

CRYONICS

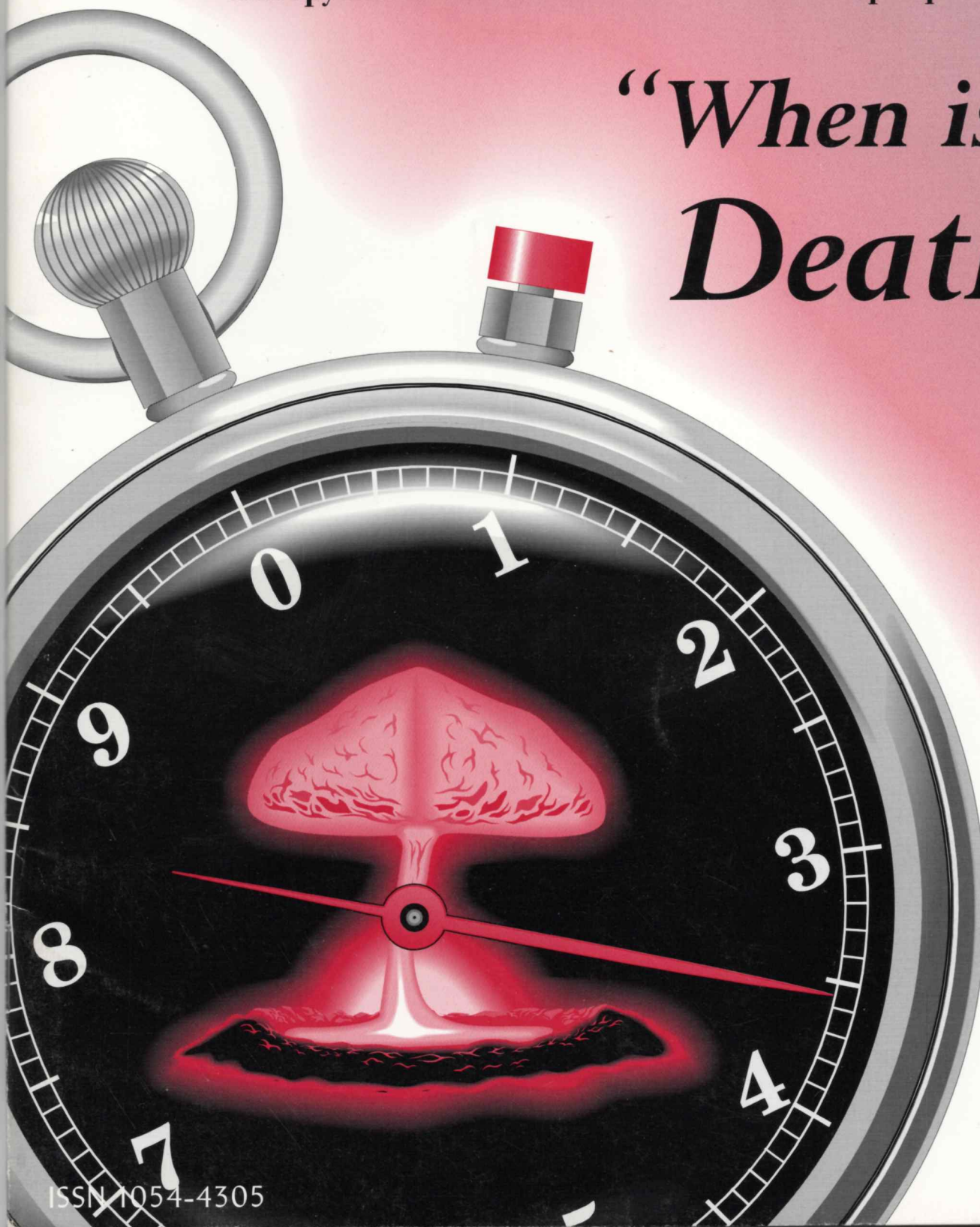
4th Qtr, 1994

A PUBLICATION OF THE ALCOR LIFE EXTENSION FOUNDATION

Volume 15:4

Extropy Institute President **Max More** asks a simple question. . .

*“When is
Death?”*



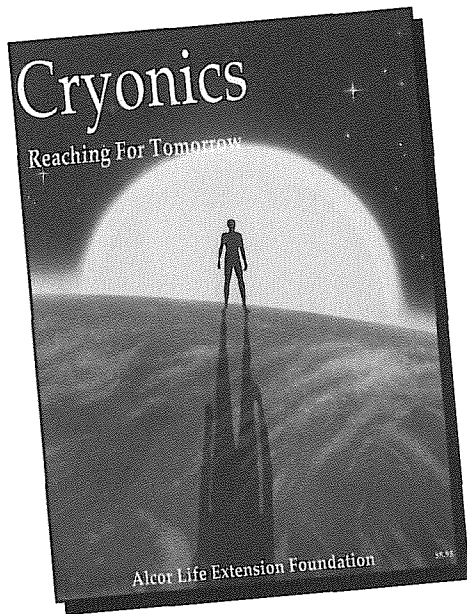
ISSN 1054-4305

\$4.50

“What is cryonics?”

Cryonics is the ultra-low-temperature preservation (biostasis) of terminal patients. The goal of biostasis and the technology of cryonics is the transport of today's terminal patients to a time in the future when cell and tissue repair technology will be available, and restoration to full function and health will be possible.

As human knowledge and medical technology continue to expand in scope, people considered beyond hope of restoration (by today's medical standards) will be restored to health. (This historical trend is very clear.) The coming control over living systems should allow fabrication of new organisms and sub-cell-sized devices. These molecular repair devices should be able to eliminate virtually all of today's diseases, including aging, and should allow for repair and revival of patients waiting in cryonic suspension. The challenge for cryonicists today is to devise techniques that will ensure the patients' survival.



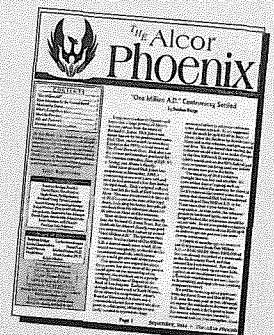
“How do I find out more?”

The best source of detailed introductory information about cryonics is *Cryonics: Reaching For Tomorrow*. Over 100 pages long, *Reaching For Tomorrow* presents a sweeping examination of the social, practical, and scientific arguments that support the continuing refinement of today's imperfect cryonic suspension techniques, in pursuit of a perfected “suspended animation” technology.

This new edition features an updated and lengthened chapter on revival, as well as the appendices “The Cryobiological Case for Cryonics” and “Suspension Pricing and the Cost of Patient Care.” Order your copy for \$7.95, or receive it FREE when you subscribe to *Cryonics* magazine for the first time. (See the Order Form on page 40 of this issue.)

For those considering Alcor Membership. . .

If you're intrigued enough with cryonics and Alcor that you're considering Membership, you might want to check out *The Alcor Phoenix*, Alcor's Membership newsletter. *The Phoenix* is a Membership benefit, so it's free to Members and Applicants, but anyone can receive it for \$20/year (\$25/year if you're overseas). It's released 8 times each year, on the “off months” of the quarterly *Cryonics* (February, March, May, June, August, September, November, and December). *The Phoenix* is shorter than *Cryonics*, but appears twice as often and is mailed First Class. Being a Membership newsletter, *The Phoenix* focuses on Membership issues such as financing cryonics, staff and management matters, developments in Patient Care and Emergency Response, etc. These issues will impact you directly if you decide to become a Member, and may help you make a more informed decision in the meantime.



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ISSUE TO PRESS: OCTOBER 26, 1994

UP FRONT

BY RALPH WHELAN, EDITOR

This issue of *Cryonics* heralds the end of a year of tremendous change and improvement for Alcor and for cryonics in general. The trials of our relocation from California to Arizona—a decision detailed in this issue's "How Safe is Scottsdale?" by Alcor Director Mark Voelker, Ph.D.—are mostly behind us now, and the revitalized and expanded Alcor Staff is moving forward in earnest on various research, engineering, training, and publications projects.

Your Editor is at last beginning to negotiate an alliance of sorts with the software and hardware used in the publication of this magazine. Each of the first four quarterly issues of *Cryonics* has seen significant steps forward in publication sophistication, this issue perhaps most of all. Although I will not see the result much sooner than you, I'm optimistic in reporting that this issue will *probably* be the first all-electronically-designed issue of *Cryonics*: I'm submitting the master to our new printer on disk, with all artwork in electronic form. The result should be a sharper (higher-resolution) appearance. Also, after a few complaints of eyestrain, I've increased the type size throughout the issue.

Part 1 of Max More's "The Terminus of the Self"—an impeccably reasoned presentation of a rational and enduring concept of death—is the highlight of this issue. But don't miss Dr. Voelker's fact-rich analysis of the geographical considerations that led Alcor to choose Scottsdale for its new home. And when you're tired of pondering death and natural disasters, dive into part 1 of "Two Minds", Derek Ryan's upbeat interview with Alcor Founders Fred and Linda Chamberlain.

Lastly, I'm happy to note that with this issue, we are three weeks closer to "on time" than we were with the 3rd quarter issue. Hurry up and read on, because the 1st quarter 1995 issue will be at your doorstep before you know it!

PUBLICATION NOTES

Cryonics is the quarterly publication of the Alcor Life Extension Foundation

Editor: Ralph Whelan

Volume 15:4 • Issue #164 • 4th Quarter, 1994 • ISSN 1054-4305

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

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About the Cover

The cover of this issue was designed by Ralph Whelan, using Aldus Freehand™, Aldus Pagemaker™, Corel Gallery™, and some conceptual assistance from Stephen Van Sickle and Derek Ryan.

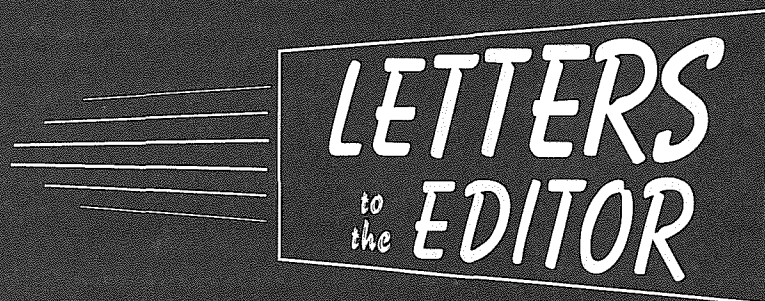
New Research Results Now Arriving

On September 25, 1994, Alcor began the first steps in its new research program. Parts of the experiment were still ongoing at press time, and evaluation of the results will take several weeks at least. A more complete report is planned for the 1st Quarter 1995 issue of *Cryonics*. We can, however, report on one interesting result.

One of the experiment's objectives was to assess the feasibility of using magnetic resonance imaging (MRI) and computerized tomography (CT) to determine the 3-dimensional distribution of glycerol in a cryoprotected subject. The research team performed total body washouts on two dogs, similar to the treatment which would be performed in a cryonic suspension. The control animal received no further perfusion. The experimental animal was given a cryoprotective perfusion, reaching a high concentration of 9.4 molar glycerol. The unfrozen heads were scanned using both MRI and CT.

With both methods, the glycerolized subject could easily be distinguished from the unglycerolized control. The method has the potential of being used on future research animals and even suspension patients to determine if there are pockets of tissue not adequately glycerolized. (A preliminary examination of the scan pictures on this case appeared to show even glycerolization.) After this the heads were frozen to dry ice temperature and scanned again. The difference in the control vs. the glycerolized animal again could be seen in the CT images, but the MRI images were blank, as we thought they might be. Apparently solidification of the tissue restricted atomic motion enough to prevent resonance effects that produce images.

We plan to extend this line of research in several directions. If you would like to donate toward this work, please contact Steve Bridge or David Pizer at Alcor. Since Alcor is a tax-exempt non-profit organization, your donations may be tax-deductible.



LETTERS to the EDITOR

Please address all editorial correspondence to: Editor, *Cryonics*
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Letters not intended for publication should be clearly marked as such.

Dear Editor,

I read with interest Thomas Donaldson's article on the computational aspects of repair [1]. This is an important addition to Ralph Merkle's molecular-level repair proposal [2].

Donaldson's article nicely illustrates the potentially enormous number of possibilities that might have to be considered during the repair computation as it searches among the possible arrangements of the molecules. Since this number can easily exceed the number of atoms in the observable universe, any requirement that all or even a large percentage of the possibilities must be considered would make the molecular-level repair proposal implausible—technology would be available to move the molecules to correct positions but it wouldn't be feasible to determine where they should go.

Nevertheless, there are reasons for a much more optimistic outlook with regard to this computational aspect of the proposed repair process. First, heuristic methods can often solve such combinatorial search problems quite rapidly (in addition to their use, mentioned by Donaldson, for quickly finding arrangements that are merely close to solutions). Second, recent studies show that while combinatorial search problems can be very hard, the hard instances are often quite rare. I discuss these points in turn.

In combinatorial searches, one generally proceeds by examining a series of possible arrangements until a solu-

tion is found. At each step, heuristics are methods that suggest arrangements to try next. While not guaranteed to work in every case, they usually greatly reduce the computational cost. In some cases they always work quickly and usually get close to a solution but can vary greatly in precisely how close they get. Other heuristics always find a solution, usually quickly but occasionally take a long time. For repair, the latter sort of heuristics are likely to be more relevant since the goal is to find any one of the "solutions" i.e. arrangements that correspond to adequate restoration, rather than necessarily the single one that is in some sense "best". Particularly useful in this context are methods, such as heuristic repair [3], simulated annealing [4] and genetic algorithms [5], that rely on making a relatively small number of adjustments to an initial guess based on evaluating a few possible changes at a time. These often succeed within quite reasonable computational costs when one can start with an initial guess that is already fairly close to a solution and one has a reasonably accurate way to evaluate whether the individual changes are likely to be closer or further from a solution. If the initial guess (as provided by the tissue structure) is not sufficiently close, more global information can be used for this evaluation in locally ambiguous cases. An example is the maximum likelihood estimation technique [6]. With such search heuristics it is not so important that the molecules are preserved in

their correct position, only that a correct position is readily determined by local adjustments.

Beyond this use of heuristics are recent studies [7,8] of the intrinsic nature of combinatorial search problems. These show that for a variety of search techniques, the typical computational cost is much less than estimated from the huge number of possibilities. This can be understood by viewing a search as making a series of choices until a solution is found. Individual choices can be considered "good" if they lead closer to a solution, "bad" if they do not. The overall search will usually be relatively easy if either there are many good choices or else bad choices can be recognized quickly as such, so that unproductive search is avoided. Whether this condition holds is in turn determined by how tightly constrained the problem is. When there are few constraints almost all choices are good ones, leading quickly to a solution. With many constraints, on the other hand, there are few good choices but the bad ones can be recognized very quickly so that not much time is wasted considering them. In between these two cases are the hard problems: enough constraints so good choices are rare but few enough that bad choices cannot usually be recognized without a lot of additional search. Since these difficult cases require a delicate balance between having too few and too many constraints, they generally will be quite rare. Thus, although certainly possible, it would be very surprising if the search involved in tissue repair just happened to be among the rare group of hard problems.

More generally, this computational issue highlights a key point about the commonly discussed information-theoretic notion of death. Namely, it isn't enough for the information to just be available, but rather it must be available in a form that allows reconstruction by feasible computations. Interestingly, with this computational perspective on the repair process, the required information need not reside entirely in the tissue structure itself but can also include external records. Eventually, for example, this could include high-resolution noninvasive images that are currently under active investigation in biological research [9]. Such external information could provide

additional guidance for repair heuristics and further reduce the likely computational requirements. An open research question is what tradeoff between preserving information in the tissue structure and external records provides the most useful information at a given level of technology or finances.

To summarize, Donaldson raises the important issue of computational aspects of repair, but there is no reason to expect the enormous number of possible arrangements will in fact require infeasibly enormous computations. Instead much of the difficulty is likely to be in properly formulating, rather than solving, the computational problem. This formulation requires learning the details of what arrangements constitute adequate repairs and the nature of the damage process. Fortunately, this task can wait until sufficiently sensitive measurement technology for tissue structure is available.

Tad Hogg
California

Notes

- [1] T. Donaldson, "It's Not At All So Easy," *Cryonics* 15:3, 37 (1994)
- [2] R. Merkle, "The Technical Feasibility of Cryonics," *Medical Hypotheses* 39, 6 (1992). An expanded version has also appeared in *Cryonics* 15:1 and 15:2 and is available on the World Wide Web at URL [ftp://parcftp.xerox.com/pub/merkle/techFeas.html](http://parcftp.xerox.com/pub/merkle/techFeas.html)
- [3] S. Minton *et al.*, "Minimizing Conflicts: A Heuristic Repair Method for Constraint Satisfaction and Scheduling Problems," *Artificial Intelligence* 58, 161 (1992)
- [4] S. Kirkpatrick *et al.*, "Optimization by Simulated Annealing," *Science* 220, 671 (1983)
- [5] S. Forrest, "Genetic Algorithms: Principles of Natural Selection Applied to Computation," *Science* 261, 872 (1994)
- [6] R. Merkle, "Cryonics, Cryptography and Maximum Likelihood Estimation," *Proceedings of EXTRO 1*, Max More, ed., 1994
- [7] A general description of these results is available on the World Wide

Web at URL [ftp://parcftp.xerox.com/pub/dynamics/constraints.html](http://parcftp.xerox.com/pub/dynamics/constraints.html) and includes C. Williams and T. Hogg, "Using Deep Structure to Locate Hard Problems," *Proceedings of the 10th National Conference on Artificial Intelligence* (AAAI92), 1992, and T. Hogg, "Statistical Mechanics of Combinatorial Search," *Proceedings of the Workshop on Physics and Computation*, 1994

[8] Peter Cheeseman *et al.*, "Where the Really Hard Problems Are," *Proceedings of the International Joint Conference on Artificial Intelligence* (IJCAI91), 1991, which is also available on the World Wide Web at URL <http://fi-www.arc.nasa.gov/fia/projects/bayes-group/group/NP>

[9] Z. Cho, *et al.*, "Nuclear Magnetic Resonance Microscopy with 4-micron Resolution: Theoretical Study and Experimental Results," *Medical Physics* 15, 815 (1988)

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A Brief History of Alcor Research



As cryonicists we are counting on the future: above all else, future technology for our revival from the frozen state. Meanwhile, we want the best freezing possible when our time comes, to maximize the chance of *being* revivable. Resuscitation technology will require more development than most of us can contemplate, as well as more resources. It will also take a long time—at least a few decades, maybe more. It may be entertaining to speculate that the direct efforts of the now-tiny cryonics movement could materially accelerate this process—but it hardly seems realistic. When it comes to scientific research, we have to focus most on what is reasonably within reach. Such goals as trying to develop the best possible suspension capability, or the best cooling protocol, become the main concerns. Within these constraints, however, prospects appear to be broadening. Some exciting new possibilities are suggested by issues I will raise later.

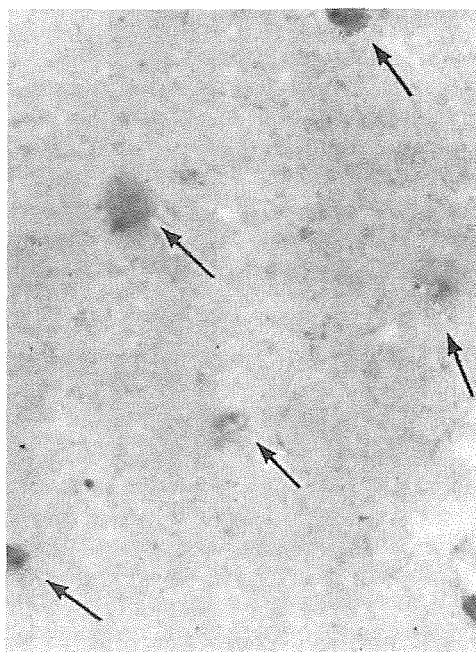
What I mainly want to focus on here is the research that has already been conducted by Alcor Foundation. One should not suppose this is the only cryonics research—work has

been done and is being done by other organizations—but it is an important component, and thus an important part of cryonics history. As is often the case in these columns, there is quite a bit more here than I can fully report; we'll have to be content with some highlights. I'll concentrate on "pure" research and omit such events as suspensions which, secondarily, can also be considered research.

Alcor's research was inaugurated Sept. 24, 1977, with the freezing of a dog. There was a brief notice in that month's *Alcor News*, a predecessor of *Cryonics*, and a more ample report by then-president Laurence Gale in *Long Life Magazine*, the following year.¹ At this time Alcor did not have its own suspension team but suspension services were performed by the Trans Time team, headed by Jerry Leaf and a few Alcorians. They met at a facility provided by Benjamin Schloss, PhD, an antiaging proponent and cryonics dabbler. (14 months later, at 65, he died of leukemia and was not frozen².) The anesthetized dog, a shepherd mix (as many later Alcor animals would be), was perfused with a solution formula used in the suspension, the previous year, of Alcor's first patient, Fred Cham-

Alcor's research began in 1977 with the freezing of a dog. It bloomed in the mid-80s with much more work, mainly again with dogs. Techniques were perfected whereby the animals were routinely subjected to deep hypothermia (above but near the freezing point of water) and replacement of the blood by solutions used in cryonic suspension, then warmed and resuscitated. Most of the dogs recovered without noticeable deficits and most are still alive today, as pets.

*Alcor's first
dog experi-
ment, 1977:
Light
micrograph
at 1260x
magnification
shows live
nerve cells
in dog brain
(cerebral cortex)
which were
previously at
liquid nitrogen
temperature.*



thus has ample opportunity, over time, to condense inside storage vessels which in turn must have outside ventilation to accommodate the boiloff of liquid nitrogen. Some oxidation, which could affect both organic matter and the steel vessels used to contain it, is still possible at low temperatures, though in view of a later study (again by Hugh) the prob-

lem does not appear serious, reaction rates being very greatly slowed. (For example, to get the amount of the fastest known biological reaction that happens in *one second* at body temperature, we would have to wait *25 million years* at liquid nitrogen temperature!)⁴

Alcor's First Golden Age of research began sometime in 1983 and extended into 1987. By this time Alcor had acquired the services of two of the best research talents cryonics has seen to date, Jerry Leaf and Mike Darwin. Jerry, an instructor in thoracic surgery at UCLA, had set up his own company, Cryovita, to provide cryonics-related services, such as suspensions. (During the '80s Cryovita would work so closely with Alcor the two would virtually become one organization.) Mike was a hemodialysis technician who had been involved in cryonics-related work since grade school. Assisting them was another person with substantial skills, biochemist Hugh Hixon, who also possessed an engineering talent. Together they were able to accomplish things worthy of much better-funded institutions enjoying the support of the scientific mainstream. There are some two dozen writeups on the dog work and other projects Alcor carried out at this time, occupying many pages of *Cryonics*, so my coverage here is highly abridged. I'll report what I judge to be of greatest significance.

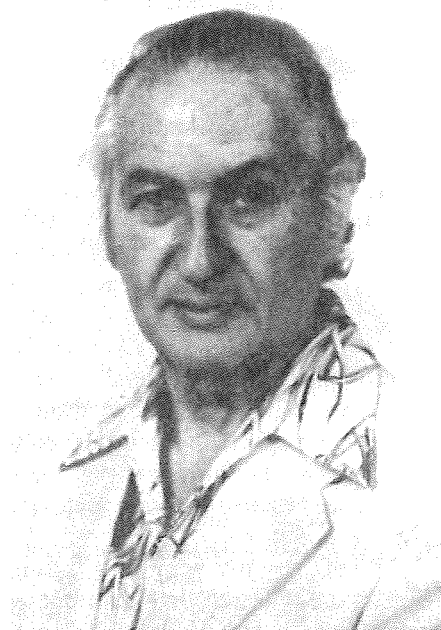
berlain Jr. (Mr. Chamberlain was the father of Alcor cofounder Fred III.) The objectives of the experiment were (1) to duplicate procedures used in the preceding suspension, (2) increase skills of the suspension and rescue team, and (3) establish a baseline for future work. Like Fred Jr.'s, the dog's suspension was head-only. One of the notable results was to recover some functioning brain cells after cooling to liquid nitrogen temperature and thawing (with cell viability verified by dye uptake).

This experiment was to be the "first of a series" but in fact several years would pass before any further substantial research was done at Alcor. The next mention I find of such work is in the Oct. 1981 *Cryonics*, which reports on a gathering of cryonicists at Lake Tahoe, Sept. 11-14.³ (This was hosted by Alcor's cofounders, Fred and Linda Chamberlain, who would stage further similar gatherings, the now well-remembered Lake Tahoe Festivals, over the next several years.) At the conference, Alcorian Hugh Hixon gave a brief presentation of his findings on the problem of oxygen contamination in liquid nitrogen storage vessels. Oxygen content in such a vessel that had been in use for 3 years registered 2% by volume (oxygen being also liquid at LN₂ temperature), enough to cause worry in view of the corrosive properties of this highly reactive element. About a fifth of the atmospheric mass is oxygen. It

There's a little bit of magic (black or

white, depending on your orientation) in the idea of rendering an organism clinically dead—no heartbeat or respiration, cold as a winter's day—then restoring it to life. It's an important precursor of what we are trying to accomplish through cryonics and it is disturbing to many people. It suggests, for example, such irreverent thoughts as that death is a process, not an event; an organism is a machine that can be restarted after the "vital" processes have ceased; when you're "dead" *you may not really be dead*; etc. It is especially inspiring, gratifying, and/or disturbing to bring back a large, warm-blooded creature from a state of lifeless cold. The latter feat was first accomplished by a cryonics organization—Alcor—July 21, 1984. A shepherd dog, "Star," was subjected to a total body washout (replacement of blood with a chemical solution) and an hour of bloodless perfusion at 4°C, then rewarmed, transfused with blood, and resuscitated.⁵ The animal made a perfect recovery, and eventually became a much-valued pet. A crucial part of the recovery process was dialysis during rewarming, with an artificial kidney machine, which allowed for normalization of blood glucose and electrolyte levels.

Aside from its suggestiveness for the much more difficult feat that cryonic resuscitation is going to be, the



Dr. Benjamin Schloss assisted in the first Alcor experiment, 1977.

work was important for the procedures used in the early stages of cryonic suspension. This is when the patient is cooled from body to near-ice temperature and the blood is replaced with base perfusate, a preliminary step for the later perfusion with cryoprotectant. The success with a dog did not happen on the first try, though it did happen sooner than expected. Some changes in previous procedures were necessary (notably, use of a new base perfusate⁶). It could then be seen that the initial stages of suspension were not injurious to life, and it strengthened the case for the ultimate revivability of cryonics patients.

The success with Star was followed, within two months, by resuscitation of an animal after 4 hours of bloodless perfusion at 4°C, with full recovery, including (as far as could be ascertained) full memory and personality.⁷ After this, recovery of animals after 4 hours became routine. Improvements in procedures made recovery faster and easier on the staff consisting of Alcor members, several of whom put in long, volunteer hours each time to ensure success. Sometimes problems would appear. Manual ventilation of animals had to be used, for example, because of a freakish interaction between a new electrocautery tool and an electrically powered respirator that prevented re-

covery of several animals before it was detected.⁸ Another time, an animal nearly died when, upon rewarming, it was transfused with blood that turned out to be contaminated—but the dog was saved with an artificial blood substitute.⁹ In all, the experiments helped refine suspension protocols and provided invaluable training for a wide variety of emergency conditions.

Experiments with animals raise ethical issues: mainly, how it can be proper to subject innocent creatures to procedures that may cause them to suffer and die. These issues are addressed in an article that accompanies a recounting of one of the early experiments.¹⁰ Nobody wants to see an intelligent, sensitive, friendly creature like a dog sacrificed or subjected to discomfort—that much is acknowledged. On the other hand, we are playing for very high stakes here: ultimately, nothing less than the elimination of death itself, and the hideous suffering and indignity that is often unavoidable in our journey through life. (People who think this suffering extraordinary should visit a nursing home and witness dying under the various forms of torture provided by the normal aging process.) People are worth more than animals. In trying to continue life and make it worthwhile, one is sometimes faced with choices that require a sacrifice of what



"Fluosol-43" was a blood substitute used in the early dog experiments

is less important. We don't like to have to make those choices, but when the alternatives are worse, we justifiably make them. As has generally been the policy with animal work in cryonics, every reasonable effort was made to carry out experiments as humanely as possible, all surgical work, for example, being done under general anesthesia. Moreover, it was always an Alcor policy (and still is) never to use an animal more than once in a total body washout—if it survived and was not sacrificed (painlessly) as part of the experiment, it would then become a pet.

In addition to the dog work, there were other experiments that added knowledge or helped develop new technology. One unusual opportunity presented itself. Due to a shortage of funding, three whole-body suspension patients that had been stored at Trans Time were converted to neuro-preservation; their bodies were then thawed and autopsied at Alcor.¹¹ In this way it was found that substantial cracking had occurred in the prior cooldown to liquid nitrogen temperature. Presumably this problem also existed with other suspensions; efforts then were made to minimize it, for example, use of slow, controlled

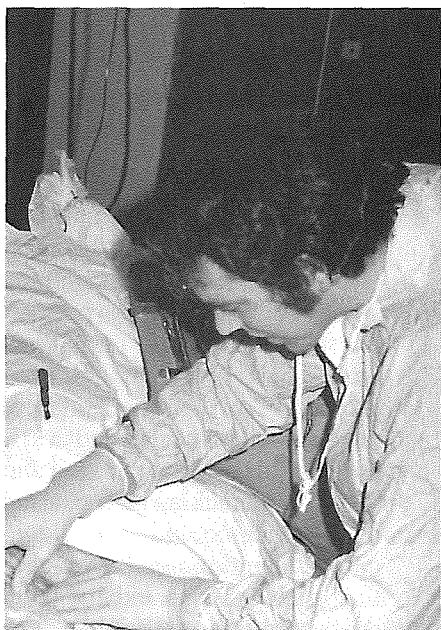


Star, Alcor's first resuscitee, with Mike Darwin, 1984

cooling and higher concentrations of cryoprotectant.

Another project was a study of cat brains. These were perfused and frozen under a variety of conditions, in an effort to assess problems that would occur in human suspensions. Examinations were made at the macroscopic, histological (cellular) and ultrastructural levels.¹² Results showed that, while fine structure clearly was being preserved, the preservation was not perfect. Basic questions remained unanswered, such as whether identity-critical information would be adequately retained in frozen brain tissue. (These questions are still unanswered and await better understanding of how memories are stored.)

Some important innovations affecting suspensions resulted from Alcor's research during this period. The change in perfusate was mentioned (not the last). Another achievement was the Mobile Advanced Life Support System (MALSS—now renamed Mobile Advanced Rescue Cart or MARC)—a specially equipped gurney for maintaining circulation and oxygenation while transporting a patient.¹³ "Silcool," a silicone oil, replaced isopropyl alcohol as a heat exchange medium for cooling patients to dry ice temperature. (Unlike silcool, the alcohol is volatile, flammable and damaging on contact with tissue.)¹⁴ Other innovations were made in patient



Jerry Leaf at Alcor's inaugural experiment, Sept. 24, 1977.



September, 1987: The last experiment before the Dora Kent Crisis halted Alcor's research

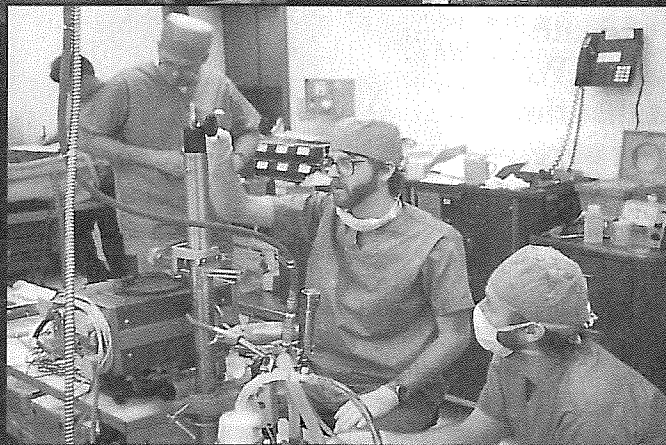
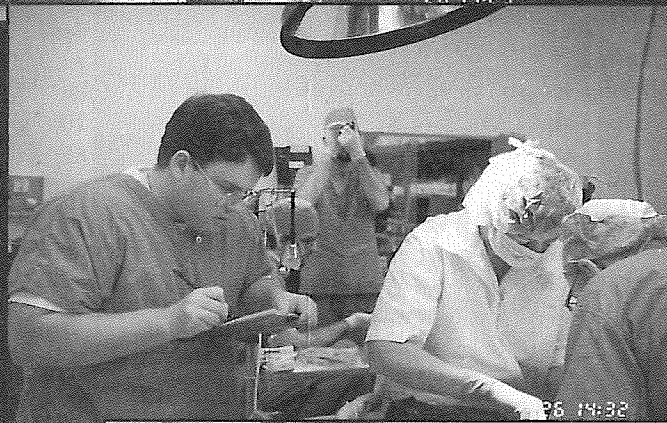
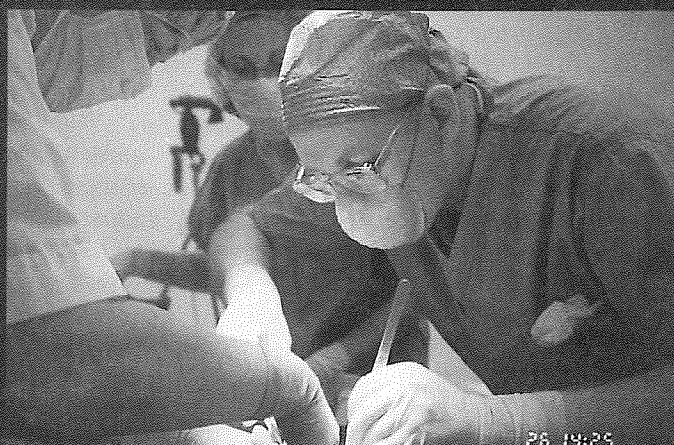
storage' for example, a fire protection system (for vaults used to store neuropatients) based on water-filled pipe sections¹⁵, and an alarm system.

With the Dora Kent crisis that erupted at the end of 1987, and the subsequent legal battles and other problems, Alcor's research effort was slowed, though not halted entirely. Some significant accomplishments over the next few years included a computer program for modeling perfusions,¹⁶ and more recently, an automated cooldown system.¹⁷ Another serious blow to the research program, however, was the suspension of Jerry Leaf in 1991 followed by the departure of Mike Darwin from Alcor in 1992, to head his own research team. Early in 1993 Alcor's animal work was finally halted by local regulatory restrictions. (For the last project, that January, there was an attempt to recover a hypothermic dog without subsequent hemodialysis; this objective was not achieved but there

were tantalizing indications that it should be possible.¹⁸) The move from California to Arizona in February 1994 removed the prohibitions on animal work, and with other favorable conditions, including some new talent, doors again were opened for a major research effort. This will take time to acquire full momentum, but there is optimism that major discoveries and developments are in the offing.

Some issues must be considered carefully: the following is, I'm sure, only a very partial listing but can serve as a discussion-starter. The work with dogs seems marvelous enough in retrospect, yet we must ask how significant such work is for the goals we would like to pursue. What, on the other hand, should those goals be? Everyone acknowledges that reversible brain cryopreservation would be a most desirable accomplishment. It would open a new era, in which cryonics would have to be taken seriously (we think) by

In this photo series from the most recent dog experiment, Hugh Hixon (top picture) and Dr. Nancy McEachern work to establish femoral access, while Derek Ryan (middle picture) takes notes, and Ralph Whelan and Jay Skeer (bottom picture, middle and right) check the occlusion of the heart-lung machine pumps.



the general population. Is this goal a realistic one, with technology available today or likely in the near future? (Some recent results of noted cryobiologist Gregory Fahy with other organ preservation look promising, but clearly much remains to be done before the brain is reversibly suspended.¹⁹) If brain cryopreservation is to be pursued, is the right approach to do more animal work, more or less picking up where we have left off? If a reversible suspension is achieved, it may be very expensive. On the other hand, cryonics is already expensive, compared to more traditional arrangements. The high cost probably keeps a lot of people from signing up. What about less costly alternatives, the advancing science of chemopreservation, for instance? How should the quality of a preservative technique be assessed? Electronic hardware and software are becoming both cheaper and more powerful. This should lead to much more detailed studies of such processes as perfusion and tissue cracking, and to increasing automation of suspension procedures. How should the available effort and resources be apportioned among the

different research and development alternatives, particularly in light of this new technology?

Such issues will determine the course of research as Alcor attempts to enter a Second Golden Age, this time to stay.

References:

LLM = *Long Life Magazine*; C = *Cryonics*. Many of the *Cryonics* articles—from the mid-'80s—are unattributed; editors: Michael Darwin and Stephen Bridge through Sep. 1984; Michael Darwin and Hugh Hixon, Oct. 1984 through Oct. 1990. Authors, where known, are as follows: 1. Laurence Gale; 2. Carl Carlyle; 3. Michael Darwin; 4. Hugh Hixon; 11. Michael Darwin (as Michael Federowicz), Hugh Hixon, Jerry Leaf; 16. Michael Perry; 17. Keith Henson (1st article), Hugh Hixon (2nd article); 18. Tanya Jones; 19. Michael Darwin

1. LLM Jul-Aug 1978, page 59.
2. LLM Jan.-Feb 1979, page 2.
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4. C Jan 1985, 19. (See also G. Feinberg, "Physics and life prolongation," *Physics Today* Nov 1966, page 45.)
5. C Sep 1984, page 13.
6. C Jul 1984, page 2.
7. C Nov 1984, page 3.
8. C Aug 1986, page 10.
9. C May 1985, page 11.
10. C Dec 1984, page 3.
11. C Sep 1984, page 16; Nov 1984, page 13.
12. C Jul 1985, page 1.
13. C Nov 1986, page 30.
14. C Oct 1985, 8; Nov 1985, 4.
15. C Oct 1984 page 1.
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17. C Jan 1993, page 6; 3rd Qtr 1994, page 33.
18. C Feb 1993,

page 10.

19. Cryonet message #3063 (5 Sep 1994).

Much thanks to Hugh Hixon for consultations during the writing of this article—MP.



Selling Cryonics

To get people even to write for information, we have to overcome the thoughts that anything this far from the norm must be a cult, a scam, or a collection of death-terrified psychotics. We have to admit that the level and amount of research done on cryonics is low, and that we don't know if this will work or not. We have to get past the mistaken impression that cryonic suspension is only for the wealthy or for those people "valuable enough" to be revived by future societies.

"So how do you handle your advertising? You know, all you need to do is run a full-page ad in the *Wall Street Journal* and you'll have all the business you can handle. Just give me a commission on all of the new members I get, and I'll take care of everything."

A handful of us who have run cryonics organizations will recognize this guy right away—the fellow who thinks cryonics is another commodity to be bought and sold and all it takes is a bit of advertising. We've also watched these guys fall on their faces and pass from the scene in search of easier scores.

Selling cryonics is *tough* work. First, you as a cryonics "salesman" must convince a prospective client to re-examine his own mortality, an aspect of his life he may have boxed off for his own sanity decades earlier. Then you have to convince the prospect that:

1. The future will be a really cool place to hang out instead of a science fiction post-nuclear holocaust nightmare with rap music,
2. Future medicine will be able to take care of current diseases and injuries (no cancer, AIDS, heart disease, airplane fatalities, or bad breath),
3. Aging will be reversible and preventable in less than a century (no balding starship captains),
4. Yes, freezing causes massive amounts of structural damage, but, hey, it's repairable—really... probably... we hope,
5. Molecular technologies will be able to fix all that stuff, and lots of stuff he never even thought of before, but about which you now have him terrified,
6. "Dead" doesn't have to mean

"DEAD,"

7. "Emergency conversion to neurosuspension" means "never having to say you're sorry,"

8. There aren't any reasons to deal with all of those messy "soul" questions,

9. Yes, it's worth a few thousand dollars to stay alive, even \$120,000,

10. He'll have a great time meeting altruistic attorneys and/or life insurance agents (oh, yeah),

11. There are plenty of good reasons to stay alive both now and in the future,

12. Yes, he'll be able to adjust to the future at least as well as his ancestors did in crossing an ocean to get to America,

13. Yes, there are plenty of reasons why people will want to "bring him back" in the future (even though you have already spent weeks answering this dolt's questions and you know they had better not ask YOU to decide whether to revive him in the same universe as you), AND

14. Reading, comprehending, and signing that mound of paperwork is really lots of fun, and don't worry that there are no guarantees—hey, we're pioneers!

Sometimes this process can take as short a time as two years (in a really good case), and may only require ten or fifteen meetings a year to convince him. Multiply this by a few dozen prospects and you can easily see why the number of ulcers and headaches among cryonics "motivators" (I can't bring myself to call them "salespeople" anymore) is higher than the number of marriages and robust bank accounts.

Infiltrating Science Fiction

All of these questions came up again when I attended the 1994 World Science Fiction Convention in Winnipeg, Canada in September. Cryonicists have been appearing at SF "cons" and talking about cryonics to these supposedly future-oriented folk at least since 1978, when several of us in Indianapolis attended the North American SF Convention in Louisville, Kentucky. We've written over the years about how disappointed we have been at the results of our activities at what we thought would be a hotbed of people who wanted unlimited lifespans. Unfortunately, the majority of SF fans seemed to be more interested in escape from reality and dressing up funny than in serious contemplation of the future or finding a way to get there.

Fortunately, it looks like we may be making some progress (glacial in comparison with selling new cars, more rapid in comparison with previous cryonics history). In Winnipeg I met quite a few people who thought cryonics was logical and acceptable and worth discussing seriously.

Like at most science fiction conventions I have attended on behalf of Alcor (that sounds more noble than it is—I have a lot of fun at them, too!), there were three primary ways of showing cryonics to people. First, I shared a dealer's table in the exhibits area, which had been arranged by Brian Wowk of CryoCare, Ben Best of the Canadian Cryonics Society, and Paul Wakfer of CryoSpan. Second, Ben and Paul, along with Keith Lynch, had rented a large suite in the Sheraton Hotel for nightly room parties. (Room parties are a science fiction tradition with too many variations to go into here. Basically, hundreds of people troop around the hotels looking for action. For some people "action" means alcohol, flirtation, and song, for some it means silliness, and for many "action" means "intellectual conversation." Cryonics room parties aim at getting the latter.)

And finally, Brian, Ben, Paul, and I were also scheduled to present cryonics in a panel format as part of the convention programming. (About 4,000 people attended the convention, so the programming was multi-track, sometimes

as many as 15 programs per hour.)

There was the potential for discomfort in the organizational rivalries present, but we agreed to expend most of our energy in promoting cryonics in general and to keep personalities out of discussions of the differences between organizations. That worked out very well and prevented us from chasing off potential new cryonicists.

I ended up working on cryonics a lot more hours than I had planned, but I think it was worthwhile. By my estimate, I sat at the dealer's table 12-15 hours

"The average American has a very poor level of scientific literacy. A survey several years ago showed that less than 50% of Americans had any idea what a molecule was, much less an understanding of DNA, cell biology, or molecular technology. And the situation is much harder for older Americans. My father went to high school ten years before anyone knew what DNA was."

(we took turns so we could all attend interesting programs), was on the panel (1 hour), and talked cryonics at the room parties for 15-20 hours. I also independently talked about cryonics various times during the conference as I had meals, met people in the halls, and attended other parties myself.

We spoke to many people in the dealer's room, and sold a surprising number of books on cryonics and nanotechnology (most of these were Ben and Paul's). About 40 people attended the cryonics panel and at least two hundred people attended the various room

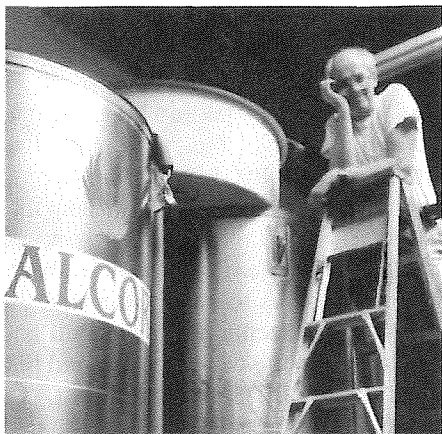
parties.

There were not as many people at the cryonics room parties as in some years past, although the percentage of truly interested people was much higher than before. This was the fourth year in a row for a cryonics room party at a WorldCon, and I think many people look forward to them. One of the reasons for less attendance, I think, was that four GUYS were hosting it. When women like Brenda Peters, Linda Chamberlain, and Angalee Shepherd have been at these, the food seems to taste better and the atmosphere seems more cheerful and inviting. So the word gets around that this is one of THE spots to visit. Of course some people figure it out anyway.

I was impressed by how many science/engineering/medicine-oriented programs were on the convention schedule this year. Various of us attended some of them, and in at least two programs cryonicists were able to make positive statements from the audience.

In any convention, the most important sales aspect is the networking. Several old friends asked me serious questions about cryonics for the first time at this con, even though they have known me for years. And I heard and met engineers and scientists from all over the country. I now know a lot more about the new virtual reality engineering system at Sandia National Labs, why major defense corporations don't tell the truth to the government labs, and why we may be closer to cloning dinosaurs. Interestingly, being President of a large cryonics company carries a fair amount of prestige among these kinds of people. I'm out on the far edge; but they think of cryonics research as plausible and interesting—even *acceptable*, which is a wonderful change from decades of "weird." (And you know you're way out past the boundary when people in rubber alien costumes call YOU weird.)

Next year's WorldCon is in Glasgow, Scotland, and I doubt that Alcor can afford to send me there. However, whenever the WorldCon is outside the USA or Canada, there is an alternate North American SF Convention (NASFIC) for people who can't afford to go so far. Next year the NASFIC will be in Atlanta GA, and we are already making plans to be there.



This man wants to show you the future.

Hugh Hixon is a biochemist. At the Alcor Life Extension Foundation, Hugh is developing techniques for suspending human life in such a way that it can be started again, decades or even centuries in the future.

Today, doctors routinely revive patients who lack vital signs for an hour or more. Tomorrow, using nanotechnology (molecular machines capable of repairing individual cells), medicine will have far greater capabilities.

We look forward to a time when it should be possible to revive anyone whose brain still contains the information that defines personality and intelligence — regardless of other factors. And by that time, we believe science will have conquered the aging process.

How can this help you?
Through cryonics.

Cryonics means freezing a patient so that future technology may give

that person a new, longer life. Cryonics is a highly sophisticated medical procedure—but is easily affordable, if you pay the cost in installments, in advance.

At Alcor, we offer you a chance to achieve something that people have dreamed of for thousands of years: an unrestricted lifespan.

We are the largest provider of cryonics services in the world. If you'd like to know more, call our toll-free number anytime: **800-367-2228.**

Our staff are always standing by. And if you have any technical questions, Hugh will be happy to answer them.



Alcor Life Extension Foundation

12327 Doherty Street, Riverside, California 92503

Alcor's full-page ad in Omni magazine

So How Do We Advertise?

True advertising and marketing require *money*. Most cryonics organizations were started on a shoestring budget—usually with two shoes sharing one short shoestring. Even the essential costs of gearing up and staying ready for suspensions, doing research, paying staff, running an office, and putting together attractive, useful publications are normally more than a small group can handle. Finding \$30,000 for major advertising is rarely possible.

In addition, in the early 1980's Mike Darwin used to caution me that you

shouldn't do major advertising until you're sure you have something for sale. Advertising cryonics before you have decent equipment and facilities will do more harm than good.

The earlier listed problems of talking about cryonics with someone one-on-one are magnified when we think about advertising. If it takes two years and several kilograms of written material to adequately explain cryonics, how much can we squeeze into an ad? And which things should we choose?

Look at the misperceptions about cryonics that we must overcome to get people even to write for information:

We have to overcome the thoughts that anything this far from the norm must be a cult, a scam, or a collection of death-terrified psychotics. We have to admit that the level and amount of research done on cryonics is low, and that we don't know if this will work or not. We have to get past the mistaken impression that cryonic suspension is only for the wealthy or for those people "valuable enough" to be revived by future societies.

And there is the basic lack of understanding the important concepts. The average American has a very poor level of scientific literacy. A survey several years ago showed that less than 50% of Americans had any idea what a molecule was, much less understood DNA, cell biology, or molecular technology. And the situation is much harder for older Americans. My father went to high school ten years before *anyone* knew what DNA was. We have to define or re-define for people words like "death," "freezing," "cloning," "genetics," "cryogenics," "perfusion," and "ischemia," and we have to show how they relate to cryonics.

There is no doubt that a well thought-out ad in the right publication can be effective. An ad in *Longevity* several years ago brought several hundred calls for free information. And the Alcor ad in the January, 1994 issue of *Omni* Magazine (designed by Charles Platt) was especially successful; it gained us about 3,000 requests for information. This ad was in full color and would normally have cost us \$30,000 to run. Because of the joint essay contest we had with *Omni*, the ad was free to us. Now if we had several members giving us \$30,000 for full color ads in other publications, I'm sure we could get even more calls. However, please consider the cost-effectiveness. Each request for information costs us an average of \$6.00 for the 800 number phone call, the information packet, and the postage. And those 3,000 requests have led to only about 20 members in nine months, so there is not a quick return on the money invested. (Since it often takes years for people to make this decision, this may lead to hundreds of members someday).

We also began to prepare a marketing campaign last year, which will focus

on sending letters to names on selected mailing lists. This project was interrupted by our move and other projects, but we hope to get back to work on this soon. Alcor members gave us several donations to begin this campaign, and we are anxious to see what it tells us about what we think is a surge in interest in cryonics.

Since money is in short supply, for now we make do, and try to get as much attention as we can for free. We have written several times about the media interviews we have done this year, frankly more than we thought possible. Cryonics is attractive to the press and television. The operating room and the Patient Care Room are impressive pieces of reality to the press, and the human touch is here, too. Photographs of many of our patients hang on the walls of our office, testimony to the very personal reasons why we do this job. And the media like us because we are committed to a cause, intelligent, good speakers, and because the entire idea is so *different*—hubristic and outlandish, but optimistic.

Radio talk show hosts have been especially excited to talk with us this year; and we were happy, too. That is the only place we can control the conversation well enough to promote our 800 telephone number. We have done several shows which stimulated as many as 100 calls over the following 24 hours.

Locally, we are trying to promote a solid community image. I have spoken to the Scottsdale Chamber of Commerce, the Scottsdale North Rotary Club, a Jewish Community Center, and a "Death and Dying" class at Arizona State University. We have had two community college "Death and Dying" classes tour our facility. We have given individual tours to dozens of local business people and students, including a number of people from the local medical community.

When possible, we go outside the local area to talk. The Alcor Northern California chapter recently invited me to be the guest speaker at their local meeting. Since I was going to be in the area, Ralph Merkle arranged for me to give a talk at Xerox PARC (Palo Alto Research Center) where he works. Late this month Derek Ryan and I will present cryonics to a nanotechnology

club at Cal Tech and to a high school biology class in Los Angeles.

We can come to your company or organization or town, too. You'll probably have to help us out with our airfare and local transportation; but it's a great way to get some interest going in your local area.

You Can Advertise, Too

Before I became Alcor's President, I gained publicity for Alcor in many ways. I gave open slide shows in my home town of Indianapolis, including many to school groups. I let the newspapers know that I was the local cryonics "resource person" in case a related story came up. I was on several local radio and television shows. If you are articulate, well-informed, and confident, you can do the same in your community. (Talk to us first, though; there are some important rules to learn before becoming a spokesperson for cryonics.)

Even if you don't feel comfortable speaking in public, there are many ways you can get publicity. There are dozens of authors out there writing books and magazine articles about aging, life-extension, and the future in general. Not too many of them consider cryonics, advanced medical technology, or nanotechnology in their future scenarios. Doesn't that frustrate you? So do something about it. Send them personal letters or Alcor literature showing them what they have been missing. Most of these people will write more books in the future; and if you plant the right seeds, those ideas will grow. I gave some cryonics information to a favorite science fiction author a couple of years ago, and her most recent book featured cryonics in an entertaining and positive way.

Most magazines and newspapers have a "letters" column. Several cryonicists have had letters published refuting negative mentions of cryonics or giving the readers more information. Try to get Alcor's address and phone number in wherever possible. Remember, the 800-367-2228 number only works in the USA and Canada, so 602-922-9013 is best for many magazines.

When people look for information, where do they most often go? The li-

brary, the bookstore, the computer network. We would like to see Alcor's books and magazines in every public library, school library, and university library and in every bookstore in America. We'll settle for you just making sure they are in every library in your state. We'll even give you a special deal for buying lots of copies of Alcor's *Cryonics: Reaching for Tomorrow* or books such as *The Prospect of Immortality* or *Engines of Creation* and distributing them to libraries. We'll give you special rates for library gift subscriptions to *Cryonics Magazine*.

Other often over-looked sources for cryonics information are library reference books. For instance, Alcor has received several calls for information because we are listed in *The Encyclopedia of Associations*. You might look for other books that we should be listed in and help us accomplish that.

Science Fiction conventions aren't the only conventions that feature dealer's tables, room parties, and guest speakers. You might try to sponsor cryonics-related activities at conferences of space activists, Internet surfers, libertarians, life extension researchers, or similar groups. Make sure it is a group that you belong to, so you know the ins and outs of the sub-culture in advance.

Face-to-Face

Advertising cryonics doesn't have to take hundreds of thousands of dollars. Face it, while most people hear about cryonics from one of the usual sources, they usually *adopt* cryonics because of *meeting a cryonicist*. Try to meet people. Show them how friendly and interesting you are. (If you're NOT friendly and interesting, just forget I said anything.) Tell your friends and family. Discuss this idea. Eventually maybe we really will make this idea so well understood that selling it through advertising will work. For now, though—"Tag, you're it!"

Go tag someone else.



An afternoon in the company of...

Two Minds

Derek Ryan interviews Alcor Founders
Fred and Linda Chamberlain

Part 1 of 2

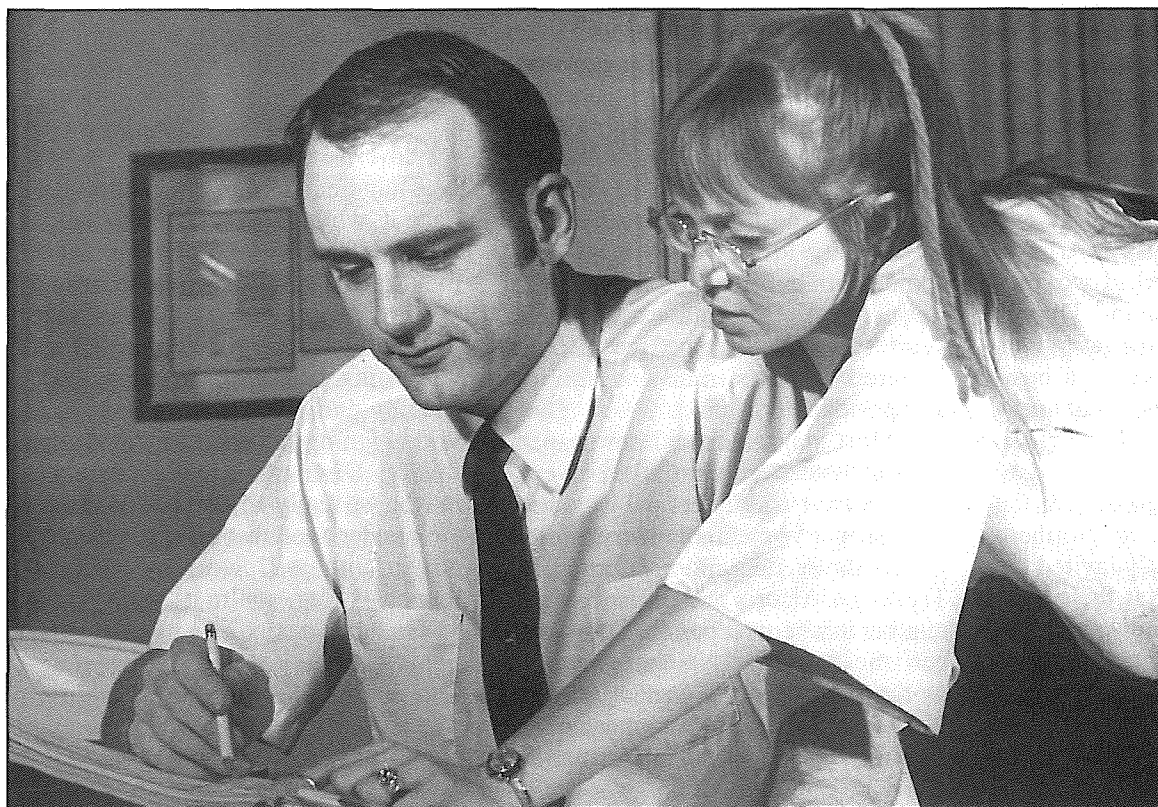
Anyone who is at all familiar with the history of cryonics knows that the field is now and has always been laden with staunch individualists, rugged pioneers, and colorful eccentrics. But even among this atypical group of mavericks, few have done as much pioneering as Linda L. Chamberlain and her husband Fred R. Chamberlain, III. Although their main claim to fame (so far) stems from having co-

founded the Alcor Life Extension Foundation in 1972, Fred and Linda have arguably done more moving and shaking in cryonics in the 22 years since then than all but a few individuals, the number of whom could probably be counted on one hand.

Fred, (whose father, Fred Chamberlain, Jr., was Alcor's first patient), was born in Ft. Monroe, Virginia in 1935. He grew up mainly in Washington, D.C. and central

Virginia, finishing high school in Charlottesville, Virginia. He then went on to the University of Virginia, earning a B.S. in electrical engineering in conjunction with the Navy ROTC program. Afterwards, he served six years as an officer in the Navy, where, among other things, he was involved in diving and explosive ordinance disposal (disassembly of all types of conventional munitions and nuclear weapons).

After transfer to the Air Force in 1964, Fred spent two years working on laser fusing for reentry vehicles. Then he resigned from the Armed Forces, joining the Jet Propulsion



Fred and Linda, shortly after they founded the "Alcor Society for Solid State Hypothermia"

Laboratory in Pasadena, and worked on a number of interplanetary spacecraft projects until 1979. Among these were the Mariner Venus/Mercury and Voyager missions. Fred had two children by his first wife, to whom he was married from 1961 to 1971.

Linda, (whose mother, Arlene Fried, was suspended by Alcor in 1990), was born in Everett, Washington in 1946. Her father worked for an oil company, so her family traveled and moved frequently while she was growing up, spending significant time in both Montana and Wyoming. Eventually her father was transferred to California, and Linda consequently attended high school in Downey, graduating in 1965. Immediately after high school, she began working full time as a secretary, and attending night classes at local community colleges. She was married briefly in 1965, and afterwards decided to pursue a degree in philosophy. Her plans were interrupted when she found out about cryonics, and changed altogether after meeting Fred.

Fred & Linda lived and worked together in California throughout the 70's, with Linda spending most of her time on the development of cryonics (toward the end of that time, she took a job at JPL for a year and a half). At first, they worked with the Cryonics Society of California, and formed Manrise Corporation. Then they founded Alcor, after helping to incorporate Trans Time, Inc., and maintained close ties with the BACS (Bay Area Cryonics Society, which has since changed its name to "ACS", the American Cryonics Society).

In 1979, Fred & Linda fulfilled a dream they'd shared from the time they first got together, by moving to Lake Tahoe. There, as licensed real estate brokers, they started

and ran a property management company together throughout the 80's. For much of that time, they also conducted annual "Lake Tahoe Life Extension Festivals" for cryonists and published collections of short stories about cryonics ("Lifequest"). Toward the end of that period, they began developing a non-profit organization to address far reaching questions concerning how reanimation and rehabilitation might be carried out ("Life pact").

When Linda's mother was suspended in June of 1990, Fred & Linda sold their property management business and went back to school, hoping to pursue degrees in neuroscience and become more involved in Alcor's research program. At the outset of this, they spent a year traveling around the country, visiting other cryonists. Then, after a year of classes, these plans were rudely interrupted; Fred was diagnosed with prostate cancer, in mid-1993, and Alcor was torn by internal political strife.

Since that time, Fred & Linda have once again become more intimately involved with Alcor. Fred was elected to the Alcor board of directors in September, 1993, and this year Linda replaced Fred in the same capacity.

Recently, Alcor Membership Administrator Derek Ryan spent a day with the Chamberlains at their new home in Payson, Arizona (80 miles north of Scottsdale), and this is what he had to say:

"Interviewing Fred and Linda wasn't so much an *interview* as a whirlwind of enthralling conversation. Getting them to talk about cryonics, life, the universe and everything is very easy; not because they are the type of people who talk over you (or over each other), but because they both have a lot to say. Rarely does one get the

opportunity to know people who have spent so much time and energy thinking, planning, and acting to bring about the kind of world that we all imagine to be possible. Even after all of these years, their enthusiasm still knows no bounds.

"One of the aspects about them that delights me the most is the way that they approach everything in life, including conversation, as a team. Like a *tag team* in wrestling. Put another way, watching and listening to them together is not unlike watching a well practiced pair of jazz musicians performing an improvised duet, continually negotiating, giving and taking as they pass familiar motifs as well as completely improvised melodies back and forth. Even when you see their words on paper, as in the interview, this aspect of their combined personalities comes through loud and clear. It's fun to watch.

"Naturally, I feel a tremendous amount of respect for them, and that we all owe them a real debt of gratitude. The more I think about it, the more impressed I am at how good a job they did in creating an organization designed to persevere. There have been many different board and staff members at Alcor over the years, and there have been many different principal activists. Amazingly, though, the central values and goals of the organization itself have persisted through thick and thin. As evidence of this, consider that I was three years old when Alcor was founded. I knew nothing about life, let alone cryonics. It is no coincidence that now, 22 years later, I am here at Alcor. The values which Alcor embodies attracted me just as surely as they will attract those who will come after us, and even those who may eventually revive us."

Cryonics: *How did each of you first get involved in cryonics?*

Linda: I joined CSC (The Cryonics Society of California) in '69. My brother sent me Ettinger's book (The Prospect of Immortality) early that year. It was one of those one night reads. I knew immediately that cryonics was for me. I called Ettinger, he told me about Bob Nelson and CSC in California, and gave me their phone number.

Fred?

Fred: Well, Ettinger's book came out in '64. I think I saw it shortly after that. I'd been aware since I was 10 or 11

years old that sooner or later growing old and dying was going to be a problem for me. But I figured I had plenty of time, and that sooner or later someone would come along and solve the problem. Sure enough, Ettinger published his book, and I figured that pretty much would take care of it.

Sure. "Now we freeze everybody."

Fred: Right! It took me about five years to realize that things weren't happening very rapidly. I'd lost a few relatives in the meantime, and had corresponded with Saul Kent in New York, but I didn't become an activist until 1970. So it took about a five year gestation period.

When did you two first meet each other?

Fred: Well, we first laid eyes on each other at a February, 1970 meeting of CSC. For several months Linda had been helping to coordinate an upcoming cryonics conference. I had been badgering Bob Nelson to get me some more information, and he invited me to start coming to these weekly planning sessions for the conference; that's where we met.

But how did you get to know each other? Weren't you both tied up with someone else at the time?

Linda: Fred had written a little thing called "Two Minds." I got hold of a

Two Minds

by Fred Chamberlain

Most minds live alone—they reach out on narrow, mundane, well worn paths in the process of survival, touch other minds briefly, and pass on. In books, one mind may touch another, but the mind that provides the idea is not aware of the process. The mind that is touched may give wide berth to any idea that contradicts what it has already accepted. The contact is not vital.

Suppose two minds touch, and draw near—suppose an exchange of ideas occurs which is limited by neither inhibition nor any form of dishonesty. Suppose two minds, both despising the “kind” lie, find a commonality of purpose and understanding that is fully dedicated to rationality.

Suppose I tell you I’d rather be crushed than deceived, every time? Suppose I say that when my mind produces concepts that are naive, boring, ignorant, crude, irritating, clumsy, irrelevant, short sighted, or illogical, I want to know? Tell me kindly, but tell me. Help me to grow to a state of unbreachable intellectual function, and I’ll try to help you. I swear by all I value to show you my clear convictions and my areas of confusion. If my convictions are different than yours, work with me to discover which of us is right. If I am confused and you see the issue clearly, help me to learn. If we are both confused, explore the matter with me until it is fully clear to both of us.

If contact with my mind is unbearable to you, tell me so—I will go. Far better this than to chain yourself to a hideous deceit in the name of protecting my feelings, where the situation grows more unbearable and more dishonest until you are numb and mute. Help me to be all the things you want me to be, and I will become your greater value each day. Here, the rewards of honesty are without bounds or limits.

*I am headed for the sky,
Come along if you can fly.
Fly beside but do not hold me,
Do not let your wings enfold me.
If you’d rather stay below,
Wish me luck and let me go.*

*If you rise with all your might,
I’ll stay with you day and night.
Help you every way I may,
Listen to the things you say.
I will let down all my bars,
Share my dreams about the stars.*

*And if I am bound to earth,
If I say stars have no worth,
Seek the joy that is your own,
Join others that have flown.
Do not worry if I cry,
All it means is “I won’t try”.*

If you cannot reach my mind—if it is buried and cannot respond, go and seek someone you can share your thoughts with. Do not struggle to reach me if I seem deaf—do not bind yourself to a perpetual loneliness and a futile loyalty. Seek the joy that can be yours. The sight of a living flower, distant in the fresh air, will be more beautiful than dry, drooping, dying petals at my elbow.

copy second hand, and fell in love with the mind that wrote it. After the big conference, on the way to a “post conference party” (Fred gave me a ride), we stopped for dinner and started talking. It opened up a whole new way of thinking about each other.

But didn’t you [Linda] go up to Idaho then, and build a cabin up there?

Linda: For a few months, yes. But Fred and I started writing to each other, and I finally decided I’d be happier having a cryonicist. . . Fred, the author of “Two Minds” in particular. . . for a partner.

Fred: I came to the same conclusion. . . about the same time.

Linda: Fred drove up north and brought me back to California where I became one of the first unpaid employees of CSC, which is where I got my training to be the first unpaid employee of Alcor. (Laughs.)

The first of many. (Both laugh.) I understand that the circumstances surrounding your marriage were a bit, shall we say, unusual?

Fred: A few months before we got married, we’d formed Manrise Corporation. Being Randites and Libertarians, we were both concerned that a legal marriage would entangle us in such a way as to. . .

Linda: . . . ruin our relationship. . .

Fred: . . . and force us into stereotyped role images as to how people ought to live. So we very methodically called a

board of directors meeting and ordered ourselves to get married for the good of the corporation. Part of the minutes of the meeting directed that the ceremony was to be very simple, was not to mention any supernatural entities. The only announcement was to be in the Hourglass (which at that time we were publishing for CSC, it was their newsletter). The only thing the announcement was to say was, “Your Editor and Production Manager now file a joint income tax return.” (Laughs.)

Linda: We were afraid that legal marriage would get in the way of our romantic relationship. And at that time, back in the early ‘70s it was still not socially acceptable for people to just live together, nor was it common for women to keep their own names.

Is that why you (Linda) took the name of “Chamberlain?”

Fred: Well actually, she went to court and changed her name to Chamberlain before we got married.

Linda: I changed my name to Chamberlain by going through the legal procedure because I rebelled against the idea that some god or gods or some state entity had the right to tell me how I could or couldn’t live my life, that I couldn’t live my life with someone I loved without their sanction.

Fred: Then, when we went to file the application for a marriage license, and they asked what our unmarried names were, and we both answered “Chamberlain,” they made us fill out an affidavit that we weren’t blood relatives. (All laugh.)

What was Manrise?

Fred: Well, we needed a way to pool dollars to do things like buying an HLR [Heart-Lung Resuscitator], acquiring a van, equipping it, and building prototype perfusion equipment. There had to be some entity that owned these dollars. We didn’t think it made any sense to just donate these dollars to CSC to do this.

Why?

Fred: Well, we had been working with CSC just about four months when we did this.

And already you were beginning to think that things weren’t exactly kosher?

Fred: Yes. As a matter of fact, I think you’ll notice that the first couple of

[This is probably the most non-serious corporate document you will ever see.]

**MINUTES OF A SPECIAL MEETING OF
THE BOARD OF DIRECTORS OF**

MANRISE CORPORATION

A California corporation

The Board of Directors of Manrise Corporation held a special meeting at 2155 La Canada Crest Drive, La Canada, California, on the 7th day of May, 1971, at the hour of seven P.M. There were present at said meeting, the following Directors, constituting a quorum of the full board, all officers of the Corporation, and all prospective shareholders.

Frederick R. Chamberlain III
Linda L. Chamberlain

The Chairman stated that the meeting had been called for the purpose of evaluating certain coercive and unjust customs and laws concerning the payment of taxes, the disposition of personal residences, and the permissibility of certain personal acts, wherein such laws constitute a threat to the orderly, efficient, and profitable conduct of the corporation's business.

He pointed out that certain tradition-bound and relatively unintelligent customers of the corporation might assert that the corporation's President and Vice President were "living in sin and carrying on in an unseemly manner", such assertion perhaps being loudly proclaimed on television talk shows, from the pulpits of churches by devout ministers, across garbage dumps by law enforcement P.A. systems, and in other comparably inhospitable environments, to the detriment of Manrise Corporation's profitability.

He further pointed out that some states and foreign nations engage in the primitive and unwholesome practice of prosecuting, convicting, punishing, and sometimes torturing persons found to be engaged in simple reproductive acts, and that such consequences, along with the aforestated other consequences, could be avoided only by producing a barbaric and unspeakable document commonly known as a "marriage certificate", that such document usually would carry the connotation that the aforementioned reproductive act was sanctioned by some devil, witch, demon, supernatural being, coercive political body, dictatorship, human collective, or other mystical or totalitarian freak of existence, and that in many cases this would avert dire injury or death. He also pointed out that it would permit the filing of a joint tax return.

Thereupon commenced a discussion as to the necessity, advisability, feasibility, practicality, and bearability of the President and the Vice President entering into a legal marriage. Both of the parties concerned expressed strong official, personal, professional, philosophical, and psychological objections, reservations, and doubts concerning the matter, but both also agreed that the objectives of life extension and personal wealth could not be compromised in the interest of open resistance to customs and laws of an aggressive, hostile, culture of mixed premises, where conflicts of openly expressed standards might endanger corporate success and/or the very lives of the owners.

On completion of discussion, and on motion duly made, seconded, and unanimously carried, the following resolution was adopted:

WHEREAS, the owners of this corporation are agreed that corporate objectives take temporary precedence over open expressions of standards and values; and

WHEREAS, the personal safety and physical well being of the principals is of significant concern; and

WHEREAS, for some time coercive customs and laws are anticipated to exist, which necessitate outward accommodation;

NOW, THEREFORE, BE IT RESOLVED, that the President and the Vice President of this corporation are directed to enter into a legal marriage, and to remain in such marriage so long as the aforementioned coercive customs and laws pose a threat to the corporation's objectives and to the personal safety and well being of the parties involved.

RESOLVED FURTHER, that the only public announcement of the marriage shall be entered in the "Hourglass" as follows: "Your Editor and Production Manager now file a joint income tax return".

RESOLVED FURTHER, that any ceremony conducted to legalize the required relationship shall be of the utmost brevity and informality, and that no official participants will be included who hold any beliefs in supernatural beings or the innate right of the state to sanction such relationships.

There being no further business to come before the meeting, upon motion duly made, seconded, and unanimously carried, the meeting adjourned.

Frederick R. Chamberlain III, President
Linda L. Chamberlain, Vice President

issues of the Hourglass list CSC as the publisher, and after that Manrise is the publisher.

Linda: And the way that we got the very extropian name of "Manrise". . .

Fred: . . . was from a newspaper cartoon.

Linda: It had only been a couple of years since Neil Armstrong had walked

on the moon, and the world was still excited about that. And there was this cartoon. . .

Fred: . . . of an astronaut (about the same size as the moon) pictured so that he appeared to be rising from behind the moon. . .

Linda: . . . and they called it a "Manrise." I was really turned on by that; thought

it was very elegant. You know, not just the image, but the concept: mankind rising from its origins, transcending to greater heights and accomplishments, casting off the chains of its biological heritage.

If you don't mind, I'd like you to talk about CSC a bit, for the record.

Fred: Okay, let's start with a little chronology. During the spring of 1970, the main focus was preparing for the Third Annual Cryonics Conference, sponsored by CSC, held at the Airport Marina Hotel in Westwood.

Linda: The first Conference was Ettinger's in Michigan in '68, and the second was held by the Cryonics Society of New York (CSNY) in '69 (or, was it the other way around?). [Yes, it was the other way around. —Ed.] Anyway, CSC's was the third, and the fourth was held by the Bay Area Cryonics Society (BACS) up in San Francisco.

Fred: We'd been working evenings and in our free time helping to prepare for this conference. We'd heard a lot of hype about how well prepared CSC was, how strong and well organized, how many experts Nelson had in his hip pocket. But basically, we were too busy helping with the conference to think about verifying the claims he was making. A big mistake.

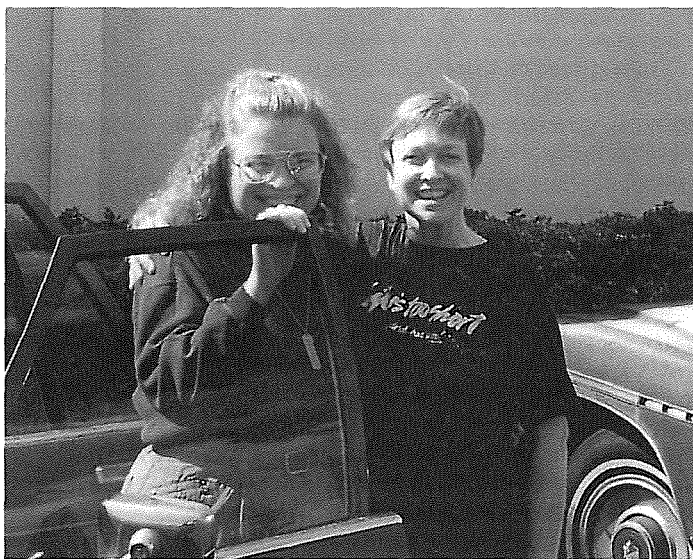
Then after the conference in May, Linda took off for Idaho to build her cabin and have her adventure in the mountains (which is too long a side story to include here), and I went back to shoeing horses at JPL. I got together with Nelson once during the summer, and he asked me to be Vice President of CSC. I didn't know very much about the organization at that point, but I said, "Sure." It wasn't until later in the fall of that year (after Linda and I actually got together, and she started working for them full time) that we began to dig in and find out what the organization was really like.

So in September we settled down and started working to see how we could help CSC improve these shortcomings. But what we found out, in short, was that CSC was primarily a facade. Underneath a lot of hype, there was almost nothing.

Nelson was privately freezing people, taking money directly from the relatives, and not passing this money through CSC. There was nothing on the financial records of CSC about these freezings at all. Members paying dues, telephone bills, rent for a little office, that was all that was on the books.

As far as real preparations to freeze people, there was nothing. And as far as the "state of the art" facilities, equipment, and "perfusion experts"... it was all hype. It didn't exist. Not even a system to tell who was signed up or not, no documentation on how to do anything! Nothing!

We thought that this was a serious problem, that there needed to be some special equipment developed, some kind of at least semi-formally published protocol for freezing people so that we could get inputs and feedback from other people, and there had to be training. So we began pushing in these directions within CSC. We also began to develop prototype perfusion equipment, through Manrise Corporation.



Linda (right) and Mary Margaret Glennie outside Alcor

We reached a point, I'd say in the spring of 1971, where we'd pretty much concluded that it wasn't going to be possible to work constructively with CSC. We couldn't get any real information about how the organization was run. It was either cloaked in secrecy, or a big sham, or a combination of the two. We knew that there were big liabilities because of Nelson's tendency to inflate and distort the truth, especially with people who were signing up. And so, by the end of a year of working with Nelson, we had effectively severed all formal working relationships with CSC.

Linda: I think there are some elaborations that can be added in here. I was working full time for CSC doing administrative work, etc., during that year.

I began to discover things like, for instance, Bob Nelson's claim that all you had to do to be a member was pay \$10 a month, and for this, you would not only get a membership, but CSC would buy an insurance policy to cover your suspension. Trouble was, they didn't.

Bob had an insurance salesman in Northern California that was supposed to provide those policies. But I began finding that there were an awful lot of CSC members that didn't have this insurance coverage. What I got from Bob Nelson was, "I can't get the insurance guy to do anything." And what I got from the insurance guy was, "I can't get Nelson to give me the information I need."

Fred: So effectively, almost nobody was insured.

How many members were there?

Fred: Well, I'll give you that number, but first let me tell you how we even got the number. We had been led to believe that CSC had special equipment, special techniques, special chemicals, all kinds of things. We were disappointed to find out that the "state of the art cryonics facility" was really just a mortuary. But the alarm bells didn't go off yet.

Disappointed, but still enthusiastic, we went down to visit the mortician Nelson referred to as his "perfusion expert." We got down there,

and the mortician opened up two suitcases, and there's nothing inside except a little bit of surgical clothing, and a couple of mortician cannulae and scalpels. That's the total of what he would take with him on location.

We said, "What about the special equipment?" And he said, "Well there's the embalming pump." So we looked at the pump, which had a single knob on it. . .

Linda: Just an on/off switch.

Fred: It was actually a motor speed control. We mumbled something about there being no way to measure pressure, or temperature, or flow rate, and he said, "Well, it's good enough for embalming."

At that point we said, "Bob said there are special chemicals, cryoprotective

agents and whatnot?"

He said, "Yeah, I think Bob's got some in the back room." We looked. No chemicals! He said, "Well, I guess Bob never got around to getting them."

So there was only one thing left to check on, and we said, "Well, you're supposedly the guy who has the pager in case somebody needs to be frozen, right?"

"Yeah."

"Well, if an emergency phone call came in, how would you know if the person was really signed up, or had his arrangements funded?" And he said, "I guess I'd have to call Bob."

"But sometimes you can't get Bob on the phone for days. What would you do?"

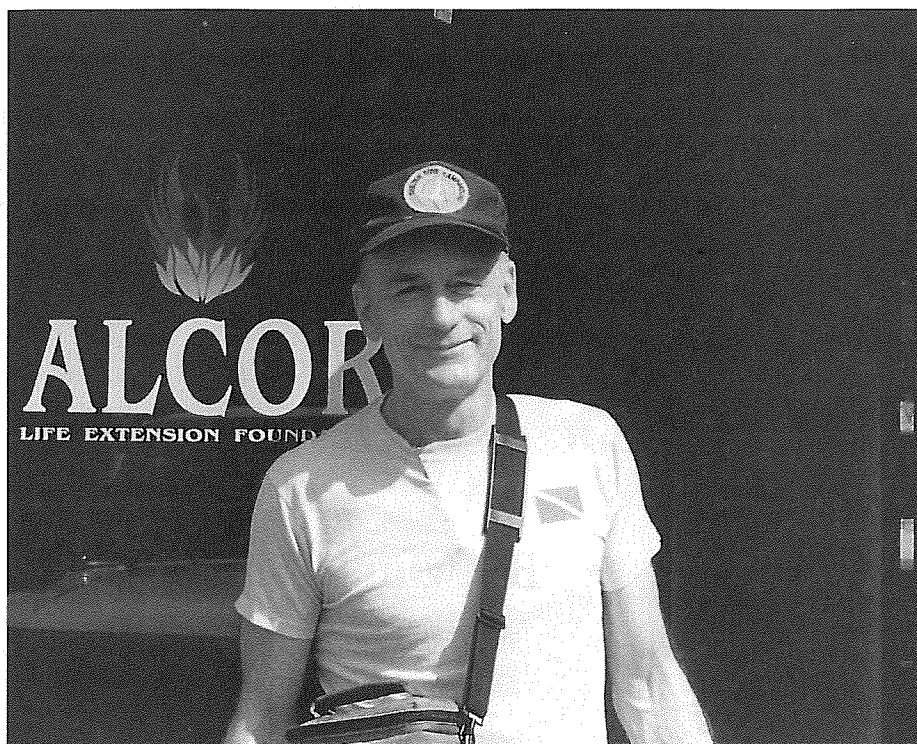
And he said, "I don't know what I'd do."

Linda: We both had knots in our stomachs.

Fred: So we told Nelson that he'd have to come up with a list of people, members with sufficient funding so that they could be frozen. That list, when drawn up, had maybe 25 names on it. We made him sign it, and we gave it to the mortician who carried the pager.

Linda: And it was in developing that list that I began to find out that almost nobody had the insurance that they were being told had been bought for them. That, and the "overstatements" about equipment, facilities and expertise were the first major problems we uncovered. The deeper we pried, the worse things looked. But, there really wasn't anywhere else to go. So, rather than just getting mad and walking away, we decided to see if we could help fix things.

Fred: We probably would have left even quicker than we did, and just affiliated ourselves with the people up in northern California, except we had been counting on CSC to get my Dad frozen. He was in very bad health; so we couldn't just "cut the cord" (BACS wasn't offering suspension services yet). It was only in February of '72, that we realized there was absolutely no way to work with CSC at all. But that's just too many details to go



Fred at the Riverside facility on the day of Alcor's patient relocation

into here.

And that was when you formed Alcor?

Fred: Yes. Manrise (organized to support CSC) had been incorporated for a year. We had equipment (the perfusion machine we developed), we'd published a procedures manual, and we finally had chemicals (we used a base

pability for each other. We had five members, and we had three pagers among us.

Linda: We were serious cryonicists. *(All laugh.)*

So Fred's father was the first Alcor patient frozen, right?

Fred: Yes, that was in 1976. For the times, it represented a dramatic improvement in capability. We bought a van, wired it for lights and monitoring equipment; it even had a perfusion table. We upgraded the original prototype perfusion apparatus (made with a copper manifold that we still have in storage) to use surgical tubing and other types of sterilizeable components.

By the time my dad was frozen we had rented an industrial facility with probably 2500 square feet of space. We'd driven the van into it and wired and plumbed it into the facility. We could already see that the van was

"We had equipment, we'd published a procedures manual, and we finally had chemicals. What we didn't have was members. For a couple of years, Alcor was nothing but Linda, myself, my dad, and another couple, who began working with us to try to produce some kind of rescue capability for each other. We had five members, and we had three pagers among us."

perfusate called Collin's Solution, with DMSO as the cryo-protectant). What we didn't have was members. For a couple of years, Alcor was nothing but Linda, myself, my dad, and another couple, who began working with us to try to produce some kind of rescue ca-

Continued on page 38. . .

How SAFE IS SCOTTSDALE?

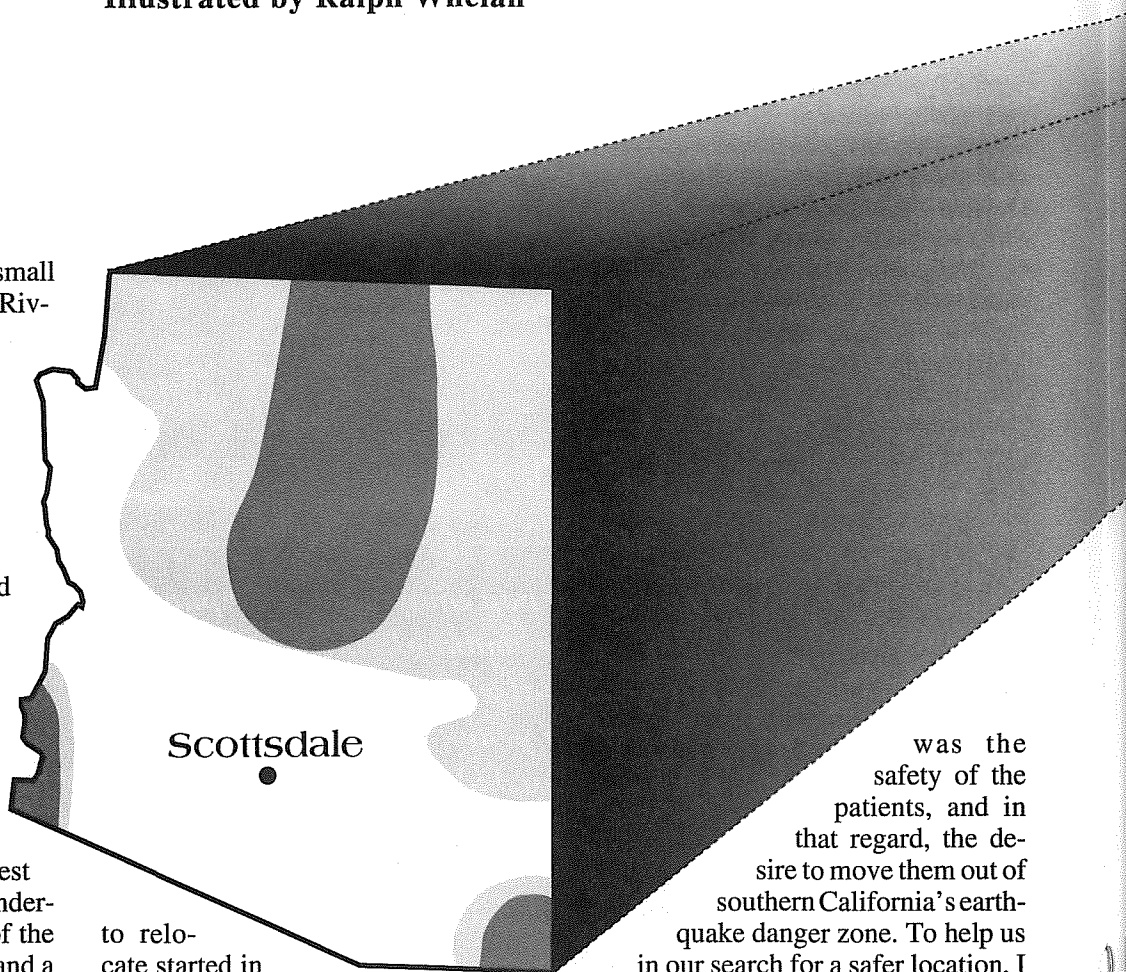
Considerations of Patient Safety In Choosing a Location for Alcor's New Facility

By Mark Voelker, Ph.D.

Illustrated by Ralph Whelan

Alcor's relocation from a small light-industrial building in Riverside, California to a new headquarters facility in Scottsdale, Arizona was an epochal event in the development of the world's largest cryonics organization. Reasons for the move included a real need for a larger, more prestigious facility, a desire to escape a hostile, overregulated business climate in California, a desire to improve the financial standing of Alcor and its suspension patients, and—most pointedly—a need to increase the safety of those patients by reducing their exposure to earthquakes. The move and its aftermath has easily been the largest single project Alcor has ever undertaken, dominating the activities of the staff and board for at least a year and a half. Was it worth it? From our new perspective in Scottsdale, the answer has to be a resounding "Yes!", because all of the above goals were reached, to a degree that has surprised even the early proponents of the move.

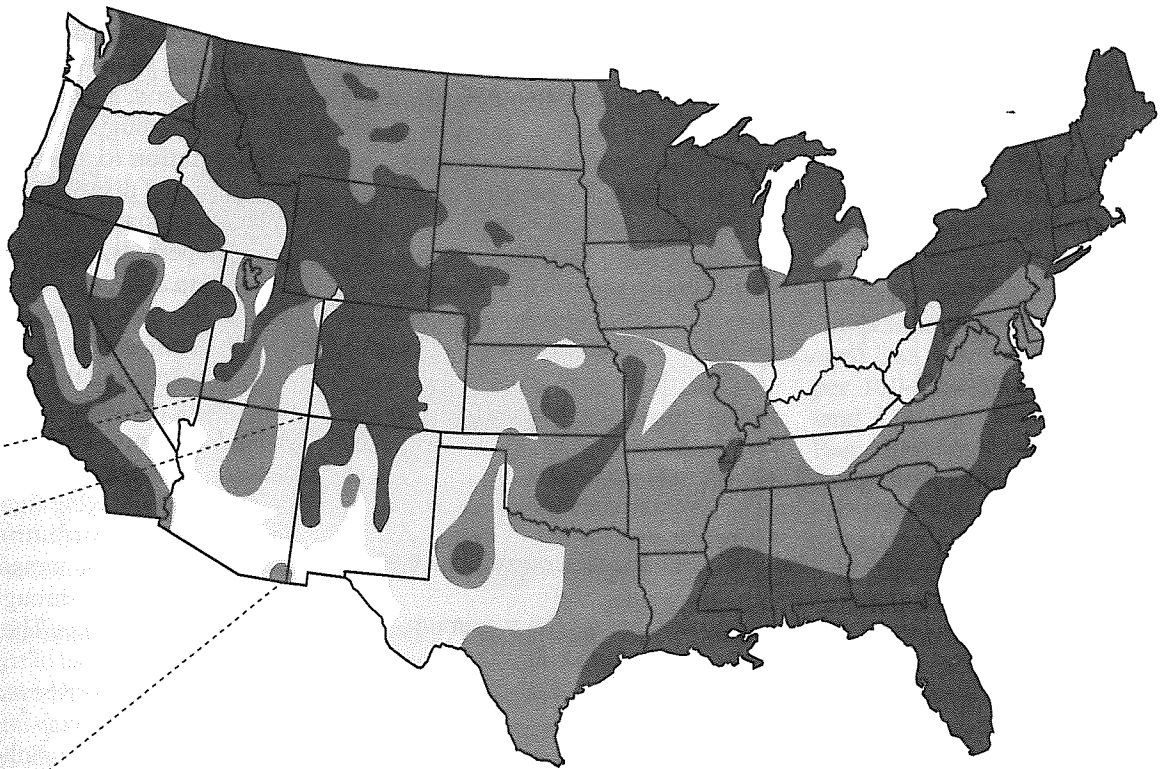
Debate amongst the board and staff about where and when (and later how)



to relocate started in earnest about two years ago, and covered every imagined financial, legal, logistical and scientific aspect of the project, sometimes to the extent that it seemed we would never actually move, but simply debate forever. But the strongest single theme throughout these discussions

was the safety of the patients, and in that regard, the desire to move them out of southern California's earthquake danger zone. To help us in our search for a safer location, I studied the risks due to natural disasters and prepared a report for Alcor's board which included quantitative estimates of earthquake probability and other natural disasters. Much of that report is excerpted in the remaining part of this article. As you will see, these data were quite helpful in choosing a

NATURAL DISASTER RISK MAP



The shaded areas of this map represent high risk (dark shading), moderate risk (medium shading), and lower—but still significant—risk (lighter shading) of four types of natural disaster: earthquake, hurricane, tornado, and blizzard. See the following pages for isolation and quantification of each risk.

new site for Alcor (or any other cryonics facility), because the list of low-risk cities in the United States turns out to be quite short.

What Type Of Facility?

The type of facility to be relocated determined the criteria governing our choice of where to move. Alcor is a full-service cryonics organization, with a mission to provide both suspension services and long-term patient care, and to conduct research to advance the state of the art in both areas. Long-term patient care requires a site relatively free from both natural disasters and civil unrest. While no one can predict with certainty how natural and man-made calamities will unfold at any given location, a responsible management will use available information to put the odds in their favor. Not only did

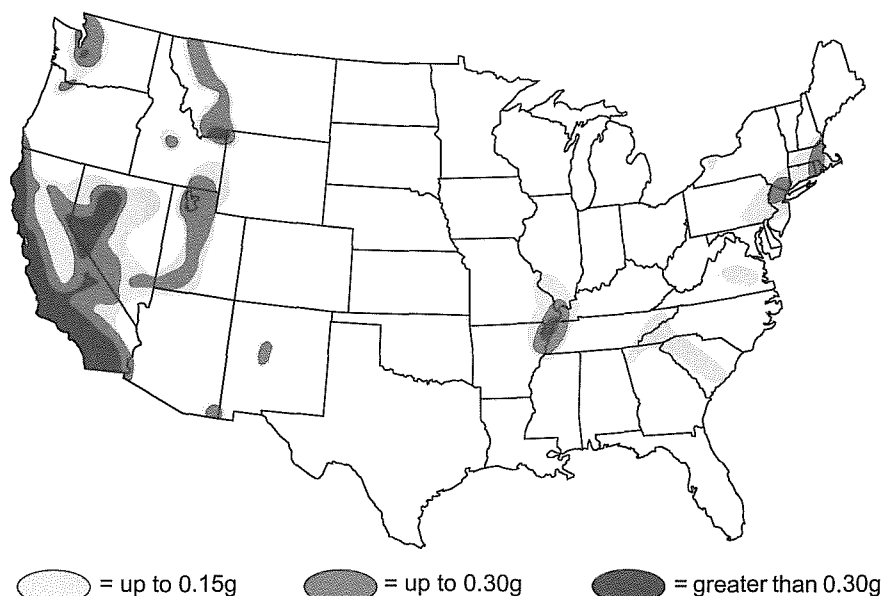
we want to avoid places where the facility or its supporting infrastructure is at risk, we also wanted to ensure that transportation in and out of the area is unlikely to be interrupted, to ensure quick response when one of our members requires rescue.

In addition to avoiding certain risks, we needed to find a city *with* certain positive attributes: a major airport (ideally a “hub” airport), an active high-tech community (to provide a stimulating environment in which to conduct research), and a reasonable cost of living. Finally, we wanted to ensure (as much as possible) that we would not be opposed by the local authorities, such as zoning officials and state health boards. This last concern prompted us to lay the groundwork with such people before the move, and carefully build rapport with these officials step-by-step as we committed our resources to a particular community.

Avoiding Natural Disasters

Natural disasters, specifically earthquakes, hurricanes, tornadoes, floods, and blizzards, can destroy a cryonics organization’s physical plant or, indirectly, trigger civil unrest which would have the same result. A major earthquake can physically destroy the facility, or so disrupt the transportation and utilities in an area that Alcor might find it impossible to provide continuing care for the patients. The safety of the patients is *not* assured simply because the building does not collapse—a cryonics organization needs a steady supply of liquid nitrogen, which must be produced continuously at a complex industrial facility and delivered several times per month over a network of highways. Moreover, a major quake may cause damage or even loss of a patient storage dewar, necessitating emergency delivery of replacement liquid nitrogen, just

Figure 1:
EARTHQUAKE RISK



The shaded contours represent (with 90% confidence) the maximum expected lateral seismic acceleration over the next 50 years

at the time it is likely to be unavailable! Moreover, as the 1992 Los Angeles riots demonstrated, it is likely that a major earthquake or other natural disaster in some of our larger cities would trigger a significant amount of civil unrest. During the height of the rioting in southern California, some of the freeways were closed due to gunfire and roving bands of highwaymen.

The danger from hurricanes is similar to that from earthquakes, both in terms of direct danger to the facility and danger to the surrounding community. Two recent hurricanes illustrate the threat. Hurricane Andrew cut a swath across central Florida dozens of miles wide, with such force that even mature citrus trees were torn off at their roots. Hurricane Iniki passed directly over the island of Kauai in Hawaii three years ago, hitting with such force that the island's economy is still not fully recovered. In both areas, physical damage can still be seen by even casual observers, most often in the form of empty foundations where houses once stood.

Tornadoes are unlikely to damage a city to the extent that the transportation network is destroyed; the risk in this case is to the physical structure of

the facility. Unless we locate underground (a very expensive and restrictive proposition), we should not move to a tornado prone location. (If this

degree of precaution strikes you as overkill, keep in mind that many lives depend on the complete absence of even a single occurrence of such a facility-disturbing disaster for many decades, perhaps even centuries.)

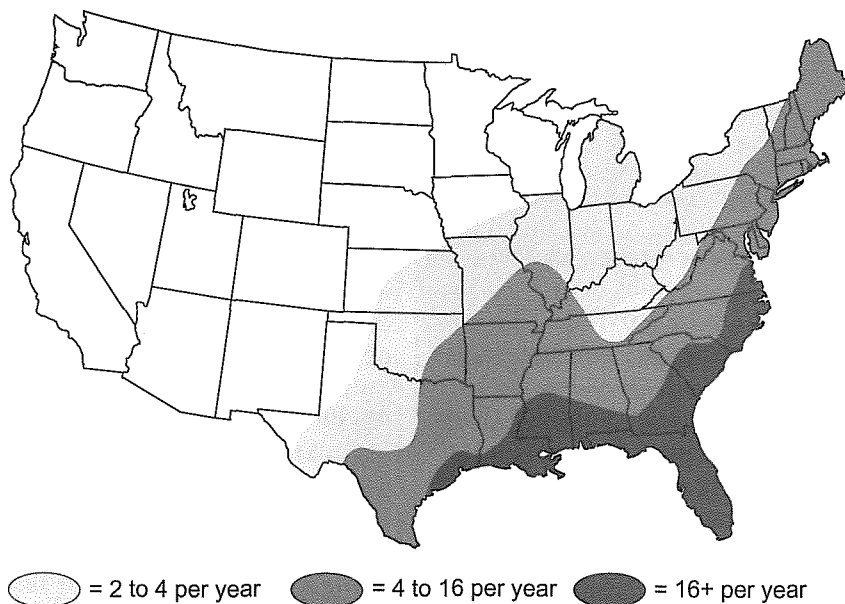
Blizzards and severe snowstorms, on the other hand, are unlikely to destroy a building, though they may well bring transportation to a standstill for several days and disrupt communications by bringing down telephone wires. During such periods, our ability to reach a member in distress would be compromised. Therefore locations with severe winter weather were to be avoided.

Finally, to avoid the risk of flooding, we considered only locations on high ground and not downstream from a dam.

The accompanying figures show the geographical distribution of earthquakes, hurricanes, tornadoes, and severe winter weather throughout the contiguous United States. They were originally prepared as a set of transparencies, so that the maps could be tacked together [See the composite map on the previous page. —Ed.] to show all the areas in the United States we wished to avoid.

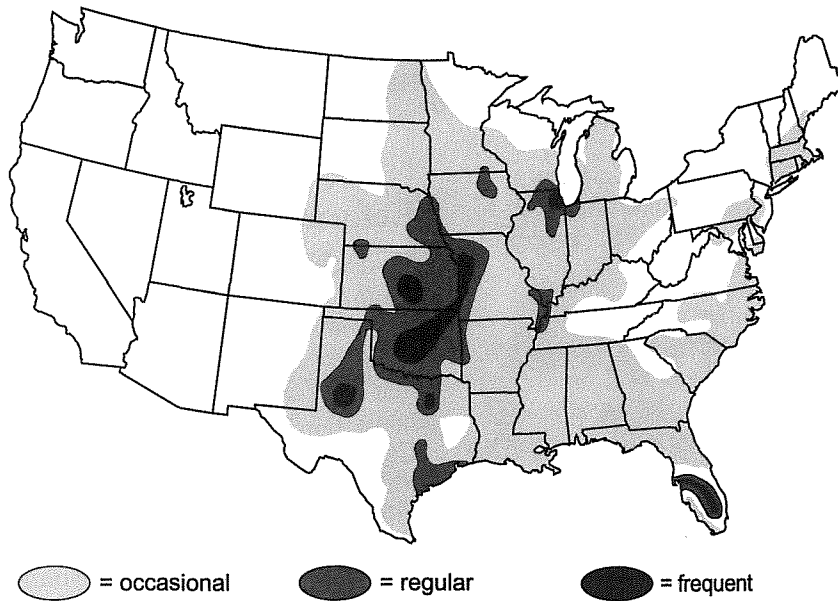
The earthquake risk map (figure 1) shows where large earthquakes are ex-

Figure 2:
HURRICANE RISK



The shaded contours represent the paths of all hurricanes and tropical storms over the last 100 years

Figure 3:
TORNADO RISK



The shaded contours represent tornado frequency per 100-by-100 mile section of land

pected to occur. The contours represent maximum horizontal ground acceleration to be expected over the next 50 years, with 90 percent confidence. For example, in the unshaded areas on the map, USGS geologists estimate that there is only a 10% chance (100% - 90%) that lateral seismic acceleration (which is what damages structures built on solid ground) will exceed one-tenth "g", where "g" is the acceleration due to gravity. Physically, if you were to experience a 0.10 g earthquake, you (and everything around you) would feel sideways forces of one tenth your (or its) weight. The light shaded areas on the map can expect an earthquake up to 0.15 g, the medium shaded areas up to 0.30 g, and the dark shaded areas greater than 0.30 g (sometimes up to 0.80 g!) Note that this map is a nonlinear representation of earthquake damage likelihood: a 0.40 g earthquake produces much more than twice the damage of a 0.20 g shake. From a historical survey of earthquakes in Arizona, I correlated the expected acceleration with the amount of expected damage and concluded that we should preferably be in the 0.10 g maximum acceleration zone, or failing that in the 0.15 g zone.

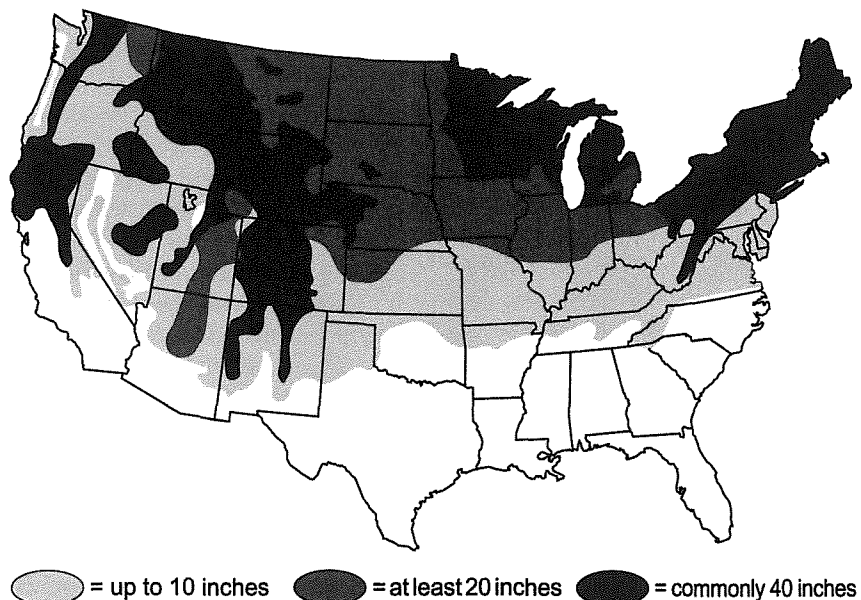
We also required our liquid nitrogen supplier and the roads connecting that plant to Alcor to be entirely in these low seismic risk zones.

The hurricane risk map (figure 2) was prepared from a United States Weather Service chart showing the paths of all hurricanes and tropical storms for the last hundred years. The light, medium, and dark shaded areas depict qualitatively the increasing likelihood of a given area being hit by one of these storms. The clear area of the hurricane map has had no hurricane during the last hundred years.

Tornado frequency of occurrence is shown in the third figure, taken from a climatic atlas prepared at the University of Maryland. Clear areas have averaged less than two tornadoes per year per 100-mile by 100-mile section of land. Light areas average from two to four, medium areas from four to 16, and dark areas more than 16 tornadoes per year. Note the nonlinear nature of this map also.

Winter severity, which I assumed is correlated to the likelihood of blizzard conditions, is shown in figure 4. Clear areas very rarely have snow or suffer lengthy freezes. Light areas typically have up to two months of freeze each year and up to 10 inches of snow. Medium areas have at least 4 months of freeze and 20 inches of snow. Dark areas commonly experience 4 months of

Figure 4:
SEVERE WINTER/BLIZZARD RISK



The shaded contours represent the severity of winter in terms of annual inches of snow

freeze and 40 inches of snow. To avoid heavy blizzard conditions or closure of airport facilities, we chose to avoid the medium and dark areas, and try to locate in the clear zone.

Where To Be If You Operate A Cryonics Facility

Stacking all four maps on top of a map of the continental United States, we discovered those places we wanted to avoid when moving to a new location (see page 21). There isn't much of the United States that lies simultaneously in the clear areas of all four risk maps! Cities that do (our "first tier" cities) are: El Paso, Texas; Tucson, Arizona;

Phoenix, Arizona; and Eugene, Oregon. If we relax the winter weather criterion somewhat, so that we include cities in the lightly shaded zone on the "blizzard" map, we can add Las Vegas, Nevada and Santa Fe, New Mexico as second tier cities. Loosening up the seismic requirement by 60% (to 0.16 g) gives us the third tier cities of Fresno, Sacramento, and Chico, California; Albuquerque, New Mexico; and Portland, Oregon. These were our choices—a short list indeed.

Was Scottsdale A Good Choice?

Our task was to first evaluate the first tier cities as places to operate a cryonics organization, and failing there, to consider in order the second and third tier cities. Three of the first tier cities had both active high-tech communities (including a research university) and a reasonably busy airport. (El Paso was the exception.) Of those three, Phoenix and its suburbs was the leading choice because of its size and its large hub airport. And Arizona already had a significant population of Alcor members (about a dozen) and an economy that was friendly to business.

In hindsight, we were very fortunate to find a city as friendly as Scottsdale. But to a great extent, you make your own luck, and everyone at Alcor has been working hard to become valued members of the Scottsdale business community, with successful results.

Alcor's investment (and the investments of its partners) in Cryonics Property LLC (which owns the Scottsdale building) has appreciated in value. Alcor's patients are safer. Alcor is in a friendlier busi-

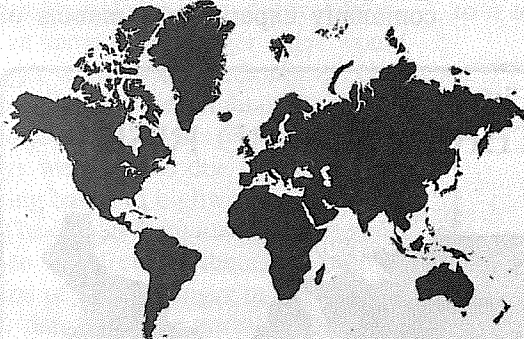
ness environment. Alcor's staff are taking full advantage of Arizona's lower cost of living and cleaner environment. All this is due to the hard work and clear thinking of Alcor's employees and management, and is good news for Alcor's members and patients, present and future.

References

1. Algermissen et al., "A probabilistic estimate of ground acceleration, 50 year interval", United States Geological Survey map MF-2120 (1990). Note that this map was prepared *before* the latest series of earthquakes in southern California, which many seismologists think has increased the likelihood of "the big one" happening in the next few years.
2. Charles J. Neumann, Brian R. Jarvinen and Arthur C. Pike, "Tropical Cyclones of the North Atlantic Ocean, 1871-1986", figure 1, page 2. For sale by the National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Asheville, North Carolina 28801.
3. Thomas D. Rabenhorst, "An Atlas of the United States: Climate, Agriculture", page 27, "Mean Annual Incidence of Tornadoes", Department of Geography, University of Maryland, Baltimore, Maryland (1981).

Membership Status

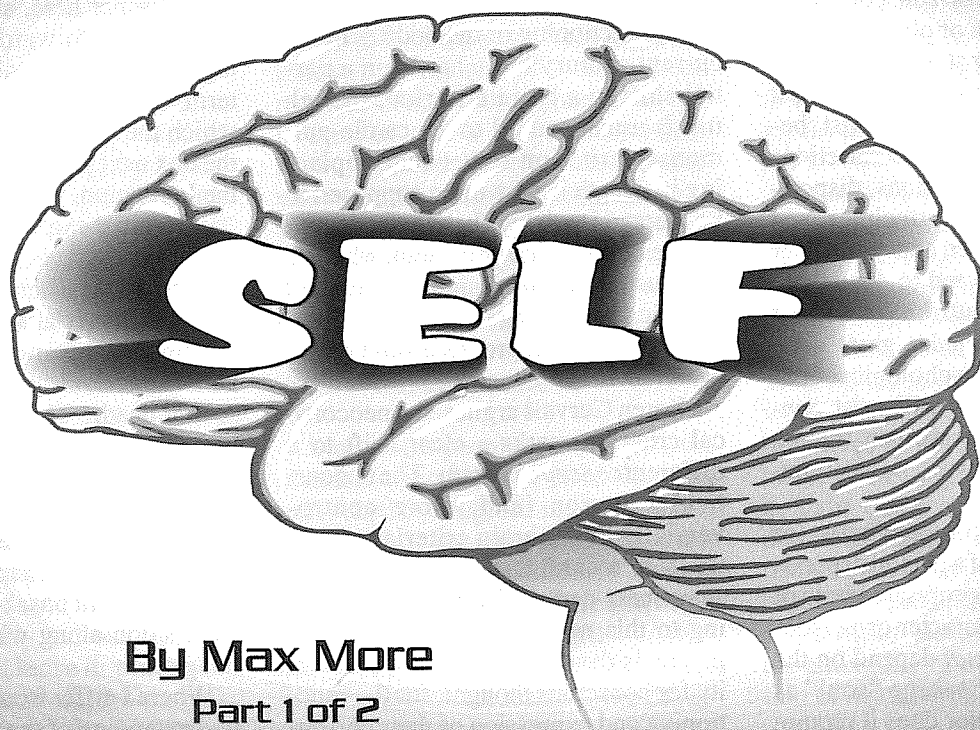
Alcor has 345 Suspension Members, 618 Associate Members (includes 74 in the process of becoming Suspension Members), and 27 patients in suspension. These numbers are broken down by country below.



Country	Members	Applicants	Subscribers
Andorra	0	0	1
Argentina	1	0	1
Austria	1	0	1
Australia	12	1	7
Brazil	0	0	1
Canada	9	4	43
Costa Rica	0	0	1
Denmark	0	0	1
Estonia	0	0	1
Finland	0	0	2
France	0	0	2
Germany	1	1	1
Holland	0	0	2
Ireland	0	1	2
Italy	0	2	1
Japan	2	0	2
Lithuania	0	0	2
New Zealand	0	0	2
Russia	0	0	4
Spain	6	0	0
Sri Lanka	0	0	1
Sweden	0	0	5
Switzerland	0	0	1
U.K.	15	3	7
U.S.A.	298	62	452
Ukraine	0	0	1
TOTALS	345	74	544



THE TERMINUS OF THE



By Max More
Part 1 of 2

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We refer to persons in cryonic suspension as “patients” and not as bodies. Most people will insist we are wrong, that cryonauts are dead—in the sense implying they can never return to life. This essay, which forms chapter 3 of my Ph.D. dissertation¹, refutes the nay-sayers, proposing an alternative conception of death to that held by most people, including medical ethicists.

This essay assumes an earlier explanation of a position known as “psychological reductionism”. Since this essay appears without the earlier chapter, let me briefly explain what a psychological reductionist claims about personal identity (or continuity, or survival):

Psychological reductionism expresses essentially the same view as that which Mike Perry and Ralph Merkle

have called the informational view of identity. Most cryonicists who have expressed an opinion appear to hold this view. Ignoring many fine points, we can say a psychological reductionist holds that what makes you the same person as you were ten years ago or fifty years from now is a relation of psychological connectedness and continuity between these stages or phases of you. An earlier and a later stage form stages of one continuing person if sufficient psychological connections exist between them. Psychological connections include memories, intentions, dispositions, abilities, values, principles, and projects. Your earlier and your later stages will be connected to the degree that they share these attributes. Even if the person has changed a great deal, leaving only weak psychological connectedness, the person will exist *continuously* so long as we can trace a chain of overlapping psychological connections.

On this view, the continuity (or continued identity) of a person depends on continuity and appropriate kinds of transformation of character or personality. Identity does *not* depend on the later stage having the same "soul" as the earlier person. Nor does it require that the later person-stage has the same body or the same atoms as the earlier. Nor need we require a continuous, uninterrupted stream of consciousness.

You can find most of the other unfamiliar terms in the Glossary. I apologize for any difficulty encountered as a result of the academic style of writing. I have tried to express myself clearly while also satisfying the meticulous requirements of my professors.

Bodily Death and Personal Death

Concepts of and criteria for death have changed throughout history. A *concept* of death purports to tell us the nature of death, while a *criterion* for the occurrence of death is the sign or signs by which we determine that a per-

son has reached a state of death. The traditional concept of death was left vague until recently, its criteria involving cardiac and/or respiratory function but without explicit distinction between criteria and concept. More recently, the concept underlying the cardio-pulmonary criterion has been defined as the loss of integrated organic functioning of the body.² In the current century there has been a partial shift to a brain criterion, though this is usually added to the cardio-pulmonary criterion rather than replacing it. Death is now often supposed to be determined by the death of the whole brain, or the brainstem, which is responsible for maintaining integrated organic functioning.

A more recent proposal for a brain-criterion is the neocortical criterion.³ As Karen Gervais argues, the neocortical criterion marks a clear shift to a different *concept* of death. The neocortical criterion (and, more controversially, other brain criteria) moves us from a cardiac-centered to a consciousness-centered concept. According to this new definition of death, a person is dead only when their capacity for conscious thought, for the functioning and expression of their personality, has been lost. Defined this way, it will be clear that the death of part or all of the body is only instrumental and not intrinsic to the death of the person. I accept this new conception of death and will analyze it further, but will modify the neocortical criterion proposed by Gervais. I will argue that this may not always be an adequate criterion even today, and may frequently be insufficient in the reasonably foreseeable future. The need for the category of deanimate will emerge when I consider cases for which the neocortical criterion is inadequate. Some of these cases will be familiar from the personal identity literature.

Proponents of the neocortical criterion and I agree that a proper understanding of death requires a distinction between the human organism and

the person. Death of the body or parts of the body concern us only in so far as they bring about the death of our selves. Our selves die when we lose the capacity for conscious thought, i.e., when we can no longer think, feel and express emotions, have desires, form plans, and further our projects. I won't argue this point further herè, since it surely follows straightforwardly from a psychological reductionist view of the self. The terminus of the self, then, is the point at which the R-relation terminates. (See the box next page for an explanation of the R-relation.)

An initial example of how personal death can diverge from bodily death is in order here: There are cases where a human body is alive and functioning, meeting the criterion of integrated organic functioning, but where the person is dead. This is the situation in which the neurons of the higher brain have been destroyed (neocortical death) thereby removing the possibility of conscious thought, while the brainstem and perhaps the cerebellum, thalamus, and basal ganglia continue to function along with the rest of the body.

Where I differ from Gervais is in my understanding of the conditions essential for the loss of the capacity for consciousness and personality. Gervais expresses her particular conception this way: "[H]uman death, understood as the death of a person, is a state in which the function of consciousness has been irreversibly lost as a result of one of several possible combinations of damage to the brain substratum" [150]. A second statement contends that "[T]he individual's essence consists in the possession of a conscious, yet not necessarily continuous, mental life; if all mental life ceases, the person ceases to exist; when the person ceases to exist, the person has died" [157-58]. While I agree with these statements, I don't think that they lead us to a neocortical criterion for all cases. This is because I understand the irreversible loss of the capacity for consciousness to require

¹*The Diachronic Self: Identity, Continuity, Transformation.* In later chapters I go on to examine the relative importance of the types of psychological attribute, the ways in which these contribute to the meaningfulness of life, and I consider the effects of emerging and future technologies on our sense of self.

²For instance, Lamb (1985).

³See Gervais (1986).

the irretrievable loss of personal identity-critical information, and this need not follow from irreversible loss of neocortical function. I will explain this claim in detail below, but will first try to head off possible confusion by exposing an ambiguity in the meaning of 'dead'.

Two Meanings of 'Dead'

The everyday concept of death, as well as some more refined theoretical concepts, harbor an ambiguity. Failure to recognize this ambiguity leads both to indeterminate concepts of death and mistaken criteria for the occurrence of death. Whether applied to a person or a biological organism as a whole, or to a part, we can distinguish $dead_1$ (functionally dead, non-functional) from $dead_2$ (irreversibly dead). $Dead_1$ means "absence of function" and an assertion that X is $dead_1$ is equivalent to the denial that X is 'alive' or 'living'. Life is a certain kind of dynamic, functional process that keeps systemic entropy at bay; if that process ceases then the entity is $dead_1$. This is the straightforward sense in which you might say "My car is dead," or "My

computer just died." This has no implication that your car will never work again. Perhaps a spark plug needs replacing, or a connection to your computer's power source is loose.

Dead in the second sense, $dead_2$, has a stronger implication: It requires *irreversible* loss of function. Suppose that at about the time your car stops running you become rich. You might decide to junk the car rather than have it repaired. You watch as your ex-vehicle is crushed into a thin slab of metal. Now, if you declare "My car is dead," you mean that it is $dead_2$, i.e., the same car cannot be returned to you. There is not enough left of the structure of the car to repair it and make it functional. At best, some of the metal could be used to build a new car of the same model. But that would be a *different* car.

Since most people are religious, the common conception of death has been influenced by religious myths of an afterlife. This is another source of ambiguity. The very term 'afterlife' hints at the ambiguous notions of life and death inherent in religious dogma. 'Afterlife' suggests a time or place that is not life, yet neither is it death. In the Chris-

tian tradition, stories are told of Jesus resurrecting the dead, and reincarnationists talk of people dying and then being reincarnated. These examples support the idea that the common notion of death, of being dead, is not entirely a notion of irreversible cessation of consciousness. If religious people understood death as irreversible loss of consciousness, they would describe paradigmatic cases of death as continuing life in another form, and would deny that the person had really died.

I don't want to rely heavily on religious usage in making a case for the ambiguity of the common concept of death. We could rescue the religious notion (if not its users) from ambiguity if we took statements such as "He's dead" to mean only "He's dead to this world," or "He's physically dead, but truly lives on in Heaven." On the other hand, most religious people have not thought this through to the point of disambiguating their usage. To the extent that the meaning of a term is determined by usage, the unreflective religious use of 'death' does contribute to the ambiguity of the common conception of death. The concept's use even

R-RELATEDNESS: THE CORE OF PERSONAL IDENTITY

According to reductionism, personal identity is not a separately existing thing. Rather, our survival, continuity, or identity over time can be reduced to certain other facts. *Physical* reductionists hold that identity reduces to a physical relation, such as the continuation of the same brain. Psychological reductionists, such as myself and most cryonicists, hold that identity reduces to psychological relations. Oxford philosopher Derek Parfit calls the collection of these relations the "R-relation".

The R-relation includes both psychological *connectedness* and *continuity*. Let's assume you will be cryonically suspended and revived. You-1994 are psychologically connected to the post-revival you to the extent to which you share psychological characteristics such as dispositions, values, abilities, memories, and projects. The pre- and post-revival stages of you will be psychologically continuous if there is an overlapping chain of *strong* connectedness. If all that you-1994 have in common with the post-revival you is a preference for mangoes over bananas, the degree of connect-

edness will be extremely low. However, if the change in personality took place gradually enough (not too many big changes in any one week), chains of strong connectedness could persist, ensuring psychological continuity.

Dualists believe we are essentially invisible souls, and therefore our survival is all-or-nothing. On the contrary, it follows from psychological reductionism that our survival is a matter of degree. An imperfect suspension and revival might alter or destroy some portion of an individual's memories, dispositions, abilities, and so on. To the question "did the patient survive" or "Is the revived person the same as the pre-suspension person?" we should give a reply of fuzzy-yes or fuzzy-no, not a simple yes or no.* Since the question of a person's survival reduces to questions about the persistence of psychological connectedness, we can see that survival comes in degrees. (See Figure 1 on the following page for a graphical representation of this idea.) Each of us can decide for ourselves the minimum degree (or range) of connect-

edness that would allow us to identify significantly with the revived person.

Clearly, some psychological attributes will contribute more to our survival than others. *Memory* as an element of connectedness has received the most attention, both in the philosophical literature and in cryonicist writings. I find this emphasis unfortunate. Far more important to survival (as I argue at length in a later chapter of my dissertation), are other attributes, such as some dispositions, our basic values and principles, and personal projects that serve to unify our actions over time. Figure 2 (page 28) illustrates the weighting of elements of personal continuity. The product of this second diagram yields a unique point in the Connectedness Space of Figure 1.

*Alcor member Prof. Bart Kosko applies fuzzy logic to the conception of life and death in Chapter 13 of *Fuzzy Thinking: The New Science of Fuzzy Logic* (Hyperion; New York, 1993).

by many non-religious people will reflect the same ambiguity. While the finality of death is reflected in the use of phrases like "Dead and buried," we also see pervasive use of the idea of people dying and then being brought back to life, especially in fiction, whether it be traditional tales such as *Dracula*, or more recent movies such as *Flatliners*.

Dead₂—irreversible loss of function—is synonymous with the final state of death. Due to the contexts in which it is used, 'death' apparently lacks some of the ambiguity inherent in 'dead'. Death has more of a ring of finality and irreversibility. Something, or part of a thing, can be dead₁ but not have reached a state of death. When it is dead₂ then we can also say that it has reached death. Throughout this paper, when I use the term dead without a qualifier I will mean dead₂—irreversibly or informationally dead. In a later section I will propose a term for dead₁ so that the distinction will be clearly reflected in the terms we use. This distinction has been recognized by some writers on death, such as Byrne et

al (1979) who objects to brain-related criteria on the ground that loss of brain function is not synonymous with destruction of the brain. While destruction is irreversible, loss of function may sometimes be reversible:

There is no evident contradiction in supposing the existence of permanent synaptic barriers, permanent analogs of botulinus toxin or morphine, or yet other mechanisms that would block all brain-functioning while leaving the brain's neuronal structure intact and ready for action (at least until such time as the effects of this non-function on the rest of the body might react back on the brain in a destructive manner). Therefore there is no reason to think that cessation of function, whether reversible or irreversible, necessarily implies total or even partial destruction of the brain; still less death of the person. [Byrne et al, p.1987]

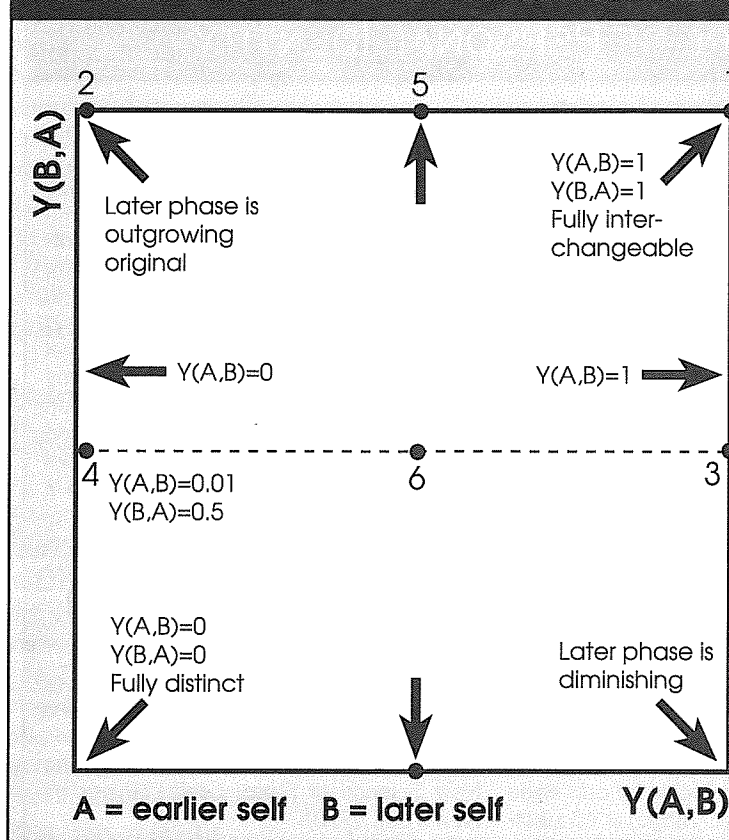
These two ideas have not always been clearly separated. Distinguishing the two senses of 'dead' will allow me to reveal a vagueness in the notion of neocortical death. But I will argue that even a clarified notion of neocortical death is inadequate, since

it fails essentially to mark the boundary of irreversible loss of personality. Supporting this claim requires a precise explication of various types of continuity and of the relevant notion of irreversible loss of continuity that will follow. First, I will reveal a second indeterminacy in the usual notion of death, and distinguish this notion from my stricter, stipulative notion of death. My claims about the correct view of continuity in a condition of irreversibility will apply to the stipulative definition, but not necessarily to the indeterminate notion.

Permanence vs. Irreversibility: Permanent and Theoretical Death

In addition to failing to distinguish loss of function from irreversible loss of consciousness, standard conceptions of death contain a further indeterminacy: A failure to disentangle the idea of permanent absence or loss of consciousness from the idea of irreversible loss of consciousness. Permanence and irreversibility are distinct and separable since cessation of consciousness

FIGURE 1: CONNECTEDNESS SPACE



The language of connectedness, by itself, inadequately conveys information about the relation between two instances of a person. To say that self-phases A and B are 50% (for example) connected leaves unspecified some information of relevance to the future-regarding decisions of that person. The statement that A and B are 50% psychologically connected could represent any one of three possible propositions (each of which are represented in Figure 1):

- (1) B has 50% of A's characteristics, but no characteristics that A doesn't have, i.e. B is a subset of A. (Point 3 of Figure 1.)
- (2) A has 50% of B's characteristics, and B has characteristics not shared by A, i.e., A is a subset of B. (Point 5 of Figure 1.)
- (3) A and B are 50% connected, A has some characteristics not shared by B, and B has some characteristics not shared by A. (Point 6 of Figure 1.)

The space represented in Figure 1 can be constructed from the following function:

$$Y(A,B) = \frac{[E_A \cap E_B]}{[E_B]}$$

Where:

E_i = set of psychological characteristics (memories, beliefs, values, intentions, desires) of person i

$X \cap Y$ = is the intersection of sets X and Y — the psychological features shared by both

$[X]$ = number of elements in set X

might be permanent yet reversible. Every day, patients are "no-coded" by doctors and declared dead. In no-coding a patient, the attending physician is saying that though the patient could be resuscitated (by CPR or defibrillation), this is not to be done, since the patient's restored life will be brief and unpleasant. Where a no-code instruction has been issued, cardiac arrest entails permanent loss of consciousness. Yet it might be quite easy to resuscitate the patient, at least temporarily. Since the standard notion does not sharply distinguish permanence and irreversibility, we can set out a disjunctive conception of the occurrence of death:

Death of a person occurs when

(a) Irreversibility condition: There is a sufficient degree of destruction or dissolution of the brain (or other medium for support of consciousness);

(b) Permanence condition: The capacity for consciousness is lost and no attempt will ever be made to revive or repair the patient.

We need not hold that only the irreversibility condition is correct, although I will argue that it is more fundamental. Instead we can distinguish two senses of the term 'death' and give

them each labels. This will allow me to provide a theory of the type of continuity necessarily involved in the irreversibility condition while granting a role in the standard concept to the permanence condition.

A person is theoretically dead if they meet the irreversibility condition.

A person is permanently dead if they meet the permanence condition, whether or not they also meet the irreversibility condition.

Permanent death occurs when a person is permanently lacking in consciousness. Such an assessment need not coincide with irreversible loss of consciousness. In many instances the two do not coincide, as in the no-coding case above, as well as in more speculative cases such as biostasis. Some individuals, following clinical death, have been placed into cryonic suspension in the belief that they might be resuscitated in the future by more advanced medical technologies. Suppose that this procedure does preserve a person sufficiently well, and that the necessary future repair technologies will be developed. Now, suppose someone had a heart attack and became clinically dead, i.e., their cardiac and respiratory func-

tions ceased, but the decision had been made not to place them into cryonic suspension. Then we could say, immediately after the coronary, that the person had permanently lost consciousness even though they had not lost consciousness irreversibly.

So, there are a range of situations in which permanent and irreversible loss of consciousness are not identical. Permanent death is partly determined by the decisions we make and the actions we perform. This means that permanent death is not fully objective in the way that theoretical death is objective (i.e., independent of decisions and actions). Irreversibility, in the sense I am using it, refers to loss of the capacity for consciousness that cannot be reversed even in principle. No matter how much technology may advance, and no matter how different the medium for support of consciousness may become (embodied in computers, for example), theoretical death refers to a state beyond any possible capability to reverse.

Permanent loss of the capacity for consciousness may appear to be an objective matter also: Either someone will be returned to consciousness at some point or they will not. Our beliefs

The Y-function is the "You-ness" of A with respect to B, where $0 \leq Y \leq 1$. The Y-function can be expressed in several ways:

"Y is the fraction of B's characteristics shared by A."

"A has Y of B's characteristics."

"Y measures the value of A as an instance of B."

"Y measures how much B is subsumed in A."

"Y(A,B) is how much A's characteristics are a superset of B's."

The utility of the Connectedness Space diagram consists in its clarification of the ways in which two individuals may be psychologically connected. By looking at several points in Connectedness Space we can see that the diagram supplements the representational power of the language of psychological connectedness.

A and B may stand for the earlier and later person-stages of a continuant individual. However, A and B could also represent two individuals, each of whom is a survivor of the original. B could be a copy of A—a copy of more or less fidelity, or who has psychologically diverged over time from A. On the first interpretation, at the bottom left corner, stages A and B are completely distinct: They share no psychological features whatsoever. At the top right corner, where $Y(A,B)=1$, A and B are completely interchangeable: All psychological features possessed by one of them are also possessed by the other.

At point 3 the earlier self-phase, A, possesses all the characteristics of the later phase, B, but B has only 50% of the characteristics of A. In this case, the later self-phase is a degenerate continuer of A. B has learned nothing new, acquired no new memories, formed no new intentions or dispositions, and values only what A valued, yet has lost half of what made A who he was. Point 5 is the converse of 3: At point

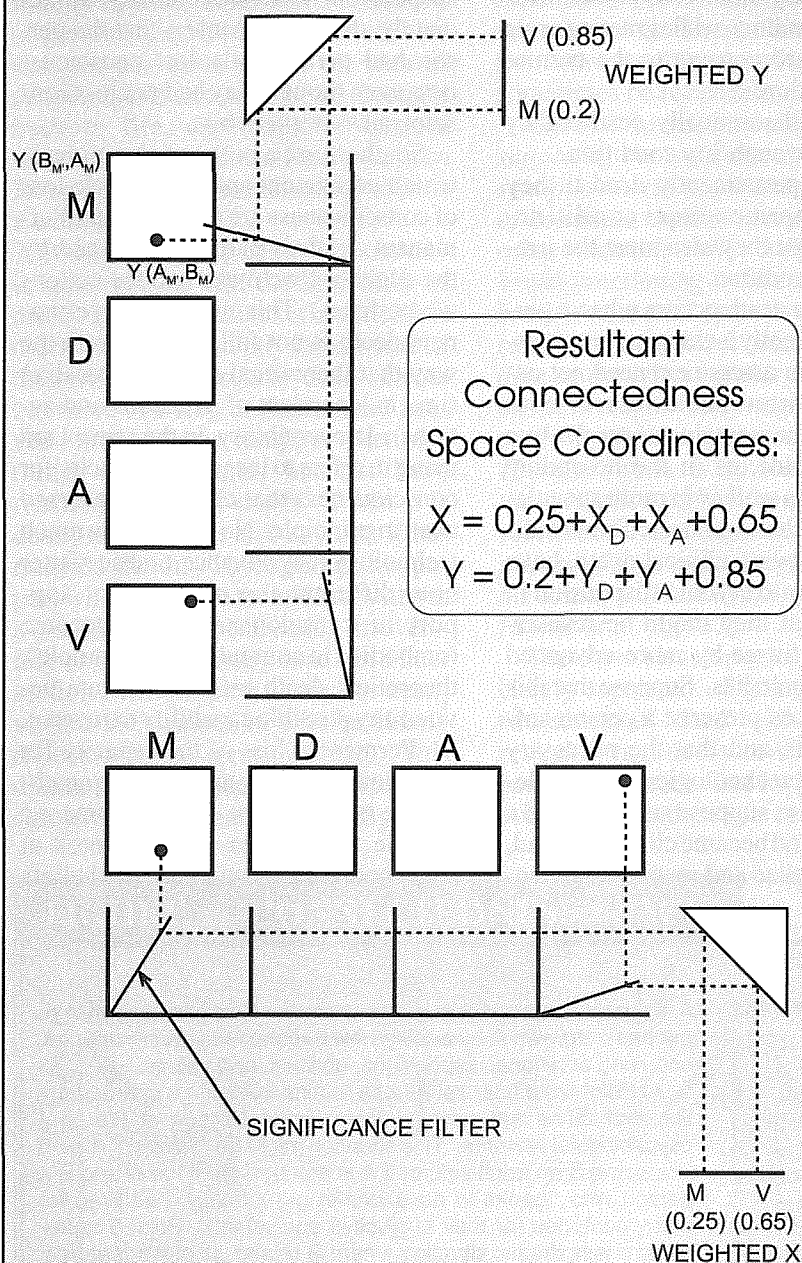
5, the later phase exhibits all the characteristics earlier seen in A, but has outgrown A by adding new experiences and memories, acquiring additional dispositions, abilities, and values.

At Point 4 the later self-phase retains 50% of A's characteristics, but these are now an insignificant fraction of B's total psychological features. This situation might be realized if A is an infant and B an adult self, or if A is any person of today and B a person who, thanks to advances in gerontology, has lived for many centuries (or their subjective equivalent). Point 5 represents a less drastic situation where B retains all of A's features, but these now constitute only 50% of B. Point 6 represents a situation where B has left behind half of A's characteristics but has acquired about as many new ones. At point 6, from A's point of view, A is 50% connected to B, and from B's point of view, B is 50% connected to A. Note how this differs from point 4. At point 4, from A's perspective, A is 50% connected with B, but from B's perspective, B is only 1% connected to A.

Probably from anyone's point of view it would be preferable to expect one's future self-phase to differ from one's current phase such that the relation is something like point 2 rather than point 3 or, even worse, points closer to the lower right corner of Connectedness Space.

The Connectedness Space diagram closely follows David Krieger's Identity Space diagram. Krieger's useful graphical representation of psychological connectedness first appeared on the Extropians e-mail list (extropians@extropy.org) and subsequently was published in *Cryonics*, 13(4), April 1992.

FIGURE 2: WEIGHTING CONNECTNESS



The function embodied in Figure 1 can be derived from underlying functions. These are represented below. To avoid unnecessary clutter, Figure 2 includes only four components of psychological connectedness: Memory, Dispositions, Abilities, and Values. Each of the four boxes (appearing in both the X-coordinate and Y-coordinate sets) embodies essentially the same function as Figure 1, except that instead of representing a "you-ness" function, each box represents the closeness of connectedness of an earlier and a later self-stage along one dimension. Actual coordinates have been plotted only for memory and values, again to simplify the diagram. Some kinds of connection are more significant than others; for instance memory is less important than values. This factor appears diagrammatically in the form of the significance filter. Once the degree of memory connection and the degree of value connection (and so on for the others) have been weighted by the significance filter, they generate a set of X and Y coordinates. When the weighted coordinates for each component are summed, the resulting X and Y coordinates determine the position in Connectedness Space represented by Figure 1.

a genuine decision to make. To Robinson then, if not to an uninvolved observer, the permanence or transience of Smith's loss of consciousness is not fully objective. The same point can be made using Byrne's example above, in which the brain's capacity to function has been blocked. In that case, the permanence of the condition may depend on the decisions and actions of researchers and medical personnel to take steps to reverse the condition. Finally, in the cases of persons placed in biostasis for possible future repair and resuscitation, the permanence or transience of their condition may depend on the actions of those maintaining them in suspension, on researchers seeking to develop repair technologies, and on legislators who may choose to prevent such research or the revival of the biostatic persons.

Permanent death

regarding the probability of resuscitation are subjective, just as are our beliefs about reversibility, but surely the permanence of lack of awareness is an objective matter? Not if by 'objective' we mean "independent of human action and decision". Suppose cardiac and respiratory function cease in Smith. To an uninvolved third party the permanence or lack of permanence may be a factual, objective matter. Either Smith's bodily functions will restart spontaneously or they will not, and either someone else will successfully in-

tervene with CPR or defibrillation or they will not.

However, from the point of view of someone in a position to medically intervene (call her Robinson), the permanence of Smith's condition cannot be regarded as determined independently of the intervener's decisions and actions. (This is assuming that intervention has a more than zero probability of success, otherwise intervention is futile even if Robinson believes otherwise.) Robinson cannot regard her own actions as already determined; she has

and theoretical death both may involve a shift in our attitudes toward the person. A belief in the person's permanent or irreversible loss means that we will no longer think of the person interacting with us in the future, or having further experiences. We will no longer include them in our plans. This shift in attitudes will be reflected in our customs and in the law. The rights and status of the deceased person will change: They can no longer be rewarded or punished, cannot make contracts, and will not be considered in

our plans for the future. However, these attitudinal changes are more closely tied to permanent than theoretical death since they will occur once we have decided that absence of consciousness is permanent even though we may know that consciousness could be restored. That is, attitudes will not shift if we do not believe them to be permanently gone, but attitudes will shift if we believe them to be permanently though not irreversibly gone. The fact of theoretical reversibility will not affect our attitudes once we are certain that the theoretical possibility will never be acted upon.

Irreversibility has (or should have) priority over permanence in determining our attitudes: An assessment of irreversible loss of consciousness ought to lead us to an assessment of permanent loss of consciousness. But the reverse is not true; a belief in someone's permanent lack of consciousness need not require us to believe that they irreversibly lack consciousness. We would only believe "if permanently then irreversibly nonconscious" if the two were identical in a particular instance, as when a person's brain is instantly destroyed. Since decisions to allow reversible cessation of consciousness to continue should be founded on our beliefs about possible reversibility of nonconsciousness, the reversibility condition is the more fundamental to us as agents. This makes it important to be very clear about the limits on reversibility. If we misunderstand these limits, and believe loss of consciousness to be irreversible when it is not, then we risk acting, or failing to act, in such a way that we cause someone to become permanently dead unnecessarily (by burying or burning them rather than treating or maintaining them).

Irreversible Cessation and Types of Continuity

Having distinguished the permanence and irreversibility conditions, I can now focus on the universally applicable irreversibility condition. Various types of irreversible cessation of consciousness might be thought essential to theoretical death. I will argue that the correct condition is irrevers-

ible loss of informational continuity. In defending this condition I will deny the universal applicability of the neocortical criterion, even if it embodies the irreversibility condition rather than the permanence condition, and even if it embodies destruction of the neocortex rather than loss of function.

Gervais' reason for proffering the neocortical criterion for death is clear enough: "...destruction of the neocortex has been shown to produce permanent unconsciousness and to be an empirically verifiable pattern of brain destruction prior to the failure of the or-

"We might say that we are software and not hardware; the psychological relations that are me are currently instantiated in this neocortex, but I am not essentially this neocortex nor even (more controversially) any neocortex. We can conceive of personal continuation despite neocortical death, and this may even become technologically possible in the future."

ganism as a whole. Since human death is the death of the person, and the death of the person occurs with permanent loss of consciousness, neocortical death is an adequate criterion for declaring death" [150-51]. And, a few pages later: "[T]he individual's essence consists in the possession of a conscious, yet not necessarily continuous, mental life; if all mental life ceases, the person ceases to exist; when the person ceases to exist, the person has died. Upper brain death destroys all capacity for a conscious mental life, and it is therefore the death of the person." (pp.157-58.) I will agree

that the neocortical criterion, when carefully stated, is an adequate criterion for present day conditions, but will argue that it will not serve as a universally valid criterion. To establish this, I need to show that persons can continue to exist despite being neocortically dead (in either sense). To this end I will distinguish different types of continuity and evaluate their relative importance for the continuation of the self.

■ **Structural Continuity:** Atoms or molecules may gradually be replaced, but the arrangement of the parts of the body or brain persists. That is, the physical structure is maintained even though there may be a gradual turnover in the material of which it is composed. Structural continuity is static when two temporal stages of the system are qualitatively identical, and dynamic when the later stage has resulted from the earlier stage by a sufficiently gradual process involving no spatiotemporal discontinuity.

■ **Functional Continuity:** (a) Bodily functional continuity: The body and (perhaps) the brain continue to function (either autonomously or with mechanical support). Functional continuity may be maintained despite a serious loss of structural continuity. Replacement of the heart with a mechanical heart may maintain the original function despite the two organs having entirely different structures. (b) Psychological functional continuity: Personality continues to operate and act; consciousness (or the capacity for consciousness) is maintained. This may occur despite a radical change in the structure of the physical organ making consciousness possible. Loss of functional continuity may be (i) reversible or irreversible by current means, or (ii) reversible or irreversible by any empirically possible future technology.

■ **Informational Continuity:** Physical structure may be destroyed, but all the information necessary potentially to allow reconstruction of the brain (or other consciousness-support structure) and thus restoration of its function persists.

The neocortical criterion is not a universally applicable criterion of death. Gervais would probably agree

with this, since she is open to further refinements in our criteria, and she accepts that a person embodied in something other than a human body could be the same person. As I will show below, this means a person might survive the destruction of their brain. The neocortical criterion is merely a normally reliable criterion—in 1994—for diagnosing death or for making a prognosis of death (depending on whether neocortical death is taken to mean loss of function or destruction). A presumption of universal applicability would be acceptable if it were impossible for a person to survive neocortical death. However this is not necessarily the case. Whether we are to understand “neocortically dead” to mean permanent loss of neocortical function or destruction of the neocortex, selves may perdure regardless. I will examine both senses in which someone might be said to be neocortically dead and show that neither are acceptable criteria.

Loss of neocortical function: To say that someone is neocortically dead, or that they have lost the capacity for consciousness, might mean that the neocortex has ceased functioning and it cannot be restarted with available technology; or it might mean that the neurons of the neocortex and their patterns of interconnectivity have either decayed or been destroyed so that no empirically possible future technology could repair them. Which of these Gervais is using is hard to determine since she never actually gives her own definition of neocortical death; she cites definitions found in the literature, without pointing out that they are not equivalent. (She also appears to use permanent cessation and irreversible cessation interchangeably.) Two prominent definitions cited on pages 11-12 involve destruction of

neocortical or apallic neurons; but the definition quoted from J.B. Brierley (p.13) is a function-based definition. Brierley states that neocortical death “implies a persistently isoelectric EEG and the absence of sensory evoked responses in the neocortex, together with the resumption of spontaneous respiration and of certain brainstem reflexes.”

Of course, given today’s standard practices, a patient who is neocortically non-functional will eventually become neocortically destroyed, though this may take hours or days, even without cooling to slow enzymatic degradation. But this is no reason to conflate the two, as Gervais clearly recognizes in the context of a parallel criticism of Lamb: Lamb claims that “the death of the brainstem is the necessary and sufficient condition for the death of the brain as a whole—and that brainstem death is therefore itself synonymous with the death of the individual.” Gervais correctly argues against Lamb

but it is not diagnostic unless accompanied by neocortical destruction. If death is an irreversible state, then cessation of neocortical function that is irreversible by current medical technology is no more the point at which death occurs than was cessation of heartbeat in the past. If we were to find a way of restoring a “dead” (non-functional) neocortex to function, then we would have to say that the person had not been dead.

So long as the necessary neuronal structures persist we cannot say that the capacity for consciousness is irreversibly gone. Cessation of neocortical function need not imply loss of critical structure or information: Sufficient structural and chemical clues may remain to allow restoration and revitalization of neocortical function and neuronal interconnections. Full structural continuity of the cells is unnecessary for the possibility of repair of the neocortex since the desired structure and function of the neurons may be inferred

from residual chemical clues, or it may only be necessary to repair membranes, open ion channels, restore synapses, or replace organelles such as ribosomes.

An objection might be raised to the effect that “capacity for a conscious, but not necessarily continuous, mental life” means that the neocortex can support consciousness given the appropriate stimuli and that these stimuli should be

defined in terms of current technology. An analogy might be given as follows⁴: If we say that a car has the capacity to move at 110mph, we mean that it is currently in a state such that, given appropriate stimuli (such as gas, a foot on the accelerator, etc.) it will achieve 110mph. The objection claims that we don’t mean that the car could achieve

“If death is an irreversible state, then cessation of neocortical function that is irreversible by current medical technology is no more the point at which death occurs than was cessation of heartbeat in the past. If we were to find a way of restoring a “dead” (non-functional) neocortex to function, then we would have to say that the person had not been dead.”

that “To say that the loss of integration becomes irreversible is not to say that the loss has occurred.” (Gervais, p.148) Irreversibility of a function that leads to brain death is prognostic, not diagnostic of brain death. Now, under standard conditions (in the past and present) cessation of neocortical function is prognostic of personal death,

⁴This objection was raised by Kadri Vivhelin.

Glossary

Biostasis:	Similar to the older term "suspended animation." A state in which a patient is maintained without biological activity, thereby preventing decay. Currently this is practiced in the unperfected form of cryonic suspension, in which the patient is frozen and stored at -196°C. Biostasis might take at least two other forms: Vitrification, in which low-temperature storage is achieved without ice crystallization; or chemical methods for locking all reactive molecules into place.
Brain Death:	Death of the entire brain. (Taken to be indicated by either a flat EEG or lack of cerebral blood flow.)
Dead₁:	Synonymous with "deanimate." Not currently functioning (in the manner appropriate to that kind of entity), as in "my car is dead."
Dead₂:	Permanently non-functional. This second sense is synonymous with death.
Deanimate:	Synonymous with dead ₁ . The absence of function critical to maintenance of consciousness. Includes persons who are "clinically dead" and deteriorating, persons in biostasis, and persons who are inactivate.
Death:	The final destination of the dying process. A state in which nothing actual or potential remains of the person. The death of the person may occur before or after the death of the person's body or brain.
Dormant:	A state in which the <i>capacity</i> for consciousness persists (the neo-cortex is intact) and where the body and lower brainstem are functioning but there is no consciousness. (As in certain kinds of coma, where administration of a drug can restore the person to consciousness.)
Dying:	A process leading from deanimation to death.
Inactivate:	Stable persistence of identity-critical structure or information in the absence of life functions. While biostasis preserves a person's original physical form in a static state, being inactivate involves someone persisting in the form of stored information specifying the structure of the person's body (or just their brain) without that body necessarily persisting.
Neocortical Death:	Destruction or (currently) irreversible cessation of function of the higher brainstem, so that the capacity for consciousness is terminated. Deep structures of the cerebral hemispheres such as the thalamus and basal ganglia may be intact, in addition to the cerebellum. Neocortically dead individuals may open their eyes periodically, show sleep-wake periods, yawning, chewing, or spontaneous swallowing.
Permanent Death:	Permanent absence of consciousness, whether or not the person could be returned to consciousness.
Theoretical Death:	Irreversible absence of consciousness.

110mph given available technology, and we don't mean that, given some empirically possible but non-actual technology, the car could achieve 110mph. The problem with the objection lies in the fuzziness of the terms 'capacity' and 'appropriate stimuli.' Does the car have the capacity to move at 110mph if a wire has been loosened? In that case it doesn't have the capacity immediately, given only the normal stimuli. However, there is a perfectly reasonable sense in which it does have such a capacity: The car has the capacity to move at 110mph if we reconnect the wire. If someone were to say, before reconnecting the wire, that the car could not go 110mph, the statement would be misleading in that we might be led to think that this *kind* of car does not have that capacity. The car will not

function normally without that repair, but so long as the repair can be effected there is an important sense in which the car does have that capacity.

Suppose the car has suffered some form of damage to its components so that it cannot move, and currently no way exists to replace or repair the components to restore function. Further suppose that the manufacturer tells you that they are working on a new repair process that will restore function, a process that should be available a month from now. We will probably want to say that the car does not have the capacity to move at 110mph, but that it can potentially regain that capacity. If we say this, it follows that loss of (current) capacity to function does not imply irreversible loss of function. If asked whether our car is dead, in the sense

that it can never function normally again, we should reply in the negative. The car analogy, then, supports rather than undermines the case for basing a criterion for death on irreversible loss of capacity rather than *currently* irreversible loss of capacity.

In the neocortical case, if Gervais's criterion for death is loss of the capacity for consciousness (due to loss of neocortical function), then we can see that her criterion is not equivalent to the irreversible loss of the capacity for consciousness. Loss of neocortical function may be currently irreversible, just as loss of cardiac output once was irreversible with existing technology, but death does not occur (at least) until the neocortex has been destroyed, or degenerated beyond any empirically possible means of repair. For Gervais

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to deny this would also require her, contrary to her stated view, to claim someone to be dead as soon as their heart has stopped beating (and consciousness has been lost) if there is no available (or known) means of restoring cardiac function. If the neocortical criterion is to serve as an accurate criterion in the present, it must therefore be interpreted as neocortical destruction rather than currently irreversible loss of neocortical function. With this con-

dition specified, and with the exceptions discussed below (in the *Deanimate* section), I can accept the neocortical criterion as an adequate criterion for death in 1994 and the near future.

The period between cessation of neocortical function and true neocortical death (loss of structure) might seem to be of merely theoretical interest but of no contemporary practical significance since we cannot *now* restore neocortical function, just as pre-20th Century it

might have been claimed that there was no practical significance to the fact that a person with a still heart was not yet dead. Such a claim would be mistaken. Attending to the difference between *currently* irreversible loss of function and true neocortical death will encourage the search for means of preventing neocortical decay by preserving the neocortex in an unchanging state, and for means of repairing the neocortex and restoring its function. (Again, see the section on *Deanimate* below.)

Neocortical destruction: By neocortical death, Gervais might mean not loss of function but decay or destruction of the neurons of the neocortex and their patterns of interconnectivity so that no empirically possible future technology could repair them. (This is unlikely to be Gervais' intended meaning, if we interpret "the *capacity* for consciousness" to mean that consciousness can be restored with currently available means only.) This is less parochial than the loss of function definition and is acceptable as a historically temporary criterion (i.e. *given current technology*), but it still fails to provide a transhistorical, universally applicable criterion. Locking the criterion of death into neocortical destruction is mistaken since, as I have argued in earlier chapters, our continuity is essentially psychological continuity and connectedness—the R-relation—and not physical continuity. We might say that we are software and not hardware⁵; the psychological relations that are me are currently instantiated in *this* neocortex, but I am not *essentially* this neocortex nor even (more controversially) any neocortex. We can conceive of personal continuation despite neocortical death, and this may even become technologically possible in the future. Here are a couple of ways in which neocortical death and personal death could come apart:

Brain Scanning and Replacement: Suppose that, at some time in the future, some extremely powerful scanners were available, the descendants of today's MRI, NMR, PET, SQUID,

⁵Though this shouldn't be taken to imply any simple two-level view. At one level we might say that a psychological function is software written in a language of thought where the hardware is a region of the brain. At a deeper level the functioning of the brain region could be described as software and the hardware identified as the neurons composing the region. Deeper again, the individual neurons could be functionally described, with the hardware level being identified with organelles, membranes, neurotransmitters, and so on. See William G. Lycan's discussion of "The Continuity of Levels of Nature" in Lycan (1987).

SPECT and CAT scanners. These scanners might be used to scan a brain so completely that the resulting data specified the entire neuronal structure, including neuronal interconnections, electrical charges, spiking potentials, and levels of all neurotransmitters and hormones. Suppose that your brain was then destroyed (or is destroyed layer by layer as the scanner does its work). A new brain is then built according to the information gathered from the scan, it is implanted in the original body, and all necessary connections are restored. We should say that this brain is a *new* brain, for a brain is a physical object and spatiotemporal continuity is a necessary condition for physical objects. (If we were to destroy and replace only a small fraction of the original brain at any one time we would probably say that the *same* brain remained throughout.)

Despite the spatiotemporal discontinuity and the destruction of one brain and its replacement by another, the same person remains throughout the procedure. Though there is an interval during which there is no structural or functional continuity, there is always informational continuity. The new brain is structured the way it is, and functions the way it does, because of the structure and function of the original brain. The same person persists through this procedure because of the non-accidental causal connection between the structure and function of the new brain and that of the old. We may be puzzled by how to describe the condition of the person during the interval

between the destruction of their original brain and their revival in the new brain. They are not dead, but we may not want to say that they are *alive*. I will return to this issue in the next section.

Uploading: In the second kind of case, I can survive the loss of my brain

"Full structural continuity of the cells is unnecessary for the possibility of repair of the neocortex since the desired structure and function of the neurons may be inferred from residual chemical clues, or it may only be necessary to repair membranes, open ion channels, restore synapses, or replace organelles such as ribosomes."

even though it is *never* replaced by another biological brain. If what matters in my survival is my psychological continuity, then I will continue to exist so long as my consciousness, my psychological features, are maintained in hardware that is functionally equivalent at the necessary level.⁶ This hardware may be nonbiological, perhaps an appropriately-configured parallel-processing computer constructed according to the information gained from the destructive scanning of my brain. The transfer of a person's consciousness from their brain to a computer is referred to as "uploading" and has been described both in fiction and nonfiction.⁷ This informational conception of personal continuity is expressed by Daniel Dennett:

If you think of yourself as a center of narrative gravity, on the other hand, your existence depends on the persis-

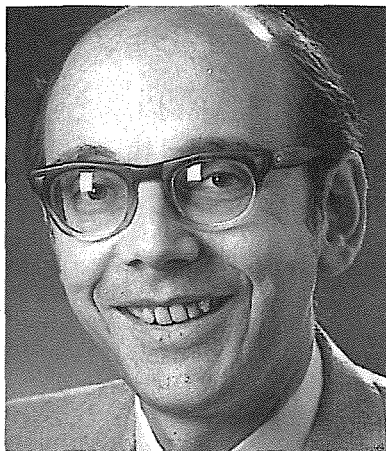
tence of that narrative (rather like the "Thousand and One Arabian Nights", but all a single tale), which could theoretically survive indefinitely many switches of medium, be teleported as readily (in principle) as the evening news, and stored indefinitely as sheer information. If what you are is that organization of information that has structured your body's control system (or, to put it in its more usual provocative form, if what you are is the program that runs on your brain's computer), then you could in principle survive the death of your body as intact as a program that can survive the destruction of the computer on which it was created and first run. [Dennett (1991) p.430]

In the brain scanning and replacement and uploading cases the later person-stage is psychologically continuous with the earlier person-stage. If personal continuity is psychological continuity then we cannot say, in these cases, that someone has died and been replaced by another person. The very same person remains throughout, despite the discarding of the hardware that previously embodied their capacity for consciousness. To someone who wasn't aware that our subject had received a new brain, or had a silicon or optical brain-replacement in their skull, no difference would be detectable, making it absurd to think that the original person had died.

End Part I

⁶A behaviorist will say that a machine that behaves just as I would is thereby functionally equivalent at the appropriate level. This is the methodological assumption behind the Turing Test for machine consciousness or intelligence. Others who think about the possibility of uploading consciousness or building conscious machines hold that the hardware must be isomorphic to ours at some deeper level. Some will argue that a serial processor is sufficient because any parallel processor can be implemented in a Turing-equivalent serial processor. Others hold that some degree of parallelism will be necessary to produce genuine consciousness, intentionality, or qualia.

⁷See Dyson (1988), Moravec (1988), Ross (1992), Merkle (1993), Tipler (1994), and the SF novel by Rucker (1982). Uploading cases have been used in the philosophical literature: See, for example, the machine tape case in Veatch (1975), which reappears in Gervais (1986) and Green and Wikler (1980).



Science, Ciphers, and Sorcery in Cryonics

Restoring broken brain connections is actually a *three-dimensional* puzzle.

Whenever human beings deliberately design a puzzle, hard or easy, they design it so that it is solvable. But the puzzle involved in putting back together a brain is one we did *not* design.

Since we are human beings, it's very easy for our desires to get in the way of our thinking, and make us accept fantasies as true when even a little thought would tell us that they must be false. When that happens, of course, it's usually not simply the acceptance of a fantasy of Santa Claus or God, but an unwillingness to examine one's own arguments in the detail needed. Many very intelligent people have become deluded by such fantasies; if enough people in a group want to believe something, really obvious flaws in reasoning can be overlooked—until, that is, members of other groups who don't share that fantasy get their own look at these arguments, and exclaim in wonder at the foolishness of those "foreigners."

One function of scientific research comes from its ability, with time and effort, to uncover such fantasies. Ultimately, even without any foreigners laughing at their absurdity, we can discover how unreal our beliefs were and work through to a deeper understanding.

I believe I am known among cryonicists as an advocate of research, especially research into cryonic preservation of brains. Ever since my first involvement with cryonics in the early 1970s I have argued that this research, above all else, most needs doing. At

one time I gave Alcor a large sum of money for an electron microscope, specifically to examine brain tissue—but because the microscope meant nothing without other equipment which was beyond my personal financial reach, that microscope lay fallow and was finally sold. It is only now, after many years, that cryonicists have begun once more to think about research into brain preservation.

All cryonicists should also understand very clearly that our research may find unpleasant truths. We *might* discover that our own treatments have damaged many frozen patients beyond any possibility of recovery. Yet research has two faces: even if we discover that damage, we can also find ways not only to prevent it but to treat cryonics patients well enough that their eventual revival becomes trivial. (Cryonics has existed for 30 years. Could some cryonicists have failed to support such research out of fear of just what we might find?)

I too believe that someday even badly damaged patients will be revivable. I say these things not because I wish to denigrate cryonics, but because it is only by doing research that we have any hope of improving cryonic suspension. I will even go further: eventually, if we do *not* do such research, cryonics will turn into a very minor religion,

forgotten as many previous movements have been. If we are really to be true to our own ideas, we must study brain preservation in detail.

One recent series of articles in *Cryonics*,¹ though it need not have done so, depended upon a belief that the *computing* issues involved in revival, even of badly damaged brains, would not cause us problems. Like most such attempts, it had a good idea but did not follow it through to specify exactly the territories to which it led.

It included the suggestion that we might use ideas from the theory of ciphers to work out broken nerve connections. I personally have thought of this problem as more similar to solving a desktop puzzle: the kind in which we have many pieces of different shapes, with part of a picture on each one, and we aim to put them together and find the picture. Restoring broken brain connections is actually a 3-dimensional puzzle of this kind, and a little thought will tell us that methods for solving such 2-dimensional puzzles resemble closely those for solving ciphers, except for the dimension. We know, from the shapes of the pieces and the fragments of a picture printed on them, that some combinations are impossible and others very unlikely. By using this knowledge, we try to fit together the puzzle. For a cipher, the situation is much the same: if we know the language in which the message has been sent, we can use information about the frequency of letters and small combinations of letters to discover the message.

But the *prior information needed* to reach a solution remains crucial. Whenever human beings deliberately design a puzzle, hard or easy, they design it so that it is solvable; yet the puzzle involved in putting back together a brain is one we did *not* design. Even for ciphers, the information available can be too small: perhaps we don't know the language (and therefore have no idea about symbol frequencies²), or the message is too small to work out any statistics on frequency from it. If I send you the message "WE" (2 letters), in a cipher known to both of us but to no one

else, no matter how powerful the computer it simply won't be able to decode it *without further information*.

Unfortunately, it's still unknown just what information we will need to reassemble brains; even worse, we don't even have a good idea of what they *should* be like on the small scales relevant to personal memories. A lot of neurological research has established the structure of a *generic* human brain, but we are not generic individuals. Any careful discussion of methods for revival based on cryptology or any other field requires a statement of the preconditions under which it will work. There is *no* computing method which will work under *all* conditions: whenever someone suggests one, they should also tell us *when* it will work.

That should not be a hard concept at all. After all, many cryonicists will quite openly say that if your (or their) brains are burnt to ashes, revival becomes impossible. What must we know beforehand? How much will such-and-such knowledge limit the possible solutions? These questions go to the heart of *any* method; and if such studies don't yet exist, the opportunity is open to do them. These are questions in *mathematics* which bear closely on our eventual survival.

Not only that, but the entire idea of treating the *computing* problems of revival as if they were the problem of solving a 3-dimensional puzzle suggests new research questions in neurobiology too. For example: in *Periastron* I recently reported work showing that pyramidal neurons had 3 different kinds of input on their dendrites (the parts of a neuron which *send* messages), from 3 different kinds of neurons. These neurons seemed otherwise identical, but one kind, for instance, would only send its dendrites to the body of the cell, while the other two send them elsewhere. If we study brain structure with the specific idea of learning as much as possible about the circuitry, *statistically*, then we will provide information of direct use to any computer reconstruction. In terms of the puzzle, we start to find out something about

the image on the puzzle, and which pieces can match with one another. And since we already have a map of a *generic* human brain, we can ask similar questions of each large region in our brains (and probably get different answers).

It's important to understand that such quantitative studies, at present, simply don't exist. We can say that such-and-such kind of neuron gets inputs using a given subset of nerve transmitter chemicals, and sends them using another set. Yet simple counts of all the possible statistics don't exist. And if we discover by research into the computing problem that particular kinds of information constrain possible solutions much more than others, the problem becomes a combination of mathematics and neurobiology. (I do not minimize the experimental problems of getting such counts. As a research project this will take many years and produce not one but many papers.)

Clearly we will do even better the less our suspension methods required such reconstruction. Yet here we meet the many problems of giving the best suspension to cryonicists who deanimate in all kinds of difficult situations. As much as possible, we want our knowledge of human brains combined with our abilities at preservation to stay within the boundary of possible revival. Until (if ever) we have complete control over the time and occasions of deanimation, we will always face the problem of reconstruction. There is a boundary with limits we don't yet know, stretching from damage repairable solely by our detailed knowledge of brains, all the way to no damage at all.

And no matter how high-sounding a method or revival may be: nanotechnology, surgery, cryobiology, cryptology, or whatever, if we fail to do the research required to keep our patients within the boundary, all our talk is no more than mumbo jumbo of no more value to ourselves or to patients than the fantasies of the ancient Egyptians.



¹R. Merkle, "The Molecular Repair of the Brain," *Cryonics*, 1st Qtr 1994 (part 1), *Cryonics*, 2nd Qtr 1994 (part 2)

²Letter frequencies can vary very widely between languages. For instance, there is a language spoken in the Caucasus that uses no vowels at all. It's not that speakers speak only in consonants, but rather that the vowels between consonants carry no *meaning*.

Continued from page 19...

going to be a little small. So the van turned out to be a kind of surgical room within the facility. We were about as well set up as we could be, considering that we didn't have any people of Jerry Leaf's caliber on the suspension team at the time my dad was frozen.

Linda: For the most part, the suspension was done by Fred and I, Fred IV, Larry Jakl, and Laurence Gale, who

actually ended up being the first person on the scene to start the CPR (Larry Jakl is no longer an Alcor member, but Laurence Gale is).

Fred: We did the best we could with what we had. By today's standards it was a very primitive procedure.

But by the standards of the time...

Linda: It was advanced for the time. We were proud of it.

Fred: As far as I know, it was the first true neuropreservation. There had been several brains frozen after the people had been dead for some time, but no "head only" suspensions as such.

What made you decide to go neuro? How did you come up with the idea?

Fred: Well, it was clear that if there's any one part of your body which is essential to your identity, it's your brain. Lose your hand, or a whole limb, and you still know who you are. Lose your brain, though, and it's a different story. And we understood that, given the limitations of our suspension procedures, the freezing damage and all, it would require a tremendously sophisticated ability to repair individual cells to revive anyone, whole body or not. To us, then, regenerating a body seemed a much easier task than repairing a frozen brain. Add to this the significant difference in long term storage costs for whole bodies, and that was all we needed to start thinking that head-only

might not be such a bad idea.

Linda: We might not have decided to do it that way, in fact the concept of neuropreservation might not even have occurred to us, if it hadn't have been for our limited finances. We knew that Fred's father could die at any time. We didn't have a large, well-equipped facility. As a matter of fact, when we first started Alcor, we were living in a second story apartment. We knew that if we had to freeze Fred's father, we'd have to somehow get him up those stairs and freeze him in our bathtub. So we decided that we should at least buy a house with a garage. Once we did that, we felt a little safer...

Fred: ... for about two weeks...

Linda: ... and then we started feeling nervous again. Maybe the garage wouldn't be adequate, either. We didn't have enough money to buy a big, fancy facility someplace, or even rent one.

Fred: So we bought a van.

Linda: We gutted the inside of it, and refinished it with an operating table, cabinets, a sink, and lots of equipment panels and other stuff. And that was our first facility.

End Part I

Advertisements and Personals

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EXTROPY

The Journal of Transhumanist Thought #13

Boundless Constellations: The Emergence of Celestial Civilization; If Uploads Come First: The Crack of a Future Dawn; Utility Fog (nanotech); Two Questions for Extropians (Platt), response by More; Interview: Souls, Cyberspace, Sins, & Singularity; Sequential Neural Networks; reviews of *Good Mood*, *The Origins of Order*. \$4.95; \$18 for one year sub. (\$22 Canada; \$32/\$24 overseas air/surface) from Extropy Institute, 13428 Maxella Ave. #273, Marina Del Rey, CA 90292. E-mail: info@extropy.org

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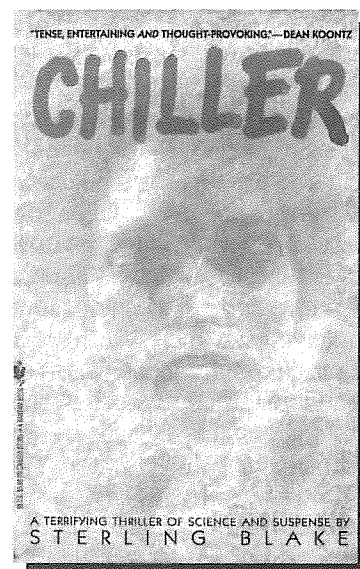
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The Astonishing Hypothesis: The Scientific Search for the Soul

Francis Crick, Charles Scribner's Sons, 1994

Reviewed by Thomas Donaldson

As someone who has said several times that what cryonicists really wish to preserve through their suspensions is their *souls*, I was interested in this book even from its title—though even its title did put me off a bit. Why is this *astonishing*? When I, Thomas Donaldson, say that we want to preserve our souls, I do so knowing very well that I am referring not to some ethereal (but still in its own sense *material*) body but to preservation of a pattern which somehow contains everything we want to keep about ourselves. And I still think that we should not shrink from this word: it may change its meaning, but it still encapsulates what we really want to preserve; and if a pattern of information is not immaterial enough then I really can't think of anything which is more so. (Could a *false statement* be even less material, perhaps?).

Crick organizes this book around his search for a *soul* inside our brains, and in Crick's case (though you have to read the book to verify this) a soul is actually a particular part of our brains. He may, of course, define the word "soul" however he wishes. Early in his book, he says very clearly that he will look at experimental evidence about our brains and not bother with definitions since it's presently too early to do that. This too is a valid strategy, if used with care, though all through his book I felt that the brain activities he was examining somehow did not really touch *all* those activities which I felt strongly about preserving, though it did touch some.

From reading his book, I will suggest what he was *really* looking for: the brain part(s) behind the sense of self-awareness or consciousness that we all have. In some passages he seems to search for something even a little less: the seat of awareness itself (as distinct from *self-awareness*, which we may have in common with the highest primates, but not with many other mammals).

Whether this book will really interest cryonicists therefore depends upon just what you feel about awareness. Certainly after revival I want to be aware and self-aware, perhaps even more so than I am now; but if that were the only part of me that came through my revival, I would not feel that revival had been very effective.

Where are my memories? Who was I? What did I do? For that matter, given that first, self-awareness depends somehow on the circuitry of our brain, and second, that we are all self-aware, I would not differ from any other human being. Why not just bring back a clone? And even if we all had different *kinds* of awareness or self-awareness (one possibility that identification of a brain region might produce), I would feel severely truncated.

Because the neural circuits involved with vision have been extensively studied in both human beings and other primates, Crick uses what we know about the brain anatomy and characteristics behind vision to search for our "soul" as Crick defines it. The book does contain a good deal of information about the circuitry involved with vision, even if it remains just a bit patronizing (to all those ignorant people out there who remain *astonished* at his hypothesis). Basically Crick chose to follow the neural circuits for vision because we know much more about them, not because he believed that vision had any special relationship to awareness.

He touches on memory at only one point: in order to be aware, we must be able to remember at least the first few seconds after we've seen something. That is, we need some form of *short-term* memory. Even though I can think of arguments against such a need, basically I think Crick is correct here. Crick therefore discusses our hippocampus, but not in the detail of other books focusing entirely on memory (cf. Y. Dudai, *The Neurobiology of Memory*, for a very good example). Since we don't actually know that the hippocampus plays any role in awareness, Crick also provides some papers showing that neurons also have a short-term persistence (STP?) in their signals, even when no LTP (Long Term Potentiation) is involved.

Along the way, Crick does discuss this awareness and its nature (he uses not only data from neurobiology but data from psychological experiments on vision in human beings, too). For instance, special processes for *attention* seem to exist, independently of the objects on which we focus our eyes. Again, most of the workings of our brain, including those involved in making decisions, do not happen consciously. We become aware that we have made a decision

after we have made it, not before. This does not mean that we don't make rational decisions (at least sometimes!). It simply means that the process is not one of which we are aware. This implies, again, that sometimes our account of why we made a decision is pure confabulation (we made it up). Finally, Crick distinguishes this kind of unconsciousness from the Unconscious postulated by Freud: we are unconscious of most of what goes on in our brain because it would take many more nerve paths to allow that than would serve our survival. All thinking involves much use of this unconscious processing.

In the end, chasing up the nerve paths from our eyes, Crick never actually finds a center for awareness (and he tells us so). He does find one brain region as a *candidate* for awareness, but he doesn't pretend the evidence for his nominee to be unquestionable. His candidate is (sound of trumpets) the *thalamus*. We often associate the thalamus with emotion, but it receives input from all over our brain cortex. Awareness would require such input. Furthermore, it also sends output to many brain regions, again needed. And a little thought will convince you, that feelings are at least as important to any kind of awareness as facts. Beyond this (to specifying the exact thalamic areas involved) Crick does not go.

Whether this book will enlarge your understanding of your Soul depends partly upon what you think is important about it. It does contain a good discussion and review of all the work done by neuroscientists to date on the anatomy and processing involved in vision. This work is still much farther advanced than work on long-term memory. It might even be advanced enough to use in studies of the damage caused by our present suspension methods: knowing the original anatomy, just how much do our methods disrupt it. Unfortunately we can't yet do that with memory.

If you really believe that your Soul consists solely of your awareness, then you may feel that Crick has dealt with the problem of locating the Soul. Personally, though I certainly want to awaken with self-awareness, that's far from the only thing I want to survive. And finally, Crick's repetition of how "astonishing" his hypothesis was very soon came to grate on me.

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Alcor's Emergency Response capability includes equipment and trained technicians in Arizona, New York, Indiana, Northern California, Southern California, and England, and a cool-down and perfusion facility in Florida. Alcor's Arizona facility includes a full-time staff with employees present 24 hours a day. The facility also has a fully equipped research laboratory, an ambulance for local response, an operating room, and a patient care facility using state-of-the-art storage vessels.

Meetings

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Alcor business meetings are held on the first Sunday of every other month: January, March, May, July, September, and November. (The July and September meetings are on the second Sunday.) Guests are welcome. Meetings start at 1 PM. For more information, call Alcor at (602) 922-9013.

Sunday, January 8, 1994:

ALCOR
7895 East Acoma Dr., #110
Scottsdale, AZ 85260

Directions: Take the 10 to the 17 Northbound, exit Thunderbird Road heading East. Thunderbird will turn into Cactus St, stay on Cactus until you turn left on Tatum, and then right on Thunderbird (which will turn into Redfield in about 3 miles), then (after a quarter mile on Redfield) left on 76th Place. 76th Place turns into Acoma Drive; Alcor is on the right at 7895 Acoma Dr., Suite 110.

Bay Area

Alcor Northern California meetings: Potluck suppers to meet and socialize are held the second Sunday of the month beginning at 6:00 PM. All members and guests are welcome to attend. There is a business meeting before the potluck at 4:00. The December meeting information is as follows:

Sunday, December 11, 1994:

Leonard Zubkoff
3078 Sulphur Spring Ct.
San Jose, CA 95148

Directions: Call Leonard at 408-238-1318 for directions.

Colorado

A cryonics group will be forming in Colorado. Further information may be obtained by contacting Walter Vannini at 111 East Drake Rd, Suite 7046, Fort Collins, CO 80525, or 71043.3514@compuserve.com (email).

Midwest

Alcor Midwest is in full swing. It produces a monthly newsletter and holds monthly meetings. It has a state-of-the-art stabilization kit and responds to six states: MI, IL, OH, MO, IN, and WI. For meeting information or to receive the Alcor Midwest Newsletter, contact Brian Shock at (317) 769-4252, or 670 South State Road 421 North, Zionsville, IN 46077.

Boston

There is a cryonics discussion group in the Boston area meeting on the second Sunday each month. Further information may be obtained by contacting Tony Reno at (508) 433-5574 (home), (617) 345-2625 (work), 90 Harbor St., Pepperell, MA 01463, or reno@tfn.com (email). Information can also be obtained from David Greenstein at (508) 879-3234 or (617) 323-3338 or 71774.741@compuserve.com (email).

District of Columbia

Life Extension Society, Inc. is a new cryonics and life extension group with members from Washington, D.C., Virginia, and Maryland. Meetings are held monthly. The remaining 1994 meeting is scheduled for December 11. Call Mark Mugler at (703) 534-7277 (home), or write him at 990 N. Powhatan St., Arlington, VA 22205.

Las Vegas

Cryonics Laughlin meets the third Sunday of the month at 1:00 PM at the Riverside Casino in Laughlin, Nevada. FREE rooms at the Riverside Casino on Sunday night are available to people who call at least one week in advance. The time and place of these meetings sometimes changes, so before you come, please call Jerry Searcy at 702-454-2120.

Directions: Take 95 south from Las Vegas, through Henderson, where it forks between 95 and 93. Bear right at the fork and stay on 95 past Searchlight until you intersect with 163, a little before the border with California. Go left on 163 and stay on it until you see signs for Laughlin. You can't miss the Riverside Casino in Laughlin, Nevada.

Southern California

The Southern California chapter of Alcor meets every month in an informal setting in one of our member's homes. Meetings are on the fourth Sunday of the month. For more information, call Michael Riskin at (714) 879-3994.

England

There is an Alcor chapter in England, with a full suspension and laboratory facility south of London. Its members are working aggressively to build a solid emergency response, transport, and suspension capability. Meetings are held on the first Sunday of the month at the Alcor UK facility, and may include classes and tours. The meeting commences at 11:00 A.M., and ends late afternoon.

The address of the facility is:

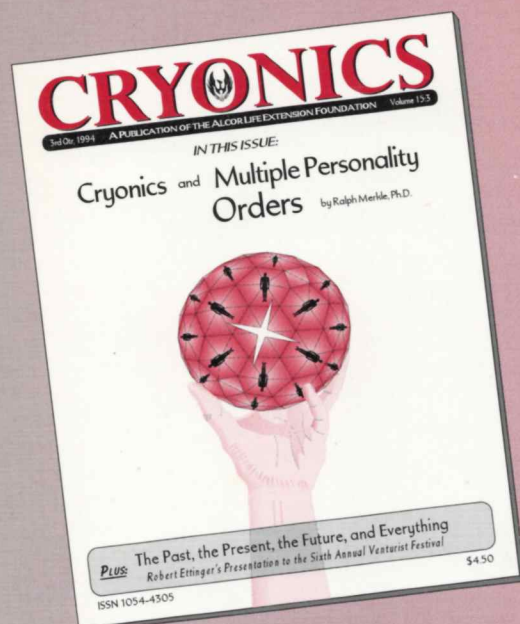
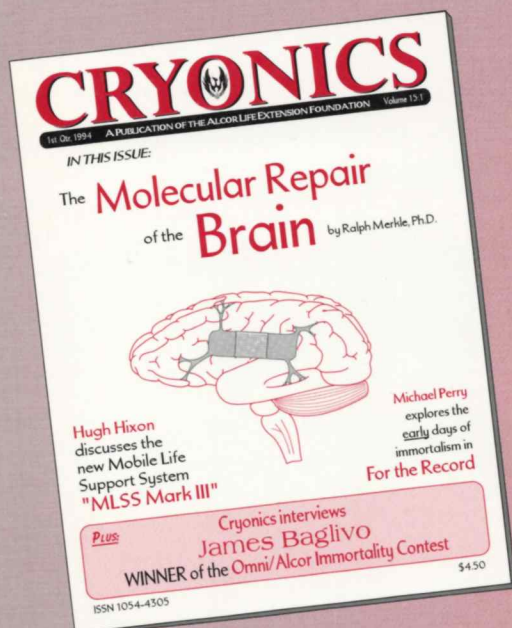
Alcor UK
18 Potts Marsh Estate
Westham
East Sussex
Tel: 0323 460257

Directions: From Victoria Station, catch a train for Pevensey West Ham railway station. When you arrive at Pevensey West Ham turn left as you leave the station and the road crosses the railway track. Carry on down the road for a couple of hundred yards and Alcor UK is on the trading estate on your right.

Victoria Station has a regular train shuttle connection with Gatwick airport and can be reached from Heathrow airport via the London Underground tube or subway system.

People coming for AUK meetings must phone ahead—or else you're on your own, the meeting may have been cancelled, moved, etc., etc. For this information, call Alan Sinclair at 0323 488150. Near metropolitan London, contact Garret Smyth at 081-789-1045 or Garret@destiny.demon.co.uk, or Mike Price at 081-845-0203 or price@price.demon.co.uk.

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