



Cryonics

Volume 10(5)

May, 1989

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First Life Cycle,
December 10, 1917 — March 21, 1989
Photo ca. 1943-1944 as Lieutenant, U.S. Army Medical Corps**

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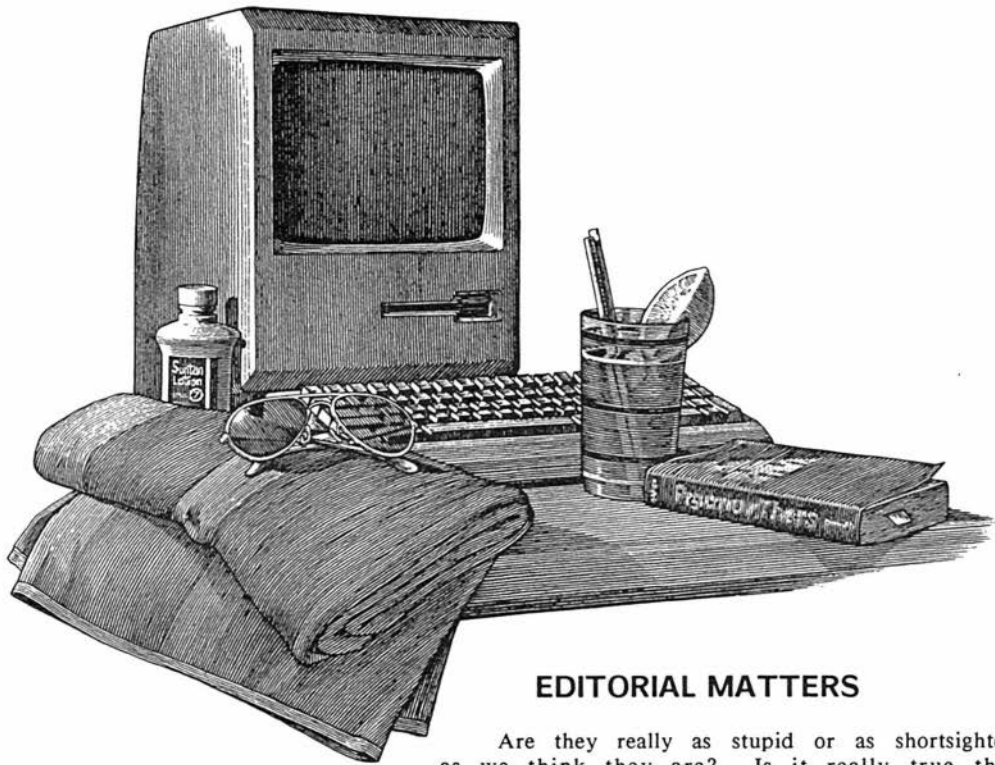
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CRYONICS is the newsletter of the Alcor Life Extension Foundation, Inc. Mike Darwin (Federowicz) and Hugh Hixon, Editors. Published monthly. Individual subscriptions: \$20 per year in the US; \$30 per year in Canada and Mexico; \$35 per year all others. Back issues are \$2 each in the US, Canada, and Mexico; \$3 each all others.

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EDITORIAL MATTERS

Are they really as stupid or as shortsighted as we think they are? Is it really true that cryonicists are born and not made? *Why* don't they understand what we're talking about, anyway?

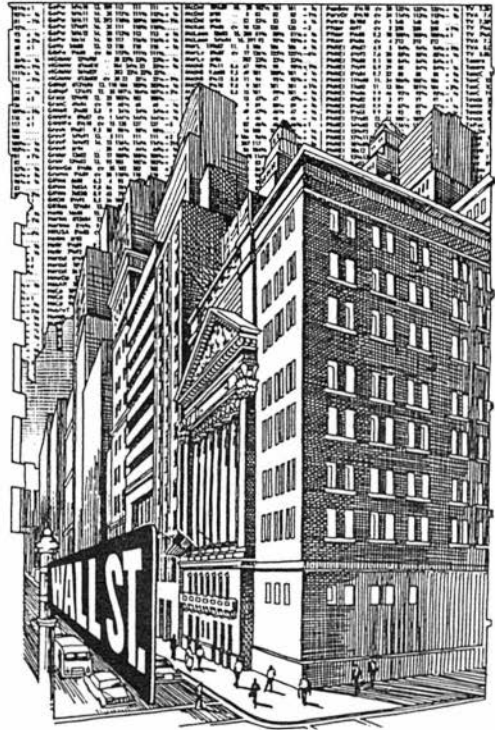
Perhaps no set of questions will provoke more passionate debate than those above. Some years ago it became clear to me and Brian Wowk that there were reasons for people not "seeing the light" where cryonics was concerned. Some of those reasons are very difficult to do anything about: changing deeply ingrained social behavior and learned responses towards illness and death that took shape over a lifetime cannot be done in one fell swoop.

Nevertheless, it was clear to us that often the reasons people remain unconvinced and/or uninvolved were due to failings on the part of cryonicists. In carefully examining the tools of evidence and argument we cryonicists use in communicating this idea and then comparing these tools and arguments to those commonly used to convince people to pursue other "products" or ways of life we found a number of surprising deficiencies.

One of the first mistakes in cryonicists' thinking that we identified was the error of mixing apples and oranges. We often hear cryonicists say things like: "I don't understand why more people don't join Alcor, look at all the people who join crazy religions." The problem here is that cryonics is *not* a crazy religion and it doesn't purport to be one either. Thus, it doesn't use the tools that mystics employ: it offers no guarantees, it does not tell people how to live their lives or what to wear or eat, it reveals no great cosmic truths, and worst of all, it offers no great reassuring certainties about life, the universe, or anything. Instead, cryonics claims to be a rational undertaking that will stand or fail on the basis of objective reality.

It is thus a terrible mistake to expect that the "public" or our critics will hold cryonics or the arguments supporting it to any lower standards than they hold other scientific undertakings.

And yet cryonics is not strictly a scientific undertaking. It is tangled up with as many hopes and dreams and values as the individuals who engage in it bring to it. But cryonics isn't nonscientific either: it isn't based on blind faith or mindless speculation. Cryonic suspension isn't like open heart surgery or a tonsillectomy, where the probabilities of success or failure are clearly understood and a *proof by example* is already demonstrated. No. Cryonics is something else. It is like buying stock in a high technology company seeking to exploit a brand-new market on the basis of careful research and *reasoned speculation*. A straightforward enough analogy, and yet we would do well to remember that in the United States only about 15% of the population holds any stock directly, and fewer still hold high-risk stocks. What this means is that few people are accustomed to taking such risks and making such assessments. When you consider how few people are willing to take the risk of financial investment, perhaps it becomes more comprehensible why there are so few willing to take the kinds of risks cryonics necessarily involves.



The fact that cryonics doesn't offer certainty and that it involves making a speculative judgment on the basis of limited insight doesn't make cryonics bad, or invalid, or an inappropriate undertaking. It does mean that if people are to be convinced of its utility and worth as a speculative undertaking, there must be as many compelling *rational* arguments mustered in its support as possible. It means that for each of the "big questions" which will likely determine the workability or failure of the cryonics proposition there has to be a clear, exhaustive, and well-organized summary of existing knowledge and rational speculation (i.e., careful projections within the constraints set by known physical law) which addresses each of the major "problem areas".

When Brian and I set out to write *Alcor Threshold To Tomorrow* (ATTT), that was the objective we had in mind. We wanted to lay out clearly the scientific evidence and rational argument for:

- 1) The physical basis of memory, personality, and identity;
- 2) The persistence of such identity-critical brain structure even after several hours of what is today called "clinical death";
- 3) The qualitative and quantitative nature of injury from cryopreservation using existing techniques;

- 4) The case for the reversibility of cryoinjury and injury due to clinical death (i.e., ischemic injury), including detailed examination of the physical and computation requirements for repairing injured cells and tissues and restoring them to function;
- 5) The financial, social, and legal mechanisms which would be required for patients to stay in suspension long enough to be revived within the confines laid out in point 4) above;
- 6) A reasonable evaluation of the *probability* of revival taking into consideration all of the foregoing.

With ATTT we didn't succeed, although we did provide a start, a survey. It was always our intention that ATTT have extensive technical appendices which would support the text and be voluminously documented. The realities of production costs prevented this from happening. But it did not prevent the appendices from being written. Or from being improved upon.

And that's really what this rather long-winded *Editorial Matters* is all about. Over the past year or so Alcor has tried to "fill in the holes" in the cryonics argument. We have published a number of seminal papers addressing these issues, such as "*Nanotechnology*", "*Cell Repair Technology*" and "*The Cryobiological Case For Cryonics*". This month we add another insightful and very important one: "*Will Cryonics Work? Examining The Probabilities*," by Steve Harris. Steve's piece will no doubt prove controversial and will hopefully provoke much thoughtful speculation. [In fact, it already has: Mike Perry saw a copy in draft form and proceeded to write the article following Steve's, *Further Thoughts On The Probability That Cryonics Will Succeed.*]

That's really the point, because it isn't possible to completely "fill in the holes" in any definitive way today. All we can do is make a start and hopefully carry the task forward to the point where we can at least *see the bottom* of the hole we're peering into.

* * * * *

EYE IN THE SKY

It started out so innocently. It was to be a simple backpacking trip lasting only a couple of days. And after all, the Cleveland National Forest is so close. Just an hour away from home and only minutes from Alcor. So close and yet so far. While neither of you were teen-agers any more you weren't exactly "over the hill" at 45.

A heart attack was the last thing in the world you expected to happen to your husband on this camping trip. A fatal heart attack was unthinkable. If you have to hike out for help you are 12 hours away from the borders of civilization. The portable CB you brought gives no response but static. Every minute that races by means more ischemic injury....

You reach into your pack and pull out a small box, extend its antenna and signal to a network of orbiting U.S. and Soviet satellites. Your position is triangulated and within minutes a massive search and rescue is mounted by the Air Rescue Service of the U.S. Air Force, the Civil Air Patrol, and other rescue teams....

Science Fiction? A cryonicist's wild imaginings? No.

It is no secret that a disproportionate number of cryonicists are avid outdoorsmen:

hikers, backpackers, and mountain climbers. Getting help in such a situation is never easy. Fortunately, it has recently gotten easier.

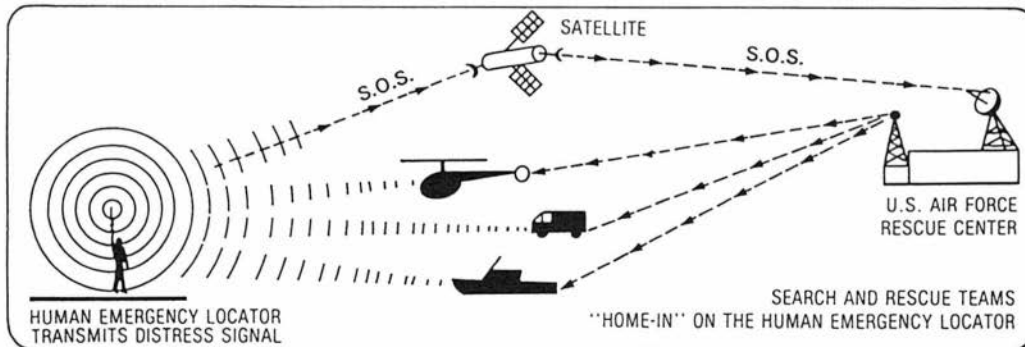
There is now a product available called the *Human Emergency Locator* which can transmit a distress signal to a network of orbiting satellites monitored by the U.S. Air Force. The Air Force locates the transmitter, and then relays that information to local civil and rescue personnel.

The device is derived from the Emergency Location Transmitters (ELTs) that have been mandatory in aircraft for a number of years. Now the ELT is available to individuals at a modest cost in a convenient package. It is marketed by Emergency Locator Products Corporation, 1565D Fifth Industrial Court, Bayshore, New York 11706 and retails for \$249.95.

This company has been in business for a number of years and markets this product primarily to light plane pilots as a back-up to their on-board emergency location transmitter. For cryonicists who enter wilderness areas a device like this would seem a prudent investment.

A few cautions are in order though: 1) You must not use this device in an urban setting or you may be punished by being forced to bear the cost of the "search and rescue," which could run to thousands of dollars! 2) You must use the device *only* in a genuine life or death emergency.

Additional information on the unit may be obtained by writing to Emergency Locator Products at the above address or by phoning them at (516) 666-5049. Our experience has been that they respond promptly to inquiries.



* * * * *

MEMBERSHIP STATUS

Alcor now has 127 Suspension Members, 243 Associate Members, and 12 members in suspension.

DICK JONES LITIGATION

The Dick Jones estate is still in litigation with Saul Kent, executor and trustee under Dick's 1987 will and trust, contesting the validity of the 1988 will and trust naming Dick's business partner Jenna McMahon as executor and trustee. Since this matter is still in litigation Alcor cannot comment on it. We have reproduced below a newspaper article which describes the "latest round in court". This article contains one error of fact where Alcor is concerned and we wish to correct it here: Alcor is not and has not contested Dick's will, nor has Alcor brought any litigation against the estate. These actions were taken by Saul Kent, Dick's executor and trustee under the first will and trust.

Cryonics Lab Battles Family Over Client's Will

By LOUIS SAHAGUN,
Times Staff Writer

While Richard C. Jones' body lay suspended in a tank of liquid nitrogen at a warehouse in Riverside on Tuesday, a bitter tug-of-war commenced in Los Angeles Superior Court over the Emmy-winning television producer's deathbed decision to change his will, cutting by half the \$10-million legacy he had previously left to a cryonics laboratory.

In 1987, Jones, who worked under the name of Dick Clair, set up a will and trust to give his \$1-million Toluca Lake estate and residuals from hit television shows, including "It's a Living," to the Alcor Life Extension Foundation of Riverside, which freezes bodies in hopes of reviving them at some future date.

Then, on Dec. 9 as he lay dying from an AIDS-related illness at Sherman Oaks Community Hospital, Jones amended the will, which was taken to the hospital by a friend, to evenly divide his estate and trust between Alcor and his sister, nieces and nephews. Jones died two days later at age 57 and, following his request, his body was frozen in Alcor's storage facility.

Will Contested

Alcor is contesting the revised will, arguing that Jones was mentally incompetent at the time the new will was signed.

"In 1987, Jones put into place the most carefully written will imaginable," Alcor lawyer David Epstein said in an interview Tuesday. "In this case, when he got to the point where he was no longer mentally capable to make such a decision,

people came to the hospital late at night and forced him to change it."

Tuesday's hearing was to determine whether Jones' writing partner of 25 years, Jenna McMahon, should continue to administer his estate pending a trial later on the validity of the will and trust.

After hearing arguments, Judge Mariam A. Vogel rejected Alcor's effort to displace McMahon with a court-appointed trustee.

"This evidence doesn't come close to persuading me. . . . He [Jones] was absolutely competent to do it [change the will]," Vogel said.

Ron Palmieri, the lawyer representing McMahon, said in an interview that "medical evidence, witness testimony and statements from the attending physician all say he was competent to change his will. Only Alcor says he was not competent."

Palmieri said Jones decided to change his will after he discovered that he had "substantially more residuals coming than he originally believed and he wanted to share with his family."

Alcor is taking a risk by pursuing the case because the second will includes a provision to have the cryonics organization cut out altogether should it challenge the document.

"If they [Alcor] violate the no-contest provision, they get nothing," Palmieri said. "Otherwise, they could get \$5 million."

Alcor's lawyers repeatedly argued Tuesday that Jones was unfit to change his will, and challenged depositions, and statements by at least eight friends and family

members who visited Jones in the hospital, which declared him of sound mind.

"He had AIDS dementia, which affected his thinking . . . high fever, and severe mouth lesions, which made it difficult for him to speak," Alcor lawyer Epstein told Vogel. "He couldn't remember if he was in the hospital . . . or where his passport was."

Vogel, however, shrugged off such arguments as insignificant.

"I can't remember where my passport is either," she said. "What does that prove?"

Jones, a three-time Emmy Award-winning television producer-writer who worked on programs including "The Carol Burnett Show" and "Flo," was a devoted supporter of Alcor and its cryonics research.

The Alcor Life Extension Foundation stores frozen heads and bodies in the hope that in the future they can be revived and new bodies cloned for them. Most scientists dismiss cryonics as fantasy.

Alcor founder Saul Kent, 47, whose 83-year-old mother's head has been suspended in liquid nitrogen at the Alcor facility, said in an interview Tuesday that Jones had three reasons for wanting to turn over his entire estate to Alcor.

Kent said Jones hoped the money would be used to ensure that his frozen body remain preserved, to fund cryonics research "and to pay for his return."

"The family's position is that it desires that Jones' last desires be carried out," said Arthur Grebow, the lawyer representing Jones' family in the case. "We view Kent's position as a sham."

Los Angeles Times

Wednesday, April 12, 1989

UNBELIEVABLE!

That's what we said when we opened our April, 1989 issue of *The Hemlock Quarterly*, the newsletter of the pro-euthanasia Hemlock Society. The newsletter detailed the ordeal of a Hawaiian physician, George M. Burnell, and his 89-year-old mother at the hands of local authorities and a medical products company.

In the past we have *repeatedly* urged our members to intelligently consider the kind of medical care they want to receive and then to *fill out a Durable Power of Attorney for Health Care and/or a Living Will*. Dr. Burnell's story should underscore the importance of such legal preparations.

Dr. Burnell's mother suffers from Alzheimer's disease to the extent that she is largely demented, and is confined to a nursing home. The relevance of her diagnosis to cryonicists is simple: Alzheimer's disease is one of those illnesses that progressively obliterates brain structure. If a metabolic scan of an Alzheimer's patient's brain is done near the end stage of the disease, the entire brain (with the exception of the midbrain and a narrow band of occipital cortex tissue) will be found to be metabolically devastated. Examination of tissue taken from almost every area of these patients' cerebral cortexes by light microscopy reveals not brain cells, but dense scar tissue. The point of this is that patients with advanced Alzheimer's are not likely to get very much benefit out of cryonics.

Dr. Burnell's mother was *not* a cryonicist. Nevertheless, what happened to her was bad enough and unbelievable enough that we should hope it never happens to any of us.

About a year ago the physician treating Dr. Burnell's mother rang him up and told him that her pacemaker needed a new battery. Needless to say, considering her nonexistent quality of life both the physician and Dr. Burnell wanted to sit down and discuss the appropriateness of such a procedure before carrying it out. They met, discussed the issues, and decided that replacing the pacemaker battery would be cruel and accomplish no worthwhile end for anyone involved. Since Mrs. Burnell was completely dependent upon the pacemaker, it was decided to let nature take its course and allow the woman to slip into a coma and expire peacefully when the battery failed. End of



problem, right?

Wrong. A short while later the physician received a letter from the pacemaker company threatening him with legal action if he failed to replace the battery. The letter stated in part: "I am sure you are aware that a failure to replace her pulse generator due to the wishes of family members...would leave any participating parties open to possible legal and ethics actions...In the absence of a Living Will..., such a failure to replace her pulse generator borders on indefensible passive euthanasia and cannot be condoned."

Needless to say, in the face of such a letter the physician got cold feet. Dr. Burnell stood his ground. They decided to talk the matter over again in a few days. They never got that luxury. Within a few days a representative from the City Prosecutor's office announced that they were conducting an investigation. The Prosecutor's office contacted Dr. Burnell and demanded an interview. Later the same day the hospital administration called asking for a meeting of Mrs. Burnell's cardiologist and internist. The upshot of that meeting was that the hospital was scared. In order to contain their liability they asked to admit Mrs. Burnell to the hospital's Definitive Observation Unit for telemetry so that if her pacemaker failed they could intervene....

The next day Dr. Burnell confronted a deputy district attorney and an investigator who told him: "A complaint has been registered with our office by a pacemaker company and we're here to investigate for possible criminal action." (Do you ever get the impression that bureaucrats must be *bored* a lot of the time, since they seem to be able to find nothing better to do than harass people so stupidly?)

After some discussion they concluded that there was no criminal intent. A few days later they called to say: "The prosecutor understands the issues in your mother's case and he remains sympathetic, but he can't give you any assurances that no further proceedings will ensue." To translate: we can't promise you we won't prosecute you for homicide.

With that kind of response, Dr. Burnell went to court and won guardianship of his mother, giving him authority to make medical decisions for her. The hospital ethics committee met and decided that *not* replacing the batter was ethically OK. Dr. Burnell spoke with the pacemaker company president, explained his situation and promised the company immunity from litigation. The company president said he would not interfere. Dr. Burnell's mother gets to die peacefully and we have an End Of Story, right? Wrong!

A short while later the prosecutor's office calls: "Another complaint has been registered about your mother. We're obligated to look into it."

Who was the complainant? Why, the attorney that represented the pacemaker company. Only now he wasn't representing the pacemaker company. As Dr. Burnell found out when he called back the company president, who said: "He [the attorney] is acting on his own behalf. I'm no longer using his services. Goodbye and good luck."

A call to the attorney revealed the following: "I represent a right-to-life organization in this matter, and I am prepared to have you removed as legal guardian if necessary and pursue it all the way to the Supreme Court!"

A meeting with Dr. Burnell, his lawyer, an authority on ethics, and this self-appointed public-spirited soul was arranged. The right-to-life lawyer brought with him the proposed new guardian for Dr. Burnell's mother! None of Dr. Burnell's arguments were considered. The right-to-life lawyer and the group he represented repeated their intention to carry the matter to the Supreme Court if necessary.

Dr. Burnell, having neither the money nor the stamina for such a protracted and costly fight, caved in. His mother got a new pacemaker.

If Mrs. Burnell had been a cryonicist she would have been deprived not only of a dignified and timely death, but of her very life as well. Let this be a lesson to us all.

We are endeavoring to find out both the identity of the pacemaker company and the "right-to-life" organization which perpetrated this atrocity against personal freedom and human dignity. We feel strongly that they don't deserve any of our business or support as cryonicists.

Finally, get those DPAHC's filled out.



SEVEN LITTLE EMBRYOS

Ahhh, what a mischievous thing suspended animation is. A few of you out there are old enough (or have been involved in cryonics long enough) to remember all those stupid "ethical" questions people used to ask us in the 1960's which went something like: "If you remarry after your wife is frozen and all of you get revived are you a polygamist?"

How times change. These days, few people would even be concerned enough about the answer to *ask* such a question in the first place! But that doesn't mean suspended animation won't bring some wickedly interesting social and ethical dilemmas.

Take the case of Mary Sue and Junior Lewis Davis. They were just your average quarreling couple in the sleepy town of Maryville, Tennessee. Maryville, with a population of 18,000 tucked away in eastern Tennessee, is hardly a likely place to be the center of a high-tech bioethical conundrum. Just about as likely a place as the sleepy town of Riverside, California....

Mary Sue and Junior Davis decided to get a divorce. No doubt a contributing factor to their martial



tensions and short tempers had been Mary Sue's five ectopic pregnancies (where the fertilized egg implants outside the womb, threatening the life of the mother) followed by six costly and unsuccessful attempts at *in vitro* fertilization. When the Davis' decided to split, among the "community property" were seven frozen embryos awaiting their chance in Mary Sue's womb.

Mary Sue wants to try to bring them to term. Junior Lewis wants to see them stay right where they are: safely frozen.

Mary Sue claims she doesn't want to tap Junior for support money. She says all she wants is motherhood and that Junior agreed when he provided sperm to fertilize the eggs. Junior Lewis isn't talking. At least not about why he doesn't want to be a father....

What will happen in this case? In August it will go to trial. Both sides have vowed to appeal if they lose.

We think we know who the "winner" may be. Based on our experience with litigation, Mary Sue will probably be in the Maryville Convalescent Home For the Genteel Elderly when the final appeal is exhausted.

We'll keep you posted.

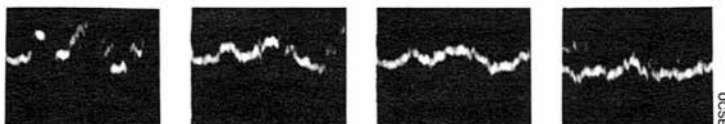
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NANO NANO

Progress towards the development of a "practical" nanotechnology continues by leaps and bounds. Space does not allow us to report in great detail but we have cited references so that interested reader may check the source.

"Movies" of Fibrin Polymerization

This one isn't likely to capture an Oscar but it's still a stellar cinematic achievement. Researchers at Stanford and the University of California at Santa Barbara have succeeded in making a "movie" of the polymerization of fibrin (a key protein involved in blood clotting) using an atomic force microscope (AFM). Reporting in the March 24th issue of *Science*, the researchers published a picture of the fibrin as it polymerizes into a sheet on a mica surface.

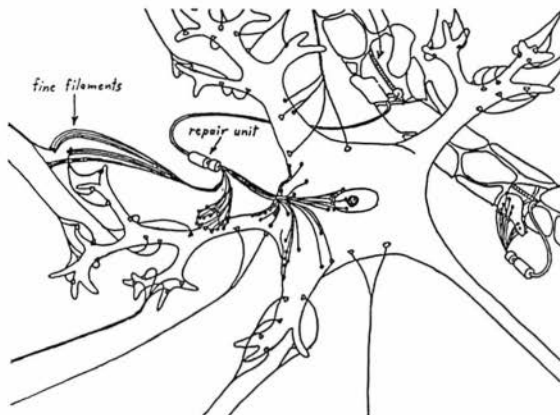


Atomic force microscope captures fibrin polymerizing on mica surface.

The researchers note that this technique can be used to look at anything from "mitochondria in cytoplasm to painted ships in sea water". This technique should allow for direct visualization of the actions of drugs and may help to characterize the structure and function of a wide range of biologically important molecules and cell components.

Cell Repair Machine Wiring?

In their article *Resuscitation: A Speculative Scenario for Recovery* Mike Darwin and Brian Wowk envision cell repair devices networked together and powered by "... fine fibers of electrically conductive polyacetylene which supply power to ice removal devices" and "... serve as communications links as well." Now researchers at the University of Minnesota have succeeded in manufacturing conducting molecular "wires" up to 7.5 nanometers long from the chaining together of polyacenequinones and imides. (The original cite is *Journal of the Chemical Society, Chemical Communications*, 1988, page 84.)



Such wires may provide a source of electrical energy to operate ice removal or tissue repair devices at subzero temperatures so that the damaged cell structure does not have to be "stirred" by rewarming and exposure to diffusive processes.

Designing A Molecular Memory

A molecular-scale "shift register" has been designed in a cooperative effort between scientists from Pasadena's Jet Propulsion Lab, Caltech, and the University of Sao Paulo (in Brazil). The shift register the researchers designed has 1,000 times the density and 1/10,000th the energy consumption of an equivalent Very Large Scale Integrated (VLSI) circuit memory chip. A shift register is a form of memory consisting of memory cells connected in a line. The authors' proposal is fairly detailed and includes a statement to the effect that construction of the device should be possible with (and fit into) existing technology. Molecular computation is of relevance to cryonics because it offers the prospect of bringing autonomous control to the cell repair process. (*Science* 241:817-820, (Aug 12, 1988))

Reports

A Molecular Shift Register Based on Electron Transfer

J. J. HOPFIELD, JOSE NELSON OYUCHIC, DAVID N. BERATAN

An electronic shift register memory at the molecular level is described. The memory consists of a chain of electron-transfer molecules and the information is stored by photoinduced electron-transfer reactions. This device integrates designed electronic molecules into a very large scale integrated (silicon microcircuit) substrate, providing an example of a "molecular device" that would actually utilize synthetic strategies to design and real-

ize the molecules, delivery of the clock signal to the device, fabrication of the molecular device, communicating the molecular information with the microcomputer features of the chip, and dealing with the errors. The available errors that will be present in computing systems are decreased as $\sim 10^{-17}$ (where k is Boltzmann's constant and T is temperature) per decade (rather than the present $\sim 10^{-12}$) and, in principle, these errors are the overall computer error due by such devices.

All the above problems can be addressed by using molecular electron-transfer reactions as the fundamental computing element. These registers (1) are desirable because they involve no bond formation or breaking, are reversible, have tunable rates, have low dissipation and a natural "switching the clock"...

Towing A Mitochondrion

Progress in manipulation and control of cell components has been realized in an unexpected fashion by using focused laser light to "grasp" and move cells and cell components. Investigators have discovered that they can use the force of light refraction to push and pull microscopic objects. They have even been able to "reach" inside cells with such a "tractor beam" and move organelles around (*Science* 241:1042 (Aug 26, 1988)).

We emphasize that these are just a few of the more dramatic things being reported which have fairly direct relevance to the development of proposed cryonic revival technology. Progress in genetic engineering, which is at least as relevant, is simply proceeding at too fast a pace to report.

Summaries are often found in *Science News* and *Foresight Update*.

LOW CHOLESTEROL AND STROKE?

You can never be too thin, too rich, or have too low a cholesterol level, right? Well, maybe. Several studies, some of them recent, have suggested a link between hemorrhagic stroke and serum cholesterol levels below 160 mg/dl. Hemorrhagic stroke occurs when a vessel in the brain ruptures due to a weakening in the wall (often unrelated to atherosclerosis). It is the most lethal type of stroke and, when its victims survive, they are often the most severely debilitated.

Unfortunately, in order to get maximum protection against atherosclerosis (and thus death from heart disease and atherosclerotic stroke) it is desirable to reduce serum cholesterol to below 160 mg/dl. It would thus appear that sometimes you can't win for losing. A recent study conducted by the Japanese documents that a Western-style diet (high in saturated fat) is markedly protective against death from hemorrhagic stroke. But before those of you who are watching your cholesterol go and pig out on pork rinds and lard, it is important to note that these findings are controversial and that another factor may be at work. In the April 6 issue of the *New England Journal of Medicine*, scientists re-evaluating the Multiple Risk Factor Intervention data collected in 1982 found a sixfold greater incidence of death from cerebral hemorrhage in middle-aged American men with total serum cholesterol levels lower than 160 mg/dl and *elevated blood pressure above 90 mmHg diastolic*. The relationship between low serum cholesterol and cerebral hemorrhage *was not present* for men with normal blood pressure or cholesterol above 160 mg/dl.

So what are the take home messages in all of this? First, controlling cholesterol without controlling hypertension may be a recipe for disaster. It is important to keep hypertension in check as well as serum cholesterol. Second, very low cholesterol (below 150 mg/dl) are probably not a good idea and are almost certainly unnecessary to prevent atherosclerotic disease.

So, no pork rinds . . . and hold the salt!

* * * * *

Grinding THEM Down

by H. Keith Henson

Mike Darwin has often used the phrase "grinding us down" to describe the actions of the various governmental authorities who (for as yet unknown reasons) have taken a dislike to cryonics.

This grinding business works both ways. Our adversarial contacts with local Registrars in California over Death Certificates and Disposition Of Human Remains forms made me *quite* curious as to the route by which the Office of the State Registrar had formulated its policies.

Thus, I made a nuisance of myself to David Mitchell, who is the Chief of the Office of the State Registrar (which is part of the Department of Health Services) by writing five letters and making 15-20 phone calls over a period of several months, invoking the California public disclosure laws to find out what they had in their files about cryonics. The legislature passed these laws to even up the battle a little between the citizens and the bureaucracy.

I started last August asking for copies of the files they had on on cryonics. My

first request to David Mitchell was rewarded with a few pages which included a copy of the April, 1980 *Vital Statistics Newsletter* and a page from the 1988 *Handbook for Local Registrars of Births and Deaths*. Both were reproduced in the September, 1988 *Cryonics*, and both turned out to be useful, but I was surprised that there wasn't more in the files.

A chance remark passed on by a reporter led me to call Mr. Mitchell and asked him about his recent correspondence between Dr. Gallagher, Riverside's local Registrar of Births and Deaths, and himself. Mr. Mitchell told me it had been overlooked, and read me his letter, which referenced Dr. Gallagher's, and I followed up with a letter requesting both (he was most reluctant to give up the Gallagher letter). These letters (printed in the October *Cryonics*) and the previous documents were part of the evidence submitted in the John Roe lawsuit.

I was now sure that more material existed, and wrote a letter asking for it under a number of possible file headings. (The problem with the law is that you almost have to know exactly what you are after to get it.)

They then admitted that there was a considerable volume of *additional* material in their files, but after the telephone admission, they stalled, using one excuse or the other for months. The final excuse was that they were in a lawsuit, which exempted them from having to comply. This was not in accord with legal precedents, and I pointed this fact out in a rather nasty letter. Finally (Feb. 8), I was told that a package of over 300 pages was ready for me. I drove to Sacramento with a check for 25 cents per page, and brought back an inch-thick stack of copies.

I am fairly sure the files I got were "sanitized," because there are lots of newspaper clippings in the last year and no memos. In the past, when cryonics made the headlines, lots of newspaper clippings were followed by a mess of memos. So another attempt to obtain more material is in the works. Still, what I got made very interesting reading, some of historical interest. There are memos and letters dating back to the late '60s and early '70s where the bureaucrats were groping for responses to transportation requests for James Bedford and the other early suspensions.

We had known for a long time that cryonics went through a serious crisis in 1980 in the aftermath of the Chatsworth disaster. How serious has only become apparent from the letters that were in the package, some of which are reproduced with this article.

In February of 1980, Merle L. Shields, who was Mr. Mitchell's predecessor, wrote to the DAs of Alameda and Orange Counties in an attempt to get them to prosecute Trans Time and Cryovita. The Board of Funeral Directors and Embalmers (under the California Department of Consumer Affairs) tried in May 1980 to enlist the Office of the Attorney General.

The letters to the local DAs did not spark investigations or prosecutions, perhaps because, as Alameda County Deputy DA Richard Michaels was quoted, "I tend to be somewhat careful when an industry seeks our assistance in legal action against someone who might be in competition with its traditional members."

Later in 1980 (July) John Gill of the Cemetary Board made the request which resulted in Attorney General's Opinion 80-710, dated Dec. 11, 1980, wherein the AG (who is now the Governor) said that while he did not think cryonics could use the Uniform Anatomical Gift Act, and that a cryonics facility was not a cemetary, he was *not* producing an opinion on the legality of cryonics. Some time after that (years?) the Department of Health Services went ahead on their own and decided to issue regulations and advised local registrars that

(text continued on page 20)



CEMETERY BOARD

1434 HOWE AVENUE, SUITE 88, SACRAMENTO, CALIFORNIA 95825
TELEPHONE: (916) 920-6078



Copy sent to Jim... 8/23 Request for Regulation

August 13, 1979

Vital Statistics Branch
Department of Health
410 N Street
Sacramento, CA 95814

Gentlemen:

"Cryonics," as we understand it, "is freezing bodies or parts thereof for future reanimation or cloning of look-alikes." It appears to be an area of potential consumer fraud and, in Northern California, may include violation of existing interment laws.

The enclosed literature, while on a Statewide basis, provides an insight to some cryonic suspension operations. There are at least two organizations of this type operating in the Berkeley area: Bay Area Cryonics Society and Trans Time. Exact locations of the "suspendees" is not known but a Northern California warehouse is indicated as a possible storage facility. Rumors are that some are stored at the Trans Time business address. Health and Safety Code Section 7054 requires that human remains be interred in a cemetery or scattered at sea in accordance with Health and Safety Code Section 7117.

A question also arises as to the information being supplied on the Permit for Disposition of Human Remains required to be filed with the County Health Office (Health and Safety Code Section 10375 et seq.)

We feel this matter warrants further investigation. All phases, however, appear to be outside the jurisdiction of this Board. We are, therefore, forwarding the information to you and hope there is some course of action you can take. If there is anything we can do to help, just contact us.

Sincerely,

J.W. Gill
JOHN W. GILL, CPA
Executive Secretary



cf
Enclosures

John Rheinheimer Dep. DA
Jan
714-834 3664

February 15, 1980

Cecil Hicks
District Attorney
County of Orange
Post Office Box 808
Santa Ana, CA 92702

Dear Mr. Hicks:

Possible violations of the Health and Safety Code relating to the disposition of human remains have been brought to our attention.

A Permit for Disposition of Human Remains was issued by the San Joaquin Local Health Department for the body of Janice D. Foote to be shipped to Cryo Vita Laboratories, 4031 North Palm #304, Fullerton. The permit and the certificate indicate this body is for scientific use. This disposition is in violation of Health and Safety Code Sections 7054 and 7153.5. There may also be other bodies stored at Cryo Vita Laboratories.

We will cooperate with you to determine the violations of State law. Please contact me at (916) 445-1719 for any additional assistance we can provide in this case.

Sincerely,

Original signed by
Merle L. Shields

Merle L. Shields, Chief
Vital Statistics Branch

Attachment

cc: L. Rex Ehling, M.D., Acting Health Officer
Orange County Health Department and
Local Registrar of Births and Deaths
Post Office Box 355
Santa Ana, CA 92702

James R. Cutright
Office of Legal Services
Department of Health Services
714 P Street
Sacramento, CA 95814

February 15, 1980

D. Lowell Jensen
District Attorney
County of Alameda
1225 Fallon Street, 9th Floor
Oakland, CA 94612

Dear Mr. Jensen:

Possible violations of the Health and Safety Code relating to the disposition of human remains have been brought to our attention.

Permits for Disposition of Human Remains were issued by the Alameda County Health Department for two bodies, for scientific use, to Trans Time Inc., 1507 63rd Street, Emeryville. This disposition is in violation of Health and Safety Code Sections 7054 and 7153.5.

Since the time these permits were filed, the body of Janice D. Foote may have been transshipped to Cryo Vita Laboratories in Fullerton. There may also be other bodies illegally stored at the Trans Time Inc. facility.

We will cooperate with you to determine the violations of State law. Please contact me at (916) 445-1719 for any additional assistance we can provide in this case.

Sincerely,

Original signed by
Merle L. Shields

Merle L. Shields, Chief
Vital Statistics Branch

Attachments: (2)

cc: Carl Smith, M.D., Health Officer
Alameda County Health Department
and Local Registrar of Births and Deaths
499 - 5th Street
Oakland, CA 94607

James R. Cutright
Office of Legal Services
Department of Health Services
714 P Street
Sacramento, CA 95814

February 21, 1980

D. Lowell Jensen
District Attorney
County of Alameda
1225 Fallon Street, 9th Floor
Oakland, CA 94612

Dear Mr. Jensen:

In my letter of February 15 I indicated that permits for disposition of human remains were issued by the Alameda County Health Department for two bodies for scientific use to Trans Time, Inc. However, both of those permits were issued by the Orange County Health Department.

I have also been informed that bodies are prepared for storage at the Cryo Vita Laboratories in Fullerton and then shipped to Trans Time, Inc. in Emeryville. Based on this information, it appears a number of bodies may be stored at the Emeryville facility in violation of Health and Safety Code Sections 7054 and 7153.5.

Again, if we can provide any assistance please call.

Sincerely,

Original signed by
Merle L. Shields

Merle L. Shields, Chief
Vital Statistics Branch

cc: Carl Smith, M.D., Health Officer
Alameda County Health Department

James R. Cutright
Office of Legal Services
Department of Health Services

State of California

Department of Consumer Affairs

Memorandum

To : JOHN PORTER, Deputy Attorney General
Office of the Attorney General
Department of Justice
350 McAllister Street, Room 6000
San Francisco, CA 94102

Date : May 12, 1980

File No.:

From : Board of Funeral Directors and Embalmers

Subject:

I would like to direct your attention to the practice of cryonics or freezing of dead human bodies which has continued to persist in California for more than a decade. The Board of Funeral Directors and Embalmers has conducted an investigation into these practices and determined that there is substantial evidence to indicate that dead human bodies are being transported and prepared by unlicensed personnel utilizing unconventional procedures. Furthermore, these remains are apparently being stored and/or disposed of in or upon unauthorized premises without proper disposition permits. Of even greater concern is the sophisticated schemes for obtaining large sums of money from survivors with the fraudulent claims that revival of these bodies in a distant future may be possible.

Enclosed is a copy of the investigative report prepared by our Southern California field representative. The two major centers of cryonics operation seem to be "Trans-Time" in Berkeley and "Cryo-Vita Labs" in Fullerton.

The Board recently held an informal hearing into the activities of a Southern California funeral director who has actively facilitated cryonics. Frightening testimony was presented concerning the crude procedures and fraudulent representations of the cryonics enthusiasts. In a letter to the Board, Dr. Maxim Persidsky, Director of the Department of Cryobiology, at the Institute of Medical Sciences in San Francisco, stated "It is my belief that the attempts to preserve corpses in anticipation of possible future revival are completely futile scientifically and totally immoral in view of anguish, false expectations and useless monetary losses by relatives of the deceased."

At the conclusion of the hearing, the Board voted unanimously to send the matter to the Attorney General in an attempt to obtain injunctive relief against the unlicensed practice of funeral directing engaged in by both "Trans-Time" in Berkeley and "Cryo-Vita Labs" in Fullerton. We fully realize that further investigation is necessary and hope to enlist the assistance of the Consumer Fraud Unit of the Attorney General's Office in this regard.

John Porter, Deputy Attorney General
Page 2
May 12, 1980

Other agencies are also interested and concerned with this problem. Mr. John Gill, Executive Secretary of the Cemetery Board, has been working with the Alameda County District Attorney's Office in an effort to obtain subpoenas to inspect the holding facilities of "Trans-Time" in Emeryville. Mr. Merle Shields, Chief of the Vital Statistics Branch, has been actively investigating the potentially fraudulent manner in which permits for disposition of human remains have been obtained. Due to various ambiguities in our respective statutes, Mr. Gill, Mr. Shields and myself have encountered a number of obstacles which make it difficult to monitor or control the cryonics operations. Therefore, I respectfully request that the Office of the Attorney General begin an investigation into these activities as soon as possible and institute whatever actions are deemed appropriate. My staff and I are most anxious to assist in any way possible and our liaison, Deputy Attorney General Joel Primes, is also familiar with the problem and available to assist in this project.

Thank you in advance for any attention given to this request.



KATHLEEN CALLANAN
Executive Secretary

KC:nw

Enclosure

cc: Joel Primes,
Deputy Attorney General -Sacramento
Robert Hatton,
Deputy Attorney General -Sacramento ✓
John Gill, Executive Secretary
Cemetery Board
Merle Shields, Chief,
Vital Statistics Branch
John Gallagher,
Southern California Field Representative
All Board Members

State of California

Department of Consumer Affairs

Memorandum

To : Jack Winkler
Assistant Attorney General
Opinions Unit
555 Capitol Mall
Sacramento, CA 95814

Date : July 15, 1980

File No.:

From : Cemetery Board, 1434 Howe Avenue, Suite 88, Sacramento, CA 95825.
(916) 920-6078.

Subject: Request for Opinion regarding Cryonic Suspension.

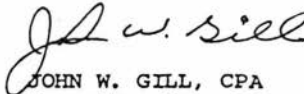
For the past two years, the Board has become increasingly concerned about the cryonics industry in California. Cryonics is the freezing of the dead until, theoretically, they can be thawed and brought back to good health. The freezing process is carried out by using liquid nitrogen and keeping the body at -196° Centigrade. The minimum cost for this indefinite storage is \$60,000. The firm of Trans Time, Inc. is operating under the Uniform Anatomical Gift Act.

The Board requests your formal opinion regarding the following questions:

1. Does cryonic suspension meet the requirements of the Uniform Anatomical Gift Act (Health and Safety Code Section 7150 et seq.)?
2. Does the holding of human bodies in cryonic suspension constitute a cemetery as defined in either 7003 or 8100 of the Health and Safety Code?

For your information and consideration, we are enclosing a copy of the Cemetery Act. The definitions found in Division 7, Part 1, Chapter 1, of the Health and Safety Code would be of interest in researching for this opinion.

Please have the Deputy assigned to this matter contact this office for further information on cryonic suspension.


JOHN W. GILL, CPA
Executive Secretary

JWG:pt
Encl.

RECEIVED

JUL 30 1980
DEPT. OF HEALTH SERVICES
LEGAL SERVICES

RECEIVED
JUL 17 1980
OPINION UNIT

Chatsworth:

From about the late 1960s to the late 1970s, the now-defunct *Cryonics Society of California* maintained a cryonic storage facility in a Chatsworth, CA cemetery. It would take a book to untangle the events that occurred, but through a combination of incompetence and fraud, all those patients thawed out, unknown to all but a very few people. Eventually, some concerned relatives found out, and a lawsuit was filed. The lawsuit ran from about 1976 to 1980, and harmed both the innocent and the guilty. In the end, the jury agreed that it was fraud, and the law went for the deep pockets. The publicity resulting from this shameful incident almost completely paralyzed membership growth in cryonics for five years and caused a number of attempts by agencies in California to ban cryonics. A good many of Alcor's policies have derived directly from the mistakes that resulted in this tragedy. The best available summary is an article by Art Quaife in the October, 1979 issue of the newsletter *The Cryonicist*, copies of which are available from Alcor upon request.

cryonics was illegal, and that they should issue no VS-9 permits. or Death Certificates.

I am fairly sure that a lot of recent material has been left out of what I was given, but the stuff I got provides many leads to follow, particularly into the files of the Cemetery Board. The public disclosure laws (which are on the books of many states, but almost unknown to their citizens) provide a useful entry into the labyrinth of bureaucratic decision-making. It often takes dogged persistence to squeeze the contents of his files out of a bureaucrat, but cryonics has a lot to do with persistence. Stay tuned while we grind on them some more.

* * * * *



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PLEASE
DON'T TELL ME
THERE'S NO
NEED TO
WORRY~

IT'S
THE ONLY
THING
I'M ANY
GOOD AT.

Ahnigh Brilliant

THIS IS ONLY ONE OF HUNDREDS OF DIFFERENT POT-SHOT CARDS. IF YOU CAN'T FIND MORE AT YOUR LOCAL STORE, WE'LL SEND YOU A STARTER SET AND CATALOGUE FOR \$2.00. WRITE TO BRILLIANT ENTERPRISES, 117 W. VALERIO ST. SANTA BARBARA, CALIFORNIA 93101

A SUSPENSION IN DETROIT

by Mike Darwin

photos by Jim and Cindy Nalley*, and Elleda Wilson

Introduction

On January 8th, a few weeks before I was to leave for Europe, an information request came into Alcor from a Detroit-area physician who informed us that he was terminally ill with cancer and giving serious thought to arranging for cryonic suspension. Mike Perry took the call, and aided by a handy copy of *The Cryobiological Case For Cryonics*, he did a fine job of fielding a number of tough questions from the physician (whose name was Eugene Nalley*) on the cryobiology of brains. A few days later Dr. Nalley called again to say that he had not received some follow-up information which he had requested from us. I called him back, apologized for the delay and ended up speaking to him at some length. It became apparent from our conversation that Dr. Nalley was anything but uninformed about cryonics and in fact had a long-standing interest in it and had been in touch with other cryonics groups.

He had given some consideration to making suspension arrangements, but was very up-front in stating that he just wasn't satisfied with what he had seen to date. At the time we spoke, he said he felt he had about six months to a year to go, depending upon how he responded to radiation therapy for his esophageal malignancy.

A few days later he received the material I sent and phoned for additional details. We spent several hours on the phone together and at that point it became apparent to me that his situation was a lot graver than he thought. I got some detailed medical history from him and ran it past a couple of Alcor members who are physicians. Their verdict was essentially the same as mine: three to four months at best.

A few days after that call my beeper went off. It was Dr. Nalley. He called to say that he was bleeding esophageally and felt he was deteriorating at a much faster pace than he had anticipated. His energy level was also low and he had decided that he wanted to put his youngest son, Jim Nalley, in charge of facilitating his cryonics arrangements. Would I talk to Jim, he wanted to know? I made the call to Jim from an auto store parking lot near an exit from the 91 Freeway.

I ended up speaking not just to Jim, but also to his wife Cindy. The starting conditions of the call were not good from any standpoint. I was at a pay phone in a noisy parking lot, there were two somewhat nervous (and I believe more than a little skeptical and suspicious) people 2,000 miles away in Detroit, and it was necessary for me to be on speaker phone on their end of the call. Their attitude was completely understandable considering the circumstances.

At that point I considered this just another one of those awful, longshot, last-minute calls that never materialize into a suspension. Here I was, talking to two people who were confronted with the fact that someone they loved very much was dying, and in addition to the usual stress of such situation there was now the issue of cryonics to consider.

As Jim and Cindy can now attest, talking with Mike Darwin about suspending (or facilitating the suspension) of a relative is not for the faint of heart. I graduated

* At the request of the family, the names used here are pseudonyms.

from the Curtis Henderson school of cryonics salesmanship, which consists of giving the person a large, undiluted dose of ruthless honesty followed by a number of worst case scenarios and harsh disclaimers to be chased with a tiny drop of optimism. The first thing I told Jim and Cindy after laying out the basics was: "Your father/father-in-law sounds very weak to me. From his description of his condition I think he has greatly overestimated the remaining time he has and unless he responds to treatment dramatically (which in my personal opinion is unlikely) he is going to be unable to make these arrangements himself. In order for him to have any chance of putting cryonics arrangements in place it is going to take every bit of courage and stamina you can summon. This may well be the most difficult and challenging thing you have ever undertaken. If, when you understand what is going to be involved you cannot manage it, then tell me *immediately* and save us both a lot of grief, expense and lost time."

I think this soliloquy impressed Jim and Cindy. I think the stream of details and information I supplied and the ready answers to their decidedly practical questions also helped. By the time that call was over, it was my impression that Jim and Cindy were "on the team".

A Trip To California

A lot had to be done. A huge stack of Alcor paperwork had to be filled out, funding had to be arranged and, most importantly, Jim and Dr. Nalley had to come and see the Alcor facility. We wanted to be very sure that they knew what they were getting into. We had already briefed them on all the "bad" things about Alcor: the litigation with the DHS, the Dick Jones case, the Dora Kent case. Now they needed to see for themselves what was available and meet a broader cross-section of Alcor's management.

The latter was especially important because I would be leaving for Europe in a few weeks. It was thus critical that the rapport we had built be transferred to someone else at Alcor so that communication would remain good and details such as hospital cooperation and shipment of the Alcor Remote Standby Kit could be worked out.

This was not an easy thing for me to do. Dr. Nalley and I had built a relationship which involved a certain amount of bonding. He trusted me, and I cared a great deal about him. He was a good, sincere, and intelligent man who obviously wanted to stay alive very much. I admire that. What I admired even more was his courage. Just three months earlier he had lost his wife (whom I could tell he dearly loved) to a long battle with cancer. He had been unsuccessful in persuading her to opt for suspension. He was 71 years old, in failing health, and none of his children had expressed much interest in cryonics either. As he said to me during one of those first phone calls, "It looks like I am going to be going into the future *alone*, but I still want to do it. I just don't see any other course of action that makes any sense at all." Spoken like a true cryonicist.

Setting Up

Jerry Leaf agreed to take over for me as the "primary" and on Friday, February 3rd, Jim and Dr. Nalley flew out to Southern California to look things over and meet with Jerry and me. Dr. Nalley was weak enough by this time that he needed a wheelchair to be taken through the facility (although he could stand and walk short distances). As soon as I saw him I revised his estimated survival time downward considerably. He had lost over 60 pounds and was markedly emaciated.

Jim and Dr. Nalley were satisfied (perhaps even impressed) with what they saw at

Alcor, they had completed the paperwork sent to them a few days before (breaking the record formerly held by Dave Pizer for fastest Alcor sign-up) and Dr. Nalley was issued a bracelet and suspension coverage at the end of the tour. They flew out of Ontario Airport and back to Detroit the next day. I left for Europe the following Tuesday.

While I was in Europe, a constant worry was that Dr. Nalley would not survive long enough for me to get back. I had promised him that I would cut short my trip to come back at a moment's notice, and he promised me he would try to hang on till I got back.

He kept his promise, so fortunately I didn't have to keep mine. I had been back only a few days when the call came in. Dr. Nalley's quality of life was very poor. He had not responded to radiation therapy nor had he gained any weight after a feeding gastrostomy (opening made through the stomach and abdominal walls to facilitate tube feeding) had been made and tube feeding started. His weight was down to 126 pounds from a pre-illness average of 250. He was bedfast, in considerable discomfort, and "wanted to get it over with." In conjunction with his physician, his hospice nurse, and his children he had decided to refuse further tube feeding and go ischemic. We would be called to fly out and stand by when his condition warranted it.

While I was in Europe, Jerry Leaf and Jim Nalley had done a magnificent job of planning. An apartment had been rented in Ann Arbor, in Washentaw County, and Dr. Nalley was to be moved there when it became apparent that he would require nursing care and was in imminent danger of death. This was done because Washentaw County has an excellent hospice program and allows the hospice Registered Nurse to pronounce death in the home without the physical presence of the attending physician being required at the moment of death. A hospice service with 24-nursing personnel was selected, the arrangements were cleared with the local coroner's office, and a cooperating mortuary with a good-sized prep room was located a few blocks away.

Another important contribution to readiness was made by Alcor member Dave Pizer, of Phoenix, Arizona. One of the things which the previous few suspensions had made obvious was the inefficiency of ice bags as a heat exchange medium. The plastic bags do a nice job of containing the ice, but they also act to dramatically decrease its heat removal capability. Not only does the plastic act as an insulating layer, it prevents the ice-cold water generated from the melting ice from flowing over the patient and carrying away heat. What is ideally needed is an ice slush bath, something that would simulate cold-water drowning, where very high rates of heat removal are known to be both possible and cerebroprotective. Ice in plastic bags simply cannot deliver the kind of heat removing capacity that ice in direct contact with the patient can or that an ice water bath can deliver.

The Pizer Tank

The problem with using such a "direct contact" scheme or an ice water bath is obvious: the mess. The only advantage to ice bags is that they keep water and ice off the floor (with varying degrees of success). What would be needed if we were to use a direct contact approach would be some kind of tub or tank which the patient could be placed in. Additional requirements would be that such a tank would have to be affordable, lightweight and above all *portable*.

This is where Dave Pizer entered the picture. Among other businesses, Dave and his wife Trudy own and operate a chain of auto upholstery shops in Phoenix. Dave has done a tremendous amount to help Alcor in the past both in terms of time and money, and he had previously volunteered to do any custom upholstery we needed. It didn't seem like a

service Alcor was likely to be needing at the time it was made, but then along came the idea of the "portable ice river", as Steve Harris calls it.

Dave seemed the man for the job. He didn't disappoint us. I rang him up, told him briefly what was needed, and followed up with a sketch which was sent off a day or two before I left for Europe. When I returned I learned that he had built the tank from the drawing and sent it along a week or so after I'd left.

The Pizer Tank, as it is called, is a 6'2" long (inside) framework of 1-1/4" PVC pipe to which a flexible Naugahyde tank is attached with snaps. The tank as executed by Dave is nearly ideal: it is inexpensive, breaks down into easy-to-transport components, is extremely rugged, and can hold a full load of 75 gallons of water without leaking or disintegrating.

Nimodipine

Another change in technique used in Dr. Nalley's transport was the substitution of the new calcium channel blocker nimodipine for Verapamil, which we have previously used. Nimodipine has been shown to be far more effective in a variety of animal models in protecting against reperfusion injury following extended periods of cerebral ischemia. One investigator has recovered pig-tailed monkeys from up to 17 minutes of total cerebral ischemia using nimodipine administered starting five minutes after the animals were resuscitated. The use of Nimodipine in cryonic suspension patients was not straightforward. It took several weeks of on-again, off-again effort just to develop a vehicle solution that the drug would dissolve in. Nimodipine is also very photosensitive and degrades rapidly when exposed to white light. Thus it must be packaged and delivered in photosafe vials and administration equipment. All of these problems were overcome: the last of them only a few days before Jerry and I left for Detroit.

Stand-By Starts

On March 11th, Jim called and informed us that his father was starting to slip badly and had requested that we come. Jerry flew out the following morning. After some consultation it was decided that I should keep my speaking engagement at the California Coroner's Convention the morning of the 15th and then fly directly from Sacramento to Detroit. Jerry Leaf arrived on the morning of the 12th.

If Dr. Nalley had proven too optimistic about how long he had to live, he proved equally pessimistic about quickly he would "die". Death from dehydration is a slow, unpleasant process.



Jim and Cindy Nalley

The Nalley family: (L to R) Ray, Jim, Gene and Diane.

The only bright spot was that Dr. Nalley was surrounded day and night by all four of his biological children (and visited frequently by his step-children) throughout the ordeal. Jerry and I have never observed such love and care on the part of *all* the children in a family. They were there with him through almost every minute of what was, to put it mildly, a painful and stressful experience.

Jerry and I spent six days with the Nalley family in very close quarters. It was an enriching experience for us and one we are very grateful to have had. They are extraordinary people, each and every one of them. Just how extraordinary we were soon to find out.



Jerry Leaf supervises Steve Bridge as he draws up transport medications a few hours before Dr. Nalley experienced cardiac arrest.

Ischemic Coma

On March 19th, it became apparent to everyone that Dr. Nalley was in the final 48 hours of his illness. He was severely dehydrated and had an overlying case of pneumonia. Steve Bridge, Alcor's Midwest Coordinator, was summoned from Indianapolis to serve as an extra hand. A few weeks earlier Steve had flown up to Detroit to meet with the Nalley family and to act as our eyes and ears in checking out the mortuary and the Remote Standby kit to make sure that everything was in order.

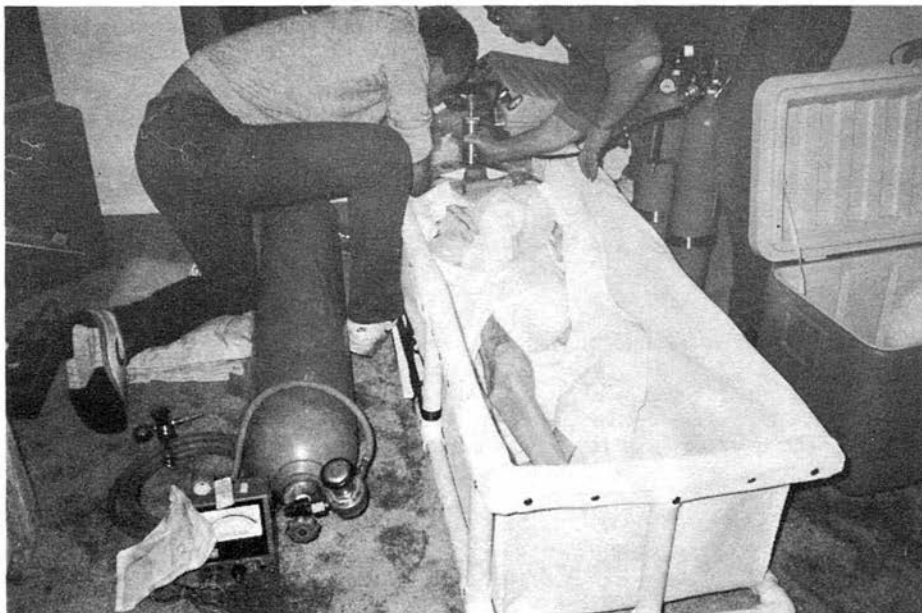
On the night of the 20th, Dr. Nalley's breathing became very labored and it was apparent that he was at most a few hours from cardiac arrest. We spent a rocky night, sleeping fitfully with several false alarms. Around 8:00 AM CST on the morning of the 21st, the hospice nurse notified us that he was frankly agonal and that he would arrest at any minute. We got out of bed and began readying the resuscitation equipment and medications. We did not have long to wait this time. At 8:19 AM Dr. Nalley experienced respiratory and cardiac arrest and was pronounced legally dead by the attending nurse. At 8:25 AM CPR was begun by Jim, followed by support with a Brunswick heart-lung

resuscitator.

Transport

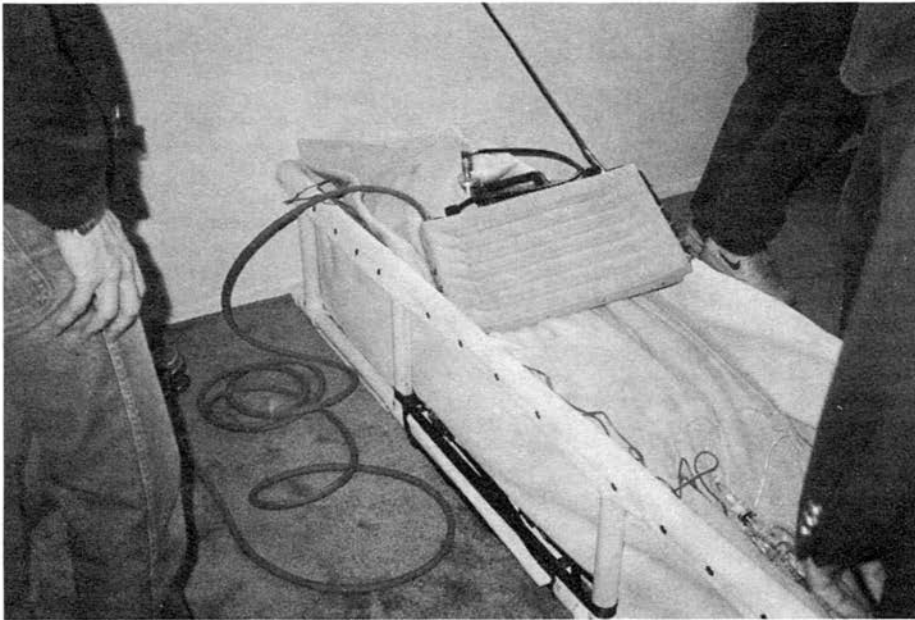
Then the first, and thankfully the last, major problem occurred: We had requested that a "heparin-loc" intravenous catheter be put in place in Dr. Nalley while he was still alive. The hospice nurse was not comfortable with this request and gently refused it. Even though Dr. Nalley had excellent peripheral veins we were concerned about our ability to insert an IV catheter if he was badly dehydrated. As it turned out, our worries were justified. Despite vigorous efforts by myself, Jerry Leaf and Cindy Nalley (who is an expert at sticking small vessels in dehydrated animals: she is a veterinary medical technician) we could not get a catheter in. After a number of frustrating minutes of failure we decided to move Dr. Nalley from the back bedroom where he had arrested into the living room where we had our Pizer tank set up and considerably more room to work. Once he was positioned in the Pizer tank we managed to do a cut-down and start our IV medications at 8:57 AM. Luckily, Cindy had her animal emergency kit in her car and we were able to fashion a makeshift cut-down tray on the scene. We have since modified the Alcor medications kit such that it contains a field cut-down kit so that we are *never* in that situation again.

Once he was in the Pizer tank, Dr. Nalley began to cool rapidly. In fact, his rate of temperature descent during external cooling was roughly twice that of the last patient Alcor suspended under similar conditions (Alice Black, see *Cryonics* 9(11) November 1989). By 11:30 AM his esophageal temperature was down to 24.5°C from a post-arrest temperature of 39.5°C at 8:55 AM. This works out to an average cooling rate of 6.4°C per hour. With further refinements such as the use of a battery-operated pump and a sump reservoir of ice



Jim and Cindy Nalley

Shortly after cardiac arrest Dr. Nalley was placed in the Pizer Tank on heart-lung resuscitator (HLR) support and external cooling with a crushed ice bath was begun. Dr. Nalley's son Gene stabilizes the plunger on the HLR as Mike Darwin re-adjusts the securing strap.



Jim and Cindy Nalley

In order to avoid splashes from the ice bath wetting the HLR backboard (which contains the pneumatic computer and monitoring gauges), a "dummy" backboard was used under the patient and the backboard containing the pneumatic "driver" was placed atop the patient where it would remain dry.



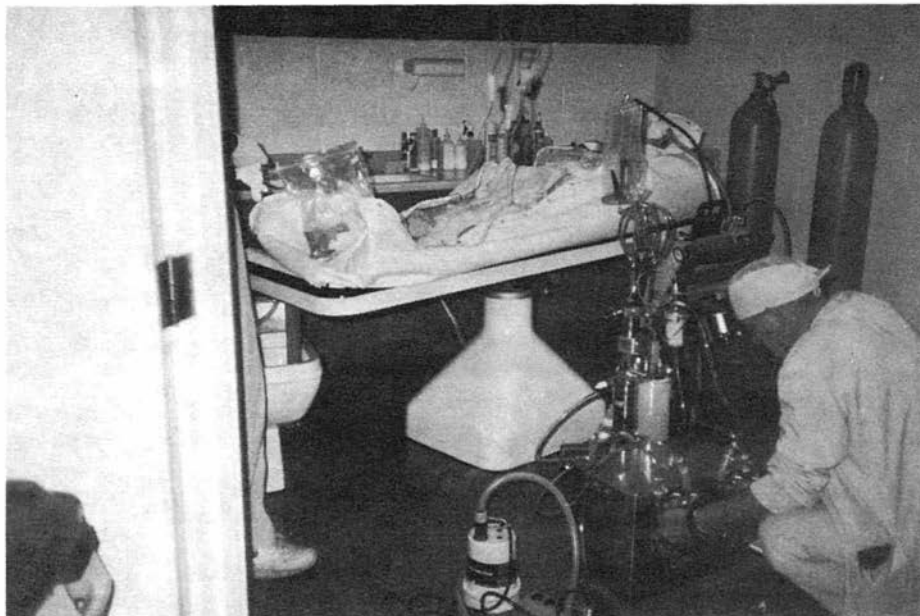
Jim and Cindy Nalley

Since the stairway leading out of the building would not accommodate the Pizer Tank, the tank and patient are lifted through a window of the hospice apartment.



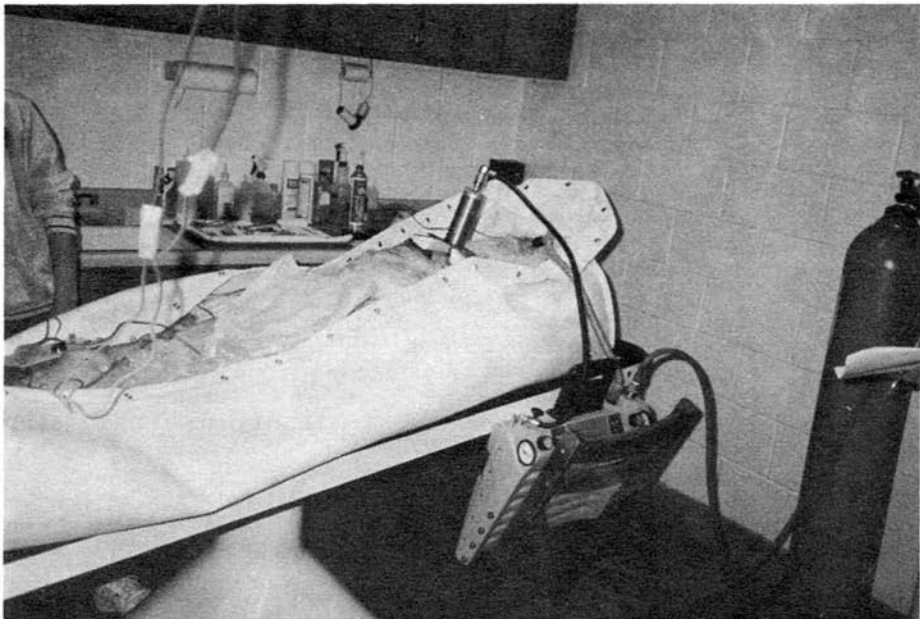
Jim and Cindy Nalley

Jerry Leaf prepares the field perfusion circuit in a mortuary near the hospice in Ann Arbor, Michigan. The dual-headed blood pump is in the foreground, 0.2 micron sterilizing filter is in Jerry's left hand, the oxygenator is in the background obscured from view by the sterile-wrapped A-V loop (used to connect the patient to the blood pump). The bottles contain perfusate (TPS).



Jim and Cindy Nalley

Overview of extracorporeal circuit and patient in the prep room of the mortuary.



Once in the mortuary, the rigid frame of the Pizer Tank was unsnapped and the patient was transferred to the embalming table for blood substitution with tissue preservative solution (TPS).

water we think we can increase the rate of core cooling using such a bath to 10°C to 12°C per hour in selected patients (i.e., those who are thin or wasted secondary to disease and who thus have little insulating fat and low body mass).

Another complicating factor which was beyond our control was Dr. Nalley's low blood volume due to dehydration. Even after administering nearly 1,500 cc of various transport medications he was still severely dehydrated and probably had an even lower than the average (inadequate) blood pressure while on CPR support. The ability to rapidly cool such patients thus becomes paramount since CPR is probably doing little to meet their metabolic needs and is probably useful primarily to circulate transport medications and prevent blood from clotting.

By 11:33 AM blood washout and perfusion of the tissue preservative solution (TPS) had begun. Perfusion was effective at rapidly reducing his core temperature; dropping it from 23.5°C to 3.5°C in 45 minutes.

Despite the probable poor cardiac output from the HLR, an arterial pulse with pressure was noted during cannulation and the first venous pH was 7.16, indicating that the THAM buffer had been circulated.

Blood washout went very well. At first, we were apprehensive that we had a serious problem, since when Jerry Leaf opened Dr. Nalley's femoral artery it was observed to be obstructed by a clot. We were immediately concerned that he might have clotted systemically. Fortunately, this was not the case and the clot in the femoral artery was the only one noted at any time during blood washout or subsequent cryoprotective perfusion. It had a "retracted" appearance indicating that it had probably occurred during the agonal period when his peripheral circulation was being shut down to conserve

blood flow to the brain and core organs.

Blood washout was terminated at 11:58 AM at a venous pH of 7.80. This is the first time we've ever reached such a desirably high terminal pH and this was achieved, we believe, as a result of the addition of a modest amount of potassium phosphate to the perfusate to augment the organic HEPES buffer which we have used alone in the past.

We also think it possible that the addition of phosphate and ribose to the flush perfusate resulted in better metabolic support to the muscles (and presumably neurons and other body cells) during the subsequent cold ischemia of air transport. When the patient arrived at the facility rigor mortis was present only in the leg that had been unperfused as a result of being used for the femoral cut-down (since Dr. Nalley had elected for neurosuspension, no effort was made to perfuse the limb supplied by vessels used to carry out the blood washout). It is not possible to be certain that the absence of rigor was a result of these changes in perfusate composition, since the use of the Pizer tank almost certainly resulted in substantial protection of muscle energy reserves by facilitating more rapid cooling than has been achievable in the past.

Another change in procedure was the use of 20 liters of Dextran 40-containing perfusate for initial washout, which was then "chased" with 10 liters of base perfusate in which hydroxyethyl starch (HES) was substituted as the colloid. Our experience with two previous patients had indicated that Dextran 40-containing flush solutions resulted in more complete blood washout and considerably less cold agglutination than we have previously observed. Unfortunately, Dextran 40 is undesirable to use for cryoprotective perfusion because it tends to leak from the capillary bed and it is somewhat toxic to the endothelial cells which line the capillaries. This latter effect is a consideration of some import when the exposure time of the capillaries to the agent will be many hours, as it is during air transport of patients like Dr. Nalley. It was for this reason that its concentration was greatly reduced by flushing the circulatory system with 10 liters of base perfusate containing HES.

From the beginning of the transport procedure, continuing through blood washout and preparation for shipping, Dr. Nalley's children, Jim, Gene Jr., Ray, and Diane were present and assisted every step of the way. Jim started manual CPR after legal death was pronounced until we could couple the patient to the heart-lung resuscitator. CPR was continued while transporting Dr. Nalley to the mortuary and setting up the circuit for blood washout. Cindy scrubbed in and assisted Jerry and me with the cutdown and blood washout.

Following the completion of blood washout, Dr. Nalley was prepared for air shipment by being placed in an insulated chest and completely packed in ice in Zip-Loc bags. We were fortunate that blood washout was completed in time to catch a direct flight leaving Detroit International Airport at around 3:00 PM and arriving at Los Angeles International at about 7:00 PM. Jim and Cindy had decided to accompany Dr. Nalley on the flight and, emotional state permitting, participate in the rest of the cryonic suspension procedure.

All of us at Alcor had real misgivings about the latter idea, but we also felt very strongly that it was important for purposes of both reassurance and accountability to let the family be present if they could handle it. As it turned out, not only did Jim and Cindy hold up well emotionally, they were two of the most useful people around.

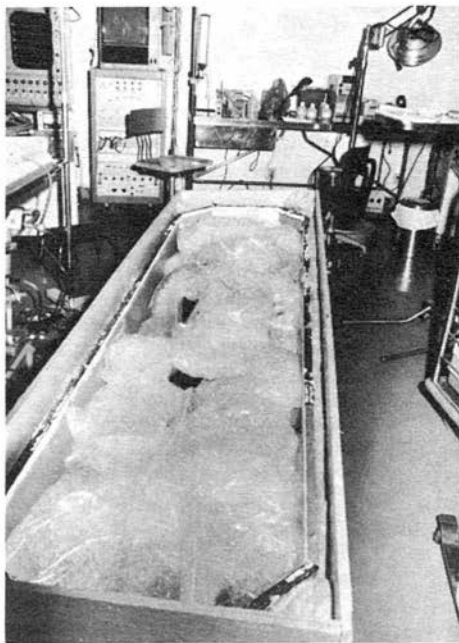
Cryoprotective Perfusion

Dr. Nalley arrived at the facility at about 10:00 PM and by 10:30 PM his rectal



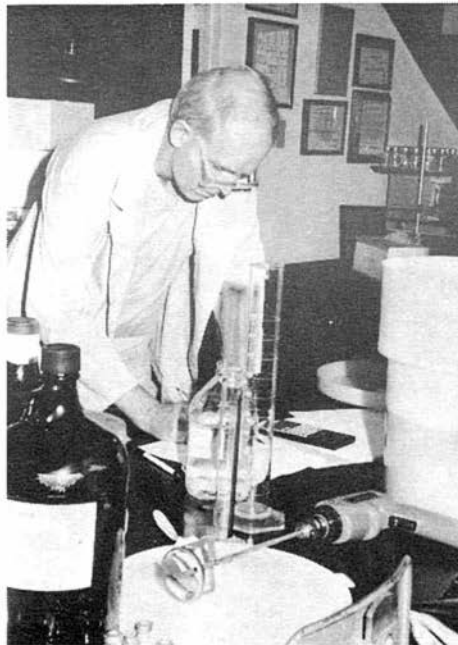
Elliada Wilson

Keith Henson records Dr. Nalley's arrival temperature as it is measured by Mike Darwin.



Elliada Wilson

Immediately after arrival in the facility the transport container holding Dr. Nalley was opened in preparation for his transfer to the operating table. He was packed in ice from head to toe for air shipment from Detroit to Riverside.



Elliada Wilson

Alcor biochemist Hugh Hixon completes final calculations on glycerol concentration near the end of perfusate preparation.



Elliada Wilson

Dr. Nalley is positioned on the operating table.

temperature had been measured at 2.0°C. Surgery was begun at 1:11 AM on the morning of the 22nd and perfusion was begun at 3:22 AM.

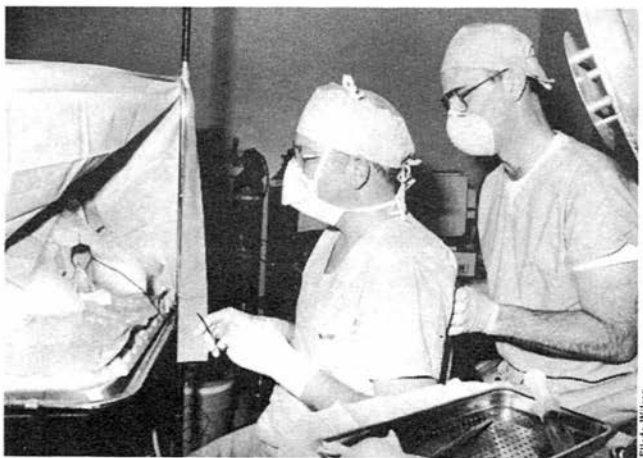
Blood washout of the brain, as evaluated through a 10 mm burr hole over the parietal cortex, was excellent. The pial vessels on the cerebral cortex surface were free of blood, as were the tissues of the chest and head which were incised to gain access for vascular cannulation and opening of the burr hole (hematocrit at the end of blood washout was unreadable). The use of Dextran-40-containing flush seemed to provide better blood washout than has been observed with the use of HES flushes, extending the experience we have had with the last few suspension patients treated under similar circumstances.

The burr hole was opened prior to cryoprotective perfusion and the cerebral cortex was observed to be free of both blood and edema. Cryoprotective perfusion with glycerol in our sucrose-HEPES (SHP-1) perfusate began uneventfully. Approximately 40 minutes after the start of glycerol perfusion, a modest increase in brain volume was observed indicative of developing cerebral edema. We had anticipated cerebral edema secondary to ischemic injury as a potential problem because of the long agonal period and poor circulation during CPR. Our initial strategy in controlling cerebral edema consisted of increasing the slope of the glycerolization ramp from a rate of approximately 20 mM per minute to 40 mM/min. This was effective for awhile, but it soon became necessary to switch from continuous perfusion to pulsatile flow (with a ramp rate around 25 mM/min.) in order to control edema.

Pulsatile flow was not effective in reducing the degree of edema, but it did stop its progression. The surface of the cerebral cortex was thus bulging into the burr hole only about 1-2 mm at the conclusion of perfusion.



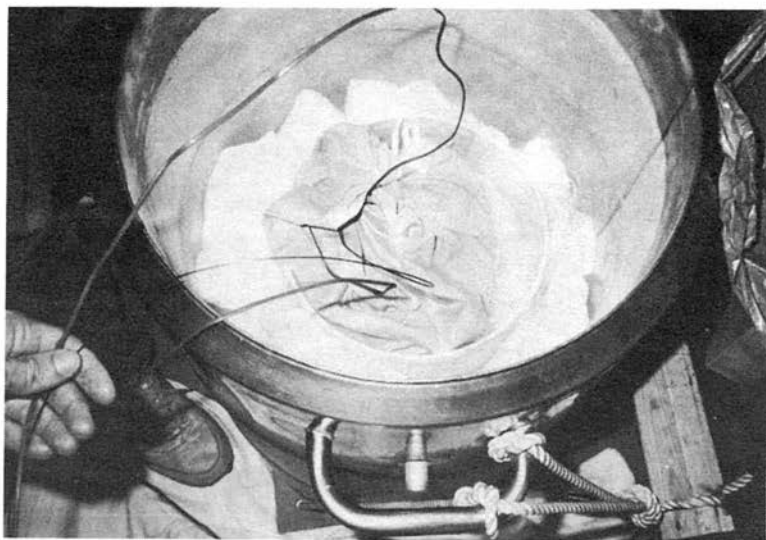
Final preparations to the heart-lung machine are made prior to the start of perfusion.



Jim Nalley supports Jerry Leaf's back as he prepares to open the dura mater covering the patient's brain.



Cindy Nalley cleans up the instruments after perfusion, with some assistance from Alcor Northern California (ANC) volunteer Naomi Reynolds.



Neurocan containing Dr. Nalley, nested inside an MVE TA-60 cryogenic dewar. The patient is in the cloth bag with thermocouple wires running into it in the center of the photo. The space between the neurocan and the patient is packed with dacron wool and the space between the neurocan and the TA-60 is filled with dry ice to maintain the patient's temperature at -79°C .

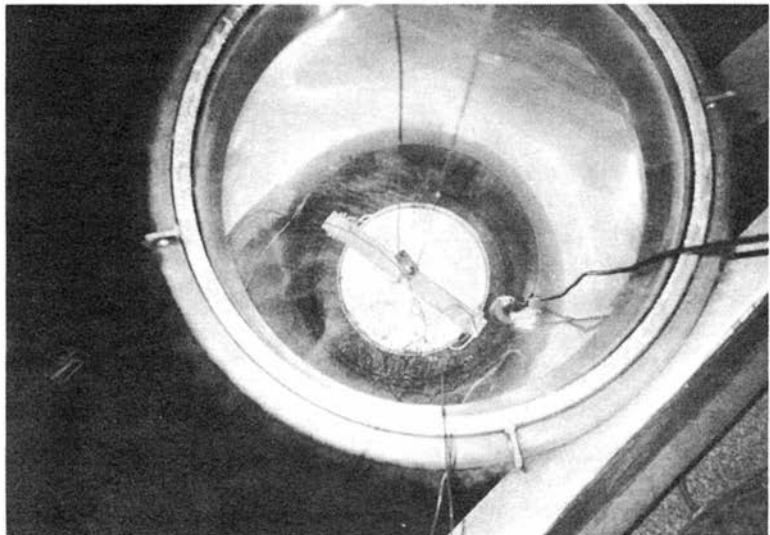


Jim and Cindy Nalley

The patient, inside the TA-60, is lowered by a hoist into a dual patient whole body cryogenic dewar. This "nested dewar" cooling scheme allows for very slow descent to liquid nitrogen temperature with minimal differential between surface and core temperatures: a cooling strategy designed to minimize tissue fracturing

Checking For Flow

Since we have no way of directly measuring intracranial pressure or performing brain perfusate flow studies, we were very anxious to know if we were in fact perfusing the brain, or if flow was shunted to bone, muscle, and other supportive tissues. To help resolve this question (this is not the first time we've been confronted with cerebral edema during cryoprotective perfusion) a bolus of 750 mg of fluoroescien-labeled dextran 70 was given into the arterial line. Immediately before the fluoroescien-labeled dextran was given the lights in the operating room were turned off and the burr hole was illuminated with UV light, thus allowing the cortical surface to be observed for the presence of the fluorescent dye.



Jim and Cindy Nalley

The TA-60 partially submerged in liquid nitrogen inside the dual patient whole body dewar.

We were not disappointed. Within seconds of administration the dye appeared in the brain pial vessels under the burr hole; one pial vein which was approximately 0.5 mm in diameter and whose path bisected the burr hole lit up like an oscilloscope tracing. Thus, we were reassured that cryoprotective perfusion was continuing in the brain despite the presence of some edema and consequent likely elevation of intracranial pressure.

Perfusion flow rates were excellent throughout perfusion with the flow rate being 1900 cc/min at the start of perfusion and 1200 cc/min near the end of perfusion (a decrease in flow rate occurs near the end of perfusion in all patients due to the increasing viscosity of the perfusate as the glycerol concentration increases).

Perfusion was terminated at 6:10 AM at a terminal glycerol concentration of 3.8 M -- very close to what we had been hoping for. Cephalic isolation was completed by 6:44 AM and cooling to dry temperature was started at 7:03 AM.

Seeing It Through

Throughout perfusion and cephalic isolation Jim and Cindy stood by and provided help where they could. After the completion of perfusion and the start of external cooling both Jim and Cindy pitched in with clean-up. Cindy's skills were particularly useful. Working almost single-handedly, she washed the surgical instruments and prepared them for resterilization -- another advantage to having a veterinary medical tech around!

Jim and Cindy remained in Southern California for the next several days -- long enough, in fact, to assist with the transfer of Dr. Nalley from the Silcool bath to the neurocan for cooling to liquid nitrogen temperature. Jim's photographs of this part of the suspension procedure are, to our knowledge, the first that have ever been made of this procedure. Jim also acted as the photographer during the transport of Dr. Nalley, and these pictures are the first ever made of an Alcor field resuscitation/blood washout.

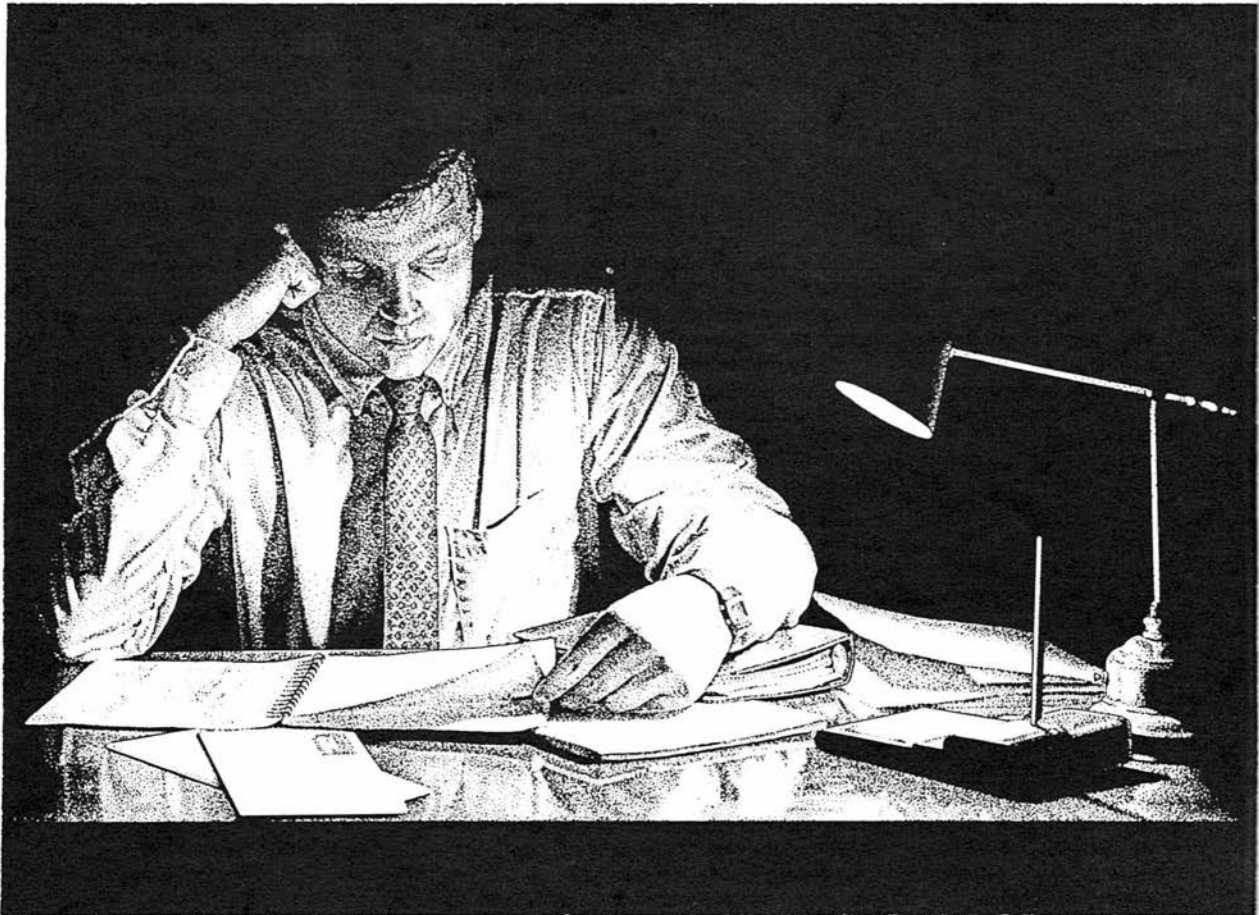
The Long Sleep

On April 4, 1989 Dr. Nalley joined the other Alcor neuropatients in the cephalarium vault. He had told me repeatedly during our phone conversations that cryonic suspension as a ticket to seeing the future had been a dream of his for 20 years. Both of us had hoped that journey could have been deferred, even if only for six months or a year, but events proved otherwise, as they often do.

Near the end, his anxieties were only that he get suspended under the best conditions available. I believe that cryonics provided a substantial element of hope, although it was clear that he considered it a long shot.

My own perspective is not greatly different from his.

Good luck, Dr. Nalley. *Au revoir*, but hopefully not goodbye.



Will Cryonics Work? Examining the Probabilities

by Steven B. Harris

Introduction

The idea of cryonics has been branded "unscientific" in the past by a number of scientists who are privately religious people, and who would no doubt become highly irate if one were to attempt to smear (say) Christianity with the same label. There is considerable irony in this.

The problem is simple prejudice. There is nothing particularly epistemologically heinous about cryonics. Most scientists recognize that there are many non-testable aspects of human belief (religious and otherwise) which, precisely because they *are* untestable, are outside the purview of science. These ideas include much of what constitutes religion, philosophy, ethics, history, and art, as well as much of what goes into ordinary planning for the future. A person who had never entertained an idea that was not immediately testable (i.e., scientific) would be in a sad way indeed.

There is, of course, a very great difference between ideas that are not scientific (i.e., *non-scientific*), and ideas that are *un-scientific*. *Un-scientific* beliefs are those which can be tested, which have been tested, and which have failed the test. The idea that laetrile cures cancer, for instance, is unscientific. Many specific claims of religious faith healers have been found to be unscientific. In general, religious claims may be scientific, unscientific, or nonscientific, depending upon whether or not they are subject to scientific testing, and what the results of the tests are.

Many good scientists not only hold nonscientific religious beliefs, but also other nonscientific beliefs as well. Examples of nonreligious nonscientific claims (as noted already) are all claims which involve aspects of the far future. The idea that the stock market will crash in the year 2010 is a nonscientific one, for it is not testable at the present time. It might even be true -- it is just that science cannot say either way. Another example of a nonscientific claim is the idea that men will one day colonize the planet Mars. Scientists and other rational people are free to accept or reject such claims as a matter of taste.

What, then, shall we say about cryonics? Because it involves a guess about the state of science in the far future, the idea of cryonics is very similar to the idea that men will one day colonize Mars. However, because cryonics involves claims which strike deep at certain mental defenses against the idea of death harbored by many, cryonics is an idea usually rejected with an amazing amount of "scientific" rationalization by scientists who in truth have no better reason to ridicule it than the fact that they find the idea personally repugnant.

This causes curious results. It is hard to imagine a late 20th century U.S. scientist being subjected to prejudice because he (or she) believes that star travel will one day be a reality, or because he believes that Jesus was the son of God, or because he invested heavily in soybean futures -- yet these are all nontestable and nonscientific beliefs. Prejudice against a scientist who has decided to gamble upon the idea of cryonics, however, is a real possibility here and now -- especially in some scientific fields like medicine and cryobiology. The reasons for this are complicated and have been discussed before in these pages. They are very similar to religious and cultural prejudice, and involve cultural psychological fears associated with the idea of nonreligious resurrection, and (especially among women) certain fundamental fears of isolation from the community which the idea of cryonics may imply.

The bottom line, though, is that cryonics is not a fully scientific idea, even though a certain portion of its claims are testable and have indeed been found to be consistent with what is known of science in medicine, biology, physics, and other disciplines which relate to the subject. Cryonics is not unscientific, but neither is it proven. Thus, when we speak about the workability of cryonics, we are forced to speak in terms of guesses and probabilities in much the same way as when we speak of damage which may be caused by future earthquakes along the San Andreas fault.

Because cryonics involves thinking about the future, any logical way of thinking about cryonics must be in terms of probabilities. Such a probabilistic model might help to identify exactly where the difficulties lie in the potential workability of cryonics, and might therefore be useful as a way to facilitate discussion of these problems.

This essay is to formally propose that we begin this process. In order to construct a probabilistic model of the workability of cryonics, it seems fitting that we take as starting point similar speculative work in other areas of science. What follows is a preliminary attempt to do this.

The Sagan-Drake Equation

As an example and a paradigm, let us begin with a purely speculative area of science relating to a belief that is nonscientific. Namely, the problem of whether there are other intelligent beings in our galaxy which we might potentially detect using a radio telescope. What are the probabilities? In the 1970's, astronomers Carl Sagan and Frank Drake first expressed this problem as a string of independent probabilities which, when multiplied together, gave a final probability of detecting such an extraterrestrial civilization. We will not reproduce and explain the entire Sagan-Drake equation here, but we will note that it begins with the number of stars in the galaxy, and is a simple product of this number multiplied by probabilities such as; 1) the probability that a star has Earth-like planets, 2) the probability that life evolves on Earthlike planets, 3) the probability that life evolves intelligence, 4) the probability that intelligence develops radio, 5) the fraction of time an intelligent civilization generates radio broadcasts before it goes on to other communications or destroys itself, etc.

The idea that intelligence may reside upon other worlds is a nonscientific idea because it is not falsifiable at present or for the immediate future. Nevertheless, even given that limitation, the idea is still amenable to a certain amount of rational dissection. The probability number which the Sagan-Drake equation gives can be encouraging or discouraging depending upon what numbers one chooses for the various probability parameters. The equation, although providing no firm answers, does help to identify at which points the greatest uncertainties lie. It even demonstrates that the probability of detection of ETs is not too bad, even if one is conservative in many estimates of these parameters. Sagan and Drake have successfully used their equation to lobby for the building of radio telescope listening devices in the *Search for Extraterrestrial Intelligence (SETI)*.

The Warren Equation

Now we ask: might not something analogous to the Sagan-Drake equation be useful in addressing the equally speculative question of whether cryonics will work? The answer turns out to be yes. Such an equation has recently been proposed by Alcor associate member Dale Warren, Ph.D., a Caltech-educated chemical engineer now living in Illinois. Warren's recently proposed simple equation for the workability of cryonics, with a few modifications, looks like this:

$$P(t) = P_a P_b P_c P_d P_e P_f P_g P_h P_i P_j P_k P_l P_m$$

$P(t)$ is the chance that cryonics will "work" (i.e., be successful) for any given cryonaut frozen at time t . I have arbitrarily defined success as obtaining if, at any time in the future, there will exist an ageless entity who has access to at least 50% of the memories of the cryonaut, and who feels him/herself, at least initially, to have the same identity (i.e., to be substantially the same person) as the cryonaut. I have picked the value of 50% also somewhat arbitrarily as the number above which I myself will be personally satisfied with the process.

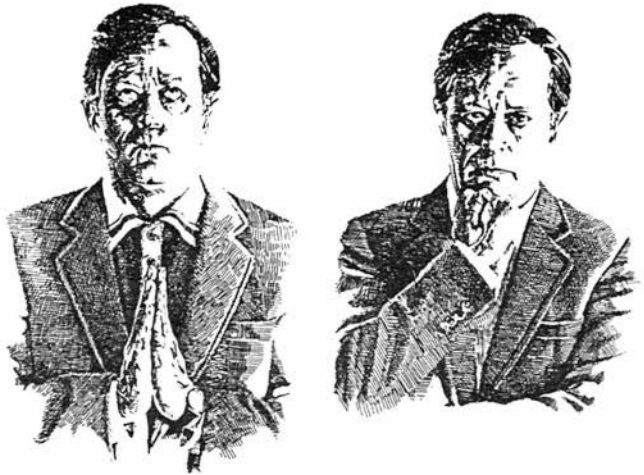
The remainder of the variables are probabilistic ones which have to do with the assumptions and events upon which the workability of cryonics depends. As the Warren equation identifies these factors, they are as follows:

P_a is the probability that the materialistic view of life is correct, and some vital essence or soul does not leave the body after metabolism stops, thus making it impossible to ever revive a frozen person. In other words, P_a is the probability that personal

identity is a purely physical-ly-defined quantity.

P_b is the probability that personal identity resides in the mechanical structure of the brain, rather than a brain electrical activity pattern which would of necessity disappear during suspension, if not long before. Thus, P_b is the probability that personal identity is a purely mechanically-defined quantity.

P_c is the probability of suffering clinical death in such a fashion as to have the physical control of one's brain be passed to cryonicists before one's mechanical identity patterns have been degraded to the point that a significant fraction of one's memories are gone. (Obviously P_c is zero if you don't get that paperwork in, folks). "Gone" here implies information being degraded below the level of quantum noise, where it is theoretically irrecoverable even with the ultimate "neural archaeology" robots.



P_d is the probability that the cryonic suspension process does not destroy so much mechanical information in the brain as to take one down below the 50% memory line. Note that this variable is not entirely independent of P_c , since the longer one goes before suspension, the better the suspension needs to be.

P_e is the probability that your brain will make it to future revival time " t_r " without a mechanical accident thawing you into unfixable neural sludge.

P_f is the probability that your cryonics organization will make it to revival time " t_r ", without suffering an internal collapse due to greed, bureaucratic incompetence, or ideological perversion.

P_g is the probability that your society will make it to time t_r intact without major social upheavals (economic collapse, nuclear war) which would force cryonics organizations out of existence even though the Earth and (ultimately society) would survive.

P_h is the probability that cryogenic storage of bodies or brains will stay continuously legal until time t_r .

P_i is the probability that full scale development of nanotechnology, complete with nanocomputers, replicators, and assemblers, is possible within the context of physical law.

P_j is the probability that, if nanotechnology can be done, mankind will do it.

P_k is the probability that mankind, your society, and your cryonics organization will survive the development of nanotechnology.

P_l is the probability that the cryonic revival process will ever be inexpensive enough to be paid for by your cryonics organization or somebody else.

P_m is the probability that society will permit the revival of cryonauts, once possessed of the ability to do so.

Values of Parameters

What are the values of each of these parameters? Each represents a probability and a guess, and the value of each can only be assigned on the basis of individual estimates and outright guesses.

In what follows, I am going to risk charges of egoism in order to give some of my personal prejudices. I am, in fact, going to go so far as to inflict upon the reader two probabilities for each variable -- one which I personally believe when I am a bit optimistic, and another which I believe when I am a bit pessimistic. (There is no use giving the values for my most pessimistic moments, for during those times I believe that several of the above parameters are zero, and life is best served by sitting in front of the television and drinking beer). Nevertheless, I include these values to give some sense of reference for the reader to compare his or her own reactions against, and I invite personal estimations of these parameters by others in future editions of *Cryonics*. It might even be interesting at some time in the future to conduct a poll to see what this equation gives when the average responses of all suspension members are put in. Although this approach might not provide any better guess about the future, at least it might show us what we collectively most fear.

My Own Guesses

To begin with, I personally believe that the mechanistic view of life is the correct one, for to me as a physician the idea that the brain is the seat of memory and intelligence best explains the results of numerous neurological syndromes. Many people entertain the popular idea that the brain, which is clearly a computer, nevertheless only functions as a sort of "smart terminal" -- a complicated transducer which allows an immaterial "soul" to jerk the muscles. Under this dualistic scenario, each human being is to be seen as what philosophers used to call a "ghost in a machine." I view this as unlikely.

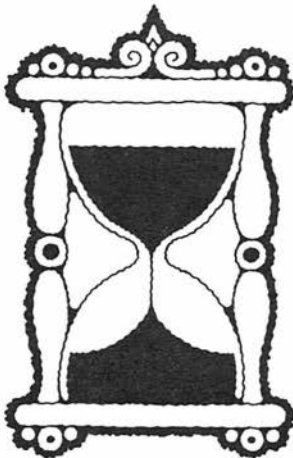
I have many reasons for this view. For one thing, if a "ghost in a machine" person is to survive death as an individual, his or her "ghost" must have a way of storing memories when the machine is cremated. Yet evidence for an "extracerebral" store of memories is hardly what we see experimentally. In split-brain experiments, for instance, where the connections of the two brain hemispheres have been cut, the two halves of the brain store memories independently of each other's knowledge, and make decisions independently of each other's knowledge. This would be impossible if they still shared a metaphysical connection (unless the "soul" can be cut into two parts, too!). Again, in the terminal portions of Alzheimer's disease (a degenerative brain disease), a patient may progress to the point of no longer recognizing his or her children, or remembering that he or she even has children, yet may still be able to carry on conversations. If personal identity is stored in a "soul," who then are we talking with in these cases of dementia, if the soul always remembers? The brain cannot be simply a communications device, for there is no way that a communications device may fail in such a way as to allow conversation but make it appear that the person on the other end has lost his memory. Thus, to me it seems very likely that the brain is exactly what it looks like -- a computer -- and I will thus set P_a , the probability that philosophical materialism is correct, at 0.99 to 0.95.



electricity through their brains, strong enough to completely override the brain's delicate internal electrical activity, and nevertheless have recovered with personality and memory (except recent memory) intact.

Thus, it seems that only the expression of personality is electrical. To use a modern analogy: if the brain is like a computer, then the continuously running computer program we call "the mind" is apparently capable of being "booted up" after a nearly complete stoppage of brain activity. But the true identity of the person lies in the computer hardware (the physical brain) that newly generates the "mind" (from a hardwired, though rewritable, program) whenever the physiologic conditions necessary for consciousness are achieved. Thus, I will set P_b (the probability that mind and memory are defined by purely mechanical structures), at 0.99 to 0.95.

The probability that one's brain will be degraded significantly before control of it passes to a cryonics organization, is very difficult to judge. For one thing, we have no idea of how much degradation is critical, for we have no absolute data on where memory is stored. Let us then take a conservative guess. If memory is stored in changes in synapse proteins, as seems most likely from current knowledge, then it appears grossly from electron microscopy studies that synapses stay intact for at least two hours after the beginning of ischemia.



If we take the two hour warm ischemic time for a standard (and the actual time may well be longer), and ask ourselves what fraction of cryonicists may we expect to suffer at least two hours of warm ischemia before being turned over to Alcor, then the fraction may be expected to be small. In fact those suffering major (> 2 hours) ischemic injury will probably be limited to persons who are allowed to suffer "brain death" on respirators, those who die suddenly without warning far from home or alone, and/or those who are deliberately autopsied at room temperature by spiteful medical examiners. A review of the circumstances surrounding the deaths of all cryonics patients ever frozen reveals many people who have suffered at least this much damage, and the numbers we've seen in the past are subject to only so much improvement at present. At best,

The probability that identity resides in the mechanical structure of the brain, rather than in a brain electrical pattern, I also believe to be high. Evidence for purely physical storage of identity in the brain comes from cases of both humans and laboratory animals who have survived complete stoppage of measurable brain electrical activity due to cold or drugs, and have subsequently recovered with no loss of long-term memory or personality. Further evidence for this point comes from the fact that many people have received heavy currents of

then, I will set P_f (probability that Alcor will get you before two hours of warm ischemia does) = 0.95, and at worst 0.75. Historically, it is encouraging to note that about 68% of all cryonics patients since 1967 that we have information about have had less than two hours of warm ischemia (and 100% since 1981). Hopefully we will continue to do this well.

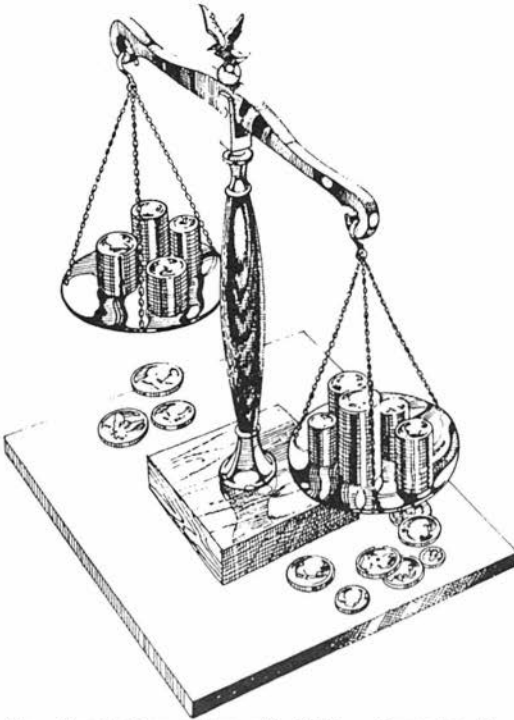
The question of how much damage the perfusion and freezing process now does is, if anything, more difficult to answer. As previously noted, studies of brains show that long periods of ischemia (two hours and more) by itself causes surprisingly little structural damage to neurons, while the damage done during blood reperfusion is massive and almost explosive. In reperfusion, neuronal membranes are holed and ripped away. Organelles are destroyed. Sad to say, reperfusion damage does indeed seem like the kind of damage that one might expect to destroy memory.

The solution might seem to be to freeze brains slowly after clinical death without attempting to perfuse at all, but unfortunately electron microscope studies of such brains show massive structural damage as well. Thus, cryonics is between a rock and a hard place until more studies are done. We know that early cryoprotectant perfusion of animals (within a few minutes after death) yields good preservation of structure. Hopefully, we will be able to develop cryoprotectant perfusion protocols which allow extension of this time interval. As to whether the present protocol works, especially with longer periods of warm ischemia (30 minutes or more), we can only guess. Thus, my probability figures are wide here, with P_d (probability that memory is preserved by present perfusion techniques after the present day average ischemic coma time) = 0.90 to 0.50.

The question of whether brains can be preserved into the future without mechanical breakdown of the freezer seems to be pretty well answered. The answer is yes, if we keep doing what we do now. All cryonics patients are presently cared for indoors in large dewars under constant surveillance, and in the history of cryonics there has yet to be a body loss or significant warmup due to mechanical failure under these conditions. Because of the long time interval between failure of dewar vacuum and ultimate warming, this seems likely to remain the case. The longest preserved cryonaut (who happens to be maintained under the above conditions) has, as of this writing, been frozen for more than 22 years. This may very well be a significant fraction of what will be the necessary time. Thus I put P_e (no significant warming due to mechanical failure) = 0.99 to 0.95. As things are presently done, any thawing in cryonics vaults in the best-run organizations will not be by accident.

The question of whether cryonics organizations will make it into the future without collapsing due to internal problems, however, is more problematic. Certainly catastrophe can happen, as witness the debacle of *Cryonic Interment, Inc.* of California, which collapsed in the mid-70's due to poor management, with the loss of at least a dozen suspendees. No matter how well run an organization, it is impossible to guarantee that it will always be so; anyone who doubts should consider what happened to NASA in the short 15 years after 1970. If cryonics is ever to work, it follows that it must become popular for a significant amount of time beforehand, since surely the utility of the technological advances which precede the first revival will be glaringly obvious for many years preceding the event. Thus, it may well be that in the inevitable "popular period" of cryonics to come, old and respectable cryonics organizations will suddenly find themselves competing on a dog-eat-dog open market with well-capitalized newcomers, in somewhat the fashion that mom and pop microcomputer makers found themselves in 1979 suddenly faced with the IBM PC. How well old cryonics organizations do at this new game will depend on many factors. However, it is not a comforting thought that the lives of people in storage at that time may well depend on the answer.

Another worry here is the possibility of corruption in cryonics organizations.



the Great Depression of 1929. Cryonics is made possible presently by the fact that liquid nitrogen is the third cheapest commercially-sold fluid on the planet (behind water and petroleum), but this happy state of affairs is the result of some pretty delicate industrial networks that might go belly up in a depressed economy or a national disaster. Thus, although the future might be infinitely rosy, cryonicists will still be out of luck if the road to how mankind arrives there is sufficiently rocky. The optimistic side to all of this is that mankind seems to be growing richer and richer yearly. Computer-robot manufacturing is already having a significant stabilizing effect on economies, and seems likely to have far more in the future. P_g (no rollercoaster economic disasters) = 0.90 to 0.70.

Aside from general collapses of the economy, there are social forces inimical to cryonics in particular to worry about. Once cryonics begins to become popular, it will come to the attention of the conservative medical establishment. That medical establishment will rightly perceive the insult implied by the fact that cryonicists see something of infinite value in what conventional medicine throws away, and disputes over perceived insults are always far more deadly than simple disputes over scientific fact. Adding to the problems which cryonics will certainly have with the A.M.A. are those which it may face from the ever-present problem of social maldistribution of resources, and the jealousy which attends that state. Cryonicists have long understood the lesson of Norman Spinrad's novel *Bug Jack Barron*; we will know that cryonics has succeeded socially when economically disadvantaged minority groups begin to complain that they do not have access to it. Ironically, however, it is at just this point that cryonics faces one of its greatest dangers. As the recent history of medicine has demonstrated, democratic societies tend to suppress that which everyone cannot have. I set P_h (cryonics will not be outlawed altogether at some point in the U.S.) = 0.90 to 0.70.

Suspension funds represent a large amount of money, and a cryonics organization with only a hundred whole body suspendees will be looking at liquid assets in excess of 10 million dollars. The relevant question here is what sort of people may be drawn to leadership in cryonics in the future solely out of profit motive. With suspension fund interest paying fat salaries to company directors, might it not be easier one day in the future to simply put off reanimation of anyone (or just most people) in an organization indefinitely while the revival problem is studied further? I will set P_f (probability that there is no significant internal cryonics organization rot) = 0.60 to 0.20.

If a cryonics organization fails to decay from within, there is always the possibility that it will be blasted from without by circumstances beyond its control. By "circumstances" here we speak not just of SWAT teams sent by the local paranoid authorities, but also of more general social upheavals that might make cryonics untenable in the face of trying to stay alive the conventional way. A nuclear war, for instance. Or even an economic collapse of the magnitude of

For cryonics to succeed, it appears necessary that devices be developed which can repair aging and freezing damage to cells from the inside out. Fortunately this (nanotechnology) seems technically possible. Self-replicating machines are possible in this universe, because we have the example of living organisms. There are no quantum problems with manipulation of atoms one at a time -- for in fact we do it with tunneling microscopes now. Also there appears no limit to how small Babbage computing engines can get until one finally runs up against molecular constraints, although this is a much less sure conclusion since there is no example from nature or engineering. Thus, I give P_i (nanotechnology is possible) = 0.98 to 0.90, only because there may be applicable laws of physics we haven't discovered (or if you prefer: formulated) yet. With a large amount of faith in the ability of man to fathom the universe on (at least) the atomic level, and a large amount of confidence in mankind's ego when it comes to doing anything that he finds it possible to do, I will set P_j (mankind can and will pursue nanotechnology until it works) = 0.99 to 0.95.

If nanotechnology is possible, it seems very probable that man will develop it eventually, for the rewards are simply too great. The big question, however, is whether mankind will survive it. Self replicating assemblers make fearsome weapons. One can think of nanotechnological weapons possibilities as subtle as bullets which make the targets into psychic slaves, or as gross as Drexler's vision of "grey goo" -- a morass of assemblers which feeds on life and thereby turns the entire biosphere of a planet into dirty tapioca pudding.

These are scary scenarios to contemplate, and our minds are not at all put at ease by looking at the universe to see how everybody else out there is doing with their own nanotech research programs -- for it all looks horribly quiet out there. In fact, it looks sort of dead. If alien civilizations develop self-replicating assemblers, according to current theory this should give them the power to manipulate the resources of entire solar systems. Such civilizations seem both likely to spread, and unlikely to waste all the free energy of high temperature sunlight that we see coming from other stars and galaxies. Yet such waste is what we do see. To borrow an analogy from Carl Sagan's last novel, the universe as we look at it does not look at all cultivated -- it looks wild. Thus the question that Enrico Fermi asked famously in regard to UFOs half a century ago: "Where is everybody?"

There are unsettling possibilities. In the late nineteen-forties, a number of science fiction stories explored the possibility that other civilizations had arisen in the universe, only to destroy themselves with atomic energy (probably the first author to use this theme was Heinlein). Now, nanotechnology presents an alternative sort of scenario. If the rise of intelligence is common in the universe, then our simple observation that most stars out there are not surrounded by Dyson spheres* or similar infrared-radiating artifacts, suggests something about nanotechnology. To wit: it is either impossible, or it is horribly dangerous. Neither of these possibilities is good news for cryonicists, which is possibly why certain nanotech-oriented futurists have lately taken to suggesting (with a peculiar fervor) that intelligent life on Earth is an anomaly in the universe. In short, according to this view the reason we don't see the galactic aliens is that there never were any, and so everything is okay after all. Thus, it is amusing to



* Dyson spheres. Artifacts made by taking apart large planets and forming a sphere made out of their materials to surround a star.

find the entire Sagan-Drake equation itself entering in at one point as one of the factors which bears upon the workability of cryonics. We never claimed this would be an easy calculation!

K. Eric Drexler in his marvelously lucid book *Engines of Creation* argues that there may be ways to minimize the danger of the development of nanotechnology. But most of the methods Drexler discusses only guard against accidental problems. Weapons are another matter. One hopes for the safety of mankind as a whole that humans have situated themselves in multiple space colonies before nanotechnology becomes commonly used. Though this sort of thing is not likely to help today's cryonicists (who by then will probably be pretty much immobilized in storage on Earth), it would perhaps be best for our species not to have all of our eggs in one basket.* In any case, I will set P_k (we will not destroy the Earth and the suspendees with nanotechnology) at 0.50 to 0.20.

If nanotechnology ever proves out, it is likely that the expense of routine robot-controlled tasks will drop to nearly zero. Energy and raw materials are plentiful in space, and self-replicating technology is nothing if not cheap. Thus, the only thing likely to have much value in a post-nanotech world is information. Archaeological and historical information about the past is likely to be particularly prized, since it will be in limited (and because of entropy, always decreasing) supply. As such, the lifetime memories of every 20th century brain (no matter from what walk of life) represent a sort of videocamera recording of a unique slice of 20th century life -- a way of life which by the era of nanotech will be completely gone. Cryonicists should be historically valuable, then -- well worth reviving from a completely economic standpoint. I set P_l (that economics will be favorable) = 0.95 to 0.85.

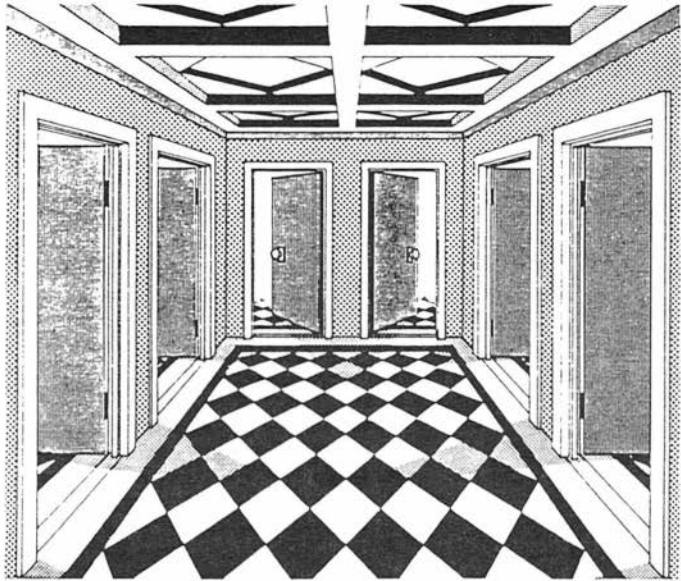
The question of whether society will choose to defer revival of cryonicists at all because of other considerations, is the final question. Besides historical considerations there will certainly be humanitarian reasons to revive cryonicists as well. The problem, though, is that there may also be humanitarian reasons against it. There will certainly be a population explosion by the time revival becomes possible. Although it seems probable that nanotechnology will help turn the materials of the solar system into space colonies and starships, it also seems true that humans are self-replicating machines, too, and may be able to keep up with anything the assemblers can do, if physical law puts limitations to interstellar growth. In particular, the speed of light itself may end up posing enough of a barrier on the expansion of mankind that immortal humans may well be forced to partially curtail their reproduction indefinitely for lack of energy and material resources. If that happens, it is not at all clear that cryonauts will be welcome, if new babies are not. At the very least, we may expect to either wake up on space colonies, or with one-way tickets already in our uncalloused hands. Or some of us may find ourselves waking to full consciousness and memory gradually over 20 years time, as our cloned bodies with hardwired (but not immediately accessible) memories are allowed

* It probably will be difficult trying to escape an assembler plague once started, though. The nasty little devices replicate anywhere there is sunlight and rock, and (if malevolently designed) launch themselves outward randomly as seeds at high speed. Calculation shows that a plague-ridden star system might conceivably "spoor" with enough assembler seeds to nail anything bigger than a baseball for light years around. So, Dr. Fermi, *that's* where everybody is out there -- they're all huddled in spaceships, headed outward from their native systems at maximum thrust, biting their tentacles in anxiety and looking back over whatever serves them as shoulders. And although we know there are not (or were not) a lot of Dyson spheres around the older stars at the core of our galaxy, we cannot hope to see the "mini-berserker" assembler plagues which even now might be spreading outward like some sort of dry rot toward peripheral stars like ours....

to be raised from infancy by sterilized humans who need some outlet for the parental instinct. That should give us a great cultural head start if we can stand the Freudian stresses. P_m that they'll decide to *revive* us, via adoption agency or not: 0.80 to 0.50.

The Final Odds

At the end, then, what is the combined probability of success? If all my best case figures are used, $P(\text{now})$ from the Warren Equation is 0.15, or a bit better than one chance in seven. This is my most optimistic scenario. The pessimistic scenario puts P at 0.0023, or less than one chance in 400.



The idea that (in my personal estimation) cryonics has all told at best only a 15% chance of working, may be a bit shocking. But answers of this sort fall naturally out of chained probability equations. Like it or not, the Warren equation simply forces one to remember that the success of cryonics depends on the correctness of at least four separate physical hypotheses, the fortunate consummation of at least eight modern social trends, and some luck in the circumstances surrounding one's demise. That's a lot of hurdles. Even if the probability for each of these 13 factors is a flat 95%, the total probability of success would still only be 51% -- barely better than flipping a coin.

Not to feel bad. Results of this sort are often not obvious at the beginning, and perceptual failures in assessing the overall probability of complex events are common. In looking at enterprises which depend on a number of things happening, people in a normal state of mental health tend to be overly optimistic. We trust Rube Goldberg schemes more than we should, because we focus on the probability of events in any cause-and-effect chain one at a time, and therefore miss evaluating the big picture. That is why we humans continue to lose money at crap tables; it is a weakness of our species.

Can These Odds Be Bettered?

That said, there are still a few soothing observations to be made about the figures given above. The first thing I note personally is that these figures, although probabilities of significant happenings, are still not entirely independent of my own effort. I can, for instance, significantly increase the probability of preservation of my own memories if I take steps to avoid autopsy (such as eating a low saturated fat diet and driving a large car), and if I spend some time carefully preparing both my estate and my family for the event of my suspension.

Furthermore, it is well to remember that these figures represent my estimation of my

chances of making it if I'm frozen *tomorrow*, not in the future. Nearly all of the probability figures discussed will doubtless be higher if I take advantage of all future life extension technology and am instead frozen in 75 years. Why? For one thing, I suspect that 75 years is a significant fraction of the required time to the development of nanotechnology, and I suspect that I will do better weathering social problems in the interim if I can do it on my own two feet, rather than helpless in a dewar. And of course there are other benefits of time: suspension and medical technology is sure to improve in coming years, and every cryonicist may lend a significant hand in that (successful brain vitrification, for example, is a research project which should not require a tremendous amount of money). And there are other future developments which should increase the chances of a "good freeze." Euthanasia may become legal for terminal patients, and so on.

Seventy-five years is also time enough that I may be able to have a significant impact on certain social factors which affect the ultimate success of my suspension. The long-term success chances of cryonics organizations in particular are susceptible to the efforts of single individuals, but that is not the only way to change the probabilities. The power of an individual is not necessarily limited to small spheres, for it is nothing but ideas which shape civilizations, and most ideas begin as the products of single minds. Might cryonics be outlawed in the future, we ask? It is then up to us to begin the necessary lobbying efforts now.

Is It Worth Doing?

It is sometimes noted that however small is the probability of cryonics working, the chance of coming back without it must be smaller still -- perhaps (religious considerations and bizarre quantum theories aside) zero. Thus, it is sometimes argued that for atheists (or even agnostics) cryonics may represent a rational gamble, no matter what the odds. Actually, to my mind, this is only true if there are no losses associated with taking the cryonics option, and of course in a way there are. Cryonics is expensive and time-consuming -- which is to say that gambling on it costs a bit of your life. Thus, cryonics in worst case is a sort of "life lottery" in which the payoff is gigantic, but the odds are so bad that one is not sure whether even a small investment is intelligent.

The numbers I have generated above suggest, however, that (at least in my personal estimation) the "life lottery" scenario is a bad description for cryonics. Even if the lower figure of a 0.23% chance of cryonics working is more realistic, and we conservatively estimate that a revived cryonicist may look forward to a lifespan of 1,000 years, then a cryonicist looking at a 75 year "normal" lifespan before suspension may still rationally spend $1,000/75 \times 0.23\% = 3\%$ of his or her time on cryonics. (The only assumption made here is that the goal is to maximize years of life). This isn't very much time -- about half an hour of every waking day. People as a rule spend that much of their time doing sillier and less significant things than cryonics. Consider stamp collecting.

Lifework -- Conclusion

Of course, in this vein there is also a sense in which time spent in the service of cryonics is not lost, no matter what. In living life, most people as a simple point of pride feel the need to leave the world a better place than they found it. Thus, some sort of "lifework" is necessary to most people for long term life satisfaction, and the only necessary ingredient to define a "lifework" is a sense that one is doing something to organize or improve things -- in other words, something against entropy. There is even evidence that a sense of having accomplished a significant lifework is necessary to a psychologically healthy old age. Thus, despite my earlier comment about beer and

television, a "lifework" is necessary even to people who do not believe that they will survive their own deaths -- in fact it is probably more important to such people.

Here is where cryonics shines, even if the odds of it working for a person personally are lower than one would like. Death is the ultimate expression of entropy for human beings, and the ultimate outrage in human life. The fight against Death, then, makes a first-class lifework -- and those who choose it may count themselves lucky no matter how things turn out at the freezers.

I personally, then, have decided that cryonics is worth the gamble. I could spend the time collecting stamps, yes, but I doubt if I am going to find a stamp as interesting as an endeavor that may be one of the greatest adventures that human beings have ever undertaken.

After all, who knows? If we -- the first and second generation of cryonicists -- succeed in our efforts, some of us may well end up on stamps ourselves one day. And if that happens, consider: we'll be the only people on U.S. stamps to ever be able to take pride in being there.

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Further Thoughts On The Probability That Cryonics Will Succeed

by Mike Perry*

Steve Harris has written a groundbreaking article on the probability that cryonics will work. The bottom line is that cryonics is worth pursuing, given the prospects that appear to exist both for success and failure; something in which I concur wholeheartedly. I confess I don't *like* Steve's conclusion that cryonics has at best only a 15% chance of working, but that in no way detracts from the thought and effort that went into the article, nor does it prove this conclusion inaccurate. However, in looking over the various probabilities and their rationales, I spot features I consider questionable, which when altered to fit my perspective on this issue, also lead to different (and more optimistic) conclusions. The major difficulty, as I see it, is that a good many of the social variables that could kill cryonics, and which are treated as independent, are not really independent at all.

Calculating the probability of an event that depends on numerous conditions holding becomes easy if the conditions are independent; the probabilities of the conditions holding are simply multiplied. On the basis of independence, for example, we conclude that the probability of obtaining "heads" on two consecutive coin tosses is 0.25 (0.5 times 0.5). Thus, if we do a great many (say 1,000,000) experiments where we toss a coin twice, in about half of these experiments, or 500,000, the first coin toss will be a head, and for about half of these in turn, or 250,000, the second toss will also be a head. This reasoning is valid because the outcome of the first toss does not influence the outcome of the second toss (and vice versa). Multiplying many probabilities this way, each of which is significantly less than 1, can produce a very small overall result. For instance the probability of *ten* consecutive heads in a coin toss experiment is $(0.5)^{10}$ or about 0.001. Thus an outcome that depends on *all* of a set of mutually independent conditions holding may have a very low probability, even though the likelihood of each condition individually is moderate or high.

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stage.) The assumption of independence makes the calculation of overall probability easy but makes the result discouragingly low (15% as an upper limit).

Seven of the thirteen conditions are not related to the technical feasibility of cryonics, or the requirement that cryonic suspension be performed under reasonable conditions, but instead are what I would lump under "the social problem", which I call *condition n*. I don't believe these seven conditions can be treated as independent, for reasons to be discussed. Steve's 13 conditions, with his probabilities and my revisions, including category 14 (*n*) relating to the social problem, are summarized on the next page.

The probabilities for "technologically, will it work?" (condition *o*) are obtained by multiplying the probabilities for the conditions not relating to the social problem, that is, conditions *a* through *e* and *i*. It will be noted that the differences I have with Steve in this area are relatively minor and our overall estimates do not differ greatly, even though they are obtained by multiplying six quantities, which itself will tend to magnify the differences. (In fact I tended to use his values unless I could come up with a specific reason for something different.)

To consider the differences briefly, I am more certain on some things such as

Steve has enumerated thirteen conditions, designated *a* through *m*, that "must hold" for cryonic resuscitation to occur. (I have some relatively minor disagreement that all of these would be required, but more about that later.) For each condition, call it *x*, there is an associated probability P_x , that condition *x* will hold. More precisely, Steve gives two estimates of each probability, a high and a low. (These probabilities must be based on gut feelings at this stage.) Since all the conditions are treated as independent, the probabilities must be multiplied together to estimate the probability that cryonics will work. Multiplying the high probabilities gives a high estimate while multiplying the low probabilities gives a low estimate. (The definition that Steve gives of what it would mean for cryonics to "work", namely that at least "50% of your memory" must survive in an ageless being that thinks he, she or it, is you, is not without its difficulties, but at least makes a useful starting criterion. It is a lenient approach that allows for some, but not an arbitrary, loss of fidelity in the resuscitation/reconstruction, and relieves the need to worry about a precise definition at this

Condition:	Probabilities			
	Harris		Perry	
	Lo	Hi	Lo	Hi
a. Materialism is correct	0.95	0.99	1	1
b. Identity encoded in structure	0.95	0.99	1	1
c. Favorable conditions for suspension.	0.75	0.95	0.75	0.95
d. Suspension preserves enough information.	0.50	0.90	0.50	0.95
e. Mishap-free storage.	0.95	0.99	0.90	0.99
f. Cryonics organization survives	0.20	0.60	n	n
g. Sufficient social stability.	0.70	0.90	n	n
h. Cryonics is continuously legal.	0.70	0.90	n	n
i. Nanotechnology is physically possible	0.90	0.98	1	1
j. Nanotechnology is perfected.	0.95	0.99	n	n
k. Nanotechnology is non-catastrophic.	0.20	0.50	n	n
l. Cryonic revival is "cheap enough".	0.85	0.95	n	n
m. Cryonic revival is permitted.	0.50	0.80	n	n
n. The social problem is non-catastrophic.	0.008	0.18	0.39	0.86
o. Technologically, will it work?	0.29	0.81	0.34	0.89
p. Overall, will it work?	0.002	0.15	0.13	0.77
	*	*	*	

materialism. (Since I resist claiming I am absolutely certain, you should read a "1" as " $1 - \epsilon$ ", where ϵ is small enough not to worry about.") I am "certain" (at least 0.999) that "nanotechnology will prove physically possible". In our case, success would require recovery of a certain amount of information from the molecular structure of a piece of solid matter (i.e., frozen human tissue). Probably not nearly all the information that ought to be locked in those molecules would be needed, but I consider it likely that the full atomic-scale structure of any given piece of matter could be elucidated, making a small allowance for errors, if you wanted to take long enough. (Similar information recovery is being done right now, on a small scale, with tunnelling microscopes.) This, of course, means only "possible in principle," not that we will carry it out. I am a little higher on the upper limit for "suspension preserves enough information" (neural archaeology may allow some stunning inferences, if we work at it) and a little lower on the minimum for "mishap-free storage" (this may have to be under adverse conditions, e.g. by an underground organization, which however, would also be expected to be very careful).

That said, let's now consider the major differences I have with Steve, which are tabulated under condition *n*, "the social problem is non-catastrophic." For Steve the probability estimates are obtained by multiplying the probabilities for the six conditions that relate to the social problem (and which are consequently excluded from the

technological problem considered above), namely: *f*, *g*, *h*, *j*, *k*, and *m*. Steve's probabilities for the six conditions are not high, and the corresponding probabilities for condition *n* are quite low. My estimates are considerably higher and are obtained by a process to be described. Multiplying the probabilities for conditions *n* and *o* gives the estimates for "Overall, will it work?", condition *p*, which are correspondingly higher in my case.

One reason it may seem plausible to treat the six social conditions as independent is an underlying assumption that cryonics itself is not considered likely to have a serious impact on how people think and feel, in general. If, on the contrary, we could assume that the population after 50 years would be largely made up of cryonicists, the outlook would change substantially. For example, we could then assume that it would not be considered "too expensive" to revive cryonics patients, a particularly repugnant idea, in my estimation. It would be highly likely that cryonic revivals of 20th century suspendees would be carried out, assuming it was technologically possible, and that cryonics would be continuously legal. A large population of anti-death individuals would also, I believe, substantially diminish other risks, such as nuclear catastrophe, nanotech running amok, or even failure of a cryonics organization. (In the latter case there would be more organizations with more competition and greater demands for accountability.) Once a substantial population became converted to an immortalist outlook, I think there would be tremendous pressures to suppress opposition, which in short would include every tendency to wind up sacrificing human life. So overall, the social outlook would be far brighter if we could only convert a major portion of the population to cryonics. If that didn't succeed, the outlook would still be encouraging if a substantial, hardcore following for cryonics existed. Ten thousand dedicated people could substantially reduce the risks of hostile legislation or patients being thawed (whether the latter was caused by outside pressures or by difficulties within a particular organization). If necessary, ten thousand might successfully support an underground operation for a number of years, so that cryonics would not have to be continuously legal to succeed. (By analogy note that the Fugitive Slave Law did not stop the Underground Railroad. Some may object that "you didn't have the potential for social and economic control (through electronic data bases) in the 1850's you are likely to have in the future, either," to which I would reply, "maybe so, but our hardcore cryonicists may have new options too, such as private spaceflight.")

Is there any reasonable ground for thinking the social outlook might improve according to one or the other of the above scenarios? I believe there is. The most significant event in this process, I think, would be the development of reversible suspended animation of brains. This now seems possible through vitrification. If successful, it would demonstrate, once and for all, that a human life can be held in suspension indefinitely. Once that point became incontestable, it could be used with devastating force against those who would oppose cryonics or the goal it aims for, the elimination of biological death. Burial and cremation, to survive as choices, would have to be treated as acceptable forms of euthanasia. The arguments for why such human sacrifice would be better than cryonic preservation could be attacked from many directions.

Even cryonics patients frozen before the advent of vitrification would benefit. If *some* patients could not be thawed without committing murder, it would become untenable to thaw *any* patients without first ascertaining, beyond a reasonable doubt, that there was no chance of *ever* bringing them back. Cryonicists could easily enforce their own standards in deciding whether there was "reasonable doubt".

It is possible that a catastrophic social upheaval would follow if society could no longer deny that the conquest of death was possible. We, as cryonicists, need to be

prepared for the day when others will need a new set of values for a future different from what they were conditioned for. Such values would recognize that it is the destiny of the human race to throw off the yoke of mortality, and that the preservation and protection of a human life must take precedence over other endeavors that would interfere with or prevent it. What we must seek then is a philosophical transformation, to alter the ages-old deathist orientation to an outlook that recognizes that current limitations on lifespan are cruel and unnecessary, and that a more open-ended existence will be a more rewarding one.

So, we have identified three possible developments that would appear to greatly improve the odds that the social problem will not become catastrophic: (1) vitrification, (2) a sizable group of hardcore cryonicists and (3) a philosophical transformation of society. Although none of these has occurred yet, I think the outlook is reasonably good that all will happen. First, progress continues in vitrification, with success apparently a few years away. (It is worth mentioning that most of the progress to date has been with non-neural organs such as kidneys. The adaptation of vitrification to the brain is expected to be reasonably straightforward, though much of the work may have to be done by cryonicists since mainstream cryobiologists are not interested in this "useless" organ!) Second, there is a hardcore group of cryonicists. It can't be called "sizable" yet (numbering in the thousands or more), but as I think Alcorians have proved in their battles with officialdom over the past year or so, it *does* exist and it is not an "easy target" for those who might oppose it. Finally, though nothing approaching a large-scale philosophical transformation has occurred, cryonics is gaining publicity and efforts are underway to formulate a cogent and satisfying philosophy that incorporates the idea of eliminating death through nonsupernatural means.



How might these three developments affect the seriousness of the social problem for cryonics? Clearly this is a complex question. I don't feel it can be easily reduced to a matter of multiplying independent probabilities, but instead a more elaborate approach is needed. To make a beginning I will assume the following rationale. The key event, I think, is the development of vitrification, which I think will likely initiate a chain of events leading to substantial growth of a cryonics community and possibly a mass conversion of society to cryonics through a philosophical transformation. For cryonics to work, a cryonics organization must first survive until vitrification is perfected. I will invoke gut feelings to estimate (1) a reasonable period of time for vitrification to be developed, (2) the probability that a cryonics patient at Alcor will stay in suspension during this period, (3) the probability that vitrification will in fact be developed by the end of the selected period, (4) the probability that the social problem will not later become catastrophic, if vitrification *is* developed, and (5) the probability of no social catastrophe, if vitrification is *not* developed.

To start with, I will set the time interval at twenty years. That is a short enough time (one patient having now been in suspension longer) that I feel reasonably confident about making a gut-level prediction about the probability of a patient staying in suspension. I will set this probability, call it P_5 , at 0.75 to 0.95. Strictly speaking,

this is the probability that a patient is not thawed for "social" as opposed to technological reasons. In other words, a suspension failure would be equivalent to "the social problem having become catastrophic" over the twenty-year period, rather than cryonics being found to be scientifically untenable. (The latter possibility is already provided for in the technological probabilities.)

On the other hand, twenty years ought to be long enough to develop vitrification, if indeed it is "just around the corner". If we haven't perfected it by then, it might be a much harder problem than it looks to us now, and thus not likely to be solved for several more decades (if then). I think that there is a good chance that vitrification will prove relatively easy, in view of the partial successes to date, so I set the probability P_y of doing it in twenty years or less at 0.60 to 0.90. If vitrification succeeds I set the probability of a favorable social outcome, call it P_y , at 0.85 to 0.95, i.e. high, though with some allowance that things could still go wrong. If vitrification is *not* developed, I am more uncertain about what probability range should be assigned, except that it should definitely be lower. I will set the probability, call it P_z , in the broad range of 0.01 to 0.50. We are now ready to calculate the probability P_n of a favorable social outcome, condition n . It is the probability of a patient staying in suspension for twenty years times the probability of a favorable social outcome from then on. That in turn is the probability that vitrification has been developed in twenty years times the probability of a favorable social outcome if vitrification is developed, plus the probability that vitrification has not been developed times the probability of a favorable social outcome if vitrification is not developed. In symbols,

$$P_n = P_s \cdot (P_y P_y + (1 - P_y) P_z)$$

It will be seen that P_n is maximized when the four quantities P_s , P_y , P_y and P_z are maximized, given their respective ranges, and minimized when these quantities are minimized. Given the assumed ranges of the four quantities, the range in P_n works out to 0.39 to 0.86, which is similar to my estimates for the technological problem, and of course, much higher than Steve's estimates in which the social problem is partitioned into independent subproblems. Overall, the probability that cryonics will work, according to my rationale, is 13-77%. I think I would sum it up, for a prospective newcomer, by saying: "In my estimation, cryonics will probably work on purely technological grounds, though there are uncertainties. When social factors are taken into consideration the outcome is less certain, maybe in the 50-50 range, but it still leaves reasonable ground for hope." I would not say, "Cryonics probably will not work," which I believe is the inevitable conclusion if the most optimistic estimate of it working is well under 50%. On the other hand my scenario puts a lot of the burden for seeing that the social problem is successfully resolved on the shoulders of us cryonicists, and there aren't many of us yet, though our number and resources are growing.

There is another argument Steve mentions against the high probability of cryonics, considered as a subset of biological immortality; namely, that we ought to see evidence of extraterrestrial civilizations elsewhere in the universe who made it to immortality. Instead, we see no signs of life. This can be explained by assuming that the putative extraterrestrials are (1) self-annihilating, (2) very rare, or (3) just unobtrusive. Whatever goes for the extraterrestrials is likely, on statistical odds, to apply to us too. Either we will destroy ourselves (the social problem will prove catastrophic after all), or we are an anomaly, with no cosmic near neighbors, or we will find no particular motive to massively advertise our presence, however far we advance. Several of these alternatives may be true, or none may be true (as, for instance, if we were created by some giant intelligence, as parts of a giant computer program). This is a mystery we are not yet in a position to resolve. Let us pursue our quest for immortality in the meantime, and hope for the best.

THE MAKING OF A SMALL WORLD

satire by Mike Perry

[This story originally appeared in *Venturist Monthly News*, April, 1989, and is reprinted with permission.]

* * *

"You summoned me, apprentice Gorn?"

"Yes O Great Wizard Snorrl, Lord of Galaxies, Ruler of Many Worlds, King of Evolved Immortals ..."

"Enough! What can I do for you, young fellow?"

"I'm having trouble playing God."

"Not an uncommon thing, your first billion years (to invoke our ancient and honored time unit) ... What is your problem?"

"They don't respect me."

"Your charges? Tell me about it."

"Well, first I made this world, got it peopled with intelligent life, in a nice setting I had made with forests and meadows, creatures that crawled and flew and leaped and galloped, all the usual things ..."

"You got a genome permit?"

"Oh yes, all straight evolved lifeforms, nothing tampered with already ..."

"Very good. Go on."

"So then I went among the inhabitants, did good things, healed the sick, fed the hungry, spoke kind words, and ... well, they ..."

"Put you to a painful death?"

"Very. Only the backup information saved me, and they would have *eaten* that if they could, the miserable vermin. Why if you could have seen —"

"Tell me about it later. How're they doing now?"

"Oh, fine, just fine, ought to be applying for membership soon, which means I'll be in a jam for overpopulating ..."

"I wouldn't worry too much, this time. How about your next world?"

"Yes, I *did* make another one, and that time, I naturally tried to avoid the public spotlight, went around in secret, showing myself to a few only, ..."

"And ...?"

"Well, mostly they didn't believe I existed. And they'll be applying for membership soon, too, and ..."

"Argh! ... So twice in a row you've lost control after only a few thousand years."

"Uh, about 900 years in the last case."

"Oh, my. Well, as you know, you only have one more try at this thing. Maybe you ought to get out while the getting's good, to avoid discredit. Take up cosmological eschatology or something respectable—"

"No! I want to build a world of primitives and keep them that way as long as possible. I want to lord it over them, century after century, millennium after millennium. I want them to sing my praises. I want it to be a *long time* before they become dissatisfied enough to develop and apply for membership and start playing the games we play..."

"Still haven't grown up, eh? Well, the rules entitle you to one more shot."

"So what you suggest is ... ?"

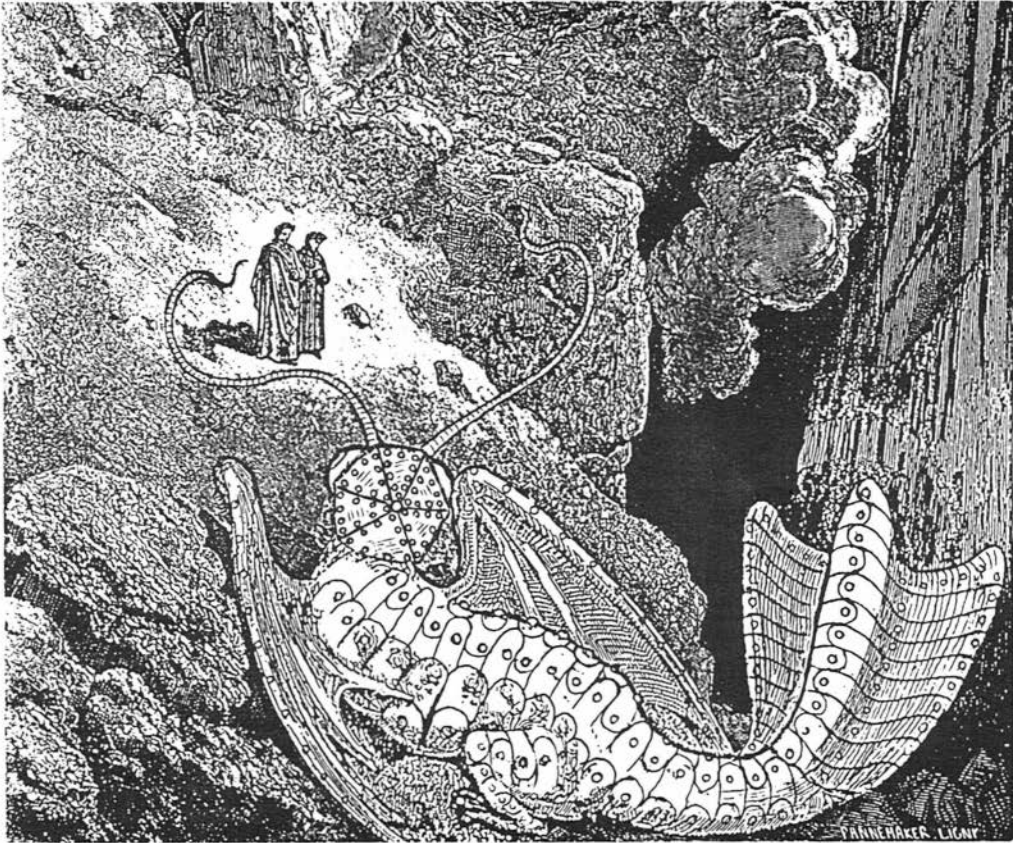
"If you really must know ..."

"Of course, why did I summon you?"

"Yes, I suppose you have to have your way. Well, this'll sound crazy, but about the best strategy is to giv'em a good, severe beating every day of their lives."

"What?"

"They'll fear you, they'll respect you, and they'll love you."



[Long pause.]

"Yes, I admit there's a certain logic to that, but I'd have to be many places at once ... use robots, of course! Big, metallic buzzing things with wings for hot pursuit and clawed feet for grasping and whiplash antennas for striking *hard*. And I know just the creatures to clone and try it on ... picked up some genomes on a nice blue planet that was third out from its primary, I can even recreate some of their original language and culture —their year is almost the same as ours, by the way —"

"I see your mindwheels are whirring, so I'll leave you be."

"Yes, I must start building this world at once ..."

* * *

1,000,000 years later, the Daily Globe, a leading newspaper on the world created by Gorn, reports:

**Weird Scheme To Defeat Just Punishment;
Scientists Scoff; Ethicists Howl;
Legislators Vow To Stop It.**

A group claiming that Just Punishment is "unjust" say they believe it can be "defeated" through science. Simon Burr, spokesman for the self-styled "Committee for the Overthrow of Physical Abuse" (COPA) claims "the robots that administer our daily beatings could be destroyed through technological means," and cites an example where a

robot was held at bay for more than an hour while its intended "victim" escaped. Scientists, however, take a dim view of Burr's proposal. Jeffrey Snag, senior researcher at Applied Mechanical and Aesthetics, a firm specializing in technology for improving the quality of life and justice, says, "The idea of interfering with such superlative machinery is just patently absurd. There's no prospect for defeating the robots in the foreseeable future — they are simply too swift and powerful. Besides, why try for an empty 'freedom from abuse' anyway? What good would it do? Recently we've developed some tight fitting clothing to better distribute the force of the blows, and that's what I consider progress."

Other voices are being raised in defense of Just Punishment and similar practices among humans. Ezeldadeath Bugler-Boss, spokeswoman for the Committee for Ethical Bruising, declares that "beatings are beautiful, pure and simple. I just bubble with warm feeling over the worth of welts." She is "looking forward to an expanded role for impact therapy in human life," and argues that "a little hand-to-hand combat from time to time could usefully augment the blessings of Just Punishment." Asked about COPA she indignantly concludes, "Our whole society is predicated on the assumption of daily beatings which we humbly accept as a foundation of our being and a springboard for spiritual growth. When you consider all the benefits — the stability, the security, the certainty — of knowing this meaningful experience will always be with us, I don't see how anyone can raise an objection."

However John Crue, a construction worker, admits he is "not entirely happy with the punishment we get for the crime of being alive" and comments further that "being whipped like a horse by giant flying things may have its advantages, but I like it better when they stop. I don't know how I'd adjust to no beatings, but I do consider it from time to time."

But some authorities are so distressed by what they perceive as an affront to the natural order of things that they are taking legal action. Recently the Department of Proper Behavior filed felony charges against COPA for obstructing due process and attempted sabotage. COPA attorney Anthony Sharp denies that his organization has broken the law, arguing that "laws protect human lives and property but there is no law specifically forbidding the sort of practice that COPA is engaged in. The robots are not human property nor an endangered species. To interfere with or even destroy them is no violation of law but simply an exercise of constitutional rights." But DPB officials are sure COPA can be challenged on legal grounds. As Chief Administrator Wilbur McTwitch put it: "The framers of the Constitution wanted to promote individual rights, but the rights of the individual must ever be subordinate to the machinery of great Gorn. I think there is legal precedent to act against those who would attempt a change on so fundamental a level, and if not it *could* be established. I am looking forward to this case."

* * * * *

PERSONALS

The Alcor Life Extension Foundation and Cryonics reserve the right to accept, reject, or edit ads at our own discretion, and assume no responsibility for their content or the consequences of answering these advertisements. The rate is \$5.00 per line per month (our lines are 90 columns wide).

Looking for other cryonicists nearby: Eric Klien, 1 Sinai Circle B10, Chelmsford, MA 01824. Phones: (508) 663-5480 (home); (508) 250-0820 (work).

Radio conversations with *The Venturists* -- An audio tape is available for \$3.00 + \$1.00 P&H. The Venturists, 1355 E. Peoria Ave., Phoenix, AZ 85020.

Business opportunities: Dave Pizer is willing to train and finance people who would be interested in starting a small business in Arizona. David S. Pizer, 1355 E. Peoria Ave., Phoenix, AZ 85020.

Cabin in Sidona, Arizona available on weekends for *Alcor* members to hold meetings on cryonics, nanotechnology, and related subjects. Contact Dave Pizer, address as above.

* * * * *

Meeting Schedules

Alcor business meetings are usually held on the first Sunday of the month. Guests are welcome. Unless otherwise noted, meetings start at 1 PM. For meeting directions, or if you get lost, call Alcor at (714) 736-1703 and page the technician on call.



The JULY meeting will be held at the home of:

(SUN, 9 JUL, 1989) Diane Alexander
(SECOND SUNDAY) 5100 Longfellow St.*
 Los Angeles, CA

*Take the Avenue 52 off-ramp off the Pasadena Freeway. Go left at Longfellow.

* * *

Alcor members in the San Francisco Bay area have formed an Alcor chapter, and are aggressively pursuing an improved rescue and suspension capability in that area. Meetings are generally held on the second Sunday of the month, at 4 PM. Meeting locations can be obtained by calling the chapter's Secretary-Treasurer, Thomas Donaldson, at (408) 732-4234 (home), or at work, (415) 593-3200 (ask for Thomas Donaldson).

* * *

The New York Cryonics Discussion Group of Alcor meets on the the third Saturday of each month at 6:30 PM, at the **El Paso** restaurant, in Manhattan's Greenwich Village. The address is 134 West Houston St., between McDougal and Sullivan. Telephone (212) 673-0828. Ask for the Alcor group at the rear of the restaurant. Subway stops: Houston St. on the 1 train; Spring St. on the C, E, or K trains.

The meeting dates are as follows:

JUNE 17 JULY 15 AUGUST 19 SEPTEMBER 16

If you live in the New York, Philadelphia, New Jersey, or Boston areas and would like to participate in the rebirth of New York cryonics please contact one or more of the following people:

Gerard Arthus (516) 273-3201
Al Roca (201) 352-5268
Curtis Henderson (516) 589-4256

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