CRYONICS

VOLUME 6(1) JANUARY 1985 Photocopy ISSUE # 54

CSSF MERGES WITH ALCOR

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VOLUME 6(1) JANUARY 1985 ISSUE # 54

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CRYONICS is the newsletter of the ALCOR Life Extension Foundation, Inc. Michael 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 North Palm, #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

Picture Credits

We neglected to mention that the pictures of BACS members in the December CRYONICS were taken by Saul Kent at the 29 July, 1984 meeting of BACS in the home of Paul Segall. This is the same meeting that was reported by Dick Marsh in his "Bay Area Updates" in the same issue. Thanks, Saul.

The picture on page 4 of the December issue is very interesting, not for its content, but for its location imbedded in the text. We had been told that half-tone pictures do not reduce very well, and have previously printed pictures full size in a center sheet. Mike Darwin decided to test this, and the results are as you see them. In the future we plan to start running pictures throughout the magazine. This should give us considerably more flexibility and improve the appearance and readability of the magazine.

New Co-Editor

Those of you who really read CRYONICS cover to cover (including the colophon) will have noticed that in September, Hugh Hixon assumed co-editorship of CRYONICS from Steve Bridge. This acknowledgement in the colophon merely reflects what has for many months been a working reality. Due to his distance Steve Bridge is simply unable to provide the kind of day to day input and assistance required in editing the magazine.

However, Steve is far from gone from the cryonics scene. In fact, he has shifted into a higher gear, and as he will probably somewhat ruefully admit he is now working harder by far on cryonics than he was as co-editor of CRYONICS. Recently Steve completed the truly massive task of rewriting the ALCOR suspension paperwork and he is now hard at work editing/typing a forthcoming ALCOR monograph on cell and tissue repair via molecular engineering.

Everyone who has enjoyed or profited from CRYONICS owes Steve a tremendous debt of thanks. Without him the magazine would never have taken shape to begin with or had the balance and thoughfulness for which we receive so many compliments. Our thanks for a job well done.

All great truths begin as blasphemies.

-George Bernard Shaw

After eight months of preparation and planning it's finally official: CSSF and ALCOR have merged! ALCOR President Mike Darwin and Jerry Leaf, President of Cryovita Laboratories, went to Florida on November 10th for a combined training session ALCOR paperwork party. On November 18th CSSF President Glen Tupler signed the final piece of paperwork making the merger official, and the overwhelming majority of CSSF members completed their ALCOR suspension paperwork. Probably never before in the history of cryonics have so many sets of suspension paperwork been filled out in so short a period of time (two weeks!).

This also marked the effective completion of Cryovita Laboratories' contract to set up a cryonics suspension facility in the Miami area and train the cryonicists there to do the necessary transport procedures to get a deanimated patient to the facility.

The merger was undertaken for a variety of reasons. CSSF has been plagued by the usual problems any small cryonics group faces, shortage of volunteers for routine administrative tasks and record keeping, and a high cost per member for undertaking such administrative tasks. It hardly makes sense to have organizations with only 10 or 15 members bearing the full burden of accounting, administration, research and so on when these tasks can be centralized and the fixed costs spread out over a larger number of people. ALCOR was in much the same position. By combining, forces CSSF and ALCOR should be able to greatly increase their efficiency and avoid needless duplication of effort.

Meeting The Challenge

It will be a major challenge for ALCOR in California to satisfactorily meet the needs of its Florida members and provide a good, working, responsive group in Florida. We plan to rise to the challenge of distance by keeping in close touch and by making frequent visits to "ALCOR East" in order to provide training and keep abreast of members' needs in that area. As the South Florida chapter of ALCOR grows and attracts people with more time and energy to spend on cryonics we hope to be among the first to encourage growing autonomy for the group. In the meantime, ALCOR West will handle literature production, emergency communications system billing and other administrative tasks.

In the next few weeks ALCOR hopes to conclude an agreement with Hollywood

Health Services, Inc., the Florida company which owns the cryonics facilities in the Hollywood, Florida area. HHS currently has a "state-of-the-art" cryonics facility and plans to make it available to ALCOR for use in ALCOR suspensions. Essentially all the suspension equipment, and the training, was purchased by HHS as a package from Cryovita Laboratories. Most of the equipment was set up in April, and part of the training was done then. Training was completed November 18th, by Jerry Leaf and Mike Darwin. Mike was in Florida in a dual capacity, as a Cryovita employee and as ALCOR President.

HHS is an independent "for profit" company which was formed by several CSSF members to protect their investment in cryonics equipment. No ALCOR directors have any financial or other interest in HHS. Because HHS consists of ALCOR members who want ALCOR's suspension services available in Florida, we expect to negotiate a contract at far below what the real costs or "market rate" for such services would be. This is necessary at this point because spreading the real cost of keeping a cryonics facility up and running over the 10 to 15 members in the area would simply be prohibitive. HHS is composed in large part of four wealthy individuals. who are currently underwriting the cost of the cryonics facility for their own protection. These members wish to make these facilities available to others because they understand that if cryonics (and they) are to survive, more members must be attracted. A suspension team of concerned and involved members is necessary to carry out a suspension, and such a team can be assembled only out of signed-up people who care enough to put the work and effort into doing the job right.

The individuals of wealth who have put money into HHS and had the foresight to be realistic about charges to the nonprofit group (in these early days) have shown tremendous and uncommon good judgment. This investment on their part has resulted in a return "investment" on the part of other Florida suspension members who have shown up weekend after weekend to master the skills necessary for rescue, stabilization and transport.

Mike Darwin demonstrates correct taping technique for endotracheal tubes tube Team A, while Team B practices intubation (background).

Training Session Success

Going into a training session, it's hard to know how things are going to turn out. The volunteers are unfamiliar with the situation and lack any confidence that they can really learn these "esoteric medical skills." The instructors also face a good measure of uncertainty: will the team members cooperate? Do they have the persistence and determination to learn new, skill-dependent tasks? Will they stand on their feet for eight hours of lab sessions and sit through half a day of technical lectures?

ALCOR East suspension team receives basic instruction on intubation techniques. From left to right: Marc Tupler, Bill Faloon, Ross Hartman, David Tupler, Glen Tupler , Doug Platte, Mike Darwin, Ed Schaerer and Dana Dye.

It is more than a little gratifying to see everybody relax and start to gain in confidence and respect for each other. The transformation has been amazing. When Cryovita (and ALCOR) first arrived in Florida, we found a group of people who had been pretty demoralized by a series of unsuccessful efforts to put together a suspension team. Everyone questioned whether it was possible. Many hours and a lot of effort later the change in attitudes could be summed up quite nicely by the leader of the A-Team, Glen Tupler, when he enthusiastically remarked on leaving the final training session of the weekend: "I really feel like we're prepared, we're definitely ready to roll!" B-Team leader Ross Hartman similarly reflects the change in attitude. When Jerry and Mike arrived in Florida December 10th, Ross had in hand a computer generated dosage schedule of transport medications he had laid out which eliminates the need for calculating dosage by weight. Ross' worksheets are a real time saver and will be incorporated into ALCOR's rescue handbook in California as well. Other team members have repeatedly and vigorously supplied us with suggestions for speeding rescue operations and for simplifying medication administration during transport. These suggestions have, almost without exception, proven valuable and have been implemented.

Another indicator of the rising enthusiasm in Florida was that several members set up impromptu speaking engagements for Mike Darwin with friends and acquaintances. Gil and Ed Schaerer and Doug Platte both arranged for evening

Marc Tupler takes his turn at practicing intubation on a dog with some help from fellow team member (and brother) Glen. Jerry Leaf (upper right) looks on and offers advice.

speaking engagements for Mike.

It is this kind of initiative and confidence which makes us optimistic about the future of ALCOR East. It is also good to know that there is now a high quality perfusion facility available on the East Coast, as well as a group of competent transport people to staff it.

For the time being perfusion personnel will be supplied by ALCOR West, and storage will carried out at ALCOR West in Southern California. Everyone agrees that with so few patients in our care at this point, centralizing storage facilities is a must to hold costs down and assure high quality care.

By the time Mike and Jerry left Florida, 11 people had completed their ALCOR paperwork. Of these 11 people, nine had adequate levels of funding and will be promptly added to the rolls of ALCOR suspension members. Two people need to provide more funding, and there are at least three other people who are still working on their paperwork/funding arrangements. Several of the Florida people were "newcomers" in that they were not previously signed up--not even with CSSF. Overall this brings us to 44 fully signed up suspension members!

There will be some shuffling of the ALCOR board and officers since the Florida ALCOR members have appointed Glen Tupler as their representative to act for them and to act as an ALCOR director.

A Change in Emphasis

The Florida merger will also mean some changes in ALCOR. In the past ALCOR has been heavily "neuro" with relatively few whole-body members. However, the Florida group is largely whole-body and is likely to remain that way. This means that ALCOR is going to have to shift emphasis somewhat and focus more attention on issues of concern to whole-body members.

The next few months should be the upgrading of the communications system in South Florida to a level comparable to that in Southern California, and deployment of handbooks for the team leaders similar to the ones used by ALCOR on-call personnel in Southern California.

Only time will tell if the merger will truly meet the needs of South Florida cryonicists. All of us, on both coasts, are aware of the difficulty of serving people well who are thousands of miles away. For the time being such a setup appears the only workable solution to a difficult situation. The past eight months of slow, careful preparation have given all of us plenty of reason for optimism.

COME TO LAKE TAHOE COME TO LAKE TAHO

The 1985 Festival will be held in Lake Tahoe on Memorial Day Weekend. There will be two days of presentations (Saturday and Sunday, May 25 and May 26) and one day for recreation (Monday, May 27), and a reception on Friday evening for early arrivals.

There are two very exciting events planned for this year. First, a special guest speaker, Eric Drexler (Director, L-5 Society; Research Affiliate, MIT Space Systems Laboratory; author of The Future By Design) who will be speaking about molecular technology and its implications for life extension.

Second, there will be a panel discussion on the general subject of personal identity and memory. The panel will be made up of Mike Darwin, Eric Drexler, Saul Kent and Jerome White. Each participant will give a short five minute summary of their ideas on this subject and we will then open the discussion to questions and comments from the audience. It will be exciting, stimulating and an event no life extensionist would want to miss.

Below is a preliminary list of speakers and their presentations:

MIKE DARWIN (Title not yet available)
JERRY LEAF (Title not yet available)
RICHARD MARSH, Ph.D. (Title not yet available)
PAUL SEGALL, Ph.D. (Strategies and Techniques in Life Extension Sciences)
RON VINER (BACS: Recent Developments)
HAROLD WAITZ (Reviving Perfused Ice Cold Hamsters)
JEROME WHITE and ART QUAIFE (Heat Flow in the Cryonic Suspension of Humans)
JEROME WHITE (Varieties of Deathism)

LAKE TAHOE COME TO LAKE TAHOE COME T

SLOPPY SCIENCE

The December 1984 issue of DISCOVER magazine contains a fascinating article on the results of Canadian anthropologist Owen Beattie's exhumation and examination of a member of the ill fated Franklin expedition of 1845. Sir John Franklin set out with a crew of 129 to attempt to find the Northwest Passage, a hoped-for Northern sea route from the Atlantic to the Pacific. What they found was death.

In the summer of 1845, the expedition set out on its voyage. By September of the following year both of the expedition ships had become locked in pack ice which they were unable to break free of the next summer, even with ship-mounted locomotives and propellers. Also during that summer, in June, 1847, Sir John died, at the age of 61. The expedition logs have never been recovered, so exactly what happened is not known. What seems likely is that without leadership and trapped in the ice for over a year, morale degenerated into panic. In April, 1847, the 105 surviving men abandoned the ships in a desperate attempt to reach help. Within a month or so, they had left a note which was later found telling of their decision. They did not say what their goal was, but they headed toward a Hudson's Bay Company outpost hundreds of miles to the south. Then, leaving a trail of abandoned supplies and their bones, all of the crew members perished from starvation, exposure, and exhaustion. Poor judgment and demoralization appear to have been a major factor in their demise.

Early in the expedition, before panic set in and morale degenerated, several members of the expedition died and were buried on Beechy Island, a frigid expanse of rock located in Canada's Northwest Territories. It was these seamen that were the object of Dr. Beattie's search.

Last August, Dr. Beattie's expedition opened the grave of one of these men, John Torrington. He found Torrington's remains to appear to be strikingly well preserved. In fact, Torrington looked as though he had been dead no more than a few days at most, rather than for 138 years! Photos of Torrington's icy remains have made the rounds in newspapers, science magazines and the popular press. The DISCOVER account is one of the first detailed popular accounts of Beattie's expedition.

***TERROR*, Torrington's ship departs from England**

Near the end of the article on page 73 of DISCOVER, the Beattie expedition pathologist, Dr. Roger Amy, in discussing Torrington's histological examination is quoted as saying: "This doesn't look good for the cryogenics people, who argue that bodies can be revived after long storage at low temperatures." Amy's remarks were made in connection with his observation that bone marrow cells recovered from Torrington's rib showed a complete loss of cell nuclei.

This seems to be a pretty stupid and shortsighted remark for Dr. Amy to have made. As most of our readers are well aware, there is a substantial difference between storage at -10 C and storage at -196 C. (See this

month's "Question Column") Also, as usual, establishment scientists chose to look on the negative aspects of their findings rather than on the positive ones. The question is not what was missing, as much as what was still there? Torrington's brain, intestines, kidneys, lungs, spleen and stomach were also sampled and found to be strikingly well preserved—even on a histological level. This kind of sloppy science, commenting on an area of work of which you are totally ignorant and comparing apples to oranges (i.e., -10 to -196 C) is something which is all too common. It also raises serious questions about the quality of the other conclusions which Dr. Amy has reached in his researchs.

The Discover article prompted Hugh Hixon to respond to Dr. Amy's comment and as a point of information (for people who may snidely be parroting Dr. Amy's uninformed comments) we reprint Hugh's letters, to Dr. Amy and to DISCOVER, below. They were also sent special ALCOR literature packages that included copies of CRYONICS with our postmortem and histological work.

Once again, it just goes to show you that you can't always believe everything you read or the word of so-called experts who cause it to be written.

21 November, 1984

Dr. Roger Amy
Department of Pathology
University of Alberta
Edmonton, Alberta T6G 2E5
Canada

"This doesn't look good for the cryogenics people, who argue that bodies can be revived after long storage at low temperatures"

Dear Dr. Amy:

In the December, 1984 issue of DISCOVER magazine, you are identified as the project pathologist for Dr. Owen Beattie's expedition to examine the remains of members of the Franklin Expedition. Remarking on the loss of nuclei in bone marrow cells, you are quoted as saying, "This doesn't look good for the cryogenics people, who argue that bodies can be revived after long storage at low temperatures." This statement appears to us to combine confidence and ignorance in such monumental amounts that we do not wish it to go uncorrected.

Minor point first; the proper neologism is "cryonics." Cryogenics is the engineering discipline concerned with the production and maintenance of low temperatures. They do not like to be confused with us. Cryobiology is of course the regular scientific discipline concerned with life (and its absence) at low temperatures. The cryobiologists also do not like to be confused with us, in general, although one of our members is a very active and productive cryobiologist.

The major point is this. The people we have frozen are stored in liquid nitrogen, at a constant -196 degrees Celsius, and not in near-surface permafrost with seasonal and daily fluctuations in temperature at most only tens of degrees below the freezing point of water. If you are aware of the effect of temperature on chemical reaction rates, as described by the Arrhenius equation, you will appreciate that at -196 C, chemical change comes to a virtual standstill. This of course assumes that there is a medium for the chemical reaction to take place in. Nuclear magnetic resonance (NMR) studies indicate

that below about -100 C, there is no liquid water in any form. It is an indication of the stability of things at -196 C that the crystallographic work on the high pressure phases of water ice was done by forming the ice crystals at several thousand atmospheres pressure, cooling them to liquid nitrogen temperature, removing the crystals from the pressure vessel, and performing the X-ray diffraction work at atmospheric pressure and -196 C. Finally, people who are treated for cryonic suspension are perfused after death with high concentrations of cryoprotective agents, such as glycerol or dimethyl sulfoxide, which can provide sufficient protection to recover a large fraction of the cells stored at -196 C in a viable condition -i.e., with functioning nuclei.

As to the lack of stem cell nuclei that you have noted, while there is no argument that the nucleus is a vital cellular component, it is reproduced in literally trillions of copies throughout the body. The technology that we envision as necessary for revival of a dead, frozen human will be capable of repairs at a molecular level, and reproduction and distribution of any surviving nucleus in the appropriate quantities will be a fairly simple process. If no single nucleus survives completely intact, present work in genetic sequencing indicates the possibility of reconstructing a complete nucleus, if a sufficient number of sufficiently long fragments of DNA are available. Failing this, there seems to be no overwhelming reason why any nucleus from any male human might not be substituted, since there is at present no indication that memory and personality are contained in any structure of the nucleus, even though the nucleus codes for the structures that contain memory and personality.

Nature already provides for the survival of genetic material. What we are concerned with in cryonics is the survival of individual personalities. Since it is not yet known what the fundamental chemical basis of thought and memory is, we are not yet able to assert with certainty that revival is possible. However, one recent hypothesis (Lynch, G., and Baudry, M., SCIENCE, 224, 1057 (1984)) indicates that the state of individual synaptic connections may be the deciding factor. In a manuscript which will be published next year, Eric Drexler (The Future by Design, Doubleday, 1985) points out that if such a mechanism is the case, even some chemical deterioration is acceptable, since the only stringent requirement is to be able to reliably identify the former state of each synapse.

Regarding the feasibility of molecular repair machines, Mr. Drexler has made calculations that indicate such a device, which would take the form of a computer or robot, with small molecules as its individual components and an overall size of about one cubic micron, is entirely feasible. It might or might not be self-reproducing. It would be capable of identifying individual molecules and rearranging individual atoms in them, and in no respect requires abilities not already observed in enzymes, except for the general-purpose computational feature.

As to when this might all take place, I'm sure that you are aware of the recent enormous strides that have been taken in the establishment of a discipline of genetic engineering. There is also a small, but growing, literature on molecular machines, with contributions being made by chemists, biochemists, and microelectronic engineers. Revival of a dead, frozen human might be possible in 20 years, but 50 years is much more likely. If it is not possible within 100 years, then the human race has probably turned down a path that I don't think either of us would enjoy. In any event, such a thing seems feasible in one or two human lifetimes, and we believe that we can keep things at -196 C for that length of time.

As you might guess from some of the above remarks, we have been interested in your work on John Torrington, and regard the histology of his brain with somewhat more than academic interest. We look forward to the publication of

your findings.

Cryonics is now about 20 years old. I regret to say that for most of that period, a lot more has been said than has been done. As you will note if you look at the enclosed articles, this is changing. We are beginning to do our own work directly related to our goals, and to attract private funding.

Long Life,
Hugh Hixon,
ALCOR Foundation

Enclosures: Literature package
Letter to Editor, DISCOVER

AS WE GO TO PRESS--WHAT DR. AMY REALLY SAID

Shortly before going to press with this issue we had the opportunity to speak at length with Dr. Amy and to question him about his alleged remarks to DISCOVER. Dr. Amy had quite another account of his interview with DISCOVER and he denied categorically making any remark relating to cryonics (cryogenics). He said that he assumes that the quote must have been fabricated by the DISCOVER reporter. We found Dr. Amy honest, at ease, and very friendly in our conversation with him. He was very free with information and provided us with potentially important facts regarding the postmortem findings on John Torrington.

No Fine Tissue Structure

To further clarify the DISCOVER reporting: Dr. Amy's light microscopic examination not only found no nuclei in any marrow cells. It found no cells or nuclei in any tissue examined! Dr. Amy said the only remaining structure discernible was collagen fibers noted in skin and collagen networks reminiscent of gross tissue architecture observed in the lung. In no tissue was any sign of cell nuclei or cell membranes found. The tissues were reportedly composed of amorphous debris under the microscope. Dr. Amy did note the presence of a few bacterial cells with intact cell walls.

Dr. Amy further noted that the remains were very dehydrated with the organs presenting a caved-in or collapsed appearance. Torrington's heart weighed only about a fourth of the weight normally expected for a man of his size. Dr. Amy expressed his regret at DISCOVER's careless reporting and agreed that there is no comparison between storage at -20 C and storage at -196 C. He promised to provide us with a copy of his forthcoming paper on the histological examination of Torrington's remains.

Unsuitability Of Arctic Storage

Dr. Amy's results should lay to rest once and for all (though they probably won't) uninformed suggestions that suspension patients be stored in the permafrost or the Antarctic ice cap. It is important that all cryonicists realize that chemical reactions and water movement are still quite dynamic down to and including the temperature of dry ice (which is considerably colder than the coldest places on earth on a year-round basis). Attempts to store biological structures (including ourselves) at such high subzero temperatures will fail and they will fail not only in terms of recovering viability but also

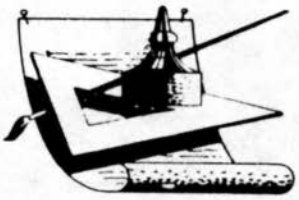
in terms of recovering structural information from which memory and personality can be inferred.

Anyone with remaining doubts about the infeasibility of "natural cold storage" should refer to this month's "Question Column" by Hugh Hixon and consult the table which shows the rate of chemical reaction at subzero temperatures relative to the rate at which the reaction would go to completion at body temperature. That should give any would-be Antarctic entombment people some pause for thought.

CRYONICS STORY IN OMNI

The November issue of OMNI magazine contains a science fiction story by Ben Bova with cryonics as a central plot mechanism. The story is entitled "Out of Time" and concerns the efforts of the Mafia to escape the law by using cryonic suspension. As you may gather from this one sentence plot synopsis, the story is not heavy on imagination and, as usual, seizes on the most mundane aspects of what cryonics has to offer. It is more than a little frustrating to see a unique and powerful idea like cryonics used in such a bland and unimaginative way.

On the other hand, I don't want to be too negative about the story either. The fact is Bova uses cryonics in a positive way. There is the presumption that what we are doing will work and the whole issue of freezing people is treated as a sober fact. Despite its pedestrian plot this is one of the very few stories I can recall seeing anywhere which treats cryonics as though it was a reasonable, acceptable thing. While this is no big triumph in and of itself, it is worth noting—particularly if it is the start of a trend. Could we, at long last, be gaining credibility?



LETTERS

POSTMORTEM FINDINGS

Dear Mr. Darwin:

I read with interest your paper dealing with the postmortem findings in three cryonic suspension patients. The presence of widespread fractures is important, particularly since they were present in all three individuals. They strikingly indicate the pressing need for more studies to improve methods of cryopreservation.

The cavities seen in the sections of liver represent fat. The liver plays an important role in the metabolism of lipids. Excess accumulation of fat occurs in liver cells very commonly in metabolic disturbances as well as in primary injury to the liver cells. Fatty metamorphosis involves the hepatocytes but not the supporting tissue of the liver. The "island" of well-preserved cellular structure in the liver shown in Figure 2 is part of this supporting tissue, i.e., a portal triad. Thus, fatty metamorphosis represents a premortem condition, independent of cryopreservation. Many of the other histologic findings, such as those in the kidney, are comparable with postmortem changes that could have occurred during the 24-hour period between death and

cryopreservation. Therefore, these changes may not have been caused by freezing and thawing either.

Sincerely,
Raymond E. Ideker, M.D.
Durham, NC

We would like to thank Dr. Ideker for his comments. It is gratifying to know that the quality of our magazine production is sufficient for him to make his determinations. It is also gratifying to know that there are people out there who can make such determinations. We have from time to time taken some criticism for running articles "too technical for anyone to understand." —HH

CREDITS

As the principal rewriter of the new ALCOR paperwork, I want to give special thanks to Robert Ettinger of Cryonics Institute and to James Bianchi and BACS for allowing us to examine and borrow ideas from their suspension paperwork. We hope that the new ideas that we have added will be of use to them someday. I also want to thank Mike Darwin, Thomas Donaldson, Hugh Hixon, Allen Lopp, and Frank Rothaker for their additions, corrections, and commentary.

Steve Bridge
Indianapolis, IN

UNCREDITS

There is no author on "The Histological Study....." in CRYONICS #52. This does not constitute good practice on a scientific paper. Especially a scientific paper.

Steve Bridge
Indianapolis, IN

Dear Steve:

It seems to me that we have gone around this question about 10 times with various people.

Again. Yes, this sort of thing constitutes poor editorial practice. No, we do not particularly like doing it. Yes, under the circumstances, we are going to continue doing it.

The author of that piece works for someone. That someone is not particularly pleased about the author's involvement in cryonics, but they have achieved a truce. The author does not let his name be publicly associated with cryonics, and the someone whose lab the author works in doesn't say much about what the author does on his own time in the lab. If the truce breaks down, i.e., if someone who knows the identity of the author motormouths about it in public, and especially in print, the someone whose lab it is has implied that

the author will need another job, and that that will NOT be easy.

We could of course suggest to our author that as a matter of high principles, he use his name here, but we feel that he is unwilling to put his job and his reputation in a sling for anyone's principles but his own, and we feel that we can relate to this attitude.

The person in question is an able and valued associate of long standing, with impeccable scientific credentials, and we feel that it is much more valuable to cryonics that we publish his valuable work without attribution, than to reject it on the grounds that he cannot identify himself in print. CRYONICS stands behind the quality of his work, and is proud to do so. Finally, as we're sure you're aware, his identity is not much of a secret, except in print. We are generally happy to tell people his name, if we feel that they will be discrete in the use of it.

MEMES

I am a recent convert to cryonics as a result of reviewing Eric Drexler's manuscript for his book. (The Future By Design, by Eric Drexler, Doubleday, 1985).

In addition to a convincing argument about future technology being able to reanimate suspension patients, his book discusses a number of mental tools that may have an impact on understanding ourselves and our culture of the same magnitude that the periodic table had on understanding chemistry. Practical uses of these new tools may take a while. It took decades for better understanding of chemistry to lead to new industries.

One of the most important of these tool is the concept of a "meme," a term coined by Richard Dawkins in The Selfish Gene. Memes are information patterns in brains which (among other things) influence the organism to propagate the meme. Additional discussion of memes can be found in the January 1983 Douglas Hofstader column in Scientific American. Cryonics is clearly a meme that competes with religious memes. If you study the evidence, it offers a believable chance of very long existance, if not virtual immortality, to people who have largely lost belief in a spiritual "life after death."

Dawkins answers the question of why religion has such permanence in the "meme pool" by ascribing to the "God meme" the function of anxiety reduction. "It provides a superficially plausible answer to deep and troubling questions about existance. It suggests that injustices in this world may be rectified in the next. The 'everlasting arms' hold out a cushion against our own inadequacies which, like a doctor's placebo, is none the less effective for being imaginary."

In the same section, Dawkins discusses co-adapted sets of mutually reinforcing memes. Assisting the God meme, for example, are memes for hellfire and blind faith. Cryonics may need "helper" memes to become a major force in society. What these might be I do not know.

There are many intelligent and technically trained people around that have no problem keeping religious beliefs in a separate mental compartment. But there are also a large number of others (most anthropologists, for example)

that look at a world full of competing "the only way to go to Heaven" memes and conclude that they are all superstition. The people who have (reluctantly) accepted oblivion on this mental level are an obvious target population for spreading the cryonics meme. I think that recognizing the quasi-religious nature of cryonics might lead to improved ways to get it accepted. We could study the surface and hidden appeals of religions and see what could be done in the cryonics movement to provide for the same psychological needs. It might be worthwhile to infiltrate religious and social groups and try to plant the meme of cryonics. Three possible groups would be the Unitarian Universalist Church, Mensa, and the L-5 Society. These organizations may have significant numbers of "pre-adapted," that is, receptive to cryonics, people in them.

Though I did not know of the "meme of memes" when I did it, I was involved in the spread of another quasi-religious meme, that of space colonies. This included founding the L-5 Society, which has grown to almost 10,000 people. The meme "got away from" the originator (Dr. O'Neill), mutated in ways he did not like, and spread to most of the science fiction community and many other places. One place where many of his ideas may have application is ballistic missile defense.

I suspect that Drexler's book will have a major impact on the cryonics movement, but the "state of the art" in the field of memetics is not advanced enough to tell what it will be. Sigh. Sometimes I feel like an alchemist who has been handed a periodic table.

Sincerely,
H. Keith Henson
Tucson, AZ

REFLECTING FORWARD by Mike Darwin

Once again it is time for me as President of ALCOR to sit down and reflect on the state of ALCOR, our past year and the one which challenges us. A year ago when I sat down to write a summary of 1983 I had only a little hope that 1984 would match the progress and growth of 1983. I suppose that the years of frustration and hardship I have experienced in cryonics have made it almost impossible for me to believe that cryonics could experience progress in anything like "normal" terms. Even now, a year later, I find it hard to believe that we have experienced the progress we have in 1984 and I still, deep down inside, remained prepared for more years of hardship. Perhaps in the long run this will prove to be an advantage if it protects us from overconfidence and from taking for granted the good things which our hard work is finally starting to bring us.

This past year has seen spectacular growth for ALCOR in ever area of its activities from research to membership to patient care. We were responsible for conducting the research and publishing the report on the first gross and microscopic examination of humans placed into cryonic suspension, and other ALCOR research on total body washouts in dogs has broken fundamental new ground.

Just our research accomplishments alone for the past year would be a worthy achievement.

But progress has not been confined to research. Our cephalarium vault has turned from raw idea to concrete reality (pun intended) in less than a year, and our suspension team, aided by research sessions, has gone from raw recruits to skilled participants. Perhaps most gratifying, we have started to grow in a way we haven't dared to dream possible: by signing up new members. The past year has seen our membership ranks swell from 27 to 44 with six of these people representing total newcomers to cryonics. Also encouraging is the fact that the number of people applying for membership has never been higher! Right now we have seven people in various stages of "signing up". We don't know if this is going to continue, but we are starting to feel some optimism that cryonics may be entering a new phase of growth and that the growth may continue to the point where it will dwarf anything experienced before.

As the year draws to a close we have also achieved the difficult task of merging with the Cryonics Society of South Florida. I was surprized to find that the East Coast division of ALCOR, or "ALCOR East" as they call it down in Hollywood, Florida, is developing outstanding leadership of its own. Both team leaders, Glen Tupler and Ross Hartman, have shown strong enthusiasm and firm leadership. It's fair to say all the way around that there now exists a first class rescue/stabilization team on the East Coast and that the existence of that capability is in no small measure to the interest and enthusiasm of our Florida members. I can't begin to describe the excitement I felt at seeing the team leaders "click into place" and get things rolling in Florida. By the time Jerry Leaf and I left Florida we were confident that the Florida team was ready.

Finally, due to the outstanding efforts of Sherry Cosgrove, one of this year's newcomers to cryonics, we are bringing our accounting out of the stone age and into the era of double entry bookkeeping. Sherry has provided the long missing "financial tracking" know how which we've been sorely in need of. She has not yet reported her findings, but I suspect that there will be some things I don't like. At least I will finally know what's under all those rocks.

One of the hardest things about reflecting on the past year and one of the most satisfying is realizing the futility of trying to name everyone who has really gone that extra mile and helped. It is a measure of our growth that it would take up the better part of this issue just to list the contributions and accomplishments of our members this past year! Anna Tyeb, Hugh Hixon, Carlos Mondragon, Bill Faloon, Saul Kent... all of these people have been instrumental in helping make this year the incredible success it has been. To them, and to those un-named—our thanks and our promise that your efforts will not go unrewarded.

We do not intend to rest on our laurels. The successes of the past year have helped to make even more clear the need for progress. We urgently need to get to the bottom of the patient fracturing problem and find a solution. We also need to get a better hold on the nature of postmortem and freezing injury at both an ultrastructural and cellular level. Perhaps no other problem in cryonics research is as important to our credibility and growth as is the area of defining how much structure survives the dying and freezing processes. We urgently need to more fully demonstrate that we are preserving the vast majority of a suspension patient's molecular inventories with existing freezing techniques.

Concomitant with a better understanding of the limits of existing suspension methods, we need to work on improving them. Finding a way to avoid fracturing of patients represents this kind of research on a gross level. But we also need to strive to develop less injurious freezing (or vitrification) techniques on a cellular level as well. The ALCOR total body washout project is the first phase of this work. During the coming year we need to complete this study and apply the findings of it to the introduction and removal of cryoprotective agents. We also need to begin evaluation of what may be superior cryopreservation techniques such as vitrification. This work is vitally important and the experience of the past 20 years is that it isn't likely to get done unless we do it ourselves.

The past year has been one of incredible growth and progress by cryonics standards. The year ahead presents even larger challenges. If the level of financial support we've had in the past year continues or improves, then 1985 will be a better year by far. We know where we want to be, and we have a plan of attack to get there. We have a proven track record of good progress over the last three years and a proven record of growing support. There's no telling what's ahead for us in 1985. With your continued support and a little luck it promises to be one hell of a good year. Whether that prediction comes true is in large measure up to you, our members and supporters!

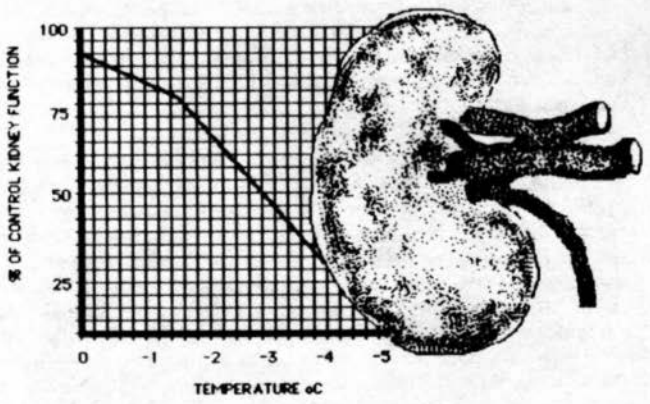
ORGAN PRESERVATION FROM A CRYONICIST'S PERSPECTIVE

by Thomas Donaldson

As many cryonicists may have already noticed, interest in organ preservation has increased markedly over the last couple of years. An excellent review in CRYOBIOLOGY (21, 377-384 (1984)) by I.A. Jacobson and D.E. Pegg has summarized the present state of knowledge in this area; cryonicists who would like a summary of the present state of knowledge would do well to consult this review directly.

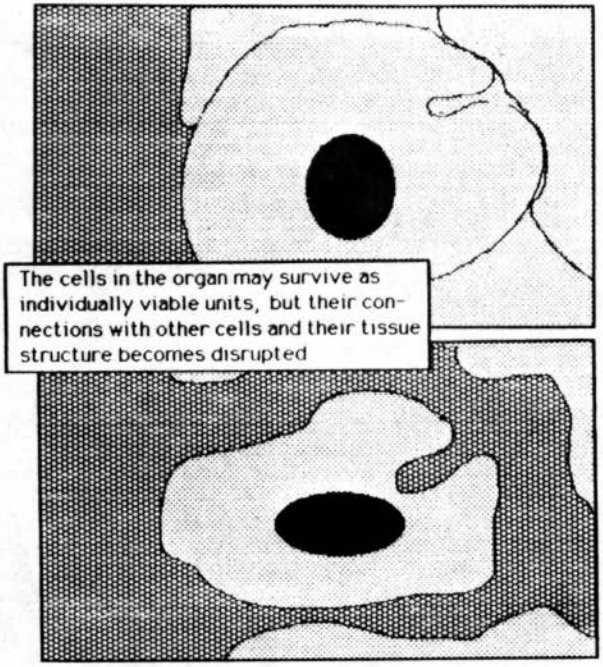
Rather than simply summarize it myself for CRYONICS, I will discuss the main findings and what they imply for cryonics itself.

In the first place, there have been some reports of functional recovery of kidneys after freezing. Unfortunately, organs never recovered even partially; the best experiment so far seems to have been a series done in 1967 by Halasz, in which kidneys were cooled to -50 degrees C, as measured in the core of these organs, and held there for only 15 minutes. These kidneys did not function at all



well after rewarming.

In cell suspensions, extracellular ice has not been damaging, and with the right protocols water will leave the cells and freeze outside. Thus, cells in suspension are not usually damaged by ice formation. However, more recent work has strongly suggested that in organs, ice formation causes a major part of the damage. The cells in the organs may survive as individually viable units, but their connections with other cells and their tissue structure becomes disorganized. Jacobson and Pegg discuss, for instance, experiments on ice formation in smooth muscle, in which ice formation disrupts the structure of the muscle bundles. Smooth muscle is a very important tissue, since it occurs in organs such as the heart and the arterioles. Disruption of all smooth muscle alone would severely disrupt the ability of any tissue to reestablish circulation. Without circulation, of course, the tissue would die.



The cells in the organ may survive as individually viable units, but their connections with other cells and their tissue structure becomes disrupted

There is some suggestion in the literature that other problems occur even if circulation can be reestablished. For instance, circulation was reestablished in the experiments of Halasz, but frozen kidneys still deteriorated markedly after only a few weeks.

Most cryobiologists have a very different set of motivations than do cryonicists. The problems addressed by these two groups do not coincide.

Cryobiologists wish to attain freezings with a very high degree of return of function in the near future; it would simply not be sufficient for them to obtain, say, an organ which recovered briefly from freezing, but shortly thereafter became useless. The majority of cryobiological papers on the organ preservation problem also look at it from the "front end". That is, they want to find a freezing method which will of itself, without the addition of any new repair techniques, allow a frozen organ to repair itself. This is likely to require a level of quality in the freezing process which may not be at all easy to attain. To the short-term goals of cryobiologists, this may appear to be the optimal research strategy, since the problem of repair appears much more difficult. If we are to freeze organs well enough to set up organ banks in the near future, it may not be practical to address the problem of repair (beyond the ability of tissue to repair itself). Such a feeling may be an illusion, but I believe it underlies the approaches used. In fact, a close reading of the cryobiological literature leaves me with some doubt about whether or not the problem of organ freezing will in fact be soluble without considering organ repair. It's already clear, for instance, that if frozen organs can recover

without assistance, then that recovery will only be possible if freezing is done under the most stringent conditions. The "area of viability", within all the different parameters, from which organs can recover naturally, has shrunken more and more as work has proceeded. Cryobiologists may have to face the possibility that it will turn out to be ZERO. That is, there may be NO methods of freezing which allows an organ to recover to significant function purely by itself.

As seen by a cryonicist, the requirements for "successful freezing" are not nearly so demanding. Rather than insist that organs can recover without any assistance from freezing and afterword work as well (or nearly as well) as normal unfrozen organs, cryonicists only want to do their freezing well enough that future repair methods can be envisioned. This is a far weaker and easier problem.

For some time, the only obstacle to freezing for cryonicists consisted of lack of knowledge about just what the damage of freezing might be. Without such knowledge, of course, we could not set about imagining any repair methods in detail. However, work on organ freezing has begun to describe some quite specific kinds of damage, from which we can easily derive means of repair.

The major present fault in frozen organs consists of damage to the vascular system. Other faults consist of other kinds of disruption to tissue structure by ice outside the cells. It's very likely that other kinds of damage happen too, but these are less well characterized. Repair methods therefore first have to restore the circulatory system.

Given that we will be able to construct machines and tissues (combinations of such machines) on a cellular scale, a method for repair might work as follows. First, the vascular system is substantially intact; a great deal of the organs are reachable already by the vascular system. It becomes blocked off due to edema, itself a consequence of damage to the vascular system, combined with the stress of removing cryoprotectant. We might therefore envision a special perfusate solution for repair, the repair broth, consisting of many of these machines. Some of them would settle on the cell walls and replace or reorganize disrupted smooth muscle; other repair machines would seek out torn capillaries and arterioles and construct a scaffolding (like a scab, only differently organized) around these so that leakage is halted. It is likely that these machines would be designed around genetically modified white blood cells and/or other types of blood cells; the repair I'm discussing is similar in kind, but not in degree, to our present repair mechanisms. If edema from removal of cryoprotectant becomes too much of a problem, we would design these repair machines so that they can function well under high concentrations of cryoprotectant.

Once the vascular system is repaired, the individual cells of the organ could also be subjected to similar kinds of repair; since circulation has been restored, we could spend much more time on that repair, since the cells would no longer face destruction due to lack of oxygen or nutrients. In fact, cells and tissues already have a substantial repair capacity. It might well be sufficient just to support them with nutrients and oxygen while they organize their own repair.

Other than the well-known refusal of cryobiologists to listen to cryonicists, I believe that ideas on these lines say something to them also.

The point that I would make is that repair methods are a matter of degree. For instance, our tissues already contain means for repair of vascular damage; a detailed study of these means might provide ideas on how to enhance them. Even a relatively small enhancement might help a freezing method to work which couldn't work without assisted repair. Even using the membrane stabilizer methylprednisolone (which several cryobiologists have done) constitutes an attempt to enhance repair. Furthermore, the organ will probably attempt its own repair and take some time to do so. Methods to increase the tolerance of frozen cells toward ischemia (sodium pentothal or inosine for instance?) might also improve their ability to survive freezing by giving more time for the repair to take place. These suggestions aren't original; I'm describing them here as illustrations of an approach that seems relatively neglected.

Cryonicists in discussing recovery of frozen organs have quite reasonably concentrated on finding means of repair which will work in the WORST possible case. That is, given freezing 12 hours after deanimation of an elderly terminally ill patient, how could we set about repair? Eric Drexler, for instance, has specifically addressed the problem of how to revive someone who has been embalmed in glutaraldehyde. I have described a method of cell-by-cell repair, in which each individual cell can be subjected to exhaustive repair "from the ground up", and Mike Darwin has described the anabolocyte, which will, again, repair a cell from the ground up. The major point which a reading of contemporary cryobiology suggests is that such extreme methods may well not be necessary. They are more to prove the validity of cryonics ideas than actual suggestions about how repair will actually take place. The kind of repair of the vascular system (alone), followed by "natural" recovery of the organ, which I have sketched above, seems a much more likely scenario for actual repair.

THE QUESTION COLUMN

Why don't you store people: (pick one)

In your freezer at home?

In a low temperature laboratory freezer?

In the permafrost in Alaska?

On the Greenland icecap?

On the Antarctic icecap?

In Siberia?

Packed in dry ice?

Other?

After all, it's really cold there, and all this fooling around with liquid nitrogen seems like a lot of unnecessary hassle. And besides, it's (free/costs less)(circle appropriate words).

-various people, some of them ostensibly with scientific educations.

Misapprehensions concerning why we use liquid nitrogen fall into roughly three classes: 1) Economic considerations; 2) Legitimate bafflement caused by the use of a simple arithmetic temperature scale where a more complex scale is much more appropriate; 3) Disnumeria, or disability to deal with numbers. This may range from reluctance to use a calculator to inability to count above five, because you need the other hand for counting. The temperature scale for people so afflicted goes something like: -very hot-hot-warm-comfortable-cool-cold-very cold-freezing. I will attempt to answer 2) and 3) together, with an explanation and examples, and then treat the economic aspect in a short afterword.

For a suspension patient, the object of cryonics is to arrest time. It is never possible to do this completely, but as we will see, our best is remarkably good. We cannot affect nuclear processes, such as radioactive decay, but for the period of time we are concerned with, radioactivity and its attendant problems are largely irrelevant. Our primary focus is on chemical processes. The human body is a dynamic structure, with creation and destruction of the chemical compounds essential to life going on in it simultaneously and continually. A good analogy would be a powered airplane, lifted by the efforts of its engines and pulled down by gravity. When the engine quits, sooner or later you're going to get to the bottom. When we die, only the destructive functions remain. Fortunately, these are all chemical processes, and proceed in such a fashion that they are well described by the Arrhenius equation. STOP!!! DO NOT GO INTO SHOCK OR TURN THE PAGE!!! The elements of the Arrhenius equation have familiar counterparts that you see every day, and while it cranks out numbers beyond the comprehension of even your Congressperson, beyond a certain point they are either so large or so small that we can safely ignore them.

To continue. The Arrhenius equation takes the form:

$$k = A\, e^{\left(-\frac{E}{RT}\right)}$$

where

k is the rate of a given chemical reaction
A is a fudge factor to make the numbers come out right
e is the symbol for a particular arithmetic operation, like +, -, X, or /.
E is the Energy of Activation of the reaction, like the push it takes to start a car when the battery is dead. Small for VW's, large for Cadillacs.
R is the Ideal Gas Constant. Another fudge factor, but a well defined one, like a dollar bill. Here, its value is 1.9872 calories/degree-mole.
T is the Absolute Temperature in degrees Kelvin (K). Which is just the Celsius (centigrade) temperature + 273.16. I should remark that the Absolute Temperature Scale is a rather arbitrary definition of a real property, and that R is used to make things come out right.

To summarize, E is what we're stuck with for the reaction, and k is the reaction rate at any given T(emperature).

By itself, k isn't very useful so I will relate it to itself at some other temperature. For the purposes of this article, I will pick two temperatures, 77.36 K and 37 C. These are, of course, liquid nitrogen temperature and normal body temperature, respectively.

Dividing the rate at some given temperature by the rate at liquid nitrogen temperature will give ratios which will have some meaning. At the given temperature, chemical reactions will occur so many times faster or slower than they would at liquid nitrogen temperature. I will then invert the process and divide the rate ratio at 37 C by the rate ratio at the other temperatures, and say that if the reaction proceeds so far in one second at 37 C, then it will take so many seconds, minutes, days, or years to proceed as far at some lower temperature.

Now, if you'll just close your eyes while I use this page to perform a simple algebraic manipulation:

$$\frac{k_{(T)}}{k_{(77.36°K)}} = \frac{A\, e^{\left(-\frac{E}{RT}\right)}}{A\, e^{\left(-\frac{E}{R\,(77.36°K)}\right)}}$$

A is the same in both cases and cancels itself out. The rest of the right side of the equation also contains several identical terms (E and R), and I will simplify it by rearranging,

$$\frac{k_{(T)}}{k_{(77.36°K)}} = e^{\left(-\frac{E}{R}\left(\frac{1}{T} - \frac{1}{(77.36°K)}\right)\right)}$$

Now. R is a constant and we will not worry ourselves more about it. E we will select later, and give reasons for doing so. The rest of the equation, we will examine to understand its properties better.

"e" is the operation for an exponential function. A familiar example of this is to take a number and add zeros to it, thus:

5 50 500 5,000 50,000 500,000 5,000,000 50,000,000 etc.

this is called exponentiating 10. With the "exp" operation a similar thing occurs, but the number is not 10, but 2.17828..., a number with useful mathematical properties, but not of interest to us otherwise.

The other important part of the equation is:

$$\frac{1}{T} - \frac{1}{(77.36°K)}$$

where

$$\frac{1}{(77.36^{\circ}K)} = 0.0129265.....$$

1/T is called a reciprocal function, and its particular property is that when T is larger than 1, 1/T is less than 1, and the larger T gets, the more slowly 1/T gets small. It does not, however, ever become zero.

Thus, the behavior for

$$\frac{1}{T} - 0.0129265.....$$

is that at high temperatures, it approaches the value -Ø.Ø129265.. closely, but at temperatures much below 77.36 K, it get larger fairly rapidly, and then extremely rapidly.

Putting the equation back together again, we can predict that far above 77.36 K, say at 37 C, the rate ratio will change relatively slowly, but that as the temperature drops, the rate ratio will change increasingly more rapidly. That is, we will see that the change from Ø C to 2Ø C is about 2.4, the change from -1ØØ C to -8Ø C is about 8.6, and the change from -2ØØ C to -18Ø C (around liquid nitrogen temperature) is about 31,ØØØ. From -24Ø C to -22Ø C, the change is a factor of 227,434,ØØØ,ØØØ,ØØØ,ØØØ. As I mentioned at the beginning of this explanation, the temperature scale that we normally use can be very misleading.

Now. Somewhere in the distant past, I was actually taught to do this kind of calculation with pencil, paper, a slide rule, and a book of tables. But I have a computer now, and I'm going to give it a break from word processing and let it go chase numbers. Some of them were bigger than it was.

One last question remains before I turn the computer loose. What should my value for E, the Energy of Activation of the reaction be, or rather, since each chemical reaction has its own E, what reaction should I choose?

I am going to be pessimistic, and choose the fastest known biological reaction, catalase. I'm not going to get into detail, but the function of the enzyme catalase is protective. Some of the chemical reactions that your body must use have extraordinarily poisonous by-products, and the function of catalase is to destroy one of the worst of them. The value for its E is 7,ØØØ calories per mole-degree Kelvin. It is sufficiently fast that when it is studied, the work is often done at about dry ice temperature. Mike Darwin remarks that he once did this in a crude fashion and that even at dry ice temperature things get rather busy. Another reason to use it is that it's one of the few I happen to have. E's are not normally tabulated.

Degrees Celsius	Degrees Kelvin	Remarks	1/T	Exponent	Rate relative to LN2 (77.36 K)	Time to equal 1 sec. at 37 C
37	310.16	Body temp.	0.0322	34.1173	776,682,000,000,000	1 second
20	293.16		0.003411	33.5817	360,555,000,000,000	2.154 sec
0	273.16	Water freezes	0.003660	32.6389	149,588,000,000,000	5.192 sec
-20	253.16		0.003950	31.6201	54,007,200,000,000	14.381 sec
-40	233.16		0.004289	30.4266	16,371,100,000,000	47.439 sec
-60	213.16		0.004468	29.0091	3,967,220,000,000	3.263 min
-65	208.16	Limit, simple mechanical freezers	0.004804	28.6122	2,667,460,000,000	4.853 min
-79.5	193.66	Dry ice	0.005164	27.3451	751,335,000,000	17.229 min
-100	173.16		0.005775	25.1917	87,222,100,000	2.474 hours
-120	153.16		0.006529	22.5353	6,123,060,000	1.468 days
-128	145.16	CF4 Lowest boiling Freon	0.006889	21.2678	1,723,820,000	5.213 days
-140	133.16		0.007510	19.0810	193,534,000	46.448 days
-160	113.16		0.008837	14.4056	1,804,070	13.652 years
-164	109.16	Methane boils	0.009169	13.2649	576,591	42.714 years
-180	93.16		0.010734	7.7227	2,259	10.9 thousand years
-185.7	87.46	Argon boils	0.011434	5.2584	192	128.16 thousand years
-195.8	77.36	Liquid nitrogen	0.012926	0.0	1	24.628 million years
-200	73.16		0.013669	-2.6141	0.07324	336.285 million years
-220	53.16		0.018811	-20.728	0.00000000099	24760.5 trillion years
-240	33.16		0.030157	-60.694	0.<26 zeros>44	5,390,000,000,000,000,000 trillion years
-252.8	20.36	Liquid hydrogen	0.049116	-127.48	0.<54 zeros>22	Long enough
-260	13.16		0.075988	-222.14	0.<95 zeros>29	Even longer
-268.9	4.26	Liquid helium	0.234741	-781.35	0.<338 zeros>19	Don't worry about it

I had never specifically done this calculation before, and I confess that I was a bit startled by the size of some of the numbers. Enough to check my procedure fairly carefully. I am reasonably confident of the picture that they show.

The first thing to notice about the table is that somewhere slightly below -240 C, the computer gave up. I did say that the equation goes rather fast at low temperatures. The last three numbers in the "Rate relative... " column I did by hand. You can see what the computer was attempting to do in the "exponent" column, trying to perform the "exp" operation. As noted, the relative rate at liquid helium temperature would be about 0.0.... (eight and a quarter lines of zeros)....19. The next thing to notice is that a reaction that would take one second at body temperature takes 24,000,000 years at liquid nitrogen temperature. This is clearly a case of extreme overkill, and seems to support advocates of storage at higher temperatures.

However, note how fast things change as the temperature drops closer to 77 K. At dry ice temperature, "only" 115 degrees higher, 100 years is about equal to 40 days dead on the floor. Clearly unacceptable.

So what is acceptable? Here is my opinion. People have fully recovered after being dead on the floor for one hour, when the proper medical procedure was followed. There are reasonable arguments to support the idea that brain deterioration is not significant until somewhere in the range of 12 to 24 hours, although changes in other organs of the body probably make revival impossible. Say 12 hours at 37 C is a limit. How long can we have to expect to store suspension patients before they can be revived? Again I guess. Biochemistry is advancing very fast now, but I do not see reanimation as possible in less than 25 years, with 40-50 years being very likely. If we cannot be reanimated in 100 years, then our civilization has somehow died, by bang or whimper, and probably neither liquid nitrogen, nor dry ice, nor even refrigeration may be available, and our plans and these calculations become irrelevant. Let us set a maximum storage period of 100 years.

Thus: In 100 years there are about 876,600 hours. In 12 hours, there are 43,200 seconds. The temperature must be low enough that each 20 hours is equal to one second at 37 C. (The ratio is about 73,000 to 1). From the table, the storage temperature should be no higher than -115 C. Add to this additional burdens, all eating into your 12 hours: time between deanimation and discovery; time to get the transport team on location; transport time; time for perfusion; time to cool to the storage temperature. -115 C is for when things go right.

There is one bright spot. Below -100 C, the water in biological systems is finally all frozen, and molecules can't move to react. We use cryoprotectants that have the effect of preventing freezing, but somewhere around -135 C they all have glass transition points, becoming so viscous that molecules can't move and undergo chemical change. While the table indicates that staying below -150 C is safe from a rate of reaction standpoint, in fact any temperature below -130 C to -135 C is probably safe due to elimination of translational molecular movement as a result of vitrification.

Okay, you say, why not use a mechanical system to hold a temperature of -135 C? First problem: They don't hold a temperature. They cycle between a switch-on temperature and a switch-off temperature. This causes expansion and

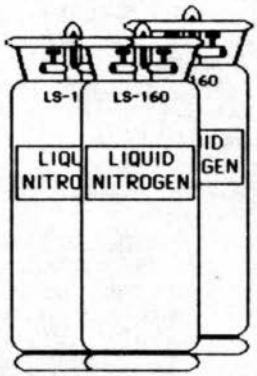
contraction, and mechanical stresses. Cracking. We don't know what is acceptable yet. This problem can probably be eliminated by the application of sufficient money. Second problem: If the power goes, you start to warm up. Immediately. Emergency generator? Sure, but you'll need at least 8 kilowatts, and it has to reliably self-start within minutes, unattended. Expensive. Third problem: Have you priced a mechanical system? $20,000 up front, and then you start paying the electric bill. Small units like this are rather inefficient so the electric bill is not a minor consideration. Fourth problem: Eventually, the system is going to die on you. Next year. Next month. Next week. Tomorrow. Read the warranty. It doesn't say a thing about a loaner within five minutes. Buy another one for backup. You may get a deal for buying two at once.

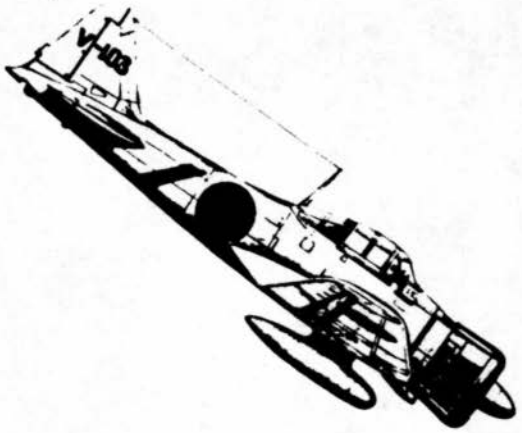
How about using some other compound with a boiling point above that of nitrogen? With careful examination of the HANDBOOK OF CHEMISTRY AND PHYSICS I came up with 30 compounds with boiling points below -80 C. When you eliminate the ones that boil above -115 C, the mildly poisonous ones, the very poisonous ones, the corrosive ones, the oxidizers, the explosively flammable ones and the very expensive ones, you're left with nitrogen and the rather expensive ones. To retain the rather expensive ones, you either need a mechanical system, with all the problems mentioned before except that you are much more tolerant to power-outs and breakdowns, or you use a liquid nitrogen condenser. If you use a condenser, you may as well use liquid nitrogen directly and save the cost of the special gas and the condenser system.

How about moving to the arctic, and using the low temperatures there to assist the refrigeration? This is a potentially good idea, but there are severe problems of cost and logistics. It's nice of you to volunteer to go up there, though.

THAT'S why we use liquid nitrogen.

As a footnote to all the above arguments, it is worth noting that ALCOR and Cryovita Labs are in an unusually favorable position with respect to liquid nitrogen. Los Angeles is a major industrial center, and liquid nitrogen is a major industrial chemical, particularly in the aerospace industry. As a result, there are at least two major liquid nitrogen plants in the LA area, one out at Fontana, about 30 miles northeast of us, and one on the Long Beach Harbor area, about 30 miles to the southwest. Each plant is several acres in size, and as efficient as only a plant that size can be. Our delivered cost for liquid nitrogen is about $0.37/liter. A short calculation will show that at that price, you can get a lot of years of liquid nitrogen for just the buy-in price of the schemes mentioned above. This does not mean that we will always use LN2, however. If our further studies on the cracking problems we have reported here previously (CRYONICS, September 1984), we will certainly have to consider storage temperatures above 77 K. As I have indicated though, the economic penalties may be severe.





PROGRAMMING PEOPLE FOR IMMORTALITY
by Saul Kent

"A twin seater plane with the red ball of the Rising Sun came hurtling down toward the Franklin (a fleet aircraft carrier-ed.). At first it seemed like a dive-bombing attack, but the pilot dropped to one thousand feet and did not pull out. Straight as a die he came in—eight hundred feet, five hundred—and it became apparent on the deck of the Franklin that he had no intention of sheering off."

"He was going to crash into the deck of the Franklin!"

"Then came the impact. An enormous explosion, and the plane disappeared in the cloud of smoke that erupted from the carrier."

The pilot, Rear Admiral Masafumi Arima, had dived to his death deliberately. The Japanese officers did not know what to call his action that day, any more than did the Americans, but Arima was the first of the Kamikazes..."

The above quote is from a recently published book entitled THE KAMIKAZES—The Dramatic Story of Japan's Desperate Suicide Missions, by Edwin P. Hoyt (Jove Books - paperback).

In this book, Hoyt tells the full story of one of the most remarkable events in human history—the campaign to destroy the American fleet in the Pacific during World War II by Japanese pilots dedicated to the preservation of Japan.

What's truly remarkable about the Japanese Kamikaze program is how meticulously it was organized and that it literally became the "lifeblood" of the Japanese effort to defend their homeland. By the end of the war, it was by far the most effective Japanese military tactic. The Kamikazes destroyed more American ships and killed and wounded more Americans than any other military tactic in history—including the surprize invasion of Pearl Harbor.

Origins of the Kamikaze Program

The Kamikaze program was the brainchild of Vice Admiral Takajiro Onishi—one of the brightest stars of the Japanese Navy. It was born of necessity. By the end of 1944, the once glorious Japanese Air Force had been virtually destroyed by hard and decisive air battles with the Americans, and by the total absence of a pilot training program by the Japanese.

Although the factories in Japan were able to turn out as many as 2,000 fighter planes per month, there simply weren't enough trained pilots to fly them. Japan had not expected a protracted war, and the need for the complex

organization that would have been required to train replacement pilots to adequate standards had been discounted. By the final year of the war, the vast majority of Japanese fighter pilots were raw, untrained recruits who were no match for the experienced American pilots.

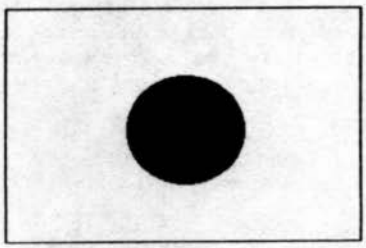
Often missions of 100 or more fighter planes were sent out, but few of the planes could inflict damage on American ships. Invariably there were massive casualties involving the death of young, brave flyers and the loss of large numbers of planes. During some missions, as many as a third of the pilots who went out to find the American fleet got lost, ran out of gas, and crashed into the sea.

If you consider the almost total ineffectiveness of the Japanese Air Force at the end of the war and the fanatical determination of the Japanese not to surrender to the Americans, it comes as no surprise that the Japanese turned to suicide attacks in their efforts to stem the tide of battle.

The fact that the Japanese would be willing to commit suicide for their country made "sense" in a culture where suicide was considered an "honorable" way of dealing with disgrace or failure and where prominent military or political leaders, artists, and businessmen would often kill themselves for the sake of "face."

The term "Kamikaze" was taken from the word "Shimpu", whose two Japanese characters mean God and Wind. Together they were pronounced Kamikaze, which to the Japanese meant Divine Wind and referred specifically to the great typhoon of 1281, which wrecked Kublai Khan's Mongol invasion fleet.

As it turned out, the Kamikazes of 1945 almost succeeded in driving the Americans from the shores of Japan. The damage they inflicted helped lead to the decision to drop atomic bombs on Hiroshima and Nagasaki in an attempt to end the war without the necessity of invading Japan.



The Scope of the Kamikaze Program

The Kamikaze program was truly remarkable in its size and organization. There were training centers where young pilots learned how to sacrifice their lives most effectively (by inflicting maximum damage on the enemy). There were frequent propaganda sessions where the young recruits were convinced that the sacrifice of their lives for their people, their country, and their Emperor was the most noble and honorable thing they could do. And there were ceremonial affairs prior to Kamikaze missions where the soon to be dead warriors were honored for their dedication and told they would "live" forever in the hearts of their Emperor and the Japanese people. Pilots often attended their own funerals before their mission.

The Kamikaze missions themselves were planned with scientific precision. The sacrificial planes were loaded with explosives in order to produce maximum damage when they struck enemy ships. The pilots were trained to trigger the explosives at just the right moment prior to impact. And there studies to determine the optimal speed and angle of the aircraft as well as the desired

point of impact.

In order to be effective, the Kamikaze pilots—who generally had poor flying skills—needed the help of the more seasoned fighter pilots, who would engage in combat with the enemy planes protecting the American fleet, so that the Kamikazes could sneak through to their targets. As soon as the Kamikazes had reached their targets, the experienced pilots were instructed to fly back and report the results of the mission.

By the final year of the war, the Kamikaze program had grown to such an extent that it virtually encompassed Japan's entire air defense. It had, in fact, become a way of life that permeated the entire Japanese nation.

Suicide As A Way Of Life

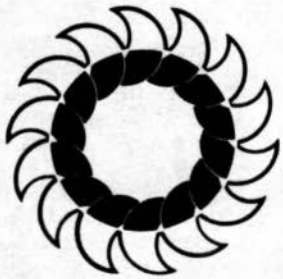
The popular image of the Kamikaze is that of the pilot of the plane diving directly into an American ship with total disregard for his life. That image is accurate and it is quite true that tens of thousands of Japanese pilots sacrificed their lives in this manner.

However, the Kamikaze principle soon became a way of life for Japan as a whole. When the Japanese Army found it difficult to destroy American tanks in a conventional manner, they would strap bombs to their soldiers' bodies and detonate them as they dove under enemy tanks.

The Japanese also developed a torpedo that could be guided manually from a chamber that had a limited supply of oxygen. The torpedo pilot would be sent knifing through the water towards an enemy ship. The pilot would then attempt to guide the underwater missile directly to the appropriate portion of the hull of the ship. If he succeeded he would experience the "glory" of his mission by being blown to bits. If he failed, he would die a less glorious death by suffocation or drowning.

In their desperate attempt to thwart the might of the enemy, suicide became the rule of battle for all soldiers. When the American troops engaged the Japanese Army in combat, they found that they were confronting an enemy of unprecedented fanaticism. The Japanese troops simply refused to surrender. When they were trapped in hopeless positions, they would continue to fight until every last soldier had been killed.

As Hoyt puts it, "The hour of the samurai was upon Japan. The Special Attack—suicide—was the new strategy of defense. In the eyes of their critics (who remained silent) the generals had gone mad. From this point on, nothing that happened in the war could be regarded with rational eyes as anything but madness."



On The Verge Of Mass Suicide

By the summer of 1945, it was apparent to all that Japan could not win the war or even achieve an "honorable" stalemate. This realization did not deter the Japanese high command in the least. They were determined not to surrender even if it meant the total destruction of Japan.

"The Army and Navy war party were gearing up for war to the finish. To them "finish" meant the end of the Japanese people. And in July the army decided that there were no more civilians as such. Every man, woman, and child in Japan was to become a soldier of the Emperor.

"The Army philosophy was chillingly simple: it was better, said the generals, that the entire nation perish rather than become enslaved. They pointed time and time again to the unconditional surrender stipulation of the Allies. The Allies had promised that the army and navy would be disbanded, and the generals assumed that the Emperor would be dishonored and probably murdered. They dangled this dread possibility before the Japanese people with great success."

Why The War Ended

Contrary to popular belief, the tremendous destruction of the atomic bomb explosions in Hiroshima and Nagasaki did not break the spirit of the Japanese people. Nor did the continuous assaults of American submarines and B-29 bombers. Not even the declaration of war against Japan by the Soviet Union.

Despite these catastrophic events, the Japanese high command was determined to continue the war to the bitter end. As Hoyt explains:

"In 1945 the world was on the brink of the greatest military massacre since the days of Genghis Khan...even to the last, in the meetings of the Imperial War Council, the peace party had the greatest difficulty in counteracting the arguments of the warmongers."

What finally led to the end of the war was the decision by Emperor Hirohito—the symbolic leader of Japan—to come out against continuation of the war. According to Hoyt, "the Emperor did something that he had been taught never to do. For one moment in history he ruled rather than reigned."

Emperor Hirohito's act helped to turn the Japanese people against war, although it was almost reversed by the war faction, which attempted a coup "to separate the Emperor from his peace-seeking advisors and persuade him to change his mind and continue the war." They came very close to succeeding. If they had, it would probably have led to the total destruction of Japan and the loss of millions of American lives.

The Value Of Life

The Japanese people came very close to mass suicide. They were programmed to die for their country and, in most cases, were perfectly willing to do so with no questions asked. Most Japanese were willing to continue to die even after it became clear that the only way to save their country was to end the war.

The reason they were willing to die was because their perception of Japan after surrender was of a country that would be so emasculated by American occupation that there would be little or no freedom or dignity left for the Japanese people. In short, they were willing to die—even for a "lost cause"—because they were convinced that life under American rule would be devoid of value.

Analysis Of Japanese Values

The Japanese perception that life under the Americans would not be worth living was based upon their fierce pride as a race and as a sovereign nation. Their lives as individuals were considered secondary to their love of the Japanese race, their country, and their Emperor--who embodied all these values and more.

These values were especially strong in Japan because of the homogeneity of the population. The Japanese were (and still are) one people racially, culturally, and psychologically. As such, they display strong obedience to authority within their country and a sense of isolation from the outside world.

When they felt that the Japanese empire was threatened with extinction, they reacted with desperation. They were willing to die to preserve everything they held sacred.

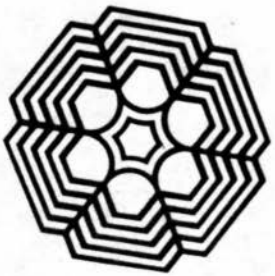
Programmed For Death

The Japanese were programmed for death within a society where death is acceptable--even desirable--under certain circumstances. The Kamikaze program was an extreme example of death programming, but it was by no means a unique one. All societies demand sacrifices from their citizens that--under certain circumstances--include death or the likelihood of death. During wartime, vast numbers of Americans, for example, have been willing to risk and in some cases, to give up their lives for "their country" or for "freedom and democracy."

If you scratch beneath the surface, you'll find that the vast majority of people on this planet hold some value or another higher than their own lives. It might be a political concept such as "freedom" or "justice", a religious principle, national pride, another human life, or obedience to a "higher" authority. In some cases individuals are willing to sacrifice their lives simply because they have been ordered or trained to do so.

There are three primary reasons that it's relatively easy to convince or coerce people into risking or sacrificing their lives:

1. First is the fact that nature has programmed us to die. All of us are aware of the fact that we are growing old (dying) and that death is "inevitable". The realization that we're "certain" to die within a specified time period makes it reasonable to search for a "meaningful" way in which to die. After all, it's really not that much of a sacrifice to risk one's life for a cause when you know that if you fail you only lose "a few short years of declining health and vigor" and if you succeed you'll benefit from the pride and glory of your accomplishments.



2. Next is the fact that our knowledge of our own mortality is constantly being re-inforced by society. Everything we see, hear, or do reminds us of our own mortality. Death is in the movies, on TV, in the newspapers, in our schools, in our careers, in the faces and movements of the elderly people we see before us, and, most of all, in the mirror images of ourselves that we must confront as we grow older. Society is thus

modeled after a "natural order" in which the individual is less important than the species. The development of civilization has involved the subjugation of the individual to the needs of Society. Is it any wonder that people are willing to give up their lives for their country, their religion, or for humanity as a whole?

3. Many people are willing—even anxious—to give up their lives for causes because they have been programmed (brainwashed) to believe that it is the pathway to "spiritual" immortality. The concept of an "afterlife" is the foundation of most religious thought. The popularity of most religions is based on their ability to convince people that subservience to their tenets will enable them to live on after "death" in an exalted state that is preferable to flesh and blood existence. The look of ecstasy on the faces of religious fanatics about to sacrifice their lives shows how much they value this "life" after death.

The Immortalist Dilemma

As immortalists we have totally rejected the "inevitability" of death as well as the "spiritual afterlife" promised by religion. Our goal is to increase the length and quality of our lives, and eventually, to achieve physical immortality through science and technology. It is a rational goal fueled by an intense love of life and a desire to continue to experience the fruits of existence for as long as possible.

The immortalist dilemma is that hardly anyone has had the courage and imagination to shed the death programming that characterizes human life. Although there are more than 4 billion people on Earth, fewer than 100 of them have actually chosen to engage in hand-to-hand combat with death by making preparations for cryonic suspension.

The evidence is solid and clearcut. Over the past 20 years, tens of millions of people in the United States alone have been exposed to the idea that it's possible for us to achieve physical immortality. During that period, millions of these people have died. A great many of them could have been frozen, but none of them chose to do so.

The truth is that only a handful of people have not been blinded by the deathist programming and propaganda that dominates this planet. Interestingly, the majority of those who have decided to challenge death were immediate converts to the cause.

I know that—in my case—I was instantly enthralled and excited beyond anything I had ever experienced before when I first heard (in 1964) there was a scientific basis for the achievement of physical immortality. It was truly a revelatory experience that utterly transformed my life into something new and different. The same type of experience has been reported by other immortalists.

The Difficulty Of Persuading Others

Because of my own reaction to the prospect of immortality, I assumed at first that it would be easy to persuade others to join the cause. The events of the past 20 years have proven conclusively that persuading others to challenge death is an exceedingly difficult task. Most immortalists have long since become discouraged at the resistance and apathy of others around them. Some

immortalists, in fact, have become convinced that it may actually be "impossible" to persuade anyone to strive for physical immortality. They've come to believe that only those who undergo revelatory experiences when first exposed to the idea are ever going to join the movement.

Programming For Immortality

Despite the difficulty of persuading people of the desirability of physical immortality and the value of cryonics as a means toward this end, I am now certain that it can be done and I'm confident that it will happen in the near future. In the past year, I've become convinced that it is possible to program people for immortality every bit as effectively as the Japanese Kamikazes were programmed for death during World War II.

I just don't think we've had nearly enough information, money, and expertise to mount the kind of campaign required to persuade people to join us in our quest for immortality. I believe that all these resources are now (or will soon be) available and that we are finally on the verge of being able to sell the idea to the public. Here's my plan:

A Permanent Cryonics Facility

In order to sell a program such as cryonics, in which we propose to place people into long-term frozen storage (perhaps for centuries), it's essential to have a secure, self-owned facility that contains the best available equipment and personnel. Such a facility should be impressive, financially stable, and capable of being expanded. It should offer state-of-the-art cryonics procedures and include a laboratory to conduct first-rate biomedical research.

Before the end of 1985, a permanent cryonics facility should be available in California. Plans are already underway to purchase the land and building (or construct a building) to meet all the needs outlined above. This facility will be bigger, more sophisticated, and more secure than any cryonics facility in history.

Cryonics Insurance Program

The only people who have made money out of cryonics up to now are the insurance companies, who have been collecting premiums for the past two decades and who have paid out only a few thousand dollars in benefits. The most effective way of financing the cryonics program would be to offer cryonics insurance directly to the public as part of a total, fully integrated package. This type of financing would make it easier for potential clients to sign up for cryonic suspension and would improve public perception of the financial stability of cryonics operations.

The major obstacle to forming a viable cryonics insurance program is sufficient funding to start an insurance company that can meet all government requirements and inspire confidence in the public. Preliminary discussions are now underway with regard to formation of such a company and I think it possible that it will be established within the next few years.

A Solid Scientific Basis For Cryonics

As the years have gone by, there has been increasing evidence of the

validity of cryonics as a means of extending lifespan. What's new and exciting is that—over the past several years—the vanguard of this research has begun to be conducted by hard-core cryonicists. Once the public is presented with a comprehensive picture of the scope and potential of this research, they'll hopefully begin to understand that cryonics is a science rather than a cult, and that financial support for cryonics will lead to suspended animation—perhaps by the end of the 20th century.

A Total Life Extension Program

Cryonics should also be promoted as part of a total life extension program. One of the obstacles in selling cryonics is that it involves deferred gratification. Many of the people who are interested in extending their own lifespans are in good health and have a positive outlook towards life. The idea of dying is very far from their mind.

It's easy for such individuals to convince themselves that their own death will almost certainly occur in the distant future and that they have no immediate need for cryonics. "When I'm closer to death," they tell themselves, "I'll have plenty of time to get frozen."

There's little use in trying to convince these people that it's possible for them to die at any moment, because they don't want to even think about dying in the near future.

On the other hand, these people are often quite receptive to more conventional methods of increasing their life expectancy such as diet, exercise, nutritional supplements, and anti-aging drugs. In my opinion, cryonics should be sold to many of these "soft-core" immortalists as part of a total life extension program.

Selling Cryonics to Older People

The greatest obstacle to selling cryonics to older people is that they've experienced a long-term decline in the quality of their lives as they've grown older, and it's difficult for them to believe that it would be worthwhile for them to come back to life after they are placed into cryonic suspension.

The key to selling this segment of the population is to convince them that scientists will be able to reverse the aging process in the future. Once they understand that it will someday be possible to make them youthful and healthy again, and they will not be brought back to life until it's possible to do so, they will be more receptive to cryonics.

In 1985, the Life Extension Foundation, of which I am President, will launch a major research program to control the aging process. Hopefully this project will be the first major step in convincing the public that control of the aging process is possible.

A Positive Picture of the Future

Once we convince people that the future is likely to bring them an increase in the biologic quality of their lives, it will also be important to convince them of the benefits that will accrue to Society from an extended human lifespan.

Many people have a negative view of the future--in part because of the age-related decline in the quality of life that they expect for themselves and in part because of the constant barrage of deathist propaganda that they're exposed to. They often talk about how catastrophic events such as wars, dwindling resources, and excessive pollution may lead to undesirable living conditions in the future.

In order to reach these people, it's important to explain to them that the quality of life for Americans--and for most of humanity--has been rising steadily throughout history and that we can expect even more rapid advances in the future.

Among the advances that should be discussed in terms of improvements in the quality of life are space exploration, artificial intelligence, the development of renewable energy sources, and innovations in transportation and communication.

In discussing these advances, it's important to describe them in terms that are not threatening to people who may be afraid of radical change. What's important to these people is how these technologic changes are likely to benefit them in their everyday lives.

A Sensible, Sober, Socially Acceptable Program

Last but not least is the necessity to convince people that cryonics is a sensible, sober, socially acceptable program. This will become progressively easier, of course, as more people sign up for the program, but even at the beginning it will be possible to invest our efforts with the kind of conservative values that most people look for when they make major decisions about their lives.

We want people to know that cryonics is scientifically sound, financially solid, and readily accessible. We don't want them to have to go through extraordinary measures and a great deal of hard work just to sign up for the program. We don't want them to have to feel they are pioneers embarking on a radical course of action that may be embarrassing or dangerous.

In short, we want to make it easy for them to join the most profound revolution of all time--without feeling like revolutionaries!

It can--and will--be done!

GENES GUIDING DEVELOPMENT IN MAMMALS?

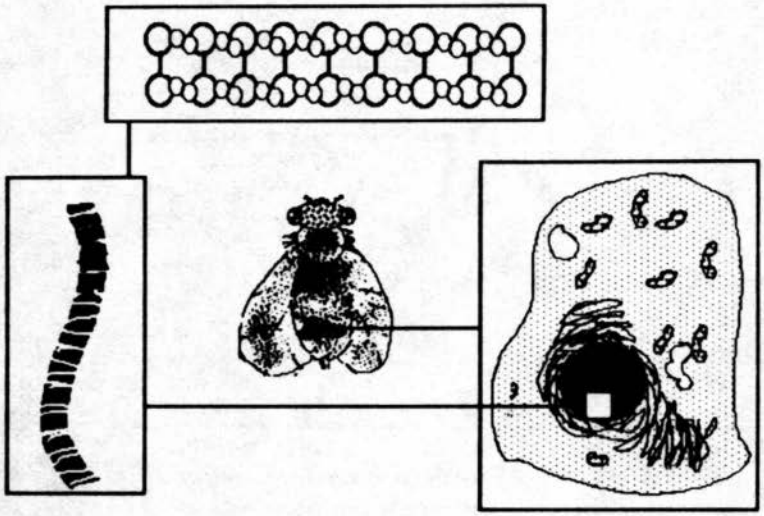
SCIENCE UPDATES

by Thomas K. Donaldson

As we all know, scientists have so far failed to make any practical progress even toward regeneration of limbs. The kind of advanced capability required to regenerate an entire body is quite unenvisioned, except in certain eccentric circles. The reason for this state of affairs consists simply of the fact that we don't really know how and why development happens in mammals. If we knew this, and the chemical means by

which our genes guide development, then we would soon also know how to guide it ourselves, and ultimately to control repair completely.

A recent discovery in the development of fruit flies may have great implications for development in mammals and other animals too, and from that to our control of such development. The important discovery consists of two elements. First, the discovery of a sequence of genes in fruit flies (its discoverers called this sequence the homeo box), and second, the very surprising and interesting discovery that similar sequences of genes exist in widely different species, including the earthworm, the chick, the mouse, and the human.



"A recent discovery in the development of fruit flies may have great implications for development in mammals and other animals too..."

In fruit flies this sequence of genes quite definitely controls genes which themselves control development. The homeo box appears on at least 7 different locations in the gene structure of the fruit fly, and each of these locations contains genes which control development of particular parts of the fruit fly embryo. One such gene and its action, the ftz gene, controls segmentation in these insects, and scientists have studied in detail its relation to development and to the homeo box.

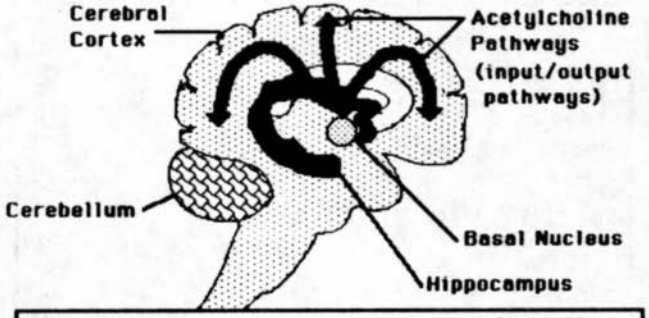
Recently W. McGinnis et al (CELL 37 403, 1984; reported in NATURE 310(2), 364 (1984)) reported that virtually identical sequences to the homeo box of the fruit fly exist in all the species listed above. In Xenopus (a frog) A.E. Carrasco et al have recently shown that the homeo box associates with a gene, AC1, for which the messenger RNA appears exactly when the embryo should be undergoing regional differentation.

This is very important. Scientists have known for a long time that some sort of chemical gradients, of a chemical present in very small quantities, controls development in the embryos of mammals. With no idea what genes were involved, they also had no idea of what chemical, or of what could be done to modify the process. If the homeo box always controls developmental genes, then we can get a complete list of such genes just by finding all the homeo boxes in the human gene sequence. We can then set about finding out how they work, and from there, means to turn them on and off at will shouldn't be too far away.

MEMORY IN ALZHEIMER'S DISEASE

One of the more difficult events of old age consists of the development of senility. We need to know why this happens, not just because we might be able to prevent it if we knew, but also because (without any progress in treatment) a significant percentage of cryonicists will eventually suffer from senility. To what degree does this mean destruction of their personalities?

We've had direct evidence for some time that people with Alzheimer's disease do still carry their old memories with them. Their problem is not so much a loss of old memories, as the loss of any ability to form new ones, even to the extent of remembering questions they've just been asked. However, further indirect evidence on this point would still be helpful.



"Destruction of connections to and from the hippocampus would interfere catastrophically with the ability to form new memories."

An interesting paper in SCIENCE (225, 1168 (1984)) by B.T. Hyman, G.W. van Hosen et al gives us further indirect evidence about the nature of the memory loss in Alzheimer's disease. It turns out that Alzheimer's disease may be particularily associated with a destruction of connections of the hippocampus to other brain regions. This would be important because surgical or other destruction of the hippocampus, or of its connections, shuts off almost completely any ability to form a new memory.

Hyman, van Hosen, et al report their results in examining the brains of five patients with Alzheimer's disease. They specifically examined the input and output pathways from the hippocampus in Alzheimer patients, comparing them to the same pathways in normal controls. One of the characteristic changes in brains of Alzheimer's disease patients consists of tangles of fibrils; Hyman, van Hosen et al report that these tangles occurred very heavily specifically on the pathways connecting the hippocampus to the rest of the brain. They found no such alterations in normal controls, even in the brain of an 83-year-old normal control. These same affected regions containing input-output connections also showed cell loss, including a nearly total loss in some regions. Nearby regions, which were not involved with input-output, remained almost unchanged.

Destruction of connections to and from the hippocampus would interfere catastrophically with the ability to form new memories. It is also associated with defects in the readout of old memories. But what is important here is that the memories themselves are unlikely to be contained in the hippocampus: it is an input-output structure, not a storage structure. We therefore have excellent reason to believe that patients with Alzheimer's disease are "still there", it's just that they're locked away inside their own brains, unable to get out, and the key is thrown away.

JANUARY-MARCH 1985 MEETING CALENDAR

ALCOR meetings are usually held on the first Sunday of the month. Guests are welcome. Unless otherwise noted, meetings start at 1:00 PM.

ALCOR

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

The JANUARY meeting will be at the home of:

(SUN, 6 JAN 1985) Brenda Peters
8150 Rhea
Reseda, CA
Tel: (818) 349-7424

DIRECTIONS: Take Interstate 405 (San Diego Freeway) north into the San Fernando Valley, to Roscoe Blvd. Go left (west) on Roscoe 3-4 miles. Rhea is 2 blocks past Reseda Blvd. Turn left on Rhea, which has a geodesic dome church on the corner. 8150 is the second house in the second block, on the left.

The FEBRUARY meeting will be at the home of:

(SUN, 3 FEB 1984) Mike Darwin and Scott Greene
350 W. Imperial Hwy., #21
Brea, CA
Tel: (714) 990-6551

DIRECTIONS: Take the Orange Fwy. (Hwy 57) to Imperial Highway (Hwy 90) and go west through Brea on Imperial Highway. 350 is about one mile from the freeway and in the third block beyond Brea Blvd., on the south side. If the gate is closed, park on the streets north of Imperial. Be careful crossing Imperial. There is a blind curve to the east and a blind hill to the west at this point.

The MARCH meeting will be at the home of:

(SUN, 3 MAR 1984) Sherry Cosgrove
3100 Palm Drive, #1
Fullerton, CA
Tel: (714) 993-3376

DIRECTIONS: Take the Orange Fwy. (Hwy 57) to Yorba Linda Blvd., just north of the CSU Fullerton campus. Go east on Yorba Linda to the second stop light (Placentia Ave.). Go north (left) on Placentia, around to Palm Drive. Turn right on Palm. 3100 is an apartment block immediately on the right, behind the K-Mart parking lot, and is not numbered. #1 is at the corner of the street and the parking lot.

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