



Cryonics

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Research and Training Update

by Tanya L. Jones

Cryonics is...

Cryonic suspension is the application of low-temperature preservation technology to today's terminal patients. The goal of cryonic suspension and the technology of cryonics is the transport of today's terminal patients to a time in the future when cell/tissue repair technology is available, and restoration to full function and health is possible—a time when freezing damage is a fully reversible injury and cures exist for virtually all of today's diseases, including aging. As human knowledge and medical technology continue to expand in scope, people who would incorrectly be considered dead by today's medicine will commonly be restored to life and health. This coming control over living systems should allow us to fabricate new organisms and sub-cell-sized devices for repair and resuscitation of patients waiting in cryonic suspension.

Alcor is...

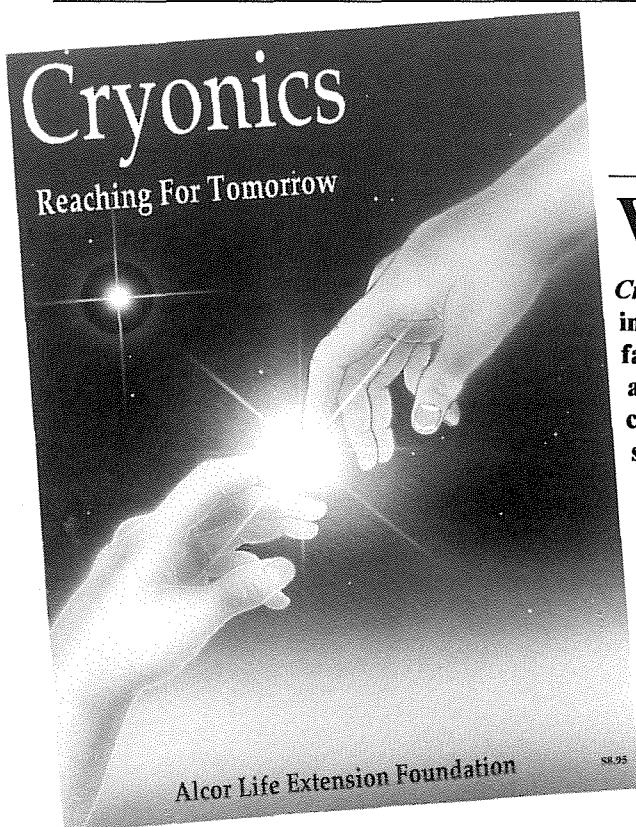
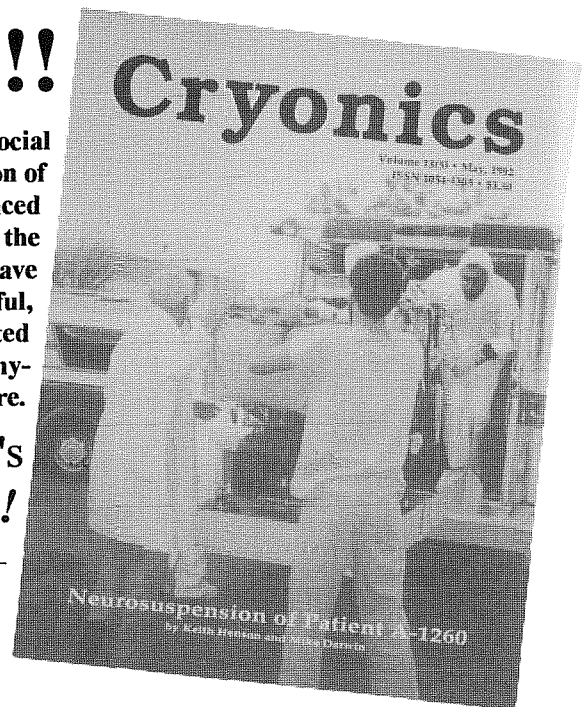
The Alcor Life Extension Foundation is a non-profit tax-exempt scientific and educational organization. Alcor currently has 25 members in cryonic suspension, hundreds of Suspension Members—people who have arrangements to be suspended—and hundreds more in the process of becoming Suspension Members. Our Emergency Response capability includes equipment and trained technicians in New York, Canada, Indiana, North California, and England, and a cool-down and perfusion facility in Florida.

The Alcor facility, located in Southern California, includes a full-time staff with employees present 24 hours a day. The facility also has a fully equipped and operational research laboratory, an ambulance for local response, an operating room, and a patient storage facility consisting of several stainless steel, state-of-the-art storage vessels.

Subscribe to *Cryonics*!!!

Cryonics magazine explores and promotes the practical, scientific, and social aspects of ultra-low temperature preservation of humans. As the publication of the Alcor Life Extension Foundation—the world's largest and most advanced cryonics organization—*Cryonics* takes a realistic, real-world approach to the challenge of maintaining in a biologically unchanging state patients who have reached the limitations of modern medicine. *Cryonics* contains thoughtful, provocative discussions of cryonic suspensions performed by Alcor, related research, nanotechnology and molecular engineering, book reviews, the physical format of memory and personality, the nature of identity, and more.

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Cryonics: Reaching For Tomorrow is truly the world's only "textbook" introduction to cryonics. Over one hundred pages long, *C.R.F.T.* is a fantastic and unique examination of the social, practical, and scientific arguments that support the continuing refinement of today's imperfect cryonic suspension techniques, with an eye toward eventual perfected suspended animation. *C.R.F.T.* is also a comprehensive introduction to the Alcor Foundation. This book is free with your \$15 subscription to *Cryonics* magazine, or can be purchased separately for 7.95.

To subscribe to *Cryonics* magazine and receive a free copy of *Cryonics: Reaching For Tomorrow*, or to order *C.R.F.T.* alone for \$7.95, call 1-800-367-2228, or write to the Alcor Foundation at 12327 Doherty Street/ Riverside, CA 92503.

Cryonics

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Cover: Alcor undergoes a training update in this month's cover story by Tanya L. Jones (photo by Derek Ryan).

"Cryonics Forum" Expands

Last month, in the Up Front piece, "Is Cryonics Having A Baby?," I encouraged members and subscribers to consider the possibility of a newsletter separate from *Cryonics* that could act as a forum for debate and disagreement. If such a newsletter existed, members/subscribers could air questions and grievances at length, in a point-counterpoint format, without concern for length, subject matter, or the potential for utter confusion in the uninitiated. *Cryonics*, then, could more specifically target non-members through newsstand sales and the like, taking more care to constantly reiterate the fundamentals, and not contain complicated debates whose factual foundations lay months or years in the past.

This idea was discussed extensively here at Alcor, to some extent on the Cryonet, and at the January Board of Directors meeting. (My thanks to the members who wrote or called with their opinions on this matter as well.) Although there are definitely those who believe that we should proceed with a newsletter, the clear consensus among the staff, Board, and members present at the January meeting was that "sanitizing" *Cryonics* magazine is not desirable at this time. Rather, as long as cryonics remains a rather experimental and unrefined technology, we must avoid the temptation to remove the "dirt" from the public relations material, and instead count on it to accurately portray cryonics and Alcor to potential members. More than one of us was attracted to Alcor by the almost belligerent frankness of *Cryonics* magazine. If the magazine should change at this time, it should change in the direction of formalizing its commitment to serve as a vehicle for disseminating, communicating, and recording for posterity all things cryonic.

So now the "Cryonics Forum," which began a few months ago as a sort of junior Editorial Page, is changing and expanding. Charles Platt, who had offered to manage a newsletter if there was to be one, happily agreed to bend his efforts instead to compiling the new *Cryonics* Forum each month. He has begun by perusing the past several weeks of Cryonet (a cryonics electronic communications network) traffic, and compiling a four-page survey of some of the debates and exchanges that occurred. But participation is not confined to

Cryonet subscribers; if you want to question or comment on a Forum topic, or open a new topic that you think deserves attention, send your submission to Cryonics Forum c/o: Alcor Foundation, 12327 Doherty St., Riverside, CA 92503. Submissions not intended for debate and discussion in the Forum, and those intended to elicit an Editorial response, should, as always, be addressed to Editor, *Cryonics* at the same address.

Lastly, if you do not have Cryonet access and you wish for your submission to Cryonics Forum to be posted on the Cryonet (so that reactions/commentary can be published along with your submission in the next issue), simply write the words "PLEASE POST" prominently on the top of your submission. (*Warning: While I can safely assert that most any posting on Cryonet will see response(s), there is no guarantee whatsoever that that response will be particularly polite and/or nurturing. Or even civil. Enter the ring at your own risk.*)

Omni / Alcor Update

The "Omni/Alcor Immortality Contest" has been in swing for about a month now, and so far public reaction can be classed as "Not overwhelming, but healthy and positive." We've received a few hundred requests for information, many of which are the result of the radio interviews that Carlos Mondragón and others have been doing.

Refreshingly, an unusually high per-

centage of the callers appear to have a serious, genuine interest in pursuing membership. This higher percentage of quality call-ins is probably a result of the upbeat, extremely-pro-cryonics presentation in *Omni*. Despite disappointment on the part of some cryonicists with the repeated emphasis on death in the magazine, Charles' article is the fairest and most accurate representation of Alcor and cryonics to appear in a major publication since his last article in *Omni*, "Confessions of a Cryonicist," which netted almost 1500 requests for information.

This contest also marks the trial of a new, more cost-effective way of responding to requests for information. For the past several years Alcor has responded to information requests by sending out *Cryonics: Reaching For Tomorrow* (previously *Alcor: Threshold to Tomorrow*), a 100+ page book that is expensive to produce and expensive to mail. After a year of "thinking about doing it," we have produced a brief brochure that introduces Alcor and cryonics, and includes an insert advertising *Cryonics* magazine and *C.R.F.T.* Recipients can subscribe to *Cryonics* for \$15 and receive a free copy of *C.R.F.T.*, or purchase *C.R.F.T.* separately for \$7.95. Full-time students are not receiving the brochure, but are receiving *C.R.F.T.* for free as usual.

It's too early to pass final judgment, but the first few mailings of the brochure have already shown encouraging returns in subscriptions to *Cryonics* (with the free *C.R.F.T.*). More on this next month.

Cryonics
and the Alcor Life Extension Foundation

Life Without Limits One day, many scientists believe that researchers will find a way to stop and even reverse the aging process. When that happens, we may be able to extend our lives—in good health—for centuries.

For those of us who enjoy life and wish we could have more of it, this is good news. And yet, we wonder: will we live long enough to be rescued by this scientific breakthrough?

The Concept Cryonics offers an answer to this dilemma. Cryonics technology

world, and has pioneered research and technical development for more than twenty years. In this brochure, we'll explain our services and our philosophy as briefly as possible. If you want more details, you may be interested in our monthly magazine or our comprehensive "fact book." See the back page of this leaflet for ordering information.

How Much Life is Enough? Some people say they'll be ready to go when it's their turn to go. They say they're happy to live a natural lifespan

how we feel and think and see. So long as our cells are supplied with nutrients by the blood stream they continue to function, and so do we. Unfortunately, cells have very limited energy reserves. If the supply of nutrients is shut down for some reason (perhaps because of a heart attack), after about ten minutes, our cells are exhausted and become damaged by toxic chemical reactions. This damage is difficult to reverse with current medical technology, and as a result, life ends.

However, cryonics offers a brief "rescue" period during which the "rescue" is performed. This "rescue" is performed by

Additional thanks to Charles Platt for his fine work on the brochure.

Special Northern California Meeting

Alcor Northern California is pleased to announce that Steve Bridge, new president of the Alcor Life Extension Foundation, will be the guest speaker at Alcor North's February meeting to be held Sun-

day, February 14 at the home of Leonard Zubkoff and Lola McCrary in San Jose, California. Steve will talk about his plans and hopes as Alcor president, and touch base with Alcor North members and any others interested in attending.

Put it on your calendars!!! The time is 4:00pm with a brief business meeting and (not so brief) potluck following. Directions to the meeting appear in the "Meetings and Announcements" on the back

page of this issue..

We look forward to seeing you there.

Cryonics Conference

A conference entitled *New Dimensions in Cryonics: Critical Issues for the 21st Century*, will be held on Memorial Day weekend (May 28-30, 1993) at the Marriott Hotel at Ontario Airport in California. For details, see page 7.

Letters to the Editor

Dear Mr. Whelan:

I congratulate the Board and staff of the Alcor Foundation for getting their contest advertised in *Omni* magazine. I hope that this signals the beginning of the social acceptance of cryonics.

I do have a concern about the way Mr. Charles Platt describes this potentially life-saving medical procedure, however. He repeatedly states in his *Omni* article that cryonics is the freezing of people "after death," which implies that the resuscitation procedure we foresee will be some sort of ghoulish "resurrection."

This is not the position of the Society for Venturism. Venturists maintain that people held in cryonic suspension are not "dead" in any fundamental biological sense. Rather, we argue that they are desperately sick and injured *patients* in a kind of profound trauma which has been stabilized at a cryogenic temperature. It is our hope that the more competent trauma centers of the 21st and 22nd centuries will be able to treat these patients, restoring them (and us, if necessary) to youth and health.

Venturists feel that making this literally vital distinction is the key to explaining the cryonics idea in a scientifically valid and emotionally appealing way.

Sincerely,
Mark Plus
Vice President, the Society for Venturism

The point that you bring up here constitutes one of the most well-trodden paths of disagreement in all of cryonics. Are patients in cryonic suspension "dead," legally, biologically, or semantically? What's more, in lieu of the general poor understanding of death and the dying process, should we portray them as such,

whether they are or are not?

In his fascinating article "The Death of Death in Cryonics," Brian Wowk argues that death can accurately be declared only after permanent cessation of vital functions, and since it's far from certain that cryonics patients are permanently functionless, they should not be referred to as "dead."

I have argued with Mr. Wowk that if we are going to try for semantic accuracy, we should acknowledge that the words "dead" and "death" are not at all interchangeable, and that which is "dead" has not necessarily experienced "death." This may seem like hair-splitting, but really it is not. We might casually say that "My TV died" or "My car died," and yet fully expect to see it repaired. Indeed, a consultation with Webster shows the following definitions for "dead": "deprived of life ... having died ... having the appearance of

death ... lacking power to move, feel, or respond ... numb ... incapable of being stirred emotionally or intellectually ... etc." Certainly cryonics patients fit all of these descriptions neatly. The primary definition of "death," on the other hand, is indeed "a permanent cessation of all vital functions: the end of life." And yet the fourth definition listed is "the state of being dead," which muddies the waters once again.

The moral of this story is that yes, Mr. Plus, I see the validity of your point, but I also see its weaknesses. The bottom line is that no one really understood life when the notions of "death" and "dead" took shape, and we are left with a square peg and several circular holes of varying diameter. None of the holes will ever fit the peg quite right, because we need a new peg.

I guess this is my way of saying that

Write a Letter!

Cryonics impacts nearly every facet of our existence. Perhaps you're an expert on one of the facets that we're just bumbling through, or maybe you just have a perspective that's worth listening to. Don't leave all the speculation and commentary to others.

If you have something to say — say it!

Send your Letters to the Editor to:

Ralph Whelan
Alcor Foundation
12327 Doherty Street
Riverside, CA 92503

Or you can FAX or email your letter:

FAX: 714-736-6917
Email: alcor@cup.portal.com

Mr. Platt had a lot he needed to say and not all that much room to say it, and I think you should forgive him for staying away from that can of worms. — Ed.

Dear Editor:

Some experts are saying that the federal government is on the verge of going bankrupt. Predictions of when this will happen seem to range from as early as 1996 to a more "optimistic" 2000. This raises questions about the financial stability of Alcor, since in certain ways its finances are tied to those of the government (whether we like it or not).

How is the Alcor Patient Care Fund invested to provide needed income to maintain patients in suspension? If the Fed went broke and could not back up federal bonds, treasury bills, etc., how would this affect our ability to continue to raise needed income? Any readers' responses are welcome.

Sincerely,
David Kurzdorfer

Much of Alcor's investments are in securities which rely on the "full faith and credit" of the federal government. In the event of a government default, we would expect a worldwide collapse of financial

markets, so really, nothing other than gold, real estate, or other "hard" assets would preserve value.

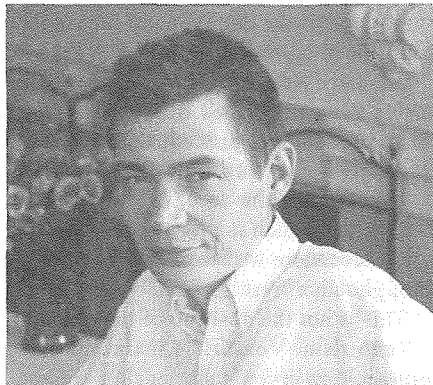
Fortunately, "experts" have been selling an awful lot of books since the early seventies predicting economic disasters of various kinds, and none have come close, so far. Two years ago there was widespread "confidence" that the insurance industry was on the verge of ruin. The reasons I predicted the opposite in a past issue of this magazine ("Life Insurers At Risk?") are still valid (I turned out to be right), and also apply to current disaster scenarios.

— Carlos Mondragon

For the Record

The Problem of True Immortality

Michael Perry



"Most of us now living have a chance for personal, physical immortality." These brave thoughts, quoted from chapter 1 of Robert Ettinger's 1964 book, *The Prospect of Immortality*, have inspired cryonics since its beginning. Yet "immortality" has been a conceptual stumbling block for many, who qualify its meaning as "indefinitely extended life" and sometimes go further, to the point of denying that the real, genuine article is possible in a universe such as ours. For example, in chapter 5 of the very book I just quoted, Ettinger states, "... permanent death will surely come *some* day, however long deferred; science can give us indefinite life, but not literal immortality, not mathematical eternity."

Despite the certainty with which such assertions are sometimes made, the *scientific* arguments for the impossibility of literal immortality are usually scanty (none are given in the book, for example). Some of these arguments will be considered in this article. The upshot, however, is that *no conclusive evidence exists that rules out*

literal immortality, at least if you grant certain reasonable possibilities for extension of a human life (that the brain of the individual might increase in size and complexity, for instance, or incorporate different materials than it is now composed of). At this point some might question whether it is worthwhile to take up one's time with such issues, given that much more pressing problems exist (one being biological aging and death, which we try to address through cryonics). Is it worthwhile? The best answer I think is not "no" but, "yes, in due proportion." In other words, we shouldn't spend *too much* time on this topic — just yet — but some reflection on the subject is desirable, even in our primitive times with more immediate crises looming.

One reason it seems worthwhile relates to the issue of how best to promote cryonics. What do we say about why we are freezing for later reanimation? Some favor the more philosophically conservative approach that treats cryonics as simply an experimental medical procedure, albeit

an unusual one: Eventually we will be able to cure diseases and improve the health of the resuscitees, assuming all goes well. This benign rationale is so close to the goals of conventional medicine that even the most hardened opponent of cryonics would be hard-pressed to object — or so it may seem. However, many will quickly detect an element of coverup in this valiant effort at conformity — after all, we can't deny that aging is one of the conditions we hope very much to see cured, and that puts us face to face with the *i*-word (or close enough). So, when addressing some individuals at least, it seems best to openly declare, "yes, we *do* want immortality, or at least something close." A relatively benign and limited "close" thing is "biological immortality" or essentially, elimination of aging and known diseases as causes of death. Virtually any cryonicist has this as a goal, since it seems no less feasible than cryonic resuscitation. (Thus attempts to conceal the goal of biological immortality to avoid controversy often backfire.)

Many cryonicists will stop there and either not worry over the larger question, or as we have seen, deny that true immortality is possible. Logically though, it has to be admitted that the true article too must be a goal (at least as an option) given that it is not known to be impossible. In fact many recognize and are irritated by the absurdity of trying to maintain that, although they want to live many centuries or millennia, the goal of true immortality is not to be taken seriously. To maintain logical consistency in our goal of survival, then, is one reason to consider true immortality. Other reasons are that it is simply interesting, fascinating, exhilarating, philosophically and even mathematically, and that it may provide or provoke insight into issues of personal identity, survival, the nature of reality in general, and other things that are important to immortalists.

Here I will sample a little more of the thinking and literature both pro and con on the issue of true immortality, then offer some thoughts. As often happens in these columns, I'll have to be much briefer than the subject deserves and only offer a limited introduction, with some notes and references for further research.

One result of physics is known as the "fluctuations and dissipations theorem." Roughly, it means that arbitrarily large catastrophes are inevitable in *your* neighborhood — eventually. So for example, you can expect a supernova to go off within a million miles of you (able to vaporize the earth and everything on it), or some equivalent disaster, given enough time. Of course, this will probably not happen anytime soon (it has never happened in the 4.5 billion years of the earth's existence, for example), but it is easy to see how this seems to doom any hopes of true immortality, at least if you take the myopic view that the physical structure and knowledge level of human beings will essentially stay the same over very long periods of time. This position however, seems about as likely as that man will never land on Mars or make an intelligent machine, and in fact many options can be imagined for avoiding eventual annihilation, such as (to be conservative) development of new technology to control, deflect or predict the "big ones." One of the more conservative possibilities is simply to imagine oneself extending over a large volume of space, with, say, many redundant copies of identity-

critical information, for ever-increasing security. Ettinger himself, in his 1972 book, *Man into Superman*, explores this possibility (showing thereby that he is no dogmatic adherent to a philosophy of necessary eventual doom, despite his views quoted above):

"The notion of 'extended bodies' can itself be extended to that of the multicorporeal giants, having not only sensors and



Robert Ettinger

Cryonics, February 1984

effectors but even brains distributed over large volumes of space. Such an idea has an interesting relation to the possibility of *infinitely* extended life.

"Apparently most scientists assume that infinite life is impossible for fundamental physical and mathematical reasons ... even know if the future of the *universe* is unlimited, it isn't clearly impossible either."

Among the skeptical scientists Ettinger challenges is James S. Hayes, who apparently felt that to add and store memories indefinitely (a prerequisite for true, conscious survival) would require at least a fixed percentage increase in brain mass per year. This would amount to geometric or exponential growth, which is not sustainable forever in a universe such as ours, with its finite number of dimensions, finite speed of light, and limited capacity for miniaturization. The remedy Ettinger proposes is simple: control the rate of growth. Then, "if available space is infinite, only the annual percentage growth

in brain tissue will have to decrease, not the tonnage." Ettinger then devotes some soothing words to the possibly nonplussed reader:

"Tons of brain tissue? Of course: doubtlessly, some irreducible minimum amount of matter, in mass and volume, is required to store a unit of information, and if we jettison no memories, we must become gigantic."

This, however, should not be viewed with undue alarm. In fact, "... we should not *want* to avoid giantism — it is our salvation with respect to the accidental death bogey." How is this so?

"There is a certain risk of catastrophe per year per cubic yard, and we can hardly expect to keep reducing this risk fast enough forever; hence any ordinary individual must expect a fatal accident sooner or later. But a *society*, if it spreads out fast enough, can have a non-zero probability of infinite life. (This will be obvious to mathematicians, and I omit the proof, simple though it is.)"

At this point, the reasonable immortalist will be thinking something like, "fry 'society,' what about the *individual*?" But Ettinger does not let us down here, recognizing that fundamentally, there is no difference between society and the individual, in particular given that future individuals may extend over several or many physically separated components that communicate by radio or other remote means. (In fact such separation seems necessary to avoid complications such as the collapse of a very large lump of matter into a black hole.)

"It is simply a matter of communication. The hemispheres of a brain, for example, in principle ought to be capable of integration by wires, or even radio, rather than nerves; and the same thing is true of smaller components. We should envisage a race of titans, each multicorporeal, the body divided into myriad components attenuated over a large and increasing volume of space, integrated by something like radio waves. If a star goes nova, only a few planets may be lost, a trifle, a toenail. (We are assuming now that space, as well as time, has no end.)"

Needless to say, there will be a price to pay. Beings extended over space will not be like ourselves of today, but very much posthuman; life will have changed greatly. However, this is what we look forward to. Such beings will have devoted

considerable labor to optimizing their enjoyment of life, and one might reasonably hope, with some significant success.

From this exhilarating vision I'll turn now to another and later nay-sayer, K. Eric Drexler, whose 1986 book, *Engines of Creation*, as the first popularization of the idea of nanotechnology, is in many ways an inspiring prophecy of things to come. In particular a chapter offers a strong case for the feasibility of eventual revival of cryonics patients through molecular repair devices. (Cryonic suspension then becomes a form of *biostasis* or suspended animation.) When it comes to the cosmological question of immortality, though, Drexler is less than encouraging:

"With or without biostasis, cell repair cannot bring immortality. Physical death, however greatly postponed, will remain inevitable for reasons rooted in the nature of the universe."

Drexler has echoed the sentiments expressed in Ettinger's earlier book rather than the more optimistic and interesting ones offered later. Why? Not because of new scientific arguments (none are given). Instead, the reason can be gathered by reading what follows:

"Biostasis followed by cell repair thus seems to raise no fundamental theological issues."

Drexler did not want to challenge the religious establishment. What about Ettinger? Chapter 5 of *Prospect*, where the anti-immortality quote comes from, is

titled "Freezers and Religion" and deals with possible conflicts between "traditional" notions of how to achieve immortality (through supernatural intervention) and the scientific approach. Again the approach

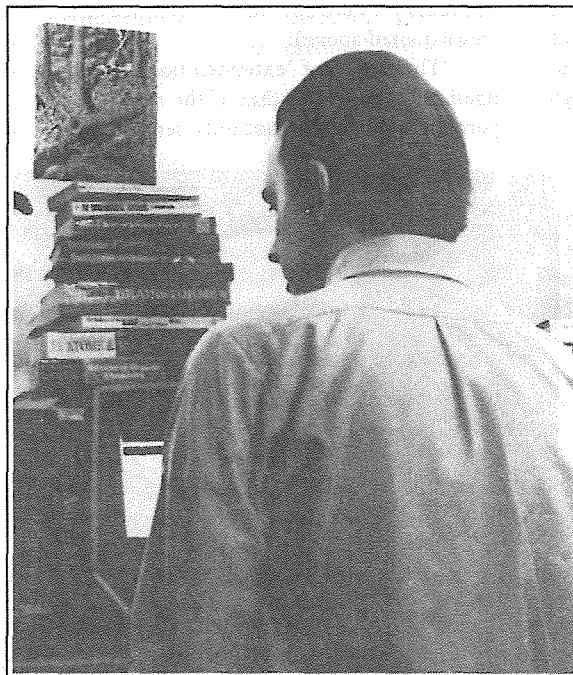


Photo: Chris Peterson

K. Eric Drexler

taken, as perusal of the chapter makes clear, is to avoid challenging the religious establishment by denying that science could confer true immortality.

The universe, however, does not adapt its rules to suit the opinions of a race of beings on a small planet at particular points in its history. True immortality may

be possible scientifically, whatever those who would speak for the gods may say. I suspect this will become an important topic of research within a few decades, when we are farther along the road to the biological approximation of immortality. It may thus be a worthy career for a would-be-transhuman scientist. Persons interested in such a career, today, should make cryonics arrangements along with other reasonable preparations.

References And Notes:

Drexler, K. Eric. *Engines of Creation*, Doubleday, 1986, quotations from pp.138-9.

Ettinger, Robert. *Man into Superman*. St. Martin's, 1972; Immortalist Society, 1989. Quotations from pp. 78-80.

Ettinger, Robert. *The Prospect of Immortality*. Doubleday, 1964; Immortalist Society, 1987. Quotations from p. 1 (Ch. 1), p. 86 (Ch. 5).

Additional references include *The Anthropic Cosmological Principle* by John D. Barrow and Frank J. Tipler (Oxford, 1988), later works by these authors, and various sporadic discussions by cryonicists such as Thomas Donaldson and Ralph Merkle, some of which are reported in such sources as *Cryonics* and Kevin Brown's cryonet E-mail.

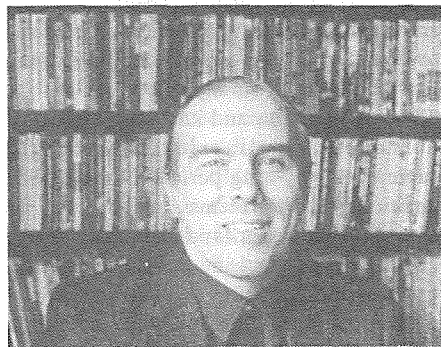
Future Tech

How Good a Job?

H. Keith Henson

I started a column on what Alcor needs in a new location, but Steve Bridge told me that *he* intended to produce a major article on this topic soon. So rather than scoop him ...

A few columns ago I discussed what I consider an exceeding remote possibility that Hans Moravec proposed, wherein a person could be recreated from the traces s/he leaves in the environment. This



sounded like just about the hardest task I could imagine. We in cryonics are trying to make it *easy* to bring us back — but how good a job do we need to do for that?

There is a clear gold standard: fully

reversible frozen suspended animation. Unfortunately for this standard, we happen to be mammals. We know how to get fully reversible suspension with dissociated cells, but nobody knows how to do that with entire mammals, or even a single organ. We have learned about some approaches by seeing how other classes of animals do it. A few amphibians and reptiles and some insects have evolved to get through the winter by making lots of cryoprotectants and freezing solid — though nowhere close to the temperature of liquid nitrogen. (A cryobiology researcher is using a research grant from Alcor to work with some Siberian salamanders to see if memory makes it through freezing. More detail on that as the experiment progresses.)

Even though I would be delighted to be proved wrong, I suspect that human knowledge is a long, *long* way from reversible suspension of humans, and it *might* lie outside of what can be done at all with pre-nanotech tools. This does not mean that research into this area is worthless; far from it. But I would not pin too much hope on expecting rapid progress.

Short of reversible suspension, future revival of the patients — especially those we put into storage with today's primitive technology — is going to require technology with the capacity to repair damaged cellular structures. This is currently going by the name of nanotechnology, or perhaps molecular manufacturing as "the n-word" acquires more baggage.

There are implications to this presumption about future technology which I will discuss later.

It is not possible in cryonics to obey the medical injunction of "do no harm," but only "do as little harm as you can." Doing as little damage as possible, unfortunately, is a multidimensional optimization problem with many tradeoffs, most of them with hard-to-quantify costs. For example, we almost certainly could do less damage if we were able to fly an operating room and all the perfusion gear to the spot where the patient is about to deanimate, but the net result (due to enormously higher cost) would be that we suspend far fewer patients, so that at the cost of doing a little better on a few, we did nothing at all on many. I don't think anyone has ever drawn a "price elasticity" curve for cryonic suspension, but *all* such graphs express the obvious fact that demand for a product goes down if you raise the price too much.

We don't have the money to do either

of these projects at present, but suppose Alcor had on the order of 10-20 million dollars to improve cryonic suspension. Would it make sense (in terms of less damage to our patients) to try develop better protocols which would (to some limited degree) reverse the effects of ischemia? Or would it be a better use of the money to try and get premortem suspension legally permitted? In fact, *either* use of the money would improve the lot of only a minority of the last half dozen Alcor patients.

And at what cost?

And all of this is in the context of what it *costs*. The board of Alcor spends more time on money matters than *anything* else. A lot of the cost of cryonics is overhead (i.e., a roof over our heads), and administrative cost. But suspensions are costly medical-like procedures. Medicine, as we all know, is in the middle of an out-of-control cost runaway.

Alcor's suspension procedures grew

Cryonics Conference on Memorial Day Weekend

A conference entitled *New Dimensions in Cryonics: Critical Issues for the 21st Century*, will be held on Memorial Day Weekend (May 28-30, 1993) at the Marriott Hotel at Ontario Airport in California. This conference is being organized by Saul Kent with sponsoring by several organizations.

The conference will begin on Friday evening (May 28) with an informal session for those who arrive early. This will be followed by seven panel discussions on Saturday, May 29 and Sunday, May 30. There will be a banquet on Saturday evening, May 29.

Among the important issues to be discussed by the panels will be the following:

- ***Is an all-purpose organization the best model for cryonics? Would it be better to have long-term storage handled by a separate organization solely responsible for patient care?***
- ***How much democracy should there be in cryonics? Should members have any legal responsibility for the governing of cryonics organizations?***
- ***How well are we preserving cryonics patients today? What can be done to preserve cryonics patients more effectively in the future? When will cryonic suspension be perfected?***
- ***What can we do to make pre-mortem cryonic suspension legal? Should cryonics patients be granted legal rights? How can we best protect cryonics organizations against legal attack? From hostile relatives? From the government? Should we seek legislation to regulate cryonics?***
- ***What are the best ways of raising money for a cryonics organization? How should cryonics organizations invest their money? Is self-insurance feasible for cryonics organizations in the foreseeable future? How much of their assets should members leave to their cryonics organization after their suspension? Should one all-purpose cryonics organization be solely responsible for all financial matters related to cryonics? Or should there be separate organizations specializing in financial matters?***
- ***Should cryonics organizations have the sole responsibility for suspension patients? Should relatives have any control over suspension patients? Should members designate personal advocates to represent them after they are suspended? What role should the government play with regard to the rights of suspension patients?***
- ***How independent should local cryonics groups be? What responsibilities should they have? Is centralized control the best way of governing a cryonics organization? Is it possible to have a loose confederation of relatively independent local groups? What are the strong points and weak points of a confederation of local cryonics groups?***

The Memorial Day weekend cryonics conference is intended for members (or those in the process of becoming members) of all cryonics organizations. A more complete program for the conference, including many of the panel participants and more details about how to attend the event, will be available in the near future.

out of Jerry Leaf's and Mike Darwin's medical experience. Much of what we do was the medical default method. Only a few of our default procedures, equipment, and instrumentation have been closely examined in light of what we should drop as ineffective on patients who will be presented to *really* advanced reconstructive techniques.

One simple example which *has* been considered is sterile technique. We are simply not very concerned when we have a break in technique — and in the frantic efforts of a suspension, this happens more often than not. *Any* level of technology up to the mind boggling task of reanimating the patients should be able to deal with a few (or even a lot of) stray bacteria. Why don't we quit using them and save the

money we spend on gloves, gowns, masks and the like? Because the patient is not the *only* one we are concerned about! We practice sterile technique as best we can to protect the team members, as well.

There are other places which need examining, and there is an ongoing evaluation of suspension methods and equipment. This has been getting a lot of emphasis lately because there is a *lot* of interest in getting washout capability into the hands of the coordinators in the field. We know field flushes with relative primitive equipment can be done — because one *has* been done.

Among the things we need for putting washout capability into the field is a long-term storable washout solution. Viaspan, which we have been using, is downright

handy, but it costs \$200 a liter, has a limited storage life, and we can use up to a dozen liters on a patient. Here, we *know* what we need to do, and have a fairly good idea of how to go about it. The monetary cost is moderate, though it will take considerable labor for the initial implementation.

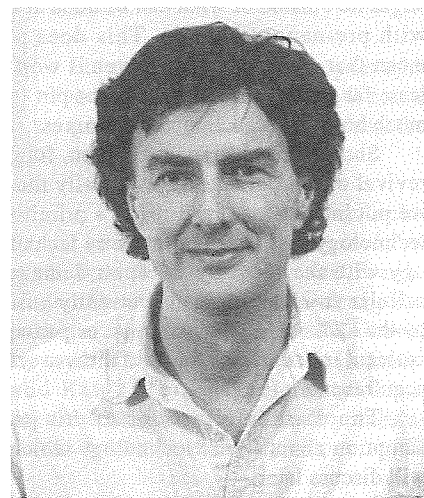
We also need simplified and "fail safe" instrumentation. We currently have several ideas which need to be tried. Some of them may work out.

One problem which I sure hope Steve can solve is to get the Conditional Use Permit modified so we can use animals for developing this capability and training the teams.

The Real-World Interface

Narrowcasting

Charles Platt



Quantity vs. Quality

At the time of writing, I have no way of knowing how the cryonics contest in *Omni* magazine will work out. When all is said and done, it may yield ten new members for Alcor, or a hundred — or none at all.

But let's suppose for a moment that the contest is a massive success, attracting a lot of attention and prompting many people to sign up. Does this mean that it has proved itself as a good way to encourage growth?

A year ago (when the idea of the contest first came to me), I would have thought so. Now, however, I'm not so sure. I'm wondering if we should be thinking more about the quality, rather than the quantity, of new members.

Addressing our Deficiencies

Quantity, of course, has its uses. Any new member generates some revenue, and is likely to spread the message about cryonics by personal contact, creating a ripple effect. We certainly need revenue, and we also need cryonics to be broadcast as widely as possible, displacing the bad associations that have been planted in many people's minds.

But this does not address the problem which I alluded to, in passing, in my last column. The service that we are selling is not yet complete. There are deficiencies that we know about, and there may be other deficiencies that we have no way of knowing about, now or in the foreseeable future.

Steve Harris has compared a cryonic

suspension with a surgical operation that is conducted by a radio-controlled robot located on the planet of a distant star. The surgeon, here on Earth, has to wait literally years for his signal to reach the robot, and for information to return, telling him how the operation is working out.

Similarly, while Alcor's suspension team uses the best available techniques and equipment, it will be decades or maybe even centuries before they have information confirming that the operation was a success.

What would improve this situation? Well, it would certainly be nice if a new perfusate were developed which would completely solve the problem of ice damage. It would be nice, too, if we could store patients slightly above the glass transition point — the temperature where frac-

turing occurs. And how about some nifty way to rewarm patients without inflicting any more cell damage than they experienced when they were frozen?

These are problems that can only be addressed with substantial programs of research. In fact, some people seem to feel that the problems are so big, they're beyond our capabilities right now, and we simply have to hope that nanotechnology will fix any damage that we inadvertently inflict.

I certainly share this hope. But I also feel that any research is better than none. Even a small improvement in our techniques might increase a patient's chance of survival. And in that case, it's worthwhile.

The Most Pressing Need

Research requires money; but more than that, it requires people. Unfortunately, cryonics research is an unattractive career prospect, to say the least. Cryonics itself still has a stigma attached, making it unwelcome on any scientist's resume. Worse still, there's barely enough money to pay for equipment, let alone a decent salary.

Despite these disincentives, a few diehard activists with the necessary training have demonstrated their commitment to work on the problems facing us. But there are barely a handful of these special people. Thus, the enhancement of cryonics procedures literally depends on the efforts of four or five human beings. This is a frighteningly small number, and I'm sure that all of us would feel safer if there were twice or three times as many.

This leads me to my conclusion: The most pressing need is to find people who can become not just Alcor members, but activists who are willing to dedicate their time, their skills, and maybe even their lives, to make suspensions safer for us all.

Narrowcasting to the Medical Community

If a mere handful of these rare activists have turned up during the past twenty years, why should I imagine that we can go out and dig up some more tomorrow?

This is certainly a good argument for doing nothing. Indeed, there are *always* good arguments for doing nothing. Per-

sonally, however, I feel I have to do something, even if I may be wasting my time. So what do I do? Or, more specifically, where do I go?

I have heard two arguments on this topic. One argument holds that since we have had a lot of success signing up engineers and computer people, we should take our message to places such as MIT (Massachusetts Institute of Technology). Ultimately, nanotechnology will save us so

The most pressing need is to find people who can become not just Alcor members, but activists who are willing to dedicate their time, their skills, and maybe even their lives, to make suspensions safer for us all.

let's encourage research in that area.

The other argument holds that cryonics is an emergency medical procedure, and in order to do successful animal research (for instance), a researcher needs skills that can only come from working in the field — in emergency rooms, or as a paramedic. People with this kind of training will also be the best ones to conduct suspensions, because a suspension is almost always complicated by the medical condition of the patient. (It's no accident that Jerry Leaf, the individual who catalyzed the single biggest advance in cryonic procedures, was trained as a surgeon.)

I am persuaded by this second argument. It seems to me that we have a good number of engineers and computer people in the cryonics community right now, whereas medical personnel are badly underrepresented.

Consequently, I'm thinking that instead of broadcasting the cryonics message, we should be *narrowcasting* it — aiming it specifically at young people in various sections of the medical community.

Into the Field

This is a lot harder than sitting at home and dreaming up public-relations stunts. This means putting together a slide show and going out to talk to an audience of strangers, many of whom are going to be skeptical or even hostile. It means

learning enough in order to answer questions that may be highly technical, extremely aggressive, or both. It means trekking around, wasting a lot of time trying to rouse the interest of people who probably don't want to be roused.

Frankly, I would much prefer to sit here at my keyboard writing about cryonics for mass-market magazines. That, after all, is what my own training enables me to do.

However, I don't see anyone else going out and talking to medical people in the area where I live, so I'm willing to give it a try during 1993. If anyone reading this column has already tackled this kind of challenge, I'd appreciate any advice they may be willing to offer. My email address is 71042.3557@compuserve.com, or I can receive mail at 9 Patchin Place, New York, NY 10011.

It seems to me that in the past, cryonicists have tried to recruit new members using a kind of triage model — which is ironically appropriate, since we are hoping ultimately to save people's lives. The population as a whole is divided into three groups:

Group 1 consists of those few resourceful types who have already been convinced by cryonics. They have decided to save themselves, so we don't need to propagandize them any further. They can be safely ignored.

Group 3 consists of people who have no distinguishing traits that make them likely to sign up. This group contains the great majority of the population, and these people, too, are ignored — left to die a natural death, because most of them probably prefer it that way.

Lastly, there is a smaller, middle group of people who aren't yet convinced by cryonics but are "good prospects," because they are libertarians, or science-fiction fans, or computer programmers — or readers of *Omni* magazine. This group (or subsections of it) is the one that cryonicists traditionally focus on.

But I'm wondering, now, if the triage model is ideal. I'm wondering if there are times when we should not be thinking in terms of who is likely to be a "good prospect." Instead, maybe we should be asking ourselves *who would be most valuable to us*.

I'd be very interested to hear what other people think about this.

Research and Training Update

Tanya L. Jones

In an attempt to evaluate Alcor's emergency response and washout capability, given the upheavals of the past year, we recently performed two canine total-body washouts. Successfully performing total-body washouts would provide us with strong indicators as to whether future research at Alcor would be feasible. The immediate goal for each trial was to quickly and correctly perform femoral cutdowns, connect the animal to a perfusion circuit, and complete a washout and cooling. Secondary goals included: familiarizing newly-certified transport technicians with the operating room; ex-

posing them to tensions similar to those involved in a suspension; and gaining further experience for myself in organizing and directing washouts, concentrating on having all supplies available and the efficient use of the team. In the list of goals, I didn't include the resuscitation of the dogs. This may seem a curious omission, but these dog washouts were intended as cutdown and perfusion feasibility studies, not washout and recovery experiments.

With the first dog, we completed the femoral cutdowns and hooked up the circuit in about three hours, from the first incision to the beginning of the bypass. The

cutdown was fairly uneventful, and everything proceeded relatively smoothly (for our first attempt) until we were well into the washout. Then, we observed steady and substantial fluid loss from the perfusion circuit. Typically, if everything is going according to plan, there is only a small volume loss.

With slight volume loss expected during washouts, we always mix more perfusate than we expect to need. This reserve is added to the circuit as the circuit volume requirements change with the descent in temperature. When the volume loss with the first dog was enough to have depleted



Photo: Derek Ryan

Tanya and Hugh work to establish the bypass circuit.

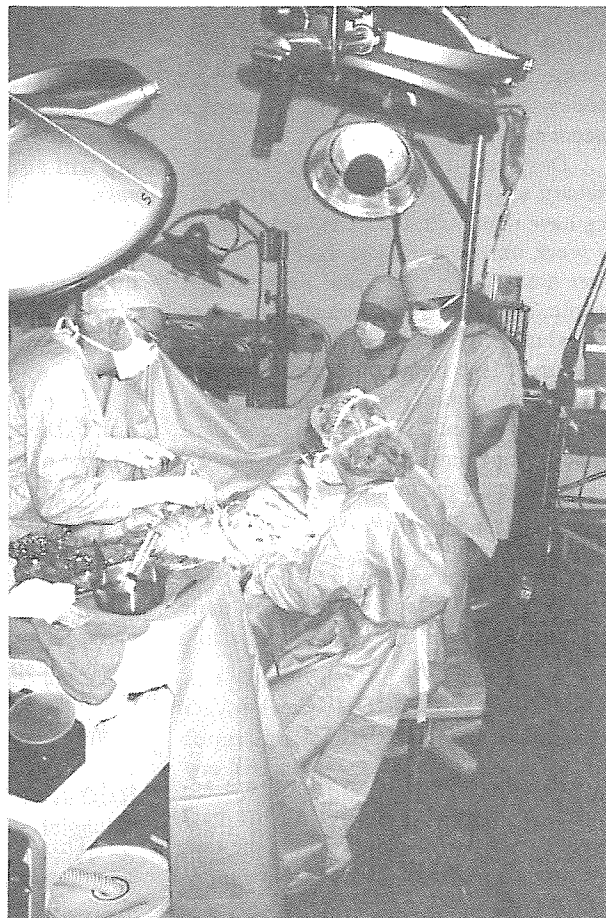


Photo: Derek Ryan

Tanya and Hugh connect the pressure lines while Brian and Regina monitor the airway.

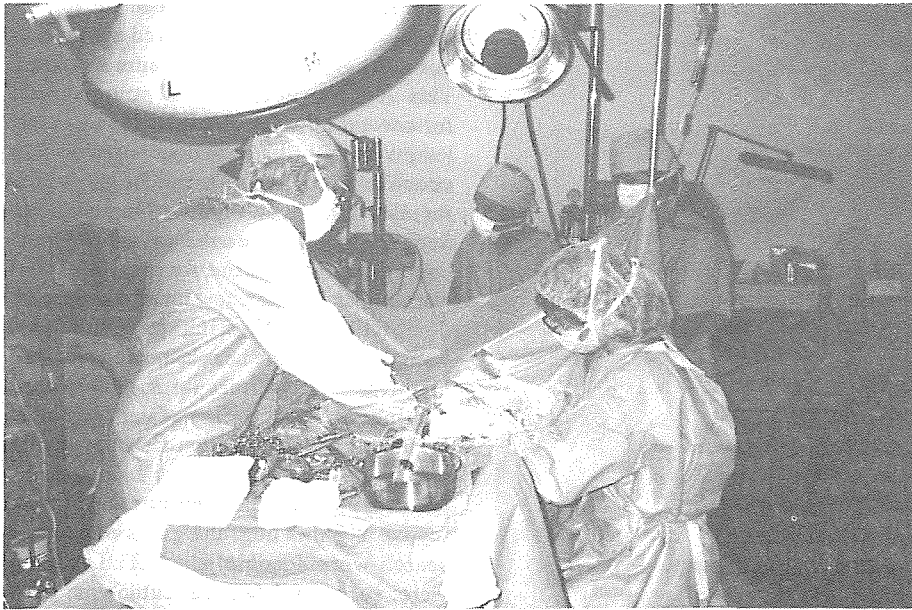


Photo: Derek Ryan

Handing off the final connections for completing the bypass loop.

our entire reserve, with the only indication as to where it was going being that the abdomen was expanding, we took the dog off bypass and began an autopsy. All of the internal organs looked about as well perfused as we could have hoped for; however, the abdominal cavity was full of fluid *between* the organs, not inside them as we might have expected. Hugh Hixon and I had performed the surgery, and during the autopsy we checked the cannula placement, looked for signs of ruptured vessels, and examined the dog in every way we could, hoping to discover the cause of the leakage. We found nothing.

It wasn't until later that night, when Hugh was discussing the problem with Mike Darwin, that Mike gave us the solution to our dilemma: colloid. The priming solution we used for the pump had insufficient colloid osmotic pressure to remove fluid from the tissues, and the result was the water loss into the tissues that we observed. This water loss is more commonly known to suspension members as *edema*. In order to prevent much of the edema we observed from happening with the second dog, we added HES to our flush solution.

That first dog gave us a taste of the multitude of complications in a total-body washout which might kill the animal. One complication which we didn't have to face with this dog (due to the fact that blood replacement did not occur) was a high level of potassium in the blood. High blood potassium levels, a consequence here of the intracellular nature of our SHP-1 per-

fusate (which mimics the high intracellular potassium level and prevents the diffusion of potassium from the cells into the blood during the metabolic shutdown that occurs at low temperatures), destroy the transmembrane potential that is required for, among other things, nerve conduction. When the balance has been lost, dialysis can usually restore it. This technique was introduced by Mike Darwin in the Alcor-Cryovita TBW experiments of ten years ago and was critical to the success of those experiments. Alcor currently has no dialysis capability, as that left with Mike Darwin and Cryovita's equipment. This has *no* impact on Alcor's suspension readiness, but without dialysis, we thought it *highly* unlikely that the animals could survive. We didn't make it to the point where this was a consideration with the first dog, but the second one was another matter.

After observing our mistakes with the first dog, we knew we could do better. We wanted the second animal to survive the

operation, so Hugh came up with a scheme which might eliminate our need for dialysis.

His scheme was implemented with the second dog. The new protocol included a flush to wash all of the potassium (to be verified using sample analysis) out of the dog using a new flush solution *before* returning the dog's blood at the end of the washout.

Femoral cannulation was completed and bypass was begun in *under* two hours, a significant improvement over the previous attempt. All of the dog's blood was washed out and much of it was collected in bladders, so that it could be returned to his circulatory system at the end of the perfusion; we weren't using a second dog to provide transfusions for the experimental animal, so the blood we withdrew was all that was available for re-perfusion.

The washout proceeded well, and the dog's temperature reached the target of 5°C in 37 minutes. Our plan called for the dog's temperature to be below 5°C for half an hour before commencing re-warming and blood replacement; however, about fifteen minutes into this portion of the ex-

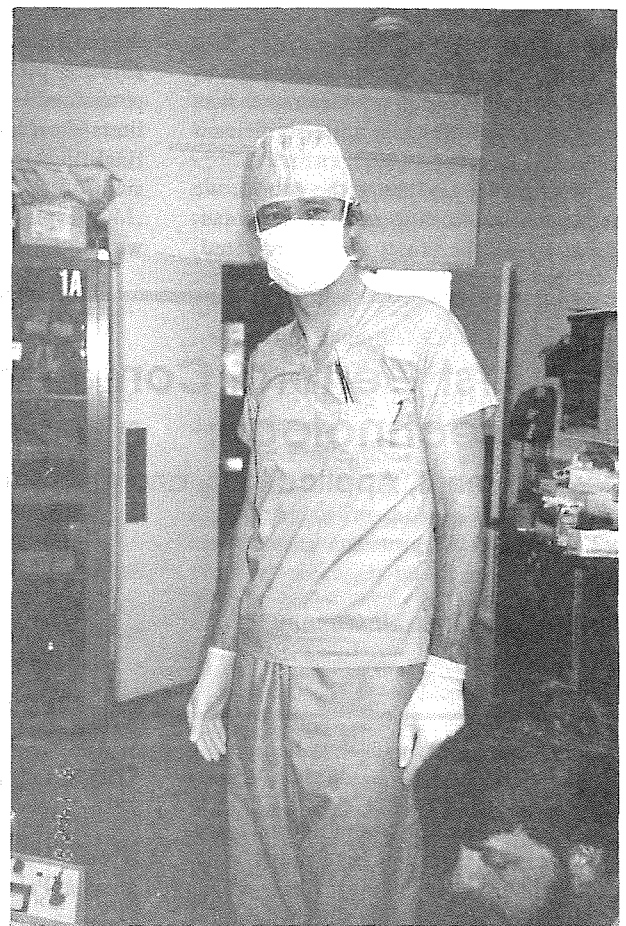


Photo: Derek Ryan

Jay Skeer: Transport Certified.

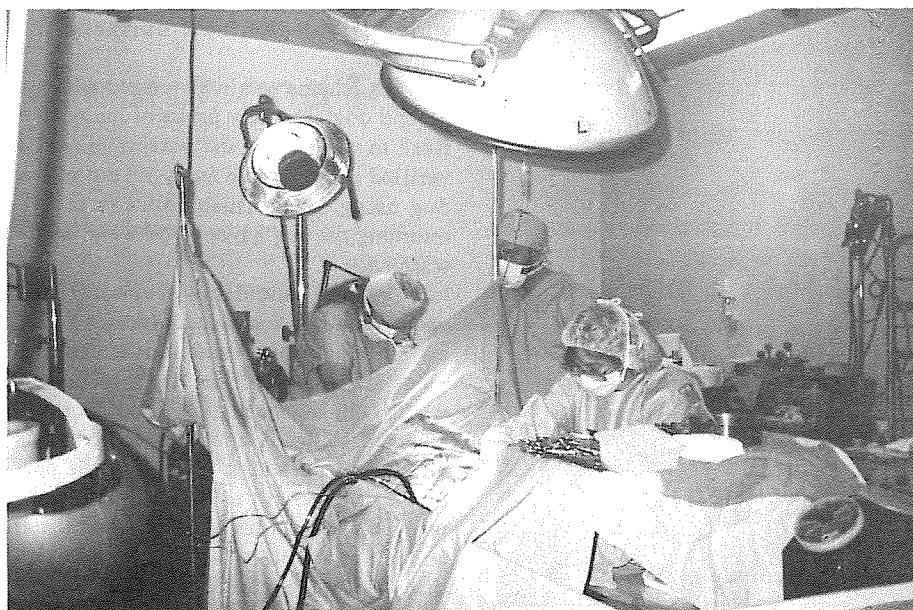


Photo: Derek Ryan

Even after bypass has begun, team members must be vigilant.

periment, the dog began losing volume and the pressure dropped from its high of 83mmHg to 48mmHg MAP (Mean Arterial Pressure). At this point, we decided to begin the re-warming a little early. As a consequence, the dog's temperature was below the target for 25 minutes rather than the planned 30 minutes, not a significant deviation.

Before re-perfusing the blood, we began another flush to remove the potassium. After the flush was completed,

sample analysis determined that the dog had a potassium level of 6 mEq/l (normal canine range: 3.7-5.8 mEq/l). This left us a little worried about the re-introduction of the blood, as we'd hoped to have sufficient solution prepared to flush out *all* of the potassium. Unfortunately, we were about 4 liters short and were unable to perform a final flush to remove the last of the potassium.

Despite the flush solution shortage, we continued the re-warming and began

introducing the blood. When the temperature was at 28 °C, we observed spontaneous heart activity on the pressure monitor. This activity continued and strengthened for several minutes. We made several attempts to defibrillate the dog, but were unsuccessful. Although the beats were regular, they weren't quite strong enough. Seeing hints of a heartbeat was very encouraging, though, and we continued the warming and made a few more attempts at defibrillation. Nothing we tried was enough to make the heartbeat stronger, and his MAP had been dropping slowly and continuously during the re-warming and eventually fell enough that we stopped the pump.

Despite the disappointment of not recovering this dog, the goals of the research *were* accomplished. The results were: successful femoral cutdowns; perfusion was accomplished, along with cooling; the newest transport technicians are much more familiar with washout procedures and the operating room environment; and each of the experiments have given me more information to improve the quality of remote washouts and suspension procedures.

My thanks to the people who have given up so many Saturdays to aid in the advancement of Alcor's suspension capability by participating in these experiments: Hugh Hixon, Brian Murdock, Regina Pancake, Mike Perry, Jay Skeer, Dan Spitzer, Dr. Wheeler, DVM, and Ralph Whelan.

The First General Conference on Nanotechnology: Development, Applications, and Opportunities

Reviewed by Russell Cheney

Overview

This conference was of special interest to cryonicists because many view nanotechnology as the most likely means for providing critical tools and methods for the restoration of the cryonically suspended, and for the eradication of physiological damage from aging.

The Conference

November 11, Wednesday evening, through November 14, Saturday late afternoon, at Palo Alto, California.

Presented by the Foresight Institute.

Attendance: Approximately 250

Corporate Sponsorship:

*Apple Computer, Inc.
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Beckman Instruments
BIOSYM Technologies, Inc.
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All formal meetings took place at the outstanding Palo Alto Holiday Inn, immediately adjacent to the Stanford University campus. Thursday and Friday had virtual back-to-back presentations/activities (including luncheon speakers) from 9:00 am to 9:00 pm; Saturday was 9:00 am to 5:00 pm. The scope was broad, with an emphasis placed on near-term applications. Informal, animated parallel hallway-discussions were frequent.

Dr. K. Eric Drexler was either participating or immediately at hand for most events. His new technical *Nanosystems*, plus the prior *Engines of Creation* and *Unbounding the Future*, in addition to a wide selection of related books, were conveniently available adjacent to the main meeting room, through The Computer Literacy Bookshops, of San Jose.

Cryonics

Perhaps of special interest were Dr. Fahy's presentation on Friday, and the following:

In a private interview, Dr. Drexler was asked how he might reply, for purposes of this *Cryonics* article, to the question, "Interest in the cryonics community has remained high in nanotechnology. Yet your emphasis on the impact of nanotechnology on cryonics has declined since *Engines*. Why is that?"

Dr. Drexler responded, "The statements made in *Engines of Creation* are still just as valid today as when originally published. No technical critiques have taken place which would indicate any change is required in the fundamental principles or their application."

The Program

Voice tapes, video tapes and/or written proceedings of the presentations may be made available in the future by the Foresight Institute. I have informally written notes, as well as the handouts that were disbursed, which I would be willing to share with anyone interested in more detail.

The following itemizes the Conference presentations and activities in the order they occurred. Where feasible, short summaries are included. An attempt was made to include here all items of potential interest to Cryonicists.

Thursday:

• *Introduction to Nanotechnology*: Dr. K. Eric Drexler

Drexler stated that the term "nanotechnology" has come to take on a broader meaning; molecular nanotechnology (MN herein) is more explicit. For example, micro machines are sometimes referred to as nanotechnology, but because of their vast scale difference, are essentially irrelevant to MN.

Drexler used a chart to picture MN development flow via organic synthesis, biotechnology, scanning probe instruments and molecular modeling to pathway technologies (early and later, with applications), molecular manufacturing and finally general applications. All development was shown as being assisted by computer-aided design.

He characterized current MN as theoretical-applied, using computer math modeling to illustrate applications that are not yet technically feasible.

• *SPM: The New Microscopy from Microns to Atoms*: Dr. Bruce Schardt

The Scanning Probe Microscope (SPM) represents a family of tools, including the Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM), and, "there will be others."

The current market is about \$40M, world-wide.

• *Paths to Nanotechnology*: Howard Landman

Profit potential of MN looks high for intermediate developments, unlike fusion energy production which requires a comprehensive implementation to realize any income. A three to five-year payback is usually critical for private investment.

Today the field looks healthy, with active research taking place in industry and academia. Intermediate payoffs appear promising in micro mechanics, microelectronics, and biotechnology (especially in pharmaceuticals). The field will grow as a branch of an existing industry, because MN sits between existing fields.

• *Nanotechnology R & D Sponsorship*: Neil Jacobstein

1991 total U.S. government research: \$68 billion in all fields. Of all research in nanotechnology, only about 10% goes into

molecular manufacturing. Our goal should be a peace-time Manhattan Project, to implement molecular manufacturing as soon as possible.

• *Transition to Tomorrow*: Dr. Jamie Dinkelacker

With the implementation of MN, we'll live a long time, maybe centuries; so will our enemies.

Mr. Dinkelacker discussed the effects that MN will have on: human relationships, boy/girl relationships, justice, freedom, pernicious problems, human emotions, greed, avarice, jealousy, sloth, money, home, family, work (and colleagues), leisure (and companions), life on the net, hierarchy of human society, transportation (material, people, data), software code for the Drexler Machine, pets, labor/capital/wealth, precious jewelry, food, birth-rate, military power, artists, poets, philosophers, musicians, organizations, personal safety, cosmetics, and social institutions.

• *Demonstrations*: BIOSYM molecular modeling software

This was live, desktop-sized computer-driven software to aid in the visualization of molecular structures. Specific applications for proteins, polymer chemistry, potential energy fields, catalysis and sorption. The results are stunning, clear, color, 3-D appearing screen-representations of molecular structures that can be rotated and examined. Looks like chemical CAD (engineering Computer Aided Design, as used extensively in today's aerospace design developments).

The applications for research, development and education are spectacular, especially so for those who have taken biochemistry and struggled to envision the physical processes based on dry text and 2-D black-and-white stick representations.

Excellent brochures.

• *Discussion*: Drexler, Jacobstein

To catalyze the evening's discussion, Drexler presented a straw man present-value analyses of MN implementation, based on benefits including increased standard of living, decreased disease and pollution, exclusive of cost (no netting). The straw man resulted in a current daily value of \$25 billion for the earth's entire population, for each day sooner MN is fully im-

plemented; that's a few dollars a day per person.

The reaction from this catalyst was enormously exothermic; a veritable explosion of discussion. Points addressed included:

- » What's the value of a vastly extended, healthy life-span?
- » Will beginning sooner mean a slower-paced start, but halt eco-system destruction sooner?
- » How can a present-value exist in subsistence-level cultures?
- » Would other cultures embrace the same benefits?
- » Would MN eradicate subsistence-level existence?
- » Can venture capital utilize this analysis?
- » Would greater material wealth reduce the likelihood of wars?
- » What is the relationship between affluence and violence?
- » Would most of the world's population be idle?
- » Does the \$25 billion value obscure the real benefit of MN?
- » With mature MN, will the cost of investment capital approach zero, because wealth will be so widespread?
- » Drexler: Implementation can be advanced with the development of software to model branching molecular structures.

Friday:

• *Modeling and Remodeling Molecules:* Michael Pique

Stereolithographic techniques are now being used to make small physical models of complex molecular structures. A couple of examples were passed around; the models had the appearance of tough, translucent plastic molded into intricate shapes.

Remodeling is the very slight change of an existing molecule by altering a couple of bonds or modifying R-groups ("mini-molecules" within a larger molecule). Benefits can include speeding up catalytic reactions, and holding a different metal atom. Especially applicable to proteins.

Recommended book: *The Machinery of Life*, by David Goodsole.

• *Diamond Growth: Today and Tomorrow:* Dr. Michael Pinneo

This subject addressed making hard,

stiff carbon materials. Approaches discussed included: CVD microwave plasma, microwave excited plasma, acetylene torch, plasma torch, arc jet, and polycrystalline deposition (PCD).

MN fiber applications could eventually include Clark's orbital bridge and tower.

• *New Hope for the Environment:* Duncan Forbes

It is estimated that the earth has about 30 million species; science has described about 1.4 million. Extinctions are running about 5,000 annually.

Hot spots (areas of extreme ecological danger) include the eastern Himalayas, peninsular Malaysia, Columbia, the Atlantic Coast of Brazil, and the Philippines.

The world human population was roughly stable to about 1500, and has since consistently increased exponentially.

• *Molecular Manufacturing as a Path to Space:* Drexler

Drexler discussed the practicality and implications of MN solar sail space vehicles, and a geosynchronous satellite with an MN carbon tether to the ground utilizing an electric elevator to move objects into orbit.

Recommended recent "Journal of the Interplanetary Society" issue on MN.

• *Nanotechnology in Japan:* Dr. Charles Sweet

Ministries: Currently there are three ministries primarily involved in Japanese nanotechnology and MN issues:

1. MITI: Agency of Industrial Science and Technology:

Stated goal: "The ultimate manipulation of atoms or molecules"

The Large-Scale Project: \$200 million over ten years. Emphasis on micro-machines.

Includes the Protein Engineering Research Institute, which has synthesized the largest protein molecule to date.

2. STA: Research Development Corporation of Japan (JRDC):

Includes the ERATO program, with 15 concurrent projects, some of which have completed, others of which are on-going.

RIKEN is the Institute of Physical and Chemical Research; it performs frontier re-

search on nano-photonic materials, nano-electronic materials, and other exotic nanotechnology materials.

3. MESC: Ministry of Science and Culture:

Is located at the Tokyo University Research Center for Advanced Science and Technology. Contains 16 labs, including biomedical devices, molecular information materials, and quantum microstructure devices.

Industry: Matsushita has the International Institute for Advanced Research, which has performed flagellar motor research and completed a first-generation application. Matsushita was represented at this Conference.

Mitsubishi Research Institute is a think-tank and physical science R & D facility.

• *Medicine and Nanotechnology:* Dr. Gregory Fahy

A number of optimistic comments were made in regard to the status of current medicine's progress against certain human complaints, including infections, auto immune diseases, genetic defects, cancer, aging and diseases of aging, and many types of accidents.

The importance of the role of the thymus in aging was discussed.

MN was contrasted to biotechnology. MN is based on non-biological processes, has wide non-biological applicability, and is not limited to biomolecules.

Size comparisons were shown. If a typical biological cell were the size of a large watermelon, a single mitochondrion within the cell would be the size of a small egg; a cell repair device comparable in size to the exposed lead in a pencil, and a mainframe computer half the size of a small paper clip.

Medical problems that may require MN:

- » New infectious diseases
- » Regenerative wound repair (i.e. limb replacement)
- » Morpho-engineering (reversing structural defects)
- » Suspended animation
- » Resuscitation

MN could be used to help build backup systems into the body, for emergencies, to prevent excess damage:

- » Anoxia defenses/oxygen-deprivation

- responses (ala the Alaskan seal)
- » Subcutaneous programmable "chain mail"
- » Reinforced resilient bone
- » Self-sealing encapsulated blood vessels
- » Fiber reinforced organs, especially the brain
- » Fire-retardant skin
- » Burn-prevention glands

Of the four or five terminal-velocity incidents reported each year, research has shown that the vast majority experience the greatest trauma due to bone failure. Several careful mathematical calculations have demonstrated that bone reinforced with MN diamond-like carbon structures would permit 120 MPH impacts, especially if care were taken to land on one's feet.

Bioenhancement of strength, coordination, reflexes and musculature should result in the ability to fly (unaided with any mechanical device). Consideration might be given as to the temporary storage of the wings when not in use.

• *National Space Society (NSS) Molecular Manufacturing as a Shortcut to Space Group Workshop:*

Several working groups were formed, including an "MN Award" group and a "Multi-Media" group.

The MN Award group had met, agreed on a \$5,000 per year for five years' award (details to be worked out by the Foresight Institute), and having completed its business, disbanded by Saturday. The chairman of the group was donating the funds.

The Multi-Media group had met and agreed to an operating approach to support the on-going needs of NSS Shortcut group by Saturday.

Saturday:

• *Decision Duel:* Marc Stiegler

Compared PERT charts, spread sheets, E-Mail, Hypermail (electronic Post-its), and decision tables.

Discussed "E-Mail Flame-War Heat Death": The phenomenon of computer mail being associated with ineffective decision-making. Sociologists report in *Scientific American* 9/91, where they were able to quantify communications as more

honest, less tactful, and more inconclusive (a decision consensus is reached less often).

• *The Politics of Nanotechnology:* Bennett

Since there is no MN now, there is no politics of MN. Regulation probably will come about through an existing agency. Advantage: known territory. Regulation may be through a new agency. Advantage:

How Many Are We?

Alcor has 353 Suspension Members, 480 Associate Members (includes 128 people in the process of becoming Suspension Members), and 25 members in suspension. These numbers are broken down by country below.



Country	Members	Applicants	Subscribers
Argentina	0	1	1
Australia	13	1	4
Austria	1	0	1
Canada	10	4	26
Costa Rica	0	0	1
Denmark	0	0	1
Estonia	0	0	1
Finland	0	0	1
France	0	0	4
Germany	1	1	1
Holland	0	1	0
Italy	0	2	2
Japan	2	1	0
Lichtenstein	0	0	1
Lithuania	0	0	2
Russia	0	0	1
Spain	6	2	0
Sri Lanka	0	0	1
Sweden	0	0	2
U.K.	13	5	8
U.S.A.	307	105	294

flexibility.

Agencies usually want to be viewed as "helpful," to increase their funding. Due to staffing and budget constraints, most agencies usually welcome the regulation-writing being done by those being regulated.

U.S. government industrial policy is not well defined now; it may be most desirable for all concerned for it to remain so. Studying and comparing the effectiveness of different countries' industries and policies, one may mistakenly assume the policies caused the final effect. Although wet streets and rain are associated, wet streets do not cause rain.

"Monocropping" in research: Different paths are not explored; only one avenue is pursued. Currently the U.S. is diverse because government policies are largely incoherent; the result is beneficial.

Recommended book: *The Enigma of*

Japanese Power. Achieving success in a new technology through switching directions rapidly.

• *Panel: The Next Decade*: Ed Niehaus; Bennett, Dinkelacker, Drexler, Peterson

"What's Going to be achieved technically in the next ten years?" The MN critical path for the next ten years includes:

- » 1 — 2 Years: Molecular manipulation with atomic placement, Construction of [a designed] 3-D molecule.
- » 7 Years: Construct molecular machines.

CAD will be a pacing technology, to be able to design MN things that actually work.

If we had \$10 million and two years, we could develop a commercial applica-

tion of an AFM-based instrument for protein molecules, including a probe.

"How do you envision the transition from tools to products?" The tools could serve as some of the first products. Instruments that provide information; for example, what molecule will bind to the AIDS virus to inactivate it? The commercial product is information.

"What additional research would you explore right away?"

- » Academic: Design and synthesis of building blocks
- » Molecular CAD systems for molecular machine design
- » Design of cheap, practical, advanced molecular machines
- » Mechanochemistry
- » State of research
- » Policies, options, implications

The Suspension of A-559211

Fiction by Guy Desrosiers

Clark Kent led an interesting double life. To some he was a mild-mannered reporter whose quiet competence always earned respect without attracting notice. Many liked him that way, and that's probably why he wasn't eager to share his other side with them. However, Clark wasn't content with conventions, even with a secure and highly-paid job he did well. Instead this quiet, unassuming man possessed a yearning of truly cosmic dimensions, to soar above the commonplace, to scale obstacles most are scarcely able to dream of, to speed like the wind to exotic lands and settings, go beyond the mere observer, however meticulous, and make a *difference*. That's about as good an explanation as any for his moonlighting job and close ties with D.C. Comics, which called for courage, skill, strength, stamina and good humor that would have felled many lesser men, and did.

Clark (no relation to Saul), seemed to have only one weakness (other than a violently toxic reaction to a certain rare mineral): he needed to *matter* to people — many people — in a special way. As he grew older he must have felt less useful, less needed, less able to inspire, and his health began to suffer, first a little, then more. Still it was a shock when D.C. contacted Alcor last November to say that Clark was nearing his "Doomsday." We had been fortunate, some time before, when Clark had been optimistic that despite current trends future generations would appreciate his old-time values of truth, justice, and yes, in its better moments, the American Way, and made his suspension arrangements. Clark, as the end approached, was living rather anonymously near the newspaper where he had worked for so many years. Though well liked he didn't seem to have much of a social life other than oc-

casional outings to his cottage up north. Friends described him as a "super" fellow, but no members of the response team had ever met or had any contact with him.

Tanya Jones was the first member of Alcor's Transport Team deployed, but she discovered that getting a plane ticket to Metropolis was extremely difficult. In fact, several carriers politely told her to "take a hike." In frustration, Tanya called the Alcor facility for help. Finally, after several calls, Ralph Whelan contacted the financially strapped Blue Sky Airlines, which was having its "if you have cash we will fly you anywhere" sale, and arrangements were secured.

Tanya met Brenda Peters (who had flown in from New York) at the airport. Renting a 1972 VW Microbus from Woodstock Vehicle Rentals, the logical first step was to visit the nearest con-

venience store and purchase all of the ice they had.

By this time I had been contacted. I had always wanted to participate in a suspension and I was extremely excited when the call from Keith Henson came. I told him that I would leave immediately by car. After throwing a couple of changes of clothes into my 1988 Ford Escort with 2.2 liters of raw fury under the hood, I laid rubber off of the driveway. Except for the unfortunate juxtaposition of my car, the street, and the neighbor's cat, Fluffy, the start of my trip could be considered routine.

Clark had not yet deanimated, and it was too dangerous for any members of the team to stay by his side. Tanya and Brenda were instructed to go to a hotel and relax.

Mike Darwin and Keith Henson arrived in Metropolis the next day. There had been no word on Clark's condition, so it was decided that they would wait at the hotel with Tanya and Brenda. When they got to the hotel, they found Tanya and Brenda had been passing the time throwing pennies off of the balcony into the pool, sending room service up to empty rooms, changing door hangers on other rooms from "Do Not Disturb" to "Early Maid Service Please," and attempting to see how much of the pay-per-view movie could be watched without it being charged to the room. In other words, it was a pretty standard remote standby.

I arrived shortly before 11:00 p.m. and introduced myself to the team. After the usual pleasantries I had to explain to the group that since I was Canadian I was required by law to end every sentence with the word "eh." Brenda had never met a Canadian before and asked if all Canadians dressed like me. I decided that was a compliment and the discussion turned to Clark's suspension.

The van had to be prepared. As I had no experience with suspensions I was assigned to be time keeper, scribe, and "gopher" (*gopher* this, and *gopher* that). We went down to check out the van. We ensured that the portable ice path (PIB), the heart-lung resuscitator

(HLR), the transport equipment box (TEB) and a bunch of donuts (BOD) were secure in the van. We retired back to the room to watch a movie and wait.

Just before the leg crossing scene in *Basic Instinct* we received a call from Clark's girlfriend, Lois. She said Clark had taken a turn for the worse and we were needed. I phoned down to the front

I arrived shortly before 11:00 p.m. and introduced myself to the team. After the usual pleasantries I had to explain to the group that since I was Canadian I was required by law to end every sentence with the word "eh."

desk to see when the movie would be replayed, and then we collected everything we needed and left.

When we got to Clark's side it was obvious he was almost gone. Lois squeezed his hand gently and he expired. Ordinarily, this would be a time of reflection and silence, but in the world of cryonics, now was the time for action.

On the way over, Mike Darwin had told me that no suspension was routine and that only the unexpected should be expected. His words rang true only seconds after Clark's deanimation.

Lois, who had had an "on and off" relationship with Clark (nudge nudge,

It had been an exhausting morning. So when Mike's scalpel dulled on contact with Clark's skin a "what's next?" sigh went up from the entire team.

wink wink), described Clark as someone who was so light on his feet that he could "leap tall buildings in a single's gown," or something like that. However, deanimated, this was not apparent. Clark's body weighed almost 800 pounds. It took all of us just to turn him over. Another problem was that Clark appeared to be rather thick skinned. The pumping machine which was connected to his chest had no detectable effect.

Fortunately, there was an equipment rental company less than two blocks away. Tanya and Mike took the micro-bus and after an animated explanation of what was required returned with all the equipment they would need.

Brenda fired up the gas powered air compressor and Tanya mounted a pillow on the business end of an Air Hammer

400 psi pneumatic jack hammer. Turning down the control to the minimum vibration, Tanya applied this to Clark's chest with excellent results. Meanwhile, Keith and Mike drove to the nearest phone and called A-1 Rescue Towing for a tow truck to lift Clark and the PIB into the van. Brenda retrofitted the air compressor for the insertion of the perflusate and I settled down with

the BOD and watched. It was about 9:53:33.424 a.m. EST.

Back at Alcor, Carlos and Saul, who had been together watching the old James Bond movie *View to a Kill*, were surprised when the movie was interrupted by a news bulletin pertaining to Clark's deanimation. Immediately they realized there would be a problem with the femoral cutdown which no one on the transport team would have thought of. Remembering a discussion with one of our subscribers regarding Clark, Ralph Whelan was called. Ralph recalled a *Cryonics* subscriber, Jimmy Olsen, who had once mentioned that Clark's case would be difficult. Jimmy was called and suggested we call another subscriber for help. Although Lex Luther expressed that he had a personality conflict with Clark, he agreed to assist. He knew exactly what was needed and said he would drive immediately to where the transport team was working.

It had been an exhausting morning. So when Mike's scalpel dulled on contact with Clark's skin a "what's next?" sigh went up from the entire team. It was unknown to us that Lex had been called, but not five minutes passed from the time of the scalpel failure to his arrival. He explained that he had been contacted by Carlos and that he brought with him something that might help. He revealed a

small jar which contained a glowing green stone. Brenda held it over the surgery site and the new scalpel cut like a knife through butter.

The shutdown went extremely well, and once a couple of hundred pounds of pressure was connected to the appropriate arteries, the washout was performed in record time.

Harvey Watson, the tow truck driver, watched patiently and helped me with the BOD. "Do you guys do this very often?" I told him it was my first time. "Cool," he responded, chewing on a jelly-filled.

Brilliantly manipulating the tow truck lift, Harvey precisely guided half a ton of Clark, ice and PIB into the van. Having some knowledge of things automotive, I cautioned that the axle may not be able to support the weight, but Keith disagreed, saying that the VW was made in Germany. Mike countered that we had two suspension members in Germany and it really didn't matter who designed the first Volkswagen. Tanya and Brenda drove to the airport in the

van while Keith and I followed in my car. Mike stayed behind to clean up and return the rental equipment.

When we got to the freight hangar we had some luck – the freight agent for Blue Sky was Canadian. He had been born just outside of Head Smashed In Buffalo Jump, and had lived for years in Moose Jaw, Saskatchewan. He was delighted to speak to one of his own. "Beauty, eh? We got this beauty of a box – " I began brightly. "It's kinda heavy, eh? But, beauty, can you, sort of, eh, get us a better rate to ship it to California, eh?" "No doubt, eh," he responded. We sent Clark *rush* but only had to pay the same rate as periodicals and junk mail in the 1100-lb class, which saved us enough to buy an additional BOD.

Tom Donaldson and Naomi Reynolds met Clark at the airport near Riverside. He was loaded onto a flatbed truck furnished by Dave Pizer, and arrived at Alcor just after 2:00 p.m. their time (whenever that was). All of them plus Hugh Hixon moved Clark into the

final stages of perfusion and then, cooling. (I understand that during the cryoprotectant perfusion, Mike Perry's modeling program was run in its unreliable, high-pressure mode, and for once it came out exactly right.)

Meanwhile, as soon as we had seen Clark was safely airborne to California and the Super Cold, the transport team collected back at the hotel. It was afternoon, we were hungry, and wanted to see the rest of the movie. We ordered a couple of pizzas, snarfed the rest of the BOD and, after the video had ended with a gripe from one of the bad guys about people who wanted to live too long and do too much, spent a long time discussing Clark's and our future.

It had been quite a rush for me and I was told that if I bought some new clothes I would be welcome on future suspensions. I drove home happy I had been involved keeping Clark's future potential alive. However, all the way back there was one nagging question on my mind. Was Bruce Wayne's adopted son an Alcor member?

Business Meeting Report

The January, 1993 meeting of the Alcor Board of Directors began at 1:10 p.m.

Immediately prior to the opening of the public session, the entire Board received a presentation about Charitable Remainder Trusts, a potential charitable giving vehicle which will be presented to Alcor members.

The following changes were made to the November, 1992 meeting minutes:

On page 1, Walt Johnson should appear in the list of "others present."

On page 6, paragraph 2, the percent sign ("%") should appear after the number 25, rather than before it.

On page 8, paragraph 6, the Endowment Fund Policy should state that "interest returned to the fund shall be recorded as contributed capital."

Resolved: *The November Alcor Board of Directors meeting*

minutes are approved with the above-stated changes. (Unanimous)

Accepted without resolution: Keith Henson is the Chairperson for the February, 1993 meeting.

Carlos reported that so far, we have received one written estimate for the changes necessary for compliance to the Conditional Use Permit: a covered parking spot, a window in crew room, and fire-proofing in the vehicle bay. The bid was slightly less than \$5,000 (which is the budgeted amount). Carlos is attempting to find at least one more bid before picking a contractor.

Carlos reported that other partners with Joe Hamilton Productions are still interested in auditing it, and we are awaiting the results of that audit. Also, we received (last week) the latest distribution of assets from the trust.

A patient who has been with Alcor for about two years is facing legal attack by a relative intending to establish that

the patient did not want to be suspended, so that the patient may receive a standard burial. Presently, though there is disagreement within the Board regarding this, it is agreed that we will wait for further progress in the court case, and Mike Perry is encouraged to continue his involvement, reporting to C.E.O. as appropriate. Mike Perry has agreed to write an article for *Cryonics* factually reporting this matter to the membership.

Resolved: *The Board accepts and understands that Mike Perry and Keith Henson are going to write a factual article about this case, which will be shown to all Directors prior to publication. (8 in favor, 1 abstention [Ralph Whelan])*

Regarding a Patient Care Trust Fund trust document, Carlos reported that our attorney in this matter has all relevant documentation, and will soon be submitting a proposal (with cost es-

timate) for preparing a trust document.

Carlos circulated a memo showing a conservative breakdown of anticipated P.C.T.F. income, expenses, and capital acquisitions. This budget projection is the same as the one circulated via email by Carlos on November 4, 1992, except that the figure for employees' salaries billed to the P.C.T.F. has been reduced by approximately \$6,000 to reflect changes in employee time spent on Patient Care, and the figure for Worker's Compensation Insurance has been reduced to reflect our new lower premium.

Derek Ryan reported that November, 1992 was his best month for sign-ups so far, with 13 new members approved. The year-end total for Suspension Membership is 350. Notably, we have now had our first sign-up from a newsstand sale of *Cryonics* – an M.D., no less. There are presently 130 people in the sign-up process.

Keith Henson made a motion that if a member cancels his Suspension Membership, that person can be "re-approved" as an Alcor Suspension Member only if a majority of the Board approves it. The motion failed, with 3 in favor, 6 opposed.

Tanya Jones reported that Leukocyte filters have now been incorporated in the Emergency Response System. Also, a Transport Training course was completed in January; there are now three new Los Angeles area Transport Technicians.

Ralph Whelan reported that the issue of *Omni* with the Immortality Contest reached newsstands on December 28, but that so far there is relatively little in the way of call-ins (less than 100). Ralph also reported that the brochure and flyer planned for distribution to contest entrants and information requests during this period have been completed and are now being mailed out.

We have now received over \$3,000 in response to a fund-raising letter written by Keith Henson.

Since there have been no nominations for ombudsman yet, Michael Riskin has offered to continue as ombudsman at least until an election takes place.

Mike Riskin reported that all of the Alcor accounting and bookkeeping that he has monitored so far is legitimate and uneventful. He also reported that our ex-

ternal auditors will begin some preliminary work during January. For the record, it's worth noting that the auditors were concerned about the change of presidency, but that they could not raise their fees because they had agreed to the negotiated fee limit.

Allen Lopp reported that \$15,327 of the \$16,500 required for the external audit has been pledged or received as of this meeting. \$1,173 is still required. (The \$15,327 figure includes \$4,000 budgeted as an Alcor expense during 1993.)

Brenda requested that the February meeting agenda include a report by Steve Bridge about the cost/feasibility of preparing quarterly financial reports.

Saul Kent reported that "New Dimensions in Cryonics," a conference re this topic, will be held on May 28-30 of this year. The meeting will encourage attendance from all cryonics organizations, and will cover issues related to organizational structure, legal issues, fund-raising, grassroots cryonics, and more.

The Operating Budget for 1993 was deferred to discussion via email, and will appear as the last agenda item on the public portion of the February meeting. If the email discussion indicates it's necessity, a special meeting of the Directors and staff will be arranged.

There was some disagreement over how the proposed contract with a new Alcor surgeon should read after last month's meeting. Ralph will draft a copy of a letter to Dr. Nancy McEachern that reflects his understanding of how the offer should appear, and circulate that draft to the Board via email. Non-response will be seen by Ralph as approval.

Carlos reported that, since he will no longer be C.E.O. as of January 23, he did not plan to prepare a business plan. Steve acknowledged that this will now be his responsibility, and that after he is better acquainted with the management of the organization as a whole, he will report on his intentions regarding such a plan.

A cryonicist in Northern California who is a member of the American Cryonics Society may be suspended within the next few months. Since he has AIDS and is a neurosuspension member, it appears that TransTime has refused to par-

ticipate, and therefore ACS is requesting assistance from volunteers who are Alcor members. This individual has been encouraged (both by Alcor members and ACS members) to switch his membership to Alcor, but has not shown a willingness to do this so far.

Resolved: That Alcor's policy is that no Alcor equipment or staff will be involved in the suspension of a non-member, and we discourage the participation in same by Alcor members for liability reasons.

An Alcor member has taken issue with the amount charged for the suspension of her dog, claiming that she was originally quoted a ballpark of \$2,000 to \$3,000, but that the figure was changed to \$8,000 when she arrived at the facility with her dog. Furthermore, a short section in the **Up Front** portion of *Cryonics* several months ago mentioned that the suspension cost for an *extremely* small dog can be in the \$2,000 to \$3,000 range, and this member believes that her dog fits that description.

Carlos and Ralph reported that this member contacted Alcor directly a few months ago and voiced concern about this. At that time, Ralph spent a day examining the cost structure for that suspension, making volume calculations for dewar space occupied by the pet, and preparing a detailed accounting of same for the member's inspection. The result of that accounting was that the actual costs appeared to total just under \$8,000. Ralph then waived all labor costs for that suspension, effectively making volunteers out of all of the participants, and, through some additional rounding down, was able to reduce the total to \$7,200 as a show of "good faith."

At this time, the member has paid just over \$5,000 toward the cost of the suspension. She believes that a refund is in order.

Resolved: That the total for this pet suspension be lowered to \$5,000 as a compromise – and that the member will receive a refund if appropriate.

Resolved: Henceforth, estimates for pet suspension costs

will be provided to pet owners in writing.

After brief discussion, it was apparent that no Director was willing to speak out in favor of a newsletter separate from *Cryonics* magazine at this time, so the matter was tabled indefinitely. Charles Platt, who offered to manage such a newsletter on a volunteer basis, will be asked about pursuing the same sort of project, but as a part of *Cryonics* instead of as a free-standing newsletter.

Tanya Jones presented a memo proposing that the Board authorize the release of \$1,850 from the Research Fund to finance a Total Body Washout

Feasibility Study, to be performed on January 9, 1993.

Resolved: The Board authorizes a \$1,850 Research Fund expense for the above-stated feasibility study. 7 in favor, 1 opposed [Dave Pizer], 1 abstention [Allen Lopp].

An associate of Mark Voelker is planning a white blood cell storage operation, for which he would like Alcor to provide the cryogenic storage. Mark was asked to request a written proposal with more detail from his associate.

Carlos announced that the commemorative coin that Mike Perry

designed is now available, and looks exquisite. The coins cost \$50 each, and come with a protective transparent plastic case. Only 100 were struck. Checks should be made out to Alcor.

Regarding a Statement of Goals:

Resolved: The unofficial statement of goals discussed at the August, 1992 meeting will be referred to at each meeting, with progress reports.

The meeting was adjourned at 5:51 p.m.

Cryonics One Decade Ago *Edited and Abstracted by Ralph Whelan*

From the February, 1983 Issue of *Cryonics*:

Ev Cooper Lost at Sea

We are deeply saddened to inform you that Ev Cooper, one of the two fathers of the cryonics concept, is reported lost at sea. Ev is reported several months overdue for his arrival at Beaufort, S.C. and neither he, nor his sailboat *Pelican*, have been sighted since shortly after they left Martha's Vineyard on December 21st [Note: this was a misprint. Ev Cooper actually left Martha's Vineyard on October 21st. - Ed.]. There is still some slight hope that he might yet be found disabled out at sea, or that he put out to sea on a sailing expedition without informing friends or relatives.

The loss of Ev Cooper would be a profound loss to both the life extension community and the world. Ev was a gentle, decent man who contributed much to the early days of the life extension/cryonics movement. We hope to have more details available on Ev's status for the next issue of *Cryonics*. In the meantime we sincerely hope we will have received word that Ev has returned safely.

Ev Cooper's ship was never found.

He remains "lost at sea" to this day. See Mike Perry's column about Cooper in the March, 1991 issue of Cryonics.

- Ed.

Public Relations: An Essay on Perspective

by Mike Darwin

Recently the Alcor phone rang at just the wrong time. I was busy troubleshooting a new monitoring system on a patient dewar, being harassed about problems with our computer printer and was just generally at wits end. It had been one of those days when you just want to walk away from it all and call it quits. Hugh Hixon, the volunteer who answered the phone, said there was a young man on the line doing a school project about cryonics. He needed some information; would I be willing to talk to him? As I was contorted into a small and uncomfortable space in the Cryovita loft my first instinct was *not* a charitable one. But I stifled a grumble, crawled down from the loft and took the call. I gave the 15-year-old caller the information he needed and told him he would get a packet from us in the mail in a few days. As I prepared to conclude the call the young man said that he would really like to thank me for taking the time to

talk to him. He said he had called a number of other cryonics groups both in California and in two other states. It seems that no one was willing to be anything but abrupt with him. After all, a 15-year old isn't anything more than a waste of time anyway, right? I accepted his thanks feeling a little bit better about the time I had spent with him. Then he caught me completely off-guard with his final remarks: "You know," he said, "I'm really excited by this idea. In fact, soon after I started researching cryonics as my biology project I realized that nothing I had ever heard of made so much sense. But, I was almost ready to give up on the idea in disgust because of all the 'down' messages I'd been getting. With the exception of you, all of the people I talked to in cryonics, gave me the impression that getting involved was the worst thing that could happen to you."

There is a message here. It is a message that many of us have either apparently forgotten or never learned: cryonics is *good* news. Cryonics is something that *is* making our lives more livable and *is* worth being enthusiastic about. Perhaps the day to day grind of problems has worn away the smoothness of an easy smile or upbeat conversation. We are a little shellshocked by the past few years of bad press and slow progress. But we must not lose sight of the

fact that others see us as we see ourselves. If we do not bring optimism to our contacts with "outsiders" we will lose the battle. We cannot neglect the realities of the hard road we have to travel, but neither can we afford to be overwhelmed and overwrought by our difficulties.

In the days that followed my conversation with that enthusiastic 15-year old, another idea, one which I have held for a long time began to crystallize in my mind. While almost all cryonicists regard inquiries from young people as tedious chores and a waste of time, we should not. In fact, if we are given the choice between spending time with a teenager excited about cryonics, or a 50-year-old businessman who is "really interested in an exposition of risks and benefits" we should pick the youngster every time. Why? Because young people are more flexible, they are in the process of searching for answers and life philosophies. They are also more directable. A young person in high school has yet to decide on a career and still is open to learning complex technical or administrative skills. Adults aren't nearly so malleable. Adults, particularly motivated and successful ones, bring

their own set of goals, priorities, and ego trips with them. Adults are also almost invariably committed: they have careers, spouses, children, and/or status to protect. A high school student has none of that.

To the skeptics who question if there is really any evidence that this ap-

In fact, if we are given the choice between spending time with a teenager excited about cryonics, or a 50-year-old businessman who is "really interested in an exposition of risks and benefits" we should pick the youngster every time.

proach will work, the answer is a resounding yes. Thanks to Curtis Henderson and Saul Kent I am involved in cryonics. I now well understand why Curtis used to say to me so often, "It's really good to see you young people involved; you're the hope of this thing." As each year flies by I begin to understand that remark more and more. I was 13 years old when I first wrote to the Cryonics Society of New York. Thanks

to the patience of Curtis Henderson and Saul Kent I have had the opportunity to practically grow up a cryonicist. Jerry Leaf and Corey Noble first heard of cryonics from Robert Nelson (then president of the Cryonics Society of California) when he spoke at their respective high schools. Anna Schoppenhorst, Alcor board member and one of our more dedicated volunteers was drafted into cryonics by this author at the tender age of 14.

We should think twice about how we handle young people. If they are genuinely interested we should invite them to visit us, see our facilities and talk about cryonics. Above all, when we deal with interested people, be they young or old we should reach into our hearts and give quite honestly of the joy cryonics has put there.

Such joy is the one commodity we can give which will return itself endlessly. In the long run, sharing our passion for life and making others believe the good news is the only thing that will save us. Believe me, I know this can work because each time I pour liquid nitrogen on a few of the Alcor patients who touched me in this way I have all the certainty of soul I need.

Reviews

A History of the Mind: Evolution and the Birth of Consciousness

by Nicholas Humphrey

Reviewed by Thomas Donaldson

For those who may not like philosophy, I shall state here at once that this is a book of philosophy. But it is philosophy informed by science, even if sometimes that science comes directly from self-observation. And Humphrey doesn't rely solely on self-observation,

but also on scientific observations made by psychologists and neuropsychologists, both on animals and human beings.

What Humphrey proposes to do, quite simply, is to define and solve the problem of consciousness: that is, to say

what consciousness is, and to locate it in the activity of our brain. When he speaks of consciousness, he does not mean any consciousness of our thinking, but the kind of consciousness that we may share with sentient animals – a basic process underlying all our experiences, whether

we think and are aware of our thinking, or simply perceive a sunset or a tidal wave. And for this problem, he at least pushes back the darkness, if not solving it completely.

In one sense, though, I cannot review this book. Humphrey puts the matter very well in a short preface titled *Read Me*: "... arrivals have very little meaning without journeys. In the *Hitchhiker's Guide to the Galaxy* it emerges that the solution to the riddle of 'life, the universe, and everything' is 'forty-two.' Maybe it is. But who cares, if there is no explanation for how and why the answer happens to be 42?" And so, ultimately, readers of this review must satisfy themselves that Humphrey has attained his solution to consciousness by reading his book.

But I shall try at least to abstract some of the ideas Humphrey uses, and a few of his reasons. Another description of the problem Humphrey aims to solve is the mind-body problem: How is it possible for the workings of a biological biochemical process to produce awareness? Humphrey argues that the mind-body problem actually has a simple solution. It stems from a confusion of viewpoints. (But much more needs to be said about it, to establish that point.) Here is an analogy. A piece of music is, of course, vibrations of the air; it may also be Beethoven's Fifth; it can also be triumphant or sad, surprising, repetitive, and many other descriptions. Yet we don't feel it odd that vibrations of the air can be triumphant: The two descriptions look at the same events in two different ways.

But that alone doesn't solve the problem. Just what are the two sides of the phenomenon, one forming the the body and the other the mind? Humphrey's argument here consists of a discussion of the evolution of life. As lifeforms evolved, they formed a membrane around themselves separating their inner and outer parts. That membrane became sensitive, so that one stimulus caused the lifeform to move away from it and another to move toward it. These responses then became gathered inside a special organ, the brain; they also differentiated into the senses we know (and some we do not,

such as the sensitivity to electric charge that fish have through their lateral lines). In each case this sensitivity did *not* simply inform the animal inside the membrane about the logical nature of the world it lived in. It also awakened feelings (at the lowest level, repulsion or desire).

A body produces a mind because it combines an ability to perceive, *and* the impact of these perceptions on the feelings of the animal perceiving. No sensation lacks this combination. When we see another animal either happy or in pain, we see these events not as events happening to us but as events in the outer world. If we ourselves are the perceiving animal, however, our perceptions affect our feelings. Humphrey proposes that this linkage, between the perceived events and the feelings resulting, is essential to awareness (that is, the mind as distinct from the body).

At least superficially, vision provides a problem for this scheme. Humphrey cites a number of studies showing that what we see does affect our feelings. Vision evolved, of course, from a special sensitivity of the skin surface.

To distinguish these two events, Humphrey uses the word *sensation* for the response we make to something perceived, and *perception* to the objective understanding that something has been

A body produces a mind because it combines an ability to perceive, and the impact of these perceptions on the feelings of the animal perceiving. No sensation lacks this combination.

perceived (ie. without any individual feelings). Perception, unlike sensation, involves learning and "higher" intelligence.

Using these ideas, Humphrey goes on to analyze many phenomena described in neuropsychology. For instance, some people, after suffering a stroke in their visual centers, seem to see perfectly well by the normal tests; but they turn out to lack all ability to recognize, say, animals of any kind. Humphrey refers to this lack as a failure of

perception, while sensation remains unaffected. Again, perception can exist without sensation. Sometimes, in people or monkeys, a brain injury can produce a strange kind of blindness in which the patient reports that he or she can see nothing – but at the same time, when asked to guess the number of fingers the doctor standing before him is showing, will give the number unerringly. Again, blind people have been trained to see using a special pad placed on their back which, combined with a camera, will give them a (low resolution) visual scene by touch on their back. Their sensations don't cease to be those of touch; at the same time they can learn to recognize objects and faces.

Finally, Humphrey discusses what might happen (in terms of nerve circuits) during sensation. The close relation between sensation and response becomes important here. It's known that sensations can take as long as 1/10th of a second to register. This is because they involve not just the incoming nerve impulses but others, too (the ones which affect our feelings). Humphrey argues from this (on this point I believe he is *wrong*) that the processing which goes on in this particular stage will make it impossible to create a robot capable of sensation, and therefore with the same *kind* of mind-body issue as living human beings. However I will let readers judge his arguments for themselves.

In essence, this book analyzes in detail a problem touching very much on our own concerns. The mind-body problem comes close to the problem of continuity. Just how much repair might cause us to become a completely different person (that may even share our memories)? Even though

Humphrey doesn't directly analyze our sense of continuity, the approach he takes implies that we would have such a sense of continuity and therefore would not be different. I don't believe we can reasonably consider our own awareness without taking account of Humphrey's ideas.

Recent Abstracts of Interest

Tenover JS

Effects of testosterone supplementation in the aging male.

J Clin Endocrinol Metab 1992 Oct;75(4):1092-8

Serum androgen levels decline with aging in normal males, such that a significant number of men over 60 yr of age will have a mean serum total testosterone (T) level near the low end of the normal adult range. It is not known whether lower T levels in older men have an effect on androgen-responsive organ systems, such as muscle, bone, bone marrow, and prostate, nor are there data to evaluate the relative benefits and risks of T supplementation in older men. We assessed the physiological and biochemical effects of T therapy in 13 each. Before treatment and at the end of both 3-month treatment regimens, lean body mass, body fat, biochemical parameters of bone turnover, hematological parameters, lipoprotein profiles, and prostate parameters [such as prostate-specific antigen (PSA)] were evaluated. Serum T levels rose in all subjects with TE treatment, such that the lowest level of T during a week's period was 19.7 +/- 0.7 nmol/L (mean +/- SE). After 3 months of TE treatment, lean body mass was significantly increased, and urinary hydroxyproline excretion was significantly depressed. With TE treatment, there was a significant increase in hematocrit, a decline in total cholesterol and low density lipoprotein cholesterol, and a sustained increase in serum PSA levels. Placebo treatment led to no significant changes in any

of these parameters. We conclude that short term (3 months) TE supplementation to healthy older men who have serum T levels near or below the lower limit of normal for young adult men results in an increase in lean body mass and possibly a decline in bone resorption, as assessed by urinary hydroxyproline excretion, with some effect on serum lipoproteins, hematological parameters, and PSA. The sustained stimulation of PSA and the increase in hematocrit that occur with physiological TE supplementation suggest that older men should be screened carefully and followed periodically throughout T therapy.

Chandra RK

Effect of vitamin and trace-element supplementation on immune responses and infection in elderly subjects.

Lancet 1992 Nov 7;340(8828):1124-7

Ageing is associated with impaired immune responses and increased infection-related morbidity. This study assessed the effect of physiological amounts of vitamins and trace elements on immunocompetence and occurrence of infection-related illness. 96 independently living, healthy elderly individuals were randomly assigned to receive nutrient supplementation or placebo. Nutrient status and immunological variables were assessed at baseline and at 12 months, and the frequency of illness due to infection was ascertained. Subjects in the supplement group had higher numbers of certain T-cell subsets and natural

killer cells, enhanced proliferation response to mitogen, increased interleukin-2 production, and higher antibody response and natural killer cell activity. These subjects were less likely than those in the placebo group to have illness due to infections (mean [SD] 23 [5] vs 48 [7] days per year, $p = 0.002$). Supplementation with a modest physiological amount of micronutrients improves immunity and decreases the risk of infection in old age.

Carey JR Liedo P Orozco D Vaupel JW Slowing of mortality rates at older ages in large medfly cohorts

Science 1992 Oct 16;258(5081):457-61

It is generally assumed for most species that mortality rates increase monotonically at advanced ages. Mortality rates were found to level off and decrease at older ages in a population of 1.2 million medflies maintained in cages of 7,200 and in a group of approximately 48,000 adults maintained in solitary confinement. Thus, life expectancy in older individuals increased rather than decreased with age. These results cast doubt on several central concepts in gerontology and the biology of aging: (i) that senescence can be characterized by an increase in age-specific mortality, (ii) that the basic pattern of mortality in nearly all species follows the same unitary pattern at older ages, and (iii) that species have absolute life-span limits.

Advertisements & Personals

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MARY NAPLES, CLU and BOB GILMORE — CRYONICS INSURANCE SPECIALISTS. New York Life Insurance Company; 4600 Bohannon Drive, Suite 100; Menlo Park, CA 94025. (800) 645-3338.

J.R. SHARP — INS. BROKER — ALL TYPES OF INSURANCE, ANNUITIES, LIVING TRUSTS and LIFE TRUSTS. Assisting Alcor Officers & Members since 1983. P.O. Box 2435, Fullerton, CA 92633. (714) 738-6200 or FAX (714) 738-1401.

EXTROPY: The Journal of Transhumanist Thought, #10 is now available. Issue #9 had: Hans Moravec on Time Travel and

Computing. Plus: Persons, Programs, and Uploading Consciousness, Nanotechnology and Faith, Extropian Principles 2.0, Exercise and Longevity, Genetic Algorithms, reviews. \$4.50 from Extropy Institute; PO Box 57306; Los Angeles, CA 90057-0306. E-mail info from more@usc.edu.

Do you want to keep up with science and technology bearing on cryonics? *PERIASTRON* is a science newsletter written by and for cryonicists, only \$2.50 per issue. *PERIASTRON*, PO 2365, Sunnysvale CA 94087.

"I'D RATHER BE DEAD THAN READ?" — NO WAY! Read *Venturist Monthly News* — News about various cryonics topics — send for free sample copy — Society for Venturism; 1547 W. Dunlap; Phoenix, AZ 85021.

LIFE EXTENSION FOUNDATION OF HOLLYWOOD, FLORIDA provides members with "inside" information about high-tech anti-aging therapies. for free information call 1-800-841-LIFE.

CRYONICS FORUM

This new section of Cryonics magazine will be open to anyone who has opinions, suggestions, criticisms, or questions about cryonics. Alcor has a tradition of openness, and many of us feel that the magazine's honesty is an important factor encouraging people to sign up. Cryonics Forum affirms Alcor's continuing belief that an organization which encourages free speech is stronger than one which attempts to suppress it.

These pages will also serve as an outlet for cryonicists who are strongly opinionated and tend to feel frustrated if the organization seems unresponsive to their points of view.

Sources

In this initial Forum, all the material is reprinted from Cryonet, a computer network that links many cryonics activists. However, Cryonics Forum is open to everyone, not just computer users. Please send in your opinions using any medium—disk, typescript, or handwritten pages.

Some readers may be aware that in 1992 I started a lit-

Compiled by Charles Platt

tle magazine titled Cryonet Digest. Since this Forum now serves the same purpose, with the added advantage that it reaches the entire Alcor membership and will appear on a regular monthly schedule, I am suspending publication of Cryonet Digest. Subscribers may choose to receive a refund or have their money passed to Alcor as a donation.

Omitted Text

November and December 1992 were active months on Cryonet. In addition to text that appears below, there were substantial ongoing dialogues which I found impossible to summarize or condense. The participants are welcome to present their viewpoints in future numbers of Cryonics Forum, if they wish. However, because of space limitations, we ask that each statement should be no longer than 500 words. If your views simply cannot be expressed within that limit, please check first to see if there is room for extra wordage. Correspondence can be addressed to me c/o Alcor.

—Charles Platt

The Case for Dividing Alcor

From Mark Voelker:

Alcor is making the painful transition from a small "amateur" organization of dedicated volunteers to a professionally run business enterprise. It is the purpose of this paper to initiate discussion of Alcor's future structure and offer a model of that structure as a starting point.

[Much text omitted; this was originally a long paper divided into several topics.]

I propose that Alcor be split into two separate organizations, one providing patient care (and in the future reanimation), the other providing suspension services and performing the rest of Alcor's functions. This structure for Alcor would provide important protection for our patients without reducing our ability to compete in the risky, fast moving, interactive arena of suspension services and marketing.

The Patient Care organization could remain as a non-profit corporation, but the Suspension Services company could be a for-profit corporation, allowing it to attract capital to stay ahead of the competition.

The Patient Care Organization would remain insulated from the risks and liabilities of the Suspension Company. The Sus-

pension Company could be more aggressive in pursuing its goals and competing in the marketplace, without increasing the risk to the patients. As a for-profit corporation, it could seek outside capital to maintain its technological leadership; and as a joint stock company it could provide incentives now lacking for its hardworking staff. The Patient Care Organization could concentrate on serving the needs of the patients and their relatives, and on managing its assets conservatively for the long term.

Physiological Considerations in Perfusion

Preamble

Edgar Swank, a member of the American Cryonics Society, had mentioned that several people in ACS had contracted for a low-cost option in which the brain only is frozen after being perfused in a mortuary via carotid arteries.

From Steve Harris:

Perfusing people through carotids alone is a bad idea, because the carotids do not lead directly to the hind brain, and

in 75% of people the connections between forebrain and hindbrain circulation are less than perfect.

Four vessels feed the brain, and these four vessels are connected perfectly to each other at the base of the brain (in a fully-formed "circle of Willis") in only 25% of people. The other 75% of people are probably best perfused through all four vessels. That means open chest surgery to isolate the ascending aorta.

At Alcor, we do this in every suspension, and we measure the glycerol concentrations in venous return from the brain so we know how much got in. I've yet to see evidence of both of these crucial operations being done together at other cryonics organizations.

Mike Darwin's Departure from Alcor

From Mike Darwin:

I would point out that the course of action I chose was not a unique one in cryonics history. Rather, it has been the routine one. In the early 1980s Jerry Leaf made a similar decision to leave BACS/Trans Time. At that time Jerry was the only source of quality suspension capability. There were bitter, frightened people

around then, as now, who labeled Jerry as unstable or unethical. I see that the passage of a decade has changed *nothing*. There are still people around who want to slap on the label of (sic) mental instability, with implications of "treasonous" behavior lurking in the background.

There has been a large turnover in staff since the mid-1980's, and with the exception of Hugh Hixon and Lawrence Gale, there has been 100% turnover since 1982. The vast majority of the people who left, left with very little notice or none at all. In several cases individuals who left created gaps in the program. In several cases individuals left immediately after time-consuming training had been completed.

I can well understand the anger that some people must feel at my departure. However, there is a very real issue of turnover and reliability in cryonics organizations, and this is an ongoing problem which should be examined honestly.

Alcor's Financial Structure

Preamble:

Some people had expressed concern that the Patient Care Trust Fund is not a trust in the narrow legal sense.

From Steve Harris:

What I'd like to see is that special subspecies of trust fund which is irrevocable (non-invadable), by anyone, including the Alcor Board of Directors. I'd like the principal of this fund to be as untouchable as if the checks or account code numbers were on Mars, and the dividends were being mailed straight from God.

Side-stepping for the moment the question of the rule against perpetuities, such a thing would operate in the way that perpetual care trusts operate for cemeteries.

If such a fund was large enough, suspendees forsaken by their brother cryonists would get well-taken care of in much the same impersonal but adequate way that the cats of a rich and reclusive person get well taken care of when left millions of dollars in trust in a will. For cats, this happens even if the decedent was unable to identify any friends or companions who were dedicated cat-lovers. For cryonauts, I see no reason why the same principles need not apply.

It has been argued that the full patient care funds must be available in case of a large cash-eating emergency which threatens the patients. This is indeed a problem, but I would prefer that it be dealt with by



putting only a fraction of monies in the irrevocable fund. I think the benefits of safety and surety outweigh the drawbacks of loss of liquidity. We can, after all, *insure* against most foreseeable big emergency expenses, including acts of God. Those premiums can be paid out of the trust return.

It has also been argued that patient care funds must be available for reanimation, and thus they shouldn't be all "frozen up" (forgive me) in such a way that they are never available en bloc. My answer to this is that should it ever become possible to re-animate suspendees by spending all of their share of the trust principal at once, then it may eventually become possible to do the same using just the return or dividends.

We need to remember that we're discussing a future world of nanotechnology-created wealth where even ordinary people will control vast riches by today's standards. Resurrection is psychologically powerful stuff, and I think that once it becomes technically possible, it will become a major focus of interest for people, and not all of that interest will be mercenary. Recently, in a PBS series on dinosaurs, I watched volunteers (just plain folks) help professors and grad students to find fossils in the desert. It was hot and horrible work, but it was being done by a coalition of private and academic people for not much more than the simple pleasure of re-creating, in a really inadequate way, some big dead lizards. Looking at this spectacular evidence of human "collecting and restoring" instinct in action, I could not help but re-think my old assumptions that cryonauts who make it to the future without reanimation funds or organizations will be doomed. On the contrary, I think it more likely that *getting* to the far future will prove to be *far* more of a problem than getting out of the can once we make it. Best to spend our attention, then, on making the *ride* more foolproof, even if the end of the journey is therefore left a bit more up to the kindness of strangers.

It has been argued that it is unrealistic to imagine that at some time in the future there will be no group of dedicated cryonists to take care of patients. I agree, there will always be dedicated cryonists; what I have doubts about is whether they will be willing to shoulder the responsibility and expense of the very "non-sexy" task of taking care of a particular load of frozen

people whose suspension funds have been spent down—in other words the ashes and the clinkers of badly run cryonics organizations.

Yes, I know, the mind reels from the very idea of fiscal mismanagement or civil war in cryonics, given the general pleasantness and peacefulness here at Alcor. In

our present organization our skeleton crew of employees labor in the vineyards of cryonics from sun-up to long after sundown with nary a wasted motion, but still it seems possible to me that some nameless cryonics organization in the future may become bloated and lazy, with salaries and poor management gradually siphoning off capital, until patients threaten to become liabilities. Really. Similarly, although in our own organization people treat each other with unflinching courtesy and respect, it seems possible that one day a cryonics organization will suffer very nasty schisms and vicious infighting (gasp) and this will happen even among people who are totally dedicated to the idea of cryonics itself and should therefore have more than enough common ground to get along. Yes, I can actually imagine it. It's only slightly more difficult than nanotechnology....

Such things have happened in the care of cemeteries for years, and that is why we have non-invadable care trust funds for cemeteries. Cryonics would do well to learn here.

I would like to see Alcor pay an appropriate attorney for authoritative advice on the current vulnerability of Alcor's assets (including the patient care funds) and whether they can be protected. Clearly, we have a big potential liability problem when we're messing about with people's lives and deaths in a way that is very threatening and foreign to their families and their society, and we have, at the same time, a giant hunk of cash in the bank. Duh. As far as I'm concerned, there might as well be a target painted on that \$1.2 million in the patient care fund, with a neon blinking arrow sign: "Free Money HERE! Ghoulish Hucksters with Deep Pockets Invite You to Find a Sympathetic Jury and Sue Right HERE! Contingency Suits Welcome! Give it a Spin; What's to Lose? SUE HERE! SUE HERE!"

Damage Caused by Freezing

From Mike Darwin:

There have been several requests for information about the kind of damage done during cryonic suspension. In particular, there have been requests for detailed,

objective studies. As a result of this interest I have decided to post a research paper which is now (hopefully) in the final stages of preparation for publication.

[This paper describes a cat cryopreservation study by Mike Darwin, Hugh Hixon, and Jerry Leaf in which cat brains were test-frozen using the same protocol that Alcor applied to human patients in the 1980s, with 3 Molar glycerol. Some of these brains were additionally subjected to ischemic damage. The non-ischemic group was given the designation Feline Glycerol Perfusion (FGP) and the ischemic group was referred to as Feline Ischemic Glycerol Perfusion (FIGP). A control group was frozen with no cryoprotectants.]

[Due to space limitations, only a few brief excerpts can appear here.]

There are many caveats about the validity of this work, and a noted cryobiologist who is familiar with it feels somewhat more optimistic about preservation of neuronal connectivity than I do. But one thing we are both agreed on: our work clearly demonstrates serious histological disruption with tears or fractures in the brain tissue appearing at approximately 3 to 5 micron intervals. I think anyone who looks at pictures of this damage would be given pause for thought about the workability of cryonics.

We all want and need to believe very desperately that cryoinjury can and will be reversed. However, there is no direct evidence that this will be possible. Does that mean we should *not* continue to freeze people? No. What it does mean is that we need to do some serious work to improve the situation.

[Much text omitted]

Effects on the Brain

In both FGP and FIGP animals the brain was particularly affected by fracturing and it was not uncommon to find fractures in the cerebral hemispheres penetrating through to the ventricles or to find most of both cerebral hemispheres and the mid-brain completely severed from the cerebellum by a fracture.

Bodian stain was used to prepare the control, FGP, and FIGP brain tissue samples for light microscopy. Three striking changes were apparent in FGP cerebral cortex histology: 1) marked dehydration of both cells and cell nuclei, 2) the presence of tears or cuts at intervals of 10 to 30 microns throughout the tissue on a variable basis (some areas were spared while others were heavily lesioned), and 3) the increased presence (over control) of irregular, empty spaces in the neuropil as well as the occasional presence of large pericapillary spaces. These changes were fairly uniform throughout both the molecular



layer and the second layer of the cerebral cortex. Changes in the white matter paralleled those in the cortex with the notable exception that dehydration appeared to be more pronounced.

Other than the above changes, both gray and white matter histology appeared remarkably intact, and only careful inspection could distinguish it from control. The neuropil appeared normal (aside from the aforementioned holes and tears) and many long axons could be observed traversing the field. Cell membranes appeared crisp and apart from appearing dehydrated, neuronal architecture appeared comparable to control. Similarly, staining was comparable to that observed in control cerebral cortex. Cell-to-cell connections appeared largely undisturbed.

Glycerolization

Cryoprotective perfusion of non-ischemically injured animals resulted in profound dehydration. This is indicative of a failure of cellular equilibration of glycerol, particularly in the brain and skeletal muscle, and in and of itself is probably a significant source of osmotic injury.

Ultrastructure

The ultrastructural preservation of the brain was unexpectedly poor in all three groups of animals: ischemic, non-ischemic and straight-frozen. Not unexpectedly, the straight-frozen animal presented the worst ultrastructural appearance. The ischemic animals also suffered extensive ultrastructural disruption. This was somewhat unexpected given the relatively good appearance of brain tissue at the light level; in particular it appeared that membranes were crisp and well preserved, that cellular ground substance was of reasonably normal density, and that the overall ground substance density of the neuropil, as well as the preservation of long individual axon fibers and cell-to-cell connections, were largely intact. Unfortunately, the degree of ultrastructural injury observed was in sharp contrast to the apparently good histological preservation. The profound loss of ground substance, gross and widespread loss of membrane integrity, presence of extensive debris, and the widespread destruction of the myelin all underscore, yet again, the critical importance of protection of suspension patients from cerebral ischemia.

While the degree of ultrastructural dis-

ruption was not as profound in the brains of the FGP animals, it was far from acceptable. The presence of frequent ice holes, tears in the neuropil, and the cellular dehydration and fracturing observed are all indicative of unacceptably poor preservation and point to the urgent need for additional research to ameliorate or eliminate these problems.

Caveats

Examination of the tissues was conducted following thawing. This introduces the possibility of significant "stirring" of damaged structure not only during thawing, but also during sectioning and fixation, since re-perfusion with fixative was not possible owing to disruption of the vasculature by fractures. This is potentially a particularly troubling "artifact" because a major concern is the presence of debris many microns from the likely source of origin (as observed in the liver and brain). When and how this debris was translocated from its point of origin, as well as its character (i.e., how unique are the fragments of debris; can their precise point of origin and orientation be determined?) is of critical importance in determining whether or not repair can be undertaken. If the extensive ultrastructural and molecular-level stirring observed in these animals occurred as a result of diffusion/stirring which took place during, or even after thawing and/or during sectioning and fixation, then the situation is considerably more hopeful than if the damage occurred during the freezing process.

From Ben Best:

Why did Mike Darwin's study only attempt to achieve a 3 Molar target glycerol concentration? It has been known for years, as his paper acknowledges, that glycerol does *not* perfuse cells well and causes fatal dehydration of the brain at room temperature. *Why*, then, has glycerol been used as a cryoprotectant in cryonics rather than DMSO, which has better perfusion properties?

I have asked this question repeatedly and the only answer I have heard is that DMSO is more expensive and more toxic. Yet DMSO could be introduced at lower temperatures, since its toxicity varies directly with temperature (and this is the procedure used in freezing human 8-celled embryos at liquid nitrogen temperature). Moreover, the mechanisms of cryoprotectant toxicity are unknown and may involve nothing more than enzyme denaturation. If DMSO produces no *structural* damage, the effects of toxicity may be more easily dealt with by reanimation technology than the damage to structure seen with glycerol. Can there be any higher priority to

cryonics research than to find a suitable replacement for glycerol? Why isn't DMSO being used *now*, given present knowledge?

A noted cryobiologist used 3.72 Molar glycerol in his electron microscope study of rabbit brains. He refers to remarkable tissue reorganization and complete recovery of biochemical function upon thawing, which seems to contradict the evident ultrastructure damage. Mike Darwin acknowledges that thawing damage, sectioning damage and fixation damage may have contributed to the ultrastructure damage observed. (And we can add dehydration damage and damage due to an inadequate target concentration.)

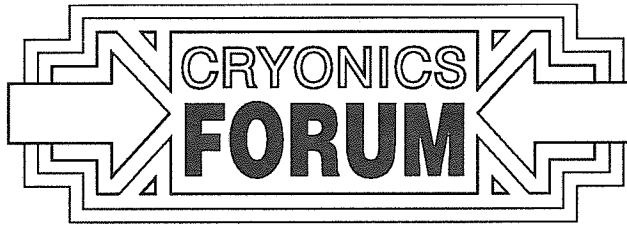
The final question I want to address is: What is the structural basis of memory and identity in the brain? As Thomas Donaldson has repeatedly alluded-to, long-term memory seems to be similar to embryological differentiation. Long-term memory seems to be associated with modification of synaptic connections and (perhaps more importantly for cryonicists) with modification of the neuronal DNA that programs the synaptic connections. The implication of this "redundancy" is that damage to synapses might not matter if the information encoding those synaptic connections is preserved in neuronal DNA. Future nanotechnology could reconstruct a brain from neuronal DNA alone, if this is true. Neuronal DNA appears to be very robust—many tissues (including neurons from aborted human foetus' used for Parkinson's patients) have been frozen to liquid nitrogen temperature without losing tissue-type differentiation. My understanding is that the damage observed with electron microscopy was *extracellular* damage, meaning that neuronal DNA may have been mostly preserved.

Damage does not mean destruction. Even current cryonic procedures may not be destructive. And titanic efforts may not be necessary for significant improvement.

From Mike Darwin:

Why did we choose 3M glycerol for this study? That was what we were using in humans at the time. When this study was begun (nearly a decade ago) there was relatively little experience with closed circuit perfusion and high terminal glycerol concentrations in human patients. Indeed, it wasn't until Terri Cannon was perfused in 1987 that the "current" system of closed-loop, dual reservoir perfusion was used. I might also add that until that time, most patients rolled in the door many hours after cardiac arrest: clotted, in full rigor and barely perfusable. We felt elated to get 1M CPA in!

Why not use DMSO? We have repeat-



edly compared light micrographs of brains treated with DMSO vs. glycerol in the same concentrations. The glycerolized brains look better —by a lot. Second, I have some experience with high concentrations of DMSO in brain slices. DMSO resulted in poorer structural preservation and foaming of the carrier solution (indicating elution of proteins) during its removal.

Also, Isamu Suda perfused cat brains with both DMSO and glycerol and found glycerol to be superior (Brain Research 70:527-31 (1974)).

But more to the point, DMSO is simply unperfusable in ischemically injured patients. They very rapidly develop massive interstitial edema and this brings perfusion to an early halt.

[Much text omitted.]

Finally, I would like to say that I am sick to death of all this hand waving about possibilities for repair. It is a fool who spends all his time trying to repair the results of an accident that could have been prevented in the first place. The problem of injury-free or modest injury cryopreservation is *not*, I repeat *not* the most difficult problem in the world to solve. As Ben points out, what we need are some fairly basic studies to determine which cryoprotective agents are the best for brains, and then we need to do brain perfusions with multimolar concentrations of the agent(s) and greatly reduce or altogether eliminate ice formation. This is work that could have been done 20 years ago! the Cat Cryopreservation Study was a survey project designed to tell us what we needed to do. It succeeded in this respect, but we failed to follow through.

From Jeffrey Soreff:

After reading Mike Darwin's informative and depressing posting about freezing damage, I'd like to know if there is any possibility of preserving neural connectivity by chemical preservation and storage above freezing? Obviously one totally loses any information encoded in reactive molecules if one pickles someone in formaldehyde, but can the cell membranes be preserved? Fractures at 5 micron intervals are going to leave an intimidating jigsaw puzzle.

(Standard disclaimer: I do not speak for my employer.)

From Brian Wowk:

According to a presentation by a cryobiologist at the Alcor Anniversary Dinner earlier this year, the breaks produced by growing ice crystals are "clean" on an ultrastructural level. In other words, the broken edges are smooth, not frayed, when viewed on (freeze-substituted) electron micrographs. Additionally the broken bits are moved only microns, not off to parts unknown. Yes, a frozen brain is a jigsaw puzzle; one with many disconnected pieces lying very close to where they ought to be, not one with badly jumbled or missing pieces. I, for one, am far from convinced that neural connectivity information is irreversibly lost in brains frozen with current (or even past) methods.

From Ben Best:

I agree that the vision of nanotechnology has lured too many people into a smug belief that massive autolytic and freezing damage can occur without destruction of critical structures. But even if Dora Kent's head had received perfect suspended animation, nanotechnology will be necessary (although perhaps not even sufficient) to reverse the effects of Alzheimer's Disease, to undo the effects of aging, and to construct a new body. If I die, I hope to be very old—and I will not expect to be reanimated until the ravages of old age are reparable and reversible.

If DMSO causes interstitial edema in ischemically injured patients, then it shouldn't be used for such patients. But why deprive others of possible benefit? Shouldn't suspension protocol be tailored to the needs of the patient?

From Mike Darwin:

I agree with your comments completely. The point is, we need to do the laboratory investigation to determine the best approach. This will only get done with a serious commitment of time and money. Those who have seen our Biopreservation/Cryovita lab will know that we have the facilities and some of the personnel required to do this work. It remains to be seen whether the cryonics community will be forthcoming with the money.

As to the immediate use of DMSO, keep in mind that ALL cryonic suspension patients suffer ischemic injury prior to suspension. The prolonged period of shock most patients experience during the agonal phase is no doubt causing severe injury to the vascular endothelium. Always remember we are working with medicine's leavings and failures. While anathema to cryonicists it *is* occasionally important to remember that these are people who have *died* (at least by current criteria). That is no small thing.

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Meetings and Announcements

Meeting Schedules

Alcor business meetings are usually held on the first Sunday of the month (July, Aug., & Sept.: 2nd Sunday). Guests are welcome. Unless otherwise noted, meetings start at 1 PM. For meeting directions, or if you get lost, call Alcor at (714) 736-1703 and page the technician on call.

The **SUN, FEB 7** meeting will be at the home of:
Linda Abrams
856 N. Harper, Los Angeles, CA

Directions: Harper Ave. is parallel to and between Fairfax and La Cienega in the West Hollywood area. 856 N. Harper is between Melrose Ave. and Santa Monica Blvd., on the corner of Harper and Willoughby. Take Fairfax or La Cienega north from I-10, or Santa Monica east from the 405 or west from the Hollywood freeway. (From the San Fernando Valley, take Laurel Canyon Blvd. south.)

The **SUN, MARCH 7** meeting will be at the home of:
Bill and Maggie Seidel
10627 Youngworth Rd., Culver City, CA

Directions: Take the San Diego (405) Freeway to Culver City. Get off at the Jefferson Blvd. offramp, heading east (toward Culver City). Go straight across the intersection of Jefferson Blvd. and Sepulveda Blvd. onto Playa St. Go up Playa to Overland. Go left on Overland up to Flaxton St. Go right on Flaxton, which will cross Drakewood and turn into Youngworth Rd. 10627 is on the right (downhill) side of the street.

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.

For those interested, there is a business meeting before the potluck at 4:00.

Once every three months there will be a party or gathering at a local eatery and no business meeting. The next dinner out will be in March. See details below. If you would like to organize a party, or have a suggestion about a place to eat contact the chapter secretary, Lola McCrary, 408-238-1318.

We are also hoping to have speakers on various topics in the near future.

The **SUN, FEB 14** meeting will be held at the home of:
Leonard Zubkoff and Lola McCrary
3078 Sulphur Spring Court
San Jose, CA
Tel: (408) 238-1318

The business meeting will start at 4 p.m., and the potluck around 6 p.m.

Directions (Via 101): Take 101 south past the 880 and 280/680 junctions to the Capitol Expressway exit, (third exit past the 280/680 junction). Take Capitol Expressway East (back over 101) toward the San Jose foothills. Go right on Aborn Road (second traffic light; there is a Red Lobster on the corner where you need to turn). Go left on White Road (third traffic light; White is to the left and San Felipe is to the right at this intersection). Go right on Stevens Lane, which is the next traffic light. Go down Stevens, past the stop sign, and then take Mount Isabel, (second street on the right after going through the stop sign). Turn left onto Sulphur Spring Court, which is the next street. 3078 is the second house on the right. In case of difficulty, call 408/238-1318.

(Via 280): Take 280 south and either take the exit onto 101 south and follow the above directions, or take the King Road exit off 280 and head south to Aborn Road as above.

There are no animals in residence, and no smoking is permitted indoors.

NOTE: This house is definitely not child-proof; in fact, the proliferation of equipment, connecting cables, and tools should probably be considered child-hostile. We have no objection to children visiting, but their parents must be prepared and take responsibility for supervising them adequately so that no accidents occur. There is a VCR available if people would like to bring video tapes for children to watch.

MARCH 14, 1993: We will meet at Fresh Choice on El Camino in Sunnyvale at 4:30 for dinner. More details next month.

Alcor's Southern California chapter meets every other month. If you are not on our mailing list, please call Chapter president Billy Seidel at 310-836-1231.

The *Alcor New York Group* meets on the third Sunday of each month at 2:00 PM. Ordinarily, the meeting is at 72nd Street Studios. The address is 131 West 72nd Street (New York), between Columbus and Broadway. Ask for the Alcor group. Subway stop: 72nd Street, on the 1, 2, or 3 trains. If you're in CT, NJ, or NY, call Gerard Arthus for details at (516) 689-6160, or Curtis Henderson, at (516) 589-4256.

Meeting dates: **Feb. 21, Mar. 21, April 18, May 16.**

New York's members are working aggressively to build a solid emergency response capability. We have full state-of-the-art rescue equipment, and four Alcor Certified Techs and four State Certified EMTs.

The Alcor New York Stabilization Training Sessions are on the second and fourth Sundays of every month, at 2:30 PM, at the home of Gerry Arthus. The address is: 335 Horse Block Rd., Farmingville, L.I. For details call Curtis or Gerry at the above number.

Alcor Indiana has a newsletter and a full local rescue kit, and two of the members have taken the Alcor Transport course. If you are interested and in Indiana, Illinois, Kentucky, Ohio, or Michigan, the Indiana group meets in Indianapolis on the second Sunday of each month, at 2:00 PM. Call Steve Bridge at (317) 359-7260, or Richard Shock at (317) 872-3066 (days) or (317) 769-4252 (eves) for further information.

There is a cryonics discussion group in the Boston area meeting on the second Sunday each month at 3:00 PM. Further information may be obtained by contacting Walter Vannini at (603) 595-8418 (home) or (617) 647-2291 (work).

Alcor Nevada is in the Las Vegas area. Their meetings are on the second Sunday of each month at 1:00 PM in the Riverside Casino in Laughlin, Nevada. Free rooms are available at the Riverside Casino on Sunday night to people who call at least one week in advance. 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 reach the intersection 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. For more information, call Eric Klien at (702) 255-1355.

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.

Meeting dates: **Feb. 7, Mar. 7, April 4, May 2, June 6.**
The address of the facility is:
Alcor UK, 18 Potts Marsh Estate, Westham, East Sussex
Telephone: 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 amazing 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. For those living in or around metropolitan London, you can contact Garret Smyth at 081- 789-1045, or Russell Whitaker at 071- 702-0234.

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