



# Cryonics

June, 1986

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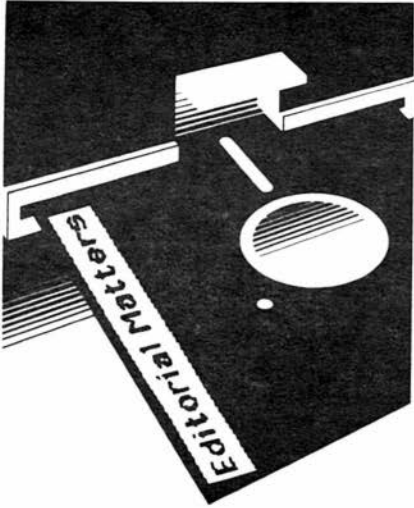
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## Editorial Matters

We were wrong. Last month we opened Editorial Matters with a comment on our missing our deadline. We thought we would miss our deadline and that it would be a first for us—even when a suspension occurred smack in the middle of a CRYONICS production cycle we made our deadline.

Surprisingly, last month we did too. We think we might be late again this month, owing to the intense workload associated with the Life Extension Breakthrough Conference held on May 2-4. But, this time we'll reserve judgement—maybe hard work and luck will let us catch up before our "deadline" of May 15th for mailing slips by.

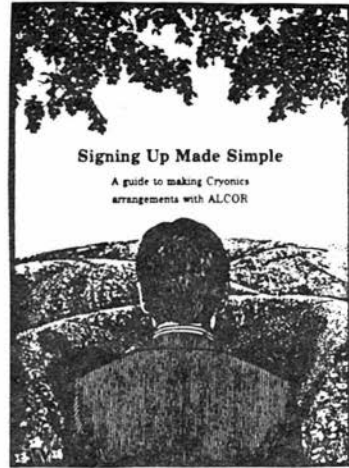
## Cryonics And Religion

In the seven years we've been putting out CRYONICS we have never had a topic excite more interest, commentary, or excitement than the issue of a "cryonics religion" or of cryonics as religion. Neither of the editors knows quite what to make of this, and neither of us has strong opinions of our own on the issue. Nevertheless, we note that it **is** an issue and we will continue to give it thoughtful coverage, both pro and con. We admit to being surprized that the religious issue sparked more interest, commentary and passionate commitment (both on and off the pages of CRYONICS) than issues of more immediate practical import—such as facility acquisition or promotion and public education. Maybe there's a message here and it could be that we've been missing an "instantaneous public nerve" which deserves more attention. In any event, we expect we'll be seeing more on religion. One of the things we would like to see explored, above and beyond the details of a putative immortalist or cryonics religion, is the question of why many of us are attracted to the idea. Are we "hardwired to believe", as Keith Henson remarks in his book reviews later in this issue? What is the true nature of the "religion meme"? And so on. We do not intend to turn CRYONICS into a theology journal, but we would be interested in some insightful thought on the matter.



## SUMS Updated

We have completed work on a second edition of our cryonic suspension legal forms manual **SIGNING UP MADE SIMPLE (SUMS)**. The revised SUMS contains several additional forms including a general purpose "Hold Harmless" to give to physicians, attorneys, and other professionals, the newly legislated California Medical Power of Attorney, the Certificate of Religious Belief, and improved Relative's and Physician's Affidavits, and, thank heavens, a Table of Contents and Index. The new SUMS should be easier to use and also includes some loophole tightening and improved language in several of the "core" documents. It represented about 40 hours of intensive effort by Steve Bridge who carried out the project in Indiana, with many phone calls and floppy disks flying back and forth between Indianapolis and Fullerton. Our thanks to Steve for his tremendous effort! It looks great, and what's more important still, it's a **lot easier to use**.



For those wishing to "sign up" copies of SUMS are available from ALCOR for \$22.00.

## THE ENGINES OF CREATION

By Eric Drexler



At long last, we are given to understand that Eric Drexler's **ENGINES OF CREATION** will be released by Doubleday this month (scheduled release date is June 6th). Most of our readers will already know well who Eric Drexler is, and will have had the opportunity to be exposed to many of his ideas about cell repair technology from his published pieces in **CRYONICS** and from his lecture at the Lake Tahoe Life Extension Festival in 1985.

The full breadth of Drexler's vision, in the form of his book **ENGINES OF CREATION**, has had a long, torturous road to broader public exposure. Doubleday has been very slow to edit and publish the book, and Drexler has suffered through over half a dozen changes in editors in the last 18 months! When we first received a draft copy of the book it was entitled **THE FUTURE BY DESIGN** (a

title we like a lot better than the one the publisher selected). We had no idea what was in the package the postman left, and we were not favorably impressed when we found it was a manuscript from someone we'd never heard from before, purporting to tell us important things about cryonics and future biorepair technology (the quality of unsolicited manuscripts sent us for review has been dismal). We were in for a surprise: — a pleasant one! No book since Robert Ettinger's THE PROSPECT OF IMMORTALITY has been as important or as influential in shaping our thinking.

Depending upon the exposure Drexler's book gets, it could be far more important in shaping the course of history than just about any other book yet written. The technology Drexler describes is a powerful one, it is one that is going to transform humanity as completely as the creation of language or the discovery of fire. ENGINES OF CREATION has gone a long way toward pointing out both the dangers and the promise which lie ahead of us.

Cryonicists have a reputation for being forward looking, of living "on the edge". That's a justified reputation. However, we can say without hesitation that we think you will find Drexler's book amazing. Amazing not only in its scope and nuance, but amazing in the sense that it provides a real taste of just what an incredible world the future is going to be. When we read the draft of ENGINES OF CREATION we had the feeling a visionary citizen of Florence might have had 450 years ago if he had been allowed the opportunity to pore over the notebooks of Leonardo da Vinci near the end of the inventor's life. Page after page of Drexler's "notebook" is filled with the "blueprints" of molecular tools and devices which will allow us to do marvelous, unbelievable, and exciting things—but which our technology cannot yet build.

However, unlike da Vinci, the world of progress Drexler envisions is not shut off to us in the future—inaccessible forever. The reason this is so is because, as Drexler plausibly argues, perfected molecular technology **implies** strongly that cryonics should work—that we should be able to get from here to there. And that, above all else, is the most exciting thing in the book for cryonicists.

If you want to "spread the word" about cryonics to intelligent, thoughtful people, particularly to those with an intellectual, technical, or scientific background, then there is no better way to do so than to purchase copies of ENGINES OF CREATION and distribute them to friends—or others whose opinion you want to shape and whose judgements and/or public pronouncements you feel are important.

Regrettably, promotion of the book may be almost completely in your hands. Doubleday is unlikely to spend much, if anything at all, on promotion of the book, and no public speaking junkets or talk show circuits are planned to help Drexler sell the book. The initial press run will be for about 5,000 and it will take brisk sales to get ENGINES OF CREATION higher priority for promotion or for production of a second edition.

We urge **you** to buy a copy of the book for



yourself and for several friends. You can order copies from us by calling our toll free number and placing a credit card order, or by writing us and enclosing a check or money order for \$19.95.

For those of our readers who are not cryonicists, ENGINES OF CREATION is still important. It's important because it deals with issues that will shape your lives and the lives of your children profoundly. It deals with an emerging technology which has the potential of transforming human existence to one of abundance and limitlessly expanding possibilities or of brutally and miserably ending it. The choices are laid out carefully by Drexler and the opportunity, indeed the necessity, of **personal involvement** in making these choices is carefully detailed. It's up to us, to you and I, to make those choices. The first stage in that decision making process is to **inform as many people as possible as quickly as possible** about the promises and the perils of molecular technology. Purchasing copies of ENGINES OF CREATION is the best first step we can suggest.

## Breakthrough Conference: A Big Success

ALCOR had a large booth at the Life Extension Breakthrough conference which was held at the Disneyland hotel on May 2-4. Both our booth and the conference were very successful. While the Life Extension Foundation had hoped for larger attendance (there were about 500 attendees) no one can complain about the level of enthusiasm shown or the quality of the presentations. This conference was particularly productive for ALCOR. In fact, we'll go so far as to say that we have never had more productive contact with prospective members than we experienced at the Breakthrough Conference.

We have a great deal to tell you about the conference, but we're going to save it until next issue when we can bring you photographs and are better organized to review the papers that are relevant to cryonics--and do them justice. One of the serious problems we face in reviewing the meeting is that virtually all of our available personnel were unable to really attend the sessions. Indeed, **none of us** saw any of the sessions! Why? Because we were busy providing support services for LEF: Al Lopp, Luigi Warren, and Marce Johnson helped pick up and transport speakers to and from the airport, Marce handled registration, Luigi was staff photographer and Mike Darwin, Hugh Hixon, Al Lopp, Luigi Warren, and others were involved in helping man the ALCOR booth. So, we'll have to look at some of the videotapes ourselves before we can tell you what happened!



Hugh Hixon and Dave Pizer at the ALCOR table at the Project 2000 Conference

## Research And Training

On the weekend of April 26th we conducted another Total Body Washout using the median sternotomy (open chest) approach. This time we dialyzed the animal to control pH during rewarming and achieve hemoconcentration and control edema. The result was still the same: we lost the animal to pulmonary edema.

The perfusion protocol employed in the last two animals was essentially the same as has been employed successfully previously with dogs using the femoral approach. The perfusate composition (a mannitol-HEPES based perfusate) and osmolality, perfusion pressure, rectal temperature, respirator settings, and perfusion duration were identical to previous runs. The sole variable was the use of the median sternotomy.

Careful scrutiny of the lungs revealed the development of serious pulmonary edema approximately two hours into the asanguineous (blood free) recirculation period. Pulmonary uptake of perfusate was so severe that additional perfusate had to be mixed up and added to the circuit in order to have enough recirculating volume to achieve rewarming to 10°C so that blood could be reinfused.

When the animal was removed from the respirator for manual bag-valve hyperventilation during rewarming a large quantity of blood-tinged pulmonary fluid poured out of the endotracheal tube. We elected to hyperinflate the lungs during rewarming (to reduce the movement of water from the capillaries into the alveoli) and vigorously dialyze the animal in an attempt to control and/or reverse the pulmonary edema. To an amazing degree this maneuver succeeded! We were surprised to find that we were able to stop leakage of water into the alveoli and to transiently restore good gas exchange by vigorous dialysis.

The animal showed the usual signs of good neurological recovery; corneal reflex, response to tactile stimulation, and responsive pupils, but succumbed to cardiac irritability during closure of the pericardium, secondary to pulmonary edema.



Hugh Hixon and Sherry Cosgrove do median sternotomy. Jerry Leaf observes

We are puzzled by the deaths of these animals and are now planning another TBW employing femoral washout to recheck our basic technique. If this proves successful we will proceed to the design of experiments to isolate which aspect of the median sternotomy approach is responsible for the pulmonary edema. We have several possible hypotheses to explore:

- 1) The use of the median sternotomy exposes the lungs to significant ambient heat in the form of room air, surgical lighting, and absent local ice cooling. The esophageal temperatures of these animals during perfusion are significantly

higher than those of femorally perfused animals. The cellular permeability of mannitol is probably sharply temperature dependent, with a rapid loss of effectiveness likely at higher temperatures.

- 2) Perfusion of the pulmonary circuit is probably better with aortic root cannulation and right heart drainage. Pulmonary artery pressures may be significantly higher with this model than with the femoral model and this may contribute significantly to the development of pulmonary edema.
- 3) The lungs may be more compliant and our use of prolonged positive inspiration pressure to help prevent intra-alveolar fluid accumulation may be ineffective without the chest wall to act as a "pressure vessel".
- 4) All of the above may be interacting to produce edema.

Careful postmortem examination of the animal revealed no evidence of edema elsewhere and no abnormalities except for multiple small hemorrhages of the pancreas which we believe are typical of the post-washout state even in animals who survive the procedure. We will keep you posted on the outcome of further experiments.

## American Cryonics Society And Trans Time Begin Canine Total Body Washouts

According to reports in the ACS NOTEBOOK (May, 1986) and presentations at the recent Life Extension Breakthrough Conference, ACS and Trans Time have begun a series of Total Body Washout (TBW) experiments employing dogs. The work is being conducted by Drs. Segall, Sternberg, and Waitz of ACS and Biophysical Research and Development (BPRD) in conjunction with veterinary researchers and a physiologist at the University of California at Davis.

The Northern California cryonics group was able to take advantage of surplus beagle dogs (left from a transplantation program) at UC Davis and to interest the Davis researchers in providing help and support. The names of the Davis researchers involved are unavailable through ACS/TT.

Initial experiments have focused on the use of an extracellular-type perfusate buffered with HEPES and employing Dextran-40 as the colloid. As of this writing four animals have been either completely washed out or profoundly hemodiluted (with red cell concentration of 10% or less). The Northern California research group is not yet ready to pursue long term survival of the animals and has concentrated on developing the initial routine. We understand some of the later animals in this series have recovered consciousness and spontaneous respiration--but were sacrificed owing to absence of sterile technique during surgery and bypass.

This model differs from the ALCOR TBWs in several ways. First of all, extended dynamic perfusion in the asanguineous state is not yet being undertaken: the animals are being washed out and then left unperfused for 45 minutes to 1 hour before being rewarmed. Secondly, the ACS researchers are



using a base perfusate which mimics the extracellular environment rather than the intracellular one (this limits the amount of hypothermic storage time achievable and promotes cell swelling due to hypothermic inactivation of ion pumps in the cell membrane). Thirdly, they are using a different colloid than ALCOR and Cryovita have employed.

We hope to have a more detailed analysis of this work in the next issue of CRYONICS, once we've had a chance to review and prepare material presented by these investigators at the Breakthrough Conference.

## Progress On Storage In Michigan?

We wish we could answer the question which titles this article, but the Cryonics Institute (CI) has provided insufficient data to allow us to perform a meaningful review or draw any hard conclusions. Thus, the review that follows is a little like American analyses of Soviet weapons technology or scientific claims: all you have to go on is a picture in the May Day parade and a small quantity of reliable information which has "leaked" or been passed on by nonprofessional visitors or tourists.

Since we have covered CI only infrequently in the past (largely because we have had little news about them to report) it is worthwhile to provide a little background.

### Some History

In 1967, shortly after the Cryonics Society of New York was formed, Robert Ettinger, one of the fathers of cryonics and the author of THE PROSPECT OF IMMORTALITY, which launched the cryonics movement, formed the Cryonics Society of Michigan in Detroit. Some years later, in 1976, CSM became the Cryonics Association (CA) and a new organization to provide actual cryonic services was formed: the Cryonics Institute (CI). Recently, CA has changed names again and become the Immortalist Society (IS).

Much Like ALCOR and Trans Time, CI offers cryonics services to the public. They do not offer neuropreservation (being philosophically and perhaps technically opposed to it) and, to the best of our ability to ascertain, they do not offer sophisticated perfusion or rescue services--apparently relying on mortuary personnel to do some degree of preparation of the body before freezing.

Virtually from its inception, CI has had a strong commitment to and interest in finding alternative storage technologies. In fact, the price which is set for whole-body suspension was, according to their promotional literature, in part predicated upon the development of lower capital cost, more efficient refrigerators for storing patients. CI's current whole-body minimum charge is \$28,000 compared to \$100,000 for ALCOR and ACS/Trans Time. At this time, to the best of our knowledge, CI has one patient in storage and that patient, a "special case", has been maintained on dry ice for the past six years.

It is not possible to evaluate the state of CI's facilities with any degree of accuracy or objectivity since they have a closed-door policy with regard to outsiders. Only members or potential members are allowed to visit or examine



## CRYONICS INSTITUTE

their facilities.

Early CI efforts were focused on foam insulation as an alternative to vacuum insulated systems. Preliminary calculations by Ettinger indicated that foam, in sufficient thickness, should allow for a workable alternative to a vacuum system. In order to further reduce costs, fiberglass was selected as the shell material for the system.

CI has never published or disclosed the nature of the problems they encountered with their attempts to use the foam/fiberglass approach as an alternative to the current superinsulated vacuum-jacketed dewars (which cost about \$10,000 for a dewar capable of holding two whole-body patients). However, some word has leaked from informal discussions and from the observations of visitors to their facilities who saw at least two failed prototypes. The problems appear to have been as follows:

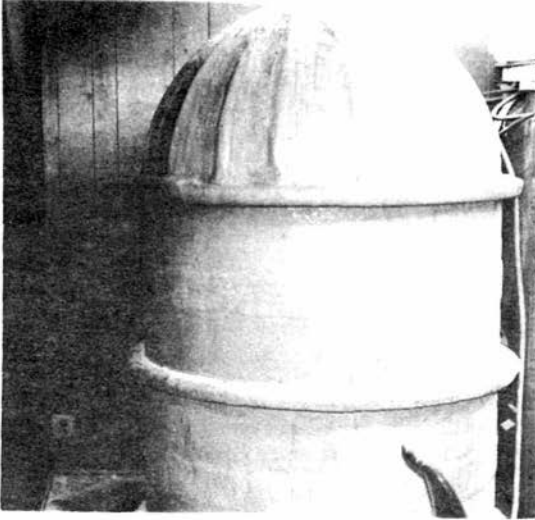
- 1) The mathematical models of the efficiency of foam did not hold up well to real-world testing. Where the flaws or incorrect assumptions were in these models is not clear, and since CI has never published any detailed accounts of their problems or evaluations of the models, we have no way of knowing what the problems were.
- 2) Thick slabs of foam (0.25 meters or better) exposed to extreme temperature differentials ( $-196^{\circ}\text{C}$  on the inside and  $+20^{\circ}\text{C}$  on the outside) experience thermal stress which can result in cracking of the foam—greatly reducing its insulating efficiency.
- 3) Shell materials may also have experienced differential contraction or other thermal stress related failures contributing to compromised mechanical integrity and reduced thermal efficiency.

Whether for these reasons or others, foam was abandoned after several years and CI switched its efforts to developing a soft vacuum system using either a "soft shell" (semirigid material) or a hard shell employing fiberglass. We have some information which indicates that early fiberglass systems failed due to thermal stress caused by wall cracks and loss of vacuum integrity. Over the years CI has briefly mentioned evaluations of a variety of materials compatible with a low vacuum system, such as powdered charcoal, aluminized fiberglass, and perlite.

### Current Efforts

It has been at least 10 years since CI began their search for economical, rugged and reliable storage equipment which does not require "mollycoddling". In the March and April 1986 issues of THE IMMORTALIST (the organ of CI's sister organization, the Immortalist Society) CI reports on the completion of a prototype soft vacuum unit of fiberglass and perlite construction.

As is their practice, no technical details are available. However, a photo did appear (which we reproduce here with their permission) along with a brief



**The Cryonics Institute "Hard Shell, Soft Vacuum, Cylindrical, Perlite" (CI-HSSV-CP-1986) Prototype Storage Unit**

description which allows us to infer something of the structure of the container.

As can be seen from the photo, the unit is of fiberglass construction; reportedly inside and out. It has reportedly tolerated filling with liquid nitrogen without loss of vacuum integrity, and according to THE IMMORTALIST the dewar is performing reasonably well, although due to an inadequate vacuum pump, and substandard valves and gauges, CI has not been able to get a vacuum of sufficient hardness to really evaluate the container properly. According to Ettinger they have plans to replace these substandard items in the foreseeable future.

#### **The CI Storage Unit**

A number of basic, critical details are missing from Ettinger's report. The report does not give the physical dimensions of the unit, the patient holding capacity, projected or working liquid nitrogen use rates, or other technical or practical information. No mention of development, construction, or other costs is made. From the photo and published information the container appears to be quite large (which is typical of perlite/soft vacuum insulated systems: our guess is a diameter of about 4 ft. with a probable height of 9 to 10 ft.). Typically perlite-insulated containers have an annulus or "insulation blanket" thickness of 8" to 12" and this would imply a two to three patient capacity limit for the CI unit. Since ceiling height in CI's facility is presumable about 9 to 10 ft., they elected to build a silo in the ground and "bury" the lower 1/3rd to 1/2 of the container. Silo construction was reportedly hampered by a high water table, which provides another clue to the height of the container.

From the photo and the scant technical information available, it is impossible to tell how patients are loaded into the dewar or whether or not the vacuum jacket extends around the entire dewar with the vacuum being "pulled" after the patient is placed inside. In other words, it is not known whether or not there is a foam neckplug or other removable cap or top which does not require loss of vacuum in order to open the container and remove, add, or inspect patients. About the only things which can be inferred from the photo are the unit's external dimensions.

#### **Analysis**

From the scant information provided it is impossible to draw any hard and fast conclusions about the current container. Until we see data documenting performance and describing the product in detail, we can do little but speculate

and offer comments and opinion based on historical experience with this group.

It is certainly fair to say that development of this system has been very labor-intensive for CI and it is not at all clear that it will ultimately prove cost effective. Much of CI's early bravado about reducing costs was predicated on the anticipation that they would be using technology very different from that used in the "conventional" cryogenic engineering field--particularly with regard to avoidance of vacuum insulation and the technical problems and "mollycoddling" associated with such systems.

ALCOR currently has quotes for the construction of 7 to 10 patient capacity perlite soft vacuum whole-body units (from reliable manufacturers) for \$50,000 to \$60,000. A trailer-mounted, very high efficiency superinsulated unit capable of handling between 6 and 8 whole body patients (from a quality manufacturer) is quoted at around \$30,000. Given the very good boiloff performance likely from these units and the need for infrequent maintenance, it is hard to imagine doing better "in-house", particularly when so many other services must be provided "in-house" which cannot be obtained elsewhere at a reasonable price (such as research, publication/promotion, administration, and perfusion/rescue/patient care).

We now also have more experience with high vacuum systems and they are less intimidating than they once were. It is now apparent that with reasonable care (not "mollycoddling"), high vacuum superinsulated dewars will run trouble-free for a decade with more or less linear performance. ALCOR now has one research dewar in service which is 18 years old, two which are 15 years old and several others over eight years old. All of these containers are performing at or near their rated efficiency. In our history we have experienced vacuum loss (and it was a "slow" failure) on only one dewar in eight with a total of 93 years of combined service life. We have also become considerably more astute about making repairs. We have found good, reliable local services which can harden vacuums and troubleshoot dewars economically with the average charge per leak test, pumpdown, and reevacuation being around \$700 to \$800 per dewar (if it just requires a revac we can get by with as little as a \$300 charge).

With infrequent shipping or "cross country" moving of containers we feel that a working life in excess of 20 years is conservative for current commercial whole body dewars. For neuro dewars of all stainless steel construction, 20 years may be an unrealistically **short** lifespan.

Will the CI dewar perform with respect to boiloff and construction cost to a degree approaching that available with current commercial containers? In particular, it will be interesting to see if the CI container will be able to hold a vacuum without continuous or intermittent pumping to keep it hard. Obtaining good, high integrity seals on multiple joints in dewars and plumbing is a serious problem for professionals in the cryogenics industry and is the bane of amateurs doing vacuum system fabrication. In the absence of expensive capital equipment (such as helium leak detectors) it is often hard to find microscopic cracks and leaks, let alone repair them. We will also be interested to see if CI publishes detailed information about construction of the container such as man hours per unit, materials costs, and other relevant details.

The questions about the CI unit which we hope to ultimately see answered are as follows:

- 1) What was the cost in terms of man hours and materials of fabricating the prototype unit? How much of the cost would be saved if a subsequent similar unit were to be produced?
- 2) Will the unit hold a vacuum over a prolonged period of time without being dependent upon electrically powered vacuum pumping equipment? If the unit does require periodic hardening of the vacuum, how will this be handled and how will the reliability of the control equipment be safeguarded?
- 3) How will outgassing from the fiberglass be dealt with? How much outgassing from the fiberglass resin will there be and how long will it continue?
- 4) What is the actual working efficiency of the unit? What are the physical details of its construction and what are the safety features with respect to a liquid nitrogen low-level alarm?
- 5) What are the industrial hazards associated with fabrication? How toxic are the materials and have personnel working with them had any special health difficulties related to handling or exposure?

Of course, there is always the hopeful possibility that the CI system does represent a real advance in cost, engineering, or performance. Only time and, hopefully, CI, will tell.

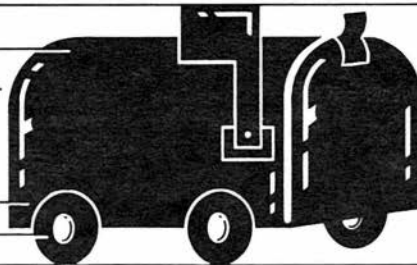
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*Letters to The  
Editors*

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Dear Mr. Darwin:

In response to your interview in the May, 1986 issue of CRYONICS, I wish to make the following comments:

Dr. Harold Waitz has never been an A.C.S. Board Member, as stated in your interview, although I would have no opposition to his candidacy. I have asked Dr. Segall to respond to your interview, but he has indicated that a mudslinging contest would be counterproductive.

It is unfair, however, to suggest that Northern California research has been confined to small animal models. In fact, dogs, apes, and a cat have been research subjects at various time, as well as hamsters. All cryonics research is embryonic. However it is my view that more research funding has come, and will come to Paul Segall Ph.D., Harold Waitz, Ph.D., and Hal Sternberg, Ph.D., than Michael Darwin, Indianapolis High. Have you considered correspondence school?

Sincerely,  
H. Jackson Zinn, President  
American Cryonics Society  
San Francisco, CA

We apologize for the error regarding Dr. Waitz's affiliations. We should have indicated that Dr. Waitz is a Director and Officer of Biophysical Research and Development (BPRD) the research contract firm which conducted much of the A.C.S. research.

As to the issue of A.C.S. and Trans Time research; we did not state or imply in the interview that A.C.S. and/or Trans Time had never carried out research with other, larger mammals. What we did state/imply was that the primary focus of A.C.S. Total Body Washout research had been the hamster model. At the time the interview was conducted and sent to press, A.C.S. had not undertaken any large animal TBW research. We stand by these remarks. —MD & LW

Dear Editors,

The dramatic and rapid development of Scanning Tunneling Microscope (STM) technology shows no signs of slowing. Of the many papers published in the first quarter of this year alone, I thought the following four would be the most interesting to CRYONICS readers:

- 1) "Simplified Scanning Tunneling Microscope for Surface Topography Measurements," Anon., **IBM Technical Disclosure Bulletin**, (28(10), March 4356-4357 (1986)). This paper shows how simple and compact STM technology can be.
- 2) "Atomic Force Microscope," G. Binnig, C.F. Quate, and Charles Gerber, **Physical Review Letters**, (56(9), 930-933 (3 March 1986)). This paper shows how STM derived technology can investigate the surfaces of insulators on an atomic scale. The technique also works in air, **and can be extended to measure atomic forces between individual atoms!**
- 3) "Scanning Tunneling Potentiometry," P. Muralt and D.W. Pohl, **Applied Physics Letters**, (48(8), 514-516 (24 February 1986)). This paper describes a technique for STMs to map the electrical potential distribution with microscopic resolution. Such information is useful for electrical transport problems, and might thus be useful for studies of bioelectrochemistry in organic molecules.
- 4) "Imaging in Real Time with the Scanning Tunneling Microscope," A. Bryant, D.P.E. Smith, and C.F. Quate, **Applied Physics Letters**, (48(13), 832-834 (31 March 1986)). This paper describes **real time** (similar to TV), atomic resolution imaging of graphite. Besides making faster dynamic processes observable with STMs, the technique has the effect of reducing the impact of various noise sources.

Many other equally interesting papers are "in press" or "in preparation", so readers can look forward to many additional announcements in the near future. An international conference on STMs in Spain this summer will no doubt contribute further advances. At least two foreign scientific instrumentation companies plan to offer STM products and at least two U.S. companies have such product offerings under consideration.

These and other advances certainly demonstrate 1) that nanotechnology need not be held up by very difficult problems in genetic engineering or protein design, and that 2) on the contrary, STMs are likely to play a leading role in the development of nanotechnology and Feynman machines.

Eternally Yours,  
Conrad Schneiker  
Tucson, Arizona

A short, concise review paper of STM technology recent appeared in **SCIENCE** (232, 48-53 (4 April, 1986)). This paper is easily comprehensible by the scientifically inclined layman and is excellent for **simply** communicating the current state of STM technology and the promise it has for tomorrow. It is particularly useful to show academics or educated laymen who haven't heard of or don't believe that the STM is a reality or even a possibility. —Eds.

Dear Editors,

I recently attended the Life Extension Breakthrough Conference in Anaheim. On the drive back to my home in Phoenix, I jotted down a few thoughts and observations and I'd like to share them with other ALCOR members.

The conference was a success. Probably a much grander success than most people will ever realize. Every one of the four hundred or so attendees will soon go home and talk to at least four or five more people. Those people will mention it to a few friends, and so... The snowball effect of this conference is hard to measure.

If this conference were to be put on as an annual event that we could all depend on, and if the date were fixed to a specific calendar event like Memorial Day or some other holiday, within a few years this event would probably host tens of thousands of people.

As the life extension speakers were taking their turns speaking on DNA, oxidation, caloric restriction, and other theories of life extension, I couldn't help but realize how embryonic our knowledge of aging is and how important cryonics is in the total picture.

Cryonics, which is often considered "not workable" by lay people in general, seemed to me to be the soundest of the life extension approaches discussed at the conference. At least for right now, anyway, it's the most important. Because, until the big, final, and complete solution arrives, probably in a few hundred years, cryonics appears to be the only way to get there.

I think many cryonicists have the false impression that we haven't made much progress. Nothing could be further from the truth. In twenty-five short years cryonics has gone from a "simple" idea to complex technology which is being **practiced**. And, most important, a growing number of people believe that cryonics may work. That in itself is a milestone.

With these thoughts in mind, I began to consider ALCOR in particular. An organization, any organization, has as its most important asset its people. And ALCOR has the people:

Saul Kent was the most visible person at the conference. He was everywhere, not just at the podium, but in the lobby, outside, in the audience, in the front, in the back, everywhere I looked I saw Saul Kent running around making sure everything was moving on schedule. At times I couldn't repress the thought that maybe one of the leading researchers in the cryonics movement had cloned Saul? In fact, the only place I didn't see Saul was in the men's room.

Saul now has a very difficult and important responsibility in the immortalist movement; with his tremendous drive, talent, and ability he faces an enormous challenge to keep the ball rolling.

ALCOR Director Hugh Hixon is a rooted rock with a thin smile on his lips and a wide smile in his eyes. Hugh does not get flustered easily. He has a way of saying more with one or two words than most of us can manage in ten minutes of speech. He has a good background on all the surrounding elements necessary to debate cryonics and he is well organized—the backbone of an operation like the ALCOR booth at the Conference. Perhaps most importantly, Hugh gets along with everyone.

Then there's Mike. Mike Darwin Federowicz. Many people think Mike's main skills are in the medical and scientific areas, and perhaps they are. Personally, I think Mike is one hell of a salesman. Coming from a business background I have the ability to spot a good salesman, and Mike is one of the best. If he were in some large merchandising concern right now he would be vice president in charge of sales if he wasn't president of the whole company.

Mike is selling something that is difficult indeed to sell: potential immortality through cryonics. He is faced with a hostile market and sometimes with a well educated and articulate hostile market to boot. I'm talking about people who can quickly spot flaws in a complicated theory and debate with the best of them.

I enjoyed watching Mike take all comers. It's easy to spend time with people who are friendly to ALCOR and would drop by the booth to chat and exchange information. All of us like talking to those people. Then there are the others—most of us would have lost our patience and our tempers long before Mike is even slightly ruffled.

But where I think Mike has the most profound perception is in his ability to recognize the importance of young people to cryonics. Mike always takes extra time to talk with young people.

Jerry Leaf, ALCOR's quiet specialist upon whom we all rely so much, made his appearance near the end of the conference. Jerry's confident manner, his tremendous competence, and his solid reputation speak for him more eloquently than any words I could put down here.

All cryonics organizations have their distinguished leaders, men like Art Quaife and Bob Ettinger come to mind. It takes a special kind of person to persevere and succeed in this field. It takes people with a blend of good intentions and good skills. I think ALCOR surely has its share of these.

As we got closer to Phoenix I began to think about the future and what lies ahead in the coming months. I began to think about the coming Lake Tahoe Life Extension Festival and the name Chamberlain came to mind--to be added to the



roster above. I think it's appropriate that it did because their efforts with the Festival will provide yet another opportunity for us to get together. One thing I've become convinced of is that you can understand a great deal more about cryonics in a short period of time just by come to these events. I hope to meet more cryonics supporters at Lake Tahoe this year and (Saul willing) at the next Life Extension Conference.

As I wrap up these thoughts the memory of Disneyland is still fresh in my brain. I will never forget the weekend where while ten of thousands of people played in the magic kingdom next door pretending to be in an eternal world where dreams come true, a tiny handful of dedicated people worked to make that dream a reality.

Dave Pizer  
Phoenix, AZ

Dear Mike & Hugh & Luigi,

On my vacation I had lots of time, so I ran through some numbers for you on the cooling costs of an N<sub>2</sub> vapor vault operation at -135°C, with one foot of foam insulation.

Consider a vault 8'x 10'x 20' holding 18 bodies:

The surface area is:

$$[2(8 \times 10) + 2(8 \times 20) + 2(10 \times 20)] [0.3048]^2 = 82 \text{ m}^2$$

The equation of heat transfer is:

$$\frac{dQ}{dt} = \frac{KA(\Delta T)}{d}$$

where:  $dQ/dt$  = rate of heat transfer  
 K = thermal conductivity of insulation  
 $\Delta T$  = temperature gradient  
 d = insulation thickness  
 A = insulation surface area

K ≈ 0.01 watt/m-°K for the best polyurethane foams at cryogenic temperatures (see NASA Tech Report #1002). This is pretty good for a solid, as it approaches the conductivity of N<sub>2</sub> at these temperatures.

$\Delta T = 25^\circ\text{C} - (-135^\circ\text{C}) = 160^\circ\text{K}$   
 d = 0.3048 meter (assume one foot thick foam)  
 A = 82 m<sup>2</sup>

Putting in the numbers:

$$\frac{dQ}{dt} = 4.3 \times 10^2 \text{ watts} = 3.7 \times 10^7 \text{ joules/day}$$

This assumes a vault encased in earth or concrete. However, the situation is not significantly different for air, since convection limits the insulating power of surrounding air to the equivalent of "dead" air, equal to an extra 0.4 inches of foam. This is a small enough contribution to be neglected.

Calculation of LN<sub>2</sub> requirement:

Let  $\Delta H$  be the heat necessary to boil a gram of LN<sub>2</sub> and raise the resulting gas to -135°C:

then

$$\Delta H = \Delta H_T + \frac{C_p(\Delta T)}{m}$$

where:

- $\Delta H_T$  = heat of transition for boiling N<sub>2</sub> (47.6 cal/g)
- $C_p$  = molar constant pressure heat capacity for N<sub>2</sub>,  
= 6.72 cal/mole-°K (close to the theoretical  $\frac{7}{2} R$ )
- $\Delta T$  = temperature change from -196°C to -135°C (61°K)
- $m$  = molar mass of N<sub>2</sub> (28 g)

Putting in the numbers:

$$\begin{aligned} \Delta H &= 62.2 \text{ cal/g} = 260 \text{ joule/g, and since one liter LN}_2 = 804 \text{ g} \\ \Delta H \text{ per liter} &= 260 \times 804 = 2.1 \times 10^5 \text{ joule/liter LN}_2 \end{aligned}$$

$$\text{Then LN}_2 \text{ use} = \frac{dQ/dt}{\Delta H} = \frac{3.7 \times 10^7 \text{ joule/day}}{2.1 \times 10^5 \text{ joule/liter}}$$

$$= 176 \text{ liter/day}$$

or,

$$\frac{176}{18} = 9.8 \text{ liters/day/"patient"}$$

I have assumed "best case" in all calculations. Since K's may be as high as 0.03, and since there will be radiation and seam losses, etc., I would estimate actual LN<sub>2</sub> use as high as 20-30 l/d/pt. Since you are currently counting on 4 l/d/pt with dewar storage, I would guess this would be prohibitive.

I have assumed that LN<sub>2</sub> @ -135°C is wasted to the air in the above system. What if it is recirculated around the walls of the vault? It turns out this isn't a great deal of help, since the effect is merely to extract some of the remaining "cold" in the gas — and there isn't very much "cold" left in relative terms. The theoretical max savings by doing this is ~40%, and in practice, it

would be much less.

What else can be done? You can go to **two** feet of insulation (some of this can be replaced with thin (1/2") dead air spaces). You can give up the idea of individual cassettes, and pack 'em in standing belly-to-butt. With **all** the above measures you might make it to the 5 l/d/pt range, but it will be a close thing, and you will have to do a small prototype first.

Conclusion: The idea is feasible, but only if you work harder than you thought. The big problem of course, is that LN<sub>2</sub> use is proportional to total temp gradient, which is only reduced by 28% when you go from -196°C to -135°C. That isn't enough by a long shot to make up for the inefficiency of foam vs. vacuum.

While I was working on the above, I thought again about the question of how much savings you get by wrapping a dewar with foam. Since in a functioning dewar the fraction of the total temperature gradient which appears at the outer surface of the dewar is determined by the relative insulative power of the dewar with respect to air; then knowing the surface temp of a filled dewar allows estimation of its thermal resistance with respect to air. This in turn can be used to calculate how much insulative power will be added by a given amount of foam. I have worked out the following relation:

$$F = 1 - [1 + (1.2 \times 10^{-4}) \Delta T/d/K]^{-1}$$

where

- F = fractional savings in LN<sub>2</sub>
- d = foam thickness in inches
- ΔT = surface temperature gradient of unfoamed dewar filled with LN<sub>2</sub>  
= room temperature minus surface temperature
- K = foam conductivity in watt/m-°K. (Multiply BTU/hr-ft-°F by 1.73)

For instance, with 6" of K = 0.01 foam, and a dewar surface temperature 10°C below room temperature (ΔT = 10), F = 0.42. This indicates a savings of 42% in LN<sub>2</sub> use. (However, I doubt that your dewars get this cold. 1.5°C is all it takes to account for the observed boiloff.) This model assumes all dewar losses are conductive. You might compare it with your computer program. This equation has the advantage of being semi-empirical in that it depends on a temperature measurement made for each individual dewar under actual operating conditions.

If you are concerned with foam splitting, you can figure the total temperature gradient across the foam, which is just 221°F. For reasonable savings, this isn't too high.

Regards,  
Steve Harris  
Long Beach, CA



## The Question Column

"I recently received a copy of your booklet CRYONICS THRESHOLD TO THE FUTURE and I still have a question it did not answer. I see that the cost of cryonic suspension is \$35,000 to \$100,000, but I do not see any figures which support the cost of **reanimation**. Of course, you cannot know how much reanimation will cost, but certainly if no money is allocated for it, the cost of reanimation can never be paid."

"I realize that since you spend only a fraction of the suspension fee for the initial suspension procedures, so that the remainder can draw interest to pay for maintenance and research, some money will be available for reanimation. Unfortunately, that remainder will not grow if you use all the interest. If however, you save enough money to let the fund grow faster than the rate of inflation, then someday the fund will be large enough to pay for reanimation, no matter how much reanimation costs. The price of suspension, maintenance, and reanimation will be significantly higher than the price of suspension alone, since only a fraction of the interest can be used to pay for maintenance. Do you have any estimates of how much higher the cost will be?"

Kevin Q. Brown  
Randolph, NJ

The question you raise is a complex one, and we can't hope to treat it thoroughly here. Nevertheless, we'll start with the simple parts of the answer and move on from there.

First of all, the \$100,000 and \$35,000 minimums are just that, **minimums**. Virtually all of our members have provided for themselves in amounts over the minimum--the younger ones with inexpensive term insurance (if you're young you can buy \$250,000 worth of term for \$150/yr) and the older ones with trusts that dump over assets from their estates to supplement insurance coverage. We know very well that staying frozen is likely to cost more than the current estimates--and reanimation might not be cheap either, although I'll argue below why I think it will be.

Right now, the Patient Care Fund (PCF) generates far more interest than is needed to pay LN<sub>2</sub> bills and otherwise care for patients. We hope to keep it that way.

Additionally, and most importantly, ALCOR has what we call the 10% rule. We divert 10% of **all** incoming revenues into our PCF to provide for R&D money for revival as well as to hedge against inflation.

Finally there's the issue of what revival will cost. Frankly, I don't think it will "cost" anything in terms you and I currently understand. Revival will depend upon the development of a mature molecular technology--a technology capable of manipulating living things at will and building molecular scale, self

replicating devices and tools. The key word here is **self replicating**. One can envision engineered bio-tools, indistinguishable in complexity or function from living things, which will be able to replicate themselves at will. Thus, an aged or diseased individual may be rejuvenated by swallowing a few such replicators which then divide as needed, simultaneously entering billions of body cells to effect repairs and add new maintenance instructions. While the "start-up" costs of developing such a technology will be staggering, the actual "cost per unit" will be trivial or nearly nonexistent and the initial expense will be amortized very quickly.

By way of example, take the issue of how much the typical \$3.00 Texas Instrument LCD wristwatch would cost in 1955? In my memory, even the best Rolex watches can't match a cheap semiconductor for precision, lightness, or dependability. No matter how much money you had in 1965 you couldn't have bought that cheap TI "disposable watch". And yet, today, oddly enough, any bum can panhandle enough in 30 minutes on a sunny day in Los Angeles to buy one!

An even more instructive example is of a present self-replicating technology. Go down to your local garden shop and look at the seed section. There is probably no plant in the rack that did not take several tens of man-years of careful selection of favorable mutations to arrive at something you pay a dollar or two for, take home, drop in the ground, and follow the directions on the package. A **lot** of the new technology is probably going to be transported in the form of "seeds". The possibility of purchasing a seed that requires no more than water, air, a wall socket, and some sticks of "plant food" for trace elements, and results in the Mk 15 Home Medical Unit capable of reviving the dead (cryonic revival option included), tailoring "designer genes", making live teddy bears for the kids, and performing maintenance on your car (which also started from a seed and sometimes gets "sick") doesn't seem especially improbable. In all respects, living things are **much** more complex than anything now made by the hand of man.

So, how much will reviving us cost? By current criteria, probably next to nothing. Per capita wealth will be absolutely astronomical compared to today, and the technology required to affect reanimation will be derived from self replicating systems which will not be energy intensive. And besides, molecular technology alone will make current energy bottlenecks a thing of the past. Rational population growth coupled with abundant energy will have increased by many orders of magnitude the energy and capital at everyone's disposal. This has of course already happened to some extent: just stop and think for a moment how much energy you have at your disposal and what life would be like if all the engines and machines in your life disappeared. Imagine doing your laundry by hand, walking everywhere, or riding on the back of an animal, stoking the furnace by hand, heating your bath manually (and only once a month or so at that!) and so on. You've got a **truly incredible** amount of joules and horsepower at your disposal compared to what was available to people even 75 years ago.

The point is, this personal wealth curve is about to take off in an acceleration that will make the industrial revolution seem like a 3 cent per year pay raise today!

One last point: the technology required to revive today's suspension patients will be largely developed **and paid for** independent of any efforts by

cryonicists. True, if we don't make the efforts directly ourselves it will probably take longer, but it's coming all the same. Why? Because that kind of technology is incredibly desirable and useful in many, many other areas of human life. Being able to design machines and devices at the same level of complexity as living things will allow us to build faster, smarter machines. It will allow us to treat aging, cancer, or heart disease, and reverse the early stages of death. It will allow us to regrow limbs and pack all the information in the world's libraries into a volume smaller than the human eye can see. These are things people want very badly, and they are things they will pay money to develop. So, the economic incentives for bio-repair technology are already there, and developments are proceeding apace completely apart from the activities and motivations of cryonicists.



**"To directly answer your question: I think reviving people suspended with today's techniques will cost about the equivalent of a \$3.00 LCD wristwatch-- or less."**

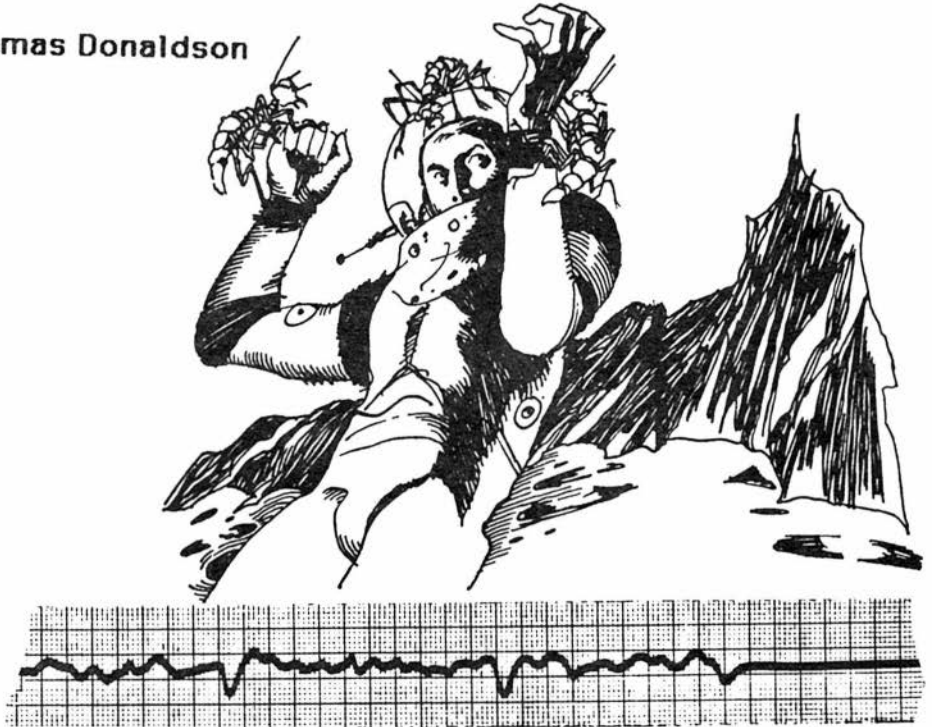
To directly answer your question: I think reviving people suspended with today's techniques will cost about the equivalent of a \$3.00 LCD wristwatch--or less. I think the big issue is seeing to it that: a) we get frozen with techniques that preserve the biological information necessary to affect revival, b) we stay frozen long enough to reach a point where revival is both possible and economical and c) ALCOR or some similar organization is around with the \$3.00 in hand to pay the bill and request the service.

This is **not** to suggest that this future is going to come without effort. **We do not know many important details of how revival of people will be accomplished, or what many of the limits will be.** A cheap job of cryonic suspension or poor maintenance may result in irretrievable loss of memory information. And your cryonics organization **must** survive to get you to that point in the future where reanimation is possible and affordable. A minimalist approach simply will not get you through the unexpected problems that are bound to turn up.

These are real issues, and I urge you to give them some thought. I also urge you to get signed up for suspension. If you think cryonics is workable you need the protection and we need the help. —MD

# *Cryonics And The Death Of Science Fiction*

by Thomas Donaldson



At one time or other in their lives, many cryonicists read science fiction avidly. I myself have a lot of attraction for it. At bookstores I will go to the science fiction section and look over the new books available. But for some reason, I almost never find what I want and leave the science fiction section empty-handed.

Cryonicists also will note, much more than most people do, how **hostile** most science fiction seems to cryonics. Cryonics almost never appears, in science fiction, as a **positive** thing. From Larry Niven's "corpsicles", one of whom is batted to the center of the Galaxy and back like a tennis ball (in A World Out Of Time), to Norman Spinrad's Jack Barron (in Bug Jack Barron), who is the victim of the evil plotter Benedict Howards who holds a stranglehold over life and death through his control of cryonics, science fiction authors have never caught on to the wonder and promise of what we are trying to do.

Furthermore, even immortality has a bad press among science fiction authors. One of the most interesting, and most characteristic, ways in which immortality comes to us is as a gift (or a curse) from the **aliens**. It's rarely something we human beings discover for ourselves. We discover Faster Than Light (FTL) drives for ourselves quite often, but immortality (which in practical terms is likely to open up the stars at least as effectively), almost never. Even John Varley, who of all the contemporary science fiction authors has **most** assimilated the possibilities and meaning of biotechnology, has his **biotechnology** coming to us via aliens from the Ophiuchi Hotline, not as the result of our own scientific and economic efforts. (Varley is a very interesting case and deserves extended discussion elsewhere).

What is the reason for this bias among science fiction writers? What accounts for this hostility?

**The reason why science fiction authors don't like immortality and cryonics is because it means the end of science fiction.** Now, I expect this to be a controversial hypothesis, especially with any science fiction fans who are also readers of **CRYONICS**, but I think I can defend it well.

Let's look at the role that the future plays in science fiction. Its biggest role is to provide a faraway **unreachable** place, the ideal location for dreams and terrors. No one expects to live in the world of Robert Heinlein's Friday. It's just a place to play with ideas and possibilities. Frederick Pohl is another interesting case in point. In **MAN PLUS**, Pohl gives us a castrated bionic man (does anyone out there believe that such a thing could seriously happen as Pohl described it?). In AGE OF THE PUSSYFOOT (which is one of the most positive science fiction novels dealing with cryonics), the story Pohl presented seems **very** unlikely when seen in its own terms. Why would all of these people flee from life and responsibility by entering suspended animation when a global crisis arises? We might just as easily (and incredibly) suppose the plot device of everybody deciding to go to sleep just before the dam breaks! The elements which these stories lack is concerned, careful involvement with **reality**. I don't mean that their authors have to get everything right, I mean that **they don't even try**.

In science fiction, the future is a convenient place for dreaming. No one would ever actually **end up** there. They could have chosen Timbuktu or Ethiopia just as well; except that nowadays retirees with heart conditions can buy tickets to Timbuktu for \$400, and sleep comfortably at the local Hilton when they arrive.

And so, into this fandom of the "future" as the quintessentially unreachable and faraway place, steps **CRYONICS AND IMMORTALITY**. The future suddenly stops being **Friday's** world and becomes the middle of next week. It's





**close.** Nobody writes **science fiction** about the middle of next week. They look at their schedules to see what appointments they have.

What would happen to **Friday's** world if most of the people who read Heinlein's book seriously expected to **be there**? They would read it in the same frame of reference in which they read their appointment schedules. If they seriously believed it (very unlikely!), they'd immediately start thinking of what they could do to stave off such a disaster. Or, more likely, they wouldn't even bother to read such fantastic drivel.

Embodied in science fiction we see a particular attitude toward the future which is fundamentally **nonactivist**. The **future** is a place of dreams, to be visited **only** by dreamers. There's nothing wrong with dreaming, but it's hardly what we, as cryonicists, are doing when we think about and plan for the future.

The important thing about science fiction is the **location** of the dreams and the consequences this implies. Any sustained plan of action aimed at altering the world must involve coming to grips with the future. If the future is the location of our dreams, we cannot seriously attempt to come to grips with it. I once attended a science fiction convention because, on the surface anyway, it seemed a likely place to recruit more cryonicists from. What better group of people to approach than one which was concerned about, as a serious issue, the world of the future?

But my expectation was far from the mark. I didn't find people who were interested in getting to the future, or even people who were concerned about the real possibilities of tomorrow—or the next hundred or five hundred years for that matter. What I found was people who were interested in playing mind games. People who were interested only in building intellectual sand castles; complicated fantasies which would be washed away with the next wave. The science fiction community, virtually to a man, was **not** populated with people who were at all concerned about the future as the location of action, but rather with people who dressed in costumes from the Middle Ages or who were concerned with creating interesting, exciting, and above all **safe** fantasy worlds. Safe because there was never for a moment the possibility they could experience any of the danger, hard work, or disappointments associated with those worlds—were they to become **real**. (One is reminded of the definition of **adventure**: Someone a thousand miles away having a hard time.) All of us have dreams and fantasies which we would never wish to see become real and in which we would never invest more time or energy than it takes to create and contemplate them on a rainy afternoon. There are many, many more of these kinds of dreams than the real ones—the ones that change the world and shape the future. To take an activist attitude toward the future can be very threatening to someone who places their idle dreams and escapist fantasies there.

Stop and look at science fiction for a moment. Really look at it. What does it concern itself with? Why, contemporary themes, of course: pollution, or nuclear disaster, or changes in reproductive biology which are on the horizon or are already here. Dreams, after all, are the way we emotionally absorb our desires and experiences. Everyone has such desires, fleeting attractions (sexual and other), worries about job, spouse, prospects, fantasies of winning the Lottery and being the center of everyone's gaze. Every single one of these dreams depends upon very particular circumstances of time and place. Even a small change in economics or biology would make such a dream pointless.

Once someone (who was not and never will be a cryonicist) asked me what my ambitions were, after I was frozen and revived. To which I could only answer that all such ambitions depended too much on time and place, to have specific ambitions in such a future would be like wanting to be chief oarsman in the tireme in 1986.

Our present dreams assume a LOT of specifics about our biology. A species able to change sex at will just wouldn't have the same kinds of fantasies we have now. No way! Even if that just became an OPTION, the fantasies would have to change. I believe that this underlies a lot of the hostility science fiction has shown to biological technology. Even to noncryonicists, it's very evident that as we advance in THAT direction, the basis of our fantasies will blow away. An accurate tale of the future would tell the story of people doing alien things to achieve goals equally alien. This is not the stuff of which people want to make their fantasies today.

This isn't even a problem unique to biological technology. It's just a statement about history and change. Six hundred years ago the enterprising young man wished to attain knighthood and a fiefdom of his own. There was no such thing as a nation-state, hence no concept of patriotism, nor of the common good. To attempt medieval knighthood in 1986 becomes laughable. It had even become laughable by 1600, as Cervantes showed (but then, who reads Don Quixote now?).

Science fiction authors therefore have a **problem**. They want somehow to transpose a contemporary world into another fantasy world, but without **too many** elements of fantasy. In particular, with **nothing** which would portend a fundamental change in the way people think, in what they believe and thus in how they behave. A bit of extra gadgetry, sure, but no **fundamental** inventions.

I believe this is why (citing a major contemporary development) computerization escaped them so much. Asimov's FOUNDATION novels, for instance, take place tens of thousands of years from now yet in a curiously 50's kind of world, where the sorts of things we do with our personal computers are done in the Fifties' way. Not only that, but Asimov is clearly aware of the **technology**. That's exactly what his robots are about. The interesting point about this is what this technology (his robots) is **not** doing rather than what it does.

Even birth control (a very tame biological invention!) plays little apparent role in this science fiction. Why? Because it was too fundamental, not enough like a gadget. Birth control **meant** something. It meant that women and men could neither of them have exactly the same kind of sexual fantasies, terrors, and inhibitions they had before that time. The **dreams** got changed. Only a little, but they changed.



In fact, biology and medicine have lots more to do with our dreams than do spaceships. Let's consider Poul Anderson's books, the Flandry series and the Polesotechnic League. These are novels of swashbuckling and derring-do. A **really** advanced medical technology, even of **repair** (much less of immortality) turns them to drivel. (Cryonicists experience this kind of shift in perspective every day: decapitation just does not have the same meaning to us!) What would happen to Flandry if he had had himself cloned and his memories duplicated? Flandry would go on, but his story would lose a lot in the transition.

We can see that a lot of art forms will be changed by immortality. Crucifixion scenes, for one, are likely to disappear...and yes, folks, science fiction is one of those art forms likely to disappear.

I think that for any human tool or device there is its particular form, and then behind that, the more general needs that it satisfies. Sure, the horse and buggy disappear, but the need for individual transport goes on. One interesting question to ask is "what may take the **place** of science fiction?"

Let's look at fantasy as an alternative. Fantasy takes place in a world by definition unreachable, because it does not exist. It's also a much more archaic world, where magic is used instead of technology. The fundamental problem with fantasy is that we've evolved a lot since the days of the witch and the prince. These old symbols just don't speak to a lot of our concerns today.

On the other hand, most science fiction stories don't present **really** technologically advanced worlds. Often the rocket just substitutes for the airplane: it gets you to another place, another world, what does it matter how this world came about or where this world may be? In science fiction terms, the trouble with a **REALLY** advanced world is that the concerns of people within it will bear about as much relation to our own dreams and terrors as witches and princes do.

One possibility for what will eventually happen is that the "future" might disappear from science fiction. It's easy enough to remove the pretense that these stories take place in the future. You simply invent another world, an alternate world. Some of the best "science fiction" stories I've read do exactly this. The point is that a story which takes place in the future must invent a **historical connection** between the present and the story. It must concern (like the world of Robert Heinlein's **Friday**) entities like the California Republic, which bear some relation to the real here and now state of CALIFORNIA (a ridiculous one, after scrutiny). If the story hinges on some piece of new technology, what allows this other world to have it even though we don't (yet)? Proponents of science fiction of course may object that such a story would lose reality. Well, reality is a strange thing to ask of a work of fiction! What we ask of a work of fiction is that the conduct of people and affairs in it not violate our sense of how real people would really act. We ask this of **all** serious stories.

The other possibility is that science fiction may become populated with people who are genuinely concerned about the future and genuinely interested in what it will **really** be like. It is possible that science fiction authors may appear who are concerned with exploring the impact of developments that can be seen and predicted with some confidence today, but which are truly some distance in the future.

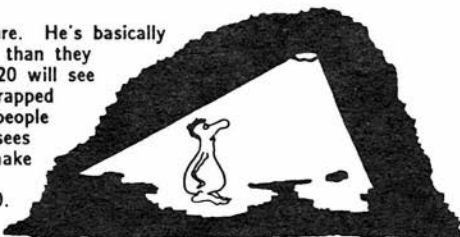
There would be several requirements to be met before such science "fiction" writers could appear. The first would be that they will have to care enough about the future to find out what's really ahead. They'll have to do their homework on biological technology and molecular engineering. They'll have to do some deep thinking about people: what makes them what they are; where do their needs and wants come from and how will changes in their biology and their technology alter these needs and wants? In short, they'll have to start thinking about and writing about the future not as some place merely to "escape" to, but rather as a place to live in.

By now, most of you will realize that the one essential change required to make that transition is to believe, really believe that you are personally going to confront that future. Only cryonicists can do that, and the fact is, most of us are too busy consulting our appointment books and worrying about how we're going to keep that date with tomorrow to give much thought to anything else.

So much for the future of science fiction.

#### FEELING TRAPPED?

This individual grew up dreaming of the future. He's basically optimistic. He knows things are better now than they were 20 years ago, and he figures the next 20 will see even greater changes. Meanwhile, he feels trapped by death, disease, aging, gravity wells, and people that try to impede all the progress that he sees as so desirable. He knows that if he can make it through the next fifty years, he probably won't have to worry about the following 500. He can live that future he's dreamed about.



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- THE LIFE EXPANSION NEWSLETTER

## Two Book Reviews by Keith Henson

### The Social Brain--Discovering the Networks of the Mind

by Michael S. Gazzaniga, Basic Books (1985) \$17.95.

### The Society of Mind

by Marvin Minsky (mid - 1986)

Cryonicists should be interested in what these authors say for at least two reasons. First, our minds are what we are really concerned about taking into the future. It is reassuring to know more about how they are embodied in the brain. Second, knowledge about the way minds function may help us understand why it has been and continues to be so hard to get people to take cryonics seriously, and conversely, why nutty cults like Scientology have grown so large.

It would be hard to imagine two more diverse approaches leading to essentially the same conclusion. Gazzaniga's approach is experimental on adults, Minsky's is a combination of modeling from computers and examining learning in children. Both authors buck the view long held in psychological research that the elements of our thought processes proceed serially in our "consciousness". They feel that minds consist of large collections of smaller semi-autonomous parts with limited communication between the parts. Neither author seems to even be aware of the other, and the only common reference besides Freud I could find on a quick scan was dated 1929! Neither feels that introspection is a useful tool for finding out much about the mind.

Michael Gazzaniga was one of the first researchers to work with split brain patients. His work with these and brain-injured patients has continued in experiments of increasing sophistication to the present day. From his work, and that of others in the field, he has developed utterly convincing evidence (to me) that our minds are modular; that is, they are organized into relatively independent functioning units that work in parallel. The mind does not operate in a single way to solve all problems, but has many identifiably different units that contribute to our conscious structure in ways that can sometimes be isolated by clever experiments.

One powerful module for which there is abundant evidence might be called an "inference engine". It is located in the left brain of most people and is closely coupled to the language interpreter module. This combination Gazzaniga believes gives rise to what we call consciousness. There is also evidence for modules for recognizing faces, and other modules for visual imagery.

A few of the split brain patients can speak from both sides of their brain. Though few in number, they have contributed greatly in understanding the limits of the systems normally located on the left side of the brain.

The belief that we act of our own free will is such a powerful one that Gazzaniga thinks it must result from a basic feature of brain organization. He proposes that this particular belief (in free will) itself follows from the



modular theory of mind. Since we are continually interpreting behaviors produced by independent brain modules as behaviors that are produced by the self, we come to the conclusion that we are acting freely, whereas (at the root of it) we don't really know why we do almost anything.

Of interest to the social acceptance of the cryonics meme is Gazzaniga's proposal that basic cognitive phenomena, such as acquiring and holding social beliefs, are just as much a product of human brain organization as our desires to eat, sleep, and have sex. We are hardwired to have beliefs. Beliefs flow from actions as much or more than actions flow from beliefs. Evidence supporting this view has long been available from studies of "cognitive dissonance"; what Gazzaniga does is elucidate the mechanism involved.

The Society of Mind takes a very different approach, as might be expected from one of the founders of the field of artificial intelligence (AI). It is a very easy book to read, depending on common sense, not specialized knowledge. Marvin Minsky's conclusion that minds consist of vast numbers of "agents" comes partly from building a very simple artificial mind that could play with blocks. Minsky is quite taken with the problem of how infants and small children build their mental agents; that is, how they learn. Where he reports on specific experiments, they are usually with children.

I found his discussion of the "society of more" especially intriguing. We apparently have a number of agents to evaluate "more". They develop in children in a specific order. Take a five-year-old and three glasses, two identical and one tall and thin. Fill the identical ones to the same level and ask which one has more. The child will answer that they are the same. Pour water from one into the tall glass and then ask which has more. Five-year-olds will almost always point to the tall one; seven-year-old children have developed a more complex "society of more" and will tell you they are still the same.

Minsky folds a vast amount of material into this book, incorporating 25 years of research papers into an integrated whole. One of my favorite sections is the one on the evolutionary origin of jokes, humor, and laughter. Some of the deepest work is on the theory of information representation by "frames" (multiply connected knowledge nodes).

My review of The Society of Mind was based on a fairly early draft that was only about 80% complete. I can hardly wait for the full text to be available this summer.

Minsky throws a much more complex grid of agents over the mind than Gazzaniga's modules, but I think each of these authors would find the other's work complementary. I strongly recommend both books to private readers.

JUNE-AUGUST 1986 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. For meeting directions, or if you get lost, call ALCOR at (714) 738-5569 and page the technician on call.

# ALCOR

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The JUNE meeting will be at the home of:

(SUN, 15 JUN 1986)            Virginia Jacobs  
(THIRD SUNDAY!)            29224 Indian Valley Road  
   Rolling Hills Estates, CA

DIRECTIONS: Take the Harbor Freeway (US 110) south to Pacific Coast Highway (State 1) and get off going west. Go along Pacific Coast past the Torrance Municipal Airport to Hawthorne Blvd. Turn left (south) on Hawthorne and go up into the hills past the Peninsula Shopping Center (Silver Spur Rd.). Hawthorne takes a long curve around to the left. Indian Valley Road is a little over two miles beyond the Center, on the left. 29224 is about 0.2 mi up Indian Valley Rd., opposite Firtridge Rd.

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The JULY meeting will be at the home of:

(SUN, 13 JUL 1986)            Paul Genteman  
(SECOND SUNDAY)            535 S. Alexandria, #325  
   Los Angeles, CA

DIRECTIONS: From the Santa Monica Freeway (Interstate 10), exit at Vermont Avenue, and go north to 6th St.  
From the Hollywood Freeway (US 101), exit at Vermont Avenue, and go south to 6th St.  
Go west on 6th 4 blocks to Alexandria, and turn right. 535 is the first apartment building on the west side of the street. Ring #325 and someone will come down to let you in.

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The AUGUST meeting will be at the home of:

(SUN, 3 AUG 1986)            Allen Lopp  
   13354 Veracruz St.  
   Cerritos, CA

DIRECTIONS: Take the Artesia Freeway (State 91) to Cerritos (Between the San Gabriel Freeway (I-605) and the Santa Ana Freeway (I-5)), and get off at Carmenita Road going north. Veracruz is the third street on the left after 183rd St. 13354 is on the southwest corner of Carmenita and Veracruz. Park in the lot of the Thrifty Drugstore directly across the street.

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