ALCOR LIFE EXTENSION FOUNDATION
A Non-Profit Organization

CRYONICS

MARCH-APRIL 2016 • VOLUME 37:2

ALDEHYDE-STABILIZED CRYOPRESERVATION PROCEDURE WINS BRAIN PRESERVATION PRIZE

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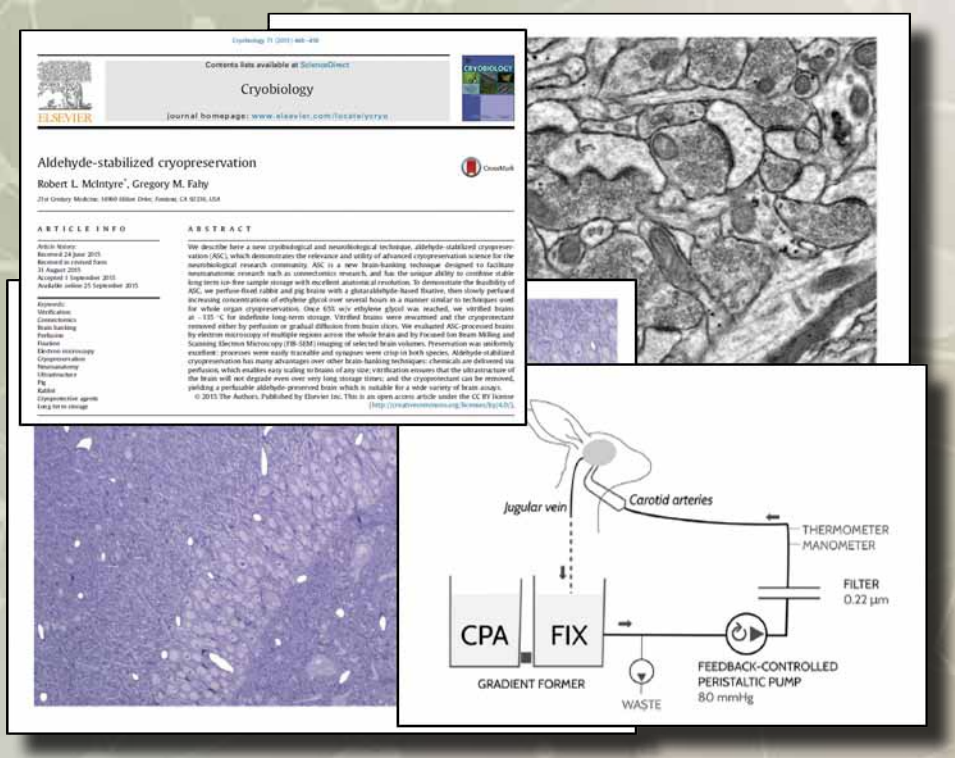

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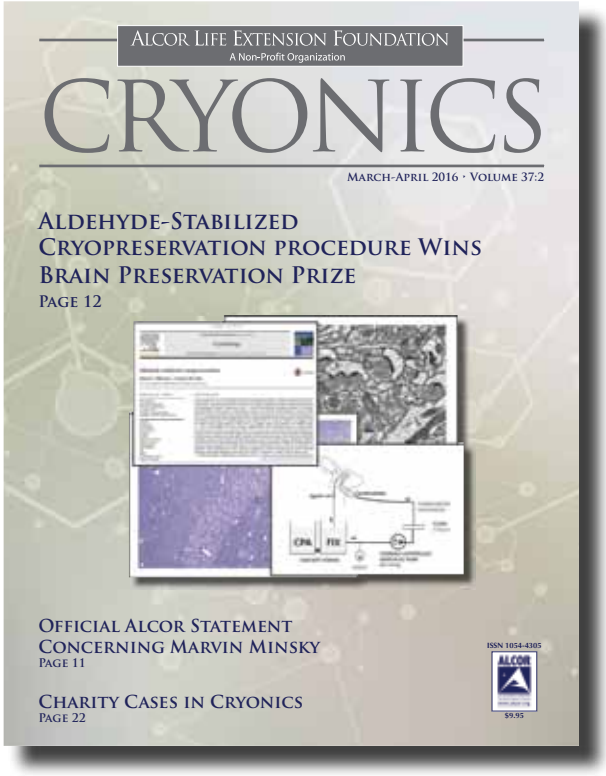

COVER STORY: PAGE 12

Aldehyde-Stabilized Cryopreservation Procedure Wins Brain Preservation Prize

21st Century Medicine has won the Brain Preservation Prize by combining chemical fixation and vitrification. As can be read in this official document from the Brain Preservation Foundation, rabbit brains that were subjected to this procedure are indistinguishable from controls.

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CRYONICS

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QUOD INCEPIMUS CONFICIEMUS

Photo: Cryo-Care Equipment Corporation at 2340 E. Washington St., Phoenix, AZ. Dr. Bedford's "home" in 1970 or 1971.

HUMAN BIOPRESERVATION OPTIONS: Advantages and Limitations

By Aschwin de Wolf

On February 9, 2016 the Brain Preservation Foundation announced that the cryobiology company 21st Century Medicine had won their small mammal brain preservation prize. The team at the 21st Century Medicine used a procedure named Aldehyde-Stabilized Cryopreservation (ASC) to preserve the ultrastructure of the brain in a "near-perfect" condition. It is important to understand how ASC differs from both conventional cryopreservation and other human biostasis alternatives to understand its merits and limitations.

In conventional cryopreservation (which is the procedure Alcor currently uses) the blood in the brain (or body) is replaced with a vitrification agent that permits long term storage at liquid nitrogen temperatures (or intermediate temperatures) without further degradation. The advantage of this method is that it seeks to both preserve viability and the fine ultrastructure of the brain. Currently, the disadvantage of this method is that it produces (severe) cerebral and cellular dehydration, which alters the ultrastructure of the brain and renders some components of the brain difficult to observe in electron micrographs.

A radically different alternative to cryopreservation is to chemically fix the brain with aldehydes (formaldehyde, glutaraldehyde) and store the brain at room temperature or in a fridge in the liquid state. While some people consider such a procedure "better than nothing", Alcor does not support this kind of "chemopreservation" as a long term care option due to concerns about long-term degradation. An extensive critique of liquid state chemopreservation can be found in my article 'Chemical Brain Preservation and Human Suspended Animation' (http://www.alcor.org/Library/html/chemopreservation2.html)

What is notable about the procedure that won the small mammal brain preservation prize is that it combines both aldehyde fixation and vitrification. In short, first the brain is perfused with glutaraldehyde, followed by perfusion of a high concentration of cryoprotectant to protect the brain against ice formation during long term care. This idea is actually not new and was discussed in in the mid-1980s in Eric Drexler's book *Engines of Creation*. The renewed popularity and technological development of this idea was recently triggered by the formation of the Brain Preservation Foundation and its emphasis on ultrastructural preservation. The protocol that won the small mammal brain cryopreservation prize has shown indeed a degree of ultrastructural preservation that has not yet been achieved with conventional brain cryopreservation.

Alcor's biggest concern with aldehyde-stabilized cryopreservation is that it renders the tissue completely dead by contemporary viability criteria by creating irreversible cross-links between biomolecules. In other words, at a molecular level structure is radically altered. In terms of research aimed at reversible biopreservation, this is a dead end.

Conventional cryo, conventional chemo, and a combination of the two are the three most discussed options of human biopreservation. Other, hypothetical possibilities include (a) vitrification with agents with much higher glass transition temperatures that permit warmer storage such as at dry ice temperature (b) poly-vitrification, in which high molecular weight polymers are used to stabilize the patient near or at room temperature, and (c) the use of molecular nanobots to induce reversible biostasis (an idea originally proposed by Robert Freitas).

The current position of Alcor is to keep researching and offering conventional cryopreservation without the use of chemical fixatives. The research emphasis of the organization and associated labs this year will be to produce better electron micrographs of cryopreserved brains and the validation of blood brain barrier modifying agents to eliminate the severe dehydration that is currently observed in patients that were cryoprotected with little ischemia. ■

CEO Update

By Max More

I have a lot of events to catch up on since my last Update in *Cryonics*. You will have seen some of the following if you read Alcor's blog and Facebook pages. Now that Cryonics is coming out bi-monthly rather than monthly – but bigger and better than ever! – we will fill in the news gap by restarting the Alcor News electronic newsletter.

MEMBERSHIP GROWTH

Early in 2015, I set a goal for the year of achieving a growth rate higher than in any previous year since I became president five years ago – and also at any time over the last ten years. Three-quarters of the way through last year, the recent drop in membership dues to clearing a backlog of terminations made this more difficult but still within sight.

We did it! As noted by Diane Cremeens, Alcor's tireless Membership Department Coordinator, we also broke the record for incoming applicants, which was 140 new ones submitted, with 97 Full Members finalized for the year 2015. So, despite terminations and cancellations (some of whom are individuals who may return when their finances improve), we achieved a net gain of 44 members and a growth rate of 4.36%.

Here are the growth rates for full cryopreservation membership for the past six years:

2015: 4.36%

2014: 4.02%

2013: -0.92%

2012: 2.4%

2011: 2.9%

2010: 2.0%

In 2015, cryopreservation membership grew from 1,010 to 1,054, or 4.36%. Associate Members grew from 144 to 197, which is 36.8%. Total members (including patients) grew from 1,287 to 1,394 = 8.31%. Looking further ahead into my sixth year as president, I see encouraging signs that this acceleration should continue. We started 2016 strongly, adding a net 6 new full members. Did this growth come at the cost of draining the pool of applicants? On the contrary, through 2015 applicants in the queue went up from 54 to 79.

To give a sense of the trend, here are some numbers for the previous three years:

2014: Cryopreservation membership grew from 971 to 1,010 = 39 = 4.02%. 80 members approved. Associates: From 89 to 144 = 55 = 61.8%. Total members (including patients) grew from 1,180 to 1,287 = 9.07%.

2013: Cryopreservation membership dropped from 980 to 971 = -0.92%. 57 approvals. Associates: From 33 to 89 = 170%. Total members (including patients): From 1,126 to 1,180 = 4.8%.

2012: Cryopreservation membership grew from 957 to 980 = 23 = 2.4%. 56 approvals. Associates: From 0 to 33. Total members (including patients): From 1,067 to 1,126 = 5.53%.

It should be noted that other cryonics organizations count "members" differently. If you look at some sources, including Wikipedia and some organization's own websites, you will find misleading numbers that fail to distinguish between what we call "members" – those who have full contractual and financial arrangements for cryopreservation, from others who are either little more than magazine subscribers or who have plans to store cell samples or pets but who lack arrangements to cryopreserve themselves. There is nothing wrong with having different levels of membership, but like should be compared with like. The fact remains that Alcor has around twice as many cryopreservation members as the next largest cryonics organization.

SUMMARY OF ELECTIONS AND RESOLUTIONS FROM THE 2015 ANNUAL MEETING

Results of the September 2015 Annual Meeting were published on Alcor's blog, but we are re-publishing them in Cryonics magazine as a printed record.

2015 ANNUAL MEETING ELECTIONS

OFFICERS

President: Max More was re-elected unanimously.

CFO/Treasurer: Michael Perry was re-elected unanimously.

Secretary: Michael Perry was re-elected unanimously.

DIRECTORS

Each director on the existing Board of Directors was re-elected unanimously:

Catherine Baldwin

James Clement

Ravin Jain

Saul Kent

Ralph Merkle

Michael Riskin

Brian Wowk

MEMBERSHIP DUES REDUCTION

For the third consecutive year, Alcor is reducing membership dues. Starting October 1, 2015: There will be a reduction in dues by approximately 1% (the exact amount in dollars to be determined) for all except family members and minor children. Minor children will receive approximately a 50% cut in dues, and dues will be charged for a maximum of two minor children in a family.

Comment: This is a smaller reduction than in 2014 and 2013 but reinforces the trend of declining membership dues. We hope to continue this trend so long as membership growth continues. The 50% cut for minor children should provide substantial relief for members who sign up multiple family members.

MARICOPA COUNTY DISCOUNT ON CMS

Maricopa county permanent residents will receive $60 off their CMS fees per year starting in October 1, 2015.

Comment: Alcor offers terminal members who relocate to Scottsdale up to $10,000 in assistance. Being located near Alcor when cryopreservation is needed not only improves response time but also reduces costs. It seemed to some a little unfair that members *already* living near Alcor could not benefit from this policy. We are recognizing this by reducing CMS (Comprehensive Member Standby) fees.

Why the focus on growth, you might be asking? Growth is not good for its own sake. It is good when it enables us to realize economies of scale, to reduce membership dues, to further build our Reserve Fund, and to add to our technical and human resources in ways that further our mission. When managed well, growth not only means that we are potentially saving more lives, it means we are improving the chances of survival for ourselves and our existing patients.

Growth is difficult. Converting interest in cryonics into actual membership is tough enough (with relatively rare and delightful exceptions). But we also lose members whose finances take a turn for the worse or who fail to maintain their life insurance policies (or who leave it too late to convert to a form suited to the long term). We have modestly reduced membership dues in each of the last three years. If we can keep doing that, we should lose fewer members for financial reasons. If we continue to enjoy a high level of often-positive press and keep up our public education efforts, we should maintain or accelerate the number of people applying. Then there are those who apply but never finish – or who take years to complete the process.

The growing number of members and a record number of applicants means that Diane has been working harder than ever. We have recently taken on some part-time support, first to help Diane catch up with filing and then to help her with the high level of membership applicants and other work. Handling the growing paperwork should be eased if we adopt a new system from Konica-Minolta, which enables us to scan directly into individual files.

We are looking further into simplifying the sign-up process and ensuring that we keep close track of applicants. Any additional barriers for overseas sign-ups need special attention. We should also do a much better job of getting in touch with people who have come on tours or requested information packets. These are our best prospects, but we have not been doing an effective job of following up with them. Some upcoming changes implemented by our IT contractor should make doing so more practical.

A MILESTONE FOR JAMES BEDFORD, THE FIRST CRYONAUT

Marie-Louis Calment is listed as the longest-lived human being ever verified. She was born on 21 February 1875 and died on 4 August 1997, making her 122 years, 164 days old. James Bedford, cryopreserved in 1967 and still maintained by Alcor, was born on April 20, 1893. That means that about a month ago, he became the longest-surviving human being ever.

I wrote press release on James Bedford – the longest-surviving human being. My thanks to Mike Perry for his input. That is now being circulated.

CASES

We performed two cryopreservations in December 2015 and another one in January 2016. The first of the December cases originated in my original hometown of Bristol, England. The person involved, Cormac Seachoy, had intended to relocate to Scottsdale and enter an assisted-living facility but wanted to put off leaving his family until he had to. We realized that this made it likely that we would have to conduct a field cryoprotection in England. We first heard from, and starting discussing this case with, Tim Gibson of Cryonics-UK in late November. Cormac, a young man of 27, suffered from terminal abdominal cancer. With support from his family, he was able to complete the paperwork and finances were in place on December 9.

In a deployment discussion on December 14, we were going on the basis of a current estimate of two more weeks to live. We had planned to move him from England to Scottsdale via air ambulance. When that was no longer workable, Aaron Drake prepared to fly to his location and perform standby, stabilization, and field cryoprotection with the assistance of Tim (who was the only member of C-UK available). However, the individual was declining rapidly on the 16th and arrested before Aaron could arrive. Tim carried out the stabilization and transport to London essentially solo (with some help from long-term Alcor member Garret Smyth, who drove from London to Bristol). I was able to get our international mortuary company in London where we store supplies to open early to accommodate Tim's expected arrival time. Aaron arrived in London in time to improve the cannulation, complete cryoprotection, and see the patient begin cooling to dry ice temperature. The patient (our 141st) is now at liquid nitrogen temperature at Alcor.

A little over a week later, several of us helped our oldest-living member move to Scottsdale when it appeared that she might be in a critical condition. A standby was started but called off on the afternoon of Tuesday December 29 when she stabilized. This was quickly followed by the unexpectedly rapid decline of a recently-signed up member in California with ALS. On December 28, medical providers suggested he had roughly 2 weeks remaining, or less. In fact, the patient arrested almost exactly as the new year began at midnight. As a whole body patient arresting on what was a long weekend without warning, we faced many difficulties. Thanks to the quick response by our partner, Suspended Animation, along with a crucial role played by a long-term Alcor advisor, the patient benefited from stabilization and washout, with cryoprotection of the brain following at Alcor a little over 12 hours after arrest in California.

PRESS RELEASE
FOR IMMEDIATE RELEASE

James Bedford, the first cryonaut, now the longest-surviving human ever

Scottsdale, Arizona – November 27, 2015 – James Bedford, cryopreserved in 1967 and still maintained by Alcor, was born on April 20, 1893. That means that he is now the longest-surviving human being ever. Previously, Jeanne Calment was listed as the longest-lived human being ever verified. She was born on 21 February 1875 and died on 4 August 1997, making her 122 years, 164 days old (or 44,724 days).

Bedford was cryopreserved on January 12, 1967, with the hope of eventual repair and revival with more advanced technology sometime in the future. It is true that Bedford is not currently, legally alive. But neither is he dead. He is in a third state akin to a deep coma but where all metabolic activity has halted. So long as he is maintained in that unchanging state, if he was sufficiently well-preserved to begin with, he should be considered as surviving. As of today, November 27, 2015, he has survived for 122 years, 219 days (or 44,779 days). This makes him the longest-surviving human being in history.

Dr. Bedford was transferred to Alcor September 22, 1987, from son Norman Bedford. When Alcor transferred him from an old, customized vessel in 1991, it was clear that the original ice cubes were intact. Alcor patient caretaker Mike Perry, who was present for that transfer, says: "Despite the relatively crude methods used in 1967, James Bedford may still be with us. I hope to be there to welcome him back to life. If the effort succeeds, the world will be a different place, with cryonics recognized as the life-saving measure it did in fact prove to be. And Dr. Bedford will be the ultimate pioneer among us."

The Alcor Life Extension Foundation, founded in 1972, is the world's largest and most advanced cryonics organization, with over 1,040 cryopreservation members and 141 cryopreserved patients.

MARVIN MINSKY

Due to press reports of the death of Marvin Minsky, many people have asked whether he was still an Alcor member at the time. I posted an official statement on Alcor's blog (which you can find elsewhere in this issue). In that statement, you will see four privacy options listed. Please note that we have now removed option 2. If you chose that option, we will be contacting you to select one of the other options. You can also specify privacy for some number of years after being cryopreserved, rather than being forced to choose eternal private status or immediate public status.

SERVER HARDWARE AND SOFTWARE UPGRADES

We have upgraded the server and replaced a failed NAS drive. Our IT company has been working hard to reset and tighten up permissions on the system, and to improve efficiency. We are deciding how best to back up very large video files, since backing up to the cloud may be too expensive (and I'm not entirely convinced of their security). We have recently started using M-DISCs to store large volumes of digital information. M-DISC is a write-once optical disc technology using a medium that is intended to last for 1,000 years and survive temperatures of at least 200° C.

We have also had meetings about new capabilities to build once our server is fully up to strength. We are looking into CRM (customer relationship management) systems, to help manage information about members and potential members. We heard a presentation about Salesforce, but want to look into other, perhaps less expensive, options. We want a system that will integrate membership information with QuickBooks, as used by Bonnie Magee, our Finance Director.

LEGAL/REGULATORY

Our legislative watchdog alerted us to House Bill 2307, which would require body-donation companies to be regulated by the state Department of Health Services. This legislation came about due to attention on the industry from the Arizona Attorney General's Office and the FBI following accusations that a Phoenix company had improperly tested bodies for contagious diseases, sold body parts that were contaminated with hepatitis B or C to researchers, and provided remains that were then used for projects that donors or their family members had not consented to. Our concern was that this new legislation could inadvertently and adversely affect Alcor. Our legislative consultant met with the sponsor of the bill and found that there was no desire to include cryonics organizations. The legislation was amended to clearly exclude organizations making use of the Uniform Anatomical Gift Act.

The fact remains that Alcor has around twice as many cryopreservation members as the next largest cryonics organization.

NEW CHAIR AND OTHER CHANGES AT BOARD MEETINGS

The February board meeting was a closed, private meeting (apart from the initial formalities). Going forward, we aim to make board meetings more efficient and productive by limiting discussion of board reports (which will be provided four days before the meeting to allow time for questions by email) and allowing more time for deep dives into important issues. James Clement was appointed Chair, taking much of the load of meeting organizing and wrangling from me. He will decide which topics are best discussed in private session. If you have never attended or called into an Alcor board meeting, you should know that the public portions (which have historically been the vast majority) are open to all.

MEDIA AND PUBLIC EDUCATION

I took a few days away in October 2015 to attend the Biohacker's Summit in Helsinki. My talk (more of a conversation with audience) included cryonics, while also connecting the bigger picture to the practical details of biohacking. The response was favorable and many people wanted to know more afterwards. During my last full day there, I met with several members of the Finland cryonics group. They would like Alcor's assistance in developing a local response capability. The culture there appears to be relatively favorable to cryonics. I said that I would like to support their efforts but not to expect too much in the near future, since multiple regional and national groups are already calling on our limited resources.

During September and October 2015, we received a great deal of press attention, most of which resulted from previous cryopreservations, especially that of Kim Suozzi (sparked by a 7,000 word story in *The New York Times* by Amy Harmon, with accompanying video), and our first Chinese patient, Du Hong, but also another burst of stories on Matheryn from Thailand. Ms. Harmon's piece, "A Dying Young Woman's Hope in Cryonics and a Future" in the September 12 2015 issue of *The New York Times* was heartfelt and accompanied by a moving 13-minute video. This story was either reprinted or published in another form in *The Boston Globe*, *The Seattle Times*, *Alternet*, *Tech Insider*, and MSN.

Matheryn's story was covered by multiple outlets, including "Frozen child: The youngest person to be cryogenically preserved" by the BBC on October 15, 2015, as well as Channel 9 news in Australia. Our patient cryopreserved in China, Du Hong, also received considerable publicity, including the Daily Mail's "Deceased sci-fi editor had her brain frozen in hope of 'resurrection' when science catches up."

The science supporting cryonics has been highlighted and debated more intensely than ever in the latter part of 2015 and the start of 2016. Some of this was sparked by *The New York Times* piece, such as "The False Science of Cryonics", which appeared in MIT Technology Review on September 15, 2015 by neuroscientist Michael Hendricks. A powerful rebuttal by David W. Crippen, Robert J. Shmookler Reis, Ramon Risco, and Natasha Vita-More, "The Science Surrounding Cryonics: What the nervous system of the roundworm, frozen embryos, and extreme hypothermia tell us about preserving the mind" appeared in the same publication on October 19, 2015.

If you attended the Alcor-2015 conference, you probably saw a presentation by Robert McIntyre on aldehyde-stabilized cryopreservation (ASC). Robert had told us some time ago that he was sure he was going to win the Brain Preservation Foundation's Small Mammal Prize. He was proven right in February 2016 when his team was awarded that prize. The press release set off a massive wave of publicity and discussion of his result and its implications for cryonics practice. You will find some discussion of this elsewhere in this issue. The story appeared, among other places, in *The Huffington Post* ("Cryogenically Frozen Rabbit Brain Hailed As Scientific First"); *Newsweek* ("Rabbit Brain Returns Successfully from Cryopreservation"); *New Scientist* ("Mammal brain frozen and thawed out perfectly for first time"); Slashgear; *Tech Times* ("Frozen Rabbit Brain Successfully Preserved Without Damage Through New Cryonics Method"); *The Daily Mail*; Gizmodo ("Brain Preservation Breakthrough Could Usher in a New Era in Cryonics"); Futurism.com; Science Recorder; Digital Trends; and several forums on Reddit. Previously-harsh skeptic Michael Shermer took a very different and more positive position in "Afterlife for Atheists" in the February issue of *Scientific American*.

Dozens of other cryonics stories have appeared in recent months, often in widely-circulated publications. Just a small sampling: "Dying is the last thing anyone wants to do – so keep cool and carry on" in *The Guardian*, October 10, 2015; "Brain Freeze: Can putting faith in cryonics deliver life after death?" in The Canadian Press, October 4, 2015; "How to Live Forever" in Shortlist in January; and "How the New Science of Freezing Can Save Your Life" in *Outside Online*.

Alcor appeared in the UK's *Financial Times*, for which we were interviewed on October 11 with photos shot on November 10. The main focus of this was the *C. elegans* research by Natasha Vita-More. On November 13, I gave a tour for an Argentine journalist for *Clarin* newspaper. The article will be published in their Sunday magazine, *VIVA*, published in *Clarin*, one of the most widely read Spanish-language newspapers. A lengthy piece appeared in the November 23rd issue of *The New Yorker*. This looked in detail at the work of Alcor member Nick Bostrom. I was pleasantly surprised to receive a call from a fact checker November 6. That practice has become all-too-rare.

I spent a couple of hours giving a tour to and being interviewed in detail by a reporter for *Stern*, one of Germany's two most widely-circulated magazines. Several other Alcor staff also spoke with him, more briefly. My impression is that the outcome will be largely positive. Given that there are dozens of German cryonicists, most of whom are not yet signed up with any organization, that should be helpful.

We have modestly reduced membership dues in each of the last three years. If we can keep doing that, we should lose fewer members for financial reasons.

The Verge published a series of six pieces, one of which focused specifically on cryonics, although the topic appeared in one or two of the others also. In the science section of the rebooted *Omni* online magazine, Esther Kim asked: "How Far Are We From Successful Cryonics?" And in the popular *Gizmodo*, George Dvorsky's "The Most Futuristic Predictions That Came True In 2015" highlighted Alcor's cryopreservation of our youngest-ever patient.

Filming: In addition to print media, over the last few months, we have hosted numerous news and film crews. So far, the resulting coverage has proven predominantly positive and helpful to us. Local coverage includes stories by channel 3, channel 10, channel 12, and *Fox News*. In October, I also spoke with a reporter from the Cronkite News Service in Phoenix, which is a student journalist outlet connected with ASU.

On Sunday November 22, Alcor was featured in the last episode of the PBS science documentary, *The Brain with David Eagleman*. I think the episode was well done and Alcor and cryonics were treated with respect, leaving a positive impression. (Eagleman is a neuroscientist at the Baylor College of Medicine.) The full episode can be downloaded from PBS.

On January 12, I spent some time filming for *National Geographic*. This is a prestigious publication and related video channel, and all indications are that we will be treated well. I talked to a reporter from the UK's New Scientist, who is covering Timeship but also wants to include 2-4 pages on Alcor. The reporter seemed very interested and sympathetic.

I spent considerable time on my feet to shoot numerous takes and different angles for a documentary by Leftfield Pictures in collaboration with the rap artist GZA (formerly of the Wu Tang Clan, for those of us familiar with that genre). This was a request that I initially turned down but Marji looked into the production company more closely and suggested I take another look. I was especially curious about GZA (pronounced "giz-uh") and pleasantly surprised and impressed by his clear and strong commitment to promoting science education among young people. As he left, he said that he would like to discuss the ideas we had covered further.

I spoke with a journalist from Australia's Channel 7 for the show *Sunday Night Seven Network*, which claims to be "Australia's most-watched premier public affairs and documentary programme, and the network's flagship national programme." We also did filming for a South Korean documentary; for Xinhua, "the most important Chinese news service"; and for the UK's Channel 4 (ITN Productions).

Cryonics was a subplot in an episode of the medical ER drama, *Code Black*, in early February. ■

Official Alcor Statement Concerning Marvin Minsky

Published on the Alcor News blog on January 27, 2016

The legal death of Marvin Minsky was publicly reported on Monday, January 25, 2016. There has been speculation on the part of numerous individuals and publications that he may have been cryopreserved by Alcor. This notice is Alcor's formal response to inquiries on this issue.

In a public ceremony at the Extro-3 conference in 1997, nanotechnology pioneer Eric Drexler presented Prof. Minsky with a bracelet given to all new Alcor members. This bracelet provides emergency contact information and basic instructions. Minsky has spoken publicly many times about his advocacy of overcoming aging and the inevitability of death and about cryonics (human cryopreservation) as a last resort. He was also among the 67 signatories of the Scientists Open Letter on Cryonics and a member of Alcor's Scientific Advisory Board. This much is public knowledge. None of this necessarily means that Prof. Minsky had cryopreservation arrangements at the time of legal death. Alcor neither confirms nor denies whether Prof. Minsky had such arrangements.

Alcor's official response may puzzle some readers, so we would like to point out the privacy options that have been and currently are available to our members. When a member signs up for cryopreservation by Alcor, they have four options:

1. They can give Alcor permission to freely release their information at its discretion.
2. They can give Alcor permission to release their name and number only to other Alcor Members.
3. They can instruct Alcor to maintain reasonable confidentiality pursuant to the provisions of Attachment I. After their cryopreservation, Alcor is authorized to freely release their information at its discretion, including information Alcor deems appropriate about the individual's cryopreservation.
4. They can instruct Alcor to maintain reasonable confidentiality pursuant to the provisions of Attachment I.

These options can be found in Attachment 1 here: http://alcor.org/Library/html/attachment1.html

Therefore, if Alcor says that we can neither confirm nor deny that a specific person has cryonics arrangements with our organization, that could mean that (a) they do not have such arrangements (even if they had them in the past), or (b) that the individual has chosen the second or fourth options.

Aldehyde-Stabilized Cryopreservation procedure wins Brain Preservation Prize

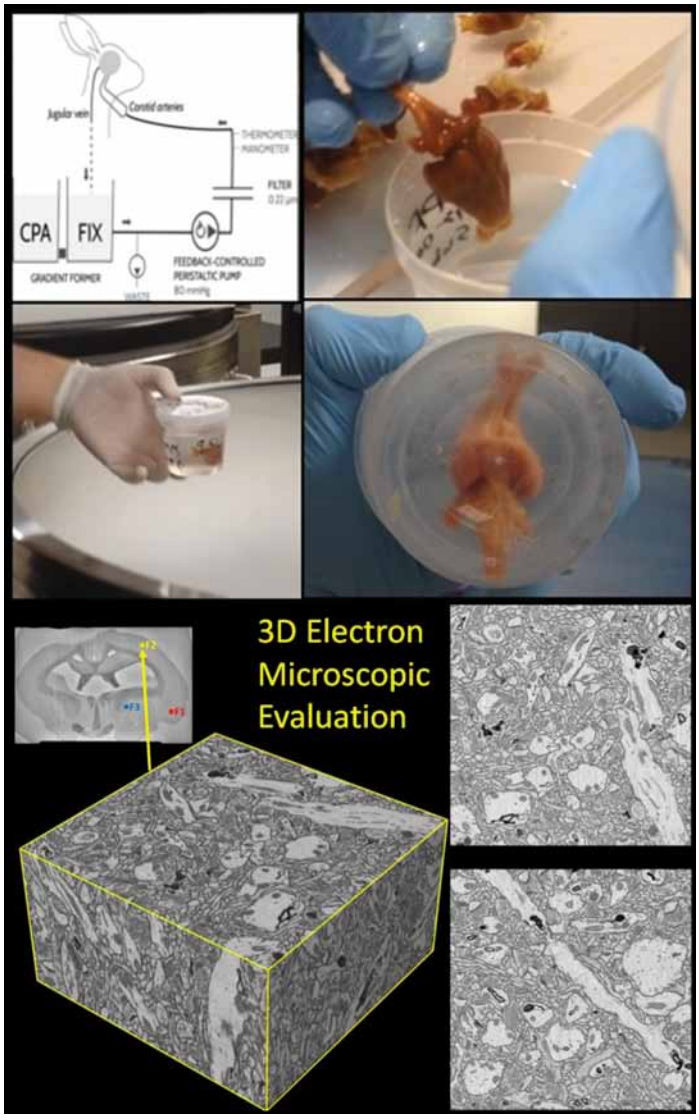
Official Brain Preservation Foundation Statement, released on February 9, 2016

The Small Mammal Brain Preservation Prize has officially been won by researchers at 21st Century Medicine. Using a combination of ultrafast chemical fixation and cryogenic storage, it is the first demonstration that near perfect, long-term structural preservation of an intact mammalian brain is achievable. You can view images and videos demonstrating the quality of the preservation method for yourself at the evaluation page. This result directly answers what has been a main scientific criticism against cryonics, and sets the stage for renewed interest, research, and debate within the mainstream scientific and medical communities.

"Every neuron and synapse looks beautifully preserved across the entire brain. Simply amazing given that I held in my hand this very same brain when it was vitrified glassy solid… This is not your father's cryonics." — Dr. Kenneth Hayworth, BPF President

The Brain Preservation Foundation's (BPF) Small Mammal Prize has officially been won. A team from 21st Century Medicine, spearheaded by recent MIT graduate Robert McIntyre, has discovered a way to preserve the delicate neural circuits of an intact rabbit brain for extremely long-term storage using a combination of chemical fixation and cryogenic cooling. Proof of this accomplishment, and the full "Aldehyde Stabilized Cryopreservation" protocol, was recently published in the journal *Cryobiology* and has been independently verified by the BPF through extensive electron microscopic examination. This answers a challenge issued to the scientific and cryonics communities five years ago by the BPF, and carries an award of $26,735.

Throughout the contest, the 21CM team was in a tight race with Max Planck researcher Shawn Mikula to be the first to meet the prize's strict requirements. Although the prize will be awarded to 21CM, we wish to emphasize that a mouse brain entry submitted by Dr. Mikula also came extremely close to meeting the prize requirements. Dr. Mikula's laboratory is attempting to perfect not only brain preservation (using a different method based on chemical fixation and plastic embedding) but whole brain electron microscopic imaging as well.



Focus now shifts to the final Large Mammal phase of the contest which requires an intact pig brain to be preserved with similar fidelity in a manner that could be directly adapted to terminal patients in a hospital setting. The 21st Century Medicine team has recently submitted to the BPF such a preserved pig brain for official evaluation. Lead researcher Robert McIntyre has started Nectome to further develop this method.

preservation of the delicate pattern of synaptic connections (the "connectome") which neuroscience contends encodes a person's memory and identity. Instead of biological revival, these new researchers often envision a future "synthetic revival" comprising nanometer-scale scanning of the preserved brain to serve as the basis for mind uploading.

This shift in focus toward "synthetic" revival opens up new avenues of research at an optimal temperature and rate for the prevention of brain shrinkage. The result was an intact rabbit brain uniformly filled with such a high concentration of cryoprotectants that it could be vitrified solid and stored at -135 degrees Celsius. Electron microscope images from across the rabbit brain showed beautifully preserved neural circuits which look identical to fixation-only control brains.

This result directly answers a main

"Every neuron and synapse looks beautifully preserved across the entire brain. Simply amazing given that I held in my hand this very same brain when it was vitrified glassy solid… This is not your father's cryonics." — Dr. Kenneth Hayworth, BPF President

BACKGROUND AND SIGNIFICANCE

Proponents of cryonics have long sought a technique that could put terminal patients into long-term stasis, the goal being a form of medical time travel in which patients are stabilized against decay with the hope of being revived and cured by future technologies. To that end, over the last two decades cryonics researchers have made progress eliminating ice formation using a technology from mainstream cryobiology called vitrification. Vitrification uses high concentrations of cryoprotectants that allow tissue to solidify during cooling without the formation of ice crystals. When optimally applied, vitrification eliminates damage to cell structures caused by ice formation and has been shown compatible with recovery of biological functioning in small slices of isolated brain tissue. But when applied to whole brains, limitations in diffusibility lead to dramatic shrinkage of the brain's tissue. Electron microscope images of such brains show dramatic distortions to the delicate neural circuits, and recovery of biological function in whole brains or animals remains far out of reach.

Such difficulties have led a new generation of researchers to focus on a more achievable and demonstrable goal—preservation of brain structure only, without concern for later biological viability. They focus on demonstrating

and brings the idea of cryonics squarely within the purview of today's scientific investigation. Hundreds of neuroscience papers have detailed how memory and personality are encoded structurally in synaptic connections, and recent advances in connectome imaging and brain simulation can be seen as a preview of the synthetic revival technologies to come. Until now, the crucial unanswered questions were "How well does cryonics preserve the brain's connectome?" and "Are there alternatives/modifications to cryonics that might preserve the connectome better and in a manner that could be demonstrated today?" The Brain Preservation Prize was put forward in 2010 to spur research that could definitively answer these questions. Now, five years later, these questions have been answered: As described above, traditional cryonics procedures have not yet been able to demonstrate (to the BPF's satisfaction) preservation of the connectome, but the newly perfected "Aldehyde-Stabilized Cryopreservation" technique has.

The key breakthrough was the quick perfusion of a deadly chemical fixative (glutaraldehyde) through the brain's vascular system, rapidly stopping metabolic decay and fixing proteins in place by covalent crosslinks. This stabilized the tissue and, along with other chemicals, enabled cryoprotectants to be perfused

skeptical and scientific criticism against cryonics –that it does not provably preserve the delicate synaptic circuitry of the brain. As such, this research sets the stage for renewed interest within the scientific community, and offers a potential challenge to medical researchers to develop a human surgical procedure based on these successful animal experiments.

FREQUENTLY ASKED QUESTIONS

What is the Brain Preservation Foundation?

The Brain Preservation Foundation is a non-profit charity with the goal of promoting scientific research and services development in the field of whole brain preservation for long-term static storage.

We incentivize the development of brain preservation technology by offering the large and small mammal brain preservation prizes, with a total prize purse value of $106,940, to the first team that can demonstrate brain preservation according to our strict criteria of synaptic preservation.

We serve the important scientific role of holding any purported brain preservation technology to strict standards of evidence and peer review. Our prize has been mentioned in the *The New York Times* and *Scientific American*.

Volunteers and advisors for the Brain Preservation Foundation include a host of experts in neuroscience, computer science, philosophy, cryobiology, medicine, and microscopy.

What is the small mammal brain preservation prize?

The challenge of the small mammal prize is to preserve a mouse brain or similarly-sized mammalian brain so that all the neurons and synapses are intact and visible under an electron microscope. Scientists have been preserving small samples of brain tissue at this level of detail since the 1960s, but until now no one has managed to achieve preservation of an entire brain.

Why is this prize important?

Whole brain preservation is a necessary technology for detailed study of the whole brain's microscopic anatomy, and is a necessary tool to help us tackle the great challenge of understanding how the brain works. An understanding of the brain's complete wiring will greatly help our understanding of diseases such as Alzheimer's — and how we might treat them. Even more importantly, there is compelling preliminary evidence from the neuroscience literature that preserving a brain at the ultrastructure level (the level of detail required to win our prize) might also preserve the memories stored in that brain. Now that whole brain preservation is a scientific reality (at least for rabbits), we look forward to a lively scientific debate over the exact level of preservation necessary to preserve memory.

We see this prize as an important prerequisite milestone towards the development of a robust memory preservation protocol for humans.

What is the history of the prize?

The Brain Preservation Foundation was founded in May 2009 with the goal of furthering research in whole brain preservation. In May 2010, after an anonymous donation of $100,000, we began offering the large and small mammal brain preservation prizes for the first team that could meet our stringent brain preservation criteria.

By 2012 two teams had stepped up to the challenge: Shawn Mikula at the Winfred Denk lab in Germany was using plastic embedding to preserve mouse brains, while Greg Fahy at 21st Century Medicine (21CM) was using cryobiological techniques to preserve brains using extreme cold.

By 2015, both teams were still having problems with their techniques which prevented them from winning the prize. Robert McIntyre, a recent MIT graduate and brain preservation enthusiast, joined 21CM to pursue research on aldehyde-stabilized cryopreservation (ASC), a hybrid method which combined elements of chemical stabilization from Dr. Mikula's techniques with cryoprotection and long-term storage methods from 21CM's efforts.

How did the small-mammal competition end?

After some early promising results with ASC, in September 2015 Dr. Hayworth visited 21CM to witness the ASC procedure and collect samples from two rabbits and two pigs which had been preserved—the first official entry of ASC into the competition. Dr. Mikula also submitted a plastic embedded mouse brain at the same time as the ASC submission, leading to a tense head-to-head competition for the small mammal prize.

After an initial evaluation of both entries, Dr. Hayworth found damage in the core of Dr. Mikula's plastic embedded brain and the entry was disqualified. Initial results for the ASC rabbit brain looked good, and Dr. Hayworth began an in-depth evaluation to determine the state of the brain's synapses: He extensively imaged hundreds of brain regions using traditional electron microscopy, and employed comprehensive 3D FIB-SEM imaging on three selected regions. This in-depth evaluation was conducted over four months, until Dr. Hayworth and the rest of the BPF prize judging panel were satisfied.

Now in February 2016, the BPF's panel of judges has determined that the rabbit brain preserved with aldehyde-stabilized cryopreservation from 21st Century Medicine meets the quality level demanded by the prize, and we finally have a winner of the small mammal prize!

What's next for the BPF?

Now that the small mammal prize has been won, we will focus our efforts on administering the large mammal prize. It is possible that 21CM's pig brains are already preserved well enough to win the prize; further evaluation is necessary.

Because whole brain preservation at the synaptic level is now a reality (at least for rabbits), we are very interested in continuing the discussion in the neuroscience community as to what level of memory preservation we can reasonably expect from brain preservation techniques like ASC. Our ultimate goal is to encourage the development of a brain preservation technique which could be applied to humans and which is shown to preserve memory. We'll do whatever we can to encourage technological development in this direction.

What's next for the competitors?

Dr. Mikula is working on imaging an entire mouse brain with electron microscopy—a massive multi-year endeavor which promises to be a major step forward in connectomics research. He may also work on adapting his plastic embedding technique to work on large mammals and attempt to win the large mammal prize.

21CM is returning to their research on reversible brain cryopreservation. If they succeed at reversibly preserving a brain, it will be unquestionable that we have a brain preservation technique which preserves memory.

Robert McIntyre has left 21CM and started his own company, Nectome, devoted to advancing the science of brain preservation. He plans to further develop ASC with the goal of creating a memory preservation technology that could work on a human brain.

We are excited to see what the future holds for brain preservation research! ■

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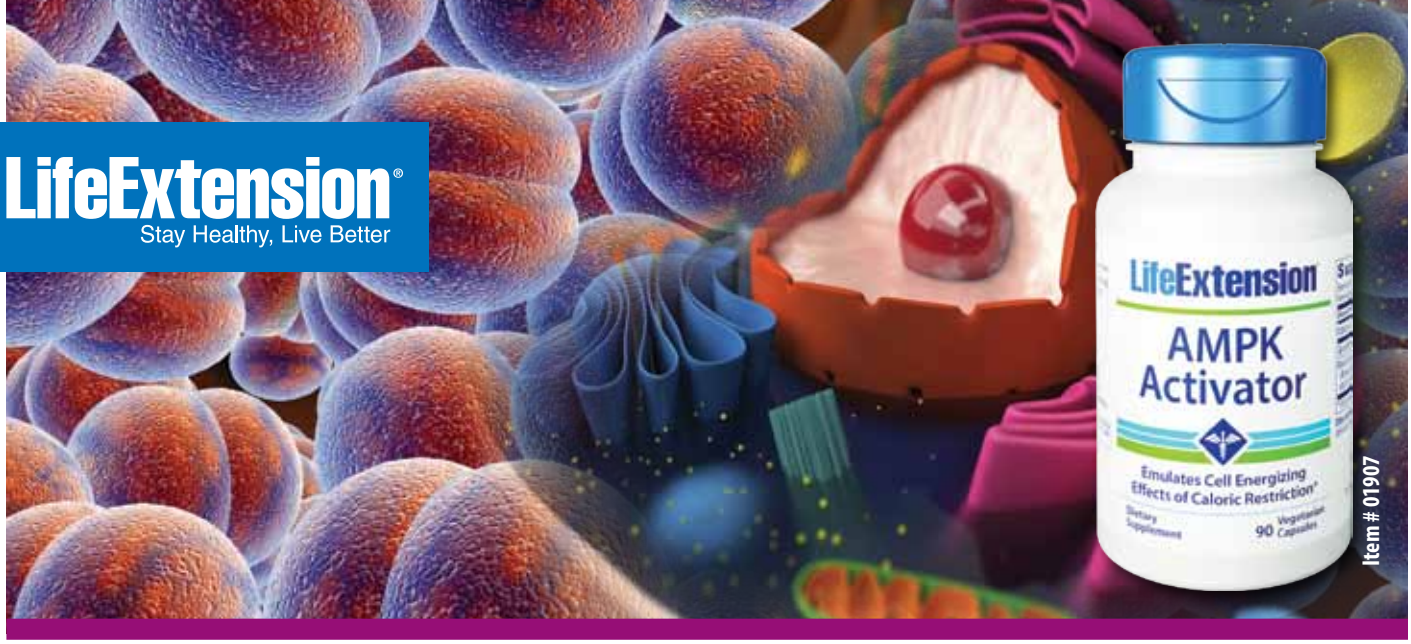

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A New Paradigm in Controlling Aging

AMPK is an *enzyme* that serves as the body's "**master regulating switch**." It inhibits multiple degenerative factors by *revitalizing* aging cells.[1]

Found in every cell,[2,3] **AMPK** promotes ***longevity factors*** that have been shown to extend life span in numerous organisms.[1,4] Increasing AMPK signaling "turns off" many damaging effects of aging, thus enabling cells to return to their youthful vitality.[5]

Life Extension® scientists have compiled years of research to create **AMPK Activator**, a specialized *dual-extract formulation* that supports **AMPK** activation for health optimization. This natural formula supports AMPK enzymatic activities required to safely support a more youthful cellular environment.

Importance of AMPK

Greater **AMPK** (*adenosine monophosphate-activated protein kinase*) activation has been shown to help target damaging factors of aging.[5] Studies show **increased** AMPK activity supports reduced fat storage,[6] new mitochondria production,[7] and the promotion of healthy blood glucose and lipids already within normal range.[4]

Gynostemma Pentaphyllum

An extract of the plant *Gynostemma pentaphyllum* was traditionally used in Asian medicine to promote longevity and scientists now know why — *G. pentaphyllum* promotes **AMPK** activation![8-10] In one of many studies showing a wide variety of benefits, researchers documented a one-inch reduction in **abdominal circumference** in overweight individuals who took **450 mg** daily of *G. pentaphyllum* extract for 12 weeks.[11]

Trans-Tiliroside

Trans-tiliroside, extracted from plants such as **rose hips**, also boosts **AMPK** activation, but triggers different downstream metabolic benefits than *G. pentaphyllum*.[12-14] Among its many benefits, a low human equivalent dose of **56 mg** daily *trans*-tiliroside has been shown by researchers in preclinical studies to promote healthy blood glucose levels and body weight already within normal range.[15]

The suggested daily dosage of **AMPK Activator** is to take two capsules with the first meal of the day and one capsule with the second meal. Three vegetarian capsules provide:

ActivAMP™ *Gynostemma pentaphyllum* extract (leaf)	**450 mg**
Rose hip extract	**1,120 mg**
Standardized to ***trans*-tiliroside**	**56 mg**

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A bottle of 90 vegetarian capsules of **AMPK Activator** retails for $48. If you purchase four bottles, the price is reduced to **$33** per bottle.

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Alcor Position Statement on Brain Preservation Foundation Prize

From Alcor President, Max More

FEBRUARY 12, 2016

In December 2015, 21st Century Medicine, Inc. published peer-reviewed results of a new cryobiological and neurobiological technique, aldehyde-stabilized cryopreservation (ASC) that provides strong proof that brains can be preserved well enough at cryogenic temperatures for neural connectivity (the connectome) to be completely visualized. And this week the Brain Preservation Foundation (BPF), after independent evaluation by neuroscientists Dr. Sebastian Seung, Professor at Princeton, and Dr. Ken Hayworth, President of the BPF, awarded The Small Mammal Brain Preservation Prize to 21st Century Medicine based on these results.

The BPF press release says: "it is the first demonstration that near-perfect, long-term structural preservation of an intact mammalian brain is achievable, thus directly answering what has been a main scientific criticism against cryonics."

Many people are wondering whether Alcor plans to adopt the "Aldehyde-Stabilized Cryopreservation" (ASC) protocol used to win the prize and what the win means for cryonics in practice. Alcor's position is as follows:

We are pleased that vitrification, the same basic approach that Alcor Life Extension Foundation has utilized since 2001, is finally being recognized by the scientific mainstream as able to eliminate ice damage in the brain. Alcor first published results showing this in 2004. The technology and solutions that Alcor uses for vitrification (a technology from mainstream organ banking research) were actually developed by the same company (21st Century Medicine) that developed ASC and has now won the Brain Preservation Prize.

ASC under the name "fixation and vitrification" was first proposed for cryonics use in 1986. ASC enables excellent visualization of cellular structure — which was the objective that had to be met to win the prize — and shows that brains can be preserved well enough at low temperature for neural connectivity to be shown to be preserved. Current brain vitrification methods without fixation lead to dehydration. Dehydration has effects on tissue contrast that make it difficult to see whether the connectome is preserved or not with electron microscopy. That does not mean that dehydration is especially damaging, nor that fixation with toxic aldehyde does less damage. In fact, the M22 vitrification solution used in current brain vitrification technology is believed to be relatively gentle to molecules because it preserves cell viability in other contexts, while still giving structural preservation that is impressive when it is possible to see it. For example, note the synapses visible in the images on the following page.

While ASC produces clearer images than current methods of vitrification without fixation, it does so at the expense of being toxic to the biological machinery of life by wreaking havoc on a molecular scale. Chemical fixation results in chemical changes (the same as embalming) that are extreme and difficult to evaluate in the absence of at least residual viability. Certainly, fixation is likely to be much harder to reverse so as to restore biological viability as compared to vitrification without fixation. Fixation is also known to increase freezing damage if cryoprotectant penetration is inadequate, further adding to the risk of using fixation under non-ideal conditions that are common in cryonics. Another reason for lack of interest in pursuing this approach is that it is a research dead end on the road to developing reversible tissue preservation in the nearer future.

Alcor looks forward to continued research in ASC and continued improvement in conventional vitrification technology to reduce cryoprotectant toxicity and tissue dehydration. We are especially interested in utilizing blood-brain barrier opening technology such as was used to win the prize (but which pre-dated work on ASC).

It may remain unclear to many whether this research result shows whether ASC or current vitrification without pre-fixation is more likely to preserve cell structures and molecular structures necessary for memory and personal identity. What we can note is that Robert McIntyre, the lead researcher on ASC at 21st Century Medicine, made a point during his presentation at the Alcor 2015 Conference of recommending against adoption of ASC in cryonics at this time.

For cryonics under ideal conditions, the damage that still requires future repair is now more subtle than freezing damage. That damage is believed to be chiefly cryoprotectant toxicity and associated tissue dehydration. It's time for cryonics debate to move past ill-informed beliefs of "cells bursting."

This is a groundbreaking result that further strengthens the already strong case that medical biostasis now clearly warrants mainstream scientific discussion, evaluation, and focus.

For a more detailed statement, and one that Alcor endorses, see (also reproduced in this issue) http://www.evidencebasedcryonics.org/media/MBPP.pdf. ■

GROUNDBREAKING SCIENTIFIC RESULTS

Show that the Proposition of Human Medical Biostasis has Potential and Needs to Be Brought into Mainstream Scientific and Medical Focus

By The Institute for Evidence-Based Cryonics and the UK Cryonics and Cryopreservation Research Network

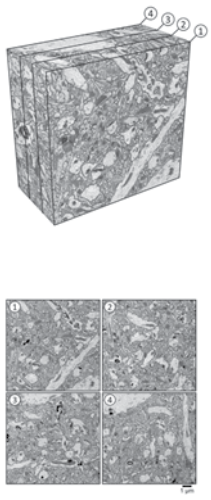
Recently we have seen scientific evidence that long-term memory is not modified by the process of whole organism cryopreservation through vitrification and revival in simple animal models (*C. elegans* nematode), supplementing knowledge that other small animals with nervous systems can also be healthily revived after storage in liquid nitrogen at a temperature of −196°C (*O. jantseanus* leech).

Earlier we also knew that in mammalian hippocampal brain slices viability, ultrastructure, and the electrical responsiveness of the neurobiological molecular machinery that elicits long-term potentiation, a mechanism of memory, can be preserved without significant damage following cryopreservation. Published transmission and scanning electron microscopic images from a whole brain cryopreserved through vitrification and also indicate structural integrity.

And now, a new cryobiological and neurobiological technique, aldehyde-stabilized cryopreservation (ASC) provides strong evidence that brains can be preserved well enough at low temperature for neural connectivity/the connectome to be completely visualized. The connectome is believed to be an important encoding mechanism for memory and personal identity (where the mind lives) within the brain.

This is a truly groundbreaking result and puts the proposition of human medical biostasis as a way to save humans who otherwise would die squarely within the realm of what may be possible.

This technology and these results were recently published by Robert McIntyre and Dr. Gregory Fahy in the journal *Cryobiology* of the Society for Cryobiology. Dr Fahy is the inventor of large tissue vitrification (*Cryobiology* 21, 407-426 (1984) and *Nature* 313, 573 - 575 (1985)), the Chief Science Officer of organ banking R&D firm, 21st Century Medicine, Inc., and a Fellow of the Society for Cryobiology. Lead scientist Robert McIntyre is a recent MIT graduate and neuroscientist.



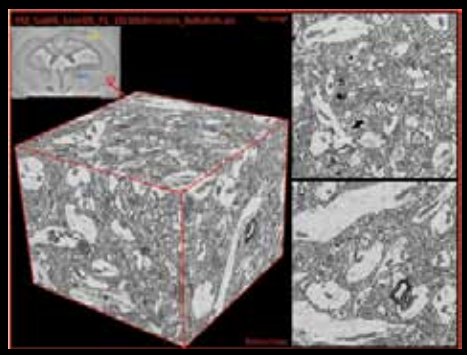
Frames from a FIB-SEM stack of rabbit neuropil near the CA1 band of the hippocampus. "Overall structural preservation is excellent: processes are clearly defined and organelles are intact. When observing slices of this volume in sequence, it is easy to track the progression of any process through the stack, demonstrating that connectivity in this region was not impaired by our preservation method (see full video available in online supplemental materials)." "KR8H washout solution. Vitrified; CPA removed by diffusion. Experiment date: 2015-04-15." Source: R.L. McIntyre, G.M. Fahy / *Cryobiology* 71 (2015).

First demonstration that long-term structural preservation of an intact mammalian brain is achievable and wins the Brain Preservation Prize

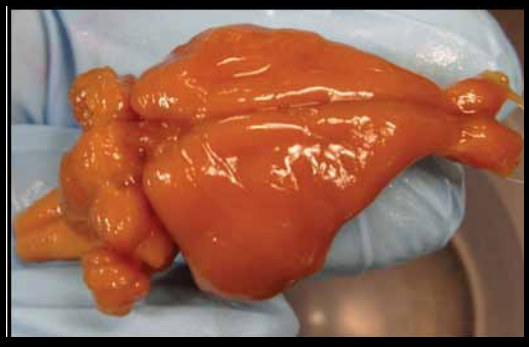
"This result directly answers what has been the main scientific criticism against cryonics — that it does not provably preserve the delicate synaptic circuitry of the brain — and sets the stage for renewed interest, research, and debate within the mainstream scientific and medical communities"

—Brain Preservation Foundation a press release

These results come five years after the Brain Preservation Foundation (BPF) launched the Brain Preservation Prize. According to the BPF, 21st Century Medicine narrowly beat a team led by Dr.



3D Electron Microscopic Evaluation



Actual whole rabbit brain vitrified and stored at -135 °C prior to slicing for evaluation. Source: The Brain Preservation Foundation.

Shawn Mikula at the Max Planck Institute of Neurobiology, which focused on chemical preservation and plastic embedding without cryopreservation (published last year in *Nature Methods*).

In addition to the accomplishment and the full "Aldehyde-Stabilized Cryopreservation" protocol recently being published in the journal *Cryobiology* by 21CM it has also been independently verified by the BPF through extensive electron microscopic examination (link also includes videos). The prize was independently judged by neuroscientists Dr. Sebastian Seung, Professor at Princeton University and Dr. Kenneth Hayworth, President of the BPF.

"Imagine being able to save, and at low temperatures, indefinitely preserve people who can no longer be sustained by contemporary medicine so that future medicine can both revive them and restore their health—these results provide strong support of that being possible"

—Dr. JP de Magalhães, Chair, The UK Cryonics and Cryopreservation Research Network

"In the winning of the Brain Presevation Prize, one of the, if not THE, most important scientific results in the history of medical biostasis and cryonics has been accomplished"

—Aschwin de Wolf, President, The Institute for Evidence-Based Cryonics

"Every neuron and synapse looks beautifully preserved across the entire brain. Simply amazing given that I held in my hand this very same brain when it was a vitrified glassy solid… This is not your father's cryonics"

—Dr. Kenneth Hayworth, BPF President and Co-Judge of Brain Preservation Prize

What Does This Breakthrough Mean (and NOT Mean) for Cryonics—Our Perspectives

(Any of the below can be attributed as quotes from Aschwin, Chana or João Pedro)

- Aldehyde Stabilized Cryopreservation (ASC) is a proof-of-concept that brains can be preserved well enough at low temperature for neural connectivity (the connectome) to be completely visualized using current technology. The connectome is believed to be an important encoding mechanism for memory and personal identity (sense of self/where the mind lives) within the brain.
- This is a truly groundbreaking result and puts the proposition of human medical biostasis as a way to save humans who otherwise would die squarely within the realms of the possible. Medical biostasis now clearly warrants mainstream scientific discussion, evaluation and focus.
- The avoidance of freezing damage in ASC is based on vitrification, a technology from mainstream organ banking research that was introduced in cryonics in 2001 by Alcor Life Extension Foundation.
- The implementation of ASC that has won the first Brain Preservation Prize also utilized a blood-brain barrier opening technology first studied for cryonics use by cryobiologist Dr. Yuri Pichugin at the Cryonics Institute ten years ago.
- The idea of ASC (even including specific use of the chemical glutaraldehyde) originated with Dr. Eric Drexler's book Engines of Creation in 1986 under the name "fixation and vitrification" where it was specifically suggested for use in cryonics.
- At the same time it is crucial to note that we primarily see this accomplishment as an important stepping stone towards biologically reversible stasis through cryopreservation/vitrification without the destructive nature of fixation and cross-linkages. Such approaches better meet precautionary/conservative principles about ensuring that everything that is needed to preserve a human's entire self has actually been preserved.
    - In fact, even though the general idea of ASC has existed since 1986, the field of cryonics has preferred to avoid use of chemical fixation because the resulting chemical changes (the same as embalming) are extreme and difficult to evaluate in the absence of at least residual viability.
    - Fixation is also known to increase freezing damage if cryoprotectant penetration is inadequate, further adding

to the risk of using fixation under non-ideal conditions that are common in cryonics.

- If future research shows that ASC can indeed preserve enough information to permit computer emulation of animal brains, this will have to be reevaluated.

- The first proposed revival method for ASC was actually reversal of chemical cross-links and repair by molecular nanotechnology resulting in revival of a biologically natural human, not mind uploading (see Engines of Creation).
  - Therefore, while the combination of ASC, destructive scanning, and mainstream brain emulation research may provide a route to cryonics revival, ASC is also compatible with revival in natural biological form by using foreseeable molecular nanotechnology.[1]

For more coverage, references and suggestions of scientists to talk with contact:

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Appendix — Context in which You May Want to Cover This

- Ever more leading people believe that it may be possible to arrest aging within a generation. Just a few examples of significant efforts towards this end include
  - Google starting a new company called Calico with at least $1.5 billion in "seed funding" that has the aim of defeating death and has recruited world class scientific and business talent, including former Genentech CEO and Apple Chairman Dr. Art Levinson
  - Meanwhile, Dr. Craig Venter, who famously tied the US government to sequence the first human genome and then created the first organism with a synthetic genome, has formed Human Longevity, Inc to work on ending aging
  - And Peter Thiel, who co-founded PayPal and is a successful biotech investor is making big investments in life and health extension via his investment firms and the SENS Foundation
- But without a path towards medical time travel through medical biostasis or human cryopreservation millions, if not billions, of humans will die before achieving "longevity escape velocity."
- As of now, 69 scientists are signatories to the "Scientists' Open Letter on Cryonics" that is administrated by the Institute for Evidence-Based Cryonics
  - Signatories encompass all disciplines relevant to cryonics, including Biology, Cryobiology, Neuroscience, Physical Science, Nanotechnology and Computing, Ethics and Theology.
  - The signatories include leading scientists from institutions such as MIT, Harvard, NASA and Cambridge University, to name a few.
- Just last year scientists began to come together in the UK and founded The UK Cryonics and Cryopreservation Network.
- The definition of what constitutes death continues to evolve and there now is a consensus that it is a process and not an event that occurs at a given moment.
  - More and more cases are reported and documented in leading journals like *The Lancet* of people who in accidents in the cold enter a state of suspended animation for hours without heart beat or brain activity and are then resuscitated after being considered clinically dead.
  - And more and more surgical procedures rely on this phenomenon, intentionally arresting brain activity with the help of hypothermia and drugs.
  - Recently the FDA even approved Defense Department funded clinical trials to induce profound hypothermia (<10°C) in critically injured trauma victims, effectively shutting the brain down and restarting it later to buy time to save the patient's life
- The public's interest has increased after for instance
  - *The New York Times* cover on "A Dying 23 Year Young Woman's Hope in Cryonics and a Future."
  - Media from all over the world featured the youngest person to be cryogenically preserved—a two year old baby. Each of these recent 2015 stories generated perhaps the largest amount of public discussion of cryonics since Ted Williams was cryopreserved.
- Leading to mainstream scientists and physicians entering the debate in support of the concept of cryonics — see for instance the recent piece: The Science Surrounding Cryonics in the MIT Technology Review.
- And "More than 1/5th of Germans Imagining Doing Cryonics" as published in a recent peer-reviewed article.
- There is a growing momentum towards organ cryobanking among the worlds scientists and government agencies where the remaining sub-challenges were codified last year at a global scientific summit (Note: The high level and main

sub-challenges in the banking of a heart, kidney or liver are almost identical to those of banking a brain).

- Just within the last year or so we have seen scientific evidence and publication
    - That long-term memory is not modified by the process of whole organism cryopreservation through vitrification and revival in simple animal models:
    - For decades, C. elegans roundworms have been cryopreserved at liquid nitrogen temperatures and later revived successfully. And in October 2015 a peer-reviewed journal publication showed that, using well-established assays for assessing recall of long-term memories, practically 100% of C. elegans can survive cryopreservation through vitrification, and retain learned behaviors acquired before cryopreservation.
    - that other animals can be healthily revived after storage in liquid nitrogen at a temperature of −196°C (ozobranchid leech)
    - [and less relevant, the 2016 publication and story in new news this month about healthy revival after 30 years of high-subzero cryopreservation (water bears)]
- Perhaps this means that we are closing in on the vision of US Founding Father (and polymath) Benjamin Franklin, who in 1773 wrote to Jacques Dubourg (French physician and inventor):

"It appears that the doctrine of life and death in general is yet but little understood...

"I wish it were possible... to invent a method of embalming drowned persons, in such a manner that they might be recalled to life at any period, however distant; for having a very ardent desire to see and observe the state of America a hundred years hence, I should prefer to an ordinary death, being immersed with a few friends in a cask of Madeira, until that time, then to be recalled to life by the solar warmth of my dear country!

"But... in all probability, we live in a century too little advanced, and too near the infancy of science, to see such an art brought in our time to its perfection…" ■

FOOTNOTE

1. Drexler, K. E., "Molecular Engineering: An Approach to the Development of General Capabilities for Molecular Manipulation," Proc. Natl. Acad. Sci. U.S.A. 78(1981):5275–5278. Ralph C. Merkle, "The Technical Feasibility of Cryonics," Medical Hypotheses 39(1992):6-16. Robert A. Freitas Jr.,"Comprehensive Nanorobotic Control of Human Morbidity and Aging," in Gregory M. Fahy, Michael D. West, L. Stephen Coles, and Steven B. Harris, eds, The Future of Aging: Pathways to Human Life Extension, Springer, New York, 2010, pp. 685-805.

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CHARITY CASES IN CRYONICS

By R. Michael Perry

INTRODUCTION

Since it began in the 1960s cryonics has faced one major obstacle not connected either to its scientific feasibility or whether society is "ready" for it to work in the first place: the cost of the procedure. Sadly, the practice might have spread faster and more people might have been preserved if it had been less expensive. The cost of cryonics levied a twofold burden: (1) many early cryopreservations were soon terminated for lack of funds, and (2) an untold number never happened at all for lack of funds. Cryonics organizations lost face as patients were thawed and lost when funding ran out. Surviving or newly-started organizations became wary. Guarantees of adequate funding were insisted upon, mainly, an up-front, one-time payment to cover the cost of maintenance of the patient indefinitely at cryogenic temperatures, using interest income. (An alternative was a for-profit corporation that insisted on adequate payments on a continuing basis.) The upside was that the failure rate dropped to near-zero and cryonics became more respected and more promising. The downside was the barrier this erected against those with little funding, granted that just "letting them in" would likely have been a tragic and disastrous path to follow, repeating what happened before. But a small handful got their chance, even though they didn't have the budget for it, thanks to the generous financial assistance of others.

Charity cryonics cases are an important, if limited and often overlooked, part of cryonics history. The summary below covers the better-known cases of people who are in cryopreservation today due to charitable interventions, either by individuals or cryonics organizations or both. I've omitted the early failures, though these too were mostly charity cases also, while they could be maintained. An essential in more recent cases is that adequate funding must be obtained somehow, before the cryopreservation can proceed, so the patient once cryopreserved is likely to stay cryopreserved.

JAMES BEDFORD[1]

On June 28, 1966, James Bedford, a 73-year-old retired psychology professor ill with cancer, wrote a letter to Robert Ettinger. He had read Ettinger's book, *The Prospect of Immortality*, and was impressed. Following Ettinger's proposal, Bedford was interested in taking part in a freezing experiment, in which his remains would be stored at low temperature until, sometime in the future, he might be warmed up again, his cancer cured, and any other debilities eliminated. He also wanted to help organize and finance a research program to advance the science of freezing organisms more generally. Ettinger corresponded and encouraged him, particularly at one point when Dr. Bedford's determination wavered and he considered giving up his plans to be frozen. As a consequence, the following January Bedford became the first person cryopreserved under controlled conditions with eventual resuscitation as a goal.

Bedford owned rental property, and from his estate provided $100,000[2] (about $710,000 in 2015 dollars[3]), to cover his indefinite cryogenic maintenance and also to conduct research under the Bedford Foundation, which he set up. Unfortunately, a legal battle quickly developed over Bedford's will, and the funds were depleted until essentially nothing was left. Relatives who were sympathetic to his wishes and had not tried to break the will (mainly, his wife, Ruby, and son, Norman) saw to his maintenance for many years at various locations, before he ended up as a charity case at Alcor. Indeed Bedford's nomadic career as a cryonics patient is unique. The story is a fascinating one which I briefly summarize here; more details will be found in an article by Mike Darwin.[4]

From the Glendale, California nursing home where he was frozen Bedford was moved within days to a Phoenix, Arizona-based company that specialized in cryogenic storage containers for human use. Cryo-Care Equipment Corporation was started and financed by E. Francis "Ed" Hope, a local wigmaker and entrepreneur, and was the first organization to make capsules to store cryonics patients. These were horizontal and the occupant inside was welded into an inner container. This in turn, which in operation contained liquid nitrogen along with any occupants, was suspended from thin steel rods within an outer container, with the annular space between the two containers evacuated to provide insulation. (Though intended for

From left: Ed Hope, Frank "Rick" Rickenbacker, and Ted Kraver, the three principals of Cryo-Care Equipment Corporation. Photo Credit: http://chronopause.com/chronopause.com/index.php/2011/02/09/thus-spake-curtishenderson-part-3/index.html

one occupant, up to four patients were on occasion crammed into a capsule as a desperate measure when space was short, though not for any cases covered here.)

Originally the intention of Cryo-Care Equipment was to be "equipment only" as its name suggested, providing its cryogenic capsules for other organizations which would handle the actual care and maintenance of human patients. It was thought that cryonics might quickly become popular with profitable consequences for the company that serviced the organizations actually doing it. Cryonics did not boom however but only attracted a handful of enthusiasts. Organizations were few and far between, with meager, volunteer staff and many problems. Sometimes there was no organization ready to accept a patient when the need occurred (or the relatives preferred not to deal with it if it did exist) and Cryo-Care reluctantly shouldered the burden.

James Bedford at Glendale Junior College, about 1949
La Reata *(Glendale Junior College, CA yearbook) 1949, 39.*

In the case of Bedford it was a fledgling organization, the Cryonics Society of California, that organized the freezing but at the time had no storage facility for cryonics patients. Bedford instead was moved to Cryo-Care in a dry ice shipping container and stored in a capsule of their own manufacture for about two years. By then Ed Hope realized there was no profit to be made in cryonics, and he closed down his facility. From Cryo-Care Bedford was moved back to California, his first stop Galiso, Inc., a small cryogenics company in Anaheim. He was maintained there for about six years. Early on it was realized that the Cryo-Care capsule had developed a leak in its inner vessel which compromised the vacuum insulation and greatly increased the boiloff of liquid nitrogen. (In addition the gauges didn't work and the need to replenish the container with liquid nitrogen had to be judged by the absence of frost on the vent tube.) It was time to transfer Dr. Bedford to a new capsule. Designed in-house, the new horizontal unit received its occupant in April 1970 and would stay in service for 21 years, a record for a container of this type.

A few years went by peacefully, then Galiso's liability insurer learned about the frozen body on the premises and would not continue coverage unless it was moved. In July 1976 Bedford found a new home, this time at a real cryonics organization, Trans Time in Emeryville, which operated as a for-profit. The family thought the costs too high, however, so after about a year he was moved again and quietly stored "privately," that is to say, in rental storage facilities, for a number of years.

By 1982 Mike Darwin was worried about what might have happened to Bedford (earlier he had tracked him to Galiso) and contacted the son. Bedford Sr. was still being maintained, but those doing it were weary of the work and expense. Mike found Dr. Bedford in a mini-warehouse in Burbank. The upshot was that he was transferred again, this time to facilities of Cryovita, Inc., a sister organization to Alcor which was set up by Jerry Leaf to provide cryopreservation services that Alcor at the time could not manage on its own. Also provided to Alcor were premises in Fullerton where it could store its patients, which then numbered only four, all neuro. Though technically neither Cryovita's nor Alcor's but the family's, Bedford's arrival meant that Alcor had now received its first whole body to look after.

A dedicated cryonicist with a background in thoracic surgery and other relevant specialties, Jerry Leaf also had a sense of history and a concern for the plight of others facing death who had seriously tried to do something about it. Bedford now essentially became a charity case, Jerry covering most of the early expenses out of personal funds; later Alcor would assume the burden, when the family, reassured by the commitment shown so far, were willing to transfer legal custody. In February 1987 Alcor moved to a facility of its own, in Riverside, with all the patients in its care, then numbering six, including Dr. Bedford. In September that year paperwork was signed and Bedford officially became an Alcor patient. A few years later, in May 1991, he was transferred to a new, upright capsule and found to be in good condition, ice placed on his body at his freezing having stayed frozen the whole time. In February 1994 he moved, along with other patients, out of California to a new facility in Scottsdale, Arizona, where he is stored today.[5]

LUNA WILSON[6]

The first "intentional" cryonics charity case was, sadly, a teenage murder victim. (Though Bedford and others were cryopreserved earlier, funding was provided initially, at least for the cases that survived long-term, and they became charity cases only later.) Patricia Luna Wilson, known affectionately as "Luna," was the fifteen-year-old daughter of science fiction and futurist writer Robert Anton Wilson, famous for the *Illuminatus* trilogy (written with Robert Shea) and other works, including an essay, "Next Stop, Immortality!"[7] Wilson was especially fond of his daughter, who impressed him with her kindness and gentleness, even refusing to denounce some ruffians who beat up and robbed her one day as she was coming home from school. She was a pacifist, vegetarian, poet and painter, trying in the latter medium to capture the "Clear Light" and having such success that to her father it seemed "as overpowering as Van Gogh."

After school hours Luna worked in a grocery store near the Wilsons' home in

Luna Wilson
The Immortalist
Nov.-Dec.
1976, 13.

Berkeley, California. On October 3, 1976 she was beaten to death in the course of a burglary. Michael McNeil, a cyberneticist friend of her grief-stricken father called and suggested gently the possibility of cryopreservation, "in the hope that future science would be able to resurrect her." Wilson declined, saying he had no money for such an undertaking. McNeil persisted, saying Paul Segall and others at the the nearby Bay Area Cryonics Society (now American Cryonics Society) would donate their labor and added, "I've got pledges for enough money to cover the first year's expenses." The thunderstruck Wilson wanted to know from whom. McNeil replied: "People who appreciate your writings on longevity and immortality, and want to help you now."

Wilson had a hurried conversation with his wife, Arlen. Cryonics was not a new idea to them. But both had felt it was impossible on their income, that they must stoically accept the passing of their daughter, however difficult it might be. Now he was struggling through an explanation of the new prospects his friend had raised, wondering whether, even with the promised support, Arlen would want to go ahead with the unconventional procedure. The answer came within seconds. "Yes. Even if it doesn't work for Luna, every cryonic suspension contributes to scientific knowledge. Somebody, someday, will benefit."

At this point there were further snags. Because of her violent death, Luna's body would normally be subject to autopsy. On the other hand, as Paul Segall noted, many hours had now passed since the murder and inevitable deterioration had set in, raising questions as to whether cryopreservation was even worth doing. He did not think Wilson should give up on Luna, however, but suggested freezing just the brain—and this is what was done, the coroner being intrigued by the whole idea of cryonics and very cooperative. Wilson himself offered this eloquent testimonial:

"And so Luna Wilson, who tried to paint the Clear Light and was the kindest child I have ever known, became the first murder victim to go on a cryonic time-trip to possible resuscitation. We are the first family in history to attempt to cancel the God-like power which every murderer takes into his hands when he decides to terminate life. Understanding fully the implications of what we were doing, I knew the answer to those who would ask me, as they did in later months, 'Do you still oppose capital punishment?' The reply is, of course, that I oppose it more vehemently than ever. I have made a basic choice *for life* and *against death* and my whole psychology has changed in the process… I am… committed now to one reality above all alternatives… in which reverence for life is the supreme imperative."

(For all that, it is sad that both of Luna's parents died without cryopreservation, Arlen in 1999 and Robert in 2007.)[8]

FRANK AND JANET RILEY[9]

The cases of Frank Riley and his wife, Janet (pseudonyms) start with Frank's clinical death in Maryland in February 1974 and his son's determination to have his father cryopreserved. Frank was frozen by his son with the assistance of Mike Darwin and an associate. Next, a place to store the patient was needed and help to get him there. At the time, as so often happened, no arrangements were in place with anyone. The nearest facility was that used by the Cryonics Society of New York, on Long Island. This organization had started hopefully in 1965 but by now was moribund, most of its patients having been returned to relatives and taken away, with any others soon to follow. Also close by was Nick DeBlasio's facility at the Mt. Holiness Cemetery in Butler, New Jersey, but Mike had serious misgivings (well-founded, it turned out), and instead strongly recommended Trans Time, Inc. in Emeryville, near Berkeley, California. Trans Time was founded in 1972 and headed by Art Quaife; this is where Frank ended up, along with Janet who followed him into cryopreservation in 1978. Expenses were covered by the son.

Trans Time, on the other hand, was a for-profit corporation which contracted with not-for-profit cryonics organizations for storage of their patients and would be paid on a continuing basis by the organizations. (In this way a one-time payment to the not-for-profit could underwrite continuing payments to the for-profit through interest income.) Trans Time would also contract with individuals, however, as happened briefly with the Bedfords, and also, now, with Riley Jr. In this case the son was able and willing to continue the payments and extend the coverage when his mother was cryopreserved.

For the next few years the Rileys' expenses were covered by their dutiful son, who however did not have cryonics arrangements himself. This came to a tragic end in 1980 when the son was fatally injured in a traffic accident and no further funding was forthcoming. At this point it appeared that the cryopreservations might have to terminate, as had happened before, but instead Alcor agreed to accept them as charity cases. To save expenses they were converted to neuropreservation, which continues today. (There was another case, too, a woman who was converted to neuropreservation along with the Rileys and was probably a charity case on the same basis; here I have less information. But this preservation continues also, though not by Alcor.) These cases are significant because they established a precedent for converting low-funded whole-body preservations to the less-expensive neuropreservation (head only) rather than sacrificing the patient, as had been done earlier when funding ran low. (Actually, however, this option has only seldom been exercised, a recent variant being some Alcor cases that initially were whole-body but were completed as neuros when found to be underfunded at the time of arrest.[10])

JAMES SWAYZE

James Swayze contacted the cryonics community late in December 1999. At 41 he had been disabled for 20 years as a near-quadriplegic and subsisted on government assistance. In addition to the quadriplegia he lived in constant pain from a bone disease. He had no money to afford cryopreservation, though that is what he wanted, to see the future and get his body working again. His story is interesting if grim; the following is excerpted or summarized from an interview at the LongeCity website.[11]

"Much of my youth was spent taking

7-11-74

THE DENTON RECORD-CHRONICLE

Youth Flies High On 16th Birthday

LAKE DALLAS — When you're 16, the sky's the limit.

For Jim Swayze[illegible] the old adage took on a literal meaning Wednesday evening. It was his sixteenth birthday and Jim celebrated by taking his first solo flight.

IN A CESSNA 150, the Lake Dallas youth did take-off and landing maneuvers to the obvious satisfaction of his dad, Jim Swayze, owner of Skyview Flyers Inc. on Lake Dallas.

After four years of flying lessons, Jim took off for the first time without his instructor in a Cessna 150, he performed several takeoffs and landing maneuvers, both with and without flaps, and on short and soft fields.

A PRIVATE LICENSE, enabling him to carry passengers, cannot be issued until he reaches his 17th birthday.

Jim has been around planes for a few years. He started flying lessons at age 12 and has flown several different kinds of small planes.

More than a hobby, the teenager says he plans to be a pilot.

SOLO FLIGHT — The sky was really the limit for Jim Swayze of Lake Dallas on his 16th birthday Wednesday. The youth, who has been taking flying lessons since he was 12, made his first solo flight that day.

James Swayze's solo flight on his 16 birthday, Lake Dallas, Texas, July 10, 1974.

things apart to see how they worked and then cleaning and putting them back together. It was natural for me to be chosen to help my father in his auto body and fender business while in California where he taught me to know tools by making me his runner for them. Later after we moved to Texas he got into painting aircraft and that progressed to rebuilding them. At age 12 I helped him build a small office for an airport he was to take over and be the fixed based operator of. He had gotten his pilot's license while still in California. This is when I began flying lessons. I later soloed on my 16th birthday although I was capable but not allowed to by law at age 13. In high school I had access to several planes and would drop leaflets on the fans of the opposing football team."

Jim naturally wanted to be a pilot himself. He helped his father build airplanes and joined the Air Force at 18 to learn jet mechanics. It didn't work out ("they weren't in the market for independent thinkers") and he returned to his father's shop after 8 months. It was then that an unfortunate accident occurred. He was working with a friend on an airplane with electrical problems, the friend using a tool called a continuity tester. It was made like a flashlight but with a needle point. Suddenly without warning the tool exploded and fired the needle like a bullet into Jim's right eye, destroying the lens and along with it his hopes for an airline career.

James at Alcor's Asilomar, Calif. Conference, June 2000. Author's personal collection.

Actually, it appears he stayed on for a while in the airline industry but when his loss of depth perception nearly caused a crash incident he left, despondent. This in turn "led to some foolish soul searching behavior that led to my eventual broken neck injury that resulted in my paralysis." Wheelchair-bound, permanently disabled, and still in his early twenties, he was taken into the religious community of his family, who were Seventh-Day Adventists. "I became a so called 'reborn' … The experience served to lift my emotions … long enough to go straight into college after rehabilitation without wasting time brooding over my fate."

But he was only able to complete 2½ years of college, in pre-med with a psychology emphasis, because of a rare bone disease related to his spinal injury, which caused intense pain and other complications. In 1989, after about eight years on his own, living on Social Security Disability with limited funds, he was forced to give up his house and a van he could drive from his wheelchair, and move back in with his parents. He acquired a PC and taught himself computer skills, along with becoming intensely interested in science and learning more generally—which, however, led to other soul searching.

"Suddenly I had a crisis of faith and discovered I could no longer depend on the hope of an afterlife as the means for my safety net to return me to full functionality should science not cure my spinal injury and bone disease before my eventual demise. I needed a replacement or else without responsibilities normal people have or a relationship of a lover or spouse and all the little things that keep one grounded and sane, I was going to lose it, unable to see any reason to keep living…"

Increasingly he studied and thought about the idea of overcoming problems

Artwork by James Swayze, using his limited arm and hand movement, though he is mostly quadriplegic (reproduced with kind permission).

through science and technology. At one point he read "The Ragged Trousered Philosopher — Talking to God" by Harry Stottle[12] and concluded, in relation to the Deity: "I don't know if such a being exists and don't care. What I took from [this writing] was that someone else saw that we could become gods in our own right through advanced technology." Finally he started reading Cryonet, the email forum set up by Kevin Q. Brown for cryonicists, and then began telling his story.

When the cryonics community learned of Jim's injury and his predicament, there was an outpouring of sympathy. Robert Ettinger made a generous offer of $13,000 as a start toward the estimated $33,000 that would be needed for cryopreservation at the Cryonics Institute. (At the time this whole-body option was the lowest-cost cryopreservation anywhere.) Thousands more dollars was pledged over the next year or so, and the Society for Venturism got into the act in January 2002, establishing a Cryonics Assistance Fund with collected funds to go to James Swayze until the goal was achieved. And it was achieved, within a few months,[13] and James had his arrangements. Quite recently, on February

28, James arrested and was cryopreserved by the Cryonics Institute.[14]

WILLIAM CONSTITUTION O'RIGHTS[15]

Born Billie Joe Bonsall, with first name unofficially formalized on occasion,[16] Bill legally changed his name in 2002 to underscore his stance as an "extreme libertarian." He lived in Maine where both of his parents had been born, and graduated from Sanford High School in the town of that name, in 1984, listed in the school yearbook as among the "academic leaders." He joined the Cryonics Institute in 2000 but didn't complete the paperwork until July 2008 because, he said, he wanted to thoroughly analyze the contracts. Bill was a lifetime member of the Immortality Institute (ImmInst, now LongeCity), which he joined in August 2002. He made nearly seven thousand postings[17] to ImmInst forums, under the name "thefirstimmortal," after the book by James Halperin.

On January 6, 2005 police entered Bill's home with a search warrant and seized 40 pounds of marijuana, $82,000 in cash, a loaded handgun, an assault rifle and evidence of drug trafficking. Sent to prison, Bill said he not only lost his freedom but also his house and half a million dollars. He qualified for state health care as an indigent, but for the same impoverishment could not complete his cryonics signup. He was a cigarette smoker before going to prison, where tobacco use was forbidden. There he was diagnosed with small cell lung carcinoma, but he resumed smoking on his release in 2008.[18] Though he lived longer than expected, he succumbed to his cancer in May 2009, and was cryopreserved at the Cryonics Institute. Then-CEO Ben Best relates how Bill's expenses were covered, with difficulty but also determination, through charitable contributions:

"In July 2008 the Society for Venturism began a fundraising campaign to raise $30,000 to pay for the cryopreservation of Bill at the Cryonics Institute. By December the campaign had stalled at $13,000 and there seemed to be little prospect that more money would be forthcoming. Bill refused to consider the possibility of KrioRus or other low-cost alternatives. 'CI or die,' he said. But on January 17, 2009 the Immortality Institute announced a program to match donations (up to $8,000) made by others for Bill's cryopreservation. That in itself might not have been adequate, but on January 21st long-time cryonicist Marce Johnson was cremated, which freed up money that had already been donated for her cryopreservation. By February the full $30,000 had been raised."

William J. Bonsall, high school senior year, 1984
Picture credits: Distaff, *1984 (Sanford HS, Sanford ME), 24, http://www.classmates.com/yearbooks/Sanford-High-School/4182711757?page=28&searchTerm=William%2BJ.%2BBonsall accessed 20 Feb. 2016*

William O'Rights with sister (left) and mother, 2008. Picture credits: http://www.longecity.org/forum/topic/23024-william-orights/page-3 Posted 07 August 2008 - 02:03 AM, accessed 20 Feb. 2016

An aside here: it's very sad that Marcelon Johnson was not cryopreserved, a decision of her (non-cryonics) family members apparently oblivious to an ongoing campaign to cover her expenses, when it was thought by those of us involved that an understanding had been reached. Well-loved and respected in the cryonics community for her many years of active, volunteer involvement, Marce was a victim of Alzheimer's disease and unable to take charge of matters when the time grew short.[19]

Bill in turn was a controversial figure. After his preservation there were postings on the ImmInst forum by his father, Rod Bonsall. Bill had been living with Carol, the mother of one of his friends, who cared for him in his last illness and helped him get hospital attention when needed. Bill represented to Ben Best how his family members were all hostile to cryonics so he couldn't count on them for support. Carol was surprised on learning that Bill's father supported him after all, and conveyed what she thought was happy news that Bill could be relieved at hearing and could also relay to Ben. Later Rod had this to say to Ben:

"I don't doubt that Bill told you that [his family members were hostile]. But Bill lied a lot when it was to his advantage (and sometimes when there was no apparent advantage). The only reason I can think of for that lie was that he knew that I and other family members wouldn't fund his cryonics procedure (although I did tell him that I would reluctantly partially fund it when he told me that about $12,000 had been donated) and he may have thought that people wouldn't donate if they knew his own family wasn't donating and he may have felt that he would have a better chance of people donating if they believed that Bill was afraid family or friends would try to block the procedure, but that is speculation on my part. But he knew that none of us would try to block the procedure if he came up with the funding. Carol and I have talked a lot with each other while Bill was in the hospital and since his death and have discovered many lies that he told both of us. I've also gone through a lot of Bill's letters and emails since his death and have found many more lies. In fact I had to read in the newspaper after he went to prison that he owned his home as he told me he was renting it for a very low price. I'm sure he said that because his income was from selling marijuana and he knew that if I knew that he owned the house I would question where he got the money to buy the house as he told me that he had stopped his illegal activities after being caught many years before in Massachusetts. … Like all of us, Bill had his faults … but he had many good points too and I loved him in spite of his lies. … I prefer to remember his good traits and put his faults in the past."[20]

William ("Bill O'Rights") had this to say in 2001, when he successfully petitioned a Maine court for his name change, which tells something more general about himself: "I love America, and every concept that

the Bill of Rights stands for, that individual liberty is held above the objectives of government. I am inspired by this most noble document ever written to define the limits that government should obey. I love the concepts of free speech, absolute privacy, and religious freedom embodied in our traditions and our Constitution. I love the rule of law, the right of accused persons to confront their accusers, the right to an attorney, the right to remain silent, the right to refuse admission to government officials wanting to enter my home or office."[21]

Around May 2008, with about a year to go before his cryopreservation, he had this to say (a quote that appeared in a later post): "I will not accept the prognosis of my demise without a fight. I plan on beating the odds and surviving this terminal lung cancer. I plan on fighting hard, not because I fear death but because I so love life. Death is staring at me and I'm staring it right back without blinking."[22]

But Bill was not simply a heartless seeker of personal freedom and immortality. In another, nearby posting he quotes from a letter to a cousin from what appears to be nearly the same time, May 2008, shortly before his release from prison, mourning the death of a lifelong friend: "This week was a difficult one for me as I learned that Donald Daney my best friend since I was 5 years old died. I was less than a month from being out; I did not even consider the possibility that I would not see him alive."[23]

KIM SUOZZI[24]

Born in June 1989, Kim was a nineteen-year-old sophomore studying psychology at Truman State College in Kirksville, Missouri when she took a cognitive science course. There she read Kurzweil's *The Age of Spiritual Machines*, "really liked it, found it really compelling." She also read the sequel, *The Singularity is Near*. She became interested in transhumanism, artificial intelligence, and cryonics, though like many young, healthy people she didn't focus much on her own mortality.

A very bright student, she majored in psychology and linguistics, with a minor in cognitive science. In her senior year, however, she started having odd headaches, which she didn't pay much attention to at first. The problem got more serious, though, and she had a seizure that lasted 30 minutes and caused speech and motor difficulties. In March 2011, about two

Kim Suozzi, photo courtesy of Alcor Life Extension Foundation.

months before she would graduate, she was diagnosed with glioblastoma multiforme (GBM), an aggressive brain cancer that is usually fatal within a few years. The main tumor, located above her cerebrum, was removed and she did graduate. But the tumor had metastasized and reappeared within a few months, this time in her brain stem, where it caused difficulties on her right side, in walking and arm movement.

After a year of fighting the cancer with radiation and chemotherapy she realized the end was drawing near and went to the online forum reddit.com via r/atheism asking what she might do for the remaining short time she would be in this world. Among the many suggestions was that she might consider cryonics. The problem was, she was not signed up and had very little funds, nor, with her terminal illness, would an option such as life insurance be feasible. As she herself put it, "Many of you know that I'm agnostic; I don't have any clue what happens when you die, but have no reason to think that my consciousness will continue on after death. The only thing that I can think to make me feel a little more at ease with my death is to secure cryopreservation plans on the off-chance that they figure out how to revive people in the future. The way I see it, it's a better bet than decomposing or getting cremated."[25]

Her case was widely publicized and aroused much sympathy. Donations were collected through the Society for Venturism, which spearheaded a fundraising effort. With some additional funding assistance Kim became an Alcor member in time for their conference in October 2012. There she gave a brief talk. Some excerpts: "Religious people think you're going to heaven so you don't need to worry about death, and atheists seem to think that you should be accepting and calm at death. And I'm neither of those [applause] … And some people think you're not enjoying life enough if you want to live forever. But I don't think that's true. … You can still want to live forever and be calm on your death." Kim goes on to make the point that she has received some $500,000 worth of medical treatments (paid through insurance) which it is agreed will very likely fail. So how, she asks, is it unreasonable to choose an $80,000 cryonics option (the price of neuropreservation at Alcor) which has no worse odds than this of being successful?[26]

In early January 2013, with the end in sight, Kim made a brave decision to refuse food and fluids and thus hasten the time of her cryopreservation and minimize further damage from the cancer. Even so it took about 11 days for arrest to occur; she was cryopreserved by Alcor January 17. Her boyfriend had this to say:

"Our hope is that technology will continue to progress to the point that Kim may have a real chance of living again in the future. Unfortunately, the development of the requisite technologies could be decades or centuries away. Since Kim is no longer with us to explore and innovate in the field of neuroscience, she is counting on all of us to push for the innovations she had hoped to see in her lifetime.

"Until (or unless) the day comes that Kim can be brought back, remember her, celebrate her, and emulate her resilience, so we can create the future of her dreams.

"Nobody is too young to make cryopreservation arrangements."[27]

AARON WINBORN[28]

Aaron was born in Groton, Connecticut in 1967, graduated from Princess Anne High School in Virginia Beach, Virginia, in 1985, and attended St. Leo College, in Norfolk, Virginia, where he majored in English Literature and Education. With a passion for learning anything and everything, he was self-taught in numerous fields, including education, computer science and programming, graphic design, European and American history, philosophy, advanced mathematics, and music. He was a longtime champion of freedom, democracy, and community, working and volunteering in various capacities

Aaron Winborn family, Easter 2011; from left: Ashlin, Gwen, Sabina, Aaron. credit: :https://www.facebook.com/photo.php?fbid=10150170209706889&set=t.672376888&type=3&theater accessed 12 Feb. 2016.

for democratic education. Here he offers further details on his interesting life story:

"I have had a full life, full of adventures and exciting times. When I was 19, I lived in a monastic retreat center briefly, before living with and working for Elisabeth Kubler-Ross, the author of *On Death and Dying*. After that, I lived in a commune in England, where I helped to build a meeting house. Then back stateside, I worked in a corporate culture for a few years. After some soul-searching, I left that, and flirted with a few jobs, including waiting tables during the graveyard shift at IHOP, working in a garden nursery, and running a flight simulator for the Navy. When I learned about Sudbury schools, and a new school being built in North Carolina, I dropped everything and moved there to be part of its startup. That began a lifelong commitment to this democratic, age-mixed, non-coercive model of schooling, where I worked at another similar school in Connecticut. I also worked as a puppeteer in 2 different puppet theater companies. Somewhere in all of that, I lived for a few months in another monastery, and met soon after my lifelong partner, Gwen.

"She changed my life. We had our 1st daughter, Ashlin, in 2003, and decided to move to a place closer to family, as we were both from the South. We chose Harrisburg, Pennsylvania, for The Circle School, so that Ashlin would be able to experience that model of schooling. Also about this time, I chose to work for Advomatic, as a web developer. In 2008, I wrote a technical book, *Drupal Multimedia*. Sabina was born in [May] 2010, and has brought much joy to our lives."

Around August 2010, with things going so well, Aaron had what seemed to be a very minor problem: his nail clippers weren't working right. He tried another pair, but the problem didn't go away, and it became clear that it wasn't the clippers but something about his hands. He suspected carpal tunnel syndrome, given how much time he spent at the computer console, and went to see a chiropractor.

Unfortunately, the news, when it finally came the following March, after he was referred to a neurologist and underwent a series of tests, was much worse. He had amyotrophic lateral sclerosis, and could expect to live only another two or three years, steadily losing strength until he would be totally paralyzed, and would likely die after respiratory failure rendered his lungs unable to fight off infection, even if he was put on a ventilator.

Aaron's condition deteriorated. In November 2012 he wrote:

"My arms and hands are already paralyzed, and my breathing is severely compromised. I currently use DragonDictate to type on the computer, and as my voice begins to fail, I am switching to an eye gaze tracker. I am in a power wheelchair, and we have moved into an accessible home. Technology holds the only hope for a person with ALS, where medical science has all but given up. I look forward to a day when, even if we have not cured all diseases, at least we have tackled this, the living nightmare that no one should have to endure."

Aaron doubted this cure would happen in time to save him, and he was led to consider one other possibility, something his scientific orientation and love of life found rational and attractive: cryonics. But he knew that cost would be a barrier, unless outside help could be found. The Society for Venturism had recently raised funds for Kim Suozzi. Aaron made a decision:

"Thus, I come to this prestigious circle of like-minded people, asking you for help. Life insurance, the usual method for funding one's cryopreservation, is out of reach for me, with the diagnosis of a terminal illness. Likewise, it is not an option for me to self-fund it, both because of the current and upcoming medical expenses, and to ensure that my family is provided for after I have gone on. I have blogged about our financial situation … but it is out of date, as on top of all of our expenses, I am now applying for disability under Social Security, and Medicaid, which has rather severe restrictions on income and assets."

An appeal was set in motion. Kim herself was going to help, but was too ill at that point and was soon cryopreserved. By the following July, the Venturists had raised $16,000. A contribution of $10,000 from the Life Extension Foundation then raised the total to $26,000. Longecity, an online forum promoting cryonics and life extension, raised another $2,000, and Aaron became a life member of the Cryonics Institute, which meant that he would be charged $28,000 for a (whole-body) cryopreservation, plus transport costs. These costs too, it appears, had been covered by the time of the Venturists' Cryonics Convention held in Laughlin, Nevada the following November.[29]

For the next year and a half, Aaron continued to weaken as the disease ran its course. He was placed on a ventilator and became almost totally paralyzed, also unable to hear tunes or easily understand speech, though his mind remained alert.[30] Finally, on Mar. 18, 2015, he made another decision:

"Farewell, all my friends, old and new. I have decided to 'pull the plug' on March 24. I have to say that these past 47 years have been a grand adventure, and it is bittersweet to see it end. It will be quick and painless, and I am at peace with my decision. I am sad that I'm leaving my family. Though these words don't adequately express my feelings, they're the best I have."[31]

What Aaron couldn't say, so as not to alienate his many mainstream supporters, was that he was not just "pulling the plug" but trying for life beyond that, through cryonics. His decision and wishes were honored and he was cryopreserved at the Cryonics Institute.[32]

ELIZABETH PUGLIESE[33]

Though cryonics is a small movement, it has its share of bright, creative people, as can be seen in the cases above. Another such person, Ron Putirka, was an Alcor member back in 1991 when he had his ailing, beloved dog Benje cryopreserved. Then in his mid-forties, Ron was a professional singer and songwriter with a career stretching back to high school days in Detroit.[34] There is where he heard about Robert Ettinger and his ideas, and decided that cryonics was a

Elizabeth Pugliese with Benje, both now patients at Alcor. Photo from about 1985, courtesy of Ron Putirka.

rational gamble and worth pursuing, for both humans and other creatures.

As the years went by, though, there were fewer opportunities to earn income and finally Ron had to face poverty and, among other things, drop his cryonics membership. (He is now an Associate Member of Alcor, with hopes of eventually becoming a full member again.) In September 2013 Ron contacted Mike Perry at Alcor, who remembered when Benje had become a patient. Ron was nearing seventy and his mother, Elizabeth Pugliese, who shared his living quarters in Las Vegas, was 88 and ailing.

For most of her adult life Mrs. Pugliese worked as a waitress and sometimes as a hostess. She lived in Detroit, Michigan; Saint Petersburg, Florida; Pittsburgh, Pennsylvania and Las Vegas, Nevada. Other, occasional work included professional singing and part-time factory work at the 3M Company. Considerably later in life she worked at a daycare center and from there became a personal nanny. Ron wanted his mother cryopreserved and she had signed paperwork giving approval and directing him to proceed according to his judgment. The problem was, neither of them were signed up and both lived on a small, fixed income not adequate to make arrangements with any existing organization.

In December Mrs. Pugliese arrested. What to do? (What would *you* do in these circumstances?) About the only ray of hope was that the son was the sole next of kin and did not have to vie with other relatives who might have had other intentions as to what would be done. A straightforward approach, without the assistance of any cryonics or other supporting organization, would be to focus on preserving the brain alone. This could be done (chemically) at low cost, as part of the disposition of the remains, the rest of which could be cremated. This, after some inquiry and difficult soul-searching (whole-body preservation was favored initially) was the course chosen.

As a start, the body was embalmed with special attention to the brain, and stored under refrigeration at a local mortuary. The next step, removal and storage of the brain, was seemingly straightforward but presented a formidable obstacle. Technically, it would be no problem for the pathologist the mortuary worked with to do the extraction, but what do you do after that? Lacking anything better, Ron wanted to take custody at that point and store the brain in his refrigerator. Did the law allow this? There were conflicting opinions; such a case had not really come up before. Initially the pathologist was hostile to the whole idea, saying you couldn't get someone back that way anyway, given that that was the real purpose in all this. But she was tender-hearted and finally relented, saying that she had been very upset when her own mother had passed away, and, even though she still thought Ron's plan would not work, she would do her part. Furthermore, she was willing to cut the Gordian knot of the legal problem by providing storage space at her lab until other arrangements could be made.

With the patient safely in storage, a fundraising drive was started through the Society for Venturism. By the following summer enough had been raised for Mrs. Pugliese to be accepted as a patient at Alcor. She was transferred to the facility in Scottsdale, and a lengthy process of cryoprotection begun. Cryoprotection is much slower for a chemically fixed, isolated brain than for the usual cryonics case because the vasculature usually cannot be used and only slow diffusion rather than perfusion is possible. In this case the cryoprotection at slightly above water-ice temperature took about 16 months. The patient finally was placed in liquid nitrogen storage in November 2015.

AFTERTHOUGHTS

Cryonics is a challenging practice in a number of ways, technically, philosophically, and financially. Here we have focused on the financial barrier to getting cryopreserved at clinical death, and how it has been overcome, in some cases, by charity drives or other fundraising efforts. The people who have been assisted form a bright, interesting group and it's sad that such extraordinary measures were needed to try to save them (or indeed, of course, that cryonics is necessary at all). That is the way reality works, however, and we can take hope from the prospects that cryonics provides, in these as well as other cases.

One special problem, underscored by the last case we looked at, that of Mrs. Pugliese, is what to do if a loved one arrests and you want them cryopreserved, only you have no arrangements or funding in place. Sadly, it appears that very many cases like this are just given up, maybe after some initial inquiries and price quotations for cryopreservation that are too high. The Pugliese case illustrates how it is possible to proceed with a low-cost alternative, in this case chemical brain fixation, immediately, and raise funds for later transference to cryopreservation. Certainly there are technical concerns about such an approach that are unanswered at this point; mainly: how well does chemical fixation preserve identity-critical structure in some form that will be inferable using future technology? Some of us, myself included, feel strongly that at least this option is preferable to giving up, and wish to see it more easily available and more widely chosen, so long as funding remains a problem.

I'll mention in passing that since the Pugliese case an organization, Oregon Cryonics, has begun to offer chemical brain fixation as a low-cost alternative to cryopreservation (albeit with reluctance, in view of the technical unknowns). Indefinite storage is provided for an up-front fee, and the opportunity of upgrading to low-temperature preservation when funding requirements can be met.[35] ■

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16. See, for example, WR1.
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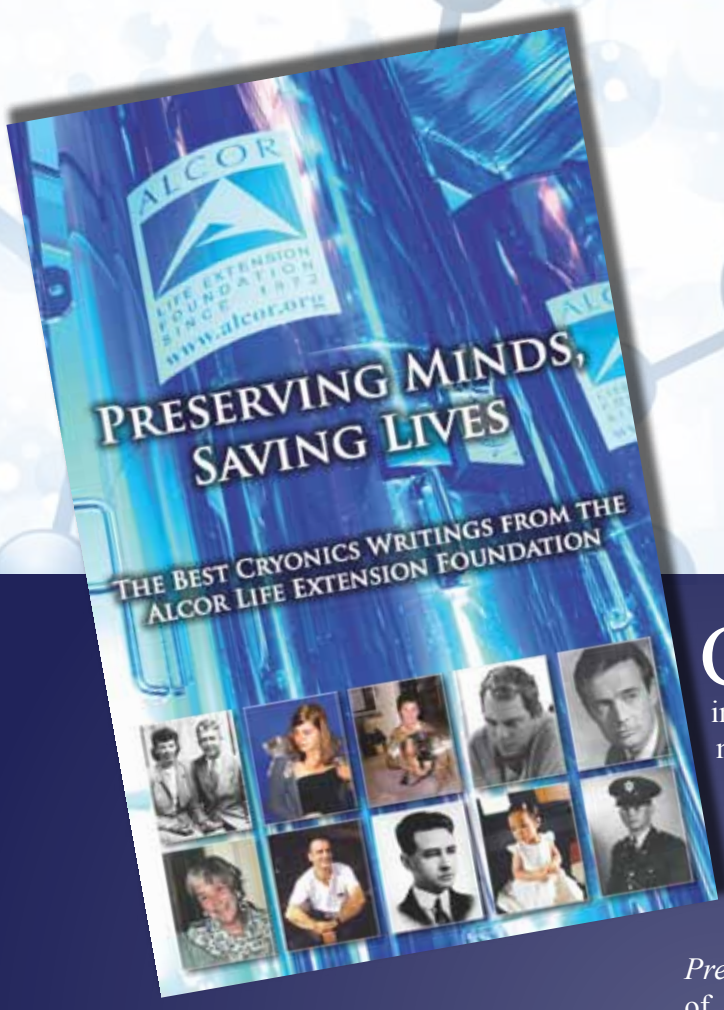

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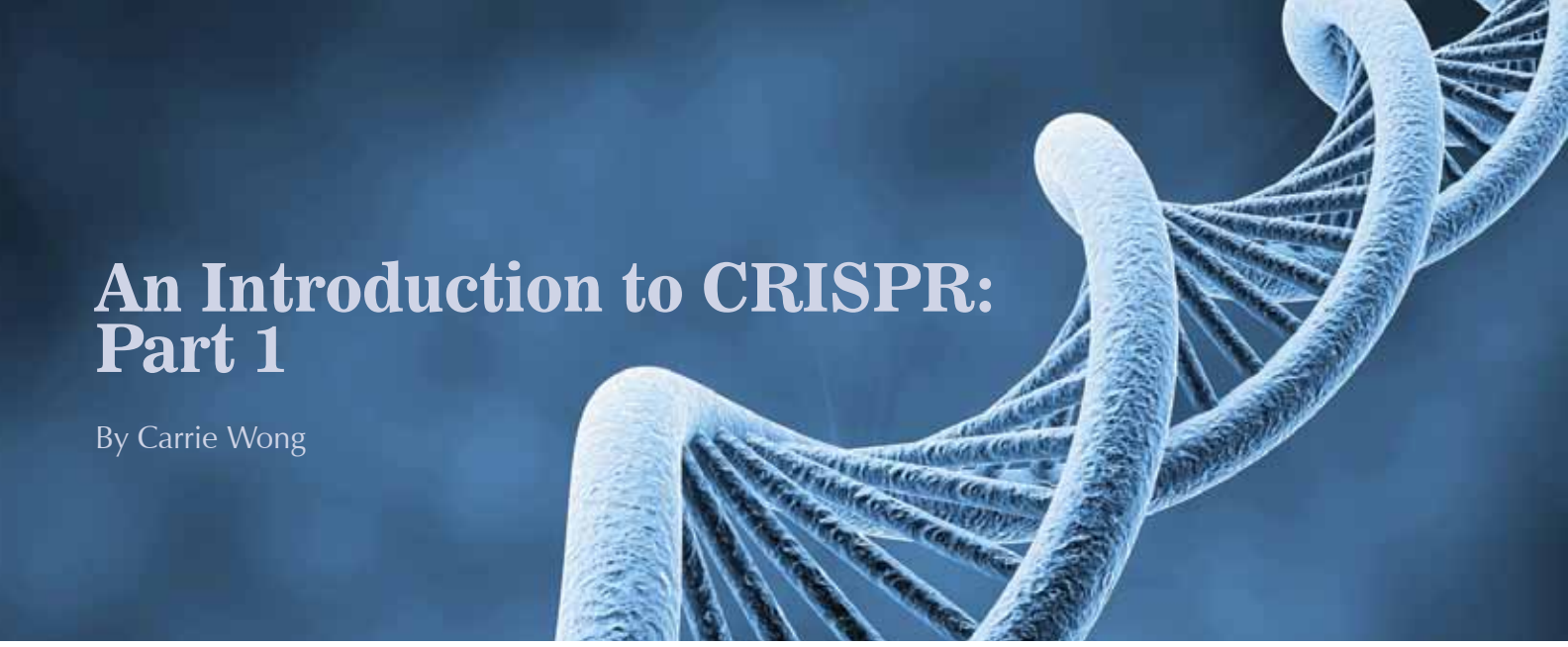
– Aubrey de Grey, Ph.D.
Biomedical Gerontologist and Chief Science Officer of the SENS Research Foundation

"Alcor appears to be the leading organization in the application of cryonics in medicine. I'm proud to be a part of this effort."

– Michael D. West, Ph.D.
Stem Cell Scientist and Chief Executive Officer of BioTime, Inc.



An Introduction to CRISPR: Part 1

By Carrie Wong

INTRODUCTION

Life-Extensionists have a saying, "Cryonics is the second worst thing that could happen to you." Obviously the worst thing that could happen to a person is Information-Theoretic Death[1], which we all know as complete and irreversible destruction of the brain that contains the information that makes us who we are. Cryonicists are very interested in any breakthroughs in reversing or halting the aging process so death can be avoided entirely. However, making breakthroughs in curing aging is an extremely difficult task, on the same level as putting a human on the moon. Putting a human on the moon was one of the most difficult problems ever solved. It took several decades, the world's most brilliant engineers, and a significant portion of the United States GDP to accomplish. Curing aging is on the same level in terms of personnel, capital and time. Yet the general public doesn't consider aging a disease or problem at all! Society's paradigm of thinking about life and death is sorely in need of a fundamental change, a phase-shift. This alone will take time, and solving aging itself is monumentally challenging. So, along with our life-extension advocacy we are signed up for cryonics, to provide a pathway to future medicine in case we need it for aging and any other now-terminal conditions.

Last year, 2015, there were two very interesting breakthroughs in life-extension. One: the FDA approved clinical trials for metformin as an anti-aging drug[2]. This is an exciting development, not only scientifically, but also in terms of social and institutional acceptance of aging as something to be solved. The other interesting breakthrough, which will be the focus of this article, was with CRISPR, a gene-editing technique that allowed scientists to target and modify DNA with unprecedented accuracy. This new technology made headlines in most major scientific publications[3]. Compared to previous techniques, it allows scientists to modify DNA much faster and easier. In just a few years, scientists may be able to use this new technology to treat genetic and viral diseases with more effectiveness than ever before. Since 2012, the number of studies published about CRISPR has increased about six times. However this new technology doesn't come without reservations.

With any new and radical technology, established health organizations have to make a careful approach. The National Institutes of Health has made it clear that they will not fund any use of gene-editing technologies in human embryos because of ethical and safety concerns[3]. NIH is the largest biomedical research organization in the world and is responsible for funding 28% of all biomedical research in the United States. It took decades for Metformin to be approved by the FDA as a marketable drug to treat Type II Diabetes and it took them additional decades to okay it for clinical trials to combat aging[2]. Based on the history of regulation, it seems unlikely the FDA would approve gene-editing technology for anti-aging in humans anytime soon. However, it has not stopped some life-extensionists taking genetic engineering into their own hands.

WHAT IS CRISPR-CAS9?

CRISPR stands for "clustered regularly-interspaced short palindromic repeats." This refers to the unique organization of short, repeated DNA sequences found in the genomes of bacteria and other microorganisms[4]. These sequences are a vital component of the immune system of simple lifeforms. Just like humans, bacterial cells can be invaded by viruses. If a virus threatens a bacterial cell, the CRISPR immune system can stop the attack by destroying the genome of the invading virus. By cutting the genome of the virus, the virus becomes unable to replicate and continue its attack.

Figure 1 below outlines the simple steps of this immune adaptation process:

1. CRISPRs are the parts of the bacterial genome that are composed of short DNA repeats (black diamonds) and spacers (colored squares). When an unknown virus infects a bacterium, a new spacer is derived from the virus's genome and incorporated among existing spacers. This is the adaptation phase.

2. After the spacer is added from the new virus, this new sequence is transcribed (by copying DNA into RNA) and processed to create the single-chain RNA. This RNA is then cut into short pieces called CRISPR RNAs. These short RNA sequences then form a molecule complex with a protein called Cas9. Cas9 is a type of endonuclease enzyme that can cut DNA.

3. The CRISPR RNA guides the molecule complex to match sequences in the invading virus. Since the RNA is copied from the viral DNA, it creates an exact match to target the invading virus at that particular point in its genome. Then the nuclease enzyme Cas9 is deployed and cuts the DNA of the virus, disabling it.

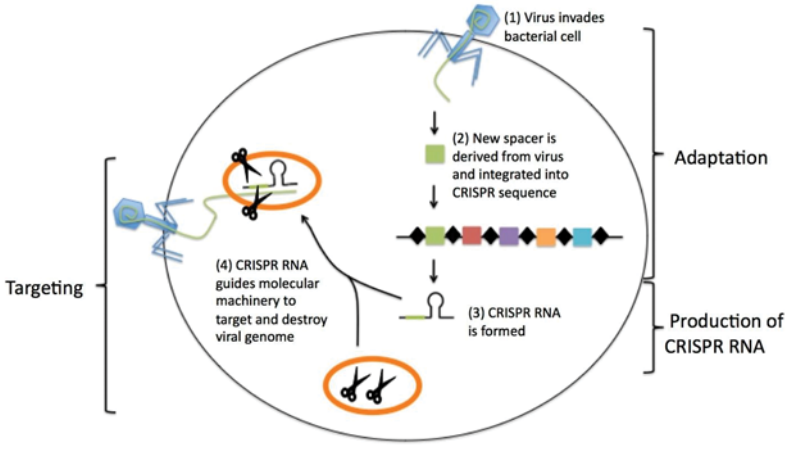


Figure 1: Pak, E: Science in the News, Harvard University[4]

Over the last few years, scientists working on the CRISPR-Cas9 system realized they could alter not just viral DNA, but any DNA at a precisely chosen location[5]. They have been able to do this by changing the guide RNA of the CRISPR molecule complex to match the target DNA segment. After the host DNA is cut, it makes attempts to repair itself, however it is not always successful and mutations could occur such as insertions/deletions that could disable or change the function of the cell. Scientists are now studying how to insert their own DNA "repair" template into where the CRISPR-Cas9 system has made its cut. With CRISPR-Cas9 scientists are able to alter multiple gene sequences at once, with greater efficiency and precision.

Figure 2 below outlines how the RNA acts as a guide for where Cas9 snips and what could happen after a gene has been cut.

BRIEF OVERVIEW OF CRISPR-CAS9 RESEARCH

There has been an explosion in research about CRISPR-Cas9. Every couple of weeks, a new "groundbreaking" study comes out. This technology has been used in mice, animals and even in human cells and embryos. In 2013, CRISPR-Cas9 was used to create mice with specific gene modification within one generation[6]. In the past these modifications were time-consuming and it took breeding a couple of generations of mice to produce the genetic results they needed. This breakthrough has sped up the process of many experiments with far-reaching benefits.

In 2014, the first monkeys with CRISPR-targeted genetic mutations were born. Monkeys are very valuable models for human diseases because of their close-matching genetic and physiological features. Researchers at the Model Animal Research Center of Nanjing University first tested the technology on a monkey cell line, by inserting CRISPR-Cas9 into one-cell stage embryos and then implanting the embryos[7]. The researchers started off by targeting one gene at a time and achieved a 10-25% success rate per gene. Based on those promising numbers, they decided to go forward and alter three genes at once. They achieved 10 pregnancies from 83 implanted embryos. This resulted in the birth of twin monkeys with mutations in two of three targeted genes.

In the last couple of years there has been a number of papers published about using CRISPR-Cas9 to target viral infections. Just last year, scientists were able to inhibit hepatitis C in human cell cultures[8]. Hundreds of millions of people around the world are currently living with hepatitis C and using Cas9 to target this virus could be a novel treatment to disable now-incurable strains. HIV-1 is a major health problem that affects more than 30 million people worldwide. Currently, anti-viral medication fails to eradicate HIV-1. Researchers are now looking into how CRISPR-Cas9 could solve this chronic condition and the results are promising so far. Scientists have been able to eradicate the HIV-1 genome and immunize target cells from infection in human cell cultures[9]. This is the first time that researchers have used Cas9 to immunize cells against HIV-1 infection. Amazingly, this preventive vaccination is independent of HIV-1 strain's diversity because the system targets genomic sequences regardless of how the viruses enter the infected cells[9]. With this new gene-editing tool, there have been many completely novel studies and results.

In the past, people who had genetic diseases had no hope of curing them within their lifetimes. The most they could hope for is that their embryos could be

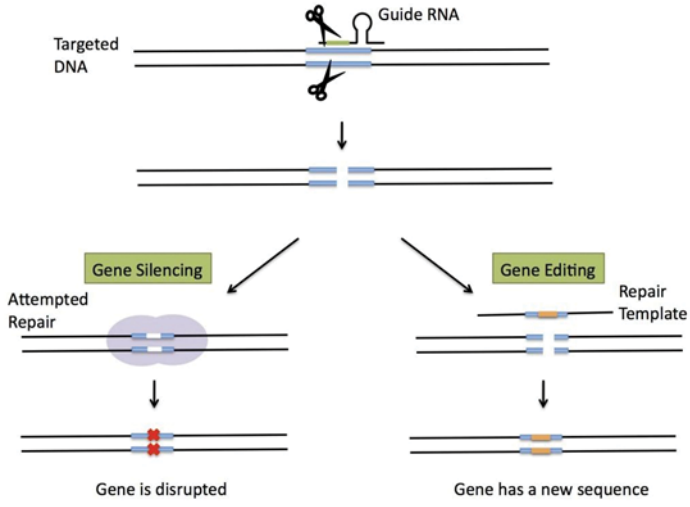


Figure 2: Pak, E: Science in the News, Harvard University[4]

screened for the diseases they carried. Now modern genetics has advanced rapidly and it is becoming possible to alter the genome of currently living biological systems. For the first time ever, CRISPR-Cas9 reversed disease symptoms in a living animal[10]. Researchers at MIT reported that they were able to cure mice of a rare liver disorder caused by a single genetic mutation[11]. In this study, researchers designed three guide RNA strands to target different DNA sequences near the mutation that caused the disorder. They delivered the CRISPR-Cas9 molecules along with the repair DNA template by injection. At the current rate of advancement, doctors will be able to cure almost any single-mutation genetic disease in the near future.

Last year, Layla, an 11-month old girl with leukemia was the first person to receive therapy involving gene editing with molecular scalpels called TALENs[12]. (CRISPR-Cas9 is a newer genetic scalpel.) Researchers were able to use TALENs to engineer immune cells to seek out and destroy cancer cells without harming other cells. Astoundingly, about a month after she got the treatment, doctors could not find any sign of leukemia[13]. She received a bone marrow transplant and has been cancer free for 12 months.

CONCLUSION

The ethics of genetically engineering people is controversial and a topic broad enough to span several books. I think, however, that the majority of people are on board with genetic treatment of terminally ill patients who have exhausted other avenues of therapy. Genetically engineering embryos is still highly controversial. Last year, Chinese researchers drew fire when they published their results on genetically engineering non-viable embryos. Less than 15 percent of the embryos showed evidence of the intended gene-editing[14]. The results are not surprising, but they highlight the fact that researchers are still figuring how to implement this new technology properly. Accidentally cutting the wrong genes could have disastrous or fatal results. The success rate should be much higher before use on patients would even be considered.

This technology is still in its infancy so the ethics of using it on humans not faced with terminal illness is not established. Life-Extensionists view all terminal debilities, including aging itself, as diseases that should be cured. All the chronic diseases that come with age are eventually terminal. There are emerging technologies that may allow us to edit our genomes to halt or even reverse the aging process. At the moment I am very pleased with all the reported progress in genetic engineering to cure chronic and terminal diseases like HIV, genetic diseases and even cancer. In my next article I will give a brief overview of what life-extension researchers are doing in this exciting field. ■

Carrie Wong is a young Canadian cryonicist. She graduated in 2011 with a degree in geology from The University of British Columbia and worked in gold exploration for a few years. In addition to writing for Cryonics Magazine, she is also writing for geologyforinvestors.com and running a cartography business.

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Alcor members pay general dues to cover Alcor's operating expenses and also make annual contributions to the Comprehensive Member Standby fund pool to cover the costs of readiness and standby. Benefits of Comprehensive Member Standby include no out-of-pocket expense for standby services at the time of need, and up to $10,000 for relocation assistance to the Scottsdale, Arizona area.

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To have the CMS fee waived, these are the minimums:

- **$220,000 Whole Body Cryopreservation ($115,000 to the Patient Care Trust, $60,000 for cryopreservation, $45,000 to the CMS Fund).**
- **$100,000 Neurocryopreservation ($25,000 to the Patient Care Trust, $30,000 for cryopreservation, $45,000 to the CMS Fund).**

If you have adequate funding and would like to take advantage of the CMS waiver, contact **Diane Cremeens at diane@alcor.org.**

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Supporters of Alcor who are not yet ready to make cryopreservation arrangements can become an Associate Member for $5/month (or $15/quarter or $60 annually). Associate Members are members of the Alcor Life Extension Foundation who have not made cryonics arrangements but financially support the organization. Associate Members will receive:

- ***Cryonics* magazine by mail**
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- **Access to post in the Alcor Member Forums**
- **A dollar-for-dollar credit toward full membership sign-up fees for any dues paid for Associate Membership**

To become an Associate Member send a check or money order ($5/month or $15/quarter or $60 annually) to Alcor Life Extension Foundation, 7895 E. Acoma Dr., Suite 110, Scottsdale, Arizona 85260, or call Marji Klima at (480) 905-1906 ext. 101 with your credit card information.

Or you can pay online via PayPal using the following link: http://www.alcor.org/BecomeMember/associate.html (quarterly option is not available this way).

Associate Members can improve their chances of being cryopreserved in an emergency if they complete and provide us with a Declaration of Intent to be Cryopreserved (http://www.alcor.org/Library/html/declarationofintent.html). Financial provisions would still have to be made by you or someone acting for you, but the combination of Associate Membership and Declaration of Intent meets the informed consent requirement and makes it much more likely that we could move ahead in a critical situation.

2nd Cryonics Symposium in Germany

By Dirk Nemitz

From 4 to 5 October 2014, the German Society for Applied Biostasis (DGAB) held a symposium in Dresden. Speakers from Germany and other countries presented about cryonics and related topics. It was the second of its kind; the first scientific cryonics symposium was organized in 2010 in Goslar. As one of the organizers of both events, I extend thanks to all presenters and participants for their contributions! I really think this is an important way of showing that cryonics is based on science, and not on any unjustified beliefs or scam.

In its two days, the 2014 conference covered a wide variety of topics relevant to cryonics and reflecting the interdisciplinary nature of the topic. These included biological and medical contributions related to cryopreservation and molecular repairs, organizational challenges given the long-term horizon of the activities, and presentations related to the history of cryonics and the definition of death. Let me give you some flavor of the symposium's highlights:

On cryopreservation, Ben Best presented "Forms of Cryopreservation Damage and Strategies for Prevention" and covered several forms of damage, including cryoprotectant toxicity, osmotic damage, chilling injury, cold shock, dehydration injury, and thermal stress fracturing. He also introduced strategies to alleviate these forms of damage, with emphasis on recent discoveries.

João Pedro de Magalhães went deeper into the topic of "Genomics of Cryoprotectant Toxicity." His research group is employing high-throughput gene expression profiling to study cryoprotective agents' toxicity in cryopreservation. The aim is to improve cryopreservation protocols to make long-term storage of stem cells, engineered tissues, organs and whole organisms more efficient. I enjoyed this talk a lot, as it gives a lot of details from very promising research.

Figure 1: Professors Peter Gouras and Klaus Sames in discussion.

The presentation of Peter Gouras focussed on another form of damage, namely age related degeneration. As an already existing example of addressing degeneration he presented remarkable breakthroughs, including transplantation of healthy epithelial cells to stop retinal degeneration in the eye. Given that cryonics will need neural repair to work, the exciting part is that this really was the first example of transplantation stopping degeneration in the central nerve system. It shows that this part of the nervous system, the retina, which is part of the brain and one of the most highly metabolizing structures in our body, can be repaired.

Related to this, Nadine Saul presented on "Anti-Aging and Pro-Longevity: What can We Learn from a Small Worm?" She explained how biogerontologists have used the nematode *Caenorhabditis elegans* (*C. elegans*) to demonstrate initial successes in longevity research with at least four methods: hormesis, calorie restriction, targeted molecular modulation and deep freezing. Just as an example: The mutation of specific genes can lead to a five-fold extension of lifespan in *C. elegans*, which would scale to 400-500 years in humans.

Klaus Mathwig in his talk "Molecular Repair at Physiological Conditions?" left the causes of longevity and damage behind and turned toward potential repair mechanisms. Summarizing early experiments with exotic molecules under extreme experimental conditions, he then addressed what would actually be needed for molecular repair of tissue. Changes in different environmental factors such as a substantially higher temperature and a liquid environment were considered. He then gave a fascinating introduction to a state-of the art nanotechnology toolkit to probe single molecules at physiological conditions.

Igor Artyuhov and Alexander Pulver from the Institute of Biology of Aging in Moscow, Russia, gave a well-received and thought-provoking introduction to the possible mechanisms of the cryoprotective effect of xenon. They presented a combined approach to the development of a protocol for the vitrification of bulky biological objects. In a third contribution Dmitry Buslov from the same institution spoke about uniform heating of multi-structural biological objects by means of electric and magnetic field-phased emitters.

Forever surrounded by an inspiring aura of optimism, Aubrey de Grey discussed "Damage Repair for People whose Hearts

Figure 2: Panel discussion with Ben Best, Aubrey de Grey, Max More and Peter Gouras.

are Still Beating." He explained that with the SENS Research Foundation he seeks to develop new medicines that will restore people to a state of full health before even needing cryopreservation. In particular, he elaborated on how they propose to perform this damage repair and why it is plausible that such medicines will be developed in the next few decades.

The talks also covered more philosophical and socio-economic grounds. It was especially fascinating to listen to Max More, who pondered the question "How to Sustain an Organization for Over a Century?" Watching this talk is highly recommended, especially for everyone not living in the US, where at least two cryonics providers have shown their long-term stability. Many mistakes can be made along the road, but looking into the past can help to avoid them.

My own talk: "History of Cryonics — A Narrative Analysis of the Cryonics Magazine" touched on exactly this point. Based on ten years of cryonics publications covering the decade of the 1970s I explored the question of what articles cryonicists write for cryonicists to read. Next to other interesting quantitative findings, a few outstanding events have been identified as remarkable turning points, such as the 1971 cryonics conference, in which Peter Gouras already participated as a speaker on the important topic of developing improved human cryopreservation protocols. The most traumatic event was the 1979 Chatsworth disaster, which was touched upon quite often — in my view, frankly, this initial tragedy can't be discussed enough in order to remind all of us about the responsibility that cryonics providers are carrying.

The presentation of Aschwin de Wolf on "Identification, Validation, and Implementation of New Cryonics Technologies" skillfully connected aspects of history and technology. His particular focus was on multiple reasons why potential improvements in cryonics are not being recognized or endorsed. He started with the observation that institutional and financial obstacles can prevent timely experimental validation and introduction of promising cryonics technologies. He then reviewed the history of technological progress in cryonics and discussed the reasons that delayed or postponed the introduction of superior technologies. Finally he offered solutions that may enable faster adoption of new advances.

Figure 3: Panelist and Alcor CEO Max More makes a point.

Finally, Klaus Sames, often referred to as the "German Robert Ettinger" for his accomplishments and dedication to the field, gave an intriguing talk about the definitions of death. He touched upon both legal and medical definitions, but extended his coverage to death as a philosophical and psychic-social phenomenon. His discussion of why so many prefer "death" to cryonics gives food for thought for all of us.

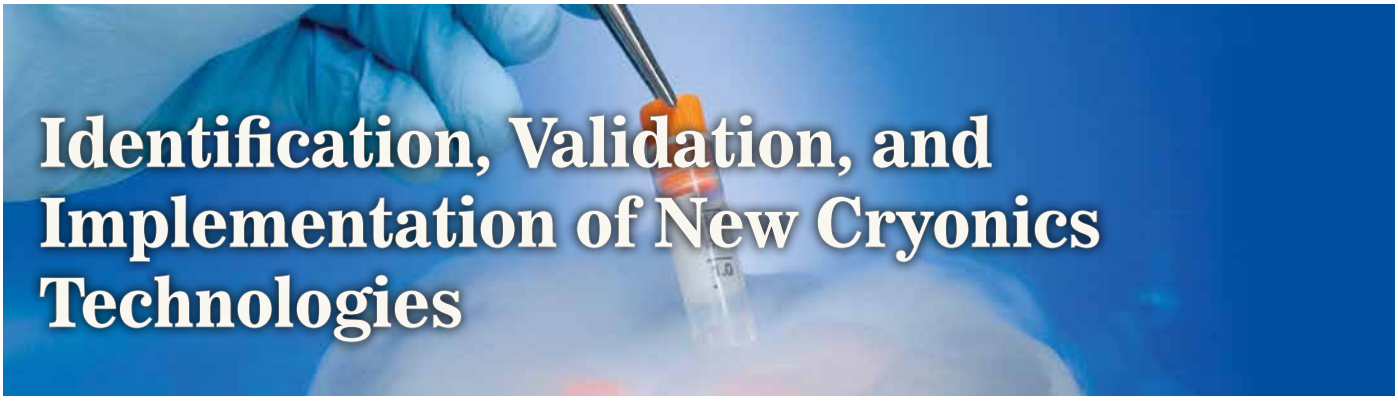
A special treat was the panel discussion on "Acceptance of Cryonics in Science and Society," with many remarkable contributions by the four panelists: Ben Best, Peter Gouras, Aubrey de Grey and Max More. It really was an honor and an inspiration to have all these great minds explore how to improve the acceptance of cryonics.

Another point to make, just to add to your regrets in case you had to miss out, is about the program of the event. The Robert Ettinger medal, which the DGAB first awarded in 2010 to Ettinger himself, this time went to Saul Kent. There was also a smorgasbord of social activities for attendees to get acquainted with each other and have some informal discussions about cryonics and any related topics. This extended from a reception on Friday night to a guided Dresden city tour and a well-visited conference dinner on Saturday.

In case you missed this event or would like to see one of the talks again, you're warmly invited to watch the videos on our Youtube channel (find the link at www.biostase.de). Lastly, I would like to highlight that our DGAB honorary board member Klaus Sames is currently working on a conference proceedings book, which will be available in English likely in 2016. The conference proceedings of the first cryonics symposium called "Applied Cryobiology — Human Biostasis" are also available from your local bookshop or online book store.

Let's stay connected on these topics, and in case you have feedback, ideas or potential contributions for a 3rd symposium in a few years, please let me know!

Before closing, let me express my special gratitude to two well-known cryonicists who have considerably contributed to my study on cryonics history by sharing their remarkable knowledge and data: Ben Best and Mike Perry, it was a real pleasure, thank you both! ■



Identification, Validation, and Implementation of New Cryonics Technologies

By Aschwin de Wolf

In an ideal world, promising cryonics technologies would be identified, followed by prompt validation and implementation. In the real world, however, there are multiple reasons why potential improvements in cryonics are not being recognized or endorsed. Even when the benefits of such technologies appear evident, institutional and financial obstacles can prevent timely experimental validation and introduction. This article briefly reviews the history of technological progress in cryonics, discusses the reasons that delayed or postponed the introduction of superior technologies, and offers solutions that may enable faster adoption of new advances.

INTRODUCTION

The practical production of liquid nitrogen from liquefied air was first achieved by Carl von Linde in 1905, although liquid nitrogen only became widely available commercially after World War II. The idea of cryonics was introduced to the general public in the mid-1960s. Since liquid nitrogen (or other cryogenic substance) is an essential requirement for human cryopreservation it is interesting to recognize that there was only a difference of roughly 20 years between cryonics being technically possible and the first efforts to practice cryonics. Robert Ettinger published *The Prospect of Immortality* in 1964. In 1967 James Bedford was cryopreserved.

Similarly, the idea of vitrification by rapid cooling as a means of cryopreservation was first proposed by Basil L. Luyet in the 1930s, followed by Pierre Boutron's screening of cryoprotectants for their glass forming abilities in the 1970s, and Gregory Fahy's pioneering work in the 1980s and beyond to achieve vitrification by high concentrations of cryoprotectants. No more than 20 years after these investigations, vitrification solutions with high concentrations of cryoprotectants were introduced in cryonics. This appears to be a reasonably rapid translation of scientific breakthroughs into cryonics technologies.

In the case of combinational pharmacotherapy to mitigate cerebral ischemia, research and cryonics implementation often went hand-in-hand and observations in cryonics cases were used to refine experimental designs.

Despite all this, there is the public perception that cryonics suffers from a lack of research and sees little technological progress. Compared to fields such as biogerontology and the developments discussed above, I think this is a misunderstanding. A major reason for it is that the general public and most scientists do not recognize that technological progress is possible in cryonics without achieving full fledged human suspended animation. For example, safe and cost-effective cryogenic storage, inhibition of ice formation, elimination of (cerebral) ischemia, et cetera, are possible without having fully reversible cryopreservation.

I do think, however, that there is a lot that can be done to further narrow the time between identification, validation, and implementation of cryonics technologies by obtaining a greater understanding of what fosters and limits the identification of technological improvements in cryonics.

IDENTIFICATION OF NEW TECHNOLOGIES

Identification of new cryonics technologies is a topic that is rarely discussed within cryonics. Upon closer scrutiny, this is a rather complex topic. First of all, for the idea of identification of new technologies to make sense one has to subscribe to the idea that cryonics technologies can and must be improved. Closely related to this is the belief that the concept of "patient care" is meaningful in cryonics and can be empirically defined. This outlook on cryonics has not been universal and from its inception proponents of perfecting cryonics technologies often had to compete with a movement in cryonics that showed little interest in delivering cryonics services that aimed for more than placing the patient in liquid nitrogen after pronouncement of legal death.

The history of the Alcor Life Extension Foundation shows a different perspective. Since its inception, the organization has

been shaped by individuals who aimed to close the gap between crude freezing and reversible human cryopreservation. One claim that I will be making in this article is that formal commitment to develop human suspended animation provides a framework to identify desirable research and development goals. When suspended animation is used as a benchmark to evaluate the state of cryonics technologies, it is possible to identify the gap between contemporary technologies and desired technologies. This, in turn, can direct the search for new developments in science and technology to replace existing technologies. For example, ice formation is clearly not compatible with human suspended animation and replacing freezing protocols with protocols that eliminate ice formation is a logical consequence of this mandate. Another example is fracturing. Long-term care protocols that induce too much thermal stress in the patient do not allow for reversible cryopreservation and need to be replaced with long term cryostasis protocols that avoid the formation of fractures, such as annealing or intermediate temperature storage (ITS).

It is important to stress here that a universal consensus to use human suspended animation as the ideal to strive for does not exclude debate over which new developments should be pursued and prioritized. I think there is a rather widespread consensus that the replacement of non-vitrification cryopreservation protocols with vitrification is highly desirable. But there can be a difference of opinion about how much effort to expend in developing completely non-toxic vitrification agents instead of accepting a small amount of toxicity and moving on to eliminating fracturing or cerebral dehydration first. Sometimes such differences in perspective reflect incomplete knowledge. For example, do we need to induce hypothermia faster during stabilization procedures, or are our existing technologies sufficient to keep the brain viable by contemporary medical criteria?

To my knowledge, no one in cryonics has ever attempted to offer a framework to make such decisions. In principle, such a framework should be possible. One could argue that the first mandate of a cryonics organization is to pursue technologies that preserve ultrastructure in such a state that no differences between controls and experimental brains can be observed. When this goal has been achieved, the next mandate is to eliminate gross mechanical damage, that is to say, prevent fracturing. The next step would be to prevent nano-scale modifications in proteins that compromise viability, that is, to develop non-toxic cryoprotectants. Such a ranking can also assist in cost-benefit analysis of proposed technologies.

Without a strong commitment to human suspended animation as a goal, a cryonics organization is at risk of becoming a freeze-and-repair operation that just goes through the routines without a framework to identify a route forward.

VALIDATION OF NEW TECHNOLOGIES

When we think of validation of new technologies we tend to exclusively think in terms of development and experimental validation *within* cryonics. A closer look at how new technologies are introduced in cryonics should lead to a more nuanced perspective. First of all, in some cases the scientific validation has already been done in mainstream science and clinical practice. In emergency medicine a routine procedure is to stabilize the patient for subsequent hospital admission and treatment. In cryonics we would like to stabilize the patient for long term care at low temperatures. In both cases, however, the aim is to prevent any further deterioration from the condition we find the patient in. If a new mechanical device can deliver more effective external chest compressions (and improve cerebral blood flow), then, everything else the same, this should translate into improved patient care in cryonics, too. The crucial part here is "everything else the same." One subtle problem that is often underestimated by medical professionals who are new to cryonics is that the conditions in which cryonics patients present themselves can be so distinctly different that a departure from standard emergency medical protocol is necessary. Thus, often mainstream technologies need to be translated into cryonics technologies and sometimes this even requires additional experimental research. In general, though, adaptation of new mainstream technologies can accelerate the progress in cryonics technologies.

Another area in which the need for conducting experimental research is often minimal is when the technological changes in question are primarily engineering challenges. A good example concerns efforts to increase the cooling rate during initial stabilization. It is well recognized that faster cooling rates during this phase confer a substantial benefit and are instrumental to keep the patient's brain viable. Any technology of internal or external cooling that can achieve this objective constitutes measurable progress. Or consider the development of computer-controlled perfusion that can optimize a perfusion protocol based on a number of chosen variables (pressure, cryoprotectant concentration, et cetera.)

When it comes to the core technologies in cryonics such as cryopreservation of the brain, however, there is no credible alternative to conducting experimental research in-house or contracting with other research labs. In an ideal world, prior to adaptation, new cryopreservation technologies would be independently verified in a number of labs using different animal models and the new technology would then be progressively implemented in cryonics with extensive data collection and analysis. It is indisputable that this is the gold standard in cryonics but at this point it cannot be claimed that all cryonics technologies have been validated with such rigor. The rationale for using technologies in cryonics has ranged from theoretical extrapolations from the scientific literature to the use of technologies that have been validated in peer reviewed publications.

The Author at the 2nd Cryonics Symposium in Germany

Conducting experimental research to validate new technologies is a non-trivial affair for the typical cryonics organization. Funding that can be allocated to research often needs to compete with other priorities such as maintaining qualified staff and promotion. There is also the increased recognition that combining patient care and experimental research is not prudent, which necessitates either outsourcing research or establishing separate research facilities. New technologies often produce new research questions. For example, the adoption of vitrification solutions has greatly increased interest in investigating low toxicity cryoprotectants.

IMPLEMENTATION OF NEW TECHNOLOGIES

After identification and validation, the final step is implementation of a new technology. As discussed above, in cases where the technology is already in use in mainstream medicine, implementation often requires some kind of adaptation for use in cryonics. Another important element of implementation is creating documentation and the training of staff and contractors to use the new technologies. In some cases, the lack of required skills can complicate or delay implementation.

Validation and implementation are not always distinct phases. Often, the only way experimental evidence can be obtained about a new technology is to carefully introduce it in human cases, collect data, and revise the technology if necessary. The introduction of new technologies should always be followed by focused and repeated data collection to evaluate its efficacy and to determine whether the addition of this technology brings the cryonics organization closer to its ultimate goal of reversible cryopreservation.

The technological progress that has been made in cryonics is impressive, especially considering its science and limited scientific support. Unlike in a field such as biogerontology, cryonics protocols can usually be tested in a relatively short time span and there is little dispute over what kind of problems need to be solved to achieve reversible cryopreservation. In the remainder of this article I will give a number of reasons (some of them intrinsic to cryonics) that have prevented more rapid technological progress in cryonics.

One of the most formidable challenges in the field of cryonics is that there is no direct feedback in a way that is obvious and recognizable for most people.

OBSTACLES TO RAPID TECHNOLOGICAL PROGRESS IN CRYONICS

Before I start with reviewing a number of causes it will be helpful to reiterate an earlier observation; the idea of technological progress in cryonics follows the recognition that reversible cryopreservation (or human suspended animation) is the ultimate goal of cryonics procedures and that we can evaluate cryonics cases with this framework in mind. This leads us to the first reason that can explain a slower pace of technological development.

No formal commitment to human suspended animation

Without a strong commitment to human suspended animation as a goal, a cryonics organization is at risk of becoming a freeze-and-repair operation that just goes through the routines without a framework to identify a route forward. While it can be argued that repair of the frozen brain is technically feasible and plausible, placing a critically ill patient in suspended animation leaves no doubt that the medico-legal status of a cryonics patient should be considered "alive." When human suspended animation is recognized as a formal goal, a cryonics organization can be judged by its efforts to close the gap between its current technologies and this goal.

No recognition of the concept of patient care

Closely related to establishing a formal commitment to human suspended animation is the recognition that the concept of patient care in cryonics is meaningful and allows for setting standards of care. For example, a cryonics organization can aim for keeping the brain viable by contemporary medical criteria during stabilization, prevent dehydration and freezing of the brain following cryoprotection and cooling, and eliminate fracturing during long term care by storing closer to the glass transition temperature. In each case, data need to be collected to determine to what degree these goals were achieved. Careful scrutiny of case data can lead to designing new research questions or pushing standards to an even more ambitious goal.

One of the most formidable challenges in the field of cryonics is that there is no direct feedback in a way that is obvious and recognizable for most people. There are no patients returning home after the procedure and the only way to determine whether a cryonics organization delivers care to the standards it is technically capable of is to collect data on cooling rates, take blood samples, perform viability assays on microliter brain tissue samples, inspect the brain for ice formation, and analyze CT scans after cooldown.

When a cryonics organization is deemed capable of producing reproducible outcomes in a typical cryonics case, the framework of suspended animation can then be used to identify new technological

innovations that will further improve the level of patient care.

Competing priorities and financial constraints

Naturally, when there is no money available for research, or to fabricate or purchase the new technologies, a cryonics organization can remain in technological stasis. Technological innovation is important but can't be the only goal for a cryonics organization. A credible cryonics organization has the secure care of its existing patients as its most import goal. Even more time-consuming can be a high caseload, which can occupy most of the time of technical and medical staff at the expense of technological innovation. As a general rule, most cryonics organizations also devote some resources to outreach and growth.

While it is correct that technological advances are usually passed on to members in the form of higher cryopreservation minimums, the fear of making cryonics too expensive for the average member has often delayed introducing new technologies. A good example is intermediate temperature storage. Replacing care at liquid nitrogen temperature for ITS systems will increase the cost of long term care (at least in its current incarnation). One way for a cryonics organization to ensure that research and technological development is not pushed below other priorities is to create a separate research fund and solicit targeted contributions. Cryonics organizations that enjoy generous financial support can also consider spinning off a separate research organization.

Lack of competent technical and scientific staff

For a cryonics organization it is important to recruit staff members who are scientifically literate and committed to technological innovation. This is not only important for staff members with technical responsibilities. When the whole staff of an organization shows strong support for technological progress it is possible to create a culture of scientific excellence. In contrast, if a cryonics organization lacks staff with solid scientific or clinical credentials, technological progress and good patient care will be compromised. This is also the case when staff members have formal scientific or medical credentials but show little initiative or are incompetent. Cryonics organizations are small and poor hiring decisions can have profound effects on the nature of the organization. Since it is usually easier to hire than to fire, such problems can be persistent and hard to reverse.

One risk in cryonics is that staff members who have excellent scientific credentials are recruited to work in other organizations and companies. As a consequence, the most technically savvy cryonicists are not employed in cryonics organizations. This potential development is another reason for a cryonics organization to spin off a separate research organization. In such a structure the finest minds in cryonics can devote their time to scientific and technological issues relevant to cryonics without being slowed down by other aspects of a cryonics organization.

A good example of a technology that is held back by the lack of enough medically qualified staff is field cryoprotection. In a sense, the idea of conducting cryoprotection on-site prior to shipping the patient to a facility first is as old as the idea of cryonics itself. Eliminating the prolonged ischemic times associated with remote blood washout and patient shipment in favor of doing field cryoprotection near the location where the patient is pronounced legally dead would constitute a major improvement in patient care. Prolonged transport times on water ice are fundamentally incompatible with the aim of reversible cryopreservation. Unfortunately, only a handful of remote cryonics cases have been conducted as field cryoprotection cases. If field cryoprotection is done for all cases where this is technically preferable, substantial cost savings could be reaped as well. Making such a transition, however, would require that a cryonics organization always have access to case personnel or contractors who are competent at surgery and perfusion, and have good cryobiological knowledge.

High turnover of staff and leadership

When there is a high turnover of management and/or staff within a cryonics organization it is hard to make technological progress or conduct long-term research projects. New management and staff members may also have different perspectives about which technological developments to pursue and, as a consequence, R&D in progress is discarded or put on hold.

Closely associated with this is the loss of institutional knowledge. Having a broad and deep understanding of cryonics is important to identify and pursue new technological directions and evaluate the quality of care at an organization. Absent such (distributed) knowledge, a cryonics organization can remain in stasis or move in reverse. At the Alcor Life Extension Foundation there have been multiple cases in which the quality of care worsened relative to prior administrations or where routine technological procedures were (unconsciously) abandoned because of poor intuitional knowledge transfer. In a worst case scenario the cryonics organization does not know that it does not know and promotes itself as delivering excellent care and committed to technological innovation while mistakes and poor R&D are rampant.

Faulty commitment to cryonics

Faulty commitment may seem a strange problem for a cryonics organization to have. But it certainly was a problem in the early days, when some naïve businessmen perceived cryonics to be a get-rich-quick scheme, or otherwise had unrealistic expectations. The popularity of cryonics turned out to be not as high as projected, and funding to undertake and continue operations, including long term care, proved very limited. Baffled by the problems, most of these people left the field, sometimes being forced to abandon patients.

In more recent years cryonics organizations have faced a different kind of problem. Organizations such as Alcor and Suspended Animation can afford to pay market wages for most of their positions and wages above prevailing market values are not unheard of. As a consequence, seeking employment at a cryonics organization can be a rational course of action, regardless of any personal or professional interest in cryonics. In such

a situation, a strong commitment to patient care and research is often lacking. Requiring staff to have cryonics arrangements in place is no longer a sufficient guarantee of dedication in these circumstances because obtaining cryonics arrangements can be considered just a small inconvenience for a well-paid job that lacks the usual professional scrutiny.

"The perfect is the enemy of the good"

One cause for a substantial delay between validation and implementation is to aim for a perfect technological solution before authorizing a technology to be used in cryonics. In reality this can mean that a technology that can already make a substantial contribution to patient care is withheld from the field. A prime example of such a technology, in my opinion, is liquid ventilation (or cyclic lung lavage). The feasibility and desirability of such a technology was established in the mid-1990s but at least 20 years has passed without formal deployment of this technology in cryonics despite various organizations having pursued its development. In fact, in this case a lot of the reasons for technological stasis in cryonics (such as high turnover of management and staff) seem to have colluded.

Another example may be intermediate temperature storage (ITS). If the recommended ITS temperature substantially reduces the amount of cracking but does not always eliminate it, a case can still be made for implementing this technology. This is particularly true if the brain is saved from fracturing events and the only remaining fractures can be healed through conventional surgery or organ replacement.

A related, but more subtle problem is not recognizing that a technology can be considered mature enough to make a contribution to cryonics but cannot be considered sufficiently developed for clinical use. A good example is organ vitrification. One might argue that the knowledge that sufficiently high concentrations of cryoprotectant can prevent ice formation existed for a long time in cryonics before it was introduced in the field. Since neither conventional cryopreservation nor vitrification could produce high viability readings, the only useful indicators for cryonics could have been inhibition of ice formation and histology. By these criteria even the vitrification solutions that did not produce good viability in slice work would have been a sensible replacement for the prevailing glycerol protocols.

For a cryonics organization it is important to recruit staff members who are scientifically literate and committed to technological innovation.

CONCLUSION

Without formalizing reversible cryopreservation as a research and clinical goal, a cryonics organization is at risk of technological stasis and poorly positioned to identify, validate, and implement superior technologies that aim to close the gap between prevailing procedures and human suspended animation. Rapid technological progress in cryonics requires prudent hiring, a tech-savvy and scientifically literate staff, a stable culture committed to cryonics, a distinct R&D program, generous financial support, and the ability to prioritize technological needs based on research and observations made in casework.

Perhaps the most formidable obstacle to creating and sustaining such an infrastructure is the lack of obvious feedback in cryonics procedures. There is no revival or healing that can easily be understood by members and the general public. Thus there is only limited validation of, or motivation to insist on, good patient care and ongoing technological innovation. The vision that cryonics organizations should offer something better than store-and-repair has always had its advocates but its influence has remained limited and fragile.

If cryonics organizations would introduce liquid ventilation, field cryoprotection, and fracture free storage, there are three remaining technological challenges to achieving human suspended animation. These are (1) the design of a vitrification agent with no or negligible toxicity, (2) eliminating severe cryoprotectant-induced dehydration of the brain, and (3) optimum distribution of the cryoprotectant in whole body cases. ■

Options for Safe, Secure and Legal Asset Preservation for Post-Resuscitation Access

The Seventh Annual *Young Cryonicists* Gathering

Teens & Twenties 7 2016: Getting to Know You - You Getting to Know Each Other

Fri-Sun; April 8-10, '16 Ontario CA Host: *Life Extension Foundation* SCHOLARSHIPS AVAILABLE

★★★

Greetings to *Young Cryonicists*,

You are receiving this invitation because you are among the future leaders in cryonics.

All attention will be focused on:
our getting to know you and
you getting to know each other.
PLUS: an update on the latest emergency response technologies and revival strategies.

Who is Eligible?

Fully signed up young cryonicists from all cryonics organizations in their late teens through age thirty *(18-30) as of April 10, 2016* - may apply to attend.

Younger Cryonicists With Parent(s):

Thirteen through seventeen year olds may attend when accompanied by their parent(s) or guardian(s).

Parents/guardians of attendees aged 18-19 are also encouraged to accompany their child. All attending parents will be put in touch with each other should they choose to have their own "get together" during the "young cryonicists" gathering.

Program

Some individuals are social butterflies. This is not so for everyone. And we want *everyone to meet everyone.* Therefore, I have designed a diverse range of "getting to know you" activities. *IF* you would enjoy participating in these various getting acquainted activities, *THEN* this is for you.

Enjoy this exciting & fulfilling weekend.

SCHOLARSHIPS:

Life Extension Foundation, through a generous education grant, is offering *40 scholarships* that pay for ALL of the following:

- U.S. airfare to/from South Florida (or up to $1000 for origin outside the U.S.)
- Hotel accommodations for Friday & Saturday nights - plus Thursday & Sunday nights for scholarship attendees who room together.
- Meals and beverages on Friday night, all day Saturday, & Sunday breakfast & lunch
- Registration fee - $350 - also covered

Please click on this website for a full packet with all details and application forms.

http://www.alcor.org/T2_7_2016_details.pdf

Forever,

Cairn Erfreuliche Idun
Founder/Director: T2

PS Come Early. Stay Late.

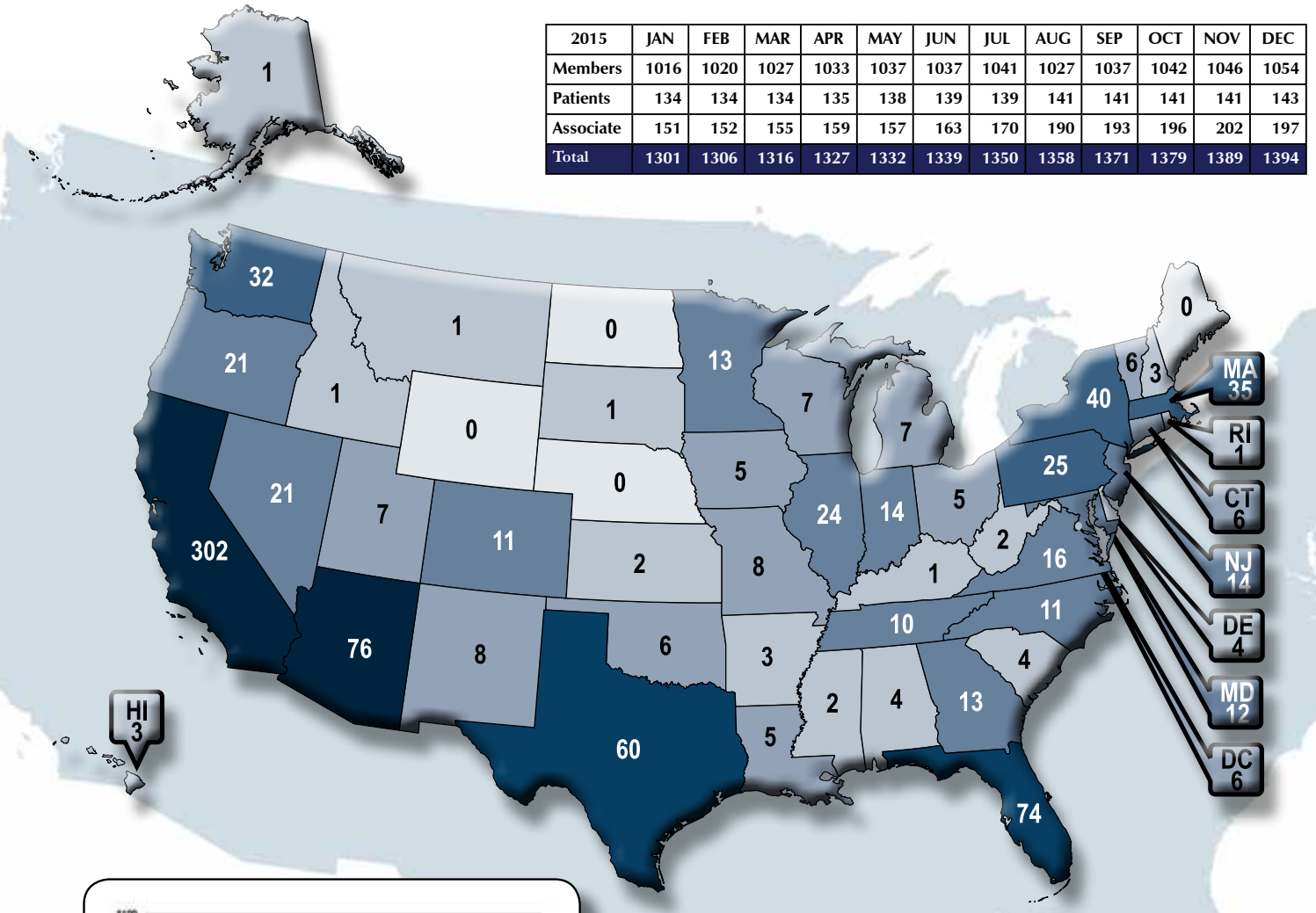
Some attendees to T2 enjoy spending *extra time in California* - especially since their flight is already paid for via their scholarship.

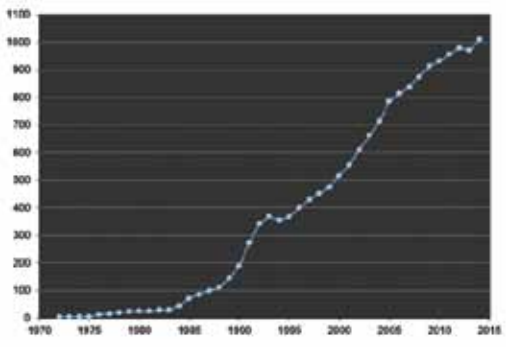
This is at their own expense for additional lodging and food.

I look forward to getting to know you.

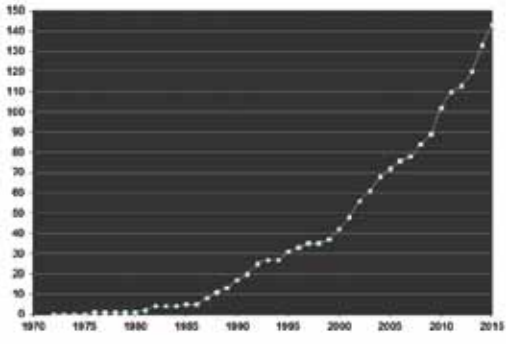
Membership Statistics

2015	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Members	1016	1020	1027	1033	1037	1037	1041	1027	1037	1042	1046	1054
Patients	134	134	134	135	138	139	139	141	141	141	141	143
Associate	151	152	155	159	157	163	170	190	193	196	202	197
Total	1301	1306	1316	1327	1332	1339	1350	1358	1371	1379	1389	1394





Number of Alcor members



Number of Alcor patients

- 0 Members
- 1–4 Members
- 5–9 Members
- 10–24 Members
- 25–49 Members
- 50–74 Members
- 75+ Members

International

Country	Members	Patients
Australia	11	3
Canada	49	2
China	0	1
Germany	8	0
Hong Kong	1	0
Israel	1	1
Italy	3	0
Japan	4	0
Mexico	4	0
Monaco	1	0
Netherlands	1	0
New Zealand	1	0
Norway	1	0
Portugal	4	0
Singapore	1	0
Spain	3	1
Thailand	4	1
United Arab Emirates	1	0
United Kingdom	25	3
TOTAL	123	12

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In **2003**, the **Life Extension Foundation®** introduced a standardized ***resveratrol*** extract shown to favorably alter genes implicated in the aging process—many of the same genes that respond to **calorie restriction**.

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Compelling evidence reveals that certain compounds found in berries, such as **pterostilbene** and **fisetin**, possess potent "longevity gene" activators that work in synergy with **resveratrol**. For example, **fisetin** (found in strawberries) has been shown to ***stabilize*** resveratrol in the body by shielding it from metabolic breakdown,[1-10] thus extending its beneficial effects.

CAUTION: If you are taking anti-coagulant or anti-platelet medications or have a bleeding disorder, consult your healthcare provider before taking this product.

References

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Life Extension® customers gain access to standardized ***trans*-resveratrol** combined with botanical extracts that favorably influence longevity gene expression. Unlike many commercial formulas, Life Extension standardizes to ***trans*-resveratrol**, which researchers contend is the most active constituent.

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The suggested dose of one capsule a day provides:	
Trans-Resveratrol	250 mg
Red grape (fruit) and wild blueberry (fruit) blend	85 mg
Quercetin	150 mg
Trans-Pterostilbene	0.5 mg
Fisetin	10 mg

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Be sure to mention code PIM601X.

MKAQAV160101_AD01

GPU-Accelerated Deep Neural Nets Look for Cures that Already Exist

Discovering cures for cancer, for Alzheimer's, for multiple sclerosis, for Parkinson's, for the halting and reversing of aging itself, may not require the development of new drugs. It may mean discovering properties and therapies in drugs already developed and used for other diseases. That's the principle driving bioinformatics start-up Insilico Medicine, a Baltimore-based company utilizing GPU-accelerated NVIDIA advanced scale computing to power deep learning neural nets using massive datasets for drug repurposing research that targets aging and age-related diseases. Drug re-targeting is not new. One of the best known cases is rapamycin, a drug originally thought to be an antifungal agent before it became widely used in organ transplantation and then as a cancer fighter. Other companies have pursued drug re-purposing as a development strategy, but Dr. Alex Zhavoronkov, Insilico CEO, said his company is using big data analytics to scale the strategy to a level never previously attempted.

Doug Black / Enterprisetech
9 Dec. 2015
http://www.enterprisetech.com/2015/12/09/gpu-accelerated-deep-neural-nets-look-for-cures-that-already-exist/

Nanoworld "Snow Blowers" Carve Straight Channels in Semiconductor Surfaces

In the nanoworld, tiny particles of gold can operate like snow blowers, churning through surface layers of an important class of semiconductors to dig unerringly straight paths. The surprising trenching capability, reported by scientists from the National Institute of Standards and Technology (NIST) and IBM, is an important addition to the toolkit of nature-supplied "self-assembly" methods that researchers aim to harness for making useful devices. Foreseeable applications include integrating lasers, sensors, wave guides and other optical components into so-called lab-on-a-chip devices now used for disease diagnosis, screening experimental materials and drugs, DNA forensics and more. Easy to control, the new gold-catalyzed process for creating patterns of channels with nanoscale dimensions could help to spawn entirely new technologies fashioned from ensembles of ultra-small structures. Beginning with studies on the semiconductor indium phosphide, the team teased out the chemical mechanisms and necessary conditions underpinning the surface-etching process.

NIST
28 Dec. 2015
http://www.nist.gov/mml/mmsd/20151228snow.cfm

Bridging the Bio-Electronic Divide

A new DARPA program aims to develop an implantable neural interface able to provide unprecedented signal resolution and data-transfer bandwidth between the human brain and the digital world. The interface would serve as a translator, converting between the electrochemical language used by neurons in the brain and the ones and zeros that constitute the language of information technology. The goal is to achieve this communications link in a biocompatible device no larger than one cubic centimeter in size, roughly the volume of two nickels stacked back to back. The program, Neural Engineering System Design (NESD), stands to dramatically enhance research capabilities in neurotechnology and provide a foundation for new therapies. "Today's best brain-computer interface systems are like two supercomputers trying to talk to each other using an old 300-baud modem," said Phillip Alvelda, the NESD program manager. "Imagine what will become possible when we upgrade our tools to really open the channel between the human brain and modern electronics."

DARPA
19 Jan. 2016
http://www.darpa.mil/news-events/2015-01-19

Engineers Invent a Bubble-Pen to Write with Nanoparticles

Researchers in the Cockrell School of Engineering at The University of Texas at Austin have solved a problem in micro- and nanofabrication — how to quickly, gently and precisely handle tiny particles — that will allow researchers to more easily build tiny machines, biomedical sensors, optical computers, solar panels and other devices. They have developed a device and technique, called bubble-pen lithography, that can efficiently handle nanoparticles — the tiny pieces of gold, silicon and other materials used in nanomanufacturing. The new method relies on microbubbles to inscribe, or write, nanoparticles onto a surface. Researchers' interest in nanoparticles, which are between 1 and 100 nanometers in size, has grown rapidly because of their versatility and strength. Some nanoparticles have optical properties that are useful for electronics. Others have the ability to absorb solar energy. In biomedical applications, nanoparticles can serve as drug carriers or imaging agents. But working with these particles while keeping their properties and functions intact can be difficult.

Cockrell School of Engineering
19 Jan. 2016
http://www.engr.utexas.edu/news/8079-bubble-pen

Delivering Genes across the Blood-Brain Barrier

Caltech biologists have modified a harmless virus in such a way that it can successfully enter the adult mouse brain through the bloodstream and deliver genes to cells of the nervous system. The virus could help researchers map the intricacies of the brain and holds promise for the delivery of novel therapeutics to address diseases such as Alzheimer's and Huntington's. In addition, the screening approach the researchers developed to identify the virus could be used to make additional vectors capable of targeting cells in other organs. "By figuring out a way to get genes across the blood-brain barrier, we are able to deliver them throughout the adult brain with high efficiency," says Ben Deverman, a senior research scientist at Caltech and lead author of a paper describing the work in the February 1 online publication of the journal *Nature Biotechnology*. The blood-brain barrier allows the body to keep pathogens and potentially harmful chemicals in the blood from entering the brain and spinal cord, but is nearly impossible to get past for many drugs and other therapeutic agents.

Caltech News
1 Feb. 2016
http://www.caltech.edu/news/delivering-genes-across-blood-brain-barrier-49679

New Delivery Method Boosts Efficiency of CRISPR Genome-Editing System

The genome-editing technique known as CRISPR allows scientists to clip a specific DNA sequence and replace it with a new one, offering the potential to cure diseases caused by defective genes. For this potential to be realized, however, scientists must find a way to safely deliver the CRISPR machinery and a corrected copy of the DNA into the diseased cells. MIT researchers have now developed a way to deliver the CRISPR genome repair components more efficiently than previously possible, and they also believe it may be safer for human use. In a study of mice, they found that they could correct the mutated gene that causes a rare liver disorder, in 6 percent of liver cells — enough to cure the mice of the disease, known as tyrosinemia. "This finding really excites us because it makes us think that this is a gene repair system that could be used to treat a range of diseases — not just tyrosinemia but others as well," says Daniel Anderson, associate professor in MIT's Department of Chemical Engineering and a member of MIT's Koch Institute and also IMES.

Anne Trafton / MIT News
1 Feb. 2016
http://news.mit.edu/2016/crispr-curing-disease-repairing-faulty-genes-0201

A Roadmap to Resuscitation

Successful rejuvenation of cryonics patients will require three distinct technologies: (1) A cure for the disease that put the patient in a critical condition prior to cryopreservation; (2) biological or mechanical cell repair technologies that can reverse any injury associated with the cryopreservation process and long-term care at low temperatures; (3) rejuvenation biotechnologies that restore the patient to good health prior to resuscitation. OR it will require some entirely new approach such as (1) mapping the ultrastructure of cryopreserved brain tissue using nanotechnology, and (2) using this information to deduce the original structure and repairing, replicating or simulating tissue or structure in some viable form so the person "comes back."

The following list is a list of landmark papers and books that reflect ongoing progress towards the resuscitation of cryonics patients:

Jerome B. White, "**Viral-Induced Repair of Damaged Neurons with Preservation of Long-Term Information Content,"** Second Annual Conference of the Cryonics Societies of America, University of Michigan at Ann Arbor, April 11-12, 1969, by J. B. White reprinted in *Cryonics* 35:10 (October 2014), 8-17.

Michael G. Darwin, **"The Anabolocyte: A Biological Approach to Repairing Cryoinjury,"** *Life Extension Magazine* (July-August 1977):80-83. Reprinted in *Cryonics* 29:4 (4th Quarter 2008),14-17.

Gregory M. Fahy, **"A 'Realistic' Scenario for Nanotechnological Repair of the Frozen Human Brain,"** in Brian Wowk, Michael Darwin, eds., *Cryonics: Reaching for Tomorrow,* Alcor Life Extension Foundation, 1991.

Ralph C. Merkle, **"The Molecular Repair of the Brain,"** *Cryonics* 15(January 1994):16-31 (Part I) & *Cryonics* 15(April 1994):20-32 (Part II).

Ralph C. Merkle, **"Cryonics, Cryptography, and Maximum Likelihood Estimation,"** First Extropy Institute Conference, Sunnyvale CA, 1994.

Aubrey de Grey & Michael Rae, **"Ending Aging: The Rejuvenation Breakthroughs That Could Reverse Human Aging in Our Lifetime."** St. Martin's Press, 2007

Robert A. Freitas Jr., **"Comprehensive Nanorobotic Control of Human Morbidity and Aging,"** in Gregory M. Fahy, Michael D. West, L. Stephen Coles, and Steven B. Harris, eds, *The Future of Aging: Pathways to Human Life Extension,* Springer, New York, 2010, pp. 685-805.

Chana Phaedra, **"Reconstructive Connectomics,"** *Cryonics* 34(7) (July 2013): 26-28.

MEETINGS

ABOUT THE ALCOR FOUNDATION

The Alcor Life Extension Foundation is a nonprofit tax-exempt scientific and educational organization dedicated to advancing the science of cryopreservation and promoting cryonics as a rational option. Being an Alcor member means knowing that—should the worst happen—Alcor's Emergency Response Team is ready to respond for you, 24 hours a day, 365 days a year.

Alcor's Emergency Response capability includes specially trained technicians and customized equipment in Arizona, northern California, southern California, and south Florida, as well as many additional certified technicians on-call around the United States. Alcor's Arizona facility includes a full-time staff, and the Patient Care Bay is personally monitored 24 hours a day.

ARIZONA

FLAGSTAFF:

Arizona without the inferno. Cryonics group in beautiful, high-altitude Flagstaff. Two-hour drive to Alcor. Contact eric@flagstaffcryo.com for more information.

PHOENIX
VALLEY OF THE SUN:

This group meets monthly, usually in the third week of the month. Dates are determined by the activity or event planned. For more information or to RSVP, visit http://cryonics.meetup.com/45/ or email Lisa Shock at lisa@alcor.org.

AT ALCOR:

Alcor Board of Directors Meetings and Facility Tours—Alcor business meetings are generally held on the second Saturday of every month starting at 11:00 AM MST. Guests are welcome to attend the fully-public board meetings. Facility tours are held every Tuesday at 10:00 AM and Friday at 2:00 PM. For more information or to schedule a tour, call Marji Klima at (877) 462-5267 x101 or email marji@alcor.org.

CALIFORNIA
LOS ANGELES:

Alcor Southern California Meetings—For information, call Peter Voss at (310) 822-4533 or e-mail him at peter@optimal.org. Although monthly meetings are not held regularly, you can meet Los Angeles Alcor members by contacting Peter.

SAN FRANCISCO BAY:

Alcor Northern California Meetings are held quarterly in January, April, July, and October. A CryoFeast is held once a year. For information on Northern California meetings, call Mark Galeck at (650) 772-1251 or email Mark_galeck@pacbell.net.

FLORIDA

Central Florida Life Extension group meets once a month in the Tampa Bay area (Tampa and St. Petersburg) for discussion and socializing. The group has been active since 2007. Email arcturus12453@yahoo.com for more information.

NEW ENGLAND
CAMBRIDGE:

The New England regional group strives to meet monthly in Cambridge, MA—for information or to be added to the Alcor NE mailing list, please contact Bret Kulakovich at 617-824-8982, alcor@bonfireproductions.com, or on FACEBOOK via the Cryonics Special Interest Group.

PACIFIC NORTHWEST

A Yahoo mailing list is also maintained for cryonicists in the Pacific Northwest at http://tech.groups.yahoo.com/group/CryonicsNW/.

OREGON:

The contact person for meetings in the Portland area is Aschwin de Wolf: aschwin@alcor.org. See also: https://www.facebook.com/portland.life.extension

BRITISH COLUMBIA (CANADA):

CryoBC, a special interest group within the nonprofit Lifespan Society of BC (http://www.lifespanbc.ca/) holds meetings for cryonicists in the Vancouver area. To be notified of meetings join the CryoBC mailing list: https://groups.yahoo.com/neo/groups/cryobc/info

TEXAS
DALLAS:

North Texas Cryonauts, please sign up for our announcements list for meetings (http://groups.yahoo.com/group/cryonauts-announce) or contact David Wallace Croft at (214) 636-3790 for details of upcoming meetings.

AUSTIN/CENTRAL TEXAS:

A new group for the Austin area has been started for those interested in discussion and understanding of the relevant technologies and issues for cryopreservation, genomics, epigenetics and medical research for increased life/health span. Contact Tom Miller, 760-803-4107 or tom@blackmagicmissileworks.com.

JAPAN

Cryonics meetings are held monthly in Tokyo. Send queries to grand88@yahoo.com.

ALCOR PORTUGAL

Alcor Portugal is working to have good stabilization and transport capabilities. The group meets every Saturday for two hours. For information about meetings, contact Nuno Martins at n-martins@n-martins.com. The Alcor Portugal website is: www.alcorportugal.com.

UNITED KINGDOM

Alcor members in the UK can contact Garret Smyth at Alcor-UK@alcor.org for information about local meetings.

If you are interested in hosting regular meetings in your area, contact Alcor at 877-462-5267, ext. 113. Meetings are a great way to learn about cryonics, meet others with similar interests, and introduce your friends and family to Alcor members!

What is Cryonics?

Cryonics is an attempt to preserve and protect human life, not reverse death. It is the practice of using extreme cold to attempt to preserve the life of a person who can no longer be supported by today's medicine. Will future medicine, including mature nanotechnology, have the ability to heal at the cellular and molecular levels? Can cryonics successfully carry the cryopreserved person forward through time, for however many decades or centuries might be necessary, until the cryopreservation process can be reversed and the person restored to full health? While cryonics may sound like science fiction, there is a basis for it in real science. The complete scientific story of cryonics is seldom told in media reports, leaving cryonics widely misunderstood. We invite you to reach your own conclusions.

How do I find out more?

The Alcor Life Extension Foundation is the world leader in cryonics research and technology. Alcor is a non-profit organization located in Scottsdale, Arizona, founded in 1972. Our website is one of the best sources of detailed introductory information about Alcor and cryopreservation (www.alcor.org). We also invite you to request our FREE information package on the "Free Information" section of our website. It includes:

- A fully illustrated color brochure
- A sample of our magazine
- An application for membership and brochure explaining how to join
- And more!

Your free package should arrive in 1-2 weeks. (The complete package will be sent free in the U.S., Canada, and the United Kingdom.)

How do I enroll?

Signing up for a cryopreservation is easy!

Step 1: Fill out an application and submit it with your $90 application fee.
Step 2: You will then be sent a set of contracts to review and sign.
Step 3: Fund your cryopreservation. While most people use life insurance to fund their cryopreservation, other forms of prepayment are also accepted. Alcor's Membership Coordinator can provide you with a list of insurance agents familiar with satisfying Alcor's current funding requirements.
Finally: After enrolling, you will wear emergency alert tags or carry a special card in your wallet. This is your confirmation that Alcor will respond immediately to an emergency call on your behalf.

Not ready to make full arrangements for cryopreservation? Then **become an Associate Member** for $5/month (or $15/quarter or $60 annually). Associate Members will receive:

- *Cryonics* magazine by mail
- Discounts on Alcor conferences
- Access to post in the Alcor Member Forums
- A dollar-for-dollar credit toward full membership sign-up fees for any dues paid for Associate Membership

To become an Associate Member send a check or money order ($5/month or $15/quarter or $60 annually) to Alcor Life Extension Foundation, 7895 E. Acoma Dr., Suite 110, Scottsdale, Arizona 85260, or call Marji Klima at (480) 905-1906 ext. 101 with your credit card information. You can also pay using PayPal (and get the Declaration of Intent to Be Cryopreserved) here: http://www.alcor.org/BecomeMember/associate.html

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