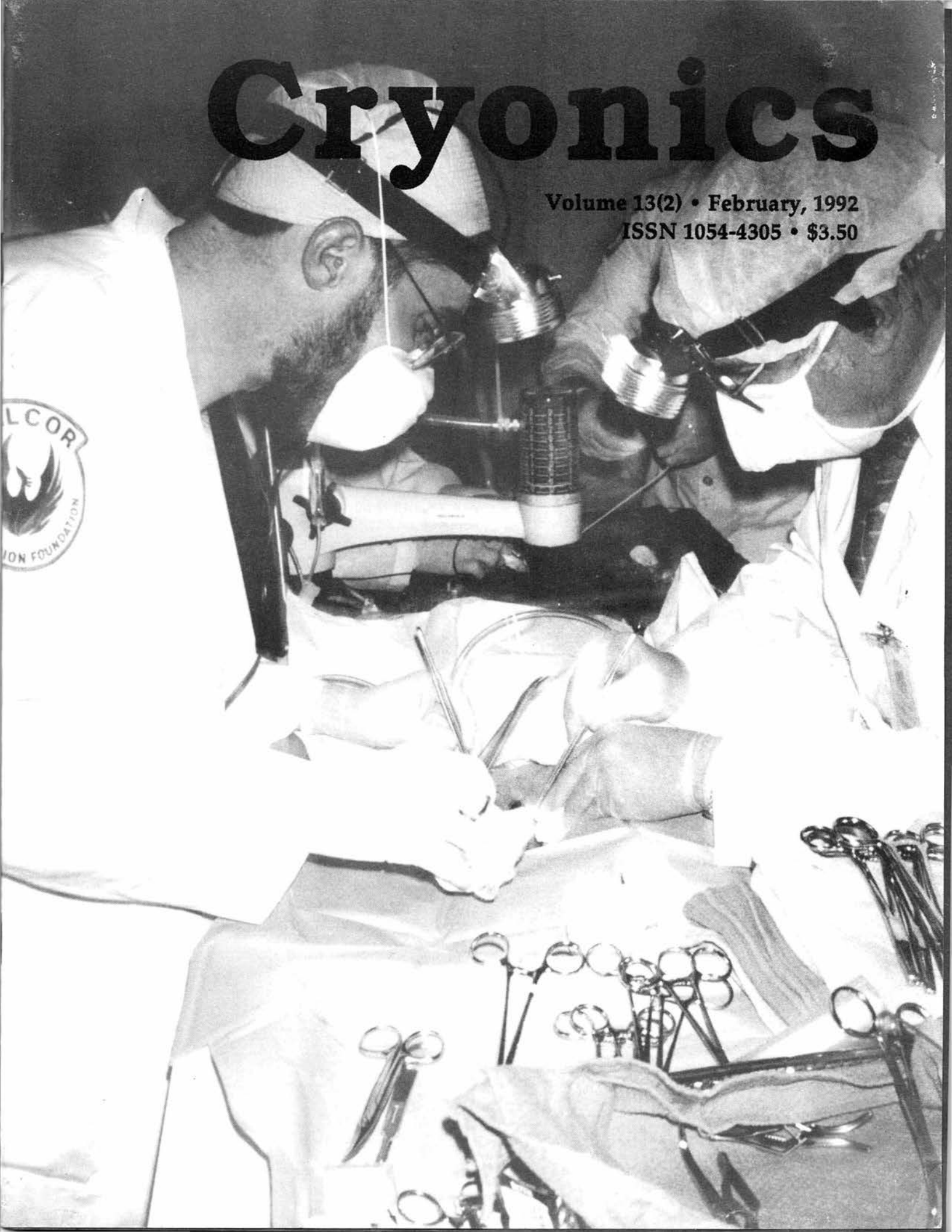


Cryonics

Volume 13(2) • February, 1992

ISSN 1054-4305 • \$3.50



Feature Articles

- In For The Kill!**
H. Jackson Zinn 4
- Magnesium — The Forgotten Mineral**
Steven B. Harris, M.D. 8
- Suspension Capability**
Carlos Mondragón 17
- The Transport of Patient A-1312**
H. Keith Henson 18
- Review: Disappearing Through The Skylight**
Thomas Donaldson 25

Columns

- For the Record**
Mike Perry 5
- Future Tech**
H. Keith Henson 16

Departments

- Up Front 1
- Letters to the Editor 2
- Advertisements and Personals 29
- Upcoming Events 29

Cryonics

Volume 13(2)
February, 1992
Issue 139, ISSN 1054-4305



Cryonics is the magazine of the Alcor Life Extension Foundation, Inc.

Editor: Ralph Whelan
Contributing Editor: Hugh Hixon
Production Editors: Eric Geislinger and Jane Talisman

Published monthly. Individual subscriptions: \$35 per year in the U.S.; \$40 per year in Canada and Mexico; \$45 per year all others. Back issues are \$3.50 each in the U.S., Canada, and Mexico; \$4.50 each all others.



Please address all editorial correspondence to ALCOR, 12327 Doherty Street, Riverside, CA 92503 or phone (800) 367-2228 or (714) 736-1703. FAX #: (714) 736-6917. E-mail: alcor@cup.portal.com



Contents copyright 1992 by the Alcor Life Extension Foundation, Inc., except where otherwise noted. All rights reserved. The opinions expressed herein are not necessarily those of the Alcor Life Extension Foundation or its Board of Directors or management.



Issue to press: January 7, 1992.

Cover:
Suspension of Patient A-1312

A Day of Sad Relief

The month of December saw our twentieth suspension, the neurosuspension of a Northern California member. The suspension began with a standby and transport that involved several of the local Transport Team members as well as three Southern California "regulars," who drove up in the ambulance and a chase vehicle. Due to heroic efforts on the part of many, the transport began in the patient's home rather than in a hospital, and he received a first-class field washout and transport. For details of the transport and preparations for same, read *The Transport of Patient A-1312* by Keith Henson, elsewhere in this issue.

To the extent of my knowledge, all feedback from Suspension and Transport team members was decidedly positive. Personally, I was happier with the general level of organization and direction in this suspension than I've been with any other.

A Day of Happy Relief

Just in time for Christmas, Dora Kent's physician got a call from his attorney — and it was *very good news*. The California Medical Board (formerly B.M.Q.A.) has finally decided to drop their inquiry into that good doctor's involvement with Alcor and Dora Kent. For the first time since her suspension, there are no currently unresolved legal or bureaucratic hassles pending.

This latest closure did not come cheap. Alcor spent well over forty thousand dollars in direct legal expenses to defend ourselves and Dora's physician from the Medical Board's attack. Although most other repercussions from the Dora Kent suspension were dispensed with by the end of 1990 (including the County's allegations of homicide), the Medical Board "investigation" heated up in April of 1991 (see the May 1991 issue of *Cryonics*).

Again, our aggressive and stubborn

insistence on being treated fairly has at last succeeded. Further, our vigorous defense of a physician associated with us will in the long run serve our reputation well in the medical community. Happy holidays indeed!

Henson Elected to Alcor Board

Keith Henson was elected to Alcor's Board of Directors at the January 5th board meeting. Keith and his family have been Suspension Members since 1985. Keith was a co-founder of the L-5 Society and is currently on the board of the National Space Society. He is an independent consultant in software engineering.

Keith has probably recruited more new Alcor members than anyone else. He has long been a member of our suspension team, and is an Alcor Certified Transport Technician. Over the past four years, Keith's tenacity in helping us deal with bureaucratic and legal issues has been invaluable.

DEAL OF THE CENTURY!

On the evening of April 4, 1992, you are cordially invited to attend the celebration honoring the 20th anniversary of the Alcor Life Extension Foundation and the 25th anniversary of the freezing of the first man, Dr. James Hiram Bedford. The banquet will be held at the Marriott Hotel, 2200 East Holt Street, in Ontario, California. Alcor of the past, present, and future will be but a few of the topics covered by the evening's speakers.

Confirmed speakers include Linda Chamberlain, the first President of Alcor (yes, a woman) and Fred Chamberlain, the second. Fred and Linda will be discussing the early days of the Alcor Foundation.

Carlos Mondragón, the current CEO, will be telling the uncensored story of Alcor today, as well as reflecting upon the future expectations of cryonics in general

and Alcor specifically. (As we all know, Alcor is the future of cryonics.)

As cryonics didn't spontaneously begin with Alcor's incorporation in 1972, Saul Kent will be on hand to discuss what life was like as a pioneer cryonicist in the '60s facing the challenges of the early cryonics movement.

Max More, CEO of the Extropy Institute, is scheduled to discuss the social and philosophical ramifications of cryonics and biostasis, as well as their potential uses in the 21st century and beyond.

One of the world's authorities on nanotechnology will be addressing guests at the affair. We are pleased to announce that Dr. Ralph Merkle, of Xerox PARC, has also accepted an invitation to speak at the anniversary dinner.

Future announcements may include speakers who have not been mentioned here. As the speakers listed above are solely those who have *confirmed* their intention to attend, we are hoping to arrange some pleasant surprises to augment our currently scheduled program.

This is an anniversary affair, and the dress code is black tie optional, although serious consideration must be given to the fact that all men look *fantastic* in tuxedos.

On the Sunday following this affair, April 5, 1992, the monthly Alcor business meeting will be held at the home of Saul Kent and JoAnn Martin. Everyone is encouraged to attend. Tours of the Alcor facility will also be available. Additionally, group rates on hotel accommodations are being offered to Alcor guests by the Marriott Hotel.

This is an excellent opportunity to meet fellow cryonicists from across the country. You can attend this Alcor function by reserving your place now. Until February 15, 1992, the cost will be \$40.00 per person. After that date, \$50.00 will save you a seat. Reservations will be accepted until March 26, 1992, with checks made payable to the *Alcor Foundation*, 12327 Doherty Street, Riverside, CA 92503. You can also make your reservations by calling (800) 367-2228 and using your Visa or Mastercard.

This is not just an event for Alcor members. All are welcome, and we encourage all attendees to bring friends. For further information, contact either Maureen Genteman or Marce Johnson at 310-398-3464.

We look forward to seeing you there!

Membership Status

As of January 7, Alcor has 302 Suspension Members, 445 Associate Members (includes 163 people in the process of becoming Suspension Members), and 20 members in suspension. The figures reported in the February 1991 issue of *Cryonics* for last year at this time were 200 Suspension Members, 572 Associate Members, and 17 members in suspension. (The loss of 127 Associate Members is largely accounted for by change to Suspension Membership of 102 Associate Members.)

Letters to the Editor

Dear Sir,

I would like to express my sincere appreciation and thanks for Mike Darwin's very sensitive article about my husband.

There were those who thought of Walt as a dreamer or visionary, but he felt strongly that there was nothing that science could not achieve, given the resources both available and yet to be developed. He was particularly interested in the tremendous possibilities medicine and space travel would have to offer in the future, and it was because of his curiosity, and his strong belief that cryonic suspension and subsequent reanimation would permit him to see the advances made in these fields, that he chose cryonic suspension.

Yours,
Louise Runkel

Dear Ralph:

After the Socreds banned cryonics in BC (British Columbia), the Premier, Bill Vanderzalm, was caught accepting an envelope full of cash in a hotel room, (it's a long bizarre story) and his government fell. The NDP, the New Democratic Party, got elected. That's "Democratic" as in "The People's Democratic Republic of Soviet Russia." Ontario fell to the NDP some time ago and most recently Saskatchewan came under their loving influence, all with less than half of the popular vote.

I had complained to Rabbitt, the Socred minister in charge of the bill, and he responded by writing to me: "It is one of many consumer protection features of the Act and was included to discourage promotions of an arrangement for which the technology is currently unproven. It does not prohibit cryonics, as such, or the study thereof."

In writing to his successor, I wondered by what twist of logic or doublethink the section doesn't prohibit what it prohibits and how stifling development of new technologies protects the consumer (if it really does prohibit what it prohibits). Perhaps their new government could review this legislation, this new impediment to the struggle for survival, I suggested.

I could have appealed to principles of

freedom, but I don't think they're interested in that.

Yours truly,
Jim Wiebe

Well, some of us still are interested, inasmuch as California is still permitting what it permits and we hope to see it stay that way. Please keep us posted. — Ed.

Dear Sir:

Regarding the November issue of *Cryonics* I think Max More places too much emphasis on the difference between serial and parallel computers. Although a parallel computer can process some programs much faster than a serial computer, Alan Turing proved 40 years ago that any program that can be run on a parallel computer can be run by a serial computer. Concerning philosophical problems it makes no difference.

I also have difficulty with the idea that consciousness can be divorced from intelligence. How in the world could evolution have produced such a thing? Natural selection works only on external attributes not internal feelings, however important they may be to us. I think it much more likely that consciousness is something that must happen when systems get intelligent enough.

As to whether it is moral to enslave a computer 1000 times as intelligent as ourselves. . . I think this is largely academic. More pertinent, do they have the right to enslave us?

Best regards,
John K. Clark
Miami, Florida

Dear Editor:

I am happy to see the discussion now taking place about cryonic funding as the entire project will founder if this problem is not solved. I would like to add some further comments to the debate.

First, I find it most useful to consider a general rise in prices as a depreciation of the currency, not an inflation. The concept of inflation means different things to different people; its original formulation was intended to convince the ignorant that prices were rising because goods were

going up and that increases in the money supply had nothing to do with it. Identifying the problem as a decline in the value of money or a depreciation of the currency keeps one's mind focused on the reality and makes the correct solution simpler.

Second, it is not enough to solve the problem by simply stipulating how much money a cryonics member must put up. Without the benefit of real compound interest, the quantities are simply too much for an average person to accumulate over his lifetime. A person who invests a fixed amount of money at a *real* yield of 5% for each year of his (50 year) working life will come out at the end of that time with 4 times as much money as he has invested. The difficulty of doing this lies in the fact that, since the U.S. adopted its current money system (in 1933), the value of the currency has depreciated faster than interest (on riskless investments) has accumulated. Conservative investors since 1933 have lost money in real terms. Thus, unless the cryonics member is very affluent, without a real return on investment of a significant amount, he will not be able to meet the funding requirement. Further, once a person is in cryonic suspension, he relies on a real yield on his capital to pay for these costs. No one knows how long he will have to remain in suspension; therefore suspension costs must be paid out of yield, not out of capital. So again we come to the conclusion that the cryonics member must seek a real return (hopefully of about 5%) on his capital.

Third, most estimates of the rate at which the currency is depreciating in the U.S. are about 5%/year. This is wrong for several reasons. One, the consumer price index is almost certainly wrong; it was deliberately changed in the early '80s (rents were substituted for housing prices) in order to understate it; and political forces exist with the power and the self-interest to change it again. Two, I have developed three methods of measuring how fast the currency is depreciating which are based on the free market. All three give me numbers very close to 7%, and I think this is more accurate than the government's 5%. Three, it is an important conclusion of Austrian economics that the monetary authorities must continue to *accelerate* their expansion of money and credit. This is because large and powerful institutions become dependent on the ex-

pansion in much the way that a drug addict becomes dependent on his drug. Take away their expansion — or merely continue it at the same rate — and these institutions (of which Chrysler and New York City are examples) will go bankrupt. Therefore, we can expect the rate of money and credit expansion to increase and with it the rate of currency depreciation.

Fourth, there is, in principle, a solution to the cryonics funding problem, but it does not concern any institutional arrangements. It does not really matter whether the cryonics member gives his money to an insurance company or some other institution. What matters is what the institution does with the money.

In the most fundamental sense, money and credit expansion is a system for robbing the creditor and enriching the debtor. It therefore follows that one must avoid being a creditor. One must avoid giving one's money to an institution which will invest it in bonds, T-bills, CDs, savings accounts, etc. All of these are almost certain guarantees of loss because the instruments will not keep pace with the depreciation of the currency. On the other hand, since most joint stock companies are heavily in debt, stocks (as Mr. Best points out [*Cryonics*, October 1991]) not only hold their own in regard to currency depreciation and give a fair (5%) return; they actually *benefit* from it.

The big drawback to investment in stocks (or other capital goods, such as real estate) is that they fluctuate in price sharply. In the 1950s and '60s, the Dow Jones Average went from under 200 up to 1000, a gain that went way ahead of currency depreciation. But in the 1970s, it actually declined in nominal terms (and of course declined substantially in real terms). Then in the '80s it resumed its climb. If we lived in a sound economy, then I would not recommend investment in stocks or real estate for cryonics members. But since we live in an economy with a depreciating currency, it is the only alternative. Either accept the fluctuations in the stock market or accept a substantial capital loss in the bond (or fixed income) market.

However, investment in the stock market has its pitfalls. The vast majority of investors will generally come in to buy at the top and get discouraged and sell at the bottom. The late '60s were a time of widespread public participation in the stock market; but in the early '80s people listened to Dr. Doom (Henry Kaufman) and stayed away. This is known as the

theory of contrary opinion, and it requires more will power and intelligence than most people possess to avoid this pitfall.

However, while not suited to the majority, stocks are very good for the intelligent minority which will use the principles of Austrian theory. In the periods of gloom and doom, it will usually be found that the Federal Reserve is increasing the rate of credit expansion; while the average person is selling out, the Austrian theorist can use this information to buy. And of course when the Federal Reserve temporarily tries to fight "inflation," the Austrian student will see the rising interest rates and sell.

The reasonable man standard of the 19th century would tell the cryonics member to seek an investment which provides preservation of capital plus (approximately) 5% interest. A 19th century financial counselor would tell him to invest in bonds, savings accounts, etc. But such investments do not work today because of the depreciation of the currency. The only way to accumulate money is to invest in an instrument which yields a real return after currency depreciation (such as stocks or real estate). Such investments have to be carefully managed, but in this day and age they are the only way that the problem can be solved.

Sincerely,
Howard S. Katz

Dear *Cryonics*,

I want to respond to Jerry Leaf's short essay, "Leaf's Paradox." Basically the article argued that schemes to achieve something of value by making a copy of oneself would fail because the copy would be no more interested in slaving for the original than the original was interested in slaving for itself. For example, if I wanted to go to Disneyland, but I had to take an exam at school, it would do little good to make a copy of myself to take the exam, because the copy would also want to go to Disneyland.

Before reading the article I had devised a scheme to achieve value based on making copies which I feel remains valid in the face of Jerry Leaf's observations.

The key to my approach is that, unlike the apparently flawed schemes which had been proposed to Jerry Leaf, the value which I am trying to achieve by copying is the same value for the copies as for the original. I try not to distinguish between

the versions. Indeed, emotionally I would probably prefer a copying system in which no version had any way of knowing which was the original. The value I seek should be understandable to any cryonicists — my copies all want our identity to continue.

There is one technical issue. If I made five copies, the six of us would start out with identical memories, desires, beliefs, in other words, the same identities. Over time, however, our experiences would be different, we would learn different things, and our identities would diverge. This brings up the second component of my scheme: frequent re-integration. Often (daily? weekly?) every version of me would have implanted all the memories and other recently added components of identity from the previous period. I am assuming that a technology which is capable of making identical copies (down to the person's identity) would be capable of such re-integration. That assumption is based on the belief that identity is a matter of information. This belief is central to the theory of cryonics, and it seems must be true if perfect copies of a person, including his/her identity, are possible.

Others might object to this kind of merging with another person, even a nearly identical copy, as not something they would want. That is fine; I am not asking anyone to follow me. Because frequent re-integration with multiple copies is what I want, this is what every version of me will want. Because I would re-integrate frequently, no version will have diverged enough from such a basic desire to have changed his mind.

In the tragic event that a version of me were to die (rather than simply deanimate in some reversible fashion), then everything I had learned as that version since my last re-merging would have been lost. I would have achieved my goal, however, in that this death would not have caused the loss of most, or even a large part, of my identity. I would have achieved the continuation of all my identity leading up to the last re-integration, and through the still-living versions a continuity of consciousness.

Having explained my scheme, I would like to make a few closing comments. First, when talking about identical copies of oneself, the golden rule becomes very persuasive. Nonetheless, I would not feel any need to strictly share tasks or resources so that every copy is treated identically at all times. My current life is time-shared across various activities. Sometimes I am watching a great movie, and sometimes I

have some tedious but necessary job to do. Multiple copies could do different things in parallel. With the frequent re-integrations, each copy can honestly believe that it (from an identity standpoint) has done and will have to do the onerous chores, and also has done and will get to do the "fun stuff." There is already more "fun stuff" I would like to do than I can do now anyway, so every copy could have "fun stuff" over time if that made a difference.

Second, Jerry Leaf recounted a strategy to get a copy to do what the original wanted done without doing itself. That strategy was to edit the copy so that the copy did not know it was a copy. To make this work required radical editing of the copy so that it would be incapable of discovering that making copies was possible, lest the copy make a copy of itself to do the task, and so on (Leaf's Paradox).

Instead, if I were going to create a copy specifically to do some undesirable task (and had reached the point where ethically I felt comfortable doing so), I would freely edit the copy so that it wanted, more than anything else, to do the task I had found undesirable. It would be silly to make the crippling edits suggested above. The copy would be more likely to achieve its task if it knew that it was a copy, and simply wanted to do the task for me. Editing out knowledge, or the ability to learn, could only reduce the capability of that

agent I had sent to achieve a task of achieving the task.

Actually, it is not obvious that there is any need to use a copy at all. If you want something done, it is, in many cases, not necessary to do it yourself (or with a copy of yourself). The obvious approach is not to make a copy, but to hire a professional.

Third, any plan which involves making copies where each generation could make copies needs to consider the dangers of exponential growth. The set of all my copies would be some size (fixed by my resources, and the resources per copy I feel comfortable with). The number of copies would not be increased, unless I made an honest increase in my resources that I wished to use supporting a larger number of copies rather than increasing the resources per copy. Indeed, depending on the technical approach of the re-integration, the number of copies might vary each period as one technique to meet various short-term objectives.

Fourth, if the re-integration consists of joining all copies into a single object, and then copying that object, there is a danger of a single-point failure on the single object killing the entire identity. As a technique, it might be safer to divide copies into several different groups each period, and have each group re-integrate separately. If N copies are divided into no more than $N^{1/M}$ groups, then every copy will have had integrated into it the ele-

ments of every other copy from no more than M periods ago. (So, if you have 9 copies, re-integrated in 3 groups every day, then every copy will have every memory which is at least 2 days old from every other copy.)

Finally, I understand that Mike Darwin has a fundamental objection to schemes such as mine (if I have misunderstood him, I apologize in advance). Basically, if an individual is, from a biological perspective, part of a community of clones, then a natural tendency is for those individuals to become something like ants with respect to that community. In particular, individuals become expendable like ants.

My personal response is that, viewing my identity as information, I do not feel that my identity is lost if a copy is lost. One could burn a single edition of Shakespeare, but the plays would still be available. Unlike books, however, human beings feel pain. I would not want any version of me to feel a painful death. I would want to recover the redundancy and safety lost when a copy is lost, but I am much more willing to face losing a copy than to risk losing every copy. If someone does not accept these personal feelings for himself, then he should consider some other approach.

Sincerely yours,
Tom McKendree

In For The Kill

H. Jackson Zinn

Preface

"I never met a Californian who was worth a cup of warm spit." — Texan to Californian Jack Nicholson in *The Border*.

"You are living in the wickedest, most corrupt, depraved and godless city on earth." — Priest Spencer Tracy to Jeanette MacDonald in *San Francisco*. (This line always meets with wild cheers from San Francisco audiences.)

"When it's 110 in Oklahoma City, it's 58 in L.A. When it's 10 in Oklahoma City,

it's 58 in L.A. People in L.A. ask me why I go back to Oklahoma City. I tell them, "There's a half million honest, decent people in Oklahoma City, 58 in L.A." — Comedian Argus Hamilton

Roe v. Mitchell Update

California, which should be the last entity to tell people the right and wrong of anything, will probably be the first entity to judicially determine the right and wrong of cryonics in a decision which will be binding in California and persuasive in other states. The Cryonics Institute and the

International Cryonics Foundation have filed a joint amicus (friend of the court) brief in support of the Alcor Life Extension Foundation in this historic legal battle. Connie Ettinger and I submitted arguments that the right to cryonic suspension is guaranteed by the Ninth, Tenth, and Fourteenth amendments to the United States Constitution, and by additional guarantees embodied in the California State Constitution, which specifically mentions the right to privacy.

Our own efforts in this case are marginal. The major effort has been, and will be, by the Alcorians. The case wherein Dr.

Donaldson seeks to be frozen prior to clinical death should be decided prior to this case, and could provide additional support for our arguments.

The Attorney General's Office has asked for more time to answer our amicus brief. They need it, in my humble opinion. Tammy Chung of that office detailed a crushing caseload which would make it impossible for her to respond to our brief under normal deadlines. Her regular appeal brief should be considered an embarrassment. Her primary authority was an Attorney General's Opinion of several years ago, wherein the attorney general opined that cryonic suspension was not a scientific use authorized under the Uniform Anatomical Gift Act. You know you're in trouble when you have to start citing yourself! The Attorney General's opinions have zero effect in imparting the authority of law in the courts. However, they have hampered cryonics somewhat because state officials normally rely on the attorney general's office in deciding how to carry out their administrative duties. At least one cryonic suspension was prevented by the reliance of a Bay Area undertaker upon the attorney general's opinion, conveyed through the Department of Health Services.

Why did I decide to get involved in this case? In part, I got into it because I smell blood. Remember the dogs in *Call of*

Excerpt from the Amicus Brief

Prepared by Constance Ettinger and H. Jackson Zinn:

The Fourteenth Amendment provides that no state shall "deprive any person of life, liberty, or property without due process of law." While much media attention has recently focused upon the so-called "right to die" cases, that is not what this case is about. On the contrary, this case concerns the right to live. By being cryonically suspended, those individuals who have indicated their wish to do so have also indicated their hope that they may, in the future, with the aid of new and advanced technologies, be able, again, to return to the life state they once enjoyed, or an improved one.

What this case is actually about is Alcor's attempt, along with that of the The Cryonics Institute and The International Cryonics Foundation, to discard the long-held and erroneous notion that "dead is dead." Certainly, many individuals with conditions once considered necessarily terminal are alive and well, due to advances in medical technology. Who can say, with any degree of certainty, that the notion of reanimation after cryonic suspension is any more outrageous than the notion of penicillin once was, or heart transplantation? Yet this is precisely what Appellants have accomplished by virtue of their actions which arguable renders cryonic suspension in California, per se, illegal.

The recent exploits of Dr. Kevorkian in Michigan have riveted the Nation's attention on the right of an individual to make a determination to end his or her own life. Numerous legal battles have been fought in an attempt to prevent individuals who sincerely wish to die from achieving their goal. In our society, every presumption favors the preservation of life. One cannot even begin to imagine a scenario under which medical treatment would be discontinued to an individual who had expressly requested its continuation. Yet, this is precisely the situation presented by the instant case.

the Wild? They would watch two dogs fighting each other. When one dog appeared bloodied and inevitably defeated,

they would jump in to finish him off. That's me, a dog in for the kill — and the life which will spring from it.

For The Record

Suspension Failures: The Dark Side Of Cryonics History

Michael Perry

In highlighting the history of any movement, one expects to find the good, the bad, and the outrageous: heroism, stupidity, perseverance, malfeasance, setbacks, suffering, and triumph. Cryonics is no exception, and if you are looking for a darker side you will not be disappointed. In fact a fair amount of cryonics history is tragic, shocking, and gruesome. This is for

the simple reason that patients can thaw out and have. It was not easy to get people frozen and keep them that way, particularly when cryonics organizations were first starting up and people didn't know what they were getting into. A body that is not kept frozen is not a pleasant thing, even by non-cryonics standards, and the early failures were many.



Nevertheless these disasters need to be documented, if for no other reason than to make it less likely that such mistakes will happen again. The subject is complex and difficult to approach, and only a brief summary is possible here. I will concentrate most on *what* happened — who was thawed, where, and when. Other issues such as who was at fault and by how

much have their place too, but are not the main focus here. It should be kept in mind that accurate information on suspension failures is often hard to come by. I have talked with most of the people who were involved and have looked at records, but more research needs to be done. What follows is the best reconstruction I am able to make, and I believe the dates are accurate to within a year or two in the worst cases.

There were three organizations in the early days (starting in the 1960s) that did freezings: Cryocare Corporation in Phoenix, Arizona, headed by Ed Hope; Cryonics Society of New York (CS-NY), New York City area, headed by Curtis Henderson, and Cryonics Society of California (CSC), Los Angeles area, headed by Robert Nelson.

Cryocare, properly speaking, did not do cryonic suspensions but only straight freezings to liquid nitrogen temperature, in capsules they manufactured. These freezings were advertised as being for cosmetic purposes rather than eventual reanimation,¹ but Cryocare would also store a person suspended elsewhere, as they did in fact with the first suspendee, James Bedford. Cryocare president Ed Hope was a wigmaker whose main interest in human freezing was financial. When, after two years or so, he saw that the operation wasn't going to return a profit, he ended it, turning any remaining patients over to other organizations or back to relatives. One individual who had been briefly stored by him was a Mrs. Schulman who was autopsied prior to being frozen in 1967, and whose son hauled her around in a truck for a time, on dry ice. She was soon turned over to a mortuary by the son and buried. Another of his patients, Louis Nisco, who was also frozen in 1967, ended up at CSC because they offered the lowest storage rates. A third patient was Donald Kester, Sr. who committed suicide in July 1968. He was thawed and buried by his son a year or so later.²

Robert Nelson meanwhile had frozen Bedford, who was promptly turned over to relatives and miraculously escaped eventual thawing. Nelson subsequently froze three others, Marie Phelps-Sweet, Helen Kline, and Russ Stanley, who were kept in dry ice at a mortuary for a year or two.

By the time Nisco arrived from Cryocare in his capsule, the mortician who assisted Nelson, Joseph Klockgether, was

very uncomfortable with having three bodies in dry ice in his garage. So he and Nelson had the capsule cut open, removed Nisco and an interior support, then crammed Nisco and the other three back inside. I was told some were put in head first, some feet first, and "it was like putting together a chinese puzzle." The placement took all night. The bodies were not

The main lesson to be drawn from this tale of woe, I think, is that cryonic suspensions should only be maintained by those who have a strong personal interest in being frozen themselves.

deliberately thawed but must have suffered a great deal of warming, though according to Klockgether they were still mostly frozen. Then a welder resealed the capsule (which required a wait of several more hours) and it was refilled with liquid nitrogen. It remained at the mortuary for awhile, about a year or so, tended by Klockgether, who refilled it periodically. However, this caused increasing problems because of the liquid nitrogen delivery trucks which showed up frequently (a very unusual occurrence at a mortuary).

Nelson meanwhile was constructing a "storage facility," an underground vault at a cemetery in Chatsworth, a suburb on the northwest side of Los Angeles. On May 15, 1970, the capsule with the four in it was lowered into the vault. Nelson, in a court document, stated that despite the fact that funds to maintain the capsule were no longer being supplied by relatives, he maintained it "for an additional one-and-a-half years."³ It appears then that he quietly let the four bodies thaw, not later than around the end of 1971.

CSNY froze their first patient, Steven Mandell, in July 1968. His capsule was eventually removed by his mother, who wanted to pay lower rates, and sent to Nelson. Their next, Andrew Mihok in Nov. 1968, only remained frozen (at dry ice temperature) for a few hours before relatives changed their minds and had him thawed. Their third freezing was that of Ann De Blasio in Jan. 1969. Eventually she was removed by her husband, Nicholas, and placed in an underground vault in New Jersey, which Nelson helped Nicholas set up. Their fourth and fifth, Paul Hurst (Mar. 1969) and Herman Greenberg (May 1970) would eventually

be returned to a mortician and buried, after the relatives stopped paying for maintenance. Their sixth, Clara Dostal (Dec. 1972), was soon returned to relatives and, after some overtures to Nelson that didn't pan out, also buried. Finally, in 1976 CSNY suspended Michael Baburka, Sr., who was then stored privately by his son for a year or two, before being thawed and buried.

CSNY stored their patients above-ground and they were reasonably well cared for. Moreover, although relatives funded the suspensions, they were also required to furnish the storage capsules, and would receive these capsules back if funding terminated. CSNY did not take direct responsibility for thawing a patient, but physical custody would be transferred first, usually to a relative, a policy that protected against the sort of legal action that would later be brought against CSC.

Robert Nelson meanwhile had frozen two individuals, Mildred Harris (Sep. 1970), and an 8-year-old girl, Genevieve de la Poterie (Jan. 1972). Both were kept on dry ice for a while. When Steven Mandell arrived (see above), the capsule was opened and these two were placed inside along with the original patient. (Possibly the capsule arrived before the freezing of the little girl.) The capsule was then stored in the Chatsworth crypt. The capsule had been manufactured by Cryocare, and had problems with the vacuum insulation which required frequent pumping to harden the vacuum and keep the boiloff of liquid nitrogen to a reasonable rate. Evidently it was not checked nearly as often as it should have been. Sometime around mid-1974 it was found to have failed and been without liquid nitrogen for "a long interval."³ I would date the termination of these three suspensions from this time (or possibly earlier, if there were earlier failures of this sort), although the capsule was refilled and maintained, again according to Nelson's testimony, for several more years.²

In October 1974 Nelson froze a little boy who had died of leukemia (name withheld by relatives' request). The boy was maintained, though poorly, for several years, until the suspension was terminated in April 1979 by the father. Nelson apparently handled the maintenance at first, then turned this task over to the father, who dealt directly with the liquid nitrogen

supplier. When the capsule was opened it was found that, although the body was frozen, at some earlier time it had thawed and, on refreezing, the head had split open. Still the body was said to have been "in great shape — from an embalmer's point of view." It was then placed in a casket for viewing by the family prior to burial.

In July 1976 Nelson froze a man, Pedro Ledesma, who had died the previous year and been kept by a relative in a mortuary refrigerator at above-freezing temperature. Since some ten months elapsed between death and freezing, this "suspension" could hardly have been viable. Ledesma, however, was placed in the capsule with the boy, and removed from suspension at the same time. (The capsule stood upright, with a removable lid, whereas Nelson's other capsules were horizontal and welded shut when in use.)

Nelson's freezing operations ended with the thawing of Ledesma and the boy. After that he and Klockgether were brought to trial by irate relatives of some of the other patients. They were found

guilty, Nelson of fraud and both of intentional infliction of emotional distress, and fined nearly a million dollars. Klockgether's insurance paid his share, amounting to \$400,000. Nelson appealed, lost, but never paid anything. Some others who were peripherally involved and had nothing to do with the loss of the patients also paid thousands of dollars in an out of court settlement. In all there were nine frozen people stored — and thawed — at the Chatsworth site. Chatsworth became a byword for disaster in cryonics, and Nelson was excoriated as a liar, cheat, and even mass-murderer, though Klockgether was viewed more tolerantly. The question of guilt vs. innocence vs. simple stupidity, and of how much blame to assign to which people is complicated, and calls for further research.

Nicholas De Blasio was living in the vicinity of New York City when his wife Ann died in January 1969. I understand his being a gun-toting policeman helped in prodding reluctant hospital officials to cooperate quickly in her freezing, which

was carried out by CSNY. His wife was stored for a time at CSNY's facility, but Nelson convinced De Blasio she could be stored at a "home-grown" site more cheaply, and helped him set up this "facility," a Chatsworth-style vault on a smaller scale, in a cemetery in Butler, New Jersey. De Blasio's site was operated under the aegis of CSC for several years, which allowed them to boast of an East Coast facility in their promotional literature.

In November 1972 CSC froze a middle-aged woman (name withheld by relatives' request) who was transferred to the New Jersey site. She and Mrs. De Blasio were stored for several years in an upright capsule which was checked only at intervals of several weeks. It had a removable lid, and over the years its vacuum evidently softened so that the lid became ice-bound and was difficult to break loose when the capsule was opened. At some point, around 1980, the capsule was handled so roughly in removing the lid that the vacuum jacket was punctured. The danger to the patients was not appreciated, and

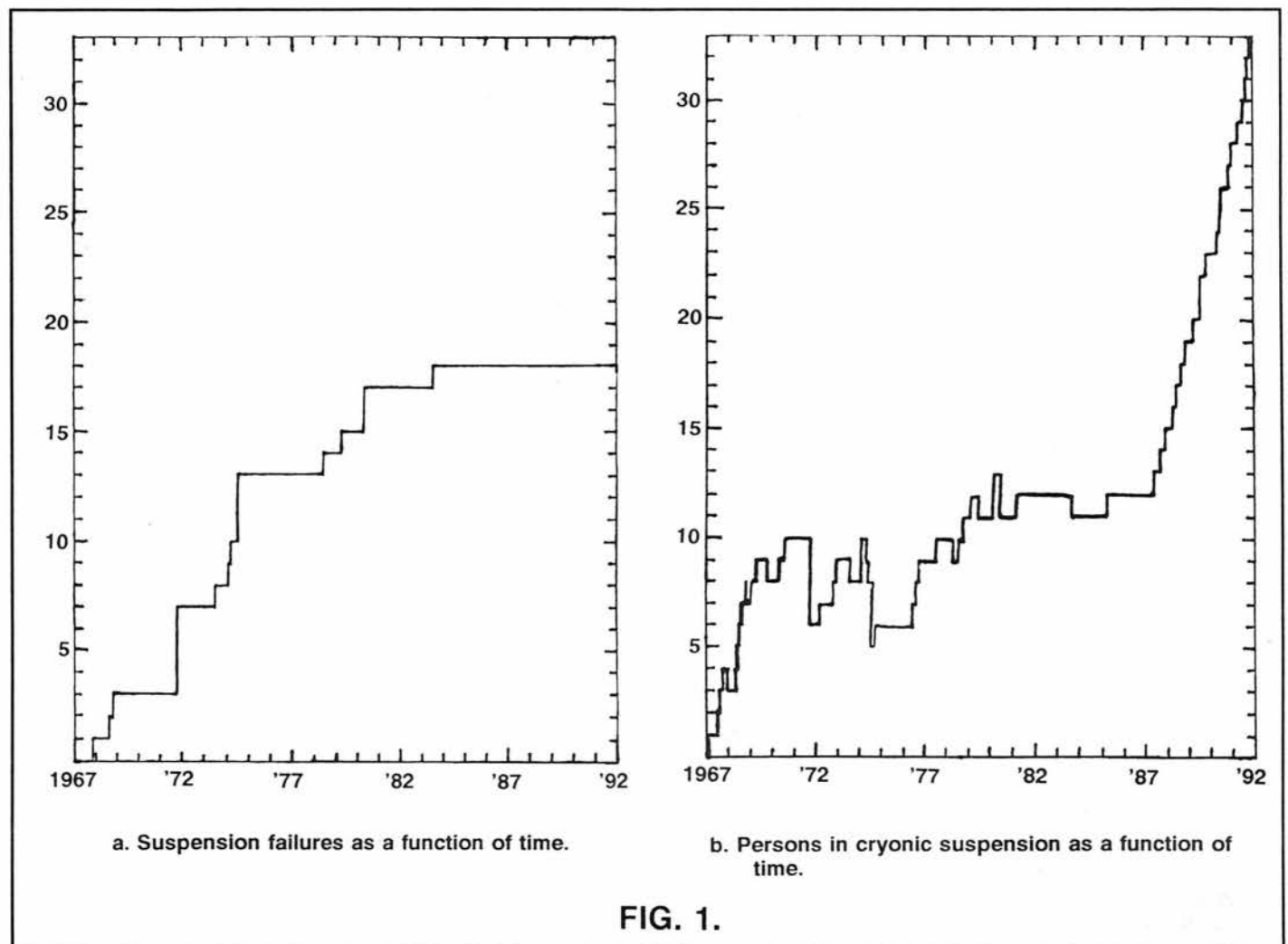


FIG. 1.

soon the unattended capsule boiled out its liquid and the patients thawed and began to rot. They were cooled down again with dry ice, to control the smell, then this effort too was abandoned. Mike Darwin eventually was called in to help clean up (assisted by Joe Allen) and spent several days scraping out human remains under indescribable conditions.

The last suspension failure was that of Samuel Berkowitz, who was frozen in July 1978 and stored at Trans Time in northern California. As happened so often in the past, his continuing maintenance was funded by relatives. As also happened so often, after a while the relatives began to lose interest and/or the wherewithal. I understand that an offer was made to continue the suspension as a neuro (head-only) free of charge, but the relatives turned it down. Instead in October 1983 they had Berkowitz thawed, submerged in formaldehyde, and buried that way.⁵ No attempt was made to specifically preserve the brain.

The main lesson to be drawn from this tale of woe, I think, is that cryonic suspensions should only be maintained by those who have a strong personal interest in being frozen themselves. This includes the financial backers as well as those in charge of daily care. Thus for example, Nelson and De Blasio did not seem to have much personal interest, nor did relatives who let other patients thaw. On the other hand, I know of other cases where relatives who *did* have a personal interest, but were short of funds, initiated suspensions that are still in effect after more than a decade. Those who are personally committed generally have superior judgment and realize the ad-

visability of the neuro option in cases where funds are limited. Such people will fight hard to maintain even someone they hardly knew, who is *not* a relative, as happened during the Dora Kent crisis for instance. They are not afraid to take measures others squeamishly shun, when a patient's survival is at stake. Neuroconversions carried out by such people have saved several patients whose funding ran out. Not one of the many suspension failures was a neuro.

Accompanying graphs, Fig. 1, show (a) the number of suspension failures as a function of time, and (b) the number of people in cryonic suspension as a function of time. Again, some of my dates are approximate, but I don't think the graphs will be seriously affected by a shift of a year or two in a few cases. In compiling these statistics a few ground rules were adopted. Only cases involving public cryonics facilities for at least some of the maintenance of the patient are considered. Permafrost burials are excluded. Two cases are omitted because it seems highly doubtful the patients were viable when frozen: the first freezing in 1966, which followed only after a long interval of unfrozen storage, and the Ledesma freezing of 1976, for the same reason. (Some other cases may not have been viable too, but the benefit of the doubt is given where information is lacking.)

The results are sobering: out of 51 suspensions to date, fully 18 ended in failure, while 33 continue. If there is a silver lining in this, it can be seen in overall trends. Suspension failures, so numerous in the past, have not occurred for nearly a decade. Most of the failures, in fact, hap-

pened prior to 1977 and thus well before the midpoint of the quarter-century that suspensions have been going on. At the same time, cryonic suspensions have dramatically increased in recent years. There are still lessons to be learned, possibly quite painful ones, but cryonics seems to be entering a new era of strength, stability, and continued growth. Let's hope this trend continues.

References:

1. *Chicago Daily News* Jan. 29, 1968 p.4, reprinted in *Freeze-Wait-Reanimate* 43 (Feb. 1968) p.3.
 2. *Cryonics Reports* Sep. 1966 p. 166 and *CFDA Newsbulletin* Nov.-Dec. 1968 p.2.
 3. Los Angeles Superior Court case no. C 161229, 2nd civil no. 63721; Appellant Robert F. Nelson's settled statement ... (20 May 1982) pp. 10-12.
 4. Los Angeles Superior Court case no. C 161229; Supplemental answers to interrogatories ... (22 July 1980) p. 14.
 5. *Cryonics* Dec. 1983 p. 1.
- See also *Cryonics* Oct. 1990 pp. 4-5.

I am also indebted to those who, in one way or another, contributed material used in this article, mainly: Fred and Linda Chamberlain, Mike Darwin, Curtis Henderson, Saul Kent, Joseph Klockgether, and Robert Nelson.

It's time to bring lowly magnesium, one of the most important biologically active substances, out of the closet and into the practical world. In what follows, I will try to close some of the magnesium knowledge gap, putting in a little more detail than usual to make up for the lack of general information in the lay literature. My subtext, as in previous columns, is the often striking difference between the value of information, in terms of life, and the value of the same information in terms of money.

Magnesium Everywhere: The Cosmic Perspective

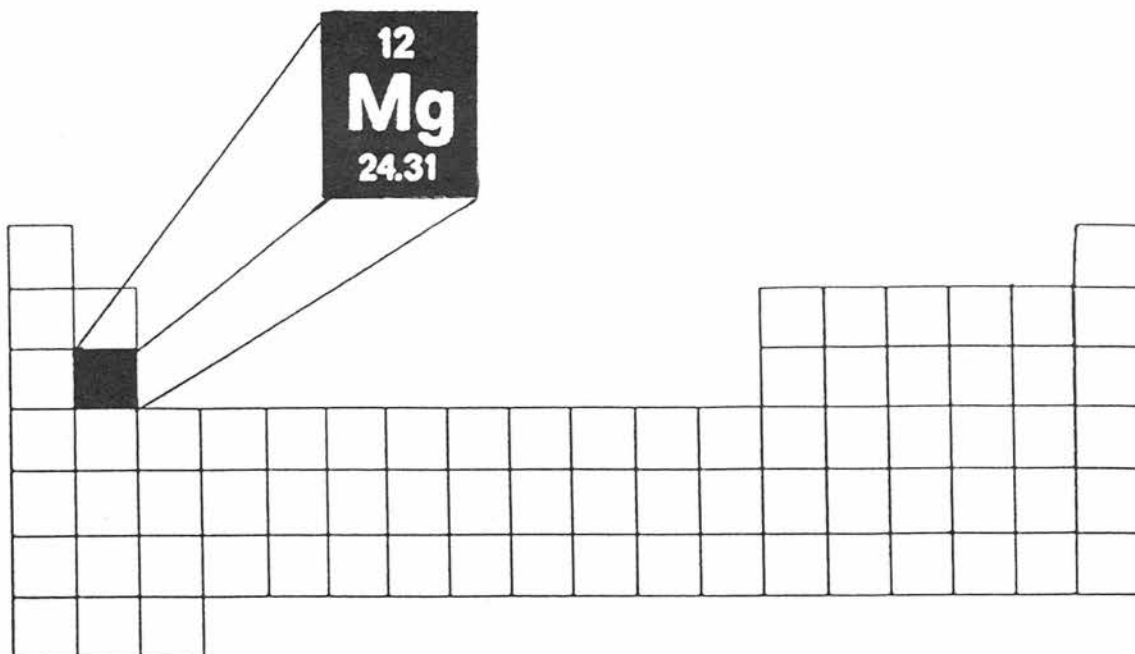
According to current theory, all but the five simplest chemical elements in the

Magnesium The Forgotten Mineral

Steven B. Harris, M.D.

The topic of this month's essay is *magnesium*, a simple nutrient which is deserving of far more attention than it has traditionally gotten from physicians and nutritionists. Because the major effects of marginal magnesium deficiency involve the cardiovascular system, magnesium also deserves to be of particular interest to *cryonicists* as a possible preventive sup-

plement, yet oddly enough this mineral has been neglected in the so-called "life extension" literature as well. Magnesium seems to have been forgotten all around, then, save among the rather exclusive group of scientists who have an ivory tower passion for it. (There are at least two biological scientific journals devoted almost entirely to magnesium.)



universe were synthesized by exploding stars ages ago, and subsequently scattered across space in cosmic dust for later use in "second generation" solar systems like our own. In the synthetic process inside stars the lightest and simplest synthesized elements (from element 6 up to about element 26) greatly won out in overall abundance, because producing them was energetically favorable. Magnesium is element number 12, and is thus very common in the universe.

Here on the outer crust of the Earth the relative abundance of the chemical elements was determined not only by their overall abundance in the dust and gas cloud out of which our solar system condensed, but also by their physical/chemical properties. Of the eight most common elements in the universe, *helium* and *neon* (elements 2 and 10) are light inert gases, and most of our planet's supply quickly escaped into space long ago. *Silicon* and *oxygen* (elements 14 and 8) along with trapped metals became the major building blocks of the Earth's crust. *Hydrogen*, *carbon*, *nitrogen*, (elements 1, 6 and 7) along with oxygen, form many liquid and gaseous compounds at Earth temperatures, and these elements therefore collected in the atmosphere and oceans, where life formed from them. Finally, *magnesium* (the eighth most common element) and some other less common soluble metal salts (e.g. sodium, potassium, and calcium) leached out of the crust under the action of erosion, and collected slowly over time in the oceans, where the ever-opportunistic chemistry of life eventually made use of

them too.

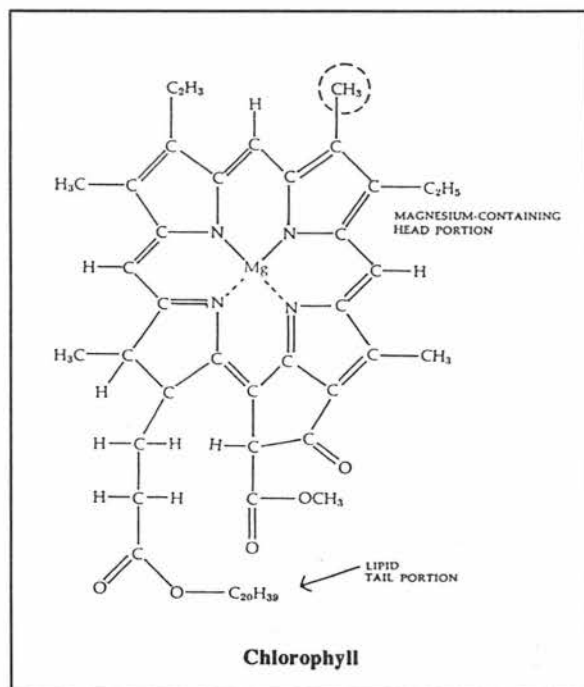
We usually think of magnesium as a light, silvery metal which is useful for making flares and lightweight devices. Magnesium is too chemically reactive to ever appear naturally as the free metal, however. Instead, magnesium is always found in nature in ionic form (each atom missing two electrons), and as such it occurs dissolved in colorless solutions, or locked in combination with other elements in white or clear crystalline salts. The magnesium ion's relatively small size and energetic interaction with water give most magnesium compounds good solubility, and this property has helped to make magnesium a major dissolved component of ocean water. As a dissolved metal, magnesium is second in abundance only to sodium in the oceans of today.

The Biology of Magnesium

The ubiquitous biological role of magnesium is probably partly a reflection of its abundance in the early oceans. Although life is sometimes thought of in first approximation as a chemical reaction of water, nucleic acids, and protein, a better description is that life is a chemical reaction of water, nucleic acids, protein, and magnesium. Magnesium is everywhere in

cellular metabolism; so much so that it is unlikely that there is a working molecular biology laboratory on the planet which does not have a bottle of magnesium chloride on the shelf.

Life makes use of magnesium in a staggering variety of ways. For instance, each molecule of chlorophyll, the green pigment whose absorption of sunlight powers (directly or indirectly) nearly all Earth-life, contains an essential atom of magnesium at its center. Elsewhere in the cell, the magnesium ion's affinity for ionized phosphate groups attracts magnesium ions to the backbones of nucleic



acids, and this property is so useful for controlling the negative charge of phosphates that most enzymes which manipulate phosphate or DNA or RNA, use and require magnesium to do their jobs. Thus, magnesium is required for the function of ribosomes (which contain RNA), and is also required for the protein phosphorylation reactions which regulate cellular metabolism and cell division (including some reactions involved in the initiation of cancer). Because

ATP-manipulating enzymes all require magnesium, the mineral is involved not only in cellular energy production, but also in control of all energy utilizing processes, such as maintenance of cell electrical excitability in muscles and nerves (all cells maintain an

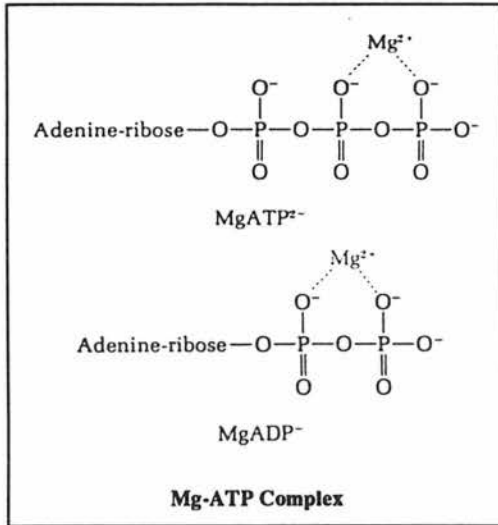
electrical charge by means of a membrane-bound "ion pump" which "burns" ATP and needs magnesium to do it). At least 300 enzymes in the body require (or at least prefer) the presence of magnesium to work.

Magnesium in the Human Body

The most abundant elements (by weight) in the human body, in order, are oxygen, carbon, hydrogen, nitrogen, calcium, phosphorus, potassium, sulfur, sodium, chlorine, and magnesium. About one atom in 10,000 in the body is a magnesium atom. Half of the body's 25 grams or so of magnesium is in the skeleton, where most of it appears to be crystallized along with the calcium salts that keep the skeleton rigid. The rest of the body's supply is distributed in tissues, but inequitably. Although only two-thirds of the body's water is inside the body's cells, more than 99% of the body's dissolved magnesium is sequestered there. Over evolutionary time cells have learned to zealously guard their magnesium supply by pumping it across their membranes to their interiors, and for this reason magnesium is the second most abundant metallic ion inside cells, just as it is in the sea.

Normal Magnesium Nutrition

As might be expected, magnesium is quite widely distributed in food, being in particularly good supply in green vegetables (due to the magnesium in chlorophyll), and nuts, grains and legumes (seeds store magnesium against the need to generate a lot of ATP and make a lot of chlorophyll quickly). Milk also (not



surprisingly) contains a fair amount of magnesium. Magnesium nutrition also receives a boost from the fact that the body is a hoarder of magnesium, capable of cutting urinary excretion of the mineral nearly to zero when reserves are low, and at the same time increasing the fraction of mag-

nesium absorbed from the diet. All this suggests that magnesium nutrition might not be a difficult dietary problem, but for all of it nutritionists are still unsure of how much magnesium the body needs for optimal health.

The difficulty is conflicting data. Some mineral balance studies (where scientists see how much mineral intake is required to maintain a normal body supply) have suggested that a dietary intake of as little as 200 mg of magnesium a day is adequate for most people, while at least one study has concluded that 700 mg a day is required for optimal magnesium balance. Most study results have tended toward numbers at the low end of this scale (especially recently as techniques for magnesium measurement have been refined), and the Food and Nutrition Board of the National Academy of Sciences has used these later experiments to suggest an RDA magnesium requirement (as of the most current 1989 recommendations) of 4.5 mg/kg body wt/day. This figure corresponds to about 350 mg per day for men and 280 mg per day for women.

The current RDA pleases those who believe in the 200 mg balance studies, and concerns those who believe in the 700 mg ones. To make matters even more controversial, recent dietary studies have put

the average American magnesium intake at about 325 mg per day for the average man and 215 mg for the average woman, and the relatively large number of people (especially women) this leaves below the RDA in the U.S. makes no one happy (personal variation in intake due to diet variation is extremely wide for magnesium, so many fall far below the RDA figure).

Currently some nutritionists, perhaps partly in response to these intake figures, but also citing their favorite balance studies, have suggested manipulating the RDA downward yet again. Changing formal parameters of concern is one time-honored way to make public health problems both appear and disappear, and indeed the magnesium RDAs for 1989 are already some 15% less than they were for 1980. Other nutritionists, by contrast, are scandalized by the idea, pointing out that the present RDA of 4.5 mg/kg already makes some rather optimistic assumptions (for instance, the assumption that magnesium absorption will be around 50%, when 30% is a more realistic figure at these dietary intakes). Most readers will not be surprised that such bickering among "objective" nutrition scientists is not a new thing, and is not confined to the subject of magnesium. (In fact, in-fighting about downward adjustment of a number of RDAs contributed to the furor which caused proposed new RDA Recommendations in 1985 to be suppressed and ultimately to never appear.) But all this is not much help in trying to decide what to do about supplementation.

At present, the situation is not resolved. The only thing that nutritionists do seem to agree on today is that, because of less and less consumption of whole grains and vegetables in the "Western diet" in the present era, we moderns eat significantly less magnesium than was eaten in the good old days. Refining the wheat germ out of flour, for example, mills out 80% of the magnesium ("enrichment" does not put it back), and other kinds of refining cause problems with other products. For instance, because sea salt contains 12% as much magnesium as sodium, it was once a significant source of magnesium in the diet. But the magnesium compounds in sea salt are hygroscopic (water absorbing), making the natural product "cake" in humid weather. Thus, when the Morton salt company was at last able to get rid of the pesky magnesium in their table salt early in this century, they were able to trumpet the fact on their label ("When it rains, it pours!"). Today we per-

haps have less cause to celebrate such convenience, and more cause to ponder whether a refined mineral product which bears much less chemical resemblance to the natural mineral content of the oceans where life began, might not have hidden drawbacks.

Short-Term and Severe Magnesium Deficiency

A major reason for the lack of serious concern among experts over the possibility of widespread marginal magnesium deficiency, is that symptoms resulting from dietary magnesium deficiency alone have never been clearly identified in humans outside of a single highly artificial experiment. In that experiment a prolonged very low magnesium diet lasting from one to four months produced (on a variable basis, depending on the volunteer) personality changes and other neurological symptoms such as nausea and anorexia, along with muscle signs and symptoms (stiffness, spasm, tremor) which were almost certainly the product of the low blood calcium levels that always accompany severe magnesium deficiency. These were the only symptoms clearly identified, and not all of them affected everyone in the study.

In contrast, since the year 1934, magnesium deficiency states have been diagnosed in many patients who had other identifiable diseases, but in all these cases symptoms have been far more difficult to separate from those of the disease in question, and the diagnosis of magnesium deficiency has been made presumptively by lab test. This kind of diagnosis in the face of confounding factors is often unsatisfactory, since it is difficult to tell what a "low" number on a lab test means, if one can't associate that number for sure with a specific symptom.

One difficulty with trying to nail down magnesium deficiency is the previously noted fact that only 1% of the body's magnesium is present in the extracellular fluid, and so it is not surprising that magnesium levels in blood plasma are not a sensitive indicator of bodily magnesium depletion. In fact, in experimentally induced magnesium deficiency in humans and animals, plasma magnesium levels do not begin to decline until at least 20% of the body's magnesium has been depleted. When found, then, low plasma magnesium is a reliable indicator of magnesium depletion, but when not found, depletion is not ruled out. The separate

stores ("pools") of magnesium in the body are known to be able to vary somewhat independently of each other, and there have been numerous reports describing chronically magnesium-depleted people who have normal magnesiums in the blood plasma outside their cells, but low levels of the mineral inside their cells (i.e., low "intracellular" magnesium). It is the intracellular magnesium concentration which is biochemically important, but unfortunately for today's physician, reliable and universally accepted intracellular magnesium assays have yet to be developed clinically. The probability, then, is that biochemical magnesium deficiency (now known to be widespread on the basis of plasma levels), will be found to be even more common when more sensitive intracellular assays become standardized.

Very-Long-Term Magnesium Deficiency in Animals

Animals made severely magnesium deficient develop tetany and die in sudden convulsions, an extension of the neuromuscular symptoms seen in humans. If this were the only effect of magnesium deficiency, the mineral would be of little interest, since apparently nobody has ever convincingly identified such an occurrence in a human.

At lesser levels of chronic magnesium restriction, however, lab animals develop more subtle problems. One is soft tissue calcification, which is exacerbated by dietary calcium and which is preventable by adding magnesium to the diet in sufficient amounts. Why this happens is unknown since magnesium is involved in so many fundamental cellular processes that the biochemistry has not been untangled. It does seem likely that there is an optimal ratio of dietary magnesium to calcium for humans as well as animals, but we do not know what it is (the oft-heard quote of a 1:2 dietary ratio

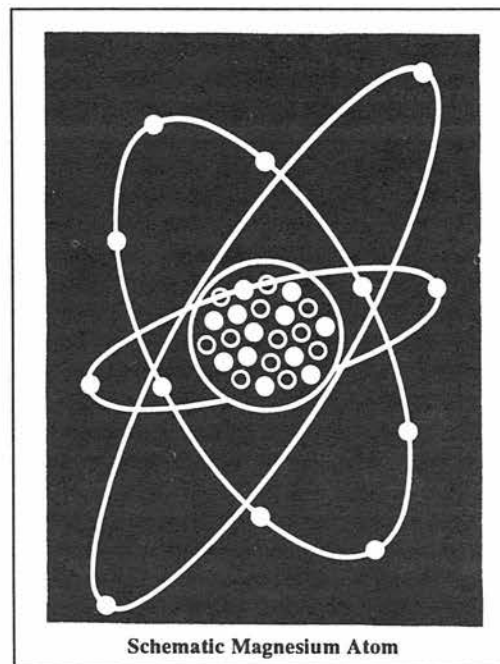
or supplement ratio appears to be no more than an oft-repeated guess).

Somewhat related to the calcification findings, but of more direct interest to the health-minded, is that the *atherosclerosis* which several species of lab animals develop on experimental very high fat and cholesterol diets may *also* be partly prevented by feeding high levels of magnesium. (Interestingly, magnesium did not affect serum cholesterol in many of these experiments, nor does it seem to in humans; apparently it acts directly on the vessel wall to prevent plaque formation). In a 1990 study in rabbits eating a high cholesterol atherogenic diet, oral magnesium supplements were found to protect against aortic atherosclerosis in a dose-dependent manner. Calcium metabolism was implicated, and the authors speculated that the results might be due to magnesium blockage of certain calcium-mediated processes in arterial epithelial cells which are known to be associated with atherosclerotic changes (footnote 1). The modern results in rabbits were reminiscent of earlier experiments on rats in the 1950s, in which fatty diets had been found to induce typical "low-magnesium" type calcified atherosclerotic lesions in rat aortas and

kidneys, even in animals receiving what would be considered to be large amounts of dietary magnesium. Nevertheless, these lesions were preventable with yet larger doses of magnesium, indicating that here again some kind of artificial magnesium deficiency was being produced by the high fat diet.

In both rats and rabbits, there was found to be typically no clear threshold for

magnesium's action, and the beneficial effects of magnesium continued with increasing dose, all the way from "subnormal" to "supranormal" dietary levels far



Schematic Magnesium Atom

(1): *Arteriosclerosis*, 10(5), 732-7 (Sep-Oct 1990); *Ann N Y Acad Sci* 598, 444-57 (1990).

greater than the highest human intake. Evidence exists, then, that the magnesium requirement is not a hard and fast number, but instead may be as sensitive to dietary intake of fat and cholesterol as it is to intake of calcium. Furthermore, formal balance studies may be far from the optimal way to tell if enough magnesium is being consumed to prevent abnormal calcium and cholesterol metabolism. The only way to tell that may be to do lifetime feeding studies and look at the results, which of course is a problem if you are interested in results for humans.

As it happens, humans eating a Western diet develop a certain amount of chronic tissue calcification and atherosclerosis as a (supposedly) normal consequence of aging, and the most disturbing thing about magnesium nutrition is the suggestion from animal studies that (if human physiology reacts like that of rats and rabbits (footnote 2) some of the expected effects of human chronic marginal magnesium deficiency will be of a type that will be indistinguishable from "normal" age-related chronic disease (one can hardly imagine a more perverse nutritional deficiency than one that is widespread and which mimics aging!).

Bolstering the idea that magnesium nutrition is tied up with atherosclerosis in

(2): Undoubtedly species differ in magnesium requirement and tolerance. For instance, the vast majority (70 to 85%) of urinary stones in domestic cats are composed of struvite (magnesium ammonium phosphate), and this suggests that high magnesium diets are not good for cats (so don't give your cat magnesium or human mineral supplements). Such a magnesium sensitivity in cats wouldn't be too surprising given that cats are obligate carnivores with a normal diet quite low in magnesium. For each species, nutritional tolerances and requirements for individual nutrients are an evolutionary accommodation to the species' natural diet. Cats have an almost infinite tolerance for dietary protein, cholesterol, and fat, and never get atherosclerosis. By contrast, humans and other primates seem to react to even moderately high fat and cholesterol diets in much the same way as vegetarian animals (i.e., by getting high blood cholesterol levels and heart disease), so it may be that human magnesium requirements and tolerances are also more in line with those of the more vegetarian animals. Certainly struvite stones in humans are rare, and when they do occur have more immediate causes than high dietary magnesium intake.

humans (but again falling well short of proof) are a great many epidemiological studies which find a correlation between a lessened risk of cardiac death and consumption of hard water, and specifically high magnesium water (there are a few negative studies too). The hypothesis that magnesium in drinking water can be a significant source of dietary magnesium has recently been strengthened by a study which found higher intracellular magnesiums in people drinking hard water. All of this evidence is circumstantial, but because the magnesium intakes of many people eating the Western diet are marginal by many standards, it is unsettling.

Magnesium as a Medical Treatment and Drug

In recent years the suggestion that it is the magnesium in hard water which lowers cardiac mortality rates has stimulated an interest in treating heart attack (myocardial infarction, or MI) patients acutely in the ICU with intravenous magnesium salts. These studies have been given an added push by the finding that roughly 2/3 of ICU patients with normal kidney function have low blood magnesium levels (magnesium deficiency has been called the most under-diagnosed deficiency in medicine). Populations now known to be especially at risk for low blood magnesium include diabetics (who excrete more magnesium when not in good diabetic control), alcoholics (who have problems with all phases of magnesium metabolism), takers of diuretic medications (many of which increase excretion of magnesium), and MI victims (who, even if not whole-body magnesium depleted, still suffer acute changes in distribution of magnesium between body pools which are not good for the heart muscle).

In hospital tests, the results of acute magnesium administration in those who have suffered MIs has been particularly dramatic. In four independent randomized placebo-controlled studies done in the last five years, intravenous magnesium administration decreased hospital mortality of MI patients (with respect to placebo) from 8% to 2% (study 1), from 19% to 7% (study 2), from 17% to 2% (study 3), and (in a study looking at some of the sickest patients) from 15% to 2.2% (footnote 3).

(3): *Magnesium Trace Elem* 9(4):177-185, (1990); *Ibid.* 9(6):333 (1990), #18 (abstract)

Side effects of the treatment were generally minimal and were never serious. These are extremely impressive results, comparable in acute efficacy (and much superior in safety and cost) to the effect of very expensive high-tech treatments like blood clot dissolvers, angioplasty, and acute coronary bypass surgery (footnote 4).

That the above results should have been attained with a few cents worth of a common mineral is both a triumph of the scientific method and (in some ways) an indictment of the way it has been applied in the past as regards medical nutritional studies. Magnesium has been used sporadically to treat certain heart arrhythmias for a half-century, and the first study to find a greatly diminished mortality in MI patients treated with magnesium was published in 1956. (!) Magnesium treatment is nothing new and is relatively low technology. With the proper studies to back up the practice, physicians could have been treating heart attacks routinely with magnesium many decades ago. But they haven't been (after 1956, magnesium as an adjunct treatment for MI was forgotten for nearly 30 years), and what's more they still aren't *today*, even with much better evidence available. Why not? Unfortunately the basic reason is that most of the money in medicine is made when physicians and hospitals do the most expensive things to patients, and the presence of this potential profit, like the gravitational field of some dark star, results in an "information pull" toward the most expensive procedures in medicine,

(4): I don't wish to imply that the current expensive treatments for MI are without value, or that I think they should be wholly supplanted. They do work and are often useful. I only wish to re-emphasize and recommend the standard medical wisdom that the cheapest, most effective, and relatively safest treatments should always be applied first, and that the more expensive, less effective, and more dangerous treatments be added more judiciously later on, if still needed (at present, exactly the opposite is happening with regard to magnesium — see the abstract in footnote 3 for an example). The application of the cheaper and safer treatments first should proceed (ideally) no matter how many scientific papers drug company advertising representatives provide free to doctors about the rest.

even in the most honest and best-intentioned of circumstances (footnote 5).

Magnesium, unfortunately, is a simple treatment and one that can't be patented under current law.

Is It Rational To Supplement With Magnesium?

The mechanism of magnesium's remarkable saving effect in MI patients has not been worked out. Dogs supplemented with extra dietary magnesium and then subjected to artificial heart vessel occlusion suffer less heart tissue damage (have smaller heart attacks) because of less collateral spasm of the small vessels feeding the area (magnesium has vasodilator properties in some cases). A similar thing may be happening in humans. Magnesium is also a well-known antiarrhythmic, as noted, and this also may be beneficial in preventing deaths (particularly sudden deaths) associated with MI. Whether or not

(5): See my comments in *Cryonics*, Jan. 1991, pp. 13-15. There are really two effects here. Companies that support expensive treatments can afford advertising to doctors, to be sure, but at the same time one can also find out a lot more in the library about the effects of expensive medical procedures and products than inexpensive ones, because there are always a lot of studies in the literature funded by companies that sell the expensive ones or support them. (Some of the expense of these treatments, in circular fashion, is the result of the cost of the studies themselves, but most of it is simply due to the inherent complexity of the treatment). This is a drawback of mixed economy capitalism as we practice it; though we should note that fully socialized payment systems are even worse at encouraging effective information gathering, because in the absence of profit very little research of any kind gets done. (Doubters should examine the state of Canadian or British medical research.) Needed is a way to initiate more extensive patent protection of new medical uses of nutrients (and any new medical treatments that can be kept track of generally) so that the people who benefit most directly from the research will pay the research costs. Right now much basic biomedical nutritional information is generated by tax-supported research, and then is available to all, essentially free, according to need. However, we must remember that there is no such thing as a free lunch, and just as socialized farming results in bare shelves in the grocery store, so "information socialism" sometimes results in bare shelves at the good-idea store.

long-term dietary magnesium supplementation would have an equal preventive effect on complications in human patients who suffer coronary occlusion is unknown, but doesn't seem unreasonable in view of the dog work.

To be fair, we should note that magnesium's effect on mortality of MI patients is independent of their plasma magnesium levels, and this finding has been used as an argument against the idea that acute (hospital) magnesium administration to heart patients is treating some underlying nutritional deficiency. However (as noted), we also know that plasma levels of magnesium cannot be used to rule out all deficiency states. There is some evidence that patients with depleted intracellular magnesiums are being helped most by acute magnesium treatment, and if true, this would be a powerful argument in favor of preventive magnesium supplementation. One well-done study from India randomized patients deliberately either to a long-term "deliberately high magnesium diet" or no diet change, and found on follow-up higher blood magnesiums in the high magnesium diet people, and also a significantly lower cardiac death rate for them. Still, many other incidental differences between the diets besides magnesium content do not rule out other variables, so this study, like the dog work, provides only a clue.

The question of whether or not long-term magnesium supplementation might modify the long-term development of atherosclerosis per se in humans is also not settled, as again no study has been done. Surely not all of atherosclerosis is caused by magnesium deficiency in man, even if our arteries do behave in response to magnesium and fat exactly like those of lab animals. Still, if we as high-fat diet Westerners are unlucky about all of the assumptions that went into determining our "normal" requirement for magnesium, and if we are further unlucky about the assumptions that have gone into the official supposition that our present sub-RDA intakes are within the margin of safety for that figure, then we are indeed in trouble. Again, atherosclerosis, calcification, and fat, cholesterol, and calcium intake were never even considered in constructing the RDA for magnesium. Even if only a small portion of the atherosclerotic disease seen in this country is due to relative magnesium malnutrition, this would be a true tragedy, since the underlying problem is so easy to correct.

What is the role of magnesium sup-

plements in optimal nutrition, then? Nobody knows for sure, although it's a safe bet that it depends a great deal on who you are and what you eat already. My own bias is that since magnesium supplements are extremely cheap and free of side effect at the proper dose, taking them is a rational option for anyone who might possibly have a marginal magnesium intake, or for anyone who has any reason at all for greater magnesium need. Such people certainly include:

- 1) Heavy drinkers.
- 2) Diabetics, at least 30% of whom are magnesium deficient. Of note are some preliminary studies which suggest that some of the insulin resistance associated with hypertension and aging is due to magnesium deficiency, and is correctable with supplementation.
- 3) Users of diuretic drugs (including blood pressure pills containing diuretics). 50% of people taking such drugs for heart failure are magnesium deficient, in part because their physicians do not monitor for it, and do not supplement to make sure deficits do not happen, as they do in the case of potassium.
- 4) People with peripheral vascular disease, 50% of whom in one study were found to be magnesium deficient (this is more indirect evidence for the atherosclerosis hypothesis).
- 5) People with a history of oxalate or phosphate kidney stones (see your doctor about this last use — magnesium is already an accepted, if optional, part of medical therapy for these kinds of stones).

And the at-risk group possibly also includes:

- 6) People with relatively high cholesterol and fat intakes.

In fact, if the human need for mag-



Magnesium oxide
alchemical symbol

nesium for optimal atherosclerosis prevention on our present high-fat American diet is only a bit larger than we presently set it officially, then the group of people with "suboptimal magnesium nutrition" may include anyone who does not subsist largely on a high magnesium, low-fat "vegan-type" diet of green vegetables, nuts, whole grains, and legumes. (footnote 6)

If this pessimistic possibility turns out to be the case, magnesium supplements may benefit nearly everyone in this society. The bottom line is that there is very little downside to ingesting extra magnesium for the average person, and a lot of possible benefit, so a rational gamble may be in order.

Magnesium Supplement Dose

The chief bad news about magnesium supplementation, once you decide to do it, is that the quantities needed are such as to require the swallowing of at least one extra pill every day. The amounts of magnesium needed to do any good are simply too large to go into any single multivitamin or multimineral tablet, so if you see magnesium listed on the label of your "one-a-day" multivitamin pill, you can be sure someone is trying to mislead you by making you think you're taking a significant amount. Don't be fooled.

My recommendation for a supplemental magnesium dose for the average adult American omnivore is 250 to 500 mg a day, preferably the higher dose (all figures in this essay refer to the equivalent weight of the pure element, which is usually the figure given on bottle labels). This dose recommendation is tailored for convenience, and is designed to bring the average American diet into the magnesium content range of the typical vegetarian/vegan diet. It also takes into account even the most extravagant experimental suggestions for the optimal magnesium need of humans. Children can safely be given a fraction of it according to their body weight relative to an adult.

(6): While milk includes a large amount of magnesium, it also includes a large amount of antagonistic calcium (not to mention a large amount of ugly saturated fat if you don't drink it skim), so it's not at all clear that relying on a large milk consumption alone is enough to ensure optimal magnesium status.

Magnesium Supplements

Commercially, magnesium is extracted by the ton from sea salt, and so preparations need not be expensive; don't let yourself be conned by the food supplement industry into taking an expensive magnesium product. Your extra mag-

With the proper studies to back up the practice, physicians could have been treating heart attacks routinely with magnesium many decades ago.

nesium should cost five cents a day (or less).

The following are the major magnesium preparations currently on the market:

Magnesium Oxide Tablets. This, for most people, is the superior magnesium supplement. Magnesium oxide is cheap, and (because it is 60% magnesium by weight) can pack a lot of magnesium into a single pill. Magnesium oxide tabs are available commercially in 250 mg magnesium sizes (dose: 1 or 2 a day) or (less commonly) 500 mg sizes (dose: 1 a day). Take tablets with the largest meals, and for better absorption divide the dose if you already take other supplements on a split basis (otherwise, it's not worth the bother). To save money, buy your magnesium oxide tablets at a chain drug store or chain grocery store in the food supplement section — never at a health food store.

Magnesium Hydroxide Suspensions. These are handy for people who hate swallowing pills. *Milk of Magnesia* (which is standardized by the U.S.P) is an approximately 8% magnesium hydroxide suspension, which you can buy in several commercial brands, flavored or not. A "double concentrated" product (16%) is available from Phillip's (Phillip's Milk of Magnesia, concentrated). The commercial product is intended as an antacid or laxative, but at smaller doses works fine as a supplement. (Do not use products such as Haley's M-0, which contain mineral oil in addition to magnesium hydroxide.) The dose to get 350 mg magnesium is about two teaspoons of the U.S.P formulation, or one teaspoon of the Phillips double concentrate.

Magnesium Sulfate (Epsom Salt).

Neither magnesium hydroxide nor oxide is very soluble in water, and both require stomach acid for conversion to a soluble form which the body can absorb. In theory, then, neither would work well in those rare individuals who have no stomach acid. People who have had their stomachs removed, or who have pernicious anemia, or (possibly) those who are on intensive anti-ulcer therapy with drugs, are at risk for having insufficient acid for this purpose (stomach acid has surprisingly few uses otherwise, and nature seems to have provided it primarily as an antibacterial which we have less use for in these days of modern sanitation). A certain fraction of older people also

lose most of their stomach acid making ability, but it's unknown how this effects magnesium absorption from oxides and hydroxides in practice. In any case, the inexpensive alternative for people who are afraid of having too little stomach acid to use oxides or hydroxides, is *Epsom salt*.

Epsom salt (magnesium sulfate heptahydrate) is about 10% magnesium by weight. The commercial crystalline product can be bought in bulk for as little as 50 cents a pound at many large drugstores (it's used to make a solution for soaking skin), and the crystals can be taken in capsules (five packed 00 gelatin capsules contain altogether about 400 mg magnesium), or dissolved in drinks (the intensely bitter taste of magnesium ion is best disguised in lemonade). Epsom salt, because of its sulfate content, is theoretically a bit more likely to produce a laxative side-effect than other magnesium compounds, but in practice at the low doses needed for supplementation should not cause any problem (see side-effect discussion below).

Antacids. Most antacid preparations on the market contain high amounts of magnesium (TUMS being the most important commercial exception). If you are taking antacid every day for some reason, check the label. If your product contains magnesium you are certainly getting a large enough dose that you don't need to supplement while you take the antacid.

Magnesium and Calcium Combined Preparations. I have found these invariably more expensive than buying magnesium oxide and calcium supplement pills separately at a grocery store. If you take calcium, shop around and you'll probably

decide to take it separately.

Magnesium Chlorides, Carbonates, Aspartates, Ascorbates, Lactates, Gluconates, and Amino acid Chelates. All of these compounds contain comparatively little magnesium per gram, and thus very little per pill. I've generally found them very expensive and a waste of money so far as the magnesium content goes. Pay no attention to claims that their magnesium is absorbed better: Magnesium is absorbed in ionic (dissolved) form, and by the time it gets into this form (which it will with any of the above recommended preparations) it doesn't matter what compound it originally started in. A recent study shows that even a fancy chelate compound like magnesium glycinate does not offer any better magnesium absorption than magnesium oxide.

Dolomite. Do NOT ingest dolomite. This mined geological mineral preparation may contain much larger amounts of heavy metals (e.g., lead) than mineral preparations from sea water, and is not well standardized.

Side Effects, Caveats, and Dangers

Magnesium is one of the least toxic of the minerals because it is so poorly taken up by the gut in large doses. Given orally in too large amounts, magnesium salts simply pass through the alimentary canal mostly unabsorbed, producing an osmotic laxative effect (this effect is usually not seen at oral doses less than about two grams of magnesium, which is roughly five times the recommended supplemental dose). In addition, such magnesium as is absorbed is easily dealt with, since the kidneys are good at excreting magnesium when it exceeds a critical level in the blood (this is how the body normally regulates magnesium levels), and have a large reserve capacity for doing so. In the medical treatment of toxemia of pregnancy, for example, where high-dose magnesium is often administered as a drug to control high blood pressure, humans are routinely able to tolerate and excrete more than 10 times the normal daily supplemental dose of magnesium, even when the magnesium is given directly by IV into the blood.

It should be noted, to be sure, that the aforementioned dose of magnesium would be deadly to anyone who had non-working

kidneys. The major caveat to magnesium supplementation is that it must not be employed in people with significant renal (kidney) disease. Since renal disease of such severity as to cause problems with magnesium is extremely unlikely to be a secret to the patient, however, there is no reason why the average person who feels well and believes himself healthy cannot simply begin magnesium supplementation in the 250 to 500 mg dose range recommended above. The rationale for this is that comparable doses of magnesium can easily be obtained by changing the diet to include a lot of vegetables and nuts, and there is no reason why healthy people should consult their doctors when they do that. Nor is there any support for the idea of great caution in the medical literature: I was able to find only one report of oral magnesium toxicity in a human due to previously undiscovered kidney dysfunction, and in that case the subject was chronically ingesting about 2,000 mg of magnesium a day, far in excess of the recommended supplementation dose.

Of course, people who do not feel well, or who know themselves to have chronic health problems (whether or not on medication), should certainly consult their personal physicians before starting magnesium supplementation. In particular, magnesium has interactions with the drugs digitalis, tetracycline, and lithium, so persons taking any of these medications will need additional medical counseling before making a decision. Diabetics taking antihypertensives may experience a drop in blood pressure when taking magnesium

The bottom line is that there is very little downside to ingesting extra magnesium for the average person, and a lot of possible benefit, so a rational gamble may be in order.

(allowing lower doses of blood pressure medication), and although this is a desired effect, it obviously needs to be carefully monitored by a physician.

Summary of Supplement Recommendations

As discussed in previous columns on preventive medicine by Mike Darwin and myself, the optimum survival strategy for the average cryonicist should be not only

to follow practices which are likely to extend average life span, but also to make a particular effort to follow those practices which are targeted toward avoiding that special bane of cryonicists: sudden and unexpected clinical death. Sudden and unexpected death, as we know statistically, is mainly the product of accidents and cardiovascular problems, and preventing it breaks down in practice mostly to problems of preventing auto injuries, falls, and atherosclerosis.

Atherosclerosis is itself a complex subject, and some risk factors for it are easy to correct and some difficult. Logic dictates that the cryonicist with a non-optimal serum cholesterol picture (see *Cryonics* Dec. 1991, pp 19-21) and wishing maximum payoff for his or her effort, pay attention first to relatively easy-to-accomplish major risk factor interventions (control of hypertension and high cholesterol by medication, for instance), and then to more difficult areas (e.g., control of smoking, and control of obesity and high cholesterol by diet). Difficult, expensive, or time-consuming "health-related" activities whose effect on longevity and sudden death is marginal (for example, exercise over and above that needed for aerobic fitness and weight control, karate lessons, yoga, etc.) will be profitably practiced by those seeking better quality of life, to be sure. At the same time, however, those whose primary goal is survival will not allow such pursuits to take precedence over activities with greater life-extension pay-off.

"Food supplementation" is a difficult category of intervention because it is not really one intervention, but rather a group of biochemically non-related practices. The difficulty/expense of supplementation regimes is widely variable (depending on what program you follow) and the benefit is also subject to wide variance in likely payoff. Because of the uncertainty in benefit, taking food supplements as part of a cryonics-oriented longevity program is most rational when it is confined to those substances most likely to intervene in *cardiovascular* processes (as opposed to other disease processes like cancer), and which are (in addition) very safe and relatively inexpensive. It obviously makes no sense to spend \$100 a month on supplements of dubious value (for instance) while you are in need of a larger and safer automobile.

My own assessment of the best sup-

plements for cryonicists, in terms of reasonable cardiovascular payoff-to-investment ratio, results in the following short list:

- 1) Beta carotene (see *Cryonics*, Jan. 1991, pp. 13-15).
- 2) Vitamin E for ischemia protection (see *Cryonics*, Apr. 1991, pp. 13-15). Vitamin E supplementation (in a report soon to be published) has also been found to be a good atherosclerosis protector in monkeys.
- 3) Magnesium.
- 4) Chromium GTF or picolinate, 200 mcg

(subject of a future column).

- 5) Possibly Co-enzyme Q10 (subject of a future column).
- 6) Possibly vitamin C (500 mg) and selenium (100 mcg), since these are cheap and safe and are known to have biochemical synergy and interaction with vitamin E.
- 7) Aspirin 325 mg (only for those with known cardiovascular disease or those with multiple risk factors for it).

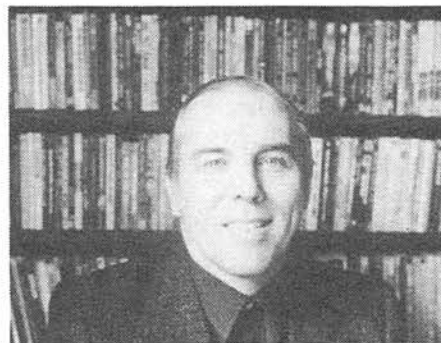
I think it is also worth taking (in addition to the above) a good one-a-day multi-vitamin/multimineral, like *Theragran M*,

as a general hedge against any other marginal dietary deficiency (many women, for example, would do well with some extra iron). All of these supplements can be taken together just once a day with the day's largest meal, and are altogether quite inexpensive (\$10 a month, not counting the CoQ10). In my opinion, cryonicists considering taking a more complex, time consuming, and expensive regimen than the above might do well to consider first if there are other areas of their lives (e.g. smoking, dietary fat and calorie control, accident prevention, general financial security, etc.) which could more profitably use the attention.

Future Tech

Nanosystems — The book

H. Keith Henson



Mature engineering fields are supported by a massive technical literature. Every engineering discipline I can think of has from tens to hundreds of feet of applicable books and bound magazines in a large university library. All of them have technical organizations which perpetuate the "culture" of the discipline. In recent decades, many technical fields have developed essential computer programs such as Autocad for the mechanical engineers, and a number of programs which help electrical engineers analyze circuits and design integrated and printed circuits.

Engineers (like me) typically accumulate some tens of feet of working books. In the case of electronic engineers, the tools of the trade are largely "data books." A measurement of the maturity of a field could almost be made in feet of books.

Nanotechnology — far, far from being a mature discipline — is presently represented by just two popular books, a handful of articles, two conference proceedings, a fair-sized penumbra of related scientific material, and a few computer programs (MM2 for example) which were designed for chemists to visualize

molecules. The basic tools are very sparse for engineers to start designing nanomachines.

This will change with the publication (next year) of Eric Drexler's long-awaited technical tome, *Nanosystems — Molecular Machinery, Manufacturing and Computation*. Partly taken from his PhD thesis, and averaging an equation or graph per page, it is not intended as a popular book. In fact, a fairly serious background in chemistry, mechanics, math, and quantum theory is required to get much out of it. (I make the grade, but barely.)

Nanosystems is a detailed source book on the basics behind molecular design. It summarizes the relatively well-known chemistry and physics of molecular bonding, and derives the simplifying (working) engineering approximations for the parameters of molecular design such as elasticity, bending resistance, and thermal properties. There are hundreds of examples of the properties of simple molecular structures worked out. Another set of questions to be asked (and answered here in detail) is: Can chemical reactions be made to happen

where you want them, and constrained so they will not happen elsewhere in a nanoscale device?

The first part of the book compares mature nanotechnology to the closest related disciplines, such as conventional fabrication, microfabrication, ordinary chemistry in solution, and biochemistry. Eric's approach, to quote him, "is to put a large portion of the requisite core knowledge between two covers in a form that does not assume specialized knowledge in the component disciplines. An effort has been made to make chemical concepts accessible to nonchemists, solid state physics concepts accessible to nonphysicists, and so forth, assuming only a basic background in both chemistry and physics. . . . [T]his work does not consist of extending the often-esoteric boundaries of established fields, but in combining their basic principles to delineate a new field of design and enquiry."

Chapter seven, for example "examines a variety of mechanisms that result in the degradation of mechanical energy to heat. . . . these include acoustic radiation, phonon scattering, shear-reflection drag,

phonon viscosity, thermoelastic damping, nonisothermal compression of mobile components, and transitions among time-dependent potential wells."

It is easy to pick out features of the book which have been driven by criticisms, especially the ones which are based on reviewers' poor understanding of the magnitude of the effects involved. Eric spends a great deal of the book delineating the *unimportant* effects on nanomechanical design. Aside from the all-too-human desire to stuff the arguments down the throats of certain critics, a new field really does need an exhaustive survey of just what physical effects are important, and which are trivial and can safely be ignored.

The second half of the book (which I

have yet to go over in fine detail) takes the "rules of thumb" established in the first part and develops detailed concepts, structural properties, and the mechanical properties of bearings, gears, and low-friction motion. This is further developed into larger parts such as electrostatic motors, actuators, and tunneling "relays" for communication with the macroscopic world. This effort works with ever-larger systems until it reaches such items as robot arms, complete with drive motors and sensors. The third part discusses some of the "how-do-we-get-from-here-to-there" issues, and gives the best readout as of 1991.

Practical progress is seldom the direct result of scientists. The measurements, models and theories of scientists almost al-

ways have to be translated through a stage of engineering design, and then to the technicians and manufacturing people who will put a product together (or run a process to make something). Nanotechnology is a real oddball because it is not based on "nanoscience." What we know of ordinary chemistry and physics is sufficient. What is needed is design tools and construction tools. The science, from what I read in *Nanosystems*, is known; the engineering rules are reasonably well presented. There is a good start made on computer design tools, and we can probably reach down into that scale via scanning tunneling microscopes and their kin to make the first tools. It seems the time is right to get started.

Suspension Capability

Carlos Mondragón

In the past six months, Alcor's suspension capability has been seriously compromised. The most serious blow was the loss of Jerry Leaf last July. For years we had heavily relied not only on Jerry's expertise and surgical skills but on his scrupulous *dependability*. No matter where he was or what he was doing, Jerry would come when we needed him. After his suspension, we knew that we would immediately have to begin working toward filling the void which he left. We didn't, however, proceed with great urgency. This was because we do have a competent (though not always available) back-up surgeon. And because Michael Darwin was still available. Although Mike didn't have all of Jerry's surgical skills, he did have a comprehensive knowledge of cryonics, of Alcor's suspension protocols, and more experience at actually doing cryonics than anyone else on the planet. Mike's resignation from his employment at Alcor and from our suspension team leave another major gap in our capability.

These events are a loud wake-up call. We can not afford to be overly dependent on any one person. While this was a problem often talked about and a concept easy to accept, ignoring it is a trap equally easy to fall into. Alas, the reality is here

and we have to deal with it now.

The losses can be divided into two categories: generalized experience and knowledge, and specific skills. Experience and a broad education can only be acquired over time. Ideally, and necessarily, this gap has to be filled with Alcor suspension team members; there will be no quick fix here. Specific skills can be replaced with relative speed, either through internal training programs or the use of outside professional contractors. In terms of our ability to deliver the same transport and cryoprotective perfusion which we've been providing, it is these skills which are critical.

We've identified three areas where our lack of specific skills have the greatest impact. In order of the immediacy with which we must address these areas, the plans we've made and actions we've already taken are described below:

Field Washout

Stabilization and transport of patients requires a multitude of skills. Application of heart-lung resuscitator support, administration of transport medications, record keeping, and a variety of other tasks can and have been performed by Alcor's

Transport Technicians. The effort, dedication, and time invested by these individuals will account for the foundation of our current and future suspension capability.

Perfusion and blood washout at this stage of the suspension process presents our most immediate problem. This washout involves the accessing of the patient's circulatory system via the femoral vessels. In what is normally a minor surgical procedure, an incision is made and these vessels are raised and cannulated. Jerry Leaf was proficient at these "femoral cutdowns." And while Mike Darwin wasn't as practiced as Jerry, he too could get this job done. There are four persons on Alcor's current suspension team who have assisted either Jerry or Mike more than once in doing femoral cutdowns, but none of them yet feel confident about the prospect of going at it alone.

Getting ourselves trained and adequately practiced in femoral cutdowns is now our first priority. Since this procedure is normally done in the field and at the culmination of a remote stand-by operation, it will probably not always be feasible to contract professional help. So, although we expect to employ professionals whenever possible, we are presently arranging a

training session (with a professional) to teach some of our Transport Technicians to do femoral cutdowns.

Cardiac Surgery

It simply is not possible to train Alcor suspension team members to do in the near future the thoracic surgery we've been using to accomplish cryoprotective perfusion. This perfusion could be accomplished via the femoral cutdown and cannulation referred to above, but that would be a degradation of patient care which our situation does not mandate. We do still have available to us the services of Cryovita's back-up surgeon, although we are unhappy that he is not able to give suspensions the absolute priority Jerry gave them. To alleviate this circumstance, we are looking to add more back-up surgeons on a retainer or "on call" basis. As of this writing, we've found three potential sources for this talent, two of which may net us more than one surgeon. The strategy is to get as many of these professional contractors on line as possible in order to better the chances that at least one will be available when needed.

From now on, patients (remote and in the L. A. area) will be washed out (via femoral cutdown) with Viaspan whenever possible. As evidenced by our experience with the Arlene Fried suspension, we can

buy a significant amount of time with a field Viaspan washout. Time during which we can wait, if necessary, for a contracted surgeon.

Perfusion

Jerry Leaf handled both surgery and perfusion. This means that he set up the extracorporeal circuit (heart-lung machine) before surgery and ran the pumps once cannulation was complete. Fortunately, Jerry spent some time in the spring and early summer training Ralph Whelan to do this job.

Ralph also spent many hours detailing the job in manual form. Since Jerry's suspension, Ralph has been in the role of perfusionist, has handled it well, and now has three suspensions worth of experience in this job.

The problem with Ralph is that there is only one of him. We will get further training from professionals for Ralph and at least two other members of the team. Right now, two free-lance perfusionists have expressed willingness to provide that training; final arrangements and scheduling are pending. We also will try to get these professionals involved in at least the next couple of suspensions to give ourselves a greater "margin of confidence."

The limiting factor in our progress will be Alcor staff time, and to some de-

gree, money. Contract services are already budgeted for in suspension minimums. Training is another matter.

The Bottom Line

There is little comfort in reminding ourselves that with all of our shortcomings, Alcor still has the best trained, most experienced, and best equipped suspension team in existence. We must strive to bring our capability back to where it was in the shortest time possible. And once there, we must go beyond that and continue to improve the quality of suspension we can deliver.

To that end, we are doing everything we can to standardize the cryonic suspension process, from start to finish, and to have written guidelines for every step of the procedure. We are doubling our efforts to have competent team members *and back-ups* in all positions, and to decentralize the knowledge and expertise that still reside in a very few people. It is unfortunate that we had to learn this lesson so brusquely, but when you learn a lesson hard you learn it *well*. The result will be a stronger organization.

We will report our progress and changes in our suspension capability as they develop.

The Transport of Patient A-1312

H. Keith Henson

Transport Team

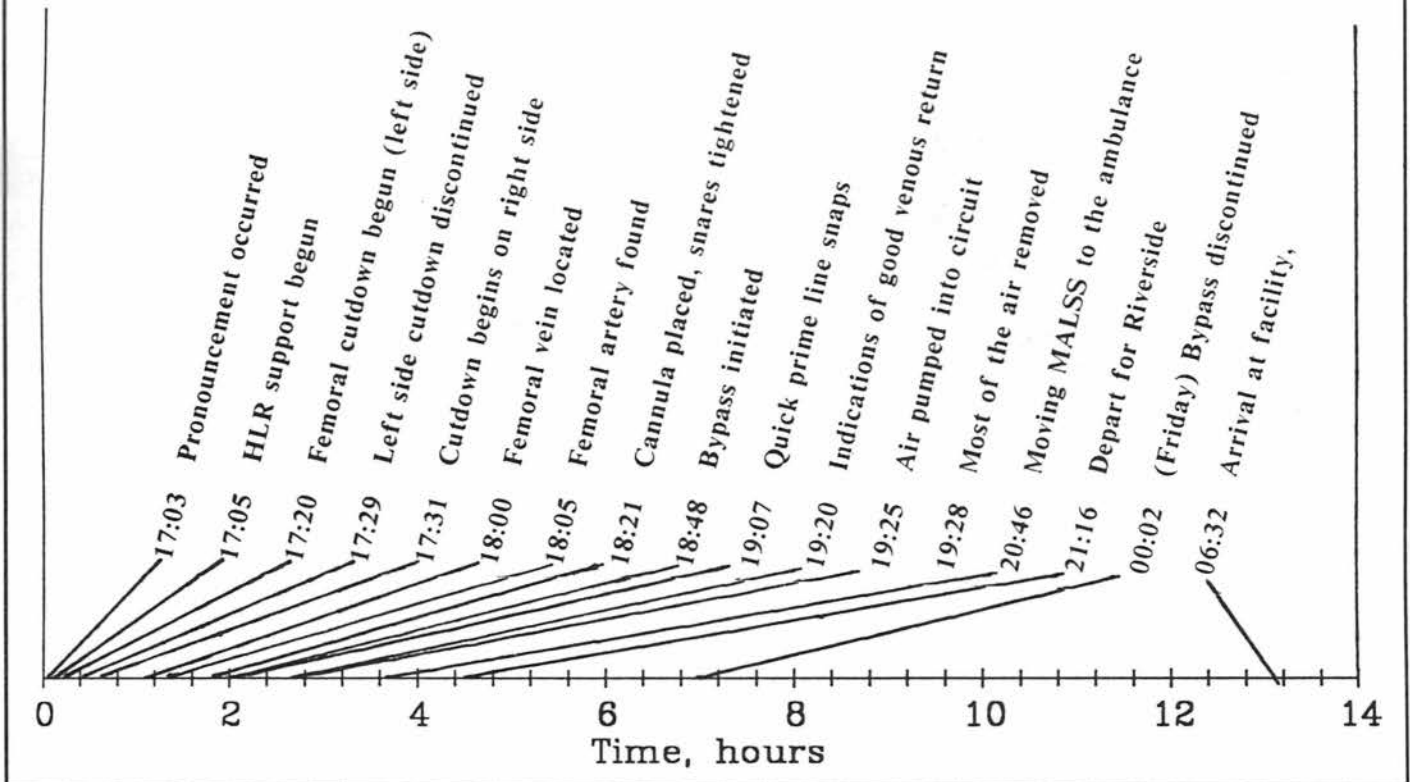
Mike Darwin, *Transport Team Leader, Surgeon, Washout Specialist*
Keith Henson, *Assistant Surgeon, Driver*
Naomi Reynolds, *Medications, Local Coordinator*
Arel Lucas, *Medications, Airway Management*
Leonard Zubkoff, *Viaspan Conversion, HLR Management*
Tanya Jones, *Physiological Monitoring, Scribe*
Joe Tennant, *Airway Management, Team Member*
Carlos Mondragón, *Legal/Executive, Videotaping*

The following article is cleaned up from a collection of personal notes from my viewpoint on the suspension. The patient's name and his wife's are pseudonyms. He happens to be a friend of three of the stabilization team members. The "warts" mentioned here are in keeping with the long-standing Alcor tradition of telling it like it happened so we can learn from each suspension.

The first indication that our patient was in imminent trouble came less than two weeks before his suspension. "Dennis" had metastasized gastric cancer which had spread into the liver before it was discovered about 5 months ago. He had been out of the country for most of that time in an experimental program which seemed to be having positive results.

On December 4, word reached Alcor that Dennis was in the early stages of liver failure. The patient's wife ("Cynthia") was advised of the near impossibility of doing an overseas transport in his situation, and

A-1312 Timeline of Events (Transport)



he was advised to get back if possible. They arrived back on Dec. 7 and checked Dennis into one of the University of California at San Francisco hospitals for evaluation.

The next day (December 8) we moved the transport kit from my place in San Jose, where it is usually stored, to the coordinator's house in Palo Alto (closer to San Francisco). There was a regular monthly meeting scheduled that day, so the local transport team members (Naomi Reynolds, Arel Lucas, Joe Tennant, Leonard Zubkoff, Keith Henson) came early to check out the equipment and review operational procedures. During the inspection/ review session, we found that the fittings on our high impulse heart-lung resuscitator (HLR) were incompatible with the oxygen-supply fittings (something which had been known for some time, but not fixed). Leonard and I did some running around to get it fixed. (The manufacturer — Michigan Instruments — happens to use "M" type air chucks, male on the machine.) We got the correct air chuck from a local hardware store, and that was the one actually used for the stabilization. The next day, Leonard picked up enough of the green Hanson fittings for us to have used those as well.

Tuesday, December 10, I was out get-

ting a second "H" cylinder of oxygen when Arel got the word that our patient was in trouble — serious enough for the team to assemble at the hospital. (Michigan Instrument HLRs use up two "H" cylinders during a stabilization. More oxygen may be needed if some gets used up for pre-stabilization supplemental oxygen, or if no washout is possible. In this stabilization, we emptied one of them and used about 1400 psi from the other one in an hour and 45 minutes of HLR operation.)

When I got home, we transferred some materials into the car — including the nimodipine which had been missed in the first load — threw in our RONKS (specialized Alcor "Remain OverNight Kits") dropped our daughter Amber with (designated childcare people) Laura and Johan, and headed off to San Francisco.

The hospital was fairly easy to find with the directions we had been given, but directions were about all the correct information we had. The initial call to Alcor central had hit when both Mike and Carlos were out of the office (Mike was in a dentist's chair!). Alcor alerted Naomi (our local coordinator) who got in contact with the nurse who had originated the call. The nurse asked what they should do if the patient should die before Alcor arrived, so

Naomi read her the abbreviated transport protocol. The nurse, perhaps in consult with a resident, told Naomi that they could not do this, so Alcor should bring their own medications, which Naomi took to imply that we could administer the transport medications if we brought them. When we got to the hospital, Naomi determined that the hospital would not let us do *any* of the initial transport protocol within their walls. We would have to remove Dennis and frantically administer the medications in the parking lot. There is a lesson here in knowing who can speak for a hospital; and neither nurses nor doctors can do that. We were allowed to move our portable ice bath into the room along with ice in chests.

About 7 p.m., an Alcor transport team consisting of Mike Darwin, Tanya Jones, and Carlos Mondragón left Riverside in the Alcor ambulance and a rented back-up van. They had a rough time of it going up the central valley in dense fog (Stephen King grade). During a discussion with Cynthia about Dennis's condition (over a cellular phone link) Mike commented that if they drove any faster, our patient was more likely to live through the night than the transport team.

Dennis, while somewhat disoriented and hard to understand, did not seem to be



Transport Team members (L to R) Kelth Henson, Tanya Jones, Naomi Reynolds (partially obscured), and Joe Tennant make last-minute preparations.

in much danger that evening. He was up to hosting a popsicle party (the humor of this hit days later) and near midnight (trailing oxygen and feeding tube lines) insisted on getting out of bed and into a chair. The reason we had been called was that his condition was deteriorating very rapidly (he had been completely lucid the previous day). His family was worried that the team's presence would distress him, but since he understood his condition, we seemed to be a comfort instead. When he saw the lab coats with the Alcor insignia stitched onto them, he began asking, "Thirty years, true or false?" in accordance with the latest local speculations that cell-repair machines might be available for rescue in that time period.

Discussions in the hospital and over the cellular phone about what we could do in the hospital led to the conclusion that having our patient pronounced there would result in a *lot* of delay and very serious ischemic injury. The doctors were cooperative, but the administration was not willing to let us do any of the initial procedures in the hospital. We could have put the Alcor

legal team on the case, but getting him out of there seemed like a much better idea. There were attempts to get Dennis out of the hospital that night, but it was impossible to make the proper connections and make the complex arrangements needed. The most important part — which couldn't be done late at night — was finding 24-hour hospice-nursing care for quick pronouncement of legal death. In the meantime, the team socialized with Dennis's family and friends, and (using a rough floor plan of the house chalked up on a conference-room board by a friend) decided how to deploy equipment at the patient's home.

About 2 a.m. we split the team, leaving Naomi and Joe at the hospital. Arel, Leonard, and I went over to a motel to get a little sleep. We arranged for a place for Mike, Tanya, and Carlos to stay when they got in. They rolled into the hospital parking lot shortly after 4 am. After checking that Dennis's condition seemed stable for the

moment, they went off for a few hours' sleep. After an uneventful night where I slept and Arel did not, we went back over to the hospital at 8 a.m. to relieve Joe and Naomi. The team from Riverside came back from the motel about 11 am.

As soon as she arrived back at the hospital, Arel began to seek out the discharge coordinators who had already made plans to move Dennis to his home. It is hard to say enough about the usefulness of hospital social workers. One of them, Bill Rosenfeld, found hospice nurses, arranged for commercial ambulance service to transport Dennis home, and took care of many critical items that no one else considered. It still took from 8 am to about 2 p.m. to get everything ready.

The hospital asked us to move the ambulance from their tiny parking lot at about 11 a.m. I moved it across the street, and stayed with it parked in a taxi zone so it would not be towed away. If any of you ever get drafted to drive that beast, *read the instruction book first*. There are ways you can immobilize it, and do several hundred dollars of damage by flipping the battery switch at the wrong time.

Come 2 p.m., the rest of the team, friends and family cleared out of the patient's room and loaded the Pizer tank (portable ice bath, or PIB), ice chests, and some other equipment into the van. Dennis traveled in a regular ambulance with a paramedic crew, his wife, and Mike. Since I have driven trucks before, I was left to drive the Alcor ambulance.



Minutes after "legal death," Heart-Lung Resuscitator support has begun and airway work is underway.

Left to right: Naomi Reynolds, Mike Darwin, Leonard Zubkoff, Keith Henson, Tanya Jones.



Mike and Keith begin the femoral cutdown that will enable a field Viaspan flush.

About halfway between the hospital and Dennis's home I ran out of gas. We later determined that this was caused by a stuck valve, which should switch between tanks. Even with the switch in the (full) auxiliary tank position, it was trying to take fuel from the (empty) main tank. On the advice of a mechanic, Carlos banged the valve with a mallet later, but we did not trust that valve for the remainder of the transport. Carlos was behind me in the van, and stopped. Naomi was behind him, and stopped. Naomi went down to the next gas station to pick up some gas, while Carlos left the van parked behind the ambulance to partly shield it from fast freeway traffic. Sitting beside a freeway with cars whizzing by is *not* my idea of a fun time! Arel came by, and we sent her off to get gas as well, since our car had a gas can in it, and we figured Naomi might have problems getting one (she did not). Naomi came back with a can and we got the ambulance started, after I took off the air cleaner and poured a little gas into the carburetor. Arel locked her keys in the car when she got to the gas station, but we lo-

cated her because it was the same gas station where Naomi had picked up gas. Naomi and Arel, driving the two station wagons, took off ahead. After filling up, Carlos and I drove the van and ambulance to the patient's home. When we got there, the transfer ambulance was just about to leave, having been held up by the lack of bed padding which was in one of the two cars. It took us nearly two hours to make what should have been a half-hour trip.

Cynthia had had Bill order several cots for us as well as a hospital bed for her husband. Once the padding arrived, Dennis was put in bed in the living room, where (as had been planned at the hospital) the furniture had been pushed back to the walls or moved out of the room. It was the best place available, and gave us adequate room to put the MALSS (Mobile Advanced Life Support System) cart next to his bed when the time

came. Some of his friends managed to get a plastic sheet down to protect the carpet. Plastic sheeting and masking tape are going to be added to our stabilization kit. We certainly would have ruined the carpet without it. His friends also acquired pitchers for spreading ice, and 5 gallon buckets for catching blood washout. These should be standard kit items as well. One of his friends also made an airport run to pick up items not brought up with the Alcor South team.

With Dennis in bed, and the MALSS cart unloaded from the ambulance and brought into the dining room, the team and the first of the hospice nurses got together for a briefing from Mike. Either we were very lucky, or the quality of hospice nurses in this area is very high. They were all surprised by the complexity (and evident effectiveness) of the MALSS cart, and the concern that the team members showed for our patient. The nurses were on an eight-hour rotating shift, which brought the first one back the next afternoon. They were all interested in what we were going to do.

As our briefing and preparations continued, the first of many visitors began to arrive. Our patient was a well-known and highly-respected figure in Silicon Valley, and had been out of town for some time, so a *lot* of people came through that night, perhaps as many as 50 people over several hours. The last prominent Silicon Valley figure came through, his latest amour on his arm, about midnight.

Dennis had markedly deteriorated since the previous night and was now in a coma from liver and kidney failure, but there seemed to be no immediate danger of cardiac arrest. We had no idea how long this state might continue; estimates ranged up to a week. Arel and I left for a couple of hours, collecting a small refrigerator from home which could keep some of the ice frozen. When we got back, we sent Joe home. He only had a few hours before being recalled about 1:30 am.

After getting things set up as well as it seemed we could, I went to bed around 1 a.m. Carlos and Tanya set up cots behind the MALSS cart in the dining room. Mike had intended to check into a nearby motel, but Dennis's vital signs kept dropping so he borrowed a sleeping bag and some foam, and slept on the floor of the garage. Arel stayed up watching somewhat longer (not entirely trusting the people who were watching Dennis to call us if he were to quit breathing). I found it impossible to sleep, being on edge and expecting to be called out at any moment. Our patient continued to deteriorate all night, and we were called about 7 a.m. to get ready. There was a frantic effort to get the medications drawn up and to get the Viaspan (washout solution) injected with heparin, insulin, garamycin, and dexamethasone (supplied from our kit, since it had not been sent with the Viaspan). We also primed the MALSS cart and moved it next to Dennis' bed. But we had underestimated the strength of Dennis' heart.

At 11 a.m. we were still waiting. At 11:12 Dennis' blood pressure hit an undetectable low, seemingly 0/0, and then to our amazement he rallied, with color coming back into his fingernail beds. We stood down for a few hours, and managed to send out for some food. There was another crisis which he got through in the early afternoon. We were beginning to worry about the life of the drawn up meds, bacteria growing in the ECMO (Extracorporeal Membrane Oxygenator) circuit, and about the life of the oxygenator. Mike injected some antibiotic into the circuit to extend its life, and was starting to think



Mike strives to achieve an acceptable flow rate.

about what we had available to tear it down and set it up again. About 4 p.m. Dennis began to experience very irregular bradycardia and a falling respiratory rate. Still, he lasted about an hour longer. He was pronounced at 5:03 p.m.

In addition to the transport team, we had several helpers available to move Dennis from the bed to the PIB. Dennis was a large guy (215 lb.), and while he was wasted in the upper body, he was *really* edematous (full of fluid) in the legs, with a massive abdomen from his cancer-invaded liver. Moving a person of that size can be nearly impossible. We did it by the sheet-pickup method, and lots of helpers; I seem to remember 4 on each side. (A week later, at a memorial at our patient's house, an old friend of mine repeated the aphorism that a friend is someone you call to help you move, and that a *real* friend is someone you call to help move a body. We had lots of real friends that day.) Moves of this type need to be carefully planned out in advance, with everyone told exactly how it is to be done. In this case, he went out over the end of his bed, and back over the end of the Pizer tank. I removed the IV

pole from the MALSS so it would not be in the way, and stuck it back on when they had him placed. The HLR was on Dennis about 2.2 minutes from the time he was pronounced.

Afterwards Leonard recommended that we measure our patients and adjust the HLR base to fit. We had significant problems with the HLR plunger moving out of position during use — partly because the massive liver and ascites made the chest slope toward the neck. As a result, the plunger walked upwards and twisted sideways, requiring frequent readjustment.

In a matter of seconds, ice and water were dumped into the portable ice bath on top of the MALSS cart, and the transport medicines were administered through an indwelling Quinton catheter which had been left in place for us. Shortly after we started the HLR, the hose blew off the plunger.

I put a cable-tie on it after Leonard stuck the hose back on. Arel had trouble keeping the airway open, but she learned that when she could hear a death rattle (raspy breath-

ing) the end-tidal CO₂ monitor showed good oxygenation, and the only way she could keep the airway open was by hyperextending the neck. This had to be done regularly to avoid poor ventilation. After a couple of these adjustments, a lap pad was rolled up and placed under the patient's neck as a bolster. To augment Arel's suggestion that a bolster should be included with the ice bath, Tanya made a better suggestion of an adjustable strap on the PIB to correctly hyperextend the neck for better ventilation.

It took a lot of strength from Joe or Leonard to keep the mask sealed to the patient's face because of facial wasting (which was also the case with Arlene Fried, whom we stabilized two years ago). Taping the mask on didn't work because Arel had failed to put the tape all the way around the head, and because the water soaked it off. But an elastic or Velcro strap such as that used earlier on the patient's oxygen mask might have helped. We should have intubated him, but what we did worked okay, and Mike, the only person who could have done it, was otherwise fully occupied. (We discovered during the glycerol perfusion the next day that the patient's head had been bruised, probably by being pressed against ice in the bottom of the bath because of the pressure needed to seal the mask.) About an hour into the stabilization the first cylinder ran out of oxygen. There was a quick change of cylinders, and everyone vowed next time to put a regulator on the second cylinder *before* the first one runs out.



Setting up for cardiac surgery.



Ralph Whelan (left) assists Alcor's contract surgeon in placing cannulas in the heart.

While Leonard, Joe, and Arel were busy at the head end, Naomi was injecting the transport meds. It was not until after the suspension that Naomi realized that she had forgotten to continue to add medications after the initial boluses and continuous infusions were set up. During this Mike and I were doing a cutdown. (Tanya was taking notes, and Carlos was videotaping.) Dennis was very edematous, and his vessels were deep, over two inches below the skin. We used up every gauze sponge we had in the kit and the ambulance trying to keep the operating field dry, and had use for the suction when we had a bleed. The night before, one of the nurses and Mike had spent a lot of time trying to find a pulse from these vessels, and had failed. We tried on the side which had been used for chemotherapy infusions, and gave up. (In retrospect, we almost certainly did not go deep enough). We cut into the other side, and eventually located a vessel with a clot in it, but no artery. After enlarging the incision in both directions, and cutting down to muscle in some spots, we finally found the femoral vein. Cutting through tissue that edematous was a real problem.

Once we exposed the vessels, Mike had to tie off a number of small branches to get down to the femoral artery. After tying off the distal ends, ligating the vessels and putting a small clamp on the proximal end, Mike clipped partway into the vessels (one at a time) with scissors. He cut the vein first, and then the artery. The cannulas went in with each of us hold-

ing one side of the vein or artery. I managed to screw up and backed out the arterial cannula in error. Cannulas need to be *securely* tied down, because having one come out is very, very hard on the patient. (i.e., in about a minute all their blood is gone.)

Operating an ECMO circuit is tricky; for one thing, you have to be sure to get all the bubbles out of the circuit where the tubing splices into the cannulas. This is done by filling the end of the tubes and the cannulas from a syringe filled with saline. When we finally did get things hooked up,

it was a relief to see that the arterial blood and even the venous blood was well oxygenated. Hats off to the head-end crew!

The nurse who pronounced stayed and helped as scrub nurse. It is impossible to say enough good things about her. She was a welcome and valuable asset to Mike. (I was green as grass as a surgical assistant.)

When we got the ECMO circuit hooked up, the patient's temperature was still rather high. He went on bypass after an hour and forty-five minutes, with an arterial temperature of 23.2°C. (Far too much time to do a cutdown, but about the same as Arlene because of the time it took to transport her to a mortuary for the cutdown and washout.) Arlene's smaller mass had cooled much further in that time. Bypass greatly increased the cooling rate, though we could have used a larger heat exchanger.

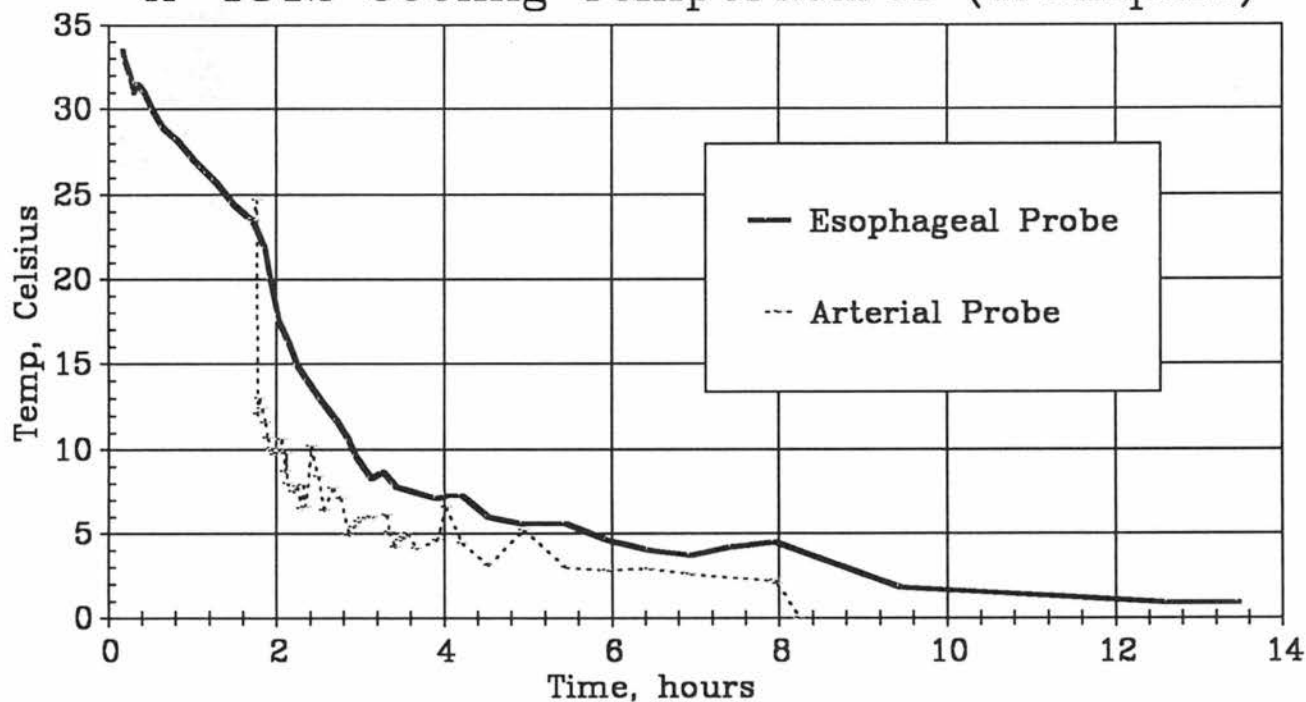
During the surgery I noticed a few problems with the squid (ice-water circulator). Dennis, being such a large guy, took up the entire tank from side to side. This caused the water to pile up at the head end, and not flow fast enough to the foot end where the pump intake was located, so the pump tended to suck air while the head end of the tank flooded. Two lengths of 2-inch plastic pipe about 4.5 feet long placed in the bottom of the tank would help get the water back to the foot of the tank and the pump.

The heat sink for the blood heat exchanger is water in the Pizer tank. This works, but you need to watch and be sure there is plenty of ice where the water is



Closing the circuit is tricky. Mike (right) works bubbles out of the line, with Ralph's assistance.

A-1312 Cooling Temperatures (Transport)



flowing. A lot of ice was melted between the intake and outlets. I suspect that the heat transfer water was not as cold as it could have been, i.e., it was above 0 degrees C part of the time.

Another improvement for getting heat out of the patient would be to put a grid of small pipes in the bottom of the PIB, and draw or release water through them. This would allow water to flow beneath the patient for much-improved heat-exchange. Large people just cool slowly from the surface. By the time we had completed the shutdown on Arlene Fried she was at the washout temperature. It took about the same time to get Dennis hooked up, but it took considerable additional time recirculating blood to get him down to washout temperature. It just takes longer for a person with three times Arlene's weight.

When the patient was cooled to about 12 degrees, Mike started dumping treated Viaspan into the bag reservoir on the MALSS cart, and opened the venous return line to begin the Viaspan flush. He had hooked up an additional large-bore dump, but the special Viaspan spike broke off in the first bag. We jury-rigged an IV spike replacement (which leaked some Viaspan on the floor) and used a small-gauge port as well. The Viaspan flow rate was very slow, and Mike had to keep turning the pump on and off. At one point he got distracted, and air was sucked into the sys-

tem, but fortunately none got into the patient. A cross-connect line at the patient end (to take the patient out of the loop temporarily) would have been a blessing to get the bubbles back in the reservoir. In spite of all our troubles, which included blowing the tubing off the oxygenator and putting more Viaspan on the plastic sheet, we got all but one or two of the Viaspan bags into the patient. Mike saved these for buffer for the trip to Riverside.

Even with all the cold Viaspan, the patient was still at a slightly higher temperature (4.1 °C) than is desirable for transport, but we had to go. Fortunately we still had plenty of people around, because we used them to move the MALSS cart down a step, and take much of the weight off the overloaded wheels as we moved it to the ambulance. (The MALSS cart started life as a *gurney*.) We bailed out the PIB and removed much of the ice for the short move to the ambulance; still, the MALSS cart and Dennis weighed about 800 pounds. The lift gate on the ambulance worked great; whatever was paid for it, it was well worth it.

During the transfer to the ambulance and for almost the entire drive to Riverside, Dennis was maintained on low-flow circulation. The MALSS cart has two large deep-cycle batteries and a charger built in. We kept the cart hooked up to AC power until we left the house. That left enough

power in the batteries to run the cart for many hours. Dennis arrived with no rigor, an indication of adequate metabolic support all the way.

We (Mike, Carlos, Tanya, Arel, Keith, and Naomi) managed to get on the road at 9:16 p.m. I drove the ambulance from Dennis' house to Stockton. After getting out of the Bay Area we hit a solid wall of fog. What with the lack of sleep, I was fading and felt my competence to drive fast into dense fog was lacking, so I swapped with Carlos and drove the van (following lights on the ambulance) for a while. At a gas stop Arel took over driving, and she lost the ambulance in dense fog. (The unholy rush down Interstate 5 was to get the patient to Alcor before the contract surgeon had to leave — although Arel didn't know this.) We drove on for a while, then swapped again after picking up gas at Kettleman City. The fog was so dense at Kettleman City that you could only see one of the gas stations at a time. I made it almost to the Grapevine before deciding that going any further was going to result in a wrecked van. We pulled off the road, called Alcor from a phone, and got a nap between 4 and 5 a.m. The cold woke us up and we reached Alcor close to 8 a.m., an hour and a half behind the ambulance, and just as Saul was rushing the contract surgeon to the airport. He had only managed to get most of the perfusion

"plumbing" in place, and Mike was able to take over and complete the job. I know we may have to make do with contract personnel, but I sure am not happy about it. Arel had the shakes from lack of sleep and sheer terror, and since there were plenty of OR people available, she appropriated one of the beds in the crew room for the next three hours.

Wasted as I was, I felt I could not go to sleep, so I scrubbed and dried the PIB on the MALSS cart, and got the cooling set-up together and down to temperature. Later I had to get into scrubs and help Mike, Hugh, and Arel with the cephalic isolation.

During the part of the operation that Mike took over, he had a serious problem with the aorta tearing, but he was able to clamp off the tear. How well our patient had been supported was apparent from the complete lack of brain swelling. All three of the last well-supported patients have lost a large amount of fluid from the burr hole (used to see how the brain is perfusing). Almost the entire perfusion circuit withdrawal amount (which sets the rate at which cryoprotective glycerol is introduced) was exiting through the burr hole. We almost certainly did not transect a blood vessel on the brain or in the dura. Possibly this behavior is just normal for uninjured brains.

Dennis perfused beautifully to a 4.5 molar glycerol concentration with no brain swelling; in fact, X-rays indicated at least

four millimeters of shrinkage. Such good perfusion was the result of a number of factors: Cynthia's complete cooperation, Dennis' personal physician (who wrote pre-mortem prescriptions to limit ischemia damage), an incredibly cooperative nurse, relatives who started out semi-hostile and became supporters, a number of friends, a team which could recover from glitches minor and major, and a large amount of luck.

After a suspension I always take time to reflect on how things went and how we might improve them. This one, coming right before Mike Darwin's resignation became effective, has more the flavor of "Can we ever do this well again?" I think we can, but it is very clear to me that a lot of hard work (and money) will be required to even partly replace the skills and leadership that we have lost with Mike and Jerry.



Perfusion underway, Hugh and Tanya monitor the Heart-Lung Machine and various temperature readouts.

Reviews

Disappearing Through The Skylight

by O.B. Hardison, Jr., Penguin, 1990

book review by Thomas Donaldson

This is a book with many faults and some virtues. Since we all have a keen interest in the future, and no one can hope to predict the future without some practical acquaintance with the past, Hardison's book may interest many cryonicists. Hardison does not pretend to predict the future. What he tries to understand is our past, specifically the last century of it. An

understanding of that past might give us, then, some idea of the directions and velocity of movement into the future. That is why I believe it merits interest among cryonicists.

But to understand the last century, and everything that happened in it in every area of human endeavor, is far too vast a task. No single individual could gather

together enough information in all fields. A college of experts, if collectively willing to talk over all the fences separating disciplines, might make a job of it. Hardison does, however, make a grand attempt.

Hardison's attempt includes virtually every field, from physics to dance, music, and art. He unifies his presentation by the metaphor he first states in his title: this

century, the 20th Century, is the one in which we leap through the skylight into distant space, leaving behind us our past, our traditions of all kinds, and even our humanity. He wrote his book shortly before he died in 1990, and he was not suspended.

As you might guess, I'm dubious about his central metaphor. But even so, he manages to survey a lot of developments, often in areas that I frankly did not know very much of. (The advantage of a survey is that it gives you the names and interest to follow it up yourself). Of course, he began by discussing physics (with the theme that the world itself was disappearing). From there, however, he went on to early 20th Century architecture (his theme here was the disappearance of history, which for him actually in architecture meant something very simple: the buildings don't look like older buildings, yes?). From architecture he passed on to the disappearance of language, which turned out to be a very interesting discussion of Dada (post WWI), early German attempts at automatic poetry, random poetry. In the '50s several Latin American writers took up concrete poetry, which is poetry whose setup on the printed page conveyed meaning in itself. An example:

silencio silencio silencio
silencio silencio silencio
silencio silencio
silencio silencio silencio
silencio silencio silencio

(He does point out that such poetry goes back at least as far as the 17th Century, in a poem by George Herbert shaped like an angel.) This tradition (a word he avoids using) has developed today into algorithmic literature, in which the poet gives an algorithm to produce many poems (the group doing this is called Oulipo).

From poetry gradually turning into visual art Hardison then discusses computer art directly, as creation of artificial environments or "artificial reality," hypertext, and computer games (including the pictures that come with them). Of course fractals show up here, and all the beautiful graphs computers can generate. The famous game *Adventure* is of course a work of literature (or something in that neighborhood!); one feature of works like this has been that they sometimes became communal, like folk songs are communal. No individual wrote them. Instead, they grew together out of changes made by many people.

Some readers may ask why they should be interested in obscure art movements of the 20th Century. What have they got to say to us? One major point Hardison makes about these developments in art and writing is that they aren't at all obscure. We see ads using just such techniques around us every day (Hardison discusses the EXXON trade name as an example). These changes will be all around us. If books become obsolete in favor of much more interactive media such as hypertext, that will cause a major difference in how we read. If all our art is interactive, then even the notion of hanging a picture on the wall ceases to make sense. The wall itself would be an art work, changing all the time.

Finally from this he passes on to human beings and their "disappearance," either because we would be surpassed by our own creations, or we would turn ourselves into them. I think this section of his book is the weakest, pointing up many other fields Hardison neglects completely. What about medicine, or farming, or design and manufacture of everyday objects? What about politics, trade, economics, and business? In some of these areas Reality intrudes on everyday life far more intrusively than in physics. Hardison might argue that many of these subjects listed are too "practical" for his survey; but the complete omission of molecular biology from Hardison's discussion stands out. (And what about nanotechnology?)

Still, as a discussion of common thinking and what it means this section of Hardison's book had a great deal of interest. Some themes are implicit in it: the primary theme is distrust of our biology and our bodies, the hardness and strength of metal (and now of silicon). And this chapter is the last one, which he ends with a passage from Yeats ("Sailing to Byzantium") which tells of these feelings:

Consume my heart away; sick with desire
And fastened to a dying animal
It knows not what it is; and gather me
Into the artifice of eternity.
Once out of nature, I shall never take
My bodily form from any natural thing
But such a form as Grecian goldsmiths make
Of hammered gold and gold enamelling
To keep a sleepy Emperor awake;
Or set up a golden bough to sing
To lords and ladies of Byzantium
Of what is past, and passing, or to come.

Yeats' poem, written over 80 years ago, captures many ideas advocates of our

transfer into "machines" are still promoting. As cryonicists, we know very well about "dying animals." Yet in this poem immortality and being "out of nature" are identified; and just as some now speak of making ourselves of diamond, here we have gold.

My own major problem with Hardison's book comes directly from his fundamental theme. The century in which we live has been full of changes: but even a quick reading of the tale told by Hardison shows how the past still plays its role, how each of these novelties came quite naturally out of its precursors. That is history. Nor have we escaped Reality, as anyone looking around themselves and reading the news can see. Physics has not so much departed from reality as come to a much deeper understanding of it, and just as usually happens with such deeper understandings, even more questions result. Nor can we ever leave this Nature, no matter what our form. And in one form or another (but neither of gold nor of diamond), human beings will continue.

I don't believe we can understand ourselves and our times without resort to our history, which cannot be abolished by a few Dadaist poems. And if we fail to understand our own times, how could we understand the unknown future which builds upon itself today while I write this? Nor do I mean to say that we aren't passing through a major transformation: but the period which most reminds me of the 20th Century is actually the 12th and 13th Centuries in Europe.

At that time, the first experiments at modifying the traditional Gregorian Chants had begun; cathedrals were in construction; and even though Europe only passed by China several centuries later in technology and sophistication, something fundamental must have happened then. It was in the 12th Century, not the Renaissance, that Europe's *rate of economic growth* became significantly greater than that of China. It was actually in *these* times that scientists began to understand optics and lenses, by *experiments* and *calculation*. People reached an understanding of rainbows as early as this. Tremendous changes were going on beneath the surface of life, while no one at the time fully understood them. Doesn't that remind you of today?

Cryonics Is . . .

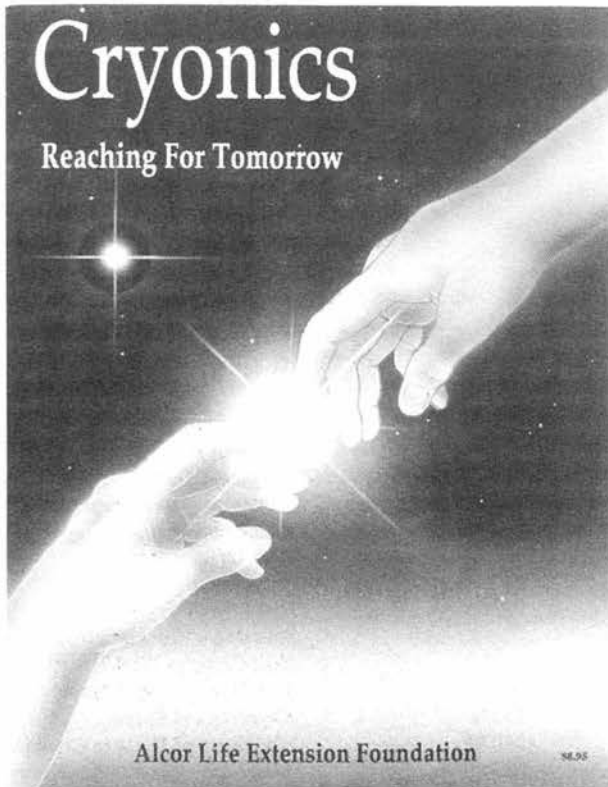
Low-temperature preservation of terminal patients when medicine is unable to heal them. This treatment is called *cryonic suspension*. The goal of cryonic suspension is the transport of today's terminal patients to a time in the future when cell/tissue repair technology is available, and restoration to youth 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.**

It is our belief that if human knowledge and medical technology continues to expand in capability, people with conditions that would cause them to (incorrectly) be considered dead by today's medicine will be routinely 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 who will have been waiting in cryonic suspension.

There is already substantial scientific evidence available that current suspension techniques are preserving memory and personality — and that the repair and resuscitation technologies we envision will be developed within the next 50 to 150 years.

Cryonics

Reaching For Tomorrow



Non-members may call toll-free (800) 367-2228 or write (see reverse for address) and receive the book, *Cryonics - Reaching for Tomorrow* for free (regular retail price: \$8.95, member price: \$5.00.)

Alcor Is . . .

The Alcor Life Extension Foundation: a non-profit tax-exempt scientific and educational organization. Alcor currently has 17 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, and Northern California, with a cool-down and perfusion facility in Florida and the United Kingdom.

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 the world's largest and most technically advanced cryogenic patient storage facility.

All Alcor Directors and Officers are required to be full suspension members.

Call toll-free (800) 367-2228 or write (see reverse for address) for the free book, *Cryonics: Reaching for Tomorrow*.

Table of Charges and Dues

Sign-Up Package: \$100 (certain limitations apply; call 1-800-367-2228 for details)

Whole Body Suspension Minimum: \$120,000

Neurosuspension Minimum: \$41,000

Outside U.S. Surcharge: \$10,000

Annual Adult Dues: \$288.00

Additional Adult Family Member Annual Dues: \$144.00

Additional Family Member Child's Dues (under 15 years of age): \$72.00

Adult Student Annual Dues (must be full time student): \$144.00



You can tour the Alcor facility in Riverside, California under the expert guidance of the Alcor staff. The facility is open to small groups (15 people or less) who wish to learn how terminal patients are placed into suspension and how they are cared for at -320°F.

The Alcor tour also features a discussion of the scientific evidence that patients in cryonic suspension have a realistic chance of being restored to life, health, and youthful vigor as well as a fascinating exploration of the advances likely to come in the 21st century and beyond. The tour provides an invaluable opportunity for you to have your questions about cryonics and the prospect of an extended human lifespan answered.

The Alcor tour is free of charge. If you'd like to make arrangements, call (800) 367-2228.

Yes, I want to make cryonic suspension arrangements with Alcor. Please send me _____ Sign-Up Package(s).

Name _____ Age _____

Address _____

City _____ State _____ Zip _____ Phone _____

First household member: \$300.
Additional members: \$150 each.

Payment enclosed (check or money order). Bill me.

I understand that an Alcor Sign-Up Coordinator will contact me at the above number.

Order Form

NOTE: All prices include postage and handling and are in U.S. dollars. Minimum order \$5.00. Overseas orders must be paid for with U.S. dollars by Traveler's Cheques or International Money Order. All orders are subject to availability and all prices are subject to change.

Cryonics Magazine

Subscriptions:

- United States: \$35.00/year
 Canada and Mexico: \$40.00/year
 Outside North America: \$45.00/year

Cryonics back issues:

U.S., Canada and Mexico: \$2.50 each. Issues: _____
 Outside North America: \$3.50 each. Issues: _____

Membership

- Alcor Suspension Membership Packet \$100.00

Books

Cryonics - Reaching For Tomorrow	\$5.00	_____
Engines of Creation	\$10.95	_____
The Prospect of Immortality	\$11.00	_____
Man Into Superman	\$14.00	_____
Great Mambo Chicken & the Transhuman Condition	\$18.95	_____
The 120-Year Diet	\$5.95	_____
The Tomorrow Makers	\$18.95	_____
Immortality, Scientifically, Now	\$11.95	_____

Brochures

Alcor Life Extension Foundation	\$0.75	_____
Why Cryonics Can Work	\$0.25	_____

Articles and Reprints

Why We Are Cryonicists	Free	_____
Alcor: The Origin of Our Name	Free	_____
Technical Case Report: Neurosuspension of Alcor Patient	\$3.00	_____
The Journey Begins: Alcor Member Enters Biostasis	\$2.00	_____
The Scientific Validity of Cryonic Suspension: A Bibliography	\$3.00	_____
Long-Time Alcor Member Enters Biostasis	\$2.00	_____
The Cryobiological Case For Cryonics	\$2.00	_____
Mathematical Analysis of Recirculating Perfusion Systems, With Application to Cryonic Suspension	\$2.50	_____
Declarations by Scientists in Support of Kent vs. Carrillo	\$20.00	_____
Case Report: Two Consecutive Suspensions	\$3.00	_____
Mathematical Models of Perfusion Processes	\$5.00	_____
Postmortem Examination of Three Cryonic Suspension Patients	\$3.00	_____
Heat Flow in The Cryonic Suspension of Humans	\$2.50	_____
Histological Study of a Temporarily Cryopreserved Human	\$3.00	_____
Calcium Blockers Given After CPR May Save Brains Denied Blood up to 1 Hour	\$0.50	_____
Viability of Long-Term Frozen Cat Brain	\$0.50	_____
Cell Repair Technology	\$2.00	_____
How Cold is Cold Enough?	\$1.25	_____
Misadventure as a Cause of Death in an Immortal Population	\$1.25	_____

Histological Cryoprotection of Rabbit Brain With 3M Glycerol	\$0.50	_____
But What Will The Neighbors Think: The History And Rationale of Neurosuspension	\$2.00	_____
Histological Cryoprotection of Rat And Rabbit Brains	\$1.50	_____
The Cephalarium Vault: A New System of Protection For Alcor Neuropatients	\$1.25	_____
Molecular Engineering: An Approach to The Development of General Capabilities For Molecular Manipulation	\$1.00	_____
Cryonics and Orthodoxy	\$0.50	_____
Molecular Technology And Cell Repair Machines	\$2.00	_____
Vitrification as an Approach to Cryopreservation	\$3.00	_____
Nanotechnology	\$2.50	_____
24th Century Medicine	\$2.00	_____
A Dream in His Pocket	\$2.00	_____
The Cost of Cryonics	\$3.00	_____
Freezing of Living Cells: Mechanisms and Implications	\$3.00	_____
Will Cryonics Work?	\$4.00	_____
Her Blue Eyes Will Sparkle	\$1.00	_____
Cryonics and Space	\$0.50	_____
The Death of Death in Cryonics	\$1.00	_____
Many Are Cold But Few Are Frozen: A Humanist Looks at Cryonics	\$2.00	_____
A Stunning Legal Victory	\$2.00	_____
What You Can Do	\$9.00	_____
Reviving Cryonics Patients	\$7.00	_____
Life Insurers at Risk?	\$2.00	_____
Slide Presentation:		
Suspension Members	\$200.	_____
All Others	\$350.	_____

Gift Items

Alcor T-Shirt, Size: _____	\$12.00	_____
Alcor Sweatshirt, Size: _____	\$17.00	_____
Alcor Mug	\$6.00	_____
Alcor Patch	\$5.00	_____
Alcor Bumper Sticker	\$2.00	_____
Lapel Pin	\$5.00	_____
Tie Clasp	\$5.00	_____
Hat Pin/Broach/Stick Pin	\$5.00	_____

Total _____

The literature above can be ordered by using this form, or by telephone with Mastercard or Visa by calling Alcor: 1-800-367-2228 (toll free).

Name _____

Address _____

City _____ State _____ Zip _____

Telephone: _____

Visa/Mastercard#: _____

Expiration Date: _____

Signature: _____

Please pay by check, money order, or credit card.

ALCOR, 12327 Doherty Street, Riverside, CA 92503

Advertisements And Personals

The Alcor Life Extension Foundation and Cryonics reserve the right to accept, reject, or edit ads at our own discretion and assume no responsibility for their content or the consequences of answering these advertisements. The rate is \$8.00 per line per month (lines are approximately 66 columns wide). Tip-in rates per sheet are \$90 (already printed and folded); or \$180 (printed one side) or \$270 (printed both sides), from camera-ready copy. Tip-in ads must be clearly identified as such.

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.

EXTROPY: The Journal of Transhumanist Thought, #7. Memetics and cryonics, privately produced law, spontaneous orders (markets, agoristic computing, hypertext) neurocomputation, neologisms, transhumanism, reviews of *Smart Drugs*, and more. \$4 from Max More; P.O. Box 77243, Los Angeles, CA 90007-0243.

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, Sunnyvale CA 94087.

In So. Cal. call Dave Montoya, agent Kachok & Co. Ins, Inc. 619-587-2727 or 714-674-0151. Serving locally since 1961.

Meeting Schedules

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

The **SUN, FEB 2, 1992** meeting will be held at:
ALCOR/Cryovita Laboratories
12327 Doherty St., Riverside, CA 92503

Directions: Take the Riverside Freeway (State Hwy 91) east toward Riverside. Go through Corona, and get off at the McKinley St. exit. Go right (south) on McKinley. Turn left (east) on Sampson (1st stop light). Go about 1 mile along Sampson to Granite. Go left on Granite to its end, and turn right on Doherty. Go about 200 yards on Doherty and turn left into the industrial park just short of "Great Eastern Furniture." Alcor is the third building from the back, on the right.

The **SUN, MARCH 1** 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.

There is an Alcor chapter in the **San Francisco Bay area**. Its members are aggressively pursuing an improved rescue and suspension capability in that area. Meetings are generally held on the second Sunday of the month, at 4 PM, followed by a potluck. Meeting locations can be obtained by calling the chapter's Secretary, Lola McCrary, at (415) 812-4422 or (E-mail) Lola@lucid.com.

The **SUN, FEB 9, 1992** meeting will be held at the home of:
Keith Henson and Arel Lucas, 1794 Cardel Way, San Jose, CA

Directions: Take the 17 South (880) and get off going east on Camden. Stay on Camden as it turns south and go to Michon Dr. Turn right onto Michon and go to Harwood Rd. Turn left on Harwood and go south to Almaden Rd. (1st street on right). Turn right on Almaden and right again onto Elrose, then left onto Cardel. 1794 is near the end of the street, on the left.

The **SUN, MAR 8, 1992** meeting will be held at the home of:
Leonard Zubkoff, 3078 Sulphur Spring Court, San Jose, CA
Tel: (408) 238-1318

Directions: 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. The business meeting will start at 4:00 p.m., and the potluck around 6:00 p.m.

NOTE: Leonard's house is definitely not child-proof; in fact, the proliferation of equipment, connecting cables, and tools should probably be considered child-hostile. I have no objection to children visiting, but their parents must be prepared to supervise them adequately so that no accidents occur.

There are two Alcor groups in the **Greater New York area**. Details may be obtained by calling either Gerard Arthus, at (516) 689-6160, or Curtis Henderson, at (516) 589-4256.

The **Alcor New York Group** meets on the the third Sunday of each month at 2:30 PM, 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.

Meeting dates: **Feb. 16, Mar. 15, April 19, May 17.**

The **Alcor New York Stabilization Training Meeting** meets on the first Sunday of every month, at 2:30 PM, at the home of Gerry Arthus. The address is: 17 Mystic Way, Stony Brook, L.I., telephone (516) 689-6160.

Meeting dates: **Mar. 1, April 5, May 3, June 7.**

There is a cryonics discussion group in the **Boston area** meeting on the second Sunday each month at 3:00 PM. The February 9 meeting will be held at 26 Ward St., Apt. 1, Boston. If you are taking the "T," get off at Andrews Square. If you are driving, take the Andrews Square exit off the 93 (first exit south of Massachusetts Ave). Go to the six-way intersection and take Prebble St. Ward St. is the second left. Further information may be obtained by contacting Walter Vannini at (603) 595-8418 (home) or (617) 647-2291 (work).

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. 2, MARCH 1.**

Directions: It is recommended you call ahead to obtain directions; most attendees drive in from different regions. For this information, call Alan Sinclair at 0323-488-150. For those living in or around metropolitan London, you can contact Garret Smyth at 081-789-1045, or Russell Whitaker at 071-702-0234.

Other Events of Interest

Alcor's 20th Anniversary and the 25th Anniversary of the Freezing of the First Man

A banquet will be held on Saturday evening, April 4th, 1992 at the Marriott Hotel, 2200 E. Holt, Ontario, California to celebrate the 20th anniversary of the Alcor Life Extension Foundation and the 25th anniversary of the freezing of the first man, Dr. James Bedford.

The evening will include good food, conversation with fellow cryonicists, and excellent speakers talking about cryonics then and now.

COST: \$40 before February 15, 1992, \$50 thereafter. Payment and reservation must be received no later than March 26, 1992. Please make checks payable to Alcor Foundation, 12327 Doherty St., Riverside, CA 92503, or call 1-800-367-2228 to use your MasterCard or Visa.

NOTE: A group rate on hotel accommodations will be offered to Alcor guests by the Marriott Hotel.

Sunday, April 5th, 1992, those who wish to can attend the monthly Alcor Business Meeting, to be held at the home of Saul Kent. Alcor will also be conducting tours of the Alcor facility.

ALCOR LIFE EXTENSION FOUNDATION
12327 Doherty Street
Riverside, CA 92503

**FORWARDING AND RETURN POSTAGE GUARANTEED
ADDRESS CORRECTION REQUESTED**



**For information on cryonics call Alcor:
1-800-367-2228 (toll-free, non-members only) or 1-714-736-1703 (members).**