

CRYONICS

The Alcor CryoTransport Program

1st Qtr. 2000 A PUBLICATION OF THE ALCOR LIFE EXTENSION FOUNDATION Volume 21:1

Growth of Alcor.....2

*To Be Accelerated by
BioTransport, Inc.*

Nanotechnology...3

*President Challenges
Science Community*

Alcor Conference....4

*June, 2000 at Asilomar
Onsite Lodging Limited*

A⁴M Conference....10

*Nanomedicine Sets the
Tone for What's Coming*

Alcor Update.....16

*Alcor U.K. Progress &
Nanotech Connections*

Rescue "Dry Run"...18

*So. Cal. Team Does
Training Exercise*

LifeQuest.....21

*Tales of Taking Action,
Trying to Stay Alive*

Book Reviews.....37

*"The Computer and
The Mind"*

Film Review.....39

*"Bicentennial Man":
(Robot with a "Heart!")*

Ready for Y2K.....40

*Upgrades to Alcor's
Liquid Nitrogen Systems*

Detailed Report.....48

*August, 1999 Standby
and Transport Operation*

ISSN 1054-4305

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SOURCE**FEATURES****PAGE**

NY Times

Nanotech at National Interest Level

3

Alcor

Asilomar Conference in June 2000

4

Staff

A⁴M Conference 1999

10

Linda Chamberlain

So. Cal. ACT Team “Dry Run”

18

Mike Perry

New Alcor Patient Maintenance System

40

Fred Chamberlain

CryoTransport Case Report, Part I

48

Editorial - “Growth”.....2

Letters to the Editor3

Nanomedicine on Sale at Discount.....14

The Donaldson Perspective.....36

Book Review; *The Computer and the Mind*.....37Film Review - *Bicentennial Man*39**Alcor update - 16****Alcor Director Joins Nanotech Firm 16****Alcor U.K. News Update 17****Alcor Membership Status 17****Lifequest - 21****CONCERT**

by Thomas K. Meyer..... 21

CONSTRUCTION SITE

by Linda Chamberlain..... 25

A PLACE BY THE SEA

by Fred Chamberlain..... 30

Growth

is on Alcor's Horizon

For decades, amazement has been expressed by new Members who learned how few others have elected cryostasis as an option and "safety net."

The concept seems so self-evident, so reasonable, that they cannot understand why so few have made this choice.

At the same time, we have heard from these same people, over and over, "We didn't think it was actually being done yet!"

Up to the time they visited Alcor, did they base their ideas about cryotransport on poor media exposure? Did they just rely on comments from others? At some point, then, did the "once is enough" idea give way to a more positive vision, that the future offers an endless adventure?

By early 2001, Alcor's new contractor, BioTransport, Inc., plans to engage in systematic marketing, offering cryostasis services openly and positively. From this, we expect a geometric rise in "short notice" operations, as well as strong acceleration of Alcor Membership growth.

BioTransport will integrate its operations with those of the medical community as quickly as possible, using new capital for this as well as marketing and technology development. Still, the underlying message will be that cryostasis is a reasonable option, which a hundred years hence will be as conventional as CPR is now.

Survival and growth have always gone together. Our goal is survival! Let's *Grow!*

Fred & Linda Chamberlain

Mark Your Calendars Today! June 17-18, 2000

The Fourth Alcor Conference on Life Extension Technologies

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Related Sites**



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Co-Editors
Fred & Linda Chamberlain

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Submissions may be sent via e-mail (fred@alcor.org or linda@alcor.org) in ASCII, Word, or PageMaker format. Mailed submissions should include a PC diskette with the file in any previously mentioned format (although printed text alone will be considered). All submitted media become property of the Alcor Life Extension Foundation unless accompanied by a self-addressed stamped envelope. The Alcor Life Extension Foundation assumes no responsibility for unsolicited manuscripts, photographs, or art. Send all correspondence and submissions to:

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Alcor Life Extension Foundation
7895 E. Acoma Dr., Suite 110
Scottsdale, AZ 85260

about the cover

CGI art by Tim Hubley

Letters to the Editors

Dear CRYONICS,

I want to see Alcor and cryonics in general grow; but I understand that, as of this moment, about a thousand or so people are members of Alcor. Hardly a trend. Maybe there is some way we could push a little. I call up all the local talk radio shows and try to discuss cryonics with the hosts. No real response comes from this, but I'm stubborn.

Perhaps word of mouth is the best way to inform people of the existence of cryonics; it is apparent that most are only very vaguely aware of it- cryonics is like the spacestation - "someone may be working on it." There seems to be a consensus that Walt Disney is in suspension, though he is not.

I think we should swallow our fear of being rebuffed and tell everyone we meet about cryonics, yes, EVERYONE. It's the 'law' of

averages; tell 100 people about something and though 99 may ignore it, there's a good chance one individual won't. I take my own advice - I carry a copy of CRYONICS all the time, it makes a great conversation piece: "Imagine that! A magazine about FREEZING people!"

Sincerely,

Never T. Late
910 Portland Place
Boulder, Colorado 80304

(Never T. Late is an actual name, legally changed, according to the writer. This is an increasingly common practice.)

Editor's comment:

Alcor's membership is a bit short of 1,000, more like 500 (see elsewhere in the issue for figures.)

Before I signed up in 1970, I felt the same as the writer of this letter to CRYONICS, talking about the idea with many people. Some of them were relatives with terminal illness. None of them got in touch with the existing groups of the day and none were suspended.

Only when my mother died and was not suspended for lack of prearrangements, did I see the necessity to plan ahead; after that, I became energetically involved.

Presently, those with active arrangements are perhaps one or two in each million people (in the U.S.). By the time one person in each hundred chooses it, we will have grown by a factor of about ten thousand. Over the next 30 to 40 years, such a transition might take place. Keep carrying those issues of CRYONICS with you, and we'll keep trying to make them better "door openers!" (F)

NANOTECHNOLOGY AT THE NATIONAL LEVEL

In the last issue of *Cryonics* we noted that on June 22, 1999, Ralph Merkle and others appeared before the 106th Congress Subcommittee on Basic Science to testify concerning the potential of nanotechnology. A follow-up of where that seems to be leading appeared in the New York Times recently. It's fascinating that the long-range goals of basic molecular manufacturing are now being presented by a U.S. President as a challenge, in a similar spirit to that which launched the space industry.

(See: <http://www.nytimes.com/library/tech/00/01/biztech/articles/21chip.html>)

A Clinton Initiative in a Science of Smallness

This was the title of an article by John Markoff for the New York Times, published January 21, 2000 on its website (URL at the lower left.)

Markoff noted that the Clinton administration would soon announce an ambitious program to accelerate basic research in nanotechnology and commented as follows:

"Nanotechnology is widely considered an extremely promising area of science and engineering, but it has realized only limited commercial success to date."

Markoff's report said President Clinton would make a speech at Cal

Tech stressing the importance of expanding basic research in both the physical and biological sciences. As part of the speech, Clinton was to announce a plan to ask Congress to finance a National Nanotechnology Initiative, which would encourage basic research in a wide range of nanotechnology-related areas.

Specifically, Markoff said, "The President will set out these 'grand challenges': Shrinking the entire contents of the Library of Congress into a device the size of a sugar cube; assembling new materials from the 'bottom up' — from atoms and molecules; developing ultralight materials that are 10 times as strong as steel; creating a new class of computer

(Continued on page 14)

June 17-18, 2000: Register Today!
**Fourth Alcor Conference on
Life Extension Technologies**

www.alcor.org

The world is changing rapidly. Only a few years ago, most people considered the cloning of mammals to be no more than science fiction. Repeated successes in this area, however, have made it a reality today.

More important, medical technologies like cloning and the use of embryonic stem cells to regenerate tissues, promise to make it possible to reverse all the major degenerative diseases within our own lifetimes.



Even aging itself is under very heavy attack by today's biological and medical technologies.

The Fourth Alcor Conference on Life Extension Technologies is a meeting of scientists, technologists, and individuals who are working in fields leading toward the expansion of human health and longevity.

This conference will cover topics relevant to these pursuits.

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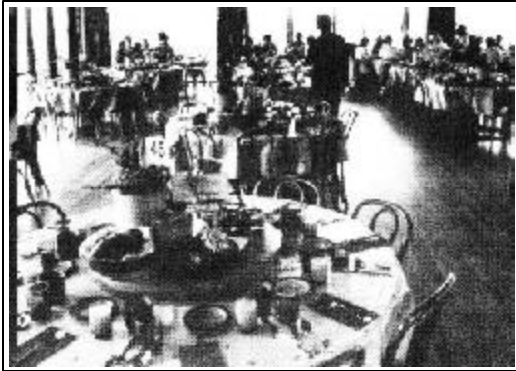
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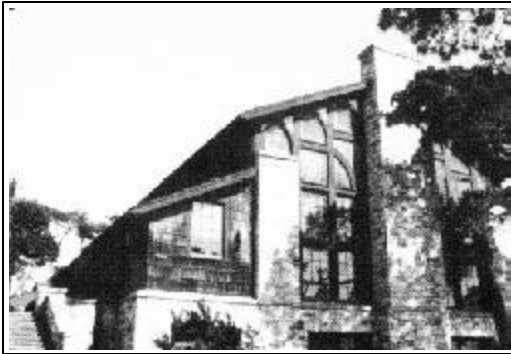
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Why Register Early? Asilomar is a special, secluded environment that is highly sought after for conferences. They tend to sell out all rooms far in advance. Alcor was on a waiting list for one year before we received a confirmed date for this conference. Part of our contract with Asilomar is that we need to estimate the number of lodging rooms and meals 180 days in advance in order to make them available to attendees, and we have to guarantee the number of rooms 30 days in advance (or incur charges). Those who make reservations after March 1, 2000, may not be able to obtain on-site lodging.

Staying on-site at Asilomar is a memorable experience. Once you are there, meals are included and very convenient. There is no driving and no hurry. Everything is close and convenient. Attendees who want to bring their families find it to be a wonderful vacation for non-attendees. Attendees and their families can come early or stay late to enjoy the general Monterey Peninsula and take advantage of Asilomar's economical food and lodging package. But reservations must be made well in advance.

Don't be disappointed by trying to make reservations at the last minute only to learn that they no longer have accommodations that will fit your needs - or worse, that they are sold out completely. Save money, as well, by registering for the Conference in advance. Registration forms available on-line. Do it today.

To Register for Conference:

Includes Social on Friday evening, June 16, 2000, after-dinner Panel on Saturday evening, and presentations on Saturday and Sunday. The Conference will conclude with two tracks on Sunday afternoon, June 18.

Speakers



Glenna Burmer, MD, PhD
LifeSpan BioSciences

*Identifying Aging Genes
by Using DNA Microarrays*



Fred Chamberlain, BEE
Alcor Life Extension Foundation

Bioimpedance



K. Eric Drexler, PhD
Foresight Institute
*The Conservative Treatment
of Transient Inviability; or,
Your Computer Crashed —
Shall I Throw It Out?*



Gregory M. Fahy, PhD
21st Century Medicine

*Cryobiological Research at
21st Century Medicine*



James J. Hughes, PhD
Univ. Chicago, Dept. Medicine

*Our Evolving Definitions
of Death: Looking Ahead*



Ralph Merkle, PhD
Zyvox Corporation

Nanomedicine and Cryostasis



Richard Morales, MD
Private Practice

Setting Your Internal Clock

DNA Microarrays, or “gene chips,” are one of the most powerful methods in biotechnology for simultaneously analyzing the expression of thousands of human genes in human diseases. Data will be presented on genes that are up-regulated or down-regulated in aging, those that are drug targets or potential diagnostic markers, and those that are clearly aging associated. This technology is changing the way discoveries are being made in both anti-aging and medicine in general.

Bioimpedance is an electrical characteristic of biological structures where tissues with intact cell membranes behave very differently from tissues that have undergone cell membrane breakdown. Means of comparatively evaluating cryostasis protocols, as well as monitoring and comparing specific cryotransport operations, will be discussed.

Emerging nanotechnologies will lead to cellular-scale robotic surgical devices able to sense and repair tissues with molecular precision. Those of us who stay intact until this technology arrives could achieve and keep good health indefinitely.

A broad range of problems in cryobiology is being probed. A central aspect is our attempt to demonstrate successful cryopreservation of mammalian organs, particularly the kidney. Construction of perfusion equipment, new surgical approaches, our new surgical staff, and initial results of perfusion with novel, low-toxicity vitrification solutions will be described.

The definition of “death” has changed radically in the West in the last thirty years. Cryostasis will be a part of a group of therapeutic modalities that will force a new personal identity-based concept of rights. One possible outcome might be that the resuscitated cryonaut would be legally and phenomenologically different from the person who was placed into cryostasis.

Human beings are made from molecules, and how those molecules are arranged makes the difference between good health and bad, between youth and old age, and between life and death. With nanomedicine, we should be able to rearrange molecular structures in most of the ways permitted by physical law, including the ability to reverse freezing injury, saving the lives of most of those put into cryostasis today.

Circadian rhythms are well-known scientific phenomena. Recently, we have learned how to reset our internal clocks with diet, exercise, sleep, and hormonal manipulation. Some of the breakthroughs in this area and their application to anti-aging medicine will be discussed.

Fourth Alcor Conference on Life Extension Technologies



Robert Newport, MD
BioTransport, Inc.

*The Fear of Death and
Its Impact on the
Rational Process*

The fear of death interferes with an individual's rational process, especially in relation to acting to preserve and extend life, and possibly via cryotransport, be resuscitated. The work of Stanislaw Groff, MD, my own personal working with depressed and anxious patients in a private practice of psychiatry, and a review of current research on the effects of stress on early brain development will be discussed.



Tomas A. Prolla, PhD
University of Wisconsin

*Gene Expression Profile
of the Aging Process*

The gene expression profile of the aging process was analyzed in mice, revealing that aging resulted in a differential gene expression pattern indicative of a marked stress response and lower expression of metabolic and biosynthetic genes. Most alterations were either completely or partially prevented by caloric restriction, the only intervention known to retard aging in mammals. Gene expression profiling of the aging process provides a new tool to test aging interventions.



Gregory Stock, PhD
**UCLA, School of
Medicine**

*Who's Afraid
of Freezer Burn?*

Long before biological reconstruction of a frozen body (or brain) is feasible, technology would have to advance sufficiently for uploading to occur. Moreover, such developments will be sufficiently powerful to dramatically transform the world in a way that would make biology a far less interesting substrate for life than silicon and its progeny. The incentives for a biological rather than a technological awakening from cryostasis are unlikely ever to exist, so cryonauts — if they are someday resuscitated — are almost certainly bidding adieu to corporeal existence.



Natasha Vita-More
Author, Artist

*A Talent for Living:
Cracking the
Myths of Mortality*

An after-dinner presentation by Natasha Vita-More on her current book project followed by a panel discussion. Many have written about the technologies of extending life but not why we would want to live longer. There is an art to living - how we maintain our well being and how we bring aesthetics into our lives. We can approach life merely as a series of events or as a creative and challenging exploration. The panel will examine the cultural myths preventing mainstream acceptance of extreme life extension and discuss how to crack them.



Michael West, PhD
**Advanced Cell
Technology**

*Human Therapeutic
Cloning*

Technologies such as the identification and isolation of pluripotent stem cells, genetic and cell engineering techniques, and advanced in-somatic cell nuclear transfer, will lead to means for developing tissue therapies that will overcome the present difficulties related to immune compatibility and graft rejection, and thus the requirements for use of immunosuppressive drugs and/or immunomodulatory protocols. These technologies set the stage for human therapeutic cloning as a potentially limitless source of cells for tissue engineering and transplantation medicine.



Brian Wowk, PhD
**21st Century
Medicine**

*Molecular Control
of Ice Formation*

Antifreeze proteins and ice nucleating proteins found in nature are able to respectively prevent or catalyze the formation of ice while present in very small quantities. It has recently been demonstrated that synthetic molecules are able to perform similar functions. The availability of inexpensive synthetic molecules for blocking ice formation opens new frontiers for control of ice in industry and agriculture and for eliminating ice in cryopreservation.

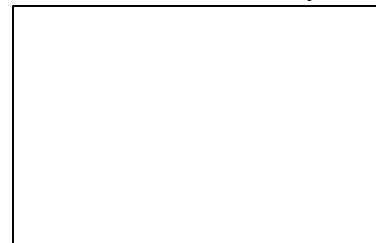
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1. No smoking allowed in sleeping or meeting rooms. Also there are no TVs or phones in the rooms.
2. All rates are for full-time participation and include housing, tax and meals.
3. Any charges accrued with the processing of foreign checks or sending faxes overseas will be the responsibility of the conference attendee.
4. All cancellations are subject to a \$25 per person processing fee. Cancellation **after April 14** is subject to forfeiture of all fees if space is not resold.

In the case of cancellation on the day of arrival or early departure, all fees are forfeited.

A⁴M December 1999

Annual Conference of the American Academy of Anti Aging Medicine

Overview

At the A4M Conference in Las Vegas, December 11-13, 1999, the world's largest association of anti-aging physicians heard new ideas on how molecular nanotechnology will contribute to the practice of medicine over the next half century. This annual conference (at the Tropicana Hotel in 1999) was attended by more than two thousand physicians and scientists as well as interested lay people and was the seventh of its kind so far.



A4M Conferences started in the wake of FDA acceptance of the use of Human Growth Hormone (HGH) as a treatment for "aging." While this seemed like a perfectly reasonable step, given the benefits that could be demonstrated for it, the outcome has been a shift in thinking to characterize aging as a *disease*, rather than a "natural order of events" to be accepted and even welcomed by those who grew old.

Part scientific congress and part trade show, A4M conferences serve both medical professionals

and those who see the emergence of fundamental medical treatments for aging and expect to benefit personally from this. While supposed "cures for aging" are as old as Methuselah, A4M ushers in a new dimension, where the promise of future science and practical medicine of today are harder to distinguish from each other.

Nanotechnology had been presented at A4M before, so the refinement of this for the purpose of medical applications was quite natural to the attendees.

Nanomedicine

A recently published book by Robert A. Freitas Jr., the first volume of three, received a lot of attention. Two speakers presented talks in which this book became the focus. The idea of nanomedicine was presented as a plausible pathway to extended lifespans as well as a radical way to survive accidents. Although the two talks approached the topic of nanomedicine from different technological points of view, both of them strongly endorsed the idea



Robert A. Freitas Jr.

of preserving biological structure in the event of irreversible cardiac



Robert Bradbury

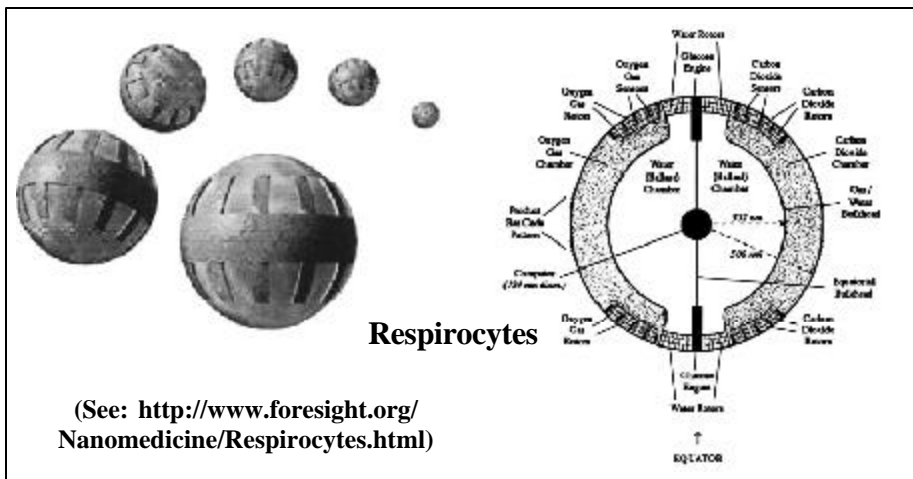
arrest, through cryotransport.

Robert Bradbury "Genomes, Biobots, and Nanobots: Implications for 21st Century Medicine"

Robert Bradbury spoke on this subject early Sunday morning, and the presentation was well attended. Bradbury's topics moved smoothly from gene chip assessments of health to "biobots" (modified microorganisms with useful health roles), to "nanobots" (manufactured devices fully under software control).

Bradbury described Robert Freitas's conceptual device, the "respirocyte," in some detail.

[The respirocyte is conceived as a tiny automated module, smaller than a red cell (design diameter is one micron), holding reserves of oxygen at extremely high pressures (1000 atm). The functional requirement will be for it to release oxygen into the local area of the blood stream



Respirocytes

(See: <http://www.foresight.org/Nanomedicine/Respirocytes.html>)

and scavenge carbon dioxide in the event of cardiac arrest. No blood will need to circulate in order to sustain life, for many hours. This advance is expected to vastly reduce deaths from accidents, as well as from SCD; “sudden coronary death”. The summary from the website cited above is as follows:

“This paper presents a preliminary design for a simple nanomedical device that functions as an artificial erythrocyte, duplicating the oxygen and carbon dioxide transport functions of red cells while largely eliminating the need to manage carbonic acidity because CO₂ is carried mechanically, rather than chemically, in the blood. The baseline respirocyte can deliver 236 times more oxygen to the tissues per unit volume than natural red cells, and enjoys a similar advantage in carbon dioxide transport.

“The respirocyte is constructed of tough diamondoid material, employs a variety of chemical, thermal and pressure sensors, has an onboard nanocomputer which enables the device to display many complex responses and behaviors, can be remotely reprogrammed via external acoustic signals to modify existing or to install new protocols, and draws power from abundant natural serum glucose supplies, thus is capable of operating intelligently and

virtually indefinitely, unlike red cells which have a natural lifespan of 4 months. This device cannot be built today. However, when future advances in the engineering of molecular machine systems permit its construction, the artificial respirocyte may find dozens of applications in therapeutic and critical care medicine, and elsewhere.”]

Robert Bradbury presented a flow chart indicating that sources of mortality will start to “dry up” over the next few decades, to a point where probabilities of death will shrink, leading to (as stated



Ralph Merkle

above) a projection that by the year 2060, average lifespans will exceed a millennium.

There was a point to all of this, and it turned out to be cryonics. Bradbury, in wrapping up, strongly advocated cryonics arrangements for older persons (and pointed out that even younger individuals might need it). He discussed Robert Freitas’s book (*Nanomedicine*) in detail.

At the Alcor booth, our stock of *Nanomedicine, Volume I* was exhausted in what amounted to a “feeding frenzy” of purchasing in the minutes following the first of these presentations. By the time the dust had cleared, we had paid orders for 42+ more copies.

Ralph Merkle “Nanomedicine”

The following day, Ralph Merkle (Alcor Director as well as the key coordinator of Alcor’s Scientific and Medical Advisory Board) spoke on the impact of nanotechnology on health care through nanomedicine.

In addition to a detailed treatment of nanotechnology in terms of its fundamentals, Ralph presented his interpretation of our current-day cryotransport program as a “clinical trial,” in which the only choices are to be part of the experimental group (arrangements for cryotransport) or to remain as part of the “control” group (this is the easy choice—just do nothing).

For the physician group, this was exactly the right message. On the heels of Bradbury’s talk the previous day, the attendees seemed even more receptive to the idea of



Bruce Cohen & visitor

cryonics as an “unproven, yet still rational approach to conditions that cannot be treated by present day medicine.”

As with Robert Bradbury’s earlier talk, Merkle emphasized the importance of Robert Freitas’s *Nanomedicine* and presented an overview of its contents. As a result, many additional attendees later visited the Alcor booth, asking, like others the previous day, about buying copies.

Distribution of the 4th Qtr. 1999 Issue of Cryonics

Alcor staff members and volunteers at the booth handed out copies of the current issue of *Cryonics* to a receptive flow of physicians and other seekers of



Kat Cotter, D.C. & visitors

extended lifespans. Several of the BioTransport directors were on hand also. Those present most of the time included Fred & Linda Chamberlain, Russ Cheney, Bruce Cohen, Kat Cotter, D.O., Robert Newport, M.D., and Karla Steen.

Ralph Merkle, a director of Alcor and one of the speakers on *Nanomedicine*, was at the Alcor booth frequently. The author of *Nanomedicine*, Robert A. Freitas Jr., was also present to sign books after both of the talks on this topic. Robert Bradbury, whose first presentation stirred up the initial surge of traffic to the Alcor booth, also spent much of his free time with us.



Rob Freitas and Linda Chamberlain

The support of the speakers on *Nanomedicine* and its author no doubt helped to convey a picture of high intensity and intelligence to those who stopped by. Also, the sheer numbers of other Alcor and BioTransport people must have contributed to the rate at which copies of *Cryonics* were handed out and discussed with those who passed by.

The cover of that issue (you may recall) was captioned:

Nanomedicine, Theme for a New Millennium

This too probably contributed to the number of copies distributed.



Karla Steen & visitor

Alcor/BioTransport Booth at A4M

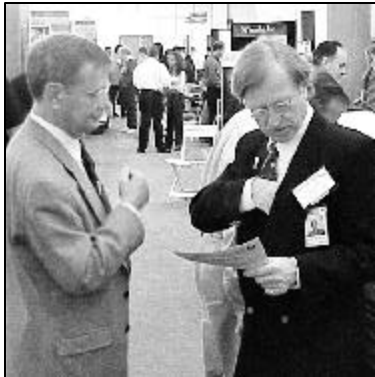
Although the booth space was paid for by Alcor, BioTransport contributed to the booth effort and thus was allowed “equal time and space.”

Bruce Cohen, as a Director of BioTransport, Inc., acted as the primary coordinator of booth preparations. He provided a large, high-luminance readerboard, which could be easily seen from the far side of the exhibit area, with scrolling messages about both Alcor and BioTransport.

BioTransport’s PowerPoint projector cycled high-intensity slides at the booth, inviting those who passed to participate in a network of physicians (see next page.) Graphics from within *Nanomedicine* were also projected, arousing interest in the book.

A new ATP (Air Transportable Perfusion) System constructed by BioTransport, Inc., was exhibited as a working display, circulating a (blue colored) liquid to and from a “patient simulator.” Questions on this opened the door to discussions

of Alcor's standby, transport and cryoprotection protocols. Since many of those who stopped by were physicians familiar with extracorporeal bypass, this display helped generate additional interest and confidence that our procedures were not simply "straight freezing" or primitive operations performed by morticians.



Robert Newport, M.D. & visitor

Physician Network

Several dozen M.D.'s registered for a physician referral



Alcor Booth (L-R) Linda Chamberlain, Ralph Merkle, Kat Cotter (facing away), Carol Shaw, and Robert Newport, M.D.

network, which allows terminal patients to be referred for further evaluation if appropriate. The goal is to help more of those considering cryostasis to remain alive. In reciprocal fashion, we expect that those who accept such referrals are more likely to suggest that their truly terminal patients consider the cryotransport option.

The physician's network idea arose in BioTransport, and Robert Newport, M.D. (a Director of BioTransport) conducted most of the discussions of this concept with the attendees. A physician's network also serves Alcor's needs (most Alcor Members who fall ill will need to explore other options before entering hospice status).

In view of this dual purpose, it made sense to promote the physicians's network as a joint effort of Alcor and BioTransport, using Alcor's greater credibility (length of existence, numbers of members, Medical and Scientific Advisory Boards, etc.). And, from

a practical standpoint, Alcor will be the only likely source of refer-



Russ Cheney

als to such a network in the near future.

Once services are offered to the public by BioTransport, starting in 2001, it is likely that most of the traffic in the physician referral network will shift to BioTransport.

Papers Given

A wide variety of talks were presented, some theoretical but many on a practical level, for other practitioners or those who might be seeking treatment for difficult illnesses. We wish we could cover this comprehensively for you here, but in the absence of that we can at least point you toward the A4M website for more details and a preview of what's coming next December (A4M's Conference for Year-2000 will be at the new Venetian Hotel in Las Vegas, featuring canals inside with gondolas, etc.).

www.antiagingexpo.com
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chip millions of times as fast as today's Pentium 3; doubling the efficiency of solar cells; using gene and drug-delivery technologies to detect and target cancerous cells; and developing new technologies to remove the smallest contaminants from water and air."

According to Markoff, this will double federal spending in the field over the next five years. Clinton's plan was expected to call for increased spending in nanotechnology research to \$497 million in the coming fiscal year, about 70 percent of it going to university scientists for basic research.

Thomas A. Kalil, special assistant to the president for economic policy, was reported to say:

"Nanotechnology is a perfect example of the kind of investments that President Clinton and Vice President Gore believe are necessary for America's future. It's long term, high risk and high payoff."

Markoff's use of the term nanotechnology included a wide range of advances rather than fundamental breakthroughs in molecular manufacturing. He characterized nanotechnology as "the ability to manipulate and move matter," and

followed this with an observation that it is, "rapidly developing as a promising approach to a wide range of sciences and technologies. For example, researchers at both corporations and universities have made significant strides in the last year toward building computers that would be several orders of magnitude smaller and more powerful than today's silicon-based machines."

The report did emphasize that nanotechnology was perceived as having "great potential in biomedicine in applications ranging from improved drug delivery to disease detection." Robert A. Freitas Jr.'s *Nanomedicine* was not specifically mentioned, but the comment helps pave the way for more interest in Freitas' book.

Markoff generalized concerning nanotechnology, saying at one point, "nanotechnology has already created billion-dollar markets for devices like ink-jet printer heads and accelerometers for automobiles". Then he returned to more long range goals, saying, "researchers are optimistic about even bigger payoffs. For example, researchers believe they are on the track of new materials that are as much as 10 times as strong as steel, yet weigh only a fraction of it."

Current advances of a practical nature and the ultimate promise of nanotechnology are thus continuing

to merge in the public mind. Perhaps this could hasten investments in the fundamental technologies we need for the recovery of cryostasis patients.

Markoff's report mentioned that the National Science Foundation, the Pentagon, the Energy Department, NASA, the Commerce Department, and the National Institutes of Health are all financing nanotechnology research. He pointed out that the new National Nanotechnology Initiative calls for increasing spending by these agencies — as much as 400 percent in the case of NASA — in next year's budget. Markoff was thus able to conclude as follows:

"There has been an explosion of nanotechnology-oriented research proposals coming from university campuses in the last year, a government official said, and it has only been possible to finance a fraction of them under the current spending limits.

"Spending under the new program will be broken down into financing long-term fundamental research; support for grand challenge efforts; the creation of new research centers; the establishment of a research infrastructure, and the study of ethical, legal and societal implications of nanotechnology."

Nanomedicine, Volume I: Basic Capabilities

by Robert A. Freitas Jr.

(The first of a three-volume technology series)

(The text to the right is
reprinted from Volume
20, No. 4 of *Cryonics*)



NANOMEDICINE

"ON THE WEB" AT

www.foresight.org/Nanomedicine

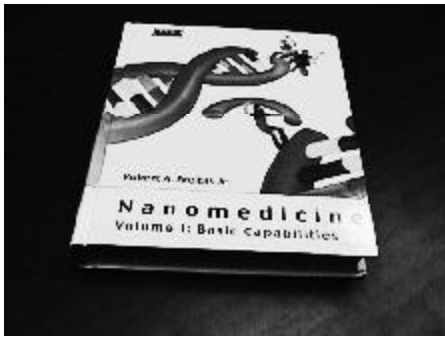
and

www.nanomedicine.com

This is an extraordinary book in many ways,

but particularly from the point of view of the open statement of possible application to the recovery of persons cryotransported to the future. With the publisher's permission, we are reprinting the following final paragraphs of the "Afterword" section. Some of the ideas will be familiar to you, but they are stated with a depth of background (3,728 references) unlike anything we have seen before (the extraordinary detail of the preceding chapters, in which the scope of application to medical repair becomes strikingly apparent).

Now, you may enjoy the conclusion, even before you probe the depths of what *Nanomedicine* has to offer. We think anyone with even a slightly positive outlook on the future of cryotransport will want a copy of this book. And, anyone who wants to see what medicine will look like as the next few decades roll by, will want to have a copy too!



(FROM THE "AFTERWORD,"
WITH PERMISSION)

"A New Medical Technology and a
New Era of Medicine"

"We are left, then, with a fairly clear set of conclusions. Living systems exist. Living systems can usually heal and cure their own injuries, unless those injuries are severe enough to prevent the living system from functioning. Too often, we suffer injuries that are indeed this severe. Molecular nanotechnology is feasible. As we master the ability to design molecular machines that can continue to function when the living system around them has failed, those molecular machines can restore the function of the living system. They can support and sustain the processes of the living system until that living system can once again function on its own. Whether this is done by a temporary assist from respirocytes or by any of the myriad other techniques discussed in *Nanomedicine*, the underlying message is clear: life and health can be restored and sustained in the face of greater injury, greater damage, greater trauma, and greater dysfunction than has ever before been realized. This will usher in a new era in medicine--an era in which



Robert A. Freitas Jr.

[Rob will be signing copies of *Nanomedicine* at Alcor's Conference next June as well as discussing his ideas on an informal basis.]

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health and long life will be the usual state of affairs while sickness, debility and death will be mercifully rare exceptions.

"The future capabilities of nanomedicine give hope and inspiration to those of us who still have decades of life to look forward to, but some are not so fortunate. Many others who rightfully should live several decades more might find that chance cuts short their expected time. Heart attacks and cancer can strike

us down even in the prime of our lives. They do not always wait their turn and politely arrive only when expected. How can today's dying patient take advantage of a future medical technology that is as yet only described in a handful of theoretical publications? How can we preserve the physical structure of our bodies well enough to permit that future medical technology to restore our health?

(Continued on Page 54)

**Alcor's Mission:
The Preservation
of Individual Lives**

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Alcor Update



Alcor Director Joins Nanotech Firm



Noted Nanotechnologist Dr. Ralph Merkle joins Zyvex

Zyvex LLC announced in a press release dated October 8, 1999, that Dr. Ralph Merkle has joined the company in the newly created position of Principal Fellow.

Dr. Merkle is a leading proponent of the developing field of nanotechnology. He is also known for co-inventing public key cryptography, winning the Kanellakis Award from the ACM in 1997. He has published a number of important papers on nanotechnology, last year winning the prestigious Feynman Prize.

Jim Von Ehr, President & CEO of Zyvex, in Richardson, Texas, said "We've known Ralph for several years, and are absolutely thrilled to have a person of his stature join us. His research has pointed to a number of promising mechanisms by which nanotechnology might be achieved, and in conjunction with our excellent research scientists and laboratory, I'm quite confident we'll achieve our nanotechnology goals."

Dr. Merkle, commenting on the move, said "Nanotechnology is developing more rapidly than expected. I've been looking for a place where I can get more directly involved in making it happen, and Zyvex has demonstrated their total commitment to that goal. The decision to leave Xerox

PARC after ten years was difficult, but the chance to get involved in a serious startup in such a major role was irresistible."

Merkle has spoken about nanotechnology to numerous groups, including the World Economic Forum in Davos, Switzerland, and the U.S. Congress. He presented his most recent paper, "Molecular building blocks and development strategies for molecular nanotechnology" at the Seventh Foresight Conference on Molecular Nanotechnology, held in 1999 at the Westin Hotel in Santa Clara, California.

About Zyvex

Zyvex was started in mid-1997 with the goal of building the key tool for creating molecular nanotechnology, the assembler. That device is expected to revolutionize manufacturing by building atomically precise materials and machines for little more than the cost of the raw materials and energy that goes into them. Such machines could manufacture extremely strong nanocomposite materials, inexpensive solar cells, or even medical nanorobots that might someday cure most diseases and control or reverse aging. The privately held company is engaged in research and development of molecular nanotechnology, developing what it believes to be the three key technologies for the field: mechano-chemistry, nanopositioning, and system design.

Alcor U.K. News Update

Alcor U.K. Website: Alcor U.K. Members are being asked to provide a photo of themselves for the website, which is now being set up. Please email to David Flude <david@dflude.freemove.co.uk>.

Members who have their own web pages are asked to help Alcor and themselves by putting a link to www.alcor.org on their sites. Most of our new members come from people who visit the sites on the internet.

Alcor Europe Internet Newsgroup:

Dalibor den Otter of the Netherlands Group has set up a NewsGroup for European Members. To learn more, please email Dalibor at <neospient@geocities.com>.

Computer for Facility:

Thanks to Garret Smyth for providing a computer for the Alcor U.K. facility. The first use will be to run Henri's new Medications Calculation Program.

New Alcor U.K. Newsletter Being Developed

by David Flude, Editor
Alcor U.K. Bulletin

In discussing his plans for the future evolution of the newsletter of the Alcor U.K. group, Mr. Flude stated: "I'm doing a complete re-think on the role of our publication. I want to produce something that will reach a wider audience so I am changing the name of it after 4 years. Also I will try to give it an independent

approach so I have deleted the name Alcor UK."

In discussing the new format, David pointed out that "I think this would be a good idea for *Cryonics* Magazine - the name is offputting to non-members. We need a magazine we can sell to our neighbours, and your approach to the contents (the new format for *Cryonics* magazine) is absolutely right - more human interest, less technical articles.

TV2k-Transhumanist Conference Planned for Summer 2000

For more information contact David Flude:
david@dflude.freemove.co.uk

Alcor Membership Status

Alcor has 488 Suspension Members (including 105 Life Members), and 37 patients in suspension. These numbers are broken down by country below.

Country	Members	Applicants	Subscribers	Country	Members	Applicants	Subscribers
Argentina	0	0	1	New Zealand	0	0	1
Australia	13	1	6	Russia	0	0	4
Austria	1	0	1	South Africa	0	0	1
Brazil	1	0	1	Spain	6	0	0
Canada	12	5	14	Sri Lanka	0	0	1
Finland	0	0	1	Switzerland	0	0	2
France	0	0	1	Taiwan	0	0	1
Germany	4	0	3	U.K.	24	10	10
Holland	1	4	1	U.S.A.	423	73	284
Ireland	0	1	1	Ukraine	0	0	1
Italy	2	2	1	TOTALS	488	97	338
Japan	1	1	1	No. of Countries: 23			
Lithuania	0	0	1				

"I am expanding it (the U.K. newsletter) from 2 to 4 pages and trying to make it more professional. Although we have about 80 people on our present mailing list I would like to draw in some of the European Transhumanists who are not yet Alcor Members.

"With this in mind Nick Bostrom and David Pearce with the European Transhumanists will be working with me and Garret Smyth to jointly plan the TV2k-Transhumanist Conference for Summer 2000. Nick, Dave, Garret, and I met in London on 6 January 2000 to start planning for the conference."

Turn to Page 20, for Front Cover of New U.K. Newsletter.

Southern California ACT Team Carries Out Dry Run CryoTransport

by Linda Chamberlain,
Assistant CryoTransport Manager



On Sunday, October 24, 1999, members of the Southern California ACT Team carried out a training exercise coordinated by Robert Newport, MD. This was a mock cryotransport beginning with a "call" from Alcor Central (part of the exercise) and including all aspects of cryotransport up to washout.

This training exercise will be part of all future certification training and continuing education for ACT-B (Basic) and ACT-A (Advanced) classes, as "Module 6" (there were previously five Modules: Coordination and Communication, Infection Control, External Cooling and Cardiopulmonary Support, Cryotransport Medications, and Checklists and Operations Management).

Module 6 will allow trainees to bring together the separate elements into a



Dr. Kathleen Cotter checks the Thumper while Regina Pancake sets up the portable ice bath (PIB) and spray cooling device (SCD).

whole picture before actually having to perform their skills in the field.

Dr. Newport developed a scenario prior to the exercise that would not



Diana Marks, Russell Cheney, and Dr. Cotter discuss medications.



Team moves patient into portable ice bath.

only challenge the team members' ability to carry out their skills but also require them to be resourceful in unexpected and stressful situations.

The team knew that they were going to participate in the development of this new module. They had been told to study their manuals and be prepared to carry out a dry run involving the entire transport process, but they were given no details in advance. They gathered at the home of Russell Cheney, the Southern California ACT Coordinator, ready for action.

Dr. Newport's scenario definitely produced heightened stress among the team members when the call came in from Alcor Central that (1) Dr. Newport himself had had a heart attack (they would not have him to lead the team); and worse (2) Alcor Central was already involved in a cryotransport on the East Coast and had deployed all of their personnel to that location (they were really on their own, with only their own knowledge and skills to rely on).

Despite initial shock and hesitation, the team organized and moved out to rescue their patient: Dr. Newport



Regina Pancake, Peter Voss, Louise Murray, and Russell Cheney work on preparing the medications (left) while Dr. Cotter examines the patient (Dr. Newport), and Russ Cheney and Michael Riskin bring the portable ice bath into the imaginary emergency room.

**MODULE SIX:
REALISM IN
CRYOTRANSPORT**

(clad in a wet suit and prepared to be placed into the icy water of the portable ice bath when the time came) was laid out in the imaginary emergency room on Russell Cheney's patio.

Michael Riskin, PhD, a team member who is a professional psychologist with extensive counseling experience, was called upon to communicate with the attending physician (also played by Dr. Newport, when he was not being the patient) by telephone while the Alcor team drove to the hospital.

Concluding the exercise, participants spent an hour discussing the operation, what went well, what did not go well, and how to do things even better the next time, real situation or mock exercise. In the future all certified ACTs will have at least one Module 6 dry run each year.

Fred and Linda Chamberlain from Alcor Central participated in the exercise by taking photos, evaluating the team members, and participating in the final review.



Clockwise from left: Michael Riskin, Dr. Cotter, Russell Cheney, Diana Marks, Regina Pancake, Louise Murray, and Peter Voss participate in post exercise discussion and review (not shown are Dr. Newport, Linda and Fred Chamberlain).



Future Life

An Independent Publication Dedicated to the Search for Immortality

The Search for Immortality has inspired

Kings, Poets & Lovers since Mankind first walked on this planet. The decay & death of a once great Human is the greatest tragedy. We spend years Growing Up, Fighting illnesses, Learning Social & Technical Skills, Carving out a Career, Marrying, Having Children and just when we want to sit back and enjoy Life along comes our old enemy Death. What a Waste!

However a New Generation has come along who have seen the Whirlwind of Change sweeping this World and they say-Nothing is impossible. They have seen the Impossible of Flight, Space Travel, Heart Transplants & the Computer Revolution all happen within one Lifetime. Now they want to conquer the Final Frontier-Death itself.

This then is our message and this Newsletter is dedicated to that Quest and the Men & Women who are the Pioneers. We seek to become like the Gods of Olympus-Immortal.

News... The Human Genome Project now

continued on page 2

INSIDE THIS ISSUE

- 2** TV2k-Transhumanist Conference coming to U.K.
- 2** News Update-continued
- 3** Cryonics-a Chance of a New Life-continued
- 3** Spotlight on Cryonics Organizations-Alcor UK AGM, Election of Officers & Training
- 4** How to Find out more about Immortality-Links & Contacts

Cryonics-a chance of a New Life

You have probably read about Cryonics-the Science of Freezing the legally dead in the hope of Future Science restoring that person to a New and Healthy Life again. What the Newspapers don't tell you is that Cryonics is undergoing something of a Revolution. Alcor Life Extension Foundation which was established as long ago as 1972 is attracting many respectable mainstream Scientists & Doctors who believe it really could work and have become Alcor Members. World Famous Scientists like Nick Bostrom pioneering the new science of Nano Technology and adviser to the U.S. Vice-President. Fellow Scientist Ralph Merkle puts the odds on Cryonic Suspension working as high as 90%. Another new Alcor Member is Marvin Minsky-famous as the Father of Robotics & Artificial Intelligence. Alcor's Medical Advisory Board has 4 Physicians. Latest programme is to Train & Equip A.C.T.'s or Alcor ParaMedics. Currently there are around 50 including 18 in Europe. Alcor is the largest of the 7 Cryonics organizations with around 500 Signed Up Members & another 400 Associate Members. They have a purpose built Facility in the UK near Fasbourne complete with Ambulance, Operating Theatre, Cooldown Bay & Offices. The American Alcor Facility is in the beautiful resort of Scottsdale, Arizona which is fast becoming the new Beverly Hills because of the perfect climate. What a lovely place to wake up in when you come back to Life! The American Facility has a Full Time Staff of 8 plus several more Volunteers and is on 24 hour Standby. Alcor has even thought of the Future Care of its Patients. It has set up a Patient Care Fund which is a Trust administered by Independent Trustees and currently worth over \$1 Million. Under the guidance of Alcor Founders Fred & Linda Chamberlain Alcor is enjoying something of a Renaissance with many young Computer & BioScience professionals becoming

continued on page 2

Future Life 1

New Newsletter of Alcor U.K. Group (See Discussion on Page 17)

Visions of the Present, Visions of the Future, Visions of Unbounded Life

LifeQuest

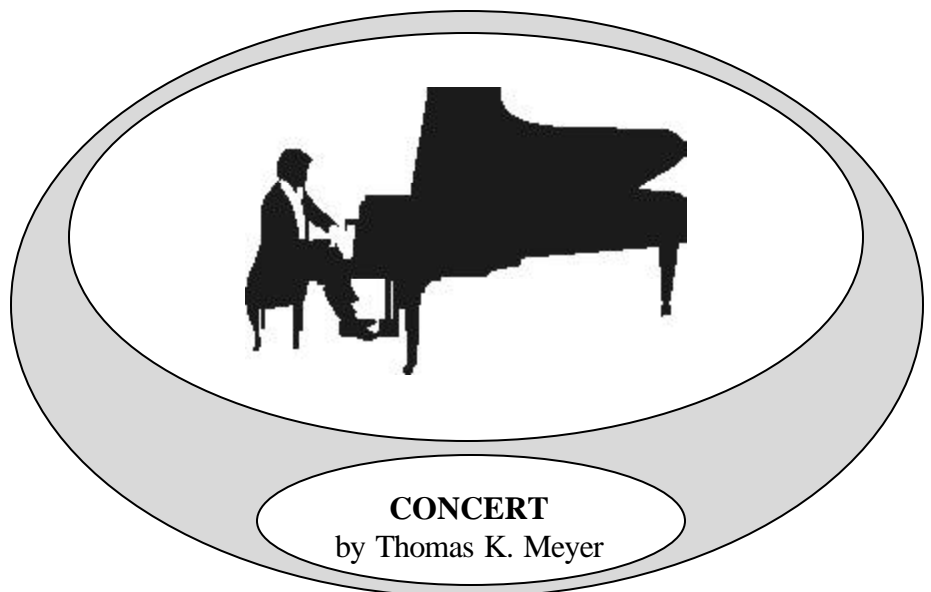
Fiction, including stories reprinted from the late 1980's

Most of the stories which follow appeared in *LifeQuest*, a semi-annual collection of life extension fiction, from May 1987 to November 1990. They ranged from practical cryotransport dilemmas to far-reaching possibilities of uploading, nanotechnology, and the deep-time aspects of living in space colonies. The contributors comprised a rapidly broadening group of authors at the time publication ceased in 1990.

Now, in a special section of each issue of *Cryonics*, we bring you reprints from past issues of *LifeQuest*, along with new stories contributed by authors from our wide readership and other sources. If you are a professional science fiction writer, or even if you are not, we invite you to submit your stories for possible inclusion. In this issue, *LifeQuest* welcomes its first new author, Thomas K. Meyer, with a story (*CONCERT*) to help us better appreciate ourselves and the "fix" we're in at this point in human history!

Table of Contents

CONCERT by Thomas K. Meyer (Original Publication)	21
CONSTRUCTION SITE By Linda Chamberlain From Issue #1, May 1987	25
A PLACE BY THE SEA by Fred Chamberlain From Issue #2, Nov. 1987	30
BACK ISSUES OF LIFEQUEST Issues #1 & #2 are already "On the Web"	35



Pi-Ling 23 adjusted her swivelchair and watched as the fossil, officially an 'ancient,' arose. She consulted deep memory and realized that she had interviewed him as a student some 235 years earlier. His real name was the antique "John," a bizarre-sounding word of biblical origins, though he had changed it early in the 24th century.

The crowd hushed as he made his way to the stage. His appearance was startling, for he was an early caucanegroid melange, utterly lacking in oriental features. His skin had been toned in the latest fashion and his hair had been genetically altered and straightened centuries earlier. But his broad nose and rounded eyes were decidedly original. He was a recluse, Pi-Ling knew, like virtually all remaining fossils and she wondered what might have brought him out of seclusion.

He was a good man. A good sense of proportion and humor. Slow, like all fossils, but decent and modest. They were all modest. They had reason to be. Despite cranial nanoimplants they could never attain the capabilities of the 28th-century's human production. Their early brains had been hard-wired in a different world, almost a different universe. This John had been born before the beginning of the third millennium. One of a handful left through the grace of cryonic preservation. How could anyone expect this being to adapt?

The crowd murmured. Several people transmitted mildly derogatory thoughts to friends across the hall. Pi-Ling grew uneasy. She was tough, but she alone in the audience knew this man and hence was appalled at the embarrassment he was sure to suffer.

The concert had been a tremendous success to this point. Instruments of all eras were strewn about the stage and illuminated by a marvelous limelight effect recreated from the mid-nineteenth century. The decade's most brilliant experience-designer, Ramju

IV, had engineered the first mass thoughtlink, intertwining the thoughts and feelings of the musician with those of the audience members. Ten of the century's most creative artists had woven magical tales of sound and thought - sleekpipe, guitar, intensiharp and dooldrums playfully intertwined with the memories of the musicians - schoolyard slights, lovely sunrises, annoyances of the bureaucracy, rapid-motion flower openings, wretched teleport delays. The excitement had left Pi-Ling a bit flushed, a bit dizzy.

And now this! It was customary to offer anyone in the audience a turn, but it was also customary not to accept. She had never seen it happen. Several people had already started to exit and were forced by protocol to return to their seats. They were particularly unhappy at this breach of etiquette.

What could he possibly think he was doing? He could practice any instrument every day for five hundred years and his fossilized brain could not possibly permit him to match the skills of today's humans! A disaster. A horrible disaster. Ramju IV rose from his director's lounge and moved carefully toward John. He too was unsure how to deal with this situation, but he knew that regardless of what happened next his great triumph would go unnoticed next to this strange development. Ramju acted as if he were trying to help the fossil, as if he were sick, although no one was sick, ever, anymore. The fossil smiled, tapped the palm of his hand on the top of Ramju's back several times (what did that mean?) and climbed

the steps to the stage. People stared, people flinched. Pi-Ling's unease grew exponentially. This wasn't right.

John picked up Ramju's cerebral transmitter and fitted the delicate ring around his neck. Its luminescence exaggerated his curious facial features and several audience members chuckled. Then he made his way to the back of the stage, into the shadows. For an agonizingly long minute he was invisible. Then - there he was, pulling a massive black object toward center stage. Pi-Ling squirmed. A—a—a—damn, she knew the name for it. She quickly downloaded her music library. A piano! Very old. Very, very heavy. Forerunner of the electroclavier. Ancient composers - Beethoven, Mozart, Bach - astonishing output for the cerebrally-unenhanced. Could John have known them? A rapid date-check said no. But he hadn't missed them by much!

Ramju IV slumped back into his lounge, defeated, sulking. Who could have expected the presence of a deranged fossil at the concert? John seemed eternally young, like all the others, so Ramju hadn't noticed him entering with the crowd. But now his true age was apparent. He walked slowly, though he didn't need to. He hesitated, without reason. His shoulders were stooped, though his body was as fresh as everyone's. That was the most curious thing. He seemed to carry a tremendous and invisible weight. Pi-Ling remembered that now, the most unsettling thing from the old interview. The weight of thought

he carried. Heavy, just like the piano. For the first time she felt afraid. Something bad was going to happen. As a historian, she understood what he had been through in eight centuries. But she hadn't felt it. In a moment she would.

He sat upon the hoverbench and adjusted his gleaming frock. His hands brushed lightly upon the keys and for a moment she thought he had changed his mind. Then his stubby dark fingers moved across the keyboard, stumbling at first. The tempo picked up. Pi-Ling consulted her archival implant. End of second millennium. Germanic. Strauss. *Auf der schonen blauen Donau*. A fine work. Not the greatest of the great, but very fine. Quite short, much shorter than the 'competition.' Embarrassingly short.

John's abilities were not innate. His playing was adequate, but flawed under his inexpert guidance. And yet - and yet - what was this thing - this immense pride which Pi-Ling felt? Pride? The player's pride. His excitement and his amazing contentment to be able to play this piece so well, despite the fact that it was awkward compared to all who had gone before. He had been raised without a music implant. He had never learned to play an instrument as a child and had no inherent musical abilities. And now, with his implant, he had this great sense of joy from playing, which was transmitted in full force to Pi-Ling and the audience.

The others before him had played so much better, yet they felt nothing of this. They had been

born with this ability due to their prenatal music download, so for them it was routine. To John, it was a great wonder to be able to play as a concert musician, despite the fact that his skill level did not meet 28th century standards. His joy for the pure joy of playing was more intense than anything else Pi-Ling had felt that day. In fact, it would have made the concert noteworthy in and of itself. But then the piece began in earnest.

A river, the blue Danube, flowing with life, a life, his life. From the murky Schwarzwald source his consciousness waxed forth. Pi-Ling saw his childhood. She felt raw brutality and uncertainty, crushing poverty beyond anything 28th century humankind had experienced. A younger brother, who looked much like John, was pummeled with fierce blows from a snarling band of desperate youths. Crimson stains surrounded his supine body. Pi-Ling reeled, felt hot blood flowing from her forehead, which had smashed against the seat in front of her. Hunger, intense burning hunger of a child in the days when food came by the sweat of one's brow. Dry mouth. Her jaws clenched involuntarily and a purple welt rose from her lower lip. Then a massive feast. A large bird, an actual living and sentient creature, which had been slaughtered, plucked of feathers, eviscerated and heated for hours until edible. Her stomach churned sourly.

Then—relaxation. Her arched body melted back into the lounge. Somehow John had risen from these dregs to become a man. She

felt his first trembling grade school kiss and flowed with the passion of his late youth. A divine, intense warmth cloaked her, held her captive with its strength.

Suddenly she was spinning high above an elaborately-garbed couple, John resplendent in long, black tails of a monochrome photograph and an ebony-skinned woman whose bright eyes would not move from his face. Her white veil swayed with her movements. Upon her nose sat ancient thick corrective lenses, giving her a ludicrous appearance. But John wasn't laughing. The feeling that enveloped Pi-Ling was indescribable - it was excitement; it was fear; it was joy; it was amazement - all rolled into one. She twisted and turned in the air, airy fairy, as the ritual was performed in a house of worship. The woman's bright eyes stared back at John, moistening, excited and happy. This archaic bonding ceremony was something no longer experienced, yet the twirling of Pi-Ling's mind suggested to her that she and her contemporaries were missing something of great importance.

The river flowed into fear, the exhausted fear of this man each day as he tried to support what had become a family in the face of a raw, primitive world. Work. Hard, tedious toil. Back-breaking manual labor which had been banished by machines for centuries. Pi-Ling's limbs ached; her back felt as if it would snap. She yearned for rest.

Then, the worst of the worst. The shining little face of a child. The youngest of five and extraordinarily beloved of John. Smallish

auburn curls and laughing eyes. Tears streamed down Pi-Ling's cheeks. John running toward the girl, gasping. A motorized vehicle smashing into her, flinging her high into the air. Now it was Pi-Ling turning somersaults in an icy river, gasping drowning. She was convulsing in the most ghastly pain she had ever experienced. The child was dead - permanent death. Never to return. No nano-repairers. Not even pseudo-organ implants. John could do nothing but scream an agonizing 800-year scream.

The concert went on to a long life filled with much love for his other children, a mostly-happy relationship with his mate-for-life. An arduous climb to business success. Many, many other permanent deaths. Then, finally, the cryonic preservation which served as his bridge to the world of today. Pi-Ling felt none of it. Her body lay limp, slumped half-in, half-out of the lounge.

The screaming of a thousand

Personal Health Alarms roused her. Aching, she pulled herself upright and looked around. Bodies lay everywhere, contorted into grotesque shapes, many in fetal position. Blood trickled from under the seats. The stench of vomit and urine had the air sanitizers roaring at full blast. Pi-Ling stared helplessly as rarely-activated EmPersonnel burst into the auditorium, stopped dumbstruck and began calling for more assistance. She caught a glimpse of the fossil standing on stage, his mouth open in astonishment, before sliding back into unconsciousness.

The Ramju Debacle, as it came to be known, caused the last great accidental mass-death of the Third Millennium. Some 384 persons suffered permanent death and many more required extensive memory re-engineering to reverse the debilitating psychological effects. Once again it became clear that the fossil population had little to offer in today's world and

held much unknown danger. But unlike all other surviving concert-goers, Pi-Ling did not have the memory erased. She became sullen, pensive, restless. Disinterest in the petty doings of her contemporaries dogged her.

It was just a matter of time. Early in the Fourth Millennium the Supreme Council voted 1145 yea, 855 nay in favor of forced resettlement of all ancients to the newly-discovered, primitive world of Beta 6. A positive outcome for everyone, the Council insisted. For once, it may have been right. When departure time came, Pi-Ling was the only non-fossil to tag along, for reasons the rest of humanity failed utterly to comprehend.



How to Submit Stories to LifeQuest

Please send submissions to *Cryonics* magazine, Alcor Life Extension Foundation, 7895 E. Acoma Drive #110, Scottsdale, AZ 85260, or email them to fred@alcor.org.

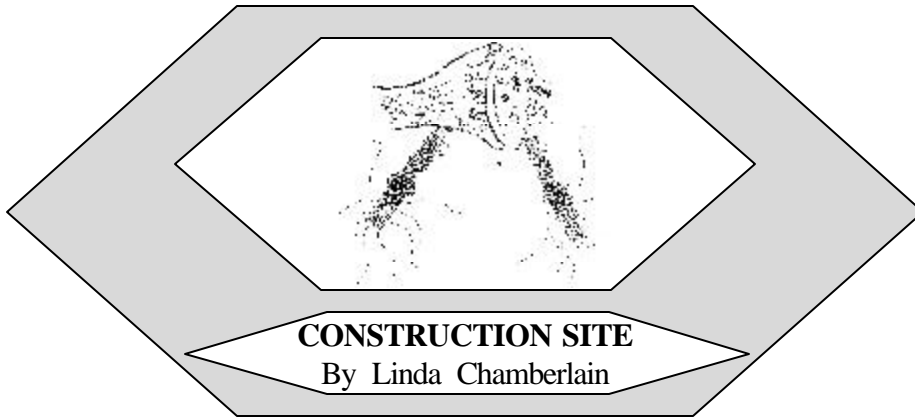
If in hard copy format, please also include a diskette (textfiles or one of these: Microsoft Word 97 & 6.0/95, or Pagemaker 6.5. Graphics (jpg/gif preferred)

should be in color if available, as these are compatible with Alcor's website. LifeQuest stories may be published on Alcor's website barring agreed restrictions to the contrary.

Alcor's anticipated rights include one-time publication in *Cryonics* magazine and website inclusion, nothing more, unless provided for in writing. Addi-

tional information on submissions may be found inside the front cover of *Cryonics*.

You *can* help others see why what Alcor does makes sense, by sharing your feelings, your deepest insights with them, in the form of LifeQuest fiction (short stories) or poems. If you have a vision, put it in writing, and submit it for consideration.



(Reprinted from LifeQuest Issue #1, May 1987)

In the dark, red glow of the dying fireplace, Bill's lean, high cheekbones appeared to have been chiseled from stone. His dark eyes were moist as he looked at the barely visible picture of his daughter, Bo, riding her rocking horse.

Soft, sobbing sounds came from Carolanne, who lay beside him, her head resting on his shoulder. Bill stroked Carolanne's hair, dark brown curls that were almost invisible in the shadowy darkness of the room.

"She's only two years old," Carolanne whispered hoarsely.

"She's so playful. So beautiful." Her voice choked and she buried her face in Bill's shoulder again.

Bill turned and kissed his wife's tear streaked face as he pulled her even closer. His own eyes began to flood. "How could Bo have cancer?" said Bill as he grabbed several tissues from the box on the table beside their bed. He cleared his nose and took another large gulp from his wine-glass.

"Bill?" Carolanne grabbed at the tissues and cleared her own

nose. "Bill, I want to talk some more about having Bo frozen."

"Carolanne." Bill's voice asked her to stop.

"Bill, please!"

"It doesn't do any good to keep going over this."

"I know it's still experimental, but what do we have to lose, Bill?" Carolanne sat up on the bed and looked into Bill's face as she placed her soft fingertips against his cheek.

"What do we have to gain?"

Bill brushed away her hand and sat up on the edge of the bed with his back to Carolanne.

"Hope?"

Bill let out a long sigh as he smoothed his hair back from his face.

"It's Bo's only chance."

"Carolanne, most hospitals still won't get involved in freezing people. That must mean something."

"Some do. Jane and Terrence had her father frozen last year. We could take Bo to that hospital."

Bill stood and turned to look down at his wife, her tear-stained face almost lost in the shadows of

the room. "We've gone over this a hundred times. Even a piece of steak doesn't last more than a month or so in the freezer. It's bad enough having to face the death of our only daughter without you torturing yourself, and me too, with these unrealistic dreams."

Bill turned, left the bedroom, and walked heavily toward the stairway. The sound of Bill falling down the stairs was like the sound of a boulder tumbling down a hillside. Terrified, Carolanne bolted straight up in the bed. Stumbling in the darkness of the room, she made it to the doorway and switched on the lights.

"Bill!" she screamed as she flew down the stairs and crouched over her husband. "Bill, are you all right?"

Bill opened his eyes and a wry smile formed at the corners of his mouth. Seeing the terrified look in her eyes, he reached up and pulled her down onto his chest. "Looks like I had too much wine."

"Are you all right?"

Carolanne pulled back to look at him. "Did you hurt yourself?"

"My leg."

"Don't move." She kissed him lightly on the nose and ran for the phone. "I'll get an ambulance."

Bill looked down at his broken leg in disgust. Carolanne, standing beside his hospital bed, picked up his hand and smiled softly down at him. "After climbing on all those roofs, it's kind of silly to have broken your leg falling down your own stairs." The grin on her face was full of love.

"It was stupid," said Bill, disgust still on his face.

The door opened and a tall, large-boned nurse walked into the room, carrying a chart in her hands. "Good morning," she said with a cheery brightness on her broad, boxy face. "I'm Mrs. Collins. How's the leg this morning?"

"How long will I be laid up?" Bill asked. "I have an important job to finish. I can't stay in the hospital."

"Broken legs don't take as long to heal as they used to, Mr. Cross. Since about the '30s we've been using molecular repair machines to assist healing. Are you familiar with the medical uses of nanotechnology?"

"Vaguely," Bill answered. "Not too much."

"You're in construction work, aren't you?" asked the nurse.

"I build houses."

"Great," said Mrs. Collins with a smile breaking from her full lips. "You'll enjoy this." The nurse handed her charts to Carolanne and pulled a wheelchair out of the closet.

"Enjoy what?" asked Bill, looking at Carolanne, who responded with a question on her face and a shrug of her shoulders.

"We have a viewing room just down the hall, Mr. Cross, where you can watch some construction that's going on here at the hospital. Dr. Van Deusen, who set your leg last night and started your treatment, would like your opinion. Being in construction yourself, I think you'll enjoy seeing this."

"But what about my leg? How long before I can leave?"

The nurse had pulled the chair over to Bill's bed. "Let's go see the construction, first, okay? Trust me," she said with a wry smile and a little jerk of her head. He did not notice the nurse reach down to his removable cast and switch on a small device. The other nurses had been switching it on and off so much he'd ceased being aware of it.

Bill looked at Carolanne again only to get that questioning look as she threw her hands in the air.

Bill's hands, gripping the arms of the wheelchair as he leaned toward the viewing screen, were large and callused from his work. His dark, full beard did not hide the high cheekbones or the excitement in his chocolate eyes. Carolanne watched Bill as much as she watched the viewing screen.

Unlike mining and construction on the surface of the earth, there was no gravity here to retard and complicate this work. All this activity was in free fall. These machines didn't lumber about like hulking giants on rough, crude roads freshly excavated for the job. They looked more like weightless Olympic gymnasts whose special training and skills had been borrowed and redirected for this special task. They floated.

The irregularly shaped work area was about the size of a small bedroom. A similar work area, which had been on the screen earlier, was filled with hundreds of machines, each relatively no larger than the size of Bill's fist, each laboring at its individual task. In addition to the machinery, the

interiors of the work areas were also full of floating objects of varying sizes and shapes, some of which were much larger than the machines that were working there. Inside this particular work area, though, there were no machines. Not yet.

The walls were made up of hundreds of tiny bead-like, interlocking spheres. Bill's attention was drawn to a small, expanding opening on the side wall. It appeared to be under disassembly from the outside. One by one, the beads were being removed. Bill watched as two, then three, and finally six to eight arm-like projections began poking through the hole.

Dragging its power and communications cable behind it, a spherical automaton floated slowly into the work area through the porthole in the wall-beads it had just created. Once inside, it repaired the hole in the wall and then pitched and rolled while searching for the correct orientation to assume in this free-fall work situation.

Numerous anchor arms began emerging from the sphere on the side next to the wall, searching and examining the wall's surface. After the sphere had securely attached itself to the wall, a computer inside the sphere began directing the sphere in the task of building and deploying the robotic appendages that would do the work under its pre-programmed control.

Small arm-like projections telescoped from the surface of the computer-sphere into the center of the work area. These robot arms

began disassembling components from the objects around it, gathering these disassembled parts into clusters of like kind.

Bill sensed that the projections and arms kept precise geometrical maps of their movements about the workspace. It was like the highly automated modular housing factories Bill had visited on tours, but much more complex. The nurse said this construction was going on here at the hospital, but what were those things anyway? It would take hundreds of acres to contain all this activity, wouldn't it? Bill didn't have a clue!

Several openings began to appear in different areas of the spherical automaton's surface. Out of these openings grew slender, rigid, cylindrical pigtails spreading in different directions, following the paths of the disassembly robots. Alongside the pigtails grew broader, flatter appendages that would function like conveyor belts. At a distance from the computer-sphere of about ten times its own diameter, pods at the ends of the pigtails opened like hands with eight opposing fingers, in four sets of two.

Back at the main computer-sphere, the parts it had been disassembling and stockpiling were being passed along by the conveyor belt fingers to the robotic assemblers at their ends. Here, these pieces were being assembled back into the same types of objects from which the parts had just been disassembled. The difference, obvious from the dynamic behavior being viewed on the screen, was that the original objects were

defective and couldn't function, while the reassembled objects functioned perfectly.

As the assembly progressed, the remote assemblers began to put out their own tethers and conveyor belts, at the ends of which other assemblers and disassemblers began to develop. A network of robot appendages, rather like a living, working scaffolding, thus grew within the work area, all controlled by the original computer-sphere that first entered the cell.

The display shifted from work area to work area. Other computer spheres continued to enter new work areas. Bill could envision thousands—or could it be tens of thousands?—of computer-spheres, disassemblers and assemblers, all working in concert in an uncountable number of work areas, to repair those work areas and all the floating, functional parts within them.

"Are they excavating beneath the hospital?" Carolanne asked Bill.

"I don't know what it is," Bill replied. "It's ridiculous, but what else can it be?"

"What are those things, anyway?"

"Nothing I've ever seen on the surface of the Earth," replied Bill. Bill and Carolanne exchanged looks of astonishment.

Carolanne drew back from the screen and noticed her surroundings. From the time the nurse had left Bill and Carolanne here in the observation room to wait for

Dr. Van Deusen, their intrigue with the drama on the screen had eliminated all sense of waiting.

The observation room was cheerful. It had been decorated with yellow and beige chairs and nicely matching tables of rich dark mahogany. Lamps with glass bases full of dried flowers sat on the tables, more for decoration than use, as the bright overhead lights provided all the illumination necessary. At the moment, the ceiling lights were dimmed so they could see the construction activity on the screen better.

The door opened and a tall, white-haired physician entered. His face was round and florid and his deep, blue eyes sparkled more from merriment than from illumination. The corners of his mouth broke open in a broad smile as he looked at his patient, so occupied by the ballet on the screen that he had not even noticed the doctor's entrance. He nodded a greeting to Carolanne.

"My apology, Mr. and Mrs. Cross, for keeping you waiting," said Dr. Van Deusen in a hearty, rich voice that filled the room.

"Ahhh, Dr. Van Deusen." Bill whirled his wheelchair to greet the doctor. "It may not look like it at first glance, but that is, without a doubt, a hard-hat area!" Bill's face glowed with appreciation for what he had been observing on the screen in front of him.

"It's not exactly the kind of construction work I understand you do. You build houses, don't you?" Bill nodded. "But I thought you would appreciate it." The smile on the physician's face was like that of a father watching a

small child fascinated with some new wonder he had discovered.

"What in the world is it?" asked Bill, staring back at the construction work on the screen. "I've never seen anything like it."

"That's the healing process going on inside your leg, Mr. Cross. You've probably noticed the nurses switching the device on your cast on and off. We're monitoring progress in your leg by telemetry through a sterile micro-lead that penetrates to the vicinity of the break."

"That?" Bill turned his wheelchair back to face the screen. "That's going on inside my leg?"

"It's just one small application of what we call nanotechnology." Dr. Van Deusen walked up to stand beside Cross's wheelchair.

"What kind of technology?" Carolanne asked.

"Nanotechnology. *Nano* means very small. A billionth. *Nanotechnology* refers to those types of technologies that work on the molecular level. In this case, we're watching molecular repair machines inside your cells."

"That's actually going on inside Bill's leg, right now?" Carolanne asked the doctor incredulously. "Do you have nano-TVcameras in there? How could you do that?"

"What you're watching is a computer simulation. The exact positions of repair machines and their working surfaces are available from millions of repair sites, and a small computer in your cast is constantly switching from one site to another, keeping track of the process. This information is usually piped to a lab where

technicians study the repair processes, but we can view it in this room, too, so patients can better understand what's going on.

"In this viewing room, we have the computer switch back to one particular repair site frequently and we display it in extremely high detail, with color graphics, so you can watch the repair as it happens at that location."

"Are those... ah... repair machines... robots?" Bill asked without looking at Dr. Van Deusen; his dark, fascinated eyes remained glued to the scene.

"Well, yes and no," answered the doctor. "A robot is a machine that does routine tasks. It depends on how you look at what these machines are doing. In some ways it's mechanical and routine, but in other ways, that description is inappropriate because the whole operation requires a lot of artificial intelligence from the tiny, local computer inside that main sphere at the repair sites."

"Those pigtailed," Bill pointed at one of the repair machines on the screen, "must be kind of like extension cords connecting the main computer to its robots?"

"Yes," said Van Deusen. "Those main spheres are the smart ones. They have tiny nano-computers inside, which are receiving directions from the computer on your cast through the micro-lead in your leg."

Carolanne smiled with delight. "How does the computer on Bill's cast know what each one of those little computer spheres inside the cells is coming up against?"

"It switches from site to site

constantly, like an orchestra leader keeping track of dozens of musicians, except here we're talking about millions of repair devices. The cast computer directs only the overall objectives for each of the computer-spheres inside and outside the cells. The nano-computers inside the main spheres determine the specific actions they take to accomplish their local objectives," answered Dr. Van Deusen.

Bill was getting the picture. "The computer on the cast is like someone who hires a contractor to fix a busted brick wall after some drunk smashed into it. The contractor, like the computer-sphere in the cell, figures out what needs to be done, then puts a crew together, like these disassemblers and assemblers, to do the actual work."

"Right," said Van Deusen with a broad smile. "From the information obtained when the disassemblers first encounter a molecular structure, the computer figures out which parts are okay and which parts are malfunctioning. Then the computer gives directions to the disassembler about which cellular parts to leave alone and which ones to take apart."

Bill continued from where Van Deusen had paused, "So, the contractor has the brick wall torn down. Then he looks over the bricks, picks out the ones still good enough to use, and has the bad ones ground up into sand and made into new bricks again?"

"That's right," said Van Deusen. "The disassembled molecular components..."

"The busted bricks that were turned back into sand?" asked

Carolanne.

“Yes,” answered Van Deusen.

Bill smiled at Carolanne and continued, “Then the sand is sent down the conveyor belt to the assembler with instructions about how to first rebuild the bricks, and then rebuild the wall so it looks like new.”

“That’s more or less the way it works, yes.” Van Deusen was pleased they were catching on so easily. “Molecule by molecule, the parts of the cell are repaired. Cell by cell, the bone, the muscles, blood vessels, and all the damaged parts are repaired, or ‘remanufactured’, if you’ll go along with the notion. The most fascinating thing, which many of us can’t stop marveling about, is how these little things make copies of themselves, almost like highly sophisticated viruses, yet we control their coming and going, their degree of proliferation, all by that computer on your cast.”

“Dr. Van Deusen, are there limits on the kinds of repairs that can be done this way?” the look in Bill’s eyes revealed that his mind was racing with the possibilities.

Carolanne stopped breathing as she realized what was going through Bill’s mind.

“Fundamentally, no,” answered Dr. Van Deusen. “It’s really a matter of engineering and the applications are mushrooming everyday.”

“What about things like cancer and heart disease?” asked Carolanne.

“That’s exactly why I had you brought down here today, Mr. and Mrs. Cross.” Van Deusen pulled a chair over next to Bill and sat

down, facing them. “The computer-spheres inside your broken leg have been encountering a lot of plaque in your arteries, Mr. Cross. We feel you should consider having this removed before it progresses any further.”

“I have ather—ah—heart disease?”

“Atherosclerosis. Yes. The accumulation of plaque in your arteries.”

“How,” Bill swallowed. “How bad is it?”

“Your condition is not serious, yet, Mr. Cross,” Dr. Van Deusen smiled reassuringly. “We recommend preventive measures early so that it won’t become serious.”

“Does that mean surgery?” asked Carolanne.

“No.” Van Deusen turned his head and looked up at the screen. “Molecular repair machines can do that job, too, Mrs. Cross.”

“You mean,” Bill said, “like turning bricks into sand, these repair machines just gobble up the plaques and I’m okay again?”

“Basically, yes. Repair machines can seek out any biological structure that is not normal, or that is malfunctioning, and can either eliminate that structure, such as plaque, or, like a brick wall, rebuild it to make it work correctly again. Molecular repair machines have almost replaced surgery and drugs in medicine. This is 2053. The day is not too far off, Mr. Cross, when surgery and drugs will be as distant as witch doctors’ beads and rattles.”

Carolanne’s delicate hand was resting on Bill’s shoulder; he could feel her tremble. Bill placed one

of his rough, large hands over hers and looked up at her before he turned his questioning eyes to Dr. Van Deusen. Carolanne felt a bolt of anticipation, like a jolt from a hot 220 volt line run through her.

“Dr. Van Deusen,” Bill started in a very deliberate and serious tone of voice, “our two-year-old daughter, Bo, is dying of cancer. Why weren’t we told about these repair machines for curing her cancer?”

Dr. Van Deusen took a deep breath. “Repair machines are not perfect yet, Mr. Cross. When you signed the treatment release to authorize their use for the repair of the tissues in your leg, you were giving us permission to do something very well proven out. There are very few dangers with this procedure, but there are still limitations. If the repair machines don’t do the whole job, your body is strong otherwise and can finish the job. The artery job is a little more complicated. That’s why we wanted you to see the simulation. Cancer is even more difficult. Perhaps your daughter’s doctors want to try some more conventional approaches first. Is your daughter in this hospital?”

“No,” said Bill, “but it looks like she should be. Can you refer us to someone here?”

“I’ll be glad to have someone from that section of the hospital come by your room and see you,” said Van Deusen.

Carolanne cleared her throat. “What’s the difference between a broken leg and cancer, I mean, as far as these repair machines are concerned?”

“The repair machines may be

able to eliminate the tumor, but we still don't know exactly what causes every kind of cancer. We can't guarantee that her cancer will not recur. Although our repair machines are getting better every day, they're still quite slow. Sometimes the disease process works faster at tearing down tissues than the repair machines can keep up with."

"So," Bill continued, "sometimes a person with something like cancer dies anyway?"

"Yes," said Dr. Van Deusen.

"But, if such a person were to be frozen," Bill's voice wavered, "these repair machines could be used after they were unfrozen to repair the freezing damage?"

Tears were forming in Carolanne's eyes and her lips

quivered as she held her breath and waited for Dr. Van Deusen's answer.

"Yes," said Van Deusen. "However, I'm an internist, not a specialist in cancer or cryopreservation of patients. But if you'd like more details I could have one of the doctors from those sections come by your room also."

"You do that here too?" Bill's face was on fire.

"Yes. This hospital is one of the leading facilities in the country on the use of molecular repair devices. Our successes in that area have made some of us very positive about the prospects for patients who have themselves cryopreserved. However, I should add that not all our colleagues share that belief."

"Doctor," Bill hesitated, "would Bo really have a chance if we had her frozen?"

"Like I said, Mr. Cross, many of us are very positive about that. But, I'm not an expert in that field. I'll ask Dr. Killian from that section to drop over and see you."

Bill looked up at Carolanne and smiled. "Yes, Dr. Van Deusen," he said, "we'd like that. We'd like that very much!"



(Reprinted from LifeQuest Issue #2, Nov. 1987)

Swinging the wide windows open, Sheila let the cool spring air flow past her into the living room. Rich smells of cut grass gave her a delicious picture of the freshly mowed lawn, cuttings still lying in streaks waiting to be raked.

Not more than fifty feet away, she imagined, her husband was almost finished. The clatter of

blades came and went as he worked his way into the narrow corner by the roses, brief whirrings revealing the tight pattern required to trim the little space. Later this afternoon, Sheila thought, she'd prune the roses, feeling the softness of each bud, each flower in the process. The thorns would still be small this time of year, needle sharp, so she'd be extra careful. If only she could actually see them once more!

"All done, Sheila," said Lloyd as he came in, hot and soaked with perspiration. He passed her on his way to take a shower, the pattern of his footsteps tracing a map in her mind, telling her wordlessly where he was headed. A robotics inventor, Lloyd spent much of his time in a workshop off the garage. Sheila left the intercom open, whenever she was near it, and

could almost see by the sounds as Lloyd assembled some of the new, automatic home appliances he was licensing for manufacture in South Korea. The closing of drawers and shutting off of motors told her, about eleven each night, when Lloyd was at a stopping place, and she'd reach over and switch on the electric blanket so his side of the bed would be warm.

For Sheila, sounds and smells were the essence of life. She could still remember the pleasures of vision, but all the doctors told her the blindness was permanent. Permanent? Nothing was permanent, she thought. Sooner or later they're going to learn how to make me see again, and when they do, I'll be ready and waiting!

Lloyd was understanding but had resigned himself to the idea

that Sheila would never regain her sight. That's why he found it incomprehensible, at first, that she would want a place by the sea.

"But the waves would be so exquisite to hear," she'd say each time it came up. "And the sounds of the seagulls, the smell of fresh salt air? It would be heaven!"

Lloyd had promised he'd start looking soon. He marveled at Sheila's capacity for enthusiasm and activity, despite her handicap. The one thing he did not share was her conviction that life would be extended so her blindness would someday be curable.

"Once in a while we get a spontaneous remission," the surgeon had said. "Light seems to start filtering in, and then vision comes back. Maybe three cases in ten thousand. Otherwise, it's totally inoperable. It could be fifty years before we're able to reach that part of the optic nerve safely. I'd advise against any expectation of her ever seeing again."

"They're here, Sheila!" called Lloyd, as he saw the light blue station wagon pull up out front. Once more, he'd made an excuse not to attend the meeting.

"But they're such nice people," Sheila had said repeatedly. "I'm sure you'd like them!"

"Until the medical community endorses it, I wouldn't touch it with a ten-foot pole!" Lloyd would say. The very idea of being frozen at death was bizarre and grotesque to him. He would go along with Sheila's wishes, since it gave her hope, but that was the extent of it! He would only go so far!

Sheila came out, dressed for the meeting, and Lloyd couldn't

help thinking she looked absolutely gorgeous. At thirty-five, her figure was like that of a twenty year old, and she kept her hair in perfect condition. The thing Lloyd couldn't understand was how she managed makeup so expertly.

"It's just a matter of feel," she'd said. "I start out by washing very completely and then only use so much. The people at the clinic helped me understand what the limitations were, and that was absolutely essential!"

"Amazing," he'd said, and Lloyd continued to be amazed at how Sheila took care of herself. His friends would ask if it were a burden of any kind for him, and he'd say, "You've got to be kidding! Sheila looks like a movie star, she's brilliant, and stays informed on things. I can't keep up with her in most of it. There's just this one thing she's convinced of..."

As she left the house, Sheila stopped at the rose bushes and took a perfect bud for her dress. She knew exactly how each thing she wore looked, and what matched, and could do things with her imagination most women couldn't do standing in front of a mirror. She walked carefully down the stairs to the street, gratefully taking the hand that helped her into the car. "My favorite day of the month," she murmured as the car moved off.

"Folks, we're all familiar with the problem!" Jay said, as the meeting started. "No one has the slightest idea of what we're up to, and we can't seem to get through.

We've grown to almost three hundred members, and it's still the same as when there were only a handful of us. Organ banking is on the verge of becoming a reality. Why can't people see what we do, and what it would mean to them?"

"Jay, you've been president of this group for a long time," said Sheila. "I don't see why it's a mystery to you! It's just a matter of credibility! People follow their leaders, watching what they do. They're like sheep; it doesn't have to make any sense. If enough respected political leaders suddenly decided to have their right hands amputated, all of us who'd still have two hands would be regarded as freaks!"

There were chuckles from around the room. "But Sheila, that doesn't help us figure out how to change it!" said Barry, a burly fire fighter. "Everyday I see people slipping away, dying, because of this 'follow the leader' thing. I can't even get my folks to come to these meetings. They think we're all crazy!"

"I'm afraid we have to be patient, Barry," Sheila replied, her voice serious. "We think because we've seen this it should be easy, but I think it's just the opposite. If we knew exactly what it took to see cryotransport in a positive light, I feel very sure this alone wouldn't solve our problem. It might make it seem even more hopeless!"

"Suppose you put me on the deck of the sinking Titanic. I wouldn't be able to see the ship pointing nose down in the water, but I'd be able to tell everyone is upset. Now suddenly suppose I can see! Does that change the

condition of the ship? Not at all!" Sheila took a deep breath and continued. "Most people out there are doomed, like dinosaurs going into an ice age. Some of us are more like mammals, and we might survive! We all look pretty much the same on the surface, but underneath, in our minds, there's something that's very different from person to person. If we could see that 'something,' we'd have the impression that some of us are dinosaurs, some are mammals, and some..." she smiled, "are insects!"

After the laughter died down, one of the younger women asked, "What about Lloyd, Sheila? You can't seem to get him interested! Does this make him some kind of dinosaur? What do you think Lloyd's hang-ups are?"

Sheila was silent for a moment. Then a tear rolled down her cheek. She dabbed at it carefully, trying not to smear her makeup. Her voice was unsteady as she said, "Susan, Lloyd and I are very close in some ways, and I don't really understand it! It's so painful, I have problems dealing with it. No, I don't think Lloyd is a 'dinosaur,' but I'm afraid someday I'll lose him! I wish I could tell you how that fits in with the dinosaur example!"

The meeting took up one business item after another, and before long it was over. Susan asked Sheila if she'd like to go out to dinner, and the two of them left together.

Later, waiting for their meals to arrive, Susan said, "I

really didn't mean to put you on the spot, but I've got the same problem with Larry! I can't just walk away, but I don't know what to do! I'm afraid that if something were to happen to me, I wouldn't even be frozen! He's so antagonistic about it I can't bring the subject up, yet in every other way we're very happy together! He's probably upset I'm not home now, even though I told him I'd have dinner out and would be okay. You seemed to understand this so well I thought maybe you could help!"

Sheila touched her chin for a moment. Her forehead wrinkled slightly in a puzzled way, and her face reflected a mixture of curiosity and humor that was uncommon among even those who had their sight. Then she said, hesitantly, "If you wanted to see through a very long, narrow tube, you'd have to have your head in just the right position, wouldn't you?"

"Sure," said Susan, "but..."

"So if your eyes weren't lined up just right, you'd miss it!" continued Sheila. "In my case, after I lost my sight, I became desperate to see again... tranquilizers for almost a year. Finally, it was the hope of living long enough to see again that got me interested in cryotransport. What about you, Susan? Is there some kind of special 'lining up' that took place in your life about the time you got involved?"

Susan looked at her hands for a moment, then glanced up at Sheila. There was something at the edge of her mind she could almost put her fingers on, but it seemed to keep slipping away. Then she had it.

"My father died six months before I joined," Susan exclaimed suddenly. "He was only fifty six! I went to the cemetery each day for months! He'd slipped away from me and I was very angry about it. Then, without really connecting the two things, I saw a TV interview on cryotransport, and that was it! Do you suppose each of us has a similar sort of history?"

"That's hard to say!" said Sheila. "Jay just read Ettinger's book and was off and running. Did he have some other experience too? We don't know! But whether it's a special viewpoint or whether it's something that happens to us, it's very rare. How do we get any good out of it? How can we help others see it?"

"Maybe we have to reach out for those special viewpoints in some other way?" said Susan in a wondering tone. "Maybe we have to create situations in people's imaginations that help them understand it without a personal disaster? Suppose we got people to imagine a loss of some kind, very personal, and then brought up cryotransport?"

"I don't think so!" said Sheila, shaking her head, smiling. "People protect their feelings too well! They'd smell that and close up like clams. Maybe it's not too different from 'dinosaur' and 'mammal' after all?"

"I don't want to leave Larry," said Susan, "but I can't give up my chance to be around to see the future either! You have the same problem! What are you going to do?"

"I don't know," said Sheila, "but you're right. Eventually,

something has to change!" She considered her own situation and was dismayed. Unlike Susan, she was very dependent on her husband. "I'm thirty-five, in good health," Sheila said. "For now, I guess I'll have to keep my fingers crossed. I'm sure Lloyd would do what he could to cooperate. He knows it would mean more to me than anything else, if something should happen. I'll just have to live very carefully!"

The months passed, the meetings came and went, and it seemed as if the same discussions took place over and over. Sheila's roses bloomed, then withered in the autumn, and bloomed again the next spring. By then, though, they were about to move. Lloyd had found a home on a hill overlooking the ocean, and royalties from the patents made it no trouble at all. After the move, Sheila planted roses and relished the roar of waves below, the delicious smell of sea air, and the cries of birds whirling and diving above the water.

Two things troubled Sheila. The meetings were difficult to attend, and Lloyd seemed to be tiring more easily. He had headaches frequently; his appetite was waning. One evening in bed, in the darkness, Sheila ran her hands over Lloyd's forehead and was shocked to feel a cool moistness. "Are you all right, Lloyd?" she whispered. Lloyd replied he was OK, but Sheila began to worry. Lloyd was not a complainer, and she felt he might be getting ill without realizing it.

"I'm really concerned about him, Susan," she said, after the next meeting. Susan had been making fifty-mile round trips to take Sheila to the meetings, and now was even more worried about Sheila being so far away, with someone who might be in danger.

"Isn't there anything we can do to get him interested?" Susan asked. "Do you ever talk about long range things at all?"

"Very seldom," said Sheila. "How I'd love it if we could! But he's always been interested only in his inventions, and they're the kind of things that take just a few months. Sometimes I think he's never looked very much further ahead than that!"

One night, Lloyd was particularly silent. In bed, Sheila could hear that his breathing was irregular and labored. "Are you sure you're all right, Lloyd?" she asked softly.

"Lloyd? Lloyd?" A choking sound came from Lloyd as he tried to speak, but couldn't. He gasped; Sheila pictured he was trying to sit up but was unable to do so.

Sheila reached out. Lloyd was chilled, trembling, soaked with sweat. "Lloyd!" she cried. "I've got to get help!"

Sheila reached for the phone, but suddenly wasn't sure how to call for help. She dialed Susan's number without thinking, and was startled to hear her voice at the other end.

"Susan! I dialed your number by mistake," Sheila said. "I should have tried to call the fire department, I guess. Something's wrong with Lloyd! He can't even

talk and doesn't seem to be breathing well! I'm terrified! Can you help call an ambulance?"

Susan panicked. "I'll call Jay," she cried. "He'll know what to do!" She hung up and rang Jay's number. "Sheila's husband is having some kind of medical crisis," she blurted. "I know he's not signed up, but we have to do something!"

"Barry's an EMT in the fire department near there," Jay said. "They'd handle this anyway! Let's call him, and then I'm going out there, too! Sheila's blind and under stress! We don't want something happening to her in the midst of this! Hang on, I'm going to do this with a conference call. You'll hear me dial!"

"I'm going too!" said Susan. She noticed, trying to dress, crawling out of bed toward the closet hanging onto the phone, that Larry was stupefied, dumb-founded.

Larry went along, saying he didn't want Susan running off alone in the middle of the night. When they drove up to Lloyd's and Sheila's place on the bluff overlooking the sea, there were so many cars Larry supposed a party was going on. They parked, hundreds of feet back down the driveway, and walked to the house.

Barry had called in a second rescue unit, and Jay had arrived just after the first unit pulled up. A number of other members had found out what was happening from Jay's wife and weren't going to let Sheila see this

through by herself. The house was practically crawling with paramedics and cryonicists when Larry and Susan walked in. There, in the living room, in the middle of it all, looking much better, was a very astonished Lloyd.

"We'd better take you to the hospital for an exam," said Barry, after things settled down a bit. "It's pretty clear you've had a heart attack, and we want to be sure you're fully over it!"

"Okay," said Lloyd, still pale and weak. "Is somebody going to stay with Sheila?" He looked around the room. "I never knew you had so many friends, Sheila!"

"They're more like family," Sheila said, tears running down her face, "but I'm not staying here! I can go along, can't I, Barry?"

"Of course you can!" said Barry, smiling. "You can ride with Lloyd. I'll bet you're not going to be alone at the hospital while you're waiting either!"

Lloyd wasn't the only one who was astonished. Sitting in the waiting room at the hospital, Larry was bewildered by all these people who had miraculously appeared in the middle of the night when trouble arose. "If something had happened to me?" he asked Susan later, on the way home.

"It probably wouldn't have been quite the same," Susan said. "We could imagine what it would be like for Sheila, and that's why so many of us rushed out there! But Sheila's right; in many ways, it's like a big family! There's only a few of us, and the rest of the world hasn't the slightest idea of what we're all about! If we don't take

care of one another, who will?"

Larry was silent the rest of the way home. The next day was Saturday, and Susan noticed he was still very distant. Suddenly, Larry got to his feet. "I'm going to see Lloyd," he said. "No, you just stay here, Susan... please! I want to go see him by myself!"

No one knew just what Larry and Lloyd said to each other that afternoon, but they both started coming to meetings after that. Lloyd became a fanatic about health food, and Larry signed up for a paramedic course. It seemed, a year later, as if they'd been members as long as anyone could remember.

Sheila and Susan began to spend more and more time together. One afternoon, waiting for Susan to arrive, Sheila found herself sitting on the patio overlooking the sea, listening to the waves rolling on the beach below, holding a rose in her hand and stroking its soft petals. The happiness in her seemed so intense she felt she would burst. Then she noticed a peculiar sensation, as she raised her head to the sound of the seagulls. It was as if there were more light.

Sheila blinked her eyes furiously, and the intensity of the sensation increased. There was movement in the sensation, and she closed her eyes again and rubbed them, then blinked them open once more. As if by magic, the movement before her eyes resolved into blurry seagulls, then into sharp, white birds sailing

lazily against a background of deep blue sky with puffy clouds so bright she could barely stand it. She glanced downward and was giddy with the sensation of endless greenish-blue waves stretching to the horizon. She almost screamed, then clasped her hands to her mouth. It would startle Lloyd, she thought... I've got to just take each second as it comes!

Turning, Sheila saw the door to the patio open. A stylish brunette stepped out of it. Then she realized, it was Susan! Fascinated, Sheila watched as Susan walked daintily down the brick steps, her broad-brimmed hat shading her delicate features. She's here to spend another afternoon with me, thought Sheila.

Susan had a strange feeling as she approached Sheila. It was the perceptiveness of Sheila's eyes! "Oh my God!" she cried, as she realized that Sheila was looking at her. Tears began to run down her face. The two of them held each other for minutes, before stepping back to look once more.

"Let's get Lloyd and go down the stairs to the beach!" Sheila finally laughed. "I've never seen it before! I want to go running in the sand! See sand swirling in the water! Come on, Susan, I've never even seen Lloyd's shop since before he started doing robotics, years ago. I can't wait!"

Lloyd heard excited voices outside the workshop door and suddenly Sheila burst in, closely followed by Susan. "What are you so delighted about, Sheila?" he asked. "And why do you have your eyes all squinched shut like that?"

Sheila shook her head, eyes tightly closed, smiling so happily Lloyd found himself smiling also, without even understanding why. Susan was having trouble controlling her laughter, but managed to say, "Lloyd, just for a moment, close your eyes. Sheila wants to show you something!"

Lloyd closed his eyes obediently, still smiling. Then Sheila tiptoed over to him, opened her eyes as widely as she could, and flung her arms around his neck. "Okay, Lloyd, you can look now," she giggled.

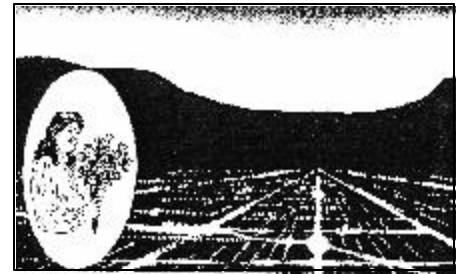
Lloyd opened his eyes. There was Sheila, grinning and staring into his eyes nose to nose, in a focused way. As he finally realized what had happened, Lloyd

felt his knees give way underneath him and the two of them collapsed on the floor, hysterically laughing and hugging each other. After a moment they sat up, gasping for breath. Susan sat down on the floor with them, and for what seemed like hours, both Lloyd and Susan looked at Sheila, as she glanced back and forth wordlessly from one to the other, beaming impishly and wiping her eyes.

Gradually, Lloyd's expression became more serious. He stood, took Sheila's hand, and helped her up. Susan rose too, and the three of them walked out onto a deck overlooking the ocean.

Sheila leaned back in Lloyd's arms, the brisk sea wind on her face, and felt her mind

asking 'what now'? She sighed, and after a long moment said decidedly, "I've often wondered what I'd do when I could see again. Now I know. There's blindness about death out there that afflicts the whole world. I'm going to end it, once and for all. Don't ask me how, right this minute. I just know this job is mine. Watch out, World! Here I come!"



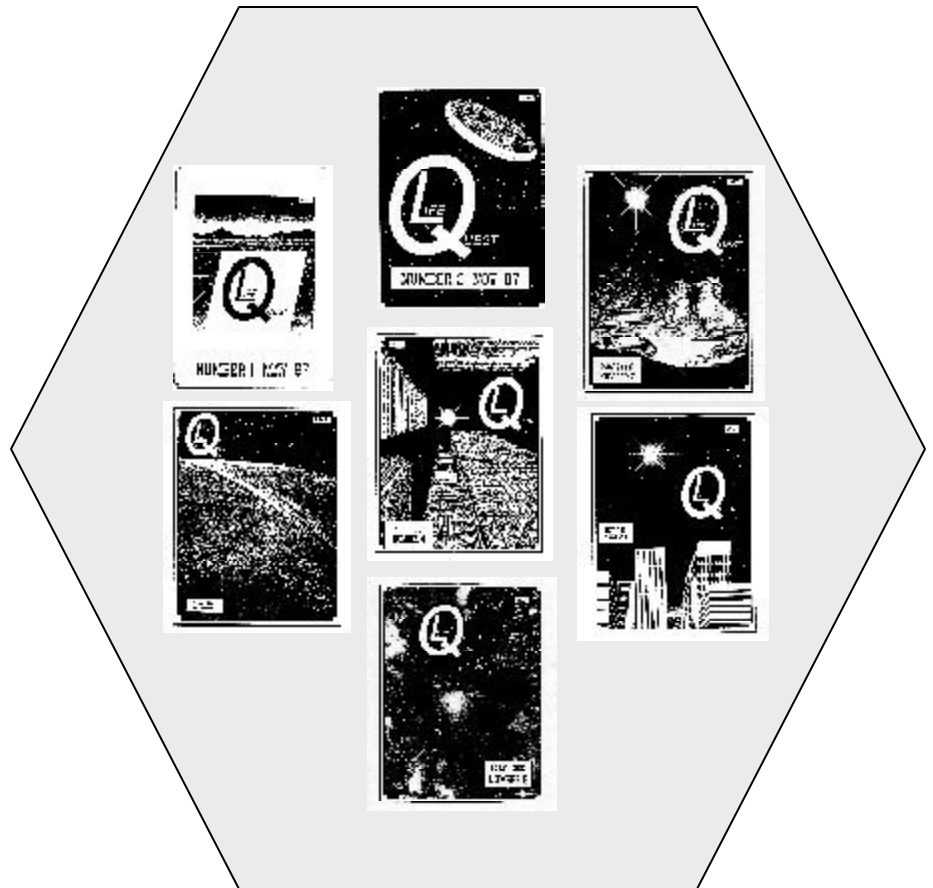
BACK ISSUES OF *LifeQuest*

If you're enjoying these stories, you'll be happy to know that issues #1 and #2 of LifeQuest are already available on Alcor's website, under "links." For ease of finding them, the URLs are:

[http://www.alcor.org/
lifeqst1.htm](http://www.alcor.org/lifeqst1.htm)
and

[http://www.alcor.org/
lifeqst2.htm](http://www.alcor.org/lifeqst2.htm)

Issues #3 through #7 will, with time, be reprinted in Cryonics Magazine, but an influx of new fiction could make this a drawn-out process. If you would like to see the back issues posted to Alcor's website more quickly, let us know. We try to give first priority to projects we know will make the most Alcor Members safest and happiest.



The Donaldson Perspective



Just How Good Has Been Our PUBLICITY?

by Thomas Donaldson, Ph.D.

This column centers not on a statement but on a question. I, just like many cryonicists who have been involved in cryonics for a long time, have had the *repeated* experience of talking to reporters or even ordinary people and finding them all asking questions that you yourself and others too have answered repeatedly... and with almost the very same wording. When I last lived in Australia, I found myself in just such a situation, as if the standard reporter or newsperson was fine at asking questions but forgot only 5 minutes later just what your answers had been.

We'd all like to know how many people have an interest in cryonics. After all, those people may actually *join a cryonics society*... and so help us in our own efforts.

But it's not enough just to ask how many people have an interest in cryonics.

If someone has never even heard of cryonics, we come to them as if from some quite different world. They will naturally start as quite skeptical about anything we say; since standard scientific periodicals such as *Science* or *Nature*, and even those journals, such as *Thanatology*, looking at common ideas about death, barely mention cryonics, their skepticism would actually be well-founded

(within their own knowledge). When they learn how (relatively) expensive suspension may be, if anything their skepticism will increase.

Moreover, those who have some quite false beliefs about cryonics will hardly be favorable. The belief that Walt Disney was frozen, for instance, implies that cryonics is only for the famous and important, not a belief likely to gain many recruits; the belief that cryonics societies are businesses will make many people come to us with lots of suspicion. Yet these are only the relatively minor misconceptions. I will not discuss any much more negative beliefs. Even if you're honest, someone who believes you're a practiced con man will hardly listen favorably to anything you say. Anyone who believes you to be deluded will hardly listen either ... though a few may decide to try to get you out of your delusion and convince you of the Truth.

To really gain an idea of just how far along we are, we need not just the number of interested people but also some idea of what common beliefs *are* about cryonics. How have public attitudes changed in the nearly 40 years in which the basic idea of cryonics was first put into action?

We could hardly find that out

with only a few questions. As a set of possible questions, we have:

- Do you see the future as better, worse, or the same as today?
- Have you heard of cryonics?
- Can you define cryonics?
- Who has been suspended?
- How many have been suspended?
- What is a cryonics *society*?
- Who joins cryonics societies?
- Can you name a cryonics society?
- Do you personally know any cryonicists?
- What do cryonicists think about *aging*? Alzheimer's or other brain destruction?
- What does cryonics cost?
- How do cryonicists pay their cost?
- Should we allow cryonics? If not, why not? If so, why?

Certainly anyone already interested in cryonics can answer these questions.

Yet some unknown number of people might BECOME interested if they came to understand just what we're doing. That understanding takes a big step towards actually considering whether or not to actually join. To simply ask how many are already interested ignores such people entirely.

Yes, in the short term we can hardly expect to convert the world to cryonics; yet it remains impor-

tant to find out just what people believe about cryonics in the first place. Just what has all the publicity about cryonics done to common beliefs? Some of these people, once freed of their ignorance, may well come to join.

Not only that, but answers to such questions will also tell us just how many people see us with suspicion, and the smaller number who not only see us with suspicion but may actually try to get politicians to implement laws AGAINST us. The proportion of people who feel HOSTILE to cryonics has been important even early on. It was just that hostility

which made the Society for Cryobiology try to prevent cryonicists from joining, something which has hardly helped us attain our goals.

In this context any such general poll should not only give us people's opinions but also tell us something about their position in society. We know that cryonicists tend to concentrate around a few major centers in the US. Do those centers also contain those who know more about cryonics generally? How many people hostile to cryonics do they contain?

Simply supporting the science that will (I believe, with support,

SOON) allow us to successfully suspend brains will not be enough. The ability to reversibly suspend brains (or even whole bodies) will not bring us to *cryonics*. In cryonics, we advocate suspending brains whenever there is a brain to suspend, so that if someday a cure for such a patient can be found, he or she can use it. We'll never know just how far future research might go.

And hence no amount of science, alone, can support cryonics itself.

And since we inevitably live in a society, it will help us to know just what others know or think they know about cryonics.

Review: book

THE COMPUTER AND THE MIND: AN INTRODUCTION TO COGNITIVE SCIENCE
2nd ed., 1991, by P. Johnson-Laird

Reviewed by Thomas Donaldson, Ph.D.

In the 2nd Quarter 1999 issue of *CRYONICS* I reviewed two books by Steven Pinker, both of which attempt to describe cognitive science and both of which suffer from several major faults. The book I review here, by Phillip Johnson-Laird, also describes cognitive science for readers unfamiliar with it, and does far better at that task, too.

Though it remains true that some researchers believe that such studies will remain premature until we understand much more about how our brains actually work, Johnson-Laird (JL for short) shows much more modesty than Pinker in his exposition of what such studies might achieve. Most important, he deals far better than Pinker with one central issue in such studies: at what point do computers become valid models of how our brains work in the first place?

Most cognitive scientists now use the model of a **COMPUTER** as a means to understand how our brains work. Some limit use of this model to particular issues, while others use it universally. With such a model, the questions of just how our brains work turns into one of finding the algorithms (and from them the programs) describing a brain working. A fundamental issue in such a method comes from one simple truth: programs running in computers will inevitably involve activity with **SYMBOLS**, while it's far from obvious that our brain **ALWAYS** works only with symbols. Even the simplest action in the world cannot be done purely symbolically: to get up after sitting down isn't just a matter of thought, but of action too.

A bit of thought tells us that even with language and thinking we cannot rely solely on symbols. To understand "tiger" it helps tremendously to meet a real, living

tiger. The brain processes which make such connections by their nature **CANNOT** be symbolic. In Chapter 10 of his book, JL describes how he and other cognitive scientists use neural nets to carry out that part of our thinking which is **NOT** symbolic (he gives two names for this general idea: connectionism and parallel distributed processing, using the term "neural nets" almost never.)

But he also tells of the evidence that neural nets may not be sufficient, and that on top of them there must also be systems which work on symbols. He's also quite honest about these ideas: right now, the main kind of neural net used by cognitive scientists uses a method of backward error propagation (BEP). BEP has no obvious connection to how our brain works.

We may still need neural methods to deal with symbols, but at just what points use of symbolism replaces some kind of neural

net remains unknown.

Although he does not mention it, neural nets using other methods may be also capable of wider processing inaccessible by BEP. (McClelland and Seidenberg, both advocates of neural nets, reviewing a later book by Pinker, point out the existence of neural nets capable of learning at higher levels than BEP, including the application of "rules.")

To understand how our brain works IN OUR BODY involves much more than just thinking. We need to know how it controls our bodily motions, how we interpret what we see (or smell, or taste, or touch), how we understand language, and how our emotions work. Each of these issues fundamentally involves an understanding of just how much of our brain consists of modules working in parallel. We're not aware of their working because our awareness remains sequential, and for that reason can only know some very abstract results of all that parallel processing. Two kinds of action have received a lot of study by cognitive science: just how we move our limbs, and how we see. Parallelism is common to both, even though we almost totally fail to experience it. As a general model of how we work, Johnson-Laird suggests the existence of one sequential process controlling very many parallel ones, at the highest level (a common idea among many cognitive scientists).

The chapters in JL's book go successively through all the different questions about how we think and act, beginning with vision, moving on to learning and memory, then to action, cogitation, communication (by now no one believes that we learn language totally without presuppositions about its structure, though he states frankly that the exact structures controlling language remain

unknown [1]). And finally, he discusses issues such as free will and intentions, our needs and our emotions. In each case he not only discusses what cognitive science has found out, but also the questions which no one has yet answered. I cannot summarize his book in this review.

However I WILL discuss Johnson-Laird's ideas about that one sequential process that guides all the parallel activity in our brains, the one sequential process which gives us our awareness, including awareness of our emotions. (He refers to our conscious mind in computer terms, as the "operating system" of our brain). In human beings it allows an arbitrary number of levels: conscious of the world and yourself, conscious of your consciousness of the world and yourself, conscious of your consciousness of your consciousness... (This can continue until the thinker chooses to stop).

He also points out that some cognitive scientists believe that with the right methods a Turing machine might be conscious of its own methods, but disagrees on the ground that indefinite regress does not work with such methods. The process is INDEFINITE rather than infinite because we ourselves are finite.

However this ability to think about our own thoughts means that we can consider consequences of our actions, choosing those which seem best to us, and in this sense have free will (contrary to the suggestions of some). Emotions, in Johnson-Laird's terms, play a major role in both our awareness and our behavior even though they aren't beliefs. Nor are they symbolic. However they DO link closely with our memories, coloring not only our beliefs but also our choice of beliefs. He sees this effect of emotions as basic to

ANY behavior in the world; without them, we cease to care about either our own or others' behavior. It is that caring that gives us our awareness.

I personally think that levels of consciousness become important here. It's not enough just to work out consciousness in human beings alone. If we truly wish to understand it, experiments on animals may prove critical.

Even in humans, some level of consciousness can occur with no symbolic thoughts at all; even in animals (such as chimps), the possibility of some symbolic consciousness may also exist. Unfortunately JL describes only his ideas of HUMAN consciousness. And as with any book dealing mainly with cognitive science, whether or not it truly tells how our minds work may depend on just what neuroscientists finally discover. In fact, one major point JL makes about different KINDS of awareness comes directly from recent neuroscience. Yet JL's modesty saves him from any accusations of shortsightedness. "The idea that we work like computers is right now our best way towards understanding," I hear him saying. "Someday that may no longer hold true, but for now I use it".

Finally, Johnson-Laird not only provides references but also discusses briefly, at the end of each Chapter, just how his references relate to its subject. These discussions help us to independently explore the subjects he discusses and form our own opinions about his suggestions.

[1] JL's opinion here differs strongly from Chomsky's.



From: <http://web4.movielink.com>

Bicentennial Man

starring Robin Williams



Reviewed by Fred Chamberlain

In this film, themes of aging, romantic love, death, identity, and sentient non-humans are united in a startling and touching way. As a robot, Robin Williams, gradually acquires more and more human characteristics, taking us through two hundred years of life experience as part of that.

For many decades, Robin (as the robot) bears the frustrations of seeking a “significant other,” first among his own kind. Then, failing success in this quest, he crosses the line in bionic transition, reaching out to a human. Later, he has dilemmas like those created by Robert Heinlein in “Time Enough for Love,” where Lazarus Long says goodbye to his beloved but aged wife Dora, and then names his intelligent starship computer “Dora” (always to have the personality of a little girl).

Linda Chamberlain and I had been told that this film ended in a negative way, and that we would not like it. The ending *was* sad, but that does not alter the value I think the film offers those of us who want to live on indefinitely. Tragic endings often drive home a point better than happy endings, and people who feel their world

view is safe (they are not in danger of being outclassed by immortal robots) may be more open to the idea that aging is a terrible thing and should be vanquished.

The terrible and rapid impact of time on humans is a key aspect of the film. The robot encounters a tiny girl, in its first contact with a human family. One wonders if this might be a human female with whom a close bond will form.

As things work out, before that point is approached, the tiny girl progresses through the various stages of her life, into her 50s and 60s, while the robot (taking his first steps toward “us”) sees aging begin to ravage a human for whom he is just beginning to deeply care.

The final parts of the film go further, portraying that at least in this special case, being condemned to always watch those he loved grow old and die would be so painful that life for the robot as a “survivor” would be of no value. In the context of the story, and from the viewpoints of many who see the film, the ending of the story and the choices made seem quite plausible to me.

“Bicentennial Man” gives us a dramatic picture of how aging can

destroy us. There is a beautiful portrayal of the best we might hope for, of the advances in robotics. The film also shows in many ways how people can lose the chance to love and be loved; this alone would make it a masterpiece of drama.

This is an “all digital” film from Disney, the first at this level, with great special effects. You could enjoy it solely for the technical aspects. Many viewers may miss the full depth of the message that life is fragile and very precious.

If you really care about some person you want to be with in the future, I suggest you take them to this film. (You might wish to reassure them that interventions for aging are likely soon, and that death as the “natural order” is not necessarily *your* viewpoint!)

With this one caveat, the film *Bicentennial Man* will take you into the future, far eclipsing the usual “Space Opera” of ships traveling faster than light, with crews who age and die at the same old, reliable rates. This is, in my opinion, an excellent appetizer for the anti-aging interventions we are all anticipating. I hope you will like and enjoy it as much as I did.



NEW SYSTEM FOR PATIENT MAINTENANCE AT ALCOR AND PREPARATIONS FOR Y2K

by R. Michael Perry, Ph.D.

A critical problem that a cryonics organization must face is that of maintaining its patients for the indefinite future. Today this is handled by storing them in insulated containers filled with liquid nitrogen. The cold liquid must be replenished regularly, and this becomes the major part of the maintenance cost. The cost is usually met by interest income derived from assets of the maintaining organization, based on funding provided by the patients at or before their suspension. The lower the maintenance cost, the better the chances of long-term survival—both for the organization as a whole and for the patient individually. A lower cost will have other benefits too, such as helping to keep the cost of cryonic suspension lower over the long haul, which could result in more people signing up and benefiting.

At the same time, there is the usual potential trade-off we want to avoid, of a compromise in quality, something that might be expected to occur with any cost-cutting measure. But cost-cutting need not involve such a compromise, and indeed, there are special circumstances where the reverse occurs and an *increase* in quality is obtained, as can happen with automation. Happily, that appears to be true also with the new system

of patient maintenance that has been put into operation at Alcor.

Under the new system, liquid nitrogen is received and stored in bulk in a reservoir on the premises, and patient dewars are replenished from it on demand. The reservoir itself, a pressure vessel of about 1,600 liters capacity, is refilled by deliveries from a supplier. These deliveries, however, will be much less frequent than before—perhaps every two or three weeks rather than weekly. When the system is fully operational the liquid nitrogen will be loaded directly into the pressure vessel from the supplier's

delivery truck. Meanwhile, nitrogen will continue to be delivered in 180-liter supply cylinders, which will now be emptied into the pressure vessel. When needed to refill the patient dewars, the liquid nitrogen is released from the pressure vessel and travels through a system of pipes rather than being emptied from the much smaller 180-liter cylinders. Multiple fills can be done at once, and this should save both work time and possibly liquid itself—though that remains to be determined. The changeover to full bulk delivery is expected to take place about the middle of February.

The preparations for the new system have had a second objective—to “dig in” in case there was any serious problem over the arrival of the year 2000 (the fabled and oft-dreaded Y2K). Supposedly, many computer-based systems, particularly those using older chips, were unable to cope with a year ending in “00” and might experience catastrophic failure. On top of this there could be substantial social unrest or terrorism over the arrival of a new millennium and all that that seemed to imply in certain people's minds. Unfortunately, the extent or gravity of this whole issue could not be predicted in advance, even though to many of us it didn't seem *likely* that dooms-



Mathew Sullivan, originator of Alcor's new patient maintenance system.



Hugh Hixon adjusts fittings on top of the pressure vessel of the new system.

day was approaching, and so soon. So like everybody else, we just tried to be as well prepared as we could. Fortunately, no bad problems developed, and we can now get back to tasks, both old and new, that do *not* involve the changeover of digits in the calendar year!

This report will briefly survey the decision-making and construction that went into the new system, and basic details of the system itself. More information should become available as the remaining details are completed and bugs are ironed out.

CREDITS

It is important in any undertaking to give credit where it is due. In the case of Alcor's new patient maintenance system, the principal credit goes to Mathew Sullivan, who thought of the idea in 1997, planned the basic design, and worked steadily and persistently to get it implemented. Mathew reports that initially there was little enthusiasm for his proposed system, so that bringing it into being involved perhaps more in the way

of promotion and persuasion than raw engineering skills. It also involved some "segmenting" or breaking down the project into smaller subunits that could be completed piecemeal, such as eliminating the small and inefficient LR40 dewars as storage containers and installing liquid level sensors on the remaining containers. At the engineering level, however, we've been very fortunate to have the assistance of Hugh Hixon. Hugh had misgivings at first, like almost everybody else, but then became convinced of the workability of the system, and his expertise has been indispensable in constructing, assembling, and trouble-shooting the various components. Mark Connaughton assisted Hugh from time to time with advice and knowledge, drew up blueprints for the pressure vessel, and did engineering modeling. Fred Chamberlain's input was also useful, particularly because he made a good critic and devil's advocate for evaluating new design concepts.

Jim Amato, whose California-based company built the pressure vessel as well as many of the bigfoot dewars, must be credited. Also deserving of mention is Nils Tellier, consultant and CEO of NTCI, a local firm with expertise in cryogenic systems. Tellier confirmed the basic workability of the design that was adopted and drew up a detailed diagram that aided planning and construction. Bruce Cohen and Rusty Holder were instrumental in getting the armor plate in place. Alcor volunteer Jerry Searcy deserves sincere thanks for his useful assistance to Mathew and Hugh in their long labors to get the system up and running, particularly on Dec. 10 when so many tasks needed doing. (I too was busy that day and other

times, documenting and taking pictures.)

PRINCIPAL FEATURES

The main purpose of the new system is, as usual, the indefinite preservation of human and pet patients and tissue specimens at liquid nitrogen temperature. ~~Supporting this are~~ *security features* that increase the level of preparedness for emergencies and improve the chances of the long-term success of the whole operation. In addition there are *safety features* that decrease the risk to personnel involved. New features in some cases created the need for further features to maintain the *same* level of security and safety, but I think overall that improvements in both have occurred.

PATIENT MAINTENANCE, THEN AND NOW

Figure 1 shows the patient care bay before and after the changeover to the new system. The large concrete vaults that used to house the neuro vault dewars are now gone, which frees up space for more dewars. Two more bigfoot dewars have been added, numbers 7 and 8. More significant as Figure 1b shows, Bigfoot 1, which was formerly unused, is now in service in a special way, as a housing for the pressure vessel that will henceforth be used to deliver liquid nitrogen to the other containers. A system of pipes and valves connects these other containers with the pressure vessel, as indicated schematically in Figure 1b, with additional details in Figure 2. It is now possible to fill all the patient containers at once.

PATIENT SECURITY

Protection against earthquakes was a principal motive for housing

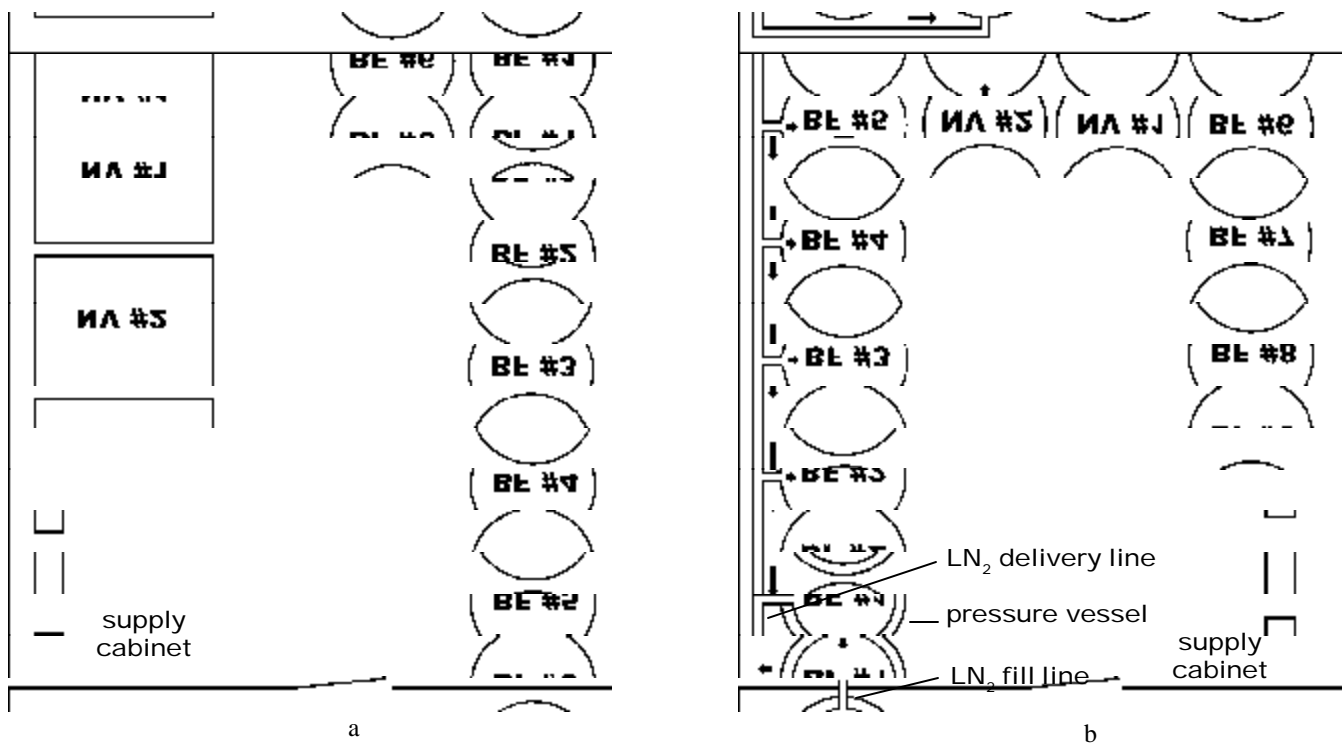


Fig. 1. Patient Care Bay, top-down view, (a) before and (b) after the recent transition to the new patient maintenance system. Dewars containing neuros or head-only cases were stored in concrete “neuro vaults” (NV #1, 2, with #1 currently unused). “Bigfoots” (BF #2-5, with #1 and 6 unused) additionally stored whole-body patients. In (b), which shows the present setup, the concrete enclosing vaults are gone with only the neuro vault dewars remaining. (NV #1 is still unused.) Two more bigfoots have been added, with #1-6 now in regular use. (Bigfoot 1 is used to contain the pressure vessel while Bigfoots 2-5 store patients and specimens as before.)

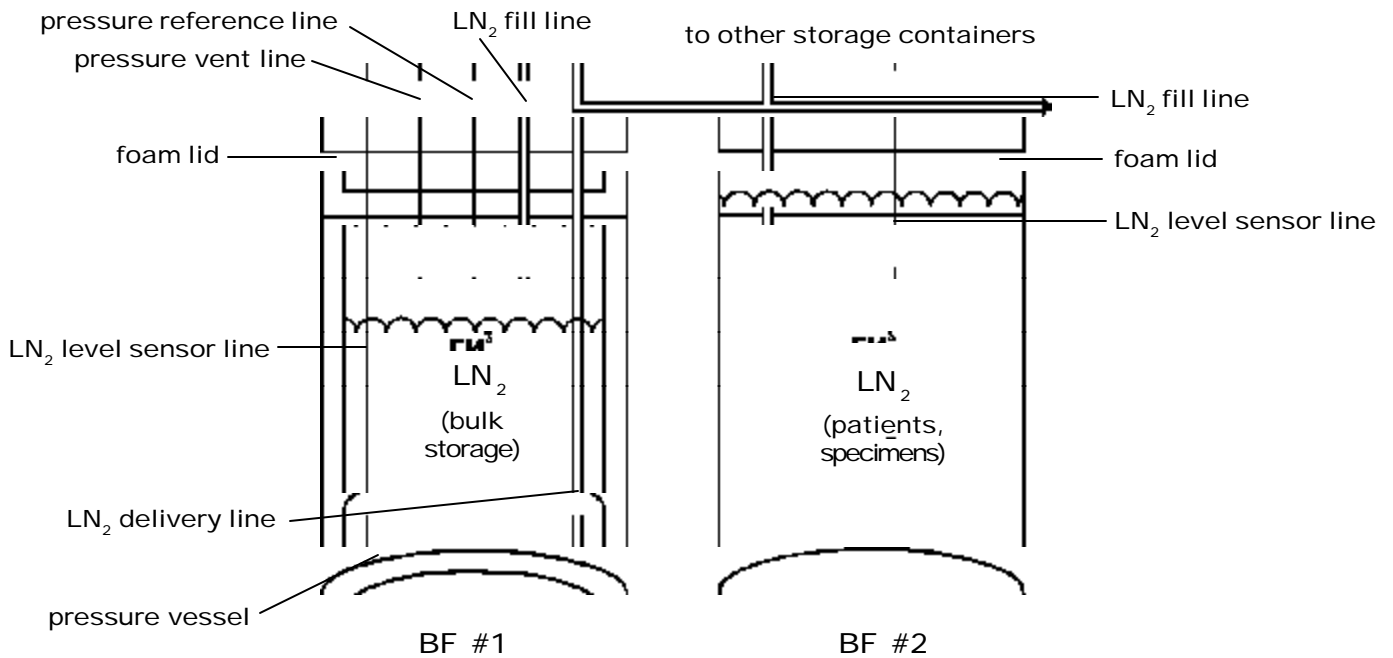


Fig. 2. Side view of bigfoots 1 and 2 in Fig. 1b, showing additional details of pressure vessel and connecting lines. (These are somewhat schematic; actual, scaled dimensions will differ and include other details not shown.) Details of BF #2 are repeated in other storage containers, which are serially connected.

neuro dewars in vaults, back when Alcor was in California. Earthquakes are not considered a problem in Arizona, but the vaults also provided protection against fire, vandalism, and other physical destruction. The fire danger should be small in view of the large, mainly concrete structure the patient dewars are now housed in, which also has a heat-activated sprinkler system. The other dangers remain, however, and armor plating has been installed along one wall to replace and enhance the shielding formerly provided by the concrete vaults.

But probably the greatest challenge to patient security is not physical disasters but simply the difficulty of keeping the caretaking organization (or its successors, should it fail) going long enough. It must deliver its patients to the future that will be able to repair them—assuming such repair proves possible. Cost reduction thus is important, and here the new system offers a clear advantage. Mathew estimates that bulk delivery will cut the cost of liquid nitrogen nearly in half, which will have the long-term effect of helping ensure that Alcor (or actually its Patient Care Trust) remains financially viable.

In an effort to further reduce cost, an extra-tall bigfoot dewar (#8) was obtained. (This idea was pioneered a few years ago by CryoSpan in California.) It is 12 inches taller than the other bigfoots and has a lid with 24 inches of plastic foam instead of the usual 14 inches. The thicker lid, it was reasoned, ought to insulate better and thus reduce the boil-off of liquid nitrogen. Preliminary tests indicate a reduction in boil-off of about a liter a day, which would be sufficient to pay for the cost of adding the extra height (\$500) in about 3 years.

SAFETY FEATURES

The new system is an upgrade of the previous system, but that carries some downsides too. Among these is the problem that liquid nitrogen is handled in greater quantity than before, especially when multiple dewar fills are being done. Liquid nitrogen is constantly boiling to the atmosphere and converting to nitrogen gas.

Nitrogen is non-toxic and indeed, it already makes up four-fifths of the atmosphere. It is not dangerous, *unless it interferes with the supply of oxygen*, and thus it is classed as a simple asphyxiant. (Any gas other than oxygen, which is vital to life, will also at best be a simple asphyxiant.) Resting quietly inside a well-insulated patient dewar, the boil-off of liquid nitrogen is low, but more boiling and release of asphyxiant gas occur during fills. To provide protection, a blower fan and an oxygen meter have been installed. The fan should vent the extra nitrogen to the air outside, but if this is inadequate and oxygen concentration falls below 19.5% (atmospheric level is 20.9%), an alarm will sound.

There is another, more mundane safety feature that has actually been in use for some time now, a transport cart for 180-liter liquid nitrogen supply cylinders. These cylinders stand about 5 feet tall and weigh more than 500 lbs. full, and around 200 lbs. empty. Normally they are handled in strong-arm fashion, by tipping them slightly and rolling them across the floor. (Needless to say, a smooth, hard, level surface is a must for this!) Accidents do happen however, and the transport cart has helped to reduce the chance of serious injury or damage should one of the heavy cylinders tip too far and come

crashing down. The cart, costing about \$400, was a generous gift from Jerry Searcy, and has been noted in Alcor's literature, but mention here is appropriate too. The cart will probably be used less in the future with the new bulk delivery system but will still be handy during a suspension, when nitrogen cylinders are needed for the cooldown.

PREPARATIONS FOR Y2K

In some ways the preparations for Y2K distracted from other tasks, but clearly this was beneficial to the system being constructed, inasmuch as a state of readiness had to be achieved by an early deadline—and it was. In addition to this, a large supply of liquid nitrogen, several thousand liters' worth, was stockpiled, in case there was an extended interruption in supply. The two new bigfoot dewars, each about 1,800-liter capacity, were filled with liquid nitrogen as a backup, and about 1,500 additional liters was stored in the pressure vessel. It should be noted that refilling the patient dewars from a reservoir has now become easier: the liquid is first transferred into the pressure vessel using a suction pump specially designed by Hugh Hixon. So, even though the emergency that the stockpiling was to guard against didn't develop, there will be no difficulty disposing of the surplus, and it will diminish additional needs over the next few weeks.



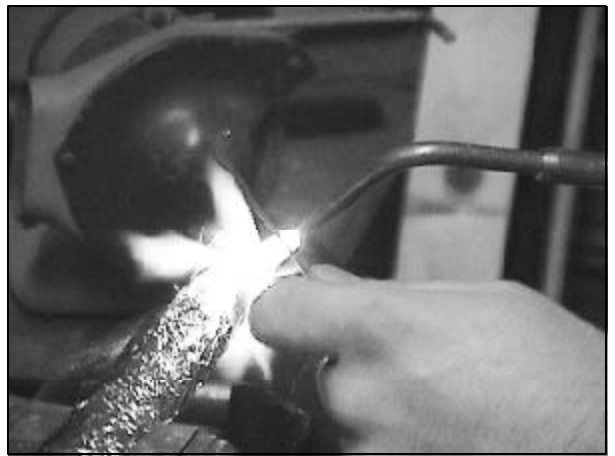
ADDITIONAL HIGHLIGHTS

(To conclude this report I've assembled some pictures showing highlights of the construction and other work that has been completed on Alcor's new system.)



Y2K Preparations. 20 180-liter cylinders of liquid nitrogen arrive on Dec. 10, 1999 (our normal amount was about 3 cylinders, delivered weekly) and are wheeled into the Patient Care Bay. Upper view shows the "sea of 180s" from atop one of the bigfoot dewars, lower view, from the front entrance.

Nov. 24. Welding work in Alcor's machine shop to create components for the delivery system.



Dec. 2. Mathew does assembly work on the new system in the Patient Care Bay.

Overhead, the intake of the blower fan for venting nitrogen gas to the outside can be seen.



Dec. 10. Three important components arrive from a manufacturer in California: (1) extra-tall bigfoot dewar, given the number 8; (2) "normal" sized bigfoot, numbered 7; (3) the pressure vessel that will hold and deliver liquid nitrogen for the new system.





Still Dec. 10, and now there's lots to be done! Among the first things, bigfoot #7 is fork-lifted over to the open sliding door in Alcor's cooldown area and scooted on inside.



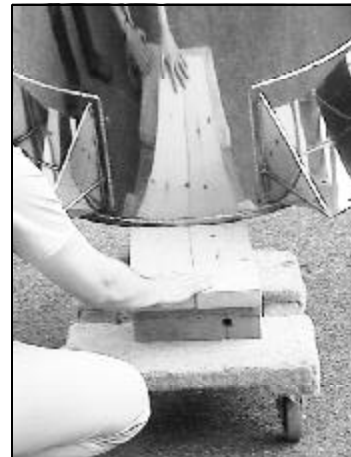
Dec. 10 is also the day of the big liquid nitrogen delivery for Y2K. Here a delivery man threads his way around the rented caterpillar tractor that is being used in hoisting the bigfoots and other heavy work.



The pressure vessel, in its lifting harness here, awaits placement in bigfoot 1, behind it.



That will be awhile however. Here is bigfoot 8 which, unlike 7, is too tall to go through the doorway upright.



At first there is a plan to tip it up and put it on rollers—but that does not look promising and is abandoned.



Instead, the 10-foot tall cylinder is just tipped way forward ... and it goes through just fine! Only problem now is getting it upright again.



“Experts” Jerry Searcy, Hugh Hixon, and Mathew Sullivan show how it can’t be done.



But Alcor Accounts Manager Joe Hovey says it’s easy—if you know what you’re doing.



Okay, time to get real, adjust some cables, lift and lower (what we’ve been doing all along, actually.)



Swing it on down, and ...(note we’ve put the wheels back on, too!)



Finally, there it is: inside, upright, standing tall, a silvery beauty shedding the last of its wrappings!



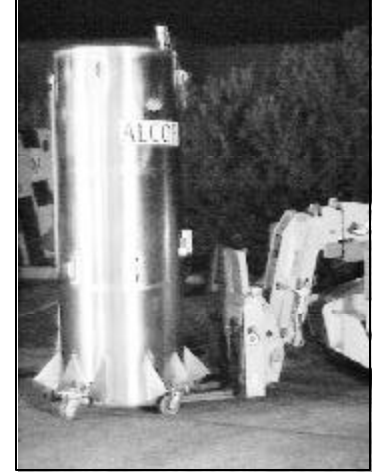
Meanwhile, we still have to deal with that pressure vessel.



Wooden slats are fastened around it to protect against contact with the container it’s going into.



Then it’s slowed very gingerly into its container (bigfoot 1), Jerry Searcy giving needed directions, Hugh Hixon handling the “Cat” as he has all through this long working day (good job, Hugh!).



It’s in (and it’s dark) but now we have to get the whole thing inside, with the pipes sticking up at the top.



Turns out it's just a hair too tall to slide on through the doorway without that awkward tipping. Removing the caps on the pipes might shorten the height just enough ...



Only 3/10 of an inch clearance—but it's enough! Soon we've got everything inside.



After that things get more routine—but there's still a lot of work to do. These pictures were made Dec. 15. The suction pump is being used to transfer liquid nitrogen from the bigfoot 8 dewar into the pressure vessel, watched by Alcor CEO Fred Chamberlain. Afterward, bigfoot 8 is refilled with liquid nitrogen, its thick foam lid resting on top.

[Added Comment by Fred Chamberlain:]

Hugh Hixon and Mathew Sullivan evaluated a number of "breadboard" configurations last summer, until time limitations of Y2K forced the choice of one of the designs.

The Patient Care Trust was in touch with this project from start to finish, authorizing increases in costs as needed. Work by Mathew

and Hugh rose to a fever-pitch in mid-December of 1999, with Y2K drawing near. At the same time, it was apparent that a working system had been developed.

The cost was far less than if the project had been contracted out. Mike Perry contributed in many ways. The documentation in his report (published here) represents the beginnings of a "Detailed Design and Operations Manual", to

be drafted and refined as operation of the system is optimized over the next six months or so.

Many others on the Alcor Staff and volunteers, as noted in Mike's article, played important roles.

*(Fantastic job, guys!
Alcor's 37 patients are
lucky to have you to
take care of them!)*

Cryotransport Case Report, A-1755, Part I

Third Party Anatomical Donor
Year of Birth: 1920
Date initiated cryotransport:
August 28, 1999

Report by: Fred Chamberlain
CryoTransport Manager
Alcor Life Extension Foundation
Scottsdale, AZ
November 30, 1999

Part I - Standby and Transport to Scottsdale, Arizona

(Condensed for publication in *Cryonics*)

Background History and Synopsis

Cryotransport can be broken down into four areas: (1) patient acquisition and initial biological stabilization, with transport to Alcor Central, (2) cryoperfusion, (3) cooldown and (4) long term care. This report, Part I of II, covers the first of these. Part II, in the next issue of *Cryonics*, will cover (2) and (3). Long term care (4) is just beginning.

The Patient was not a member of Alcor. The Next of Kin (of the Patient) was in the sign-up process for Alcor Membership and made arrangements to have the Patient placed into cryostasis as a "third party anatomical donation".

This is acceptable to Alcor if there are no indications that the Patient has rejected cryostasis. Alcor also was confident that there were no other problems (such as serious conflicts among family members) which might prevent the third party anatomical donation from taking place.

In August 1999, the Patient was hospitalized with apparent pneumonia. (To obtain hospital cooperation, Alcor agreed to confidentiality, not to name the hospital or the town in which it was located.)

By 8/26/99 the Patient's oxygen saturation level had fallen as low as 46. At the time Alcor was contacted, O₂ saturation level had been restored to nearly 80, by oxygen administration. This was still a very low value. Lymphoma was suspected, but not confirmed. The attending physician predicted mortality within 24 hours.

Administrative and Logistics Factors

Less than two hours after the initial contact, Alcor Directors had been contacted and consented to a third party anatomical donation. Funding and paperwork were to be accomplished incrementally.

Most of the administrative and logistics arrangements had to be completed in a period of about five hours, prior to departure of the last flight to Chicago for the day.

[Although there were special factors which gave the Alcor Board' confidence that in this case, rapidity of response was appropriate, the Board has now formally resolved that this cannot be a routine response of Alcor to requests for acceptance of third party anatomical donations.

As provided in Alcor's mission statement, its priorities are (1) safety of patients already in cryostasis, followed by (2) the capability to respond to members who already have arrangements.

Rapid response to a request for rescue of a non-member could be in conflict with these priorities.

In a future case of this kind, it is likely that at least an additional twelve hours delay would be required prior to Alcor's initiating a standby. From our knowledge of this case, such a delay might have prevented a team from being on-site, ready to initiate cryotransport, before the Patient's cardiac arrest.

Those who have not competed their arrangements in advance are at far higher risk that Alcor will decline to become involved or that its response will be delayed, in a non-member, third party anatomical donation case.

Even with "direct public service" through BioTransport, Inc., there will be no way to respond as quickly as if the Patient were a fully signed up Alcor Member.]

Due to the failure of pagers and cell phones to work in all areas, Dr. Robert Newport could not be contacted to deploy with the remote rescue team. Linda Chamberlain called many funeral homes in the Patient's area without success, trying to secure local support. Only minutes before leaving for the airport did she find one which turned out to be extremely cooperative and helpful.

[The mortuary provided use of their surgical facility far in advance, not knowing how long the standby might take; they provided a mortician and vehicle standby at the hospital, assisted with surgery for blood washout, helped with packaging and shipment support, and solved problems from hundred miles away, when an air-cargo office initially refused to load the Patient.]

ACTs Louise Murray and Russ Cheney were asked to deploy as part of the standby team.

They reached the airport (Los Angeles International) in time, Russ missed the flight due to an airline foulup, but found an alternate flight and arrived in Chicago an hour ahead of the rest of us.

Alcor Central Activities; Standby Team Travel/Logistics

At Alcor Central, Hugh Hixon and Bruce Cohen set up the operating room and prepared for filtering of perfusate. Two local surgeons, Jose Kanshepolki M.D. and Nancy McEachern D.V., were on-call. Other ACT team members were contacted to participate in the cryoprotective perfusion.

The standby team (total of four) regrouped at O'Hare International Airport, at about 2:00 a.m. Central Daylight Time and departed. Equipment taken with us included the PIB/SCD (Portable Ice Bath & Spray Cooling Device) Kit, Medications Kit, ATP (Air Transportable Perfusion) System, MHP (organ preservation fluid; 20 liters), and a Thumper (automatic chest compression device dependent on hospital wall oxygen or local acquisition of high pressure oxygen cylinders).

Travel time by highway was about five hours (the distance was slightly over 200 miles; light fog slowed us down; team members were sleepy). Our two cell phones proved valuable in coordinating the drive and later were indispensable in organizing the standby.

Near the Patient's hospital, a motel was located as a base of operations; 24 hours had passed since Alcor was first contacted.

Communications and Coordination

The Patient's Next of Kin (PNK) was contacted by cell phone and found to still be en route. Instead of arriving in Chicago, the PNK's plane was diverted and landed even farther from the Patient than the Alcor team. The PNK was expected to reach the Patient's location about noon. Team Members slept if they could, 1-4 hours. Since we were not yet in contact with the Patient's physician or relatives (except the PNK), we were at a standstill pending the PNK's arrival.

The PNK informed the team (by cellular phone) of an arrangement for a staff physician in the PNK's company to be present and (possibly) participate. In view of the difficulty we had experienced in contacting Alcor's primary team M.D., this was welcome backup.

During this phone call, the possibility was discussed that the washout procedure take place on the hospital's premises. With this idea in mind, the PNK called the hospital (again, from a cell phone en route) to propose this approach.

The hospital was *resistant* to the proposal. They made an urgent request for detailed information concerning our protocol, credentials of team members, and the extent to which hospital facilities and their personnel would be needed.

In the end, communications with the hospital by the PNK's staff physician led to partial cooperation. Without this, we could have been far more restricted in our procedures. Although the hospital finally allowed medications to be given without delay after cardiac arrest, they refused to allow use of

the Thumper (chest compression device), based on the fact that this could disturb other patients.

Preparations for Transport

By mid-afternoon (Friday, August 27, 1999, at about 4:00 p.m.) the PNK told us that the Patient was slipping rapidly and that we should prepare for a cryotransport as quickly as possible. Logistics work accelerated. Drawing medications began at about 4:15 p.m. At the mortuary, setup and checkout of the ATP took place. Readiness for a suspension was complete by 7:00 p.m. By this time, about 35 hours had passed since the first call came in to Alcor.

By 10:30 p.m., following brief meals in shifts, the team regrouped outside the hospital. The principal concern was the timeline. Based on the afternoon's outlook that cardiac arrest was hours away, all medications were drawn (except Streptokinase, because of its expense). Within 24 hours, our protocol would require discarding the old medications and redrawing them when a suspension appeared to be near at hand. At that point, we would already be arranging for more medications to be flown in, as a backup.

Nearing 40 hours with very little sleep, we began planning how to obtain as much sleep as we could, while maintaining enough on-site presence to start a transport if a sudden turn for the worse occurred.

Outside the ICU, the team reviewed the "First Ten Minute" protocol, assigning actions to team members and rehearsing procedures to make them go as smoothly and quickly as possible.

Changes in Support; Criteria for Decision-making

The PNK requested that any optional life-support measures for the Patient be stopped, so long as they did not cause discomfort, yet the hospital staff would not cooperate with this request until certain criteria were met. The criteria kept changing, ranging from “pupils fixed and dilated” to “pain unresponsiveness.”

At about midnight, a nurse from ICU informed the team that the Patient was unresponsive and they were about to remove physiological support, but they could not find the PNK. While a search began for the PNK, the last of the medications were made ready.

CPR, Medication, and Initial, External Cooling

The Alcor Team was finally allowed to move to a location close to the Patient at 2:10 a.m., when pronouncement was imminent. At 2:35 a.m. the PNK told the Team that the Patient had been pronounced, and we were permitted to begin our procedures. The PNK provided the times of arrest and pronouncement. Major events logged are as shown in Figure 1.

Remote Whole Body Washout

The Patient was transported from the hospital to the mortuary's field washout facility. There was no delay in removing the patient from the hospital inasmuch as the mortician was on standby throughout the critical waiting period from about 10:00 p.m. the previous evening until transport began at 2:35 a.m.

Times logged during the washout are as shown in Figure 2. The mortician assisting with cannulation was unfamiliar with medical cannula and the surgical instruments in Alcor's kit. For fear of friability of vessels, the cannula used were smaller than optimal. Thankfully, the washout went smoothly; brain cooling was effective.

The flow rates noted reflect less actual arterial pressure than measured, since pressures were measured upstream of the small cannula. While the flow rates were thus less than usually employed, they nonetheless produced a rapid bilateral reduction in brain temperature.

Alcor had been advised by a scientist at 21st Century Medicine, Inc., that lower perfusion pressures than in the past be used, at least in the cryoprotection phase, even at the expense of lower flow rates. In that light, the lower pressures may have not detracted, and could have been beneficial. As medications were able to be given immediately after pronouncement, coagulation was minimal and posed no significant obstacle. Except for initial problems with cannulation, the washout was uneventful.

One important observation: During recirculation, which was maintained for more than one half hour with rapid drop of temperatures in the brain, there was no evidence of tissue accumulation of fluids or loss of them, based on a static level in the venous return reservoir. Thus, although the cannula were maintained in position manually, leakage as might have occurred was undetectable.

When brain temperature on both probes dipped below 10°C and the remaining reserve organ preser-

Transport Timeline; Major Items - at Hospital

0235 Team notified in waiting room (down hall from ICU).
0239 Tympanic temperature probes placed in patient's ears.
0241 Data logger turned on (to record temperatures).
0242 Ice bags placed around patient's head.
0245 Manual CPS begun.
0249 THAM I.V. (500 ml) started into Schwan catheter.
0250 Mannitol IV started (500 ml).
0254 Dextran 40 IV started (500 ml).
0255 Diprivan (10.9 cc).
0259 Potassium chloride (27.2 cc).
0300 Sodium Heparin (2.3 cc).
0301 Streptokinase (250,000 IU).
0301 Metubine Iodide (1.9 cc).
0303 Epinephrine (10.9 cc).
0303 Nimodipine (0.5 cc).
0304 Deferoxamine (2000 ml).
0304 Chlorpromazine (6.5 cc).
0304 Methylprednisolone (8 cc).
0305 Gentamicin sulfate (2.7 cc).
0306 Bactrim 10 cc given (End of IV).
0309 Maalox 60 cc given by gastric tube.
0310 Prepared to leave hospital room.
0318 Permission from hospital to remove patient.
0325 Removal of patient from ICU.

Figure 1.

Transport Timeline - Major Items
Field Washout and Shipping Preparations

0335	Arrival at mortuary with patient.	
0349	Prep patient with Betadine scrub.	
0353	Patient's left Femoral artery raised.	
0357	Patient's left Femoral vein raised.	
0437	Vein cannulated with 18 french Sairns venous cannula.	
0439	Artery cannulated with 16 french Baird arterial cannula.	
0410	Primed cannulas; problems with insertion.	
0410	Observations of sclerotic vessels.	
0437	Cannulation complete.	
0445	Perfusion commenced.	
	(Paused to resolve cannulation difficulties.	
	Washout .commenced.)	
0510	Ten liters of perfusate expended.	
0512	Clamps switched on supply/venous return lines	
	(Recirculation commenced)	
0513	Second blood sample taken	
(See * at	Flow vs. Pressure Determination; 85 mm Hg ~ 0.70 l/min.	
right.)	Flow vs. Pressure Determination; 95 mm Hg ~ 0.80 l/min.	
	Flow vs. Pressure Determination; 105 mm Hg ~ 0.90 l/min.	
	Flow vs. Pressure Determination; 115 mm Hg ~ 1.00 l/min.	
0523	Brain temperature 15.1°C, 15.1°C	
0544	Final blood sample taken	
0546	Recirculatory perfusion terminated.	
	(Venous outflow 8.6°C, 10.2°C)	
0605	Cannula secured for airshipment of Patient.	
	(Preparations for Shipment)	
0515	Placed dropcloth in shipping tray	
0708	Surround Patient with ice bags	
0709	Close body pouch	
0710	Place lid on Ziegler case.	
0712	Wrap fiberglass insulation around Ziegler case	
0730	Place insulation on top of Ziegler case.	
0731	Place cardboard outer cover in place	

* (Times not noted. These were rapidly sequenced measurements of flow vs. perfusion pressure to characterize vascular resistance.)

Figure 2.

hours and minutes after start of data logging. "0:00" on the data logger corresponds to 02:41 a.m. 2:24 on the logger would be 5:05 a.m. Comparing this with the timeline log, 05:12 a.m. is commencement of recirculation, and the first phase (open circuit washout) would have been started at almost exactly 5:00 a.m. This matches the change in trend of the graph exactly. T1 and T2 represent the two channels of the data logger (unfortunately, the relationships of left and right tympanic probes to channel numbers were not recorded).

Figure 4 on the next page shows, at higher resolution, shifts of tympanic temperature during recirculatory washout of the brain. Clock times vs. relative times to the start of data logging are shown, to help relate data to the chronology of events.

As mentioned above, open circuit perfusion started at about 5:00 a.m., and continued for about thirty minutes after recirculation began (at 5:12 a.m.). In that time, typanic temperatures as recorded by the data logger (DualLogR)

vation fluid was permitted to flow open circuit, it was apparent that none of it had been used to replace fluids lost by surgical leakage or edematous buildup of body fluids. This was a very positive aspect of the washout.

At your right in Figure 3 is the primary temperature profile of the washout. Other supporting plots are included and discussed.

Temperature Descent Data;
Tympanic Membrane Probes

In Figure 3, temperature descent data is timed in terms of

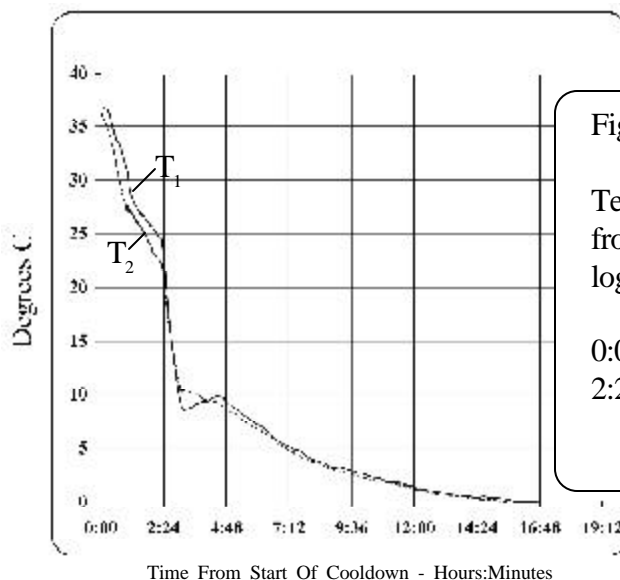


Figure 3.

Temperature Descent from initiation of data logger operation.

0:00 = 02:41 a.m.
 2:24 = 05:05 a.m.

(See text.)

showed a drop of 17°C for T2, and 13°C for T1.

Figure 3 shows T2 rising sharply immediately after insertion, and then staying at a higher temperature until the crossover shown in Figure 4. Channel T1 was the “cooler” channel initially, and then became warmer during blood washout. Both channels converged during air shipment, and other comparisons lead us to believe that instrumentation error or lack of calibration do not explain the differences. What might have happened?

The most logical explanation is that the probe placement, in which wax was used to secure the probes, resulted in a shallower placement for T1 than T2, and that T1 cooled more rapidly than T2 in the beginning due to closer proximity to surface cooling. Based on this scenario, T2 (cooling more slowly) would more accurately reflect blood temperature at the tympanic membrane and would be the best measure of initial brain cooling.

Once blood washout commenced, the conditions would reverse. T1, coupled to the inertia of surface temperatures, would have been overtaken by T2, which would more closely be coupled to the cold perfusate circulating in the vascular system. While this explanation is hypothetical, it is consistent with all of the data.

Until Figure 4 was generated, with the foregoing analysis, Figure 3 had been used as the primary interpretation tool. Comments had been obtained from team members as to the possibilities for the data’s divergence prior to washout, and the apparent excellent convergence once perfusion began. Figure 4, however, clearly indicates that the washout produced a systematic

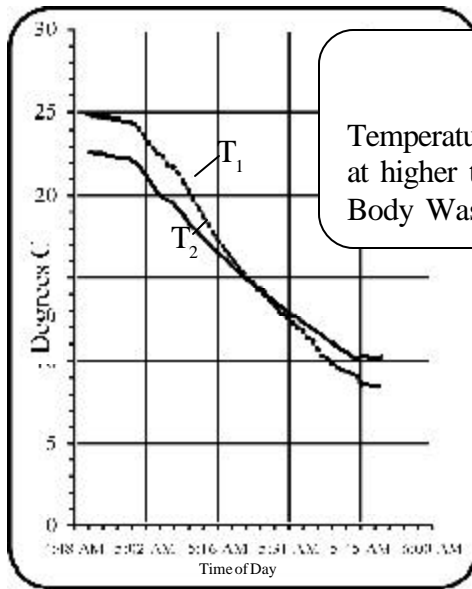


Figure 4.
Temperature Data from tympanic membranes at higher time resolution during TBW (Total Body Washout).

crossover of temperatures, rather than a convergence, and helped to better explain what might have happened.

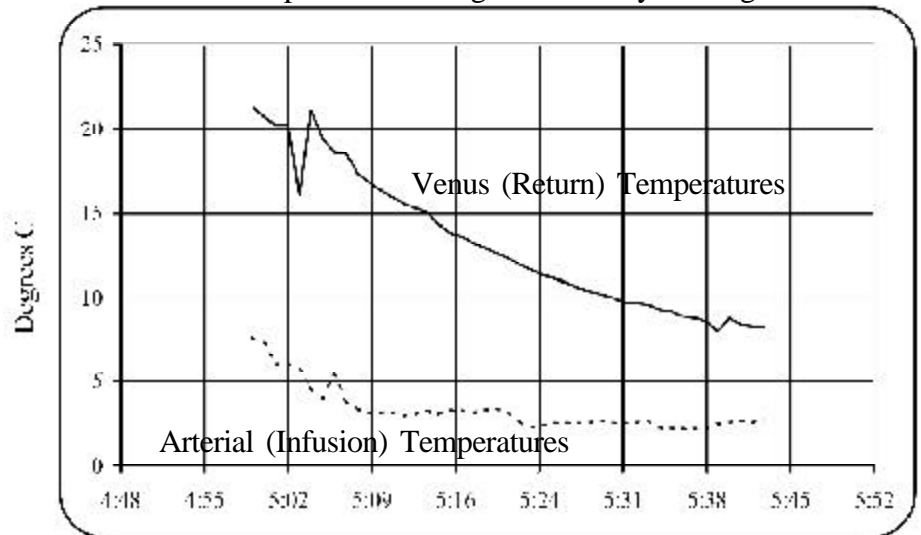
[In an earlier article in *Cryonics* (see Appendix A), referring only to Figure 3, the observation was stated as follows: “In particular, data showed smooth, balanced cooldown of the brain during

initial blood washout and recirculatory perfusion for cooling. This not only showed that perfusate was reaching the brain, but (as the diagram shows) it was bilaterally effective (both sides of the brain were equally protected). The two plots tracked closely during perfusion, as compared with the earlier stage of transport. We are still sorting out reasons for this difference in the data.”]

Temperature Descent Data; Field Washout Perfusion Circuit

In addition to temperatures at tympanic membranes (Figures 3 and 4), temperatures in the arterial and venous lines were measured

Figure 5. Extracorporeal circulation system line temperatures during recirculatory cooling.



Local Time - A/V Loop Cooldown

during recirculatory cooling. The temperature differential between arterial and venous lines is a clear measure of the degree to which each liter perfused removed heat, so this data could be correlated with reduction of brain temperature, if desired.

In Figure 5, it is apparent that the chilled perfusate (once recirculation began at 5:12 a.m.) stayed at approximately 3°C throughout the recirculation, while the relatively warm venous return dropped systematically with the exception of a few fluctuations between 5:02 and 5:09 (a period during which we were struggling to obtain secure cannula placement - finally one of the surgical team members was instructed to "hold the cannula in place manually," as discussed earlier.)

The temperature difference of the two lines varied from nearly 15°C at the outset to about 5°C near the end, and flow was slightly less than one liter per minute. A "straight line" analysis of this would thus project that (assuming one liter per minute, for convenience) that thirty minutes of such perfusion at an average temperature difference of 10°C would have cooled a mass of 120 pounds (approximately 55 Kg or 55 liters) by $30 \times 10 / 55 =$ (only) 5.45°C. But the brain was cooled between 13°C and 15°C, according to the tympanic data!

The explanation is almost certainly a combination of (1) better perfusion of the brain than of the body core in general, and (2) circulation that did reach the body's surface area being further cooled by externally cooled tissues, augmenting the cooling that would have been expected by reference to the temperature

change of the perfusate alone.

Each patient's physiology will be different, as to degree of obesity, patency of circulatory system, etc. In the case of this Patient, we may recall that there was no evidence of loss of fluids to tissues or dehydration during the period of recirculation. This is consistent with the idea that the circulatory system was in very good condition in general and contributed to the overall cooling effect of TBW (total body washout) with thirty minutes of recirculation.

Packaging and Air Transport to Scottsdale, Arizona

By the time field washout procedures were complete, it was nearly 6:00 a.m. The first available flight to Scottsdale from O'Hare International Airport in Chicago was at about 2:00 p.m. With a driving time of (conservatively) at least three hours, a necessity to deliver the Patient to the air cargo office two hours before takeoff and the patient yet to be packed, there was little margin for unforeseen delays. In Scottsdale, preparations for surgery and cryoperfusion were in progress, based on our making that particular flight. The cardboard outer box (per the time line above) was placed at 7:31 a.m., and the team's two vehicles left for Chicago between 8:00 and 9:00 a.m.

During transit to Chicago, it was possible to contact the driver of the mortuary vehicle that was transporting the Patient by cell phone and to monitor his progress. It was nearly noon at the time the teams reached the airport, and a decision was made to check the equipment in and proceed to the boarding area rather than attempt-

ing to use the rental cars to supervise loading at air cargo. A problem was encountered when the mortuary driver failed to communicate well with the personnel at air cargo, and there was a brief period during which it appeared the Patient would not be loaded. As mentioned earlier, the mortuary, several hundred miles away, was contacted by cell phone, and resolved the problem in short order.

In Phoenix, Joe Hovey picked up the team at the airport, and Bruce Cohen took Alcor's ambulance to air cargo to transport the Patient. By late afternoon, all team members and the Patient were en route to Alcor. At that point, about 5:00 p.m. Scottsdale time, it had been approximately 57 hours since the first call had come in to Alcor.

End of Part I (Part II will be published in the next *Cryonics*).

Note: This report conveys a realistic picture of some of the many challenges and uncertainties involved with cryotransport.

Alcor's rescue teams are presently its only means of responding, if your life is endangered. Someday, such rescue efforts might be launched by calling "911".

Until then, we ask that you encourage and support all of the Alcor CryoTransport Team (ACT) Members you know. Your life might depend on them, and they have pledged to be there for you, if you need them.



Afterword, from
Nanomedicine, by Robert A. Freitas, Jr.
 (continued from page 15)

The extraordinary medical prospects ahead of us have renewed interest in a proposal made long ago: that the dying patient could be frozen, then stored at the temperature of liquid nitrogen for decades or even centuries until the necessary medical technology to restore health is developed. Called cryonics, this service is now available from several companies. Because final proof that this will work must wait until after we have developed a medical technology based on the foundation of a mature nanotechnology, the procedure is experimental. We cannot prove today that medical technology will (or will not) be able to reverse freezing injury 100 years from now. But the patient

dying today must choose whether to join the experimental group or the control group. The luxury of waiting for a definitive answer before choosing is simply not available. So the decision must be made today, on the basis of incomplete information. We already know what happens to the control group. The outcome for the experimental group has not yet been confirmed. But given the wonderful advances that we see coming, it seems likely that we should be able to reverse freezing injury--especially when that injury is minimized by the rapid introduction through the vascular system of cryoprotectants and other chemicals to cushion the tissues against further injury.

Conclusion

The development of nanomedicine depends on us: what we do and how

rapidly we do it. Research is not done by a faceless "them," nor is it something that happens spontaneously and without any human intervention. It is done by and supported by people. Unless we decide to support and pursue this research, it won't happen. How long it takes to develop depends on us. We are not idle bystanders watching the world go by. We are a part of it. If we sit and wait for someone else to develop this technology, it will happen much more slowly. If we jump in and work to make it happen, it will happen sooner. And developing a life saving medical technology within our lifetimes seems like a very good idea--certainly better than the alternative."

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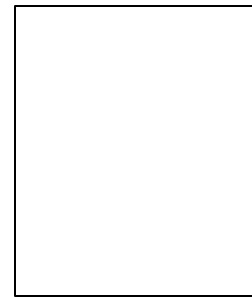
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