogram; used to aid the evaluation of heart function.

**Film Boiling Effect:** The property of a gas to insulate a liquid, similar to a droplet of water being briefly insulated from a scalding-hot skillet.

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are absolutely going to get liquid nitrogen temperature throughout.

**Q:** If what has been said is true, then if the heart is truly frozen to liquid nitrogen temperature for ten minutes, you could assume the heart could be frozen for ten years without damage?

**MD:** You could assume, but I've been surprised at the instability of things, even at very low temperatures, and that there are changes going on.

**Q:** So my point is, you can't assume.

**MD:** You can't assume. But it's a reasonable bet.

**Q:** But I think independent of the temperature you're measuring, the time in which the heart is maintained in nitrogen is critical.

**MD:** Yes, I wouldn't argue with that.

**Q:** Wait six months.

**OV:** I won't be here for six months.

That's the only thing I'm sorry about.

**Michael Cloud:** Mrs. Visser, science tends to be very rough and tumble when you're doing research. What kind of internal obstacles are you finding at your university, and within the cryonics community, to you doing the kind of work that you're seeking to do?

**OV:** Can I tell you a secret? Well, it's a very open secret; most of you probably already know. I can't even write on the Internet. I've got this spokesman in front of me that does all my Internet work, and I sometimes get shocked at what he says. So I personally have nothing against any one of you, but I think my spokesman can be hard, and I'm sorry for some people who may just at random read what was said to me, and what was said back. I don't think I am that type of person at all. I am very quiet, very shy, cannot work with the Internet.

**CP:** You mean none of your messages on Internet are written by you?

**OV:** That's right. Only the research that I had the answer that had to do

with work. Anything else, I've got the spokesman, as you saw in the newspaper, and he stands to speak for me all the time.

**Q:** I'm not aware what the state of the art is in organ preservation, but it's my understanding that hearts have been moved around, and liver have been moved around, for transplanting in humans, for some time now. How is what you're doing different than the current state of the art?

**OV:** For human transplants, the shelf life of a heart has been four hours. I believe the capability exists to extend that to eight hours now?

**RS:** Yes, I would say we've had fairly good function for ten hours. But that's not frozen.

**Q:** Is that liquid nitrogen frozen?

**OV:** There is currently no capability to store human organs for transplants at liquid nitrogen temperatures.

**RS:** Except for skin.

**Glycerol:**  $C_3H_8O_3$ ; A colorless, odorless, syrupy liquid used for preserving food, and in medicine. A traditional cryoprotectant.

**In Situ:** Literally, in its usual place; within the living organism (not isolated).

**Langendorff system:** An isolated-heart perfusate-circulation apparatus used extensively in pharmacological and physiological laboratory research. It is especially suitable for the hearts of small animals.

**Mannitol:** A sugar frequently used to reduce edema (swelling).

**Osmolarity:** A measure of the total solute concentration in a liquid.

**Perfusate:** A liquid that is perfused.

**Perfuse:** To pass liquid through blood vessels.

**Trypan Blue (Methyl Blue):** A special dye used to differentiate living and dead cells. Living cells exclude the dye; dead cells absorb it, becoming visibly colored.

**Tyrode's:** A traditional carbonate used to buffer perfusate solutions.

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**MD:** The limits right now for livers and kidneys are 72 hours for perfusion storage, and 24 hours for flush storage. They're carried on ice, unfrozen.

**OV:** Yes, at around four degrees Centigrade, yes.

**RS:** In our lab, in conjunction with the people from a local medical center, we have actually frozen skin to liquid nitrogen. These are full-thickness skin samples, after whole-animal cryoperfusion, and stored them for up to a month. Then thawed them out, and transplanted them, and showed that we can get graft takes. So while no complex organ that I know of has been frozen in nitrogen, some people do consider skin an organ, so therefore, in that respect, I think that could be counted.

**OV:** That's very interesting. In the exchange of labs at the University, my next research project will be to freeze skin for Africa. We get the skin now from overseas, and it's very expensive, and the color frequently does not match. Most of our people that get burned and have accidents are black, and only white

skin patches are currently available. That is one of my researches, so if you can tell me more about it, it would save me a lot of time, when I get back.

**NF:** The preliminary reading that I've done on your topic indicates that one of the ultimate — or one of the long-term — goals is to be able to set up banks of organs instead of having to wait for donors. Is that the way you see it?

**OV:** That's correct, yes. That is what I want to do. I won't be able to do it in South Africa and that's why I've got people working with me, all over the world. They will probably be able to do it before me. We're a bit restricted on the transplant business now, at the moment.

**NF:** has there been any research done regarding the effect of cryopreservation on recipient organ rejection?

**OV:** We believe we lose some genetic material at -196. The research to date has not been extensive. But when you freeze heart valves, and they are transplanted and there's no

rejection, the patient does not exhibit an auto-immune reaction. So we believe that there will probably be a difference, but minimal.

We have targeted places like Portugal, where if you die you are an organ donor. Portugal has so many organs that they throw them away. An organ bank could be used for inter-Europe, and for Africa, and for America, for people that are awaiting organs. I think more and more countries are going to follow the same path as Portugal. That will mean work on freezing organs that would otherwise be thrown away and lost.

**DB:** You mentioned that you feel some of the DNA is damaged in freezing? Would that be the mitochondrial DNA?

**OV:** No. DNA will *not* be damaged when freezing, but I think some anti-immune type of genetic material that causes your own body to reject the organ will probably not be there to cause the heart or other organ to be rejected. That's what we currently believe is a major factor in the rejection of the organ.

**DB:** Will the freezing enhance rejection, or help?

**OV:** The freezing will help against rejection.

**DB:** What's damaged? I mean, what's immunologically different on frozen than on unfrozen? I mean, what has changed?

**OV:** I really don't know. I can't answer that. I haven't done the necessary research to answer that. But we know that when we remove, for example, a heart valve from a donor, that certain material gets onto the valve, and when it's transplanted to a fresh recipient the degeneration of the valve occurs much faster than if the valve goes through freezing and then is transplanted.

**Michael Windenbaum:** What type of damage do you notice if you examine the heart?

**OV:** We found there is some edema on the heart. We don't know why yet. We don't know if it's the Langendorff system that's causing the edema, because of its external circulation. The circuit includes crystalloid solution which is well known to cause edema to cells. We don't know if it's the freezing process. Or some combination. But, after we bring the hearts back, we can always treat the edema with Mannitol.

**MD:** Have you done control studies with other cryoprotectants in the same model? In other words, say the more conventional cryoprotectants like DMSO or ethylene glycol or whatnot. Have you tried to cryopreserve hearts with these

cryoprotectants using the same technique you're using with your agent?

**OV:** Yes, I have. I've tried glycerol and DMSO, and they don't work.

**RS:** I'm very interested in this statement that places like Portugal have more organs than they can use. Could you say a few words about why that is? In the United States, of course, everything available gets used immediately. Could you say why Portugal is that way, and do you know of other countries where there's an abundance of organ that aren't being used?

**OV:** OK. In Portugal, once you die,



you are a donor. The only exceptions are those who have made legal arrangements before death.

**RS:** Is that the only country in Europe like that, or...?

**OV:** At the moment, yes. I believe there are going to be more and more of them that follow, but at the moment, the only one I know is Portugal.

**Q:** You mentioned that there was either some resistance or slow-down in the transplants in South Africa. Is that just because of availability, or is there a political aspect to it?

**OV:** Yes, South Africa is now emphasizing first-hand medicine. Transplants are considered too expensive for government to support.

**Q:** So even if you wanted to help the people of South Africa, might there be a point at which you would need to leave it in order to carry on your research? Or there would be some place that would be so much more favorable for your research that you would move there?

**OV:** There is no way I can carry on with my goals in South Africa in cryobiology.

**Q:** So you're actually at a standstill at this point?

**OV:** Yes. Our current objective is to do the first transplant, to prove the point that a heart can be frozen, placed back in a body, and still function properly. We wish to settle that controversy.

I'm also getting my PhD in cryobiology, so I'll carry on with my graduate work.

But there is no hope of developing organ banks and related capabilities in South Africa now.

**Robin Helweg-Larsen (RHL):** If you were looking for the ideal place to be able to carry on research, what would be the criteria that you'd be looking for, and which examples can you give of countries or states around the world that would interest you at all?

**OV:** America.

**RHL:** Why? What criteria?

*Concluded on page 43. . .*



## Mortal Faith

Traditional religions may be causing the very terrible thing they are trying to prevent -- eternal death for their followers. Typically, such movements promise their followers that if the followers do specific things (believe certain dogmas, take part in certain rituals, hold certain attitudes, etc.) they will be guaranteed an eternal, heavenly life after death. However, in light of new discoveries in science, and new knowledge in the history of how religions came about, this traditional religious approach may now be causing the followers to miss out on eternal life.

In a strategy for survival, as in other matters, the most important thing is to choose what is the truth and not just what feels the best. Choosing a false belief may bring a feeling of relief from the anguish of realizing that one is going to die someday but may distract the person from other actions that might really save his life and the lives of loved ones.

### Challenge to Traditional Religions

My challenge to traditional religions depends on cryonics, freezing people at legal death and storing them indefinitely at low temperature in hopes that technology of the future will find a means to restore them to a functioning, healthy state. Some prominent scientists such as encryption expert Ralph Merkle are convinced that persons frozen under good conditions and maintained this way (generally at the temperature of liquid nitrogen,  $-320^{\circ}\text{F}$ ) have a reasonable chance of eventually being resuscitated. Cryonics advocates imagine that nanotechnology — the controlled manipulation of matter at the atomic level — will be important in the repair and recovery process. It should be possible to repair freeze-damaged tissue cell by cell at low temperature, and eliminate all deleterious effects of aging and diseases. (These occur because atoms are misplaced, not because the atoms themselves are damaged or unhealthy. All the needed repairs and

reconditioning should thus be doable, if necessary, by repositioning individual atoms, though such fine-scale work may not be required.) Eventually a careful warming process should enable the tissue to resume its functioning.

My challenge can then be expressed as a very straightforward proposition:

*A. Since there is a chance that traditional religious philosophy may be in error and there may not be any Heavenly afterlife after biological death for humans;*

*B. Since cryonics may work and provide a means for humans of today to reach the future and obtain biological immortality;*

*C. Since there is new evidence that the Heat Death and Eternal Return Theories of the fate of the Universe may be wrong and biological immortals may achieve complete immortality;*

*D. Therefore, the only logical conclusion is that religions that really want their followers to obtain eternal life should quit guaranteeing*

*their followers a heavenly life for engaging in certain religious acts. Instead they should encourage the faithful to practice cryonics—that is, arrange for cryopreservation at their legal death — as a backup plan in case traditional religious philosophy is wrong.*

Notice, that I am not asking religions to say that their traditional views are wrong, just that they realize that their traditional views *may* be wrong and they should not give a guarantee of a heavenly afterlife. They may continue to say they think and hope there is such an afterlife, but they should not guarantee one.

When we review the history of religions, we will see that most (if not all) of them have been wrong on major convictions in the past. Some of them have admitted it and apologized. It is possible that they are also wrong on their hope for an afterlife.

### Save The Soul

Many people have a feeling that they have or are a soul. They feel

that their soul is separate and distinct from their physical body. They feel that it is composed of something that is not the usual matter and/or energy that exists in the universe. They may not know what their soul is, but they think it will survive their biological death and live on, perhaps forever, in some other place called Heaven.

Today there is another explanation for what a soul is. The other explanation is that the thing trusting people call a soul is in fact solely the complex workings of the human brain, and nothing more.

Historically people were unable to explain how they had feelings of self-awareness, memory, and the ability to create ideas inside their heads. So for lack of a better explanation, the concept of the soul came into being. Today, neurobiology describes how the brain can do these things and produce certain feelings. Simply put, the human mind has the ability to provide a sense of personal, self-awareness or self-existence through the electrical and chemical processes that are produced and also sensed in the brain. Or put another way, the soul is the mind, which is the brain.

Recent research on neuro-chemicals is beginning to show that chemical events in the brain are what affect brain, or mental, states. This work demonstrates that the feeling of selfness or of being a soul is modifiable from state to state by simply modifying the chemical activity.

So if it turns out that what was once thought to be a soul is only the brain, people who want to survive eternal death need to figure out how to modify their brain so that it does not die.

## **The Potential For Biological Immortality**

If a person can keep his/her body and brain in a state of optimum good health where they neither age nor grow old, then that person has biological immortality. That person will live forever, or until an accident or disease terminates him. At present we can not do this, but there is much evidence that this technique will be available to humans in the relatively near future. Even though it is not available, it is not of merely academic interest. Currently there is a technology, available to us biological mortals, to reach the future and become immortal; that technology is called cryonics.

The new technology that promises to end aging and reverse it when needed is called nanotechnology. In the not-too-distant future, using nanotechnology to fashion tiny replicating assemblers, scientists should be able to build or repair anything from a brain to a computer atom by atom. It should also be possible to leave tiny devices in place inside human cells to keep these cells youthful and healthy indefinitely.

In considering the relationship of the brain and body, it is the brain alone that is the essence of a person. The rest of the body is a support system for the brain. The cardiovascular system supplies oxygenated blood and nutrients for the brain. The legs provide mobility. The arms and hands make it possible to grasp objects and perform many useful tasks. The digestive system provides a way for the brain to get nutrients. The eyes and ears provide a way to accumulate data, and to learn. So in this way, each part of the body can be seen as a way for supporting the brain or helping the organism to re-

produce.

Until now, the meaning of life for humans was to live until the age of breeding ability and produce offspring, then live long enough to help these offspring reach the age of breeding. However, through nanotechnology, the human race is about to change the meaning of life for humans. The new meaning of life will be for the original organism to stay alive as long as possible. If this seems alien keep in mind that it is not so different from religious ideas of an afterlife, in which the human being attains a happy, immortal state.

## **Nothing To Lose, Everything To Gain**

The way some people are planning to get their brain to the future where this life-saving future technology will be available is through the present technology of cryonics. Cryonics, as we noted, is the practice of being frozen at legal death (but not biological death)—to be unfrozen and reanimated in the future when more options are available to humans. The brain with or without the body can be frozen. Those who choose the brain-only option (typically it is head-only rather than just an isolated brain, for better protection of the delicate organ) expect to be provided with a new body through future nanotechnology. (Nature makes a human body in about 20 years from the information in the DNA of a single cell; we should be able to learn how to do this too, probably in less time.)

Having oneself frozen for future revival is not in conflict with religion. Most major religions have tenets instructing the faithful to try to stay alive as long as possible.



Cryonics is one way religious people can follow those instructions.

If a religious person also opts for cryonics, he/she is multiplying his/her chances to avoid being dead forever. Either cryonics will work or it won't; either there is a heavenly afterlife or there is not. The following are the four possible outcomes if one opts for cryonics:

**ONE:** There is no God and cryonics works. In this case choosing cryonics saves you from death.

**TWO:** There is a God and Heaven and cryonics works. If there is a God who is all-powerful, there is nothing man (cryonics, nanotechnology, science, medicine) can do to thwart God's will if and when God wants to call a specific person to Heaven. So there is no harm in trying for cryonics. And if life is a gift from God, the act of trying to extend that gift through cryonics would seem to be a demonstration of genuine appreciation for that gift.

**THREE:** There is a God and cryonics doesn't work. Same outcome as TWO.

**FOUR:** There is no God or Heaven and cryonics doesn't work. You are doomed. You don't lose anything by trying for immortality and your attempt gives your life some meaning.

No human can know God's mind. No human can really know if God and Heaven do or do not exist. If religious leaders claim they know everything for sure about God, they are claiming to *be* God. On the other hand, if they admit they don't know all the answers, then the only moral thing for them to say is that they think and hope there is a heavenly afterlife of some type but they cannot guarantee it.

The concerned, ethical, religious leader will ask his followers to fol-

low the religious tenets and sign up for cryonics. If it turns out that there is no God and no heavenly afterlife, then those who guaranteed their following an afterlife and caused the followers to reject cryonics will have done them the worst disservice possible.

### **Is There Any Real Evidence for A Heavenly Afterlife?**

People of the past were not stupid, but they did not have the tools to understand the universe as we now do. Many questions in the past were unanswerable at the time, so the causes of many things were said to be the work of God.

As man came down from the trees and then out of his caves, he began to realize that he was doomed to die as all the other people in his tribe and all the animals around him did. The thought of one's death (without a possible afterlife) was a gruesome thing. Realizing that one was going to cease to exist caused a pain or despondency that most people could not bear. Hence early man felt comfort with the concept of religion; all organisms instinctively avoid pain and seek pleasure.

Today's religions are more fully developed philosophies. The basic justifications are revised versions of the old standards: the ontological and cosmological arguments, and faith in miracles, scriptures and religious leaders. I won't get into all the arguments here other than to say that a reasonable person will agree, after reviewing all the hard evidence, that the only reason to believe in a God or Heaven is faith. That does not mean that his God and Heaven do not exist, it just means that there is no scientific justification to declare such thing as proven.

### **Can Man, On His Own, Become Immortal?**

Even if we can obtain biological immortality, some people think the universe might end someday, so at most we would gain a very long life but not true immortality. They point out that the universe was created in the Big Bang and will be destroyed in the Big Crunch (when all matter and energy come together again and the universe is annihilated).

Arguments like this cannot be dismissed, because there is much we still do not know. Some scientists now feel the Big Bang did not happen. Either way, our lack of knowledge means, not that immortality is precluded, but that it simply is not guaranteed. In fact there are several possibilities for immortality based on what we know and don't know. The case for the Big Bang cannot be considered closed—and even if it did happen, that is no guarantee that the universe must end in a Big Crunch (the evidence currently favors an open universe that will expand forever, which may allow immortality).

It makes more sense to believe that matter and energy or some precursors have always existed and some form of these will always continue to exist, forever. It makes less sense to believe that the universe, or that something, was formed from nothing.

### **Conclusion**

The conclusion is we must accept what "The Truth" really is as the crucial element and not what one wants "The Truth" to be.

Traditional religions *may* hold an answer for an afterlife, but then again, they may not. No one can prove it either way. We do know

that most if not all religions have made major mistakes in the past. The Roman Catholic Church condemning Galileo because he felt the earth revolved around the sun rather than, as the church believed at the time, that the sun revolved around the earth, is but one of many examples of how wrong religions have been in the past.

One has nothing to lose by making arrangements for cryo-preserva-

tion, and everything to gain under certain circumstances. So there is only one main reason why a person who longs to avoid being dead forever would not sign up for this option now. That reason is that his religion has guaranteed him eternal life with a mystical, heavenly, afterlife concept, and so he believes that cryonics is not necessary.

Now is the time for all responsible religious authorities to inform

their following that there may be some chance (no matter how small they think it is) that the religion may be wrong on the afterlife matter. They should then encourage their followers to obtain the additional protection of cryonic arrangements.



## Comments on David Pizer's Editorial

by R. Michael Perry

Many religious sects or movements advance claims of being able to speak for "God" and/or to have other special, esoteric knowledge not accessible except through them. This of course seems untenable to those of a rational, materialist outlook — which includes most people in cryonics. We in cryonics hope that people will use their rational faculties to examine *all* beliefs and claims of knowledge objectively. If this can be done, it seems reasonable to us that at least some doubt about inadequately supported claims and beliefs must linger. Once such doubt is acknowledged, the choice of cryonics seems inevitable. Yet cryonics has had few takers so far.

Many of those who reject cryonics use the excuse that "God has solved the problem of death for those who put their trust in him," or some similar rationale. Dave Pizer proposes one possible way to get through to such people, which is to say to them that they can't be *sure* they are right, therefore why not opt for cryonics as additional insurance of some form

of afterlife? This may seem reasonable to those of us who are skeptical of supernatural beliefs, but not for the religious faithful. They will be reluctant to admit to themselves that they may be wrong, particularly in cases where such doubting is openly discouraged. Such is the case in Christianity, the most widespread religion. Christians like to quote John 3:16: "For God so loved the world that he gave his one and only Son, that *whoever believes in him* shall not perish but have eternal life." (New International Version, emphasis added.) Unbelievers in turn are sternly rebuked and must suffer eternal damnation (Rev. 19:15, 21:8). To many people, any serious uncertainty is "unbelief"; it won't do to say, "Jesus may well be the Son of God, but I'll take the freeze in case he isn't."

I think the rejection of cryonics goes deeper than this, however, deeper than adherence to any religious belief. Though religious people rarely become cryonicists, this is also the case with nonreligious people. The latter especially have seemed most baffling to us; we ask, "what do they think they have to lose?" Apparently whatever it is has deep

psychological significance. I have written about this before (*Venturist Monthly News* Oct, Nov '96), as have others before me (Tim Freeman, David Stodolsky on CryoNet).

People, it seems, have a "cultural anxiety buffer" that shields them from the terror of death *and is mainly reinforced from the outside*. They defer to their surrounding culture — its beliefs, attitudes and practices — when deciding on a policy about death. Cryonics in turn demands independent thought and a willingness to make decisions apart from one's culture. This capacity is apparently very rare, and its rarity seems to reflect a selection process. Historically, people with that much of an independent bent — and who might have chosen cryonics had it been available — may also have lost out in the Darwinian game of species propagation.

With the end of biological death, this "game" will certainly change — something we can look forward to!



# CryoTransport Case Report:

## Edward W. Kuhrt, Patient A-1110

by Linda Chamberlain, CryoTransport Manager  
Alcor Life Extension Foundation

### Author's Notes

The format used in this report follows closely that used by Mike Darwin of BioPreservation, Inc. This, and the brevity used to describe events during the washout and cryoperfusion, was done in order to make it easier for those who will be using these technical reports in efforts to improve CryoTransport (both transport and preservation) protocols. This technical report was sent out for review and comment prior to publication. Special thanks is given to Hugh Hixon of Alcor and to Mike Darwin of BioPreservation, Inc. for comments and suggestions which improved both the form and substance of this report.

CryoTransport can be broken down into three major areas: (1) Remote rescue and transport to Alcor, which includes patient acquisition and stabilization, (2) Cryoprotective Perfusion, and (3) Cooldown and Long-Term Care. This report covers all areas except long-term care, which is just beginning.

### Background History and Synopsis

Mr. Kuhrt was one of the earliest members of a cryonics organization. In a LifePact interview made in the hospital several weeks before his cardiopulmonary arrest, Mr. Kuhrt told me many interesting stories about his early involvement with cryonics. In the mid 1970's, newspapers ran an article about the Cryonics Society of New York and about how cryonics was being funded by life insurance. Insurance companies were concerned CSNY might be fraudulently selling insurance policies. As a private investigator, Mr. Kuhrt was retained to look into this. To their surprise, he was himself a member. He assured the insurance industry that cryonics was legitimate. Mr. Kuhrt and his wife became Alcor members in June, 1986.

In January of 1997, Mr. Kuhrt was diagnosed with an aggressive form of lung cancer that had already metastasized to the bones. Upon learning that his cancer was termi-



**Edward W. Kuhrt**

*Date of Birth: December 28, 1931*

*Date of Biostasis: February 8, 1997*

nal, Mr. Kuhrt expressed a desire to move to Scottsdale, Arizona to be close to Alcor when he experienced cardiopulmonary arrest.

Due to insurance (HMO) rules, and the loss of strength resulting from his radiation treatments, Mr. Kuhrt was not able to relocate to Arizona. The relatively slow

progress of his disease, however, allowed two members of Alcor's CryoTransport Team (Linda Chamberlain and Tanya Jones) to visit Long Island several weeks in advance of his cardiopulmonary arrest in order to make arrangements with his oncologist, the hospital, and a cooperating funeral home.

The oncologist and Mather Memorial Hospital in Port Jefferson, Long Island, were very supportive and gave Alcor unprecedented assistance. The positive, cooperative attitude displayed by the entire nursing staff comforted Mr. Kuhrt's family and proved invaluable to Alcor during its remote standby and transport.

At the time of arrest, a code team was called from the emergency room and cardiopulmonary resuscitation began, along with administration of heparin, sodium bicarbonate, streptokinase, and Maalox (through gastric tube). After the emergency room personnel finished this initial protocol, Alcor personnel continued cardiac compression, packed Mr. Kuhrt

in ice, and delivered additional medications to limit ischemic damage and stabilize cell membranes.

The patient was then transferred to the funeral home for whole-body washout before being shipped by air to Scottsdale for cryoperfusion and long-term storage. Mr. Kuhrt's long acquaintance with both cryonics and Alcor, as well as his aggressive involvement in his own care — particularly as it related to his impending cryonic suspension — established his informed consent. Both the washout and perfusion went well. Full details follow.

### Medical History

(Although repeated attempts have been made to acquire full medical records, to date such records have not been received. The medical history below is, at the time of this publication, still limited and was primarily gained through personal conversations with family members.)

Mr. Kuhrt smoked two packs of cigarettes per day since 1945 (52 years). In 1987 he was diagnosed with colon cancer and received a colostomy. In 1995 he was diagnosed with Type II, adult onset diabetes. Mr. Kuhrt's diabetes was managed with 2000 mg. of Glucophage q.d., and 40 mg. Glucotrol q.d. The patient also took 20 mg. of Zestril

q.d. for hypertension.

On January 6, 1997, at the age of 65, Mr. Kuhrt was admitted to Mather Memorial Hospital, Port Jefferson, NY, for right-hip pain that had been problematic for several months. Examination was performed with markers [*sic*] to include the right hip, the proximal shaft right femur and the right iliac bone, the ischial bone and the pubic bone. Mr. Kuhrt was diagnosed as having metastatic non-small cell lung cancer. Palliative radiation was prescribed to slow tumor growth and manage pain. Blood transfusions were also given.

During a logistics trip to Long Island (to make arrangements with a funeral director, the oncologist, and the hospital), we observed that Mr. Kuhrt had a normal level of consciousness, his spirits were high at being visited by Alcor members, and he was eager and happy to talk about his cryonics arrangements and his hopes for re-entry and rehabilitation. Nonetheless, he was obviously in pain and tired easily. The patient's circulation in both legs was badly compromised by tumors in his hips and buttocks. Premortem signs included almost total lack of color, lack of pedal pulse at either the dorsalis pedis or posterior tibial, and a greatly distended and rigid abdo-

men due to ascites (cause as yet not known). While we were there, Mr. Kuhrt's morphine level was doubled in an effort to maintain his comfort.

The day after returning from the reconnaissance trip (January 18, 1997) the author called the patient's wife, Anne Kuhrt. Mr. Kuhrt's level of consciousness (LOC) had declined remarkably; he remembered that we had been there, but did not appear to understand the purpose of our trip. Mr. Kuhrt did not even remember that his cancer was terminal. The increased morphine was making a marked difference in his LOC.

### Cardiopulmonary Arrest

The oncologist had planned to implant an abdominal morphine pump on February 5, 1997, but before this could be done the patient experienced abdominal bleeding that brought on an emergency requiring intubation and artificial respiration. Mr. Kuhrt was no longer a candidate for the abdominal pump and had come very close to cardiopulmonary arrest.

Anne Kuhrt called Alcor with this information. After discussing the situation with the nurse on duty, it was decided that the transport team should be deployed as soon as possible the next day.

Date	Time	Pulse	Resp/Min	Temp (°F)	Skin condition	morphine drips/minute
2-5-97						10
2-6-97	100-110	12-14		97	cool, dry, grey	12
2-7-97	19:39	104	14	101.7	warm, dry	14
	21:12	BP = 98/58				16
	22:50	116	12	97.3	warm, dry	16
2-8-97	12:17					20
	03:57	weak, labored			cool, damp	26

**Figure 1: Agonal Course Vital Signs**

The transport team arrived on the evening of February 6, 1997. Mr. Kuhrt was experiencing uncontrollable pain and was not able to communicate well, but he did seem to recognize and respond positively to the two team members who had met previously (Linda Chamberlain and Tanya Jones). CryoTransport medications were drawn and put on ice, and washout equipment was set up at the mortuary. (For Vital Signs, see Figure 1.)

Mr. Kuhrt and his family (wife, son, and daughter, their respective spouses, and Anne's two sisters) requested that medical life support efforts be terminated. On doctor's orders, at 11:19 AM on February 7, 1997, the nursing staff discontinued the IV insulin drip. The patient was kept on oxygen, and his morphine was increased. The patient's urine output (to Foley catheter) was nearly nonexistent; extant urine was dark brown.

The nursing staff agreed to leave the patient's subclavian catheter and nasogastric tube in place for the administration of Alcor cryotransport

Time:	Medication Administered:
no record	60,000 IU heparin (for anticoagulation)
04:34	120,000 IU streptokinase (lysis of hemostatic fibrin )
no record	250 cc Maalox (to neutralize gastric hydrochloric acid)
04:37	700 mEq sodium bicarbonate (to combat acidosis)
04:40	patient's head packed with ice bags

Figure 2: Medications Administered by Hospital Personnel.

medications. After saying farewell to Mr. Kuhrt and his family, the Alcor team retired to a nearby lounge at 10:00 PM. Thereafter, Linda Chamberlain checked the patient approximately once per hour. The patient's son and daughter-in-law remained at his bedside.

**Remote Transport:  
CPR, Medication, and Initial,  
External Cooling**

**Participants:**

- Steve Bridge, Logistics
- Fred Chamberlain, Logistics
- Linda Chamberlain, Transport team
- Hugh Hixon, Transport team
- Tanya Jones, Transport Manager

At approximately 4:15 AM on

February 8, 1997, the patient was attended by his son, daughter, and daughter-in-law. As the patient's level of consciousness (LOC) had been declining over the early morning hours, they were watching him closely. When his rate of respirations dropped to less than 1 per 15 seconds, they summoned the Alcor team and the attending nurse. When the author arrived in the patient's room, the nurse was auscultating the patient's chest for lung sounds. The author stepped out into the hall to talk with other team members and heard the code called.

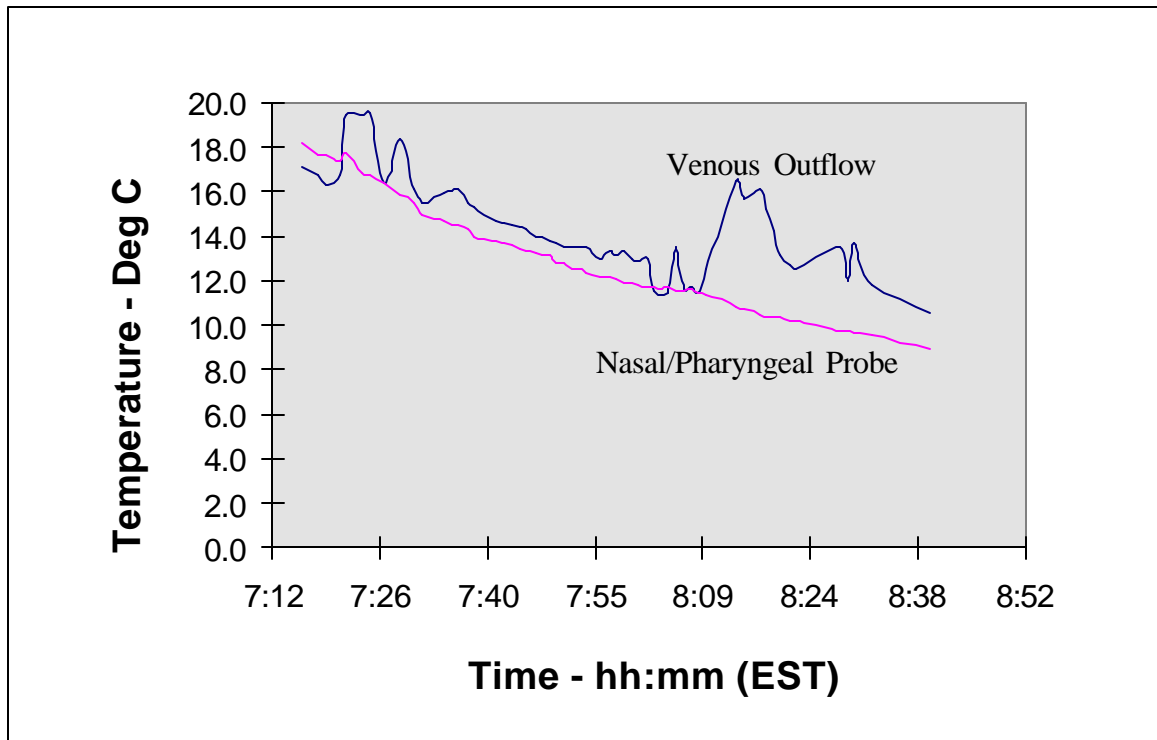
An Emergency Room code team responded, took an EKG, and pronounced the patient at 04:25 EST. From prior arrangement with Alcor, the code team then began manual

Time:	Medication Administered: (Dosages determined for a 160 lb. patient.)
04:49	2.6 cc metubine iodide (to inhibit shivering)
04:51	37.5 cc potassium chloride (reduce cerebral metabolic demand)
04:54	15 cc epinephrine (to improve perfusion and blood pressure)
04:55	4 cc deferoxamine (to reduce free-radical damage)
04:55	2 cc gentamycin (to inhibit microbial overgrowth)
04:55	75 cc sodium citrate (to reduce cerebral reperfusion injury)
04:56	8 cc methylprednisolone (to stabilize cell membranes)
04:57	9 cc chlorpromazine (to stabilize cell membranes)
04:58	30,000 IU additional heparin (to inhibit clotting)
04:57	250,000 IU additional streptokinase (lysis of hemostatic fibrin )
05:05	manual cardiac compression discontinued

Figure 3: Medications Administered by Alcor Transport Team

cardiopulmonary resuscitation with 10 liters of oxygen per minute by bag valve mask from 04:25 until 04:49. Simultaneously, cryotransport medications (Figure 2) were administered by IV push.

Hospital regulations did not allow the presence of non-hospital personnel in the patient's room during initial resuscitation



Graph 1:  
Temperature  
Graph for Total  
Body Washout.  
Data log below  
(Figure 4).

Time AM	Temp °C Ven. Outflow	Temp °C Nasal	Note Number	Time AM	Temp °C Ven. Outflow	Temp °C Nasal	Note Number
			1				
7:16	17.1	18.2	2	7:56	13.0	12.2	
7:18	16.8	17.6		7:57	13.3	12.2	
7:19	16.3	17.6	3	7:58	13.1	12.1	
7:21	16.8	17.3		7:59	13.3	11.9	
7:22	19.4	17.7		8:00	13.0	11.9	
7:24	19.4	16.9	4	8:01	12.9	11.8	
7:25	19.5	16.8		8:02	13.0	11.7	7
7:27	16.4	16.4		8:03	11.5	11.7	
7:29	18.4	15.8		8:04	11.3	11.6	
7:31	16.1	15.5	5	8:05	11.4	11.7	
7:32	15.5	15.0		8:06	13.5	11.5	8
7:35	15.9	14.7		8:07	11.6	11.5	
7:36	16.0	14.5	6	8:08	11.7	11.6	
7:37	16.1	14.5		8:09	11.4	11.4	
7:38	15.5	14.3		8:10	12.5	11.3	9
7:39	15.3	14.0		8:14	16.5	10.9	
7:42	14.7	13.8		8:15	15.6	10.8	
7:43	14.6	13.7		8:17	16.1	10.5	
7:44	14.5	13.6		8:18	15.2	10.4	
7:45	14.4	13.4		8:19	14.2	10.4	
7:46	14.3	13.3		8:20	13.1	10.4	10
7:47	14.0	13.2		8:21	12.7	10.2	
7:48	14.0	13.1		8:22	12.5	10.2	
7:49	13.8	13.1		8:28	13.5	9.7	11
7:50	13.7	12.8		8:29	12.0	9.7	
7:51	13.5	12.8		8:30	13.7	9.6	
7:52	13.5	12.5		8:32	11.8	9.5	
7:53	13.5	12.5		8:40	10.6	9.0	12
7:54	13.5	12.4					

Figure 4:  
Temperature Log  
for Total Body  
Washout.

procedures. (We were not aware of this regulation until the moment hospital staff members asked us to leave the room.) This meant that the Alcor team was not able to direct the ER team in their efforts. As a result, no one documented the code team's protocol, and a significant (though unrecorded) warm-ischemic period occurred before anyone placed ice on the patient's head.

Hugh Hixon took over manual compression at 4:49 when the ER team turned the patient over to Alcor. The Alcor team had anticipated using the hospital bag valve and oropharyngeal tube to continue giving oxygen to the patient; unfortunately, ER personnel departed with their code cart and other equipment. While continuing manual sternal compression, Linda Chamberlain and Tanya Jones administered further cryotransport medications (Figure 3).

The transport team had planned to place a thermocouple probe through the nasogastric tube. The team member assigned to get and place the probe was not able to find it and the temperature monitoring could not be done.

### **Remote Whole-Body Washout**

The patient was transported to a local mortuary for whole-body washout. While the Alcor team finalized set-up of the roller pump and elimination of air bubbles from the tubing, the mortician cannulated brachial vessels on the patient's medial right arm. This was a departure from the normal protocol, which was to cannulate femoral vessels for the washout.

The departure from normal protocol was necessitated by the patient's condition. Circulation in both legs was badly compromised

by tumors and ascites. (Premortem signs: almost total lack of color, lack of pedal pulse at either the dorsalis pedis or posterior tibial, greatly distended and rigid abdomen.)

Cannulation was completed at 06:40 and the washout perfusion was begun. No clots were seen and the embalmer was vocally and visually impressed by the flow as well as by the amount of hemodilution achieved.

The perfusate used (20 liters, pH of 7.8 and 335 mOs) was a proprietary high potassium formulation developed by Alcor. An ice bath was used for heat exchange, rendering the perfusate at approximately 5°C at injection. (Graph 1 and Figure 4 show the temperature descent achieved during whole-body washout with external cooling and internal cooling.) Because of the small bore of venous cannula (20 Fr), venous return was less than one liter/min, resulting in a very slow systemic cooldown. In fact, most of the initial cerebral cooldown was accomplished by external ice packs; the procedure's principal benefit was the washout of blood.

### **Whole-Body Washout Notes:**

(The following notes correspond to the data shown in Figure 4.)

1. 06:55 EST Cannulation of brachial vessels and start of washout within approximately 1 hour and 40 minutes of pronouncement (due to delay on part of funeral director in picking up patient). Immediate clearing of capillaries in the face was very noticeable. Line pressures taken from immediately above the arterial cannula ranged from 160 mmHg to 260 mmHg. Temperature probe placed in nasal gastric tube.
2. At 07:09 the venous effluent had

cleared remarkably and the perfusion circuit was stopped to change to recirculation.

3. 07:19 Recirculation established with flow at about 1 liter/min. The hematocrit appeared to increase as the perfusate color darkened markedly. It was assumed that blood was leaking from the abdomen.

4. 07:24 Pump stopped to allow reservoir to refill. Upon palpation, the feet and femoral area felt very cool.

5. 07:31 Reservoir had refilled sufficiently and recirculation was reestablished with 0.6 liter/min flow and arterial pressure at 70 mmHg. We were not able to increase pressure due to the low venous return (which may have been due to the brachial cannulation).

6. 07:36 Temperature of the venous output rose due to the mortician massaging the patient's abdomen in an attempt to relieve distention.

7. 08:03 Flow rate rose to 0.8 liters/min.

8. 08:06 Mortician raised the patient's feet to increase the return of cold perfusate from the feet to the trunk.

9. 08:10 Pump stopped due to low venous return (to allow the reservoir to fill). Recirculation started again at 08:17.

10. 08:20 Line pressure was at 80 mmHg.

11. 08:28 Line pressure was at 100 mmHg.

12. 08:40 Perfusion was terminated, cannula removed, and vessels ligated. The nasal temperature was 9.0°C.

The patient was cleaned up on the mortuary preparation table and transferred to a heavy-duty (8 mil) vinyl body bag. A trocar was used to remove serous fluid from the peritoneal cavity. At this time it was noted that there was no rigor present.

The body bag containing the patient was then placed atop a bed of zip-lock bags containing crushed (water) ice, which had been laid down inside an insulated air transport box (Zeigler case). The patient was covered with additional bags of crushed ice, and the transport container was wrapped in R-20 insulation and closed for air transport to Scottsdale, Arizona. Air transport was uneventful.

## Cryoprotective Perfusion at Alcor Life Extension Foundation

### Participants:

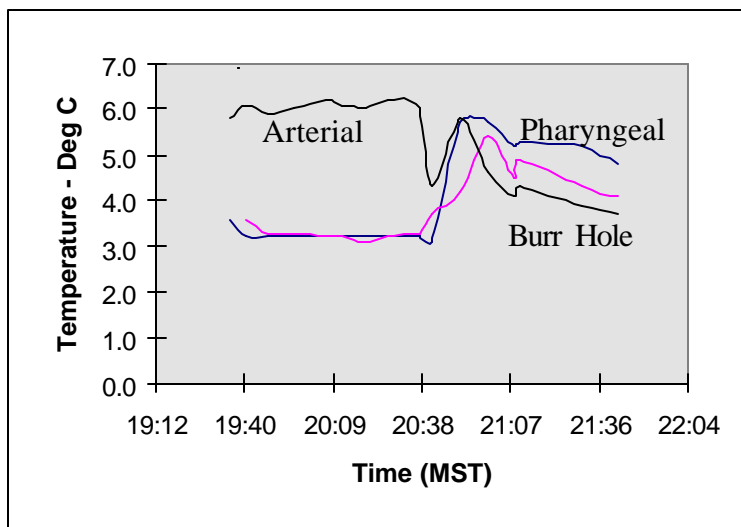
Steve Bridge, Logistics  
 Fred Chamberlain, Logistics  
 Linda Chamberlain, Burr Hole  
 Tony Cerrulo, Funeral Director  
 Matt Day, OR Assistant  
 Keith Henson, Assistant Surgeon  
 Hugh Hixon, OR Assistant  
 Tanya Jones, Transport Manager  
 Judy Krantz, R.N., Surgical Nurse  
 Nancy McEachern, D.V.M., Surgeon  
 Judy Muhlestein, Blood Samples, Scribe  
 Mike Perry, Administrative  
 Derek Ryan, Blood Samples  
 Brian Shock, Refractometry  
 Mathew Sullivan, Cephalic Isolation, Scribe  
 Ralph Whelan, Perfusionist

The patient was picked up by the Alcor ambulance at Phoenix Sky Harbor Airport on February 8, 1997 and transported to the Alcor facility in Scottsdale. Below are significant points in the cryopreservation of the patient.

**18:20** Patient moved into the Operating Room, laid on a bed of ice bags, re-packed with ice bags, and then prepared for a median

sternotomy and cranial burr-hole by scrubbing with providone iodine solution and draping.  
**18:47** The first of two burr-holes begun.  
**18:53** Incision for the median sternotomy begun.  
**18:59** Sternum spread for access to great vessels of the heart.

**18:59** Second burr hole begun.  
**19:23** Thermocouple probes and crackphone probes inserted into left burr-hole.  
**19:28** Pressure monitor placed in the ascending aorta.  
**19:30** Brain observed to appear clear and translucent.  
**19:32** Pulmonary artery exposed.



Graph 2: Cryoperfusion Temperature Descent.  
 Series 1-- esophageal temperature.  
 Series 2--burr hole temperature.  
 Series 3--arterial temperature.

Cryoperfusion Data Collection Sheet					
Time	Temp *C			Pressure	Flow Rate
	Esoph	Burr	Arterial	mmHg Arterial	L/min Arterial
19:36	3.6		5.8		
19:41	3.2	3.6	6.1		
19:48	3.2	3.3	5.9		
19:57	3.2	3.3	6.0		
20:07	3.2	3.2	6.2		
20:12	3.2	3.2	6.1		
20:20	3.2	3.1	6.0		
20:27	3.2	3.2	6.2		
20:37	3.2	3.3	6.0		
20:41	3.1	3.7	4.3		
20:51	5.7	4.2	5.8	110	
21:00	5.7	5.4	4.6	125	
21:08	5.2	4.5	4.1	122	1.60
21:10	5.3	4.9	4.3	121	
21:30	5.2	4.3	3.9	133	1.10
21:42	4.8	4.1	3.7	143	0.91

Figure 5: Cryoperfusion Temperature Descent, Pressure, and Flow Rates.



**19:34** Pharyngeal thermocouple probe identified as non-functional and replaced.

**19:36** Second burr hole finished. Burr holes placed coronally, approximately two inches lateral of the center line.

**19:36** Began nasal, esophageal, and burr-hole temperature monitoring (see Figures 5, Graph 2).

**19:41** Placed pursestring in ascending aorta.

**19:42** Ligated pulmonary artery and vein.

**19:56** Ascending aorta cannulated.

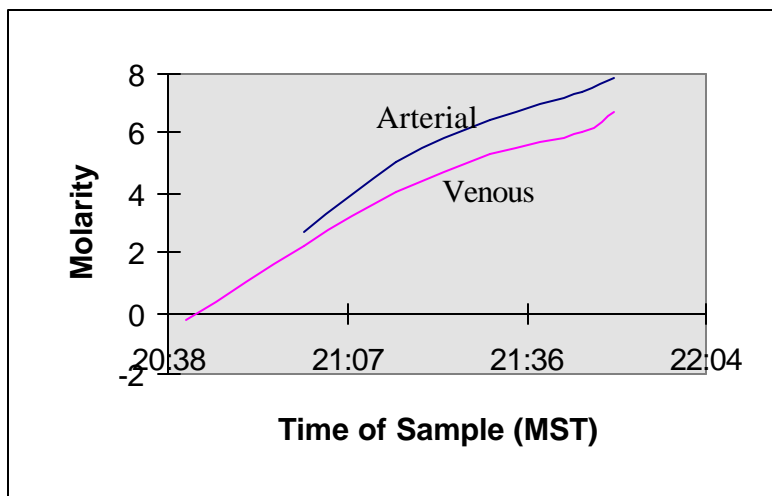
**20:16** Trouble encountered while attempting to clamp descending aorta.

**20:18** Descending aorta ligated.

**20:22** Placed pursestring in right atrium.

**20:26** Right atrium cannulated.

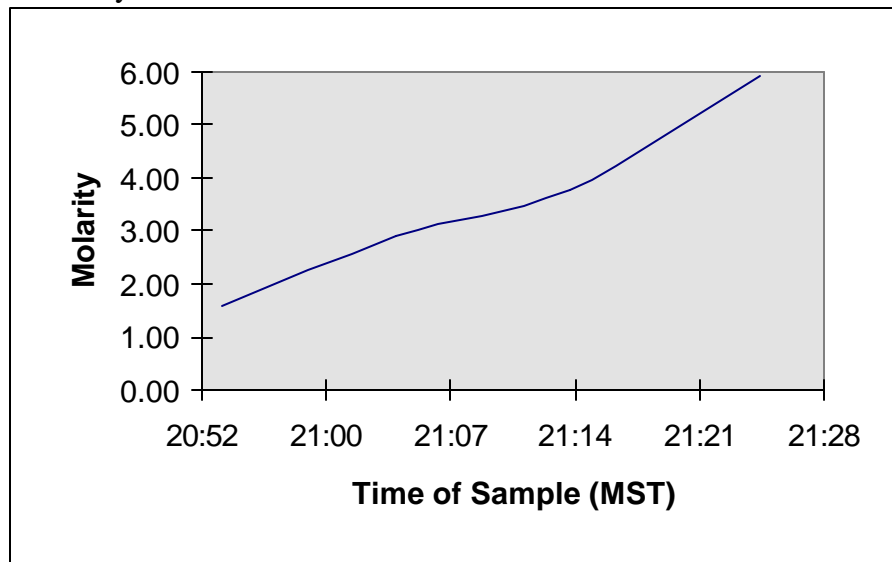
**20:32** Connection of arterial/



Graph 5: CPA Concentration Ramp  
Series 1=Arterial, Series 2=Venous

CPA Concentration Log							
Time	Sample	Arterial	Venous	Arterial	Venous	Arterial	Venous
19:10	4% Glycerol	12.00					
19:10	75% Glycerol	64.10					
20:41	Sample #1		8.00		-1.45		-0.20
21:00	Sample #2	23.60	20.80	19.81	15.99	2.71	2.19
21:15	Sample #3	36.40	30.90	37.25	29.76	5.10	4.07
21:30	Sample #4	43.60	37.30	47.06	38.48	6.44	5.27
21:45	Sample #5	48.60	41.20	53.97	43.87	7.39	6.01
21:50	Sample #6	51.00	45.20	57.15	49.24	7.83	6.74

Graph 6: Burr Hole  
Glycerol Concentration



Time	Sample	Refrac	V/V%	Molarity
19:10	4% Glycerol	12.00		
19:10	75% Glycerol	64.10		
20:54	Sample #1	17.50	11.50	1.57
21:04	Sample #2	24.50	21.03	2.88
21:14	Sample #3	29.20	27.44	3.76
21:25	Sample #4	40.80	43.25	5.92

Figure 8:  
Burr Hole Glycerol  
Concentration Log

Figure 7: CPA Concentration Ramp

venous loop to cannula.

**20:36** Bypass flow started.

**20:37** Pump started.

**20:41** Venous sample #1 (see chemistries below). Samples taken every 15 minutes (Figure 6).

**20:43** Glycerolization ramp started with 4% glycerol (Figure 7 and Graph 5).

**20:54** Cerebral cortical volume rapidly decreased to 2-3 mm below the margin of the burr-hole.

**20:54** Burr-hole sample #1. Samples taken every 10 minutes (Figure 8 and Graph 6).

**21:00** Injection flow 1.6 liters/min, 125 mmHg (Figure 5).

**21:55** Perfusion terminated. Glycerolization at 6.74 molar (Figure 7 and Graph 5).

Perfusate Sample Data								
Test	Normal Range	Units	Sample#1	Sample#2	Sample#3	Sample#4	Sample#5	Sample#6
Time of Sample		hours:minutes	20:41	21:00	21:15	21:30	21:45	21:55
GLUCOSE	65 to 115	MG/DL	68	74	76	81	86	93
BUN	5 to 25	MG/DL	10	11	13	12	12	10
CREAT	0.5 to 1.5	MG/DL	0.2	0.2	0.3	0.3	0.2	0.2
BUN/CRE	10.0 to 20.0	MG/DL	50	55	43.3	40	60	50
URIC ACID	2.2 to 8.0	MG/DL	0.8	0.9	1.3	1.1	1	0.8
SODIUM	133 to 145	MEQ/L	51	56	61	59	58	58
POTASSIUM	3.5 to 5.2	MEQ/L	24.2	27.6	29.9	30.5	31.7	32.7
CHLORIDE	95 to 112	MEQ/L	47	53	56	55	54	54
CO2	22 to 30	MEQ/L	11	11	12	13	12	11
GAP	4 to 18	MEQ/L	-7	-8	-7	-9	-8	-7
OSMO-CALC	275 to 295	MOSM/K	145	159	173	170	170	171
TPROT	5.9 to 8.4	G/DL	0.2	0.5	0.6	0.9	0.9	0.9
ALBUMIN	3.6 to 5.2	G/DL	0.1	0.2	0.2	0.2	0.2	0.1
GLOBULIN	1.9 to 3.4	G/DL	0.1	0.3	0.4	0.7	0.7	0.8
ALB/GLOB	1.1 to 2.2	MG/DL	1	0.7	0.5	0.3	0.3	0.1
CHOL	0 to 200	MG/DL	0	0	0	0	0	0
TRIG	30 to 175	MG/DL	452	114	35	247	175	227
CALCIUM	8.5 to 10.5	MG/DL	1.6	1.7	1.9	1.7	1.6	1.6
ION CA-CAL	3.5 to 5.2	MG/DL	1.5	1.5	1.7	1.4	1.3	1.3
PHOS	2.5 to 4.5	MG/DL	2.6	2.4	4	3.6	3.8	3.5
GGT	0 to 65	IU/L	0	0	1	0	0	0
ALK PHOS	30 to 130	IU/L	19	4	6	3	8	11
SGPT(ALT)	0 to 40	IU/L	53	45	117	102	118	58
SGOT(AST)	0 to 41	IU/L	204	188	471	415	477	239
LDH	95 to 250	IU/L	554	496	1158	1050	1222	726
CPK	25 to 225	IU/L	295	200	250	233	273	212
TBILI	0.2 to 1.2	MG/DL	0	0.1	0	0.1	0.1	0.1
DBILI	0.0 to 0.3	MG/DL	0	0	0	0	0	0
IBILI	0.0 to 1.2	MG/DL	0	0.1	0	0.1	0.1	0.1
IRON	40 to 150	MCG/DL	1	2	3	3	4	2
HIV 1 & HIV 2		NEG	NEG					
HEPATITISA		NEG	NEG					
HEPATITISB		NEG	NEG					
HEPATITISC		NEG	NEG					

Figure 6: Perfusate Sample Data Log

Cryoprotective perfusion was started with 4% glycerol and ramped by mixing with 75% glycerol perfusate (see Figure 7). Cryoperfusion proceeded uneventfully. The cerebral cortical surface was repeatedly examined during cryoprotective perfusion. The brain was noted to be moderately dehydrated at the conclusion of cryoprotective perfusion with an estimated shrinkage of 2-3 mm from the surface of the bore hole. Terminal glycerol concentra-

tions were 7.83 Molar arterial and 6.74 Molar venous at 21:55. Terminal burr hole glycerol concentration was 5.92 (see Figures 8 and Graph 6). Perfusion was discontinued at 21:55 MST.

Venous perfusate samples were drawn at 15 minute intervals during cryoprotective perfusion. Due to a lab error, CPK isoenzymes were not run. (For perfusate sample data, see Figure 6.)

### Cephalic Isolation

Closure of burr holes was completed before cephalic isolation. Burr holes were filled with bone wax (with the thermocouple and crackphone probes in place) and the skin incisions over burr-holes were sutured. All probes were secured with surgical staples to the skin of the patient's head.

Surgery for cephalic isolation was begun immediately after closure of the burr holes. The skin,

## Significant Blood Tests

Note: Levels will depend on specifics of washout and perfusion protocols, and of timing of samples.

TEST	SIGNIFICANCE	SIGNIFICANCE
<b>BUN</b>	<b>NORMAL FUNCTION</b>	<b>CRYOPROTECTIVE PERFUSION</b>
(Blood Urea Nitrogen)	Normally evaluates kidney function	Pre-mortem — may be elevated due to dehydration, common in terminal patients.
		Perfusion — extracted from tissues by perfusate
Triglycerides	Normally evaluates for heart disease	May be an indicator of cellular breakdown
SGPT/ALT — (alanine aminotransferase)	Normally evaluates for liver disease	Indicates damage to liver cells
SGOT/AST (aspartate aminotransferase)	Myocardial infarction or liver disease.	Indicates cell damage (many organs)
LDH (lactate dehydrogenase)	Normally used to indicate myocardial damage, but also indicates more general cellular damage.	Indicates generalized cellular damage
CPK (creatine phosphokinase)	Normally indicates cellular damage in skeletal muscle. Isozyme tests can localize to the specific organs.	Indicates damage in brain, heart, and brain, cardiac muscle, and skeletal muscle, specifically.
GGT (gamma-glutamyl transferase)	Normally used to indicate liver damage	Indicates damage to liver cells
Alkaline phosphatase	Used in identifying a wide range of diseases	Indicates generalized cellular damage

cervical musculature, and spinal cord all exhibited complete blood wash-out and typical signs of thorough, uniform glycerolization (dehydration, waxy texture, ambering of the skin and deepening of skeletal muscle color).

### Cooldown

The patient (cephalon) was then placed in two 1 mil polyethylene bags with two thermocouple probes and two crackphone probes protruding from the bags' opening. At 20.08 hours (post-pronouncement) the patient was submerged in a 15 liter Silcool bath, which had been pre-cooled to -31°C. The first tempera-

ture readings after submersion in the Silcool were #1: pharyngeal, -22.1°C (this probe was not securely placed and later failed to give accurate data, resulting in the data of Graph 3 being based on burr hole temperature); #2: Silcool bath, -30.9°C; #3: Head surface, -38.9°C; and #4: Burr hole, -33.2°C.

The patient's cooling curve to dry-ice temperature is shown in Graph 3. The computer-controlled temperature descent, proprietary to Alcor, was set for -4°C/hour, to a temperature of -55°C (6 hours). At -55°C, controlled rate cooling was terminated and the bath filled with dry ice. The temperature descent to

-79°C took place over a period of approximately 7.5 hours. This data is based on the burr hole probe. Readings on the pharyngeal probe were erratic. Surgical staples used to secure the pharyngeal probe had not been placed tightly, resulting in temperature readings which were not a reliable indication of the cranial interior.

The patient's cooling curve to liquid nitrogen is shown in Graph 4. The bath probe was calibrated at liquid nitrogen temperature, and the other probes were set to it while at dry ice temperature. On February 10, 1997, computer-controlled temperature descent was set for -1°C /

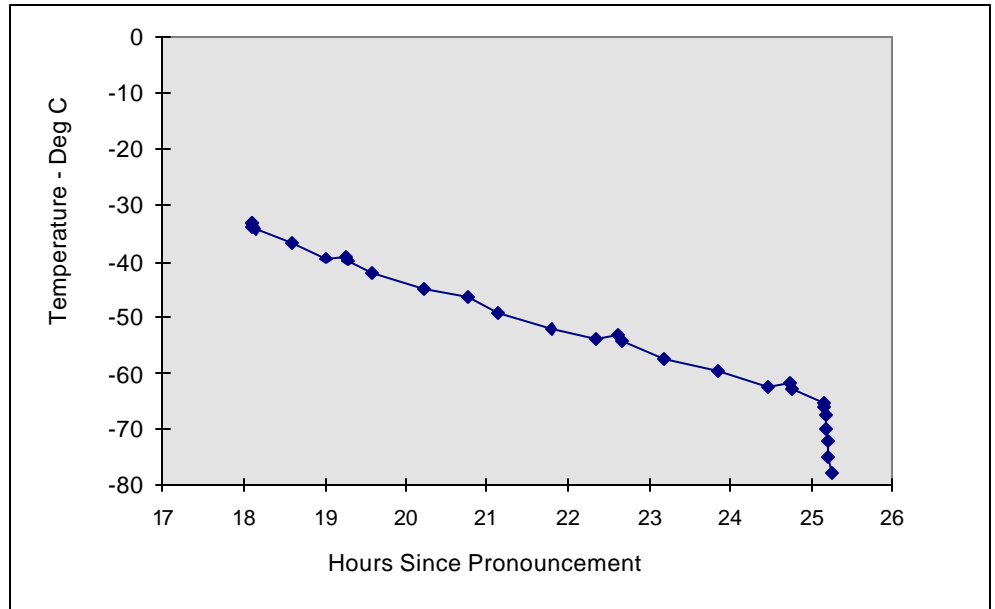
hour to a temperature of  $-90^{\circ}\text{C}$ . On February 11, 1997, computer-controlled temperature descent was set for  $-1/2^{\circ}\text{C}/\text{hour}$  to a temperature of  $-190^{\circ}\text{C}$ . Temperature descent to  $-196^{\circ}\text{C}$  took place over a period of approximately 300 hours (12.52 days). At 287.8 hours post pronouncement ( $-196.1^{\circ}\text{C}$ ) a computer crash was experienced. At 291.4 hours post pronouncement ( $172.7^{\circ}\text{C}$ ) the cool down was resumed.

### Crackphone Analysis

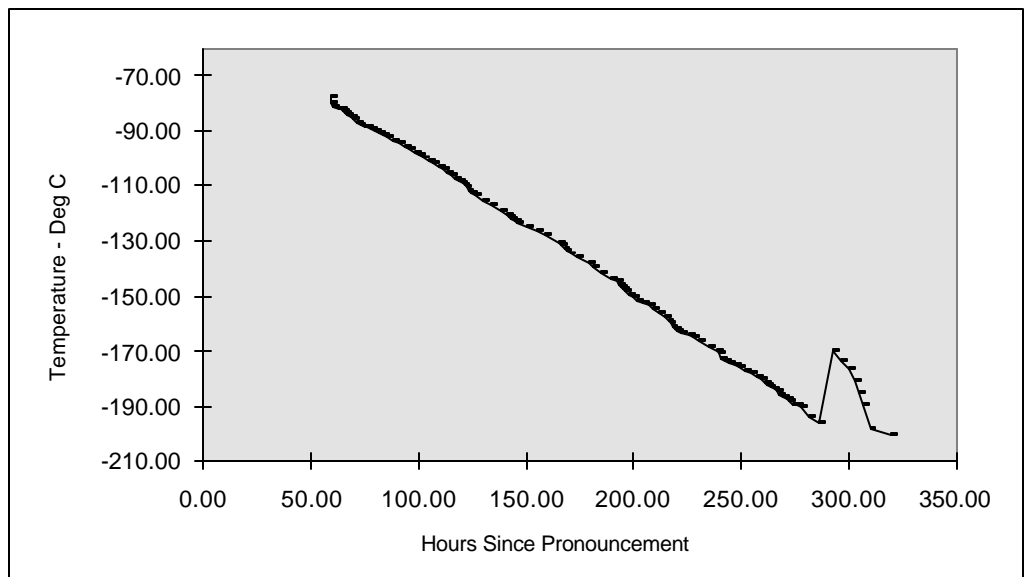
The final venous glycerol concentration was 6.74 Molar. The response (amplitude) of the Channel 1 crackphone was consistently about one-half the response of the Channel 2 crackphone. 22 of the events recorded by the crackphone have been identified as cracks. The amplitude of crack signature ranges from approximately 0.05 volt to 2.4 volts (Channel 2 amplitude).

The largest amplitude crack was the first one recorded. A second, smaller crack occurred within one second after this. The amplitude of the second, smaller crack was about  $1/4$  that of the first crack. The temperature was about  $-107^{\circ}\text{C}$ . One other double crack occurred, on IN<sub>2</sub> fill at liquid nitrogen temperature. Again, the amplitude of the second, smaller crack was about  $1/4$  that of the first crack and occurred within a second. (The limit of resolution of the event clock is one second. The record length for each event is four milliseconds.)

The events are dispersed fairly evenly along the time-temperature ramp. However, a plot of amplitudes vs. temperatures appears to show a



Graph 3: Temperature Descent to  $-79^{\circ}\text{C}$  (burr hole temperature).



Graph 4: Temperature Descent to  $-196^{\circ}\text{C}$  (burr hole temperature).

trailing-off of events that might indicate a relationship between cracks; that is, cracking events do not occur at random, but have a propagating structure, even though long periods of time (up to 32 hours observed in this case) may elapse between recorded events.

### Discussion

During the medial sternotomy, the descending aorta was surgically ligated. Post perfusion examination revealed (an expected) transition

from perfused to un-perfused tissue which was strikingly sharp. We believe that both observations and the data show that the patient received good total-body washout and cryoperfusion of the upper body and head which resulted in an excellent degree of glycerolization and cryoprotection.



# Cooldown, Strain Energy, and Cracking

by Hugh Hixon

Cracking has always occurred during cooldown. Until the crackphone was developed, however, we could pretend that the problem of brain cracking didn't exist. We did have some hints: In 1983, the bodies of three whole-body patients were autopsied, and cracking was noted in many tissues, including the spinal cord (See *Cryonics* #50, Sep. 1984, pg. 16). A fourth patient was autopsied in 1994, and the brain was found to be cracked into five large pieces (*Cryonics* 1st Qtr. 1995 pg. 28).

In some respects, the autopsy and subsequent crackphone observations were a relief. A worst-case situation would have been that the amount of strain energy built up during cooldown would have been sufficient to completely shatter the brain, as occurs in highly strained structures such as Prince Rupert's drops and to a lesser degree in tempered automobile glass (popcorn).

In scenarios involving reanimation by molecular nanotechnology, cracking at the level we observe should not be a particular problem. Nanomachines would presumably map one side of the crack to the other (the two sides being held in place by the skull) and splice the sides back together as appropriate.

In reversible suspended animation scenarios, however, cracking is absolutely devastating. "Restart" solutions pumped into the tissues would leak into cracks and

expand them, blocking any chance of self-repair. Tissues beyond the cracks would not get perfused, as the cracks would short-circuit the vascular system, etc.

In my opinion, heterogeneity of the brain in the skull makes cracking inevitable below the glassification temperature (below  $-95^{\circ}\text{C}$  for glycerol-water mixtures; other values for other cryoprotectants). Therefore, any reversible suspended animation procedure must incorporate storage just slightly above the cracking temperature.

This new temperature is considerably above the accepted temperature for long-term cryopreservation. However, the object of long-term cryopreservation (and cryonics) is to bring the chemical reaction rate in the body tissues sufficiently low that there is no significant chemical change in the patient during the anticipated period of storage. The chemical reaction rate is really the product of two terms: the energy of activation and the viscosity of the solvent. The energy of activation term of the reaction rate is essentially the rate in a vacuum — i.e., without a solvent. But of course, the tissues of our patients are in a solvent — the cryoprotectant. At the glassification temperature, that solvent becomes a solid sufficiently stiff to be cracked. If it is that stiff, then the individual molecules are firmly embedded in the cryoprotectant and unable to move and take part in any chemical reaction. The reaction rate therefore approaches zero at a *much* higher temperature than has previ-

ously been postulated for successful cryonic storage.

Thus, the initial cracking temperature observed with the crackphone may have profound consequences for the practice of cryonics, given a reversible suspended animation procedure. A short list of these consequences includes:

- A detailed examination of my above argument, and a necessarily theoretical decision concerning storage at some higher temperature.

- Given that there will be variations in cryoprotectant, degree of cryoprotection, tissue differences, etc., all of which may affect the storage temperature, there may be some acceptable compromise storage temperature for an individual patient (and in the interests of economical storage, for groups of patients).

- Reliable methods for determining the presence of cracks *after* the event.

- Methods of dealing with cracks during reanimation, the fallback position being to recool, and wait for nanotechnological methods to become available.

- Coming up with an entire new storage technology sufficiently robust and economical to meet our needs.



# Alcor's Third Annual Cryonics Conference

April 3 - April 5, 1998

Scottsdale/Phoenix, Arizona

## Featuring...

From **Alcor**: Ralph Merkle, Marvin Minsky (tbc), Michael Cloud, Dave Pizer

From **BioTime**: Dr. Paul Segall, Hal Sternberg

From **Cryonics Institute**: Robert Ettinger

For: Anyone interested in cryonics technology and community  
Information: (602) 922-9013 (800) 367-2228 (970) 484-8184

When: April 3 - April 5, 1998. Friday evening, Saturday, Sunday.

Where: The Holiday Inn Airport Select, near Phoenix Sky Harbor Airport. 4300 E. Washington, Phoenix, AZ 85034. (602) 273-7778

Lodging: \$99/night/single or double room. Fifty rooms are being held through March 4, 1998.  
For additional information, contact the Chamber of Commerce in Scottsdale at (602) 945-8481 or in Phoenix at (602) 254-5521.

Cost: Full package includes all speakers and materials, Saturday awards luncheon and Saturday fund-raising banquet.

**Early Bird "Thank You For Getting Us Started" Special Rate...received by December 1, 1997...\$97**

**Regular Rate...received by March 3, 1998...\$149**

**Late Rate...received by April 2, 1998...\$179**

**Door Rate.....\$195**

### Ala Carte:

Individual Speaker/Panel...\$25

Saturday Awards Luncheon...\$20

Saturday Banquet...\$36

## REGISTRATION

Name \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_

State/Prov. \_\_\_\_\_

Postal Code \_\_\_\_\_

Country \_\_\_\_\_

Phones, E-mail \_\_\_\_\_

\_\_\_ Registration(s) at \_\_\_ \$97 Early Bird \_\_\_ \$149 Regular \_\_\_ \$179 Late \_\_\_ \$195 Door

\_\_\_ \$25 per Speaker/Panel \_\_\_\_\_ \_\_\_ \$20 Luncheon \_\_\_ \$36 Banquet TOTAL \_\_\_\_\_

Mail registration and payment to:

**1998 Alcor Conference, 7895 E. Acoma Dr., Ste. 110, Scottsdale, AZ 85260**

Please make check payable to **Alcor Foundation**. Your check is your receipt

Please pick up your tickets at the conference. *Thank You!*

Watch for future program developments as Alcor's Third Annual Cryonics Conference approaches.

## PROGRAM

Friday, April 3, 1998

7:00-8:00 pm	registration, reception
8:00-10:00 pm	welcome: Merkle Mode Desert Contest Speaker (tbc) "Cryonics in Science Fiction"

Saturday, April 4, 1998

9:00-9:30 am	Introduction
9:30-10:30 am	Speaker (tbc)
10:30-11:00 am	break
11:00-12:00	Ralph Merkle "Nanotechnology Update and Molecular Repair of the Brain"
12:00-12:15	break
12:15-1:30 pm	awards luncheon
1:30-2:30 pm	Marvin Minsky (tbc)
2:30-3:00 pm	break
3:00-4:00 pm	panel "What's in It for Me?"
4:00-4:30 pm	break
4:30-5:30	Michael Cloud "How to Make the Idea of Cryonics Infectious"
5:30-7:00 pm	break
7:00-7:30 pm	reception with no host bar
7:30-11:00 pm	banquet and fund raiser Speaker (tbc)

Sunday, April 5, 1998

8:45-9:30 am	Bus to Alcor Facility
9:30-11:15 am	Alcor Tour and Sign-up Party
11:15-11:45 am	Bus returns to Conference Site
11:45 am-1:15 pm	lunch break
1:15-2:15 pm	Paul Segall and Hal Sternberg
2:15-2:45 pm	break
2:45-3:15 pm	Dave Pizer "A Retirement Community and Safe Storage"
3:15-3:30 pm	break
3:30-4:30 pm	Robert Ettinger
4:30-5:00 pm	wrap-up



## Who am I? Where Am I?

Recently neuroscientists have begun to look at consciousness, a word with many meanings, all of which have one background idea. We may say a person is conscious of a blue light if somehow he/she senses that light and its color. But then what is “senses”? A computer can be hooked up to respond to changes in our house, yet no one would claim that the computer is conscious. These neuroscientists seek some understanding of how our brain (a physical entity, subject to many different measurements) can produce my sense that I am aware, my *me*-ness.

The last neuroscientist content with the simple idea that we had something inside us, separate from our brain, that gave us this feeling was Eccles, in the 1950's. No one now would be content with such an explanation, which does no more than put the problem back a step. (OK, then how does this separate thing give us our feeling of aware-ness?) Even so, methods to work out empirically just how this sense of consciousness works have not arrived. Such methods may *never* arrive; the best we can do is to provide an explanation in terms of how our brain works, and show that the predictions it gives of brain operation fit what we can observe. To some extent, we can insist that any explanation of consciousness also fit our own intro-

spection, too, though no one claims introspection to be a fully accurate test.

How does this issue relate to cryonics? It relates very deeply. We do not just want a copy of ourselves to be revived, we want *ourselves* to be revived. Most cryonicists have decided, one way or another, that cryonic suspension will preserve *them*, not just information needed to make a copy. Many (no, I don't have a poll) of those who have *not* signed up may ultimately have chosen not to do so because they cannot bring themselves to believe *they* will be revived. Sure, revival from cryonic suspension might ultimately produce a good copy, maybe a very *close* copy. But will that copy be *the person suspended*?

One of the first obstacles to cryonics comes from popular notions of death. Common belief seems to hold that when you are dead, *you* are gone. Sure, a zombie might be created by reviving your body, but it would not be *you*. No matter that it looks like you, no matter that it acts like you, no matter that it fools everyone you knew — it would still be something other than *you*.

When stated so plainly, this looks unreasonable. Yet right now, though neuroscientists have started to get a handle (as much of a handle as they may ever get) on the human sense of

awareness, their research remains unfinished. Francis Crick\*, in his book “The Astonishing Hypothesis,” discusses only vision as a basis of consciousness, yet blind people exhibit the same conscious behavior as the sighted. Some researchers believe in a special location for consciousness, which they suggest may lie in brain centers lower than the cerebral cortex. Other more sophisticated hypotheses go as far as identifying consciousness with a constant interplay between cortical areas and the amygdala and thalamus.

Any such hypothesis must satisfy several tests. We know, both by introspection and actual testing, that we are *not* aware much of what happens in our brain. In the most visible case, we may be quite unaware of any special processing before an idea to solve a problem pops into our awareness. Not only that, but actual testing has revealed cases in which we may act on a decision before we become aware of that decision. We also know that awareness may have degrees: are you aware while you sleep? In deep, undreaming sleep? On some drugs? When you are a small child? Clearly it's not enough

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\* This is the same Francis Crick who discovered our DNA contained the plans for our body and brain. He went on to study consciousness.



just that our brain be active.

I believe that I will be revived because I believe that I am a physical being, and everything about me, including all my internal awareness and sense of Self, comes from my physical self. If that physical self is revived or even recreated from stored information, then it will be *me* that is revived. Yet for any arguments with someone who finds he cannot believe that, I can give him no more than philosophy. We should all be clear about what we can and cannot scientifically prove on this issue.

The discussions in “The Prospect of Immortality,” by Robert C.W. Ettinger (1964), remain among the better ones for issue of consciousness. These days we have even more possibilities to give someone: what if all the work on brain ischemia succeeds, and we learn how to revive people after 60 minutes at room temperature. If that happens to you, will *you* revive? And use of low temperatures (though still above 0°C) in surgery to literally “turn people off and on” has spread. The number of “miraculous revivals” reported of people

found in snowdrifts has slowly gone down.

It may take a successful revival from suspension to convince some people that cryonics can work. Even so — though the patient claims he is the same, believes he is the same, and to all appearances seems the same — if you were not the one revived, the problem remains.



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**W**

***True Odds***

by James Walsh, Merritt Publishing, CA, 1996

***A Mathematician Reads the Newspaper***

by John Allen Paulos, Basic Books, NY, 1995

**Reviewed by Thomas Donaldson, Ph.D.**

**B**oth of these books deal with a subject of great importance to us, one for which it has turned out to be hard to get valid information from any popular source. That subject is *risk*: for cryonicists, primarily risk of severe injury or death. Walsh, in “True Odds,” takes a somewhat less mathematically sophisticated view of this issue, but contains much more criticism of popular estimates of risk. Paulos has some very good sections on computation of risk, so that you can do it for yourself.

Both have value for us — and even, at times, a bit of humor.

Only a little acquaintance with popular media will tell you how badly

the newsmen and their audience misjudge many risks. The most famous popular misjudgement is the risk of driving versus flying: airline crashes are big news, while thousands of people die in auto accidents with very little notice by newspapers or television...except when the accident is local. Does this mean that it's safer to fly? Not quite: if we look at the statistics in detail, and assume that you do *not* drive while drunk, under the influence of drugs, or after a period without sleep (this last turns out to be every bit as dangerous as driving while drunk, though no one has noticed it enough for cries to make it illegal), then the crossover

point between a choice of driving or flying is at about 1000 miles. That is, if you are travelling more than 1000 miles, it's safer to take a commercial airliner. If less, driving is safer — assuming that you keep in mind the restrictions above. Unfortunately neither author pays much attention to the safety of commercial *land* transport (buses or trains).

Walker's book abounds in such careful comparisons, generally to the detriment of popular media. The Ebola “plague,” for instance, turns out to have been almost a complete furphy. Though Ebola is a very gory disease, it could only spread by personal contact, and its victims had

little opportunity for that before dying. Walker also discusses the scares about cancer: that radio waves or power transmission wires or cellular phones increase cancer rates, that very small amounts of a substance in our foods increase cancer rates, etc, etc. (He comes down especially hard on the Alar scare a few years ago, which turns out to be based on no valid evidence at all.) One major point about electromagnetism or radiation: the Earth itself has a magnetic field which *exceeds* that of all our household devices by a wide margin. The same is usually true for natural sources of radiation. As for chemical contamination, many readers may already know that some of our foods contain entirely natural carcinogens in much higher concentration than pesticides or any chemicals farmers have used. (As before, there *are* caveats for special members of the population).

Paulos discusses health and death risks, too, but he mostly discusses other issues, always with a mathematical bent. For instance, he has a chapter commenting on voting methods as they apply to Lani Guinier, the woman who was first chosen for a position in the first Clinton administration and then turned down for racism (she is a black). It's important here that many entirely "democratic" voting schemes can produce different choices. He goes through a wide range of cases: politics, investment, games, economics, always with that eye to the math behind a situation.

However in one section Paulos concentrates on health risks. First of all, the most risky drugs we take are

tobacco and alcohol; deaths and disability from the "hard" drugs make a poor second. Many Americans fear nuclear power; lead in old paints and old pipes has damaged many more people than radioactivity. But from there he goes on into more mathematical issues: it is not true that you can get an overall average if you take the averages of several averages. (Example: 36% of A's and 46% of B's improve in one study, 60% of A's and 65% of B's in another. The problem with simply taking an average is that each of the studies may use different numbers of A's and B's. Paulos suggests 100 A's and 1000 B's in the first, 1000 A's and 100 B's in the second. You do the arithmetic.) Statistics of any kind need a context.

total population, but the total number of those who have tested positive).

Finally, we have all worried over one special risk: the risk that our cryonic suspension will fail. Several authors have produced probability figures. However, if we think carefully about what probability may mean in this context, it's clear that *no* such figures have any foundation. To derive a probability, we need "atomic" events (events which aren't just a set of other events). Even if we cannot *predict* a chance event, we still need some knowledge to work out atomic events. Without them, we can make no *meaningful* probability calculations at all.

Suppose, for instance, that we say the probability for successful suspension is 50%.

Well, it either succeeds or it doesn't, yes? So we have a probability of 50% for each possibility. The fallacy here is that we may really have 20 entirely separate ways to

succeed and 5 separate ways to fail: the real probability is then 80%\*. Besides other problems in working out probabilities here, *none* of us really knows the future. We therefore cannot work out any set of *atomic* events on which to base our calculations. *All* calculations of the probability that cryonics will either succeed or fail suffer from this fallacy.



\* Since this is an entirely hypothetical example with *no* foundation, I will not discuss the case in which success and failure are reversed.

Figure 1: Paulos' Example of Conditional Probability

	Has AIDS	Doesn't Have AIDS	Totals
Test positive	99	999	1098
Test negative	1	98901	98902
	100	99900	100000

The *denominator* of your probability calculation should be 1098, *not* 100000.

Paulos is also very good on conditional probability, the means by which we can work out such things as whether a positive test for AIDS implies that we have AIDS. He gives a little table for a disease D which makes the issues very clear. Suppose that the test detects those with AIDS with 99% accuracy, we have a total population of those tested of 100,000, out of which 100 have AIDS, and you go innocently in to your doctor, who tells you that you tested positive. How likely is it that you really have AIDS? The table tells you that your chances, though certainly worse than someone who tested negative, come to about 9% (the denominator in your calculation should *not* be the

**Visser Speaks**  
*Continued from page 22. . .*

**OV:** First of all, transplants are acceptable. Second, funding for research is available. Those are both critical issues. I've found that here people are very, very hard workers, which I don't find back in South Africa. If I wanted to stay and work twelve hours in my lab, I have been told to leave after seven hours because the cleaners must lock the doors and go home. Research is not taken seriously at all.

**DB:** Has the attitude toward research

changed since the Mandella government has taken over?

**OV:** Yes. It has changed. Mr. Mandela is a very nice man and I understand his point of view, that we've got millions of people dying, and we can't afford to carry on research on something that is not going to help that type of people first-hand and very quickly.

**DB:** In regards to your research, keeping the lab open at night you can work...?

**OV:** I now have my own lab, so I've now got my own key!

**RHL:** I think some people in the US probably look with envy at other countries where research can be performed outside the scope of FDA regulations, and not constrained by other restrictions. I'm wondering if you take that into account?

**OV:** I don't know if you read in the latest newspaper what type of person I am. If something needs to be done, I do it. That's how I've gotten so far.



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