CRYONICS

VOLUME 6(10) OCTOBER, 1985 ISSUE # 63

Contents:

CRYONICS is the newsletter of the ALCOR Life Extension Foundation, Inc. Mike Darwin (Federowicz) and Hugh Hixon, Editors. Published monthly. Individual subscriptions: $15.00 per year in the U.S., Canada, and Mexico.; $30.00 per year all others. Group rates available upon request. Please address all editorial correspondence to ALCOR, 4030 N. Palm St., #304, Fullerton, CA 92635 or phone (714) 738-5569. The price of back issues is $2.00 each in the U.S., Canada, and Mexico, and $2.50 for all others.

Editorial Matters

Editors like to think of themselves as fearless and upright, publishing the whole truth and devil take the hindmost. The problem is, when you hurt people's feelings, even by telling the truth, your circle of friends, acquaintances, and customers—or at least acquaintances and customers--often contracts abruptly. Thus it is with CRYONICS. We sit on our web of connections and listen to the vibrations.

Interpretation is all-important. After hearing two people's accounts of one event, anyone who believes only a single account is a fool. Further caution comes from getting three or more accounts from two observers, as you go back and forth between them trying to find out what **really** happened. Talk with the participants directly? Forget it! For one thing, you have to protect your sources of information. Often, the mere fact of possession of information points right back at your source, and there are places where the editors of CRYONICS are counted as the **ENEMY.** Faced with telling the truth or being cut off from the flow of information (assuming that direct interrogation doesn't get you lies and evasions anyway), the usual decision is to keep your mouth shut! Then there's a more difficult value judgement. If you care about what will happen if you spring the truth on people, you're faced with: "If I tell what I know, will it make the overall situation better or worse?" This is where it comes down to a matter of values, to deciding what you really care about.

As it happens, the editors of CRYONICS care about **cryonics.** Combine this with the hassle factor ("Do I really need this?"), and there is a natural tendency to keep quiet and hope things will get better. Unfortunately for this point of view, failing to say anything or to take action often results in things getting worse!

So, we finally decide, against all the above considerations, to publish the truth, or at least our educated opinion of it. Is this forthrightness well received? No way! There are people out there (Not you, of course, you're an adult and can accept criticism) who can detect a slight in a child's bedtime prayer. Still, it makes for some interesting "Letters to the Editors".

Thus the piece following this. We do not anticipate that it will be well received by those cryonicists associated with the Bay Area Cryonics Society (soon to become the American Cryonics Society), or Trans Time, Inc. For one thing, they've been caught red-handed in a violation of customs and can't blame their problem on anyone else. For another, it is going to impact a major source

of their income (not seriously, if they make the right moves, but significantly). And third, they were counseled against such activity by some members of ALCOR, and "I told you so" is never counted as a big friend-maker.

Selling Your Soul

At the beginning of the following article, there is a quote. If you're new to cryonics, the author's name won't mean much to you. But listen....for herein lies a tale worth telling, with more than a little relevance to the article which follows.

Once upon a time, when the idea of cryonics was bright and new, a group of people in a large metropolitan area decided to form a cryonics society. For a time, they prospered, sending out promotional literature and gaining members. And in the manner of other discoverers of new lands, they thought they saw an opportunity to get rich, so they split into a for-profit and a non-profit organization, to protect their opportunity. Unfortunately, what they quickly found was that they had taken on more responsibilities than opportunities, and it was not long before they had to freeze some of their members. So, they shouldered the ultimate responsibility of a cryonics organization: to see their charges across the long and weary years to a new day of life eternal.

But there were problems. For one thing, they had little business experience, and had badly miscalculated their costs, so they made the difference up out of their pockets, the few of them that would. For another, they had miscalculated their market, thinking that cryonics' time had come, when in fact it had not. And then, they discovered that most of their number had signed up to be suspended when the time came, not to put up with the hassles of money and technology that would make cryonics real. So, the organization began to hemorrhage, and the load got heavier and heavier on the people who **really** wanted cryonics to work.

One day, two men looked around, and they were the only ones left, and they were burned out. Burned out from **caring**, and from trying to do everything with nothing. Thus passed from the scene the Cryonics Society of New York and Cryo-Span Corporation, whose emblems hang above the desk as I write this, as a sad and profound reminder of what **can happen**—and did. Before CSNY closed down for good, they managed at least a nominal transfer of responsibility for their patients. Out in California, history was repeating itself already, with

variations, and the ending was much worse, and anyone who wants to see old-timers in cryonics flinch only has to ask about what ever happened to the Cryonics Society of California and Cryonic Interment, Inc.

One of these two men was Curtis Henderson. When Curtis Henderson got into cryonics, he was a well-paid corporate attorney. When he left, he was not. He had helped publicize cryonics, and his employers had not approved. He assured them he would refrain from such activity in the future, and kept his word. But his image had been captured, and every time the subject of cryonics came up in a newsroom or television station, old footage and photos were called up and that

Cryonics Society of New York

image was made to perform again. And so he and his employer parted company. Nearly 20 years have come and gone since then, and every now and then the image still is made to dance. So, the the comment used to open the article below was made to Mike Darwin. And it is true. -HH

ETHICS, COMMON SENSE AND HUMAN DIGNITY

by Mike Darwin, Hugh Hixon and Jerry Leaf

"You don't understand. Ya just don't understand. Ahhhh, but you **will.** You see, the Indians were right! When they take your picture--they own your soul. They'll come round, they'll come round with their fancy lights and their cameras and they'll take your picture. 'For the good of cryonics', they'll tell you. 'For the money', they'll tell you. And once they have your photograph, they have your soul--and its theirs to do with as they damn well please. They'll take your picture and they'll put it with any filthy lies or dirty half-truths they want. They'll use it, and they'll use you. And there's not a damn thing you can do about it."

—Curtis Henderson, circa 1973
President, CSNY and Cryo-Span

At the beginning of August we received a phone call from a rather shocked and astonished ALCOR member in Florida who asked if we had heard of, or perhaps had even seen a videocassette called "FACES OF DEATH", which was a big hit in the video rental market. We had heard of it, since just prior to Mike Darwin's departure from Florida there were several lengthy articles in the Florida press discussing the "film" and the "phenomenon" it represented.

The member informed us that not only was the film a disgusting, pro-death, anti-life outrage, it also contained a treatment of cryonics which included what the member thought to be very inappropriate footage of a suspension patient, including views of his genitals, as well as a disclosure of the patient's name and other relevant identifying information. The member commented that one of the most distressing things about the cryonics footage was that "it seemed to fit right in with all the other horrors in the film". The member offered to secure and send to us a copy of the tape. Within a short while, another member who had seen the tape called and wanted to be reassured that we would under no circumstances allow footage of him (should he ever be suspended by us) to be used in such an insensitive and degrading manner.

A little over two weeks ago the videocassette of FACES OF DEATH arrived and we had a chance to view it. It is hard for us, even now, two weeks later, to

contain the anger we feel about this callous and unthinking abuse of cryonics and of a suspension patient's privacy and human dignity. This "film" (we hesitate to dignify it enough to call it that) is in reality nothing more than a macabre, sick, exploitive series of episodes of human tragedy and perversion strung together with little pretense of being anything other than cheap sensationalism. There are scenes of animal slaughter under the most inhumane and awful conditions, scenes of autopsies, decomposed bodies, and embalmings. The viewer is treated to heart-rending scenes of **live humans** being attacked and devoured by wild animals (a Kodiak bear and an alligator)—in one case before the stunned members of the man's own family. There are graphic videotapes of suicides, sky diving accidents, and a chilling and unspeakably grotesque sequence involving a group of cultists who butcher and partially devour the body of a young woman and then slather themselves in her blood and proceed to have sex with each other—all in the pursuit of physical immortality! This sequence appears on the tape a few minutes before the cryonics sequence.

The only thing that outrages us more than the film itself is the awareness that it was made with the cooperation and assistance of cryonicists. The footage of the suspension patient used in this film was provided by Trans Time, and the footage is of a BACS suspension patient (who has since been removed from suspension and conventionally interred). For some time we have repeatedly urged BACS and Trans Time to stop selling video images and to stop exploiting suspension patients by selling photos of them. Death is a terrible thing. Never are we more vulnerable or more defenseless than when we have deanimated. Even under the best of circumstances a suspension patient does not look good. From a simple common sense standpoint it is devastating to circulate photographs to the media for public consumption of suspension patients—even under the best of circumstances. It is completely inappropriate to distribute photos not only of a patient's face, but of his or her naked body and genitals as well. We have quietly, politely, and repeatedly urged BACS and Trans Time to stop exploiting their suspension patients in this way. We were told in response that Trans Time derives a significant amount of revenue from sales of such video and photographic materials.

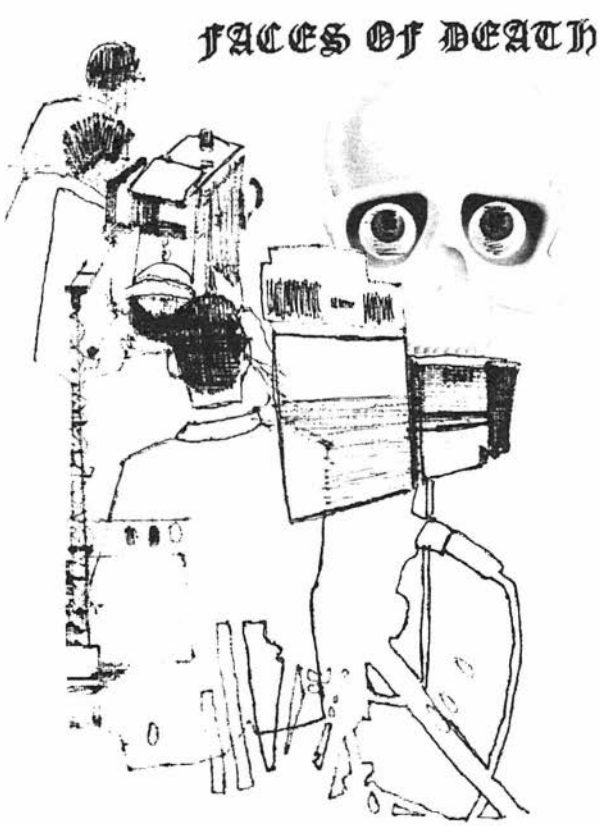
Our first indication of a reaction from the Northern California group to FACES OF DEATH came in the form of a phone conversation with BACS president Jack Zinn. Zinn told us that Trans Time was probably going to make a great deal of money from FACES OF DEATH since the use of the cryonics footage was unauthorized. Zinn was at pains to point out that Trans Time has made a great deal of money from such (similar) lawsuits in the past. Indeed, it seems that a number of Northern California cryonicists have come to regard income from litigation as a major asset. Never mind the fact that aside from the dollars it brings in, such misuse, in our opinion, does incalculable harm!

A short time after Jack Zinn's call, we learned that the lawsuit was a dead issue. It seems that Trans Time actually **sold** the footage to the makers of FACES OF DEATH, thus it was unlikely that there was any basis for a case, or "revenue" to help put Trans Time back in the black. According to Art Quaife, President of Trans Time, the footage was sold in 1979 to a production company which was preparing the film for Japanese television. It was so successful in Japan that the producers put a new sound track on it and released it in the United States. At last report FACES OF DEATH was one of the hottest rental cassettes available in US metropolitan areas.

Fulminations aside, it is interesting to look at this incident from a sociological point of view. Human behavior can be roughly divided into the rational and the irrational. Into thinking, and into feeling. Into Law, and into Custom. There is nothing illegal about FACES OF DEATH. Rationally, it portrays a common aspect of our existence with the accuracy (and inaccuracy) of the camera's eye. All the above remarks can also be made about sexually explicit material.

So what's the fuss about? Why is FACES OF DEATH a best-seller? Why are we outraged when we see cryonics depicted in it, when we want to acquaint the public with the idea of cryonics and here it is in a best-selling videotape?

Because it is an offense against CUSTOM. Customs don't have the "force of law" behind them, mostly. In reality though, they are far stronger than the laws; in fact, it might be said that law begins where custom fails. Custom is a powerful thing and breaking it carries a heavy penalty. "What penalty?", you may ask. When you walk down the street, do you want your friends to cross to the other side to avoid you? Do you want to be hounded out of the neighborhood you've lived in all your life? Do you want to be suspected, officially, of breaking the most trivial laws and regulations, to have the cops come visiting at odd hours when someone on the other side of town hears something go bump in the night? Do you want children to be warned against you as they would be about a child molester? When the gang gathers around the water cooler, do you want your approach to cause everyone to remember they have urgent business, elsewhere? Do you want your business to dry up because people refuse to cross, to even be suspected of crossing, your doorstep? All this can happen to you. JUST OFFEND CUSTOM!



Which is not to say that customs, minor ones, are not routinely violated. There is a certain titillation to breaking custom, and the scale and profits of the sexual pornography industry amply attest to that. But the norms and taboos surrounding sexuality are becoming increasingly individual as time goes on and generally, sex is something people associate with pleasure. This is not the case with death.

Conjure up in your mind the local funeral parlor or cemetery. Yes, you are a cryonicist and a rational, thinking person, and funeral parlors and cemeteries are nothing more than irrational homage to a piece of dead meat about to be buried or burned up. But how do you FEEL? Edgy? Apprehensive? Solemn? Peaceful? In this society, and in most others, customs involving death are MAJOR CUSTOMS. All the ritual, the appearances, and the detail of the funeral industry exist to cater to (and reinforce, profitably) our death customs. We do not see, do not want to see, are forbidden to see, the behind-the-scenes activities of the keepers of the dead. For you to walk unaffected among the dead and dying requires a major reprogramming effort. A major part of medical and mortuary training does just that, subtly and effectively. But most people never make it.

So we come back to FACES OF DEATH. FACES OF DEATH is a major offense against custom, AND CRYONICS IS IN IT! There is no reason to believe that the inclusion of cryonics in FACES OF DEATH will do cryonics any good, and a lot of feeling to indicate that it will subtly poison our public image and drive away at the outset people who might otherwise become interested. The viewers of this tape will want nothing to do with the other sordid ways of death which are depicted--animal attacks, cult rites, suicides, and misadventures--and probably they will associate the same revulsion with cryonics. The viewer who perceives cryonics as a means towards life instead of a practice of death will be rare indeed.

FACES OF DEATH is not the only copy of that material out there. The principals at Trans Time sold that material in 1979, and they freely tell us that they have sold it and other graphic material again and again since then. Because selling it was profitable, there was, predictably, little said against such sales by the people responsible. Most of the criticism came from outside and was easily dismissed as sour grapes. (This accusation may contain some truth, but how do the grapes taste now?) We can reasonably predict that those offensive images will surface again and again to haunt us.

In defense of the decision to sell material that might offend custom, we should point out the following arguments in mitigation:

- Cryonics itself is not exactly a customary practice. In fact, it is a thoroughly rational act against an uncaring nature. It also separates us from customary behavior. Anyone who cares a great deal about what other people think will not sign up for cryonic suspension.

- Most of the people working in cryonics did not come to it by formal training. There was a great deal of self-teaching. As a consequence, the avoidance customs that were unlearned were not replaced by the customs that are instilled in medical and mortuary training to avoid offending the customs of the general public.

- Even within cryonics there is custom and offense against it. For example, neuropreservation. ("You think freezing dead bodies is bad? Down there in Southern California, they'll cut off your **head** and freeze it, and **burn** the rest.")

Ours is a commercial society, and in the short term, it was, and will be, profitable to sell materials that offends customary practice. Since cryonics is at best a financially precarious undertaking, revenue, **any** revenue, may seem welcome and worth the price of good taste.

Most of these defenses are arguments of the "...but I didn't know it was loaded" category. And now the gun has gone off in our faces. In **all** of our faces.

People want to know why we say things in print that are critical of other cryonics groups, that seem to "lecture" or **that hurt people's feelings or interfere with good, honest folks making a profit?** The problem is that neither we, nor other cryonics groups, act in a vacuum. What they do affects us and what we do affects them. There's no escaping this. It's naive and unrealistic to think otherwise. Some years ago the attitude of live and let live **regardless** was the dominant one in cryonics. "Don't rock the boat" was the slogan of the day. That contributed in no small way to the Chatsworth disaster--patients thawed and lawsuits. And **that** affected everyone in cryonics.

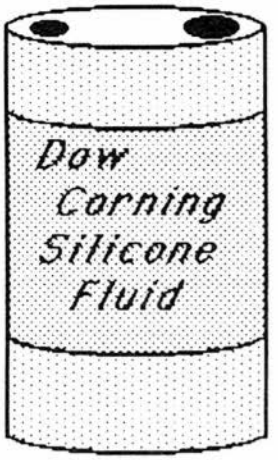
At ALCOR and Cryovita Laboratories, we are painfully aware of the tenuous position we are in. We know for a fact that if cryonics experiences another major, public disaster the state will almost certainly step in. How? Perhaps by simply banning cryonics activity outright. But more likely (and we have indications that this is the case) by requiring any organization or company wishing to pursue cryonics to post a bond--perhaps in the range of millions of dollars, before being allowed to do business.

In addition to local authorities and lawmakers being able to make our practical existence impossible by such mechanisms as increasing the requirements for insurance coverage, we also face the spectre of a national (Federal) agency passing regulations that would prevent cryonics from existing anywhere in the United States. At the last meeting of the International Society for Cryobiology, Dr. Harold T. Meryman stated that cryonics is considered a danger to rational, constructive regulation of organ and other tissue banking practices in the United States. The implication was that cryonics should be regulated out of existence. You can imagine the impact of showing FACES OF DEATH to a Federal Commission or Committee whose job it is to render judgement about all current practices involving the preservation and storage of human tissues. Cryonics would almost certainly be viewed as an exploitive and unethical practice, which should not be tolerated in a humane and concerned society. Profiteering on death is a charge we are all too familiar with, even before the appearance of FACES OF DEATH.

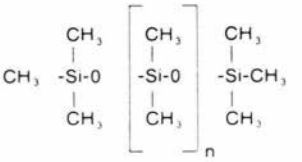
For us, for now, these actions would amount to being put out of business. As long as we live in a world where what others do can so drastically affect us, we must continue to speak up and to be critical if necessary. And we will be (and have been) ready to take criticism from others as well.

Once again we urge Trans Time and BACS, this time **publicly** to immediately stop any new sale or distribution of photographic or video images which show or exploit patients. In the long run, such practices make all of us losers.

Silicone Cooling Fluid



In the July, 1984 issue of CRYONICS we published a technical paper documenting our research with Dow Corning 5 centistokes Silicone Fluid as a heat exchange fluid for cryonic suspension. The work to find a superior heat exchange fluid was undertaken in large part because of the hazards and difficulties we were experiencing with the current heat exchange fluid, isopropyl alcohol.



Isopropyl alcohol is pretty awful stuff. It invariably leaks through the protective bags the patient is in and comes into contact with the patient's skin, eyes, ear drums, and respiratory tract. It readily dissolves in both water and ice and is toxic--as well as being a good solvent for lipids—which cell membranes are made up of! Worst of all, it is flammable. That means personnel are at risk if they are splashed with it, and it means our entire facility it as risk since we have 55 gallons of a flammable liquid sitting around—just waiting for an earthquake or accident!

We undertook a two year search for a replacement, something which would be nontoxic, nonflammable and would not turn gooey and thick at dry ice temperature as isopropanol is wont to do. We found it. The Dow-Corning silicone fluid (or Silcool, as we call it) we evaluated is definitely a far superior and safer material all the way around. But it isn't cheap. Last year a number of ALCOR neuromembers chipped in and bought enough Silcool for a neurosuspension. At that time a call was put out to raise money for enough fluid for whole-body suspensions as well. The response wasn't just disappointing--it was disgraceful.

In Florida the ALCOR East folks have chipped in and bought a 55 gallon drum of Silcool for their use. The burden for this was divided almost evenly among the group. This hasn't been the case in California. In part, that may be our fault for not "pushing it" more. We are now going to give acquiring Silcool more of our attention. At the September ALCOR Board of Directors meeting it was decided to put up $500 for the purchase of Silcool. Jerry Leaf (who is already providing tremendous financial support for cryonics) offered to match that amount. We now have $1,000 for purchase of Silcool and we need another $1,600. The balance is going to have to come from **you** the ALCOR whole-body members who did not contribute in Florida. We also wouldn't dissuade neuromembers from providing some additional support as well. Why? Because your interests are at stake too. Fifty-five gallons of alcohol should make you uneasy even if you don't have to worry about the prospect of soaking in it for 3 days!

So let's give Jerry a hand. Get those checks in the mail.

BACS Gets A New Name

The Bay Area Cryonics Society, which was originally incorporated in 1968, has a new name. On September 15th BACS changed its name to the American Cryonics Society (ACS).

The name change was undertaken as a marketing strategy to broaden BACS's appeal. The ACS name was suggested by a New York insurance agent, Irving Rand, who is interested in selling BACS memberships. According to ACS President Jack Zinn the name change was approved by a vote of both the BACS board and membership.

ALCOR TURKEY ROAST

Incredible as it seems, it's almost time for another ALCOR Turkey Roast! We're starting a little early this year to inform people about this annual event so they can put the weekend on their calender of holiday socializing well in advance.

This year's Turkey Roast promises to be an extra special one. Not only are we lavishing extra care on preparations, we have been fortunate enough to have the event hosted by ALCOR Board member Brenda Peters at her extraordinary home in the San Fernando Valley. What's extraordinary about Brenda's home is its warmth and style. Brenda has hosted several Board meetings, and they've all been special—cozy and relaxed. Brenda has promised a fire in the fireplace and generous doses of her lovely Southern Hospitality. It promises to be the best Turkey Roast ever!

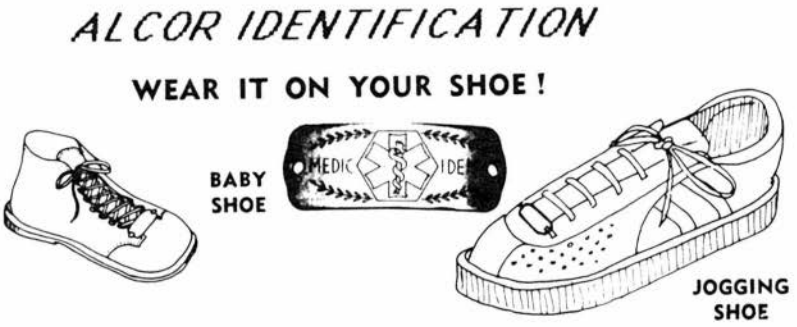
The Turkey Roast will be held on Saturday, December 7th. We've switched the event to a Saturday to accomodate folks who've got a distance to drive home the following day (or who need Sunday to recover from the

festivities!). For those who've not attended past "Roasts" the format is a pitch-in, and next month we'll provide a coordinator to contact so that an appropriate variety of food wil be present. Soooo, start thinking now and get ready for the Best Turkey Roast Ever!

ALCOR Shoe Tags Available

For children who are signed up, it can be a problem keeping a bracelet or neck tag on the child. For very small children it can be next to impossible to keep ALCOR identification safely in place. To solve this problem we now have an ALCOR ID available as a shoe tag. This tag, which is very much like the standard stainless steel ALCOR bracelet, is threaded onto a shoelace and positioned over the toe of the shoe. This tag is also great for joggers who want extra cryonics ID protection.

If you're an ALCOR member and you want to order a shoe tag for yourself or child just drop us a line and enclose a check or money order for $7.00 for each tag ordered. It takes about two weeks from the time its ordered for us to get the tag to you, so please be patient.



One Man's Trash...

People often ask if there isn't "something they can do" to help. Naturally, we suggest things like buying us a $5,000 laser printer, or spending a weekend mopping and vacuuming the lab. We ain't dumb! However, the number of folks willing to do those kinds of nice things to help us out is small. So, we got to thinking about relatively painless things which you might be able to do to help us. These thoughts were inspired by the recent generosity of Ed Tandy and Saul Kent. We were complaining about not having an encyclopedia (which is a serious problem when you put out a magazine and edit manuscripts) and Ed donated a **American Standard Encyclopedia** set which he was not using and which was gathering dust in the attic. This set of books has gotten a real workout since it arrived from Florida—it gets used several times a week.

Saul Kent heard us complaining about our chronic linen shortage, and donated a load of bedsheets and a blanket. In both cases these were items which

were of little use to their owners, but which have been of tremendous use to us. Thus, we thought we'd see if there were other folks out there who are anxious to give us a hand but don't happen to have an extra $5,000 laying around. If you'd like to help out, your attic or linen closet may be as far as you have to go.

ALCOR's animal research work consumes immense amounts of linen. We need serviceable (**not** moth eaten rags) blankets, sheets, pillow cases and old cloth diapers. We recently saw a member getting ready to toss some bath and hand towels because they didn't match the color scheme in her repainted home—we can use such items! We also badly need a working portable black and white or preferably color TV (or monitor) for videotape work. And, while Ed Tandy's gift has helped, we still have our eye out for an **Encyclopedia Britannica.** We'll take any Britannica, all the way back to pre WWII! Other needed items include: an upright, beater brush type carpet vacuum cleaner, any automobile that will pass California emissions standards and doesn't require pedaling, and back issues of CRYOBIOLOGY.

Several of our members have contributed very, very useful reference books and library items and if you're thinking about thinning your library, we ask you to give us right of first refusal. We're trying to build up a good, well rounded library, so don't forget us even if you don't have copies of SUSPENDED ANIMATION or PRINCIPLES OF HEART-LUNG BYPASS lying around. Urgently needed is a good unabridged dictionary!

In short, think before you toss, and if you've been meaning to clean out that garage or overflowing closet, consider checking with us. You may be able to help yourself and help us at the same time!

ALCOR Coordinator Program--A Start

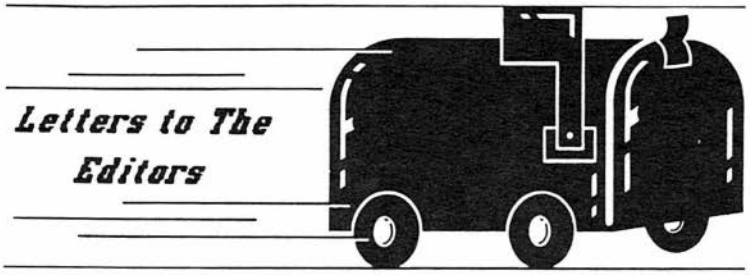
The response to our request for ALCOR Coordinators has been reasonable, if not overwhelming. We are now happy to list the following people as ALCOR Coordinators. These people are all ALCOR Suspension Members with a substantial interest and history of participation. All of them are people we know and trust. If you need information or are interested in some grass roots cryonics activity on a local level, contact these people. They can help.

ALCOR COORDINATORS

Steve Bridge, 1720 N. Layman, Indianapolis, IN 46218

Mike Perry, 1035 Adams Circle #222, Boulder, CO 80303

Dave Pizer, 1355 E. Peoria Ave., Phoenix, AZ 85020



Dear Mike and Hugh:

I have decided to take the plunge. I am going to try to make the grade in commercial writing. I hope to do this in a way that will allow me to serve cryonics at the same time. I have finished two chapters of a cryonics novel, and I am furiously working on chapter three. I am also planning several pro-cryonics magazine articles which I hope to sell to various non-cryonics periodicals.

All of this is going to take huge amounts of time. Therefore, I am cutting the rest of my schedule to the bone. This means that, after sweating it out, I have made a very difficult and painful decision: I am asking for a leave of absence from writing BAY AREA UPDATE.

I have enjoyed writing the column enormously, but it takes much more time than anyone realizes except my wife and me. I need the time for my commercial writing project. So I am reluctantly letting go.

I hope the time will come when circumstances will permit my resuming BAY AREA UPDATE. This is why I am requesting a "leave of absence" only and not submitting a resignation.

Thanks for the opportunity to be part of the cryonics scene in a very special way. It's been fun.

Longlife,
Dick Marsh
San Francisco, CA

Gentlemen:

In the May '85 issue of CRYONICS, Mike Darwin again denounced Robert Ettinger and the Cryonics Institute and Cryonics Association (CA/CI). Mr. Ettinger's proposal represented a rare opportunity to begin a positive dialog between his group and other groups, especially those based in California. Mike Darwin's negative response has hurt the chances of better relations and communications with the Michigan cryonics groups.

In the June '85 issue, Allen Lopp wrote a "Letter to the Editors" which was highly critical of the research work of Dr. Paul Segall and his associates at BPRD, Inc. in Berkeley. The underlying motivation of this article seemed to be

that BPRD was getting research money which Mr. Lopp apparently thought would be better spent by ALCOR. Dr. Paul Segall and his co-researchers are professional scientists. Several of them have PhD's from UC Berkeley, which is a world-class research institution. BPRD, Inc. is bringing life extension and cryonics research into the mainstream of scientific research. Thus, it is unfortunate that Mr. Lopp chose to "trash" their fine efforts. In addition to this, it has had a negative effect on relations between Northern and Southern California cryonics groups.

These and other articles (i.e., Feb '85 pp 1-2) in recent issues of CRYONICS demonstrate ALCOR's habit of publicly and privately knocking other cryonics groups. Thus, it is ludicrous for ALCOR to expect support for CRYONICS outside of ALCOR. The lack of support for CRYONICS is a direct response to years of offensive statements and actions by ALCOR, in CRYONICS and elsewhere. If ALCOR sincerely wants more support for CRYONICS, as well as better relations with other cryonics groups, then ALCOR must abandon its chauvinism, and its efforts to build itself up by attacking other cryonics groups.

Aside from the negative articles and letters, CRYONICS is an excellent and interesting source of information related to cryonics and life extension science. I personally recommended a group subscription to CRYONICS, and the BACS board agreed to a one year group subscription. But then CRYONICS started attacking both BACS and Trans Time, Inc. in its articles and editorials. Further, BACS was blamed by others who were also being attacked by CRYONICS for supporting CRYONICS through its group subscription. It was clear that we had purchased a Trojan Horse from ALCOR. This situation, along with a need to lower costs, lead to the elimination of BACS sponsored group subscriptions. To the best of my knowledge, this policy remains to this day.

I can only hope that someday a friendlier, less combative attitude will someday prevail at ALCOR. Then perhaps relations between ALCOR and other groups will improve enough to justify more support for CRYONICS from other cryonics and life extension groups. Time will tell.

Sincerely,
Lee H. Gabriel
Hilliard, Ohio

(Ed. note: Mr. Gabriel is a former Officer and Director of BACS)

In response to Mr. Gabriel: We would refer you to "Editorial Matters" and "On Ethics, Responsibility, and Decency", the two pieces which open this month's issue of CRYONICS. It would be different if the issues at stake here were simply ones of access to resources or to members. Unfortunately, that is not the case. The issues which have divided ALCOR and other cryonics groups are ones of **quality care** and **decent treatment of suspension patients and members.** They are ethical and technical issues of immense import to the long-term success or failure of cryonics.

Perhaps other members or former members of BACS would care to comment on the fairness of our coverage of issues related to Northern California cryonics organizations, or for that matter on the fairness of Mr. Gabriel's accusations? —MD

To the Editors:

I recently read your three-part series presenting Mr. Conrad Schneiker's article, "Prospects and Applications for the Genesis and Ultra Mass Production of Sub-Millimeter Machines, Devices, and Replicating Systems" (here referred to as PAG, for short). In your introduction to the series, you suggest that it can serve as an "excellent base" for further papers on the subject. A work so long and so rich in citations is indeed apt to contain information that is true and important. But if PAG were to serve as a foundation, then any structure built on it would be in grave danger. In addition to considering the sheer quantity of sound information, one must also consider the average quality. Information of low quality--in the sense of having many errors--can do a field more harm than good, filling lay readers with misinformation and encouraging knowledgeable readers to scoff.

Evolution, whether of organisms or of ideas, proceeds as much through the reduction of error as it does through the generation of novelty. We need to evolve and spread sound ideas in this field. Public criticism is an unpleasant task, but if ideas are not weeded before publication, then they must be weeded in public.

Even knowledgeable readers may be dazzled by the sheer range of subjects touched on by PAG. Biologists may be impressed by its engineering proposals, and engineers may be impressed with its biological. Both may be impressed with its computer science, while computer scientists may be impressed by its biology and engineering. In fact, its range and size (and often, vagueness) would make thorough critical review a large and messy task. Instead, I will confine myself to a few points that indicate problems of sorts that are widespread throughout.

A problem that involves biology, engineering, and computer science makes a useful illustration. The section on "Biological Cellular Automata for Large Memories and Parallel Computing," proposes that supercomputers could be built consisting of "large oil tank sized" volumes of genetically-engineered, interacting cells. It notes only one basic requirement: that the cells be "augmented with very simple, communicating, state machines," each representing a few bits of information. A page is devoted to listing various cells and cell-like structures, kinds of conceivable state machines, kinds of signaling mechanisms, and alleged computational applications.

It fails to mention that existing cell-culture techniques yield cell monolayers or small colonies, not large, solid masses of cells. In biology, large masses of active cells always have active vascular systems, for elementary reasons. No mention is made of this requirement, or of the problems introduced by piercing a regular cellular automation with a vascular tree. Nor, for that matter, is it suggested how the cells might be regularly arranged (or given some more elaborate form of order) in the first place.

PAG suggests that inter-cell communication "might use randomly assorted lengths" of optical fibers (or insulated metal, or one dimensional organic conductors, or...). But nowhere does it suggest how a computational process might be programmed to operate on a system consisting of randomly-linked components. (There is a reason why computers are designed, rather than being thrown together haphazardly.)

Thus, this section proves to be a set of implausible proposals for creating

a huge mass of cells which, even if made as described, would have no plausible use. Yet PAG later suggests that such biological "computers" could be made artificially intelligent, and help us develop microtechnology. In effect, this is a proposal to reinvent and improve on the brain--as a step toward building devices that are vastly simpler than a brain. This illustrates a characteristic sloppiness found not only in PAG's biological and computational proposals, but also in its evaluation of levels of engineering difficulty.

Problems also appear in its treatment of physical phenomena—for example, in the section "Advanced Electromagnetic Radiation Processing," on the next page, which proposes nanometer-scale, quarter-wave transmitting antennas. To meet this specification, an antenna would have to radiate x-rays in the hundred electron-volt range, with frequencies five orders of magnitude beyond those produced by any amplifying circuit available today. This is wholly implausible on a variety of grounds.

To continue such technical criticisms of the rest of the article would be a long, tedious task.

Though PAG's proposals are often unsound, the size of the bibliography might lead one to expect that the unreferenced proposals might at least be novel. But some citations are, in fact, missing; it is difficult to guess how many others are missing (one can only notice a missing work when one is familiar with the uncited work). For example, PAG proposes arrays of quarter-wave dipole antennas in the micron range for the non-laser production of coherent light, and cites no source. But this idea was suggested by Richard Feynman in 1959, in a paper which PAG itself references on other subjects. Many other ideas show a strong similarity to those in an early draft of my forthcoming book, Engines of Creation, also sporadically referenced in PAG.

Further, PAG's descriptions of previous work are often inaccurate. Again, I can only comment on its treatment of work familiar to me. For example, the section on "Bootstrapping Techniques" describes me as proposing (in my 1981 paper in the Proceedings of the National Academy of Sciences) the development of protein-based robots and computers, but this is incorrect. Rather, I propose that the development of protein machines could serve as one path to the development of second-generation, non-protein molecular machines, and these in turn could be used to construct computers and virtually anything else. The paper presents proteins as a stepping-stone, at most.

Further, PAG's section on "Micromechanical Synthetic Chemistry..." states that Richard Feynman suggested "controlling chemical reactions of large molecules by mechanical handling with miniature machines." But in fact, the Feynman talk referenced by PAG speaks of "maneuvering things atom by atom," and of "putting the atoms down where the chemist says." There is no specific mention of controlling chemical reactions by handling molecules, much less "large molecules." In my PNAS article, I describe how small reactive molecules can be manipulated to build up complex structures.

PAG even misattributes concepts. In the section on "Medical Technology," it calls cell repair machines "micro-robot-cops" (a misquotation of an informal name for a different concept) and attributes the concept to a friend of mine, Mark Miller. So far as I can tell, concrete proposals for sub-cellular, computer-directed repair machines originated with my work. The concept was described at length in my book manuscript.

Given the confident presentation of technical absurdities elsewhere in PAG, it is odd to see it state that "whether detection, repair, or replacement at the subcellular level is ultimately going to be technically feasible is unknown..." In fact, the detection, repair, and replacement of damaged molecular structures is going on right now in every active organism. Artificial molecular machines will clearly be able to do likewise--and with computer direction, they will clearly be able to do better. The case for this is made in two of my works referenced elsewhere in PAG, one published in a refereed journal.

A lack of appreciation of the implications of cell repair machines for future resuscitation technology underlies PAG's statement that "every person now alive is living under a biological death sentence," and the associated claim that a headlong rush to develop these technologies is a moral imperative. As this readership well knows, future medical technology can be applied to present medical problems, if people know what to plan for.

Today, we chiefly need to understand molecular technology, and to have that understanding become widespread. Understanding will speed its development, but it will speed needed preparations still more--and it will help ALCOR immediately. Muddying the water of public discussion with a heap of misinformation and ill-conceived speculations seems unlikely to advance understanding. It seems more likely to give the field a bad name, lowering standards, discouraging sound research, and stimulating bogus "research" by people who haven't done their technical homework.

We need to have these matters taken seriously: it is a matter of life and death importance. To do this, we must take the task of criticism seriously. To advance the field, we need to do our best to present writings that can serve as a foundation for future work, rather than serve as a distraction from that work.

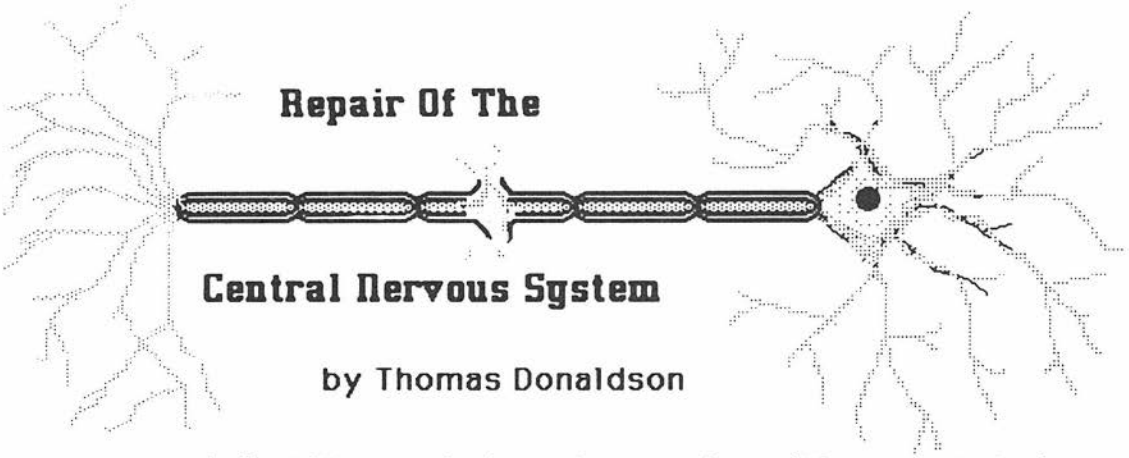
In a field as broad and interdisciplinary as molecular technology, judging technical material is very difficult. Given the importance of the field, your interest in trying is laudable. One approach you might consider would involve relying on the screening mechanisms of the scientific community. The more cautious version would be to publish chiefly summaries of work that has appeared in refereed journals. A less cautious version (but one that would still give some protection against flaky degeneration) would be also to include articles written by people who have published on related subjects in refereed journals.

Sincerely,
K. Eric Drexler
Redwood City, CA

To the Editors:

I was surprised to see Conrad Schneiker refer to cell repair machines (in your June issue) as "micro-robot-cops" and attribute the idea to me. I first heard of cell repair machines (and the automated defense concept they've been confused with) from Eric Drexler. The record should be set straight.

Sincerely,
Mark S. Miller
Menlo Park, CA



Repair Of The Central Nervous System

by Thomas Donaldson

Over the last 10 years, the dogma that we can't possibly repair the brain and central nervous system tissue has looked sicker and sicker. Recently, several scientists have published significant papers which greatly increase our fundamental understanding of nervous tissue repair.

A great deal of indirect evidence exists that severed nerve cells WILL try to grow together, but their attempts fail because scar tissue forms, preventing further repair. The problem isn't one of a mechanical barrier. What happens is that these nerves need chemical and other information telling them where to grow. When scar tissue grows up, it prevents this information from getting to the nerve cells. Ultimately, scar tissue takes over completely.

Scar tissue formation prevents repair of severed spinal cords. It also forms in the brain after injury there, with equally devastating consequences.

Three different papers recently explored the formation of scar tissue and what nerve cells can do when scarring isn't a problem. In SCIENCE (228, 497-499 (1985)) D. Giulian and L.B. Lachman report some very interesting studies into the reasons why scar tissue forms. There is a family of chemicals called the **interleukins** which play a role in normal immune function. They are among the chemical factors causing inflammation.

When scarring occurs in the central nervous system, the **glial cells** (a kind of cell, not neurons, very common in the nervous system) are affected. Glial cells seem to perform a supporting role for the neurons. They proliferate when learning occurs. They also proliferate in case of injury, forming part of the scar tissue.

Giulian and Lachman suspected that the interleukins may cause this proliferation of glial cells. They therefore prepared experiments in culture to test this idea.

There are two kinds of interleukins, **interleukin 1** and **interleukin 2.** Interleukin 1 caused an increase in the proliferation of one class of glial cells, the **astroglia.** Treated with interleukin 1, astroglia in culture multiplied by a factor of 20. The other interleukin, interleukin 2, had no effect on astroglia. NEITHER chemical affected the proliferation of a second

kind of glial cell, the **oligodendroglia.**

Giulian and Lachman also tested their theory directly. They took a population of rats, systematically injured their brains, and measured the levels of interleukin in these brains after injury. After analysis, they could show that the injured brains had greatly increased levels of interleukin 1.

Giulian has herself suggested that proliferation of astroglial cells plays a big role in the scarring which happens in brain and spinal cord after injury (D. Giulian, PROC NATL ACAD SCI, 81, 3567 (1984)). If so, chemicals which neutralize interleukin 1 may help recovery. Once we know that we need to neutralize a specific chemical, we're quite far along the road to repairing injured brains.

The factors preventing brain recovery after injury must involve much more than interleukins. Here is another specific factor. In the very same issue of SCIENCE (228, 499-501 (1985)) a team at Stanford, headed by Hans Muller and E.M. Shooter, reports finding a new protein which increases both in wounded nervous tissue and in growing nerves of newborn animals. They could identify this protein specifically, including its molecular weight.

Earlier work by Shooter and others showed that synthesis of this protein increased in injured tissue, both crushed rat sciatic nerve and rat optic nerve. In the SCIENCE paper, Shooter and the others working with him report their studies on this new protein in normal growth and in injury.

They found that newborn rats had high levels of this protein in their nervous systems. Both the **peripheral nervous system** (nerves to the limbs and body) and the **central nervous system** (the brain and spinal cord) showed increases. Furthermore, when they cut the spinal cords and optic nerves of adult rats, the amount of protein also increased. In peripheral nerves, after injury, levels reached up to 5 percent of the total protein of the cell.

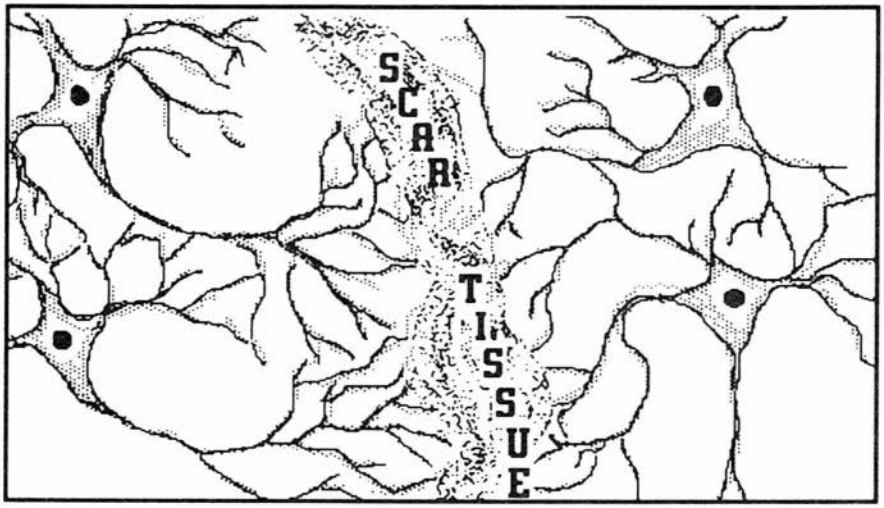
However, injured adult rats **responded** very differently from growing normal rats. Although central nervous system tissue synthesized this protein at a very high rate, it did not accumulate. Some other influence removed it. It seems very likely that there is a close relation between this fact and the fact that central nervous system tissue shows so little ability to grow and regenerate.

After injury to peripheral nerves such as the rat sciatic nerve, the levels of this new protein slowly decreased as the nerve regenerated. Shooter et al tried preventing regeneration in severed sciatic nerves. This caused the levels of this protein to stay high for 10 weeks afterward.

It is therefore clear from these experiments that this new protein plays some kind of central role in regeneration of nerves. Without knowing why it disappears so quickly in the central nervous system, we can't yet specify its exact role. It deserves a great deal of further study.

Another significant paper along the same lines recently appeared in NATURE (314, 751 (1985)), by E.M. Johnson and H.K. Yip.

If nerve cells are to repair injuries, they must somehow know where to grow. This information must come from outside. Further, it must be **chemical,** since the cell itself can only "see" directional information which comes by



"Nerve cells will grow together, but their attempts fail because scar tissue forms, preventing further repair."

means of some kind of chemical message. After all, a cell can't step out of the microscope slide and see that it must grow in a westward direction.

Right now we don't even understand how these chemical directions work in the case of a superficial cut to the skin, much less know how repair might work in nervous systems. The new protein discovered by Shooter and Muller must play some such regulatory role. Johnson ant Yip present in their NATURE paper evidence for another kind of chemical agent which guides growth, development, and even **continued existence** of nerve cells.

Their work began with studies of **nerve growth factor,** or NGF, which Levi-Montalcini had discovered about 10 years ago. NGF unfortunately doesn't control growth in the central nervous system, but it does promote growth of peripheral nerves (outside the brain and spinal cord). It is very clear, however, that there must exist several other chemicals which also guide development even in peripheral nerves.

For some time, scientists thought that NGF only promoted nerve growth in fetal animals. Johnson and Yip, however, have found evidence that NGF is one of TWO different chemicals which continuously support peripheral nerve cells. If both chemicals are removed, nerve cells will atrophy.

Johnson and Yip did their experiments on the **dorsal root ganglion** in guinea pigs. This is a neuron which connects both to the spinal cord and the skin and muscles.

Since the time that Levi-Montalcini had discovered NGF, scientists have known of one way to deprive animals of this chemical. Their method works both

in adult and infant animals, and consists of causing an immune reaction to the NGF. If we do this to fetal animals, the sensory neurons, including the dorsal root ganglia will all DIE. The animal will live, but lack sensory nerves to the skin and muscles. If we do it to adult animals, however, the peripheral nerves will still live.

Johnson and Yip tried this method in young guinea pigs, but unlike other experimenters, they suspected that the central nervous system also made a similar guiding chemical. They therefore cut all connections between these sensory neurons and the spinal cord. This deprived the dorsal root ganglia of their guinea pigs of any influence from the **central** nervous system.

If we cut off its connection to the spinal cord without any other treatment, the neuron in the dorsal root ganglion will usually survive. When they tried this in animals deprived of NGF, however, the dorsal root ganglion often died. This means that peripheral nerves in adults need a chemical from the central nervous system in order not to degenerate.

This experiment proves the existence of a second factor, and specifies it as coming from the central nervous system. Unfortunately, Johnson and Yip have no characterization of this new factor.

Finally, in two different papers from EXPERIMENTAL NEUROLOGY (88, 1-12; 44-55 (1985)), Lloyd Guth and others, at the University of Maryland School of Medicine and the City of Hope Research Institute, describe a new method for studying repair in spinal cords.

Guth et al observed that scar tissue usually forms in cut spinal cords after the tough sheath (called the **dura mater**) which surrounds them is broken. After injury, white blood cells flock into the area of the cut, connective tissue grows inside, and scar tissue begins to form.

Guth and his colleagues therefore tried to study spinal cord repair when the dura mater wasn't broken. They developed a method of crushing the spinal cord while leaving the dura mater intact.

They achieved some very interesting results with this model. Among other things, for the first time, they could get unequivocal proof that the neurons themselves will actually try to grow together. After their special kind of crush injury, astroglial cells and others, which seem to act as a support for growth, first grow into the area of injury. Blood vessels also grow into the area. The nerve cell regeneration happens only after this growth of support cells.

This kind of regeneration resembles regeneration in salamanders and other animals capable of nerve cell repair (M.E. Michel and P.J. Reier, J NEUROCYTOLOGY, 8, 529 (1979)). Mammals must retain some of the same guiding principles.

This kind of injury, crushing without breaking the dura mater, obviously lacks any immediate practical importance. It's interesting because we now can use it as a MODEL to study the general phenomenon. Guth and his coworkers have also done exactly that. They argued that some drugs might improve recovery in these favorable conditions even though they show no measurable effects elsewhere. They report attempts with two different drugs, **triethanolamine** and

cytosine arabinoside. Both these drugs promote outgrowth of neurons in chick embryos. It turns out that BOTH drugs will promote growth of neurons into the injured area in spinal cords.

This work again doesn't have immediate practical use. What it shows is that drugs do exist which will promote repair in spinal cords. Even one drug with a proven positive effect gives us a tremendous clue towards even better drugs.

All this work together centers upon repair in the central nervous system. Cryonicists depend on the idea that someday we'll control **repair.** We are just as ignorant of repair in the case of trivial cuts and bruises. After all, it is one of the commonplace, routine mysteries that your cut skin will know enough to grow together.

If we think about repair after suspension, it's even likely that the "only" techniques we'll need are, first, methods to support tissues long enough for their own repair processes to work, and second, some trivial enhancement of ordinary repair processes. We could provide support even on a cellular level by an artificial vascular system which would grow into the tissues, perhaps at low temperatures. With nutrients and oxygen, these tissues might well know how to repair themselves. If they did not, they might need only minor enhancements. For the central nervous system, for instance, it seems likely that our brains differ chemically only in minor ways from those of salamanders. It's a famous fact about salamanders that they can repair massive brain damage.

Review of the 22nd Annual Meeting of the International Society for Cryobiology

Part II

The 22nd Annual Meeting of the Society for Cryobiology was held this year in Madison, Wisconsin (see previous discussion in CRYONICS) on June 18-21. There were 130 registrants this year—significantly more than were present in San Diego last year--and a total of 90 presentations and 26 posters. In addition to being a financial success for the Society for Cryobiology, there seemed to be general agreement that the meeting was also a scientific success, which was encouraging compared to the meeting in 1984. This report will cover briefly the scientific aspects of Cryo'85. The papers presented on Tuesday involving so-called ethical issues in cryobiology were not science (as the policy statement says) and will not be considered further here. Our coverage this year will be by category rather than by chronology.

ORGAN CRYOPRESERVATION

From the viewpoint of cryonics, organ cryopreservation is the most important part of cryobiology at this time. Unfortunately, in this particular area there was very little reported activity this year.

Greg Fahy presented a paper called "A Fully Automated System for Treating Organs with Cryoprotective Agents". In this paper he described how he is planning to use an IBM XT personal computer and other commercially available equipment to control the perfusion of organs with cryoprotectants. He showed several slides describing the details of his system, which was nearly complete at the time of his presentation. Unfortunately, he had no actual organ perfusion results to report. Next year, however, he should have a wealth of data to present concerning the fate of organs perfused with his system.

David Pegg reported on some fascinating and important results concerning kidney perfusion with the relatively "new" (in terms of popularity) cryoprotective agent propane 1,2 diol (propylene glycol or PG). This agent is more rapidly permeating, more readily vitrifiable, and, according to Pegg's work with kidney slices, less toxic than glycerol. Rabbit kidneys were perfused with 3 or 4 molar PG and assessed either by transplantation or by making cortical slices and assessing the viability of the slices. Kidneys perfused with 3 M PG survived after being transplanted, and in fact showed less injury than kidneys perfused with 3 M glycerol. The slices made from such kidneys also performed similarly to freshly prepared control slices. When 4 M PG was perfused, however, the kidneys were "dead". The difference between 3 M and 4 M levels represents a much more abrupt increase in toxicity than had previously been seen with glycerol, which permitted survival of most kidneys even after exposure to 4 molar levels.

Surprisingly, these were the ONLY two papers on whole organ cryopreservation to be presented! Pegg's coauthors, well-known cryobiologists Jacobsen, Diaper, Foreman, and Hunt, did not even make it to the meeting. We can only wonder what is going on in other laboratories where organ cryopreservation has been investigated and hope that work in these laboratories is still under way.

One paper was presented which was particularly relevant to organ cryopreservation, although it was concerned directly only with preservation of cells. This paper was by A.T. Schafer and colleagues at the Helmholtz-Institut fur Biomedizinische Technik in Aachen, West Germany, which is maintaining its reputation as one of the very few significant centers for cryobiological experimentation. Human endothelial cells (the type of cells which line the blood vessels of organs and which are thought to be a prime target of injury during freezing) were obtained from umbilical cords. They were frozen using a cryomicroscope and viability was judged by a vital staining technique immediately after thawing. The optimal cooling rate without cryoprotectant was 3-5 degrees per minute and the survival was about 30%. 10% glycerol gave survival above 40% between cooling rates of 1 and 10 degrees per minute. Warming was always rapid. Since very slow cooling and higher concentrations of cryoprotectants are needed for cryonics and for organ preservation, it is nice to note that the tendency for this cell, as for others, is to show survival at progressively slower cooling rates as the cryoprotectant concentration is progressively elevated before freezing.

TISSUE CRYOPRESERVATION: VITRIFICATION

Despite the lack of activity on the whole organ cryopreservation front, we can take some encouragement from the work on tissue cryopreservation reported at the meeting. This is especially true since an unusual amount of it was relevant to the problems of whole organ cryopreservation, particularly several reports dealing with attempts to vitrify a variety of biological systems. It seems that vitrification research is heating up (no pun intended!). This seems to be mostly due to the prodding influence of Bill Rall, and this research activity will surely be relevant in the long run to vitrification of organs (perhaps even including the brain, which Rall, as a staunch anti-cryonicist, might NOT be too happy about.)

Rall presented the work of himself and Fahy on vitrification of mouse embryos (see report in an earlier issue of CRYONICS) but also reported on some new work he has done since moving to Rio Vista International (a cattle breeding company in San Antonio which also employs cryobiologist Stanley Leibo). In this work, he vitrified later stage embryos, i.e., morulae and early blastocysts as compared to the 8-cell embryos studied earlier, and found that these more advanced embryos survived just as well as younger embryos (82-85% survival vs. 85-88% survival of the 8-cell embryos). These survivals are based on culture results in vitro.

In a separate report, Rall also revealed details of the fate of previously vitrified embryos after transfer to foster mothers. Two control groups were: 1) Untreated embryos, and; 2) Embryos treated with the vitrification solution without being vitrified. 95% of all embryos studied developed normally in culture and were transferred to foster mothers. 55%, 27%, and 26% of untreated, cryoprotectant control, and vitrified-rewarmed embryos, respectively, developed into normal late-stage (16-17 day) fetuses and 48%, 37%, and 30% developed into normal live born pups (this was a separate experiment from the one for late-stage fetuses). It would seem that the cryoprotectant exposure resulted in a significant loss of ability to develop in vivo and that vitrification resulted in a possible slight further loss. Neither effect was evident from the results of in vitro culture. Nevertheless, Rall and coauthors concluded that the results were similar to those obtained with conventional (freezing) cryopreservation. These mice were also allowed to grow up and reproduce. No defects in either the vitrified-rewarmed embryos or in their progeny were observed.

More unfavorable results were reported by Ray Rajotte and coauthors, who reported on their preliminary attempts to vitrify rat Islets of Langerhans (the portion of the pancreas needed by diabetics for the control of their blood sugar levels). The method used for vitrifying the islets was nearly identical to the technique reported in **NATURE** earlier this year by Rall and Fahy for mouse embryos, and employed "90% VS1" as the "vitrification" solution. (This solution has a concentration 90% as high as VS1. VS1 is a vitrification solution giving very little or no ice formation during cooling. Hence, 90% VS1 does not fully vitrify, but seemed to vitrify well enough to cryopreserve embryos.) The results with islets were, unfortunately, poor. There was some functional preservation after "vitrification" and subsequent warming, but it was worse than control responses and also far worse than responses obtained after conventional freezing and thawing. On the bright side, there were several problems with the techniques used by these authors (including use of 90% VS1 rather than VS1 itself), and we can hope that these preliminary results will be followed by more satisfactory results by next year's meeting.

More encouraging was work on human monocytes by T. Takahashi et al. Although monocytes are individual cells, not tissues, the successful vitrification of these cells is obviously particularly relevant to tissue and organ cryopreservation. Using similar techniques to those used for embryos and pancreatic islets, Takahashi was able to find 95% of the cells he had vitrified, and 92% of those retained normal functions, making them essentially as good as control or frozen-thawed cells.

TISSUE CRYOPRESERVATION: FREEZING

As far as advances in conventional freezing techniques for tissues are concerned, the most interesting and probably the most important paper was one given by David Pegg. Although he did not actually freeze a tissue, he discovered a new and fundamental phenomenon in cryobiology which apparently accounts for the "packing effect". This is of fundamental relevance for the freezing of tissues, organs, and, it would seem, organisms such as people. Basically, the "packing effect" is the extra damage that one observes when cells are frozen and thawed after having been packed together before freezing, compared to the smaller amount of damage seen when the same cells are frozen in a more dilute suspension. The reader should note that cells in organs and tissues are in fact closely associated with each other, resembling "packed" cells much more than typically dilute cell suspensions. Pegg's experiment was simplicity itself: he simply looked at dilute vs. packed human red blood cells as they were frozen and thawed on the stage of a cryomicroscope and noted what happened. What he saw was that the packed cells forced ice to form in narrow, feathery patterns that followed what little extracellular space was present, whereas dilute cells allowed ice to form in large slabs. But thin, tendril-like ice has a very high surface energy and a much greater ability to recrystallize into the same sort of large slab-like forms seen to form during freezing of the dilute suspensions. Consequently, slow warming of packed cells leads to greater injury due to the recrystallization of the feathery ice crystals formed during cooling, and this recrystallization was proposed to account for the "packing effect". The remedy for this is to thaw rapidly (100 degrees per minute seems to be fast enough) or to use a high enough concentration of cryoprotectant to reduce the amount of ice formed to tolerable levels even when it recrystallizes.

The above-mentioned Ray Rajotte gave the keynote paper in a session on liquid-state organ preservation which will be more fully described later. Rajotte's paper was a review of cryopreservation of islets and the prospects for success with human islets. Although frozen-thawed rat islets remain somewhat damaged after thawing, frozen-thawed dog islets, which are more similar to human islets, controlled blood glucose levels in dogs after transplantation for up to 2 years, with similar glucose tolerance tests to those obtained following transplantation of fresh islets. The dog islet model is being used to formulate an optimal cryopreservation protocol for human islets.

S.J. Aggarwal et al. submitted a poster on the freezing of dog beta cells (which are the key cells of the pancreatic islet). They are collecting fundamental information on the osmotic responsiveness of these cells both above 0°C and during freezing, on a cryomicroscope. This information should be helpful in better understanding and optimizing the freezing of these cells and of islets. E. Martinez and co-workers reported similar work on the osmotic responses of whole islets at 21 degrees C.

E.R.V. Lloyd-Davies et al. submitted a poster disclosing that they were unable to isolate islets from previously frozen fragments of pancreas despite histological and functional evidence of islet survival and despite easy isolation of these islets from fragments which were prepared for freezing but not frozen. This finding might provide a lead on understanding better the effects of extracellular ice on extracellular tissue structure.

A similar clue concerning the mechanical effects of ice on tissues might be found in a paper by Michael Taylor on cryopreservation of corneas. He found that corneas were better preserved if they were frozen in air rather than in a surrounding solution. This implies that ice formation in the medium surrounding the corneas is damaging, which is significant in view of the fact that with few exceptions the various tissues in the body or in individual organs are surrounded by solution which can't be removed prior to freezing.

PHYSICAL EVENTS AT LOW TEMPERATURES

This was the title of a session organized by Greg Fahy which brought together several experts in the area of the behavior of ice and water at low temperatures. The first two speakers, Don Rasmussen and Alan MacKenzie, were heavily involved in cryobiological research in Madison at Fr. Luyet's establishment many years ago. They did a great deal of relevant fundamental work at that time before going on to continue their productive careers elsewhere. The third and final invited speaker was Doug MacFarlane, a newcomer to cryobiology and an expert on the physical chemistry of glass.

Don Rasmussen spoke on the fundamentals of nucleation. Nucleation is the initiation of crystallization, or the first event that occurs in the process of freezing. Rasmussen has been doing pathbreaking new work in this field which could lead to better methods for suppressing nucleation and, therefore, greater ease in vitrifying organs. Although most of his talk was spent giving the audience a very basic introduction to classical nucleation theory (which Rasmussen, in fact, no longer believes is correct!), he mentioned some of his recent and interesting work on the suppression of heterogeneous nucleation by cryoprotectants, an area of critical importance about which very little is known. The suppression of this type of nucleation parallels the depression of the normal solution freezing point as does suppression of homogeneous nucleation by cryoprotectants.

Alan MacKenzie spoke on recrystallization. He first had to define his terms, as this term has meant different things to different people. Recrystallization is the rearrangement of previously formed ice. This can, at times, lead to the opacification of a previously frozen but transparent solution; Fr. Luyet, who had once believed that transparent solutions were vitreous, had mistaken recrystallization for devitrification, which is the formation of new ice from a previously vitrified solution during warming. As mentioned above in the context of the "packing effect", recrystallization can have quite deleterious biological effects, so the more we understand about it the better.

MacFarlane spoke on devitrification, a critical issue, as he pointed out, in the successful vitrification and recovery of whole organs. His talk consisted of essentially all new and penetrating studies in this area and was excellent. The bottom lines: 1) the critical heating rate needed for the

complete suppression of devitrification is in fact higher than what his previous studies had suggested, and might even be inaccessible for a large organ, BUT, 2) his computer simulations indicate that the AMOUNT of devitrification is drastically reduced at higher heating rates and, therefore, that the total suppression of devitrification may be quite unnecessary, so that accessible heating rates may be adequate despite 1) above.

In addition to the invited speakers, two contributions from the floor were concerned with "physical events at low temperatures" and are quite relevant to organ cryopreservation and to cryonics. One of these was about the potential for damaging electric fields to be generated during freezing and was given by Ch. Korber of the Helmholtz-Institut fur Biomedizinische Technik. His conclusion: not to worry.

The second paper was by David Reid of the University of California at Davis and was concerned with studies of the behavior of the VS1 solutions used to vitrify embryos, islets, and monocytes as described above. He found that this solution, in fact, allows "spherulites" to form during slow cooling. Spherulites are fragile, tenuous ice crystals. The spherulites were seen in the cryomicroscope to be embedded in a vast excess of vitrified material, and the amount of ice formed could not be detected by very sensitive thermal means. Nevertheless, complete vitrification of VS1 does not occur at slow cooling rates, and this calls into question Fahy's criteria for judging when vitrification takes place. We asked Fahy about this and he responded that, in fact, VS1 also fails to vitrify completely in his experience because it contains less sugar than his standard solutions and this was not taken into account when VS1 was originally formulated. In any event, Fahy and Reid agree that the amount of ice formed in VS1 is so small as to be irrelevant to the work which has been done with it so far.

BIOLOGICAL EFFECTS OF CRYOPROTECTIVE AGENTS

This was the title of a second symposium organized by Dr. Fahy. This symposium brought together several experts on cryoprotectant effects to share their knowledge with mainstream cryobiologists about these agents so that better means of circumventing cryoinjury might ultimately be found.

Fahy himself gave the keynote address to introduce the subject and orient the audience. He noted that, based on theoretical predictions of how much cryoprotective agent is needed to protect to given final freezing temperatures, the concentrations needed for good cryoprotection may be too toxic to use in practice. He then went on to review evidence that cryoprotectants may in fact cause damage during freezing and thawing, and suggested that better understanding and control of cryoprotectant toxicity would be helpful in making further progress in cryopreservation.

The infamous Dr. Stanley Jacob, the DMSO expert, was the next speaker, who reminded the audience of the manifold pharmacological effects of dimethyl sulfoxide. We are not sure if Jacob's remarks will be of any direct help, but perhaps one or more of DMSO's pharmacological effects will turn out to be important also for its cryobiological effects. In any case, Jacob's paper will serve as a convenient reference work for investigating this possibility after it is published in Cryobiology, and it was interesting to see this "celebrity" at the meeting.

New Faces: Dr. Anthony Fink, cryoenzymologist; Dr. Stanley Jacobs, DMSO authority. Dr. Greg Fahy, back to camera.

The next speaker was also a new face in the crowd. He was Dr. Anthony L. Fink of the University of California at Santa Cruz, a well-known cryoenzymologist (cryoenzymologists cool enzymes to low temperatures in the presence of high concentrations of cryoprotective agents so that they can understand better the mechanisms of enzyme action by slowing down the enzyme reaction rate to the point where measurements become feasible). He said that the most useful cryoprotectants for cryoenzymologists were methanol, ethylene glycol, and dimethyl sulfoxide, but that few generalizations could be made of their effects on various enzymes. He concluded with a table which, however, provided some general guidelines for predicting the effects of cryoprotectants on enzymes of various types. Perhaps if certain key sensitive enzymes are subsequently identified, his table will be helpful for formulating a less damaging cryoprotectant mixture. Obviously, the fewer molecular machines we need to put ourselves back together again after our cryonic sojourns, the better!

The last invited speaker was Pierre Douzou, the father of cryoenzymology and the author of a book entitled **Cryobiochemistry.** He noted that cryoprotective agents and ions such as magnesium and potassium have effects on the self-assembly of ribosomes which are often antagonistic to each other. This raises the possibility that an optimal electrolyte balance exists for minimizing cryoprotectant toxicity.

FUNDAMENTAL CRYOBIOLOGY

Tsuneo Takahashi and co-workers submitted a poster dealing with the mechanism of action of extracellular cryoprotective agents. It has long been known that there are two classes of cryoprotectants, penetrating and non-penetrating, and that these two classes can sometimes be used together with synergistic protective effects. The mechanism by which the non-penetrating agents protect against freezing injury has long been mysterious. Now Takahashi et al. find that monocytes, which can survive freezing in the presence of non-penetrating agents only, show survival which correlates with a glass transition of the non-penetrating agent HES (hydroxyethyl starch) at $-20^{\circ}C$. So, at least some non-penetrating agents may act by causing a great elevation of the glass transition temperature of the extracellular solution during freezing, preventing further dehydration of the cells at lower temperatures. It is interesting to see how many ways vitrification is being found to be of importance in cryopreservation.

Felix Franks had a couple of papers dealing with a fundamental matter which might be interpreted as having importance to cryonics. Franks devised an incredibly effective method for supercooling proteins or cells in small droplets, such that they do not freeze even after several months of storage at temperatures in the vicinity of -20°C. He found that one protein (chymotrypsinogen) showed a slight unfolding (denaturation) at subzero temperatures, but this was reversed spontaneously upon warming. He also found essentially 100% survival of yeast after they were stored at -20°C for as long as 16 weeks (the longest storage time looked at) in the supercooled state. The conclusion: low temperatures per se do not seem to be damaging even given very long exposure times. The relevance to cryonics is that this may mitigate injury occurring during the very long times needed for cooling and warming people. It is also relevant to cryopreservation by vitrification, wherein supercooling injury is the only type of damage that might be anticipated when the process is successfully carried out.

MEMBRANES AND FREEZING INJURY

This was the title of Peter Steponkus' session, and a topic of fundamental importance in cryobiology, and to cryonics. After all, no membrane, no cell! Steponkus assembled several experts on membrane biology to consider the deleterious effects of freezing on membrane structure.

The first speaker was W.P. Williams of the Biochemistry Department of King's College in London. He noted that the presence in biological membranes of lipids which do not contribute to normal membrane bilayer stability has been ignored but might be of prime importance in freezing injury due to their effects on lipid-protein interactions in the membrane. He then went on to relate the behavior of these lipids to the dehydration and temperature reduction accompanying freezing and suggested that cryoprotectants might protect membranes by affecting the behavior of these lipids, a new idea in cryobiology.

The next speaker was John H. Crowe of the University of California at Davis, whose expertise on anhydrobiology (survival by desiccation) has made him a popular person at cryobiology meetings when he has come to them in the past few years. His major contribution has been the identification of trehalose as an extraordinary membrane stabilizer which prevents membranes from becoming structurally altered during desiccation. He now finds that this sugar can even protect membranes during freeze drying, apparently both because of its ability to inhibit membrane fusion and because of its ability to prevent freezing (gelation) of the lipid portion of the membrane. The action of trehalose is due to its ability to specifically interact with the water-loving portion of the membrane. It could be regarded as a nice little natural molecular machine whose primary function is to take up space and so to prevent the various alterations of the membrane which otherwise occur.

The next paper, by Steponkus himself and William J. Gordon-Kamm, both of Cornell University, discussed the formation of inside-out membrane lipid cylinders within the cell membrane (more technically known as a hexagonal-II phase) as a consequence of normal freezing. The formation of this abnormal membrane structure was associated with the death of their model plant protoplasts (naked cells), but it was blocked by, among other things, DMSO, which increased survival in a parallel manner.

THE GREAT DEBATE

A unique feature of the cryo meeting this year was David Pegg's "debate symposium", in which certain schools of thought in cryobiology were pitted against each other in a quasi-debate format. Greg Fahy took on the idea that thermal shock is an important contributor to freezing injury, while John McGrath stepped in at the last minute to argue for thermal shock on behalf of John Morris, whose ability to attend the meeting and defend his proposition was ended by upheavals at his place of work. Stanley Leibo attacked the minimal cell volume hypothesis, which was defended by Harold Meryman, who originated this hypothesis. And Peter Steponkus challenged the notion that the unfrozen fraction of water is a major determinant of freezing injury, while Peter Mazur defended this proposition, which he originated.

Debaters Dr. Peter Mazur and Dr. Peter Steponkus.

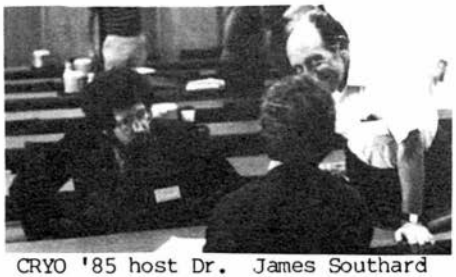
The conclusions from these debates seemed to be as follows. The notion of thermal shock as a contributor to freezing injury may be interesting from a theoretical point of view, but has little or no evidence to support it and considerable evidence to undermine it, although it is a real phenomenon for many cells under various conditions. Leibo's argument against the minimum volume hypothesis was essentially to focus on one irrelevant example, so that Meryman's hypothesis came out looking pretty good. It was apparent that the hypothesis has undergone several revisions with time and it was not clear to the audience exactly what the hypothesis currently consisted of. It was also apparent that it is now closely similar to Steponkus' ideas, though not identical to them. As far as the unfrozen fraction hypothesis is concerned, Steponkus blew this one out of the water in a big way by showing how completely irrelevant the unfrozen fraction is for plant protoplasts, and by criticizing Mazur's execution and interpretation of his experiments. The fact remains, however, that Mazur HAS shown a correlation, of unknown meaning, between the unfrozen fraction and freezing injury to red cells, and this correlation must be telling us something.

HYPOTHERMIA AND HIBERNATION

W. M. Wolowyk et al. suggested that one key difference between hibernators and non-hibernators might be the ability of the former to prevent calcium and potassium leaks across the cell membrane at low temperature. A. Malan further posited that respiratory acidosis also contributes importantly to the reversible suspension of metabolism in hibernators. Barry Fuller et al. made the fascinating observation that if the kidneys were removed from a hibernator shortly after the induction of hibernation, they could be preserved longer by standard cold storage techniques than was possible if the kidneys were removed from the same species in the summer, when it was not hibernating. Similarly, cold-acclimatizing rats doubled the possible storage time for their kidneys compared to results with control rats. This work might provide a means of isolating the factors responsible for the differences between kidneys from warm vs. cold animals and lead to better methods of conventional organ preservation.

ORGAN PRESERVATION: MECHANISMS OF INJURY

A session on this subject was chaired by meeting organizer Jim Southard, who brought together an impressive lineup of people who are on the cutting edge of death reversal technology to share their knowledge with cryobiologists intent on maintaining organ viability for transplantation.



CRYO '85 host Dr. James Southard and Dr. Felix Franks, editor of Cryoletters.

Matthew B. Grisham, from Joe McCord's well-known free radicals and ischemia lab at the University of South Alabama, showed how the use of catalase and superoxide dismutase could markedly reduce the damage done to rat hearts reperfused with oxygen- rich, glucose-rich solution after 40 min utes of glucose-depletion and anoxia. Their doses were 20 micrograms of SOD and of catalase per milliliter of perfusate. They also got good results with allopurinol (a xanthine oxidase inhibitor) as well as with another drug whose action is similar to that of allopurinol. These studies are of direct relevance to ALCOR's plans to resuscitate dogs after prolonged periods of clinical death.

The next speaker was the legendary Benjamin F. Trump, pathologist extraordinaire, whose electron microscopic and other investigations of cell death and ischemia go back many years. His title was "Mechanism of Tissue Injury", and he discussed the role of calcium as a key mediator of ischemic injury.

I. H. Chaudry of Yale then described the remarkable ability of complexes of magnesium and ATP to resuscitate organs which would otherwise be given up for dead and even to resuscitate whole animals subjected to global ischemia (clinical death) and hemorrhagic shock. The plethora of uses and virtues of Mg-ATP can't be done justice to here, but when Chaudry`s paper is published in Cryobiology we will make an effort to review it.

Nick Halasz of the University of California at San Diego Medical Center described how the use of either catalase or catalase plus SOD improved the function of 24-hour perfused rabbit kidneys to levels superior to fresh control kidneys! This was found whether the enzymes were added to the perfusate or simply given to the perfusor rabbit to block reperfusion injury.

Barry Fuller reported that oxidative damage in rabbit kidneys could be blocked to an amazing degree by using desferrioxamine (4mg/kg), given to the recipient rabbit just before transplantation of the kidney. This compound is a free iron chelator, and free iron is known to be a key substance for free radical production.

Paula Jablonski et al. of the University of Melbourne in Australia, and Jim Southard et al. of the University of Wisconsin at Madison, both presented papers on the fate of the glomerulus (the kidney's "blood filter") during preservation and found significant injury after longer-term preservation. Southard suggested that this damage is mechanical and might be prevented by suitable alterations in perfusion technique. On the other hand, G. L. Cohen et al., of the University of Manchester in England, claim that 5 day preservation of kidneys is possible

simply by charcoal-filtering the fatty acids out of the perfusate used for preservation (plasma protein fraction).

This session also contained the two cryonicist contributions to the cryobiology meeting, which were discussed in a previous issue of CRYONICS.

ORGAN PRESERVATION: MISCELLANEOUS ADVANCES

The final session of interest to cryonicists was chaired by Jim Southard's boss and legendary organ preserver Folkert O. "Fred" Belzer.

W.A. Baumgartner of the Department of Surgery at Johns Hopkins Hospital in Baltimore found that he could preserve lungs for as long as 24 hours by preventing white blood cells from entering the lungs immediately upon blood reperfusion. He also found positive results using SOD and catalase, which would permit lungs to be preserved for 12 but not for 24 hours.

Anthony D'Alessandro et al. of the University of Wisconsin at Madison reported some pathbreaking studies on liver preservation in which the combination of chlorpromazine pretreatment and addition of methylprednisolone and deoxycoformycin to the perfusate allowed excellent 72 hour preservation of the liver as judged by various assays made on tissue slices prepared from the preserved livers. This result was only found if all three modalities were combined. Transplantation studies are now underway to see how the slice assays correlate with transplant survival. If there is any correlation at all, it could mean a fantastic breakthrough in liver preservation, since livers currently can be stored only for 6-10 hours rather than the 72 hours studied by this group.

Brian W. Haag et al. of the University of Chicago reported that they could double the possible storage time for cold stored rat kidneys from 24 hours to 48 hours by perfusing the kidneys with rat blood on an artificial perfusion circuit for 2 hours after the first 24 hours of preservation. This technique is called "rescue" and might be practical for doubling the available storage time for human kidneys as well.

Vernon Marshall of the University of Melbourne (Australia) reported that simply replacing the glucose of Collins solution with sucrose yielded a great improvement in the preservation of rat kidneys. Even a solution consisting of nothing but sucrose and phosphate buffer was a good preservation solution for these kidneys, supporting Marshall's view that the key ingredients for success are good buffering and prevention of cellular swelling. Glucose both penetrates cells (allowing them to swell) and leads to pH changes which could be harmful.

The final paper, by J. Cederna, Luis Toledo-Pereyra, and G. H. MacKenzie of the Mount Carmel Mercy Hospital in Detroit, indicated that catalase, as found by other labs, is able to protect livers from ischemic injury and that insulin might also be useful in this regard.

This concludes our coverage of Cryo'85. The field of cryobiology seems to be moving ahead, both above zero and below. Although little work on organ cryopreservation was reported, there were many indications of renewed activity in this area in the near future, with potentially exciting results. On the whole, this meeting at least lets us know that progress continues to be made in

cryobiology, and we can hope that eventually this will lead to something useful for us. As usual, however, it also continues to be clear that cryobiologists are not about to do any research relevant to cryonics unless they do so by accident, and for the really important answers cryonicists will probably have to continue to do the work ourselves. In this regard, a lot of good hints and clues came from the meeting which should be of direct relevance to us in just these sorts of cryonicist-initiated studies in the near future. Hopefully we will continue to be able to attend these meetings in the future and continue to be allowed to absorb and dispense information which will benefit both ourselves and cryobiologists.

The Cephalarium Vault: A System of Advanced Protection For Neuropreservation Patients

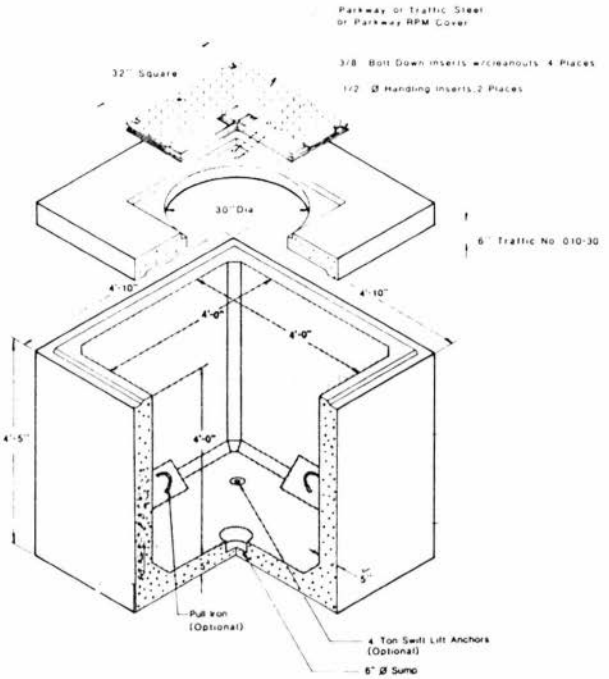
by Mike Darwin and Hugh Hixon

INTRODUCTION

A little over two years ago, a decision was made to upgrade substantially the level of security and care available to ALCOR cryonic suspension patients—both neuropatients and whole-body patients. A significant motivating factor for undertaking this effort was the vulnerability of almost the entire State of California to serious earthquake damage. While ALCOR's storage facilities are located in a very low earthquake risk area which would sustain only light damage during even a severe earthquake, we still faced a number of risks. There is always the possibility that even if overall damage to our immediate area is modest, a falling structural member could seriously damage a storage dewar. Additionally, wide disruption of civil services and communication after a major earthquake could leave the facility vulnerable to fire or civil unrest. These considerations were a major motivating factor in our decision to provide better protection.

But they were not the sole factor. All suspension patients, regardless of where they are being cared for, are vulnerable to risks from fire, vandalism, and accidental mishandling of storage equipment. In the past, suspension patients have been cared for in stainless steel or aluminum cryogenic dewars. These have been housed in industrial or commercial structures which offer little in the way of protection against fire or vandalism. What is needed is a protective system that would essentially eliminate risk from vandalism or deliberate sabotage (such as gunfire into the storage facility) and from collapse and/or burning of the structure. Such a system would provide nearly complete protection of suspension patients from localized natural disasters and from limited directed sabotage or vandalism. Of particular concern to us has been the recent growth of the animal "rights" movement and their increasing use of terrorist tactics. Because of our heavy reliance on and support of animal research and our increasing public visibility, we are a potential target of such groups.

The system ALCOR developed to provide protection has been designed with these considerations in mind. Since neuropatients are much more compact (and in fact, all ALCOR's patients at the moment are neuros), initial protection efforts have been directed to the protection of the 9-patient capacity MVE A-2542 dewar. The protective system consists of a steel-reinforced concrete vault with exterior dimensions of 5' x 5' x 5', a wall thickness of 5 inches, a fireproof access plug and a quantity of containerized water to act as a heat sink in the event of a fire. The vault is mounted on a trailer to facilitate easy movement to new quarters should the need arise.



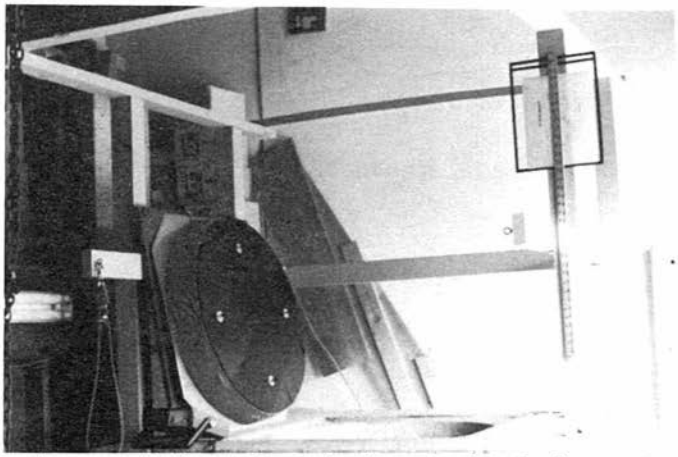
Standard utilities vault.

SPECIFICATIONS

The steel-reinforced concrete vault selected for our application is a utilities vault of the kind commonly employed to act as an junction box for underground electrical and telephone connections. It is a standard item which is ruggedly constructed and designed to withstand a wet soil pressure of 80 psi., and heavy traffic burdens such as semi tractor-trailers. The vault consists of two parts; a lower box with 5" thick walls, and a 6" thick cover which fits tongue-in-groove onto the lower box. The groove into which the top seats onto the bottom of the vault was filled with Kaowool™ blanket to eliminate possible convective heat leaks during a fire. (Kaowools™ are durable ceramic fiber materials used as insulation and convective barriers in high temperature ovens and furnaces. They are made by Babcock & Wilcox.) The cover has a tapered circ ular opening which is 30" in diameter at the top. A 32" square, 1/2" thick steel plate weighing approximately 250 lbs fits into a recess over the access opening and provides mechanical protection.

In order to close the large diameter access opening to heat in case of a fire, a neckplug was fabricated from sections of Kaowool™ M board. In an evaluation we conducted, a 0.5" thick section of Kaowool™ M board withstood vigorous heating with a propane torch, sustaining a temperature rise of only 75°C in 6 minutes. (Heat conduction is an exponentially defined property. Doubling the thickness of insulation may reduce heat conduction by an order of magnitude.) The neckplug consists of three layers of 1.5" thick Kaowool™ M board bolted onto a 12 guage stainless steel cover with 6" carriage bolts. The neckplug fits into the access opening and is then covered with the 1" steel plate for further protection against falling structural members.

In order to brace the dewar in the vault, it was mounted on a piece

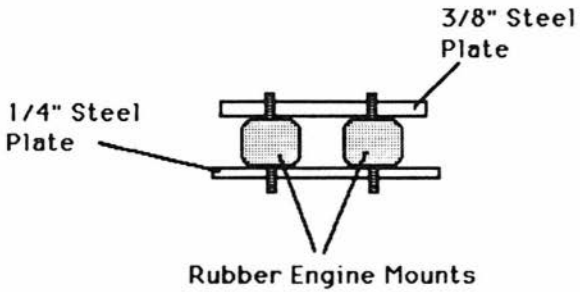


The top of the vault, showing the insulating neck plug, the steel cover plate (behind the plug), and the personnel guard rail.

of 3/4" plywood with six rubber engine mounts. The plywood serves to immobilize the dewar both laterally and vertically, and the rubber engine mounts provide shock absorption in all three dimensions.

After the dewar was positioned inside the vault, it was further immobilized using mats of fiberglass insulating material. Three corners of the vault then were filled with containers made from sections of ABS pipe. Each ABS container had been built to release two gallons of water. With six containers in each of three corners there is a total of 36 gallons of water available during a fire. The ABS pipe was cut into sections 46" long, capped on one end and filled with water. The other end (the top) was then closed with an ABS pipe cap which had a 1/4" hole drilled in it. The hole was plugged with wax and covered with aluminum foil. In the event of fire, when the interior vault temperature reaches the temperature of boiling water, the wax will melt and allow steam to escape. As long as any water remains, the interior vault temperature hopefully will not greatly exceed 100°C, a temperature which superinsulated vacuum dewars can easily survive.

A-2542 Shock Mount Assembly

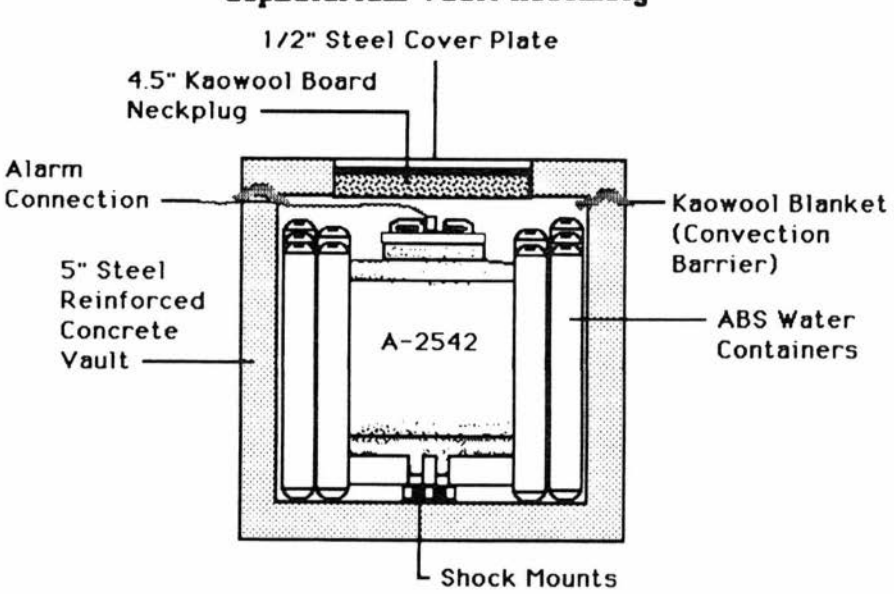


MOBILITY

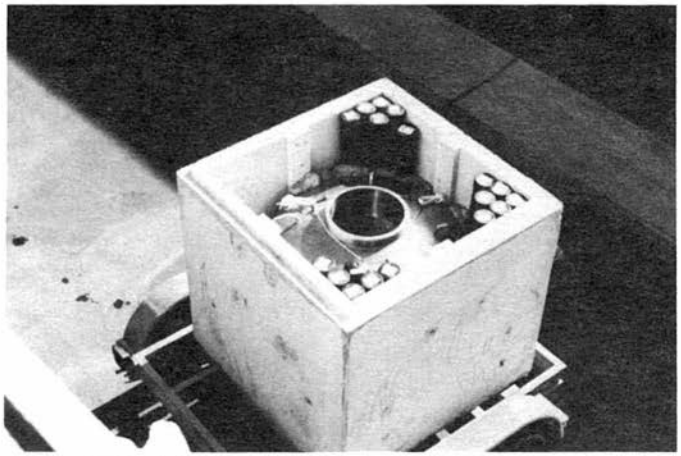
The entire vault is mounted on a 9,600 lb capacity trailer to provide mobility in the event that rapid movement due to political or civil threat becomes necessary. Although the trailer will be supported on concrete pylons to minimize the effects of tire rupture during a fire, we estimate that two people will be able to put the trailer/vault on the road in a little more that half an hour, with an appropriate tow vehicle.

SPECIAL CONSIDERATIONS

Placing the patient dewar in a heavily protected enclosure has created several new problems. One problem is that until we have completed work on a



lifting system for the massive steel cover plate, access to the dewar for regular external inspection will be reduced. We anticipate that we will have a system to ease opening the vault within a month or two. In the meantime, a thermocouple thermometer has been installed on the container which allows us to determine minimum liquid depth and dewar jacket temperature. This system acts as a backup to the liquid level sensor and the necktube temperature sensor (the latter to detect sudden, massive vacuum failure) which have been tied to an automatic dialer since we started up the A-2542 almost four years ago. The dialer calls both ALCOR's Emergency Response System and key personnel.

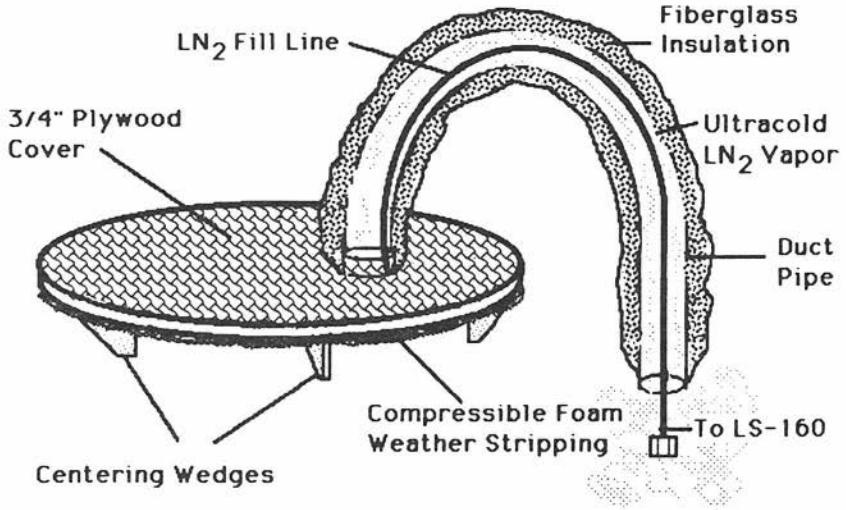


The vault interior with the concrete top removed.

From the outset, it was obvious that filling the A-2542 in the vault could result in water condensing on the dewar and accumulating in the vault. In order to eliminate this problem, a lid was built that vents most of the escaping cold nitrogen vapor outside the vault during the filling operation. This design should also help reduce the problems of oxygen contamination of the liquid nitrogen, ice pumping, and transfer losses.

The filling lid for the 15" wide opening of the A-2542 is a circle of 3/4" plywood with a flexible weatherstrip foam seal, centering guides, and a fill line mount on the bottom. A 3" diameter clothing dryer duct fitting runs through the lid and connects to a 6' section of 3" corrugated flexible aluminum duct pipe. The 1/2" copper fill line runs inside the duct. The duct pipe is wrapped in 1" of fiberglass insulation which is in turn covered with a foil-backed polypropylene vapor barrier. With this assembly, cold gas evolved during filling is vented outside the vault, while serving as a cold jacket around the fill pipe, reducing heat leak into the fill line as a source of liquid loss. By preventing mixing of the cold gas with outside air over the dewar mouth, the lid also reduces oxygen and water contamination.

A-2542 FILLING LID ASSEMBLY

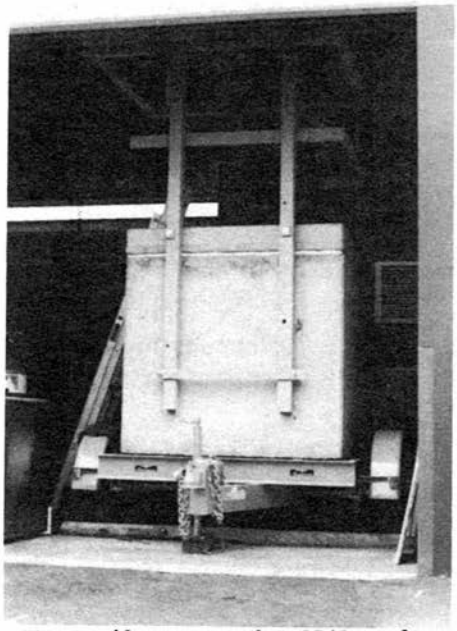


We know from a study conducted in our laboratory several years ago that open mouth storage dewars steadily accumulate liquid oxygen (LOX) as a contaminant in the liquid nitrogen. Even at -196°C LOX represents a potentially serious long-term hazard. Not only will LOX act to degrade welds over long periods of time, it has the potential for damaging biologicals, including suspension patients. In our experience, a 45 liter Linde LR-40 open mouth dewar accumulated 2% - 3% LOX over a 3 year period of operation. The lid was opened an average of twice a week for liquid level checks. While there are no accepted standards for safe levels of LOX, it is ALCOR's policy to refill patient care

dewars when the LOX level reaches the 2% - 3% range. The use of our fill lid should reduce the LOX contamination which occurs during the filling of the A-2542. Accumulation of water crystals (ice pumping) which occurs during filling operations should also be minimized by this device. About 200 cc of water was removed from the A-2542 while it was empty and warmed up prior to being placed in the vault.

SUMMARY

As designed, we believe that our neuropatient dewar is now reasonably immune to the effects of earthquake, building collapse, and fire, and to any malicious action not involving military weapons or sustained direct access to the vault. This represents an unprecedented degree of protection never before available to suspension patients. Considering the extended periods of time during which care of patients is likely to be necessary we firmly believe that such "superprotection" of patients is in reality the minimum standard of good care. We note that recently marketed safes and vaults designed to protect computer media (diskettes) from fire and vandalism employ the same basic approach as we have (heavily armored container with water saturated "vermiculite" jacket). This underscores that fundamentally there are only two approaches to preservation of information: superprotection of the original, or duplication. At this point in time the option of duplicating and safely storing copies of ourselves or suspension patients is not a possibility. The alternative is to provide safe, secure storage using the best means available. We believe we have met that challenge with the Cephalarium Vault.



The trailer-mounted A-2542 vault, with removable personnel guard rail mounted.

OCTOBER-DECEMBER 1985 MEETING CALENDAR

ALCOR meetings are usually held on the first Sunday of the month. Guests are welcome. Unless otherwise noted, meetings start at 1:ØØ PM. For meeting directions, or if you get lost, call ALCOR at (714) 738-5569 and page the technician on call.

ALCOR
ALCOR LIFE EXTENSION FOUNDATION
4030 NORTH PALM #304
FULLERTON CALIFORNIA 92635
(714) 738-5569

The OCTOBER meeting will be at the home of:

(SUN, 6 OCT 1985) Paul Genteman
535 S. Alexandria, #325
Los Angeles, CA

DIRECTIONS: From the Santa Monica Freeway (Interstate 1Ø), exit at Vermont Avenue, and go north to 6th St.
From the Hollywood Freeway (US 1Ø1), exit at Vermont Avenue, and go south to 6th St.
Go west on 6th 4 blocks to Alexandria, and turn right. 535 is the first apartment building on the west side of the street. Ring #325 and someone will come down to let you in.

The NOVEMBER meeting will be at the home of:

(SUN, 3 NOV 1985) Maureen Genteman
524 Raymond Avenue, #12
Santa Monica, CA

DIRECTIONS: Take the Santa Monica Freeway (Interstate 1Ø) to Santa Monica and get off at the 4th Street exit. Turn south (left) on 4th. Go south on 4th to Ocean Park Ave. (4-way flashing stop). Go left on Ocean Park, down ramp to stop and up to 6th St. on Ocean Park. Turn right on 6th. Raymond is the second street. Turn right on Raymond. 524 is on the left. #12 is on the second floor.

The DECEMBER meeting (Annual Turkey Roast) will be held at the home of:

(SAT, 7 DEC, 1985) Brenda Peters
(FIRST SATURDAY!) 815Ø Rhea
Reseda, CA

DIRECTIONS: Take the San Diego Freeway (Interstate 4Ø5) north into the San Fernando Valley, to Roscoe Blvd. Go west (left) on Roscoe 3-4 miles. Rhea is 2 blocks past Reseda Blvd. Turn south (left) on Rhea, which has a geodesic dome church on the corner. 815Ø in the second house in the second block, on the left.

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ADDRESS CORRECTION AND FORWARDING REQUESTED