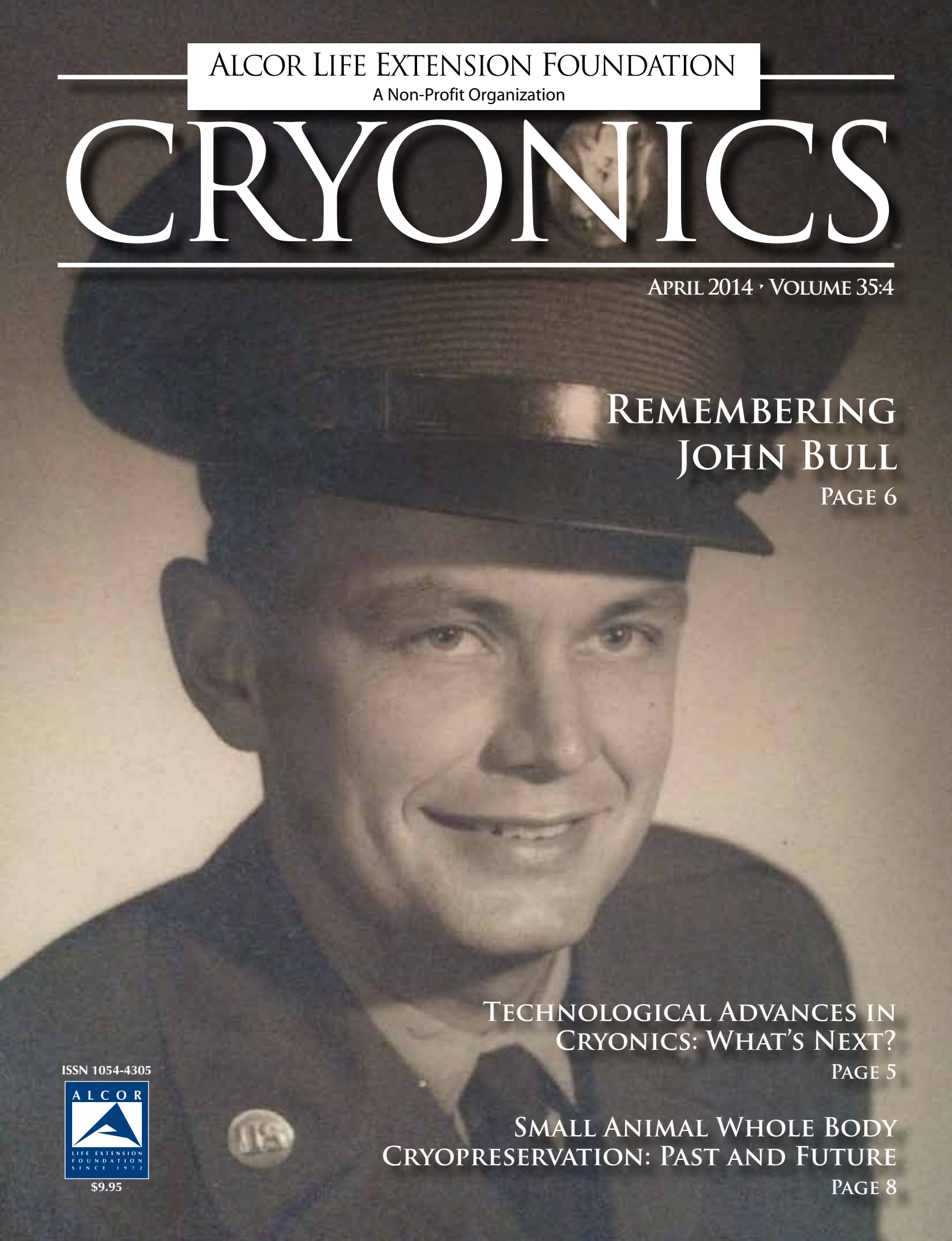
ALCOR LIFE EXTENSION FOUNDATION
A Non-Profit Organization

CRYONICS

APRIL 2014 · VOLUME 35:4



REMEMBERING JOHN BULL
PAGE 6

TECHNOLOGICAL ADVANCES IN CRYONICS: WHAT'S NEXT?
PAGE 5

SMALL ANIMAL WHOLE BODY CRYOPRESERVATION: PAST AND FUTURE
PAGE 8

ISSN 1054-4305

ALCOR LIFE EXTENSION FOUNDATION SINCE 1972

$9.95

Improve Your Odds of a **Good Cryopreservation**

You have your cryonics funding and contracts in place but have you considered other steps you can take to prevent problems down the road?

- ✓ Keep Alcor up-to-date about personal and medical changes.
- ✓ Update your Alcor paperwork to reflect your current wishes.
- ✓ Execute a cryonics-friendly Living Will and Durable Power of Attorney for Health Care.
- ✓ Wear your bracelet and talk to your friends and family about your desire to be cryopreserved.
- ✓ Ask your relatives to sign Affidavits stating that they will not interfere with your cryopreservation.
- ✓ Attend local cryonics meetings or start a local group yourself.
- ✓ Contribute to Alcor's operations and research.

Contact Alcor (1-877-462-5267) and let us know how we can assist you.

Visit the ALCOR FORUMS www.alcor.org/forums/

Discuss Alcor and cryonics topics with other members and Alcor officials.

- The Alcor Foundation
- Cell Repair Technologies
- Cryobiology
- Events and Meetings
- Financial
- Rejuvenation
- Stabilization

Other features include pseudonyms (pending verification of membership status) and a private forum.

Visit the ALCOR BLOG www.alcor.org/blog/

Your source for news about:

- Cryonics technology
- Cryopreservation cases
- Television programs about cryonics
- Speaking events and meetings
- Employment opportunities

Alcor is on Facebook

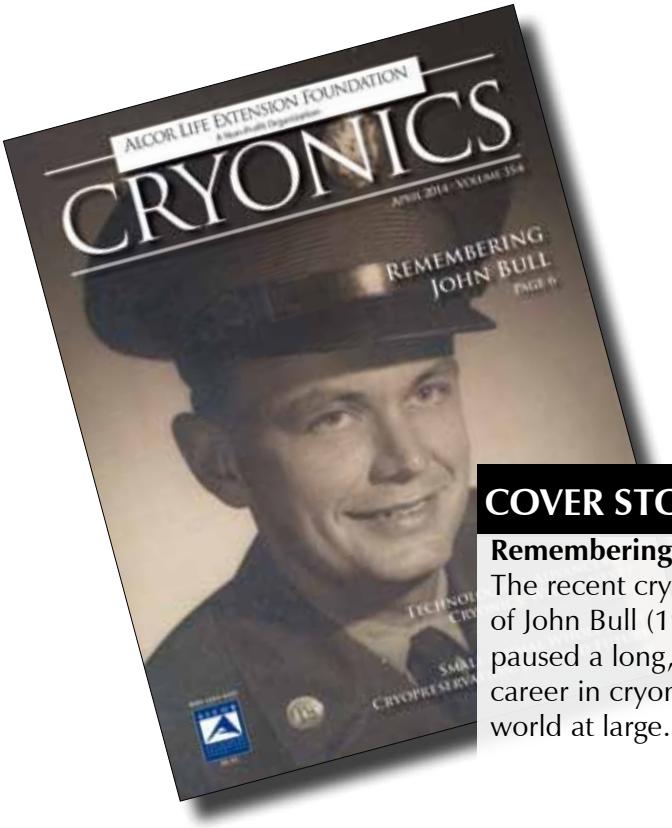
Connect with Alcor members and supporters on our official Facebook page:

www.facebook.com/alcor.life.extension.foundation

Become a fan and encourage interested friends, family members, and colleagues to support us too.

ALCOR LIFE EXTENSION FOUNDATION
A Non-Profit Organization

CRYONICS



On the cover:
John Bull in the U.S. Army, 1950s (courtesy of Debbie Fleming)

COVER STORY: PAGE 6

Remembering John Bull
The recent cryopreservation of John Bull (1929-2014) paused a long, productive career in cryonics and the world at large.

CONTENTS

ALCOR LIFE EXTENSION FOUNDATION
A Non-Profit Organization
CRYONICS

Cryonics magazine is published monthly.

To subscribe to the printed edition and/or change your address, please call 480.905.1906 x101or visit the magazine website:
www.alcor.org/magazine

Please note: If you change your address less than a month before the magazine is mailed, it may be sent to your old address.

Address correspondence to:
Cryonics Magazine
7895 East Acoma Drive, Suite 110
Scottsdale, Arizona 85260
Phone: 480.905.1906
Toll free: 877.462.5267
Fax: 480.922.9027

Letters to the Editor welcome:
aschwin@alcor.org

Advertising inquiries:
480.905.1906 x113
advertise@alcor.org
ISSN: 1054-4305

Visit us on the web at www.alcor.org

Alcor News Blog
http://www.alcor.org/blog/

2014 Annual Giving Program

Alcor provides a wide array of services for you the member, and the general public. We inform and educate, we protect and preserve, and we strive to remain at the forefront of cryonics technology.

Since its founding, Alcor has relied on member support to maintain its mission and attract new members. Your support, regardless of size, can provide a better future for all cryonicists. **Please act now.**

SUGGESTED GIVING LEVELS

$20	FRIEND
$60	JUNIOR SUPPORTER
$120	SUSTAINING SUPPORTER
$500	ADVOCATE SUPPORTER
$1,000	LEADING SUPPORTER
$2,500	VISIONARY SUPPORTER
$5,000	SILVER SUPPORTER
$10,000	GOLD SUPPORTER
$25,000	TITANIUM SUPPORTER
$50,000	VANGUARD SUPPORTER

We encourage every member to donate. Even if you can only afford $5 right now, you will make a significant contribution to Alcor's future.

Donations may be made via the Donations button on the Alcor website or by contacting Alcor's Finance Director, Bonnie Magee, at bonnie@alcor.org. Your donation may be made as a lump sum or divided into easy monthly payments. ■

The James Bedford Society

Gifts have played a fundamental role in the cryonics movement since its earliest days. Dr. James Bedford, a man whose extraordinary vision led him to become the first person to be cryopreserved, and the first to make a bequest to a cryonics organization, exemplified the determination of the early pioneers of cryonics. We invite you to follow in his footsteps, and join the James Bedford Society.

The James Bedford Society recognizes those who make a bequest of any size to the Alcor Life Extension Foundation. If you have already provided a gift for Alcor in your estate, please send a copy of your relevant documents to Alcor's Finance Director, Bonnie Magee.

If you'd like to learn more about setting up a bequest, send an email to bonnie@alcor.org or call 480-905-1906 x114 to discuss your gift. ■

QUOD INCEPIMUS CONFICIEMUS

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

TECHNOLOGICAL ADVANCES IN CRYONICS: WHAT'S NEXT? By Aschwin de Wolf

In the history of cryonics we can identify a number of major technological developments: the introduction of cryoprotectants to reduce ice formation, the use of mechanical chest compression devices to restore brain perfusion and accelerate cooling, comprehensive Multi-modal medications protocols to mitigate warm ischemia and favor good cryoprotective perfusion, remote blood washout with an organ preservation solution to protect against cold ischemia, closed-circuit cryoprotective perfusion to reduce osmotic damage, and, of course, the introduction of vitrification agents to eliminate ice formation altogether.

What are the kinds of major technological developments that we can expect in cryonics in the foreseeable future? When we talk about technological progress we should distinguish among advances in medical science that simply require implementation in cryonics, advances in medical science that require various degrees of modification to be used in cryonics, and technological developments that are conceived and developed within cryonics. These distinctions are important to recognize because they can tell us whether new advances "simply" require acquiring these technologies or whether an ambitious research and development program needs to be launched to validate, develop, and introduce these technologies.

The three most important future technological advances that I can foresee are:

1. ***Liquid ventilation (cyclic cold lung lavage).*** Currently there are two basic modes of cooling in cryonics: (a) external cooling in an ice bath and (b) internal cooling with an organ preservation solution. Considering the harmful effects of warm ischemia on the structure of the brain and distribution of the vitrification agent, it is very important to introduce a rapid method of initial cooling that does not require surgery and can approximate the rates of internal cooling. The most potent candidate here is liquid ventilation in which a cold perfluorocarbon is pumped in and out of the lungs to accelerate cooling of the patient.
2. ***Intermediate temperature storage (ITS).*** If vitrification eliminates ice formation, fracturing remains the only mechanical form of injury in contemporary cryonics. The most obvious solution is to store patients below the glass transition temperature but not so low as to induce fracturing. Functional neuro ITS units have been built and detailed designs for whole body ITS units have been developed. Concerns that have not been fully addressed yet include optimal storage temperature and cost. The most pressing practical question at this point is whether fracture-free storage may be possible at liquid nitrogen temperatures if ischemia-induced ice formation is eliminated and a proper cooling protocol is used. Also, would it possible to eliminate the need for ITS altogether if a cold gas is circulated through the patient's circulatory system instead?
3. ***Opening the blood-brain barrier.*** It has been well established that under good conditions loading of the cryoprotectant (vitrification agent) produces severe dehydration of the brain. While dehydration may not substantially alter brain structure, it is a problem in terms of maintaining viability of the brain. We now know of a number of agents that can modify the blood-brain barrier to allow cryoprotectant perfusion without severe dehydration. Current concerns include whether such agents produce edema in other parts of the body, what the optimum protocol and dosage should be for humans, and whether the use of such agents reduces or favors ice formation in ischemic brains.

Other conceivable advantages that can improve cryonics include lower toxicity vitrification agents, drugs that can substantially reduce metabolism of the brain, and integration of brain imaging and cryoprotectant perfusion. ■

Remembering John Bull

By R. Michael Perry

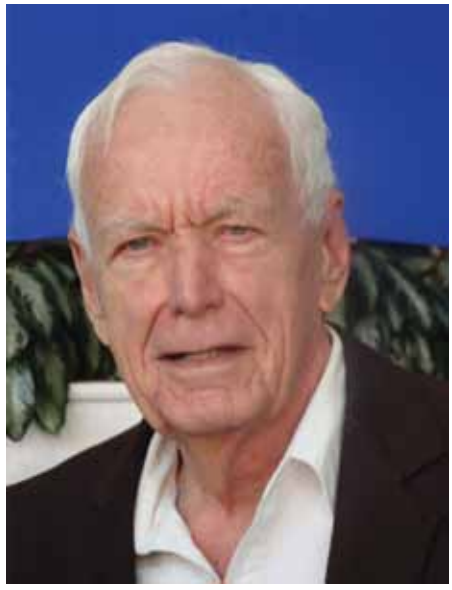


Photo by Mike Perry
14 Jun. 2009, Doubletree Inn, Melbourne Beach, FL

A longtime cryonicist who was active in the early movement in New York and more recently with the Cryonics Institute, John B. Bull, aged 84, was cryopreserved by that organization January 19. "He lived his life preparing for his death," his daughter Debbie Fleming would say, but John, while indeed strongly committed to cryonics for much of his life, was not narrowly focused on it but had a long, full life in other pursuits as well.[1]

He was born in Brooklyn, New York, November 28, 1929, the only child of John and Catherine (née Cameron) Bull, who had immigrated to the U.S. in 1922 and married in 1927. His father was born in Ireland (Irish Free State) and his mother in Scotland. The family of three spent the 1930s in and around Long Island, though at one point making an excursion as far as the village of Contoocook, New Hampshire. The 1930 Census shows them living in Manhattan, the father's occupation given as dry goods salesman. In the 1940 Census they were living in Hempstead, Nassau County, New York. John Jr. is a 10-year-old who has completed the 4th grade. His father's occupation now is "Special Police" for a shipping company. John finished high school in the 1940s; one residence around this time was Valley Stream, Long Island. After high school he went to work on a chicken farm his parents by this time owned. Exercising mechanical talent, he also got involved in maintaining and servicing vending machines. He then joined the U.S. Army, had basic training in Texas, and was sent to Heidelberg, Germany. His parents kept his vending equipment while he served out his two-year tour. Returning to the States temporarily in 1954, he married Miss Nevora Robarge in Yaphank, New York. He went back with his wife to Germany, finished his tour; then in November 1955 the couple flew back, this time for good, when their first child was on the way. She was born the following year; a second daughter was born in 1963.[2]

Living again in the New York City area, John tried various occupations including a milk delivery service and a paper route. Vending machines, however, proved his forte, and he organized and for many years was the proprietor of the Long Island Vending Company. Sometime around 1970 he saw an advertisement about cryonics on a garage wall and contacted Curtis Henderson, principal founder of the Cryonics Society of New York (CSNY). John found cryonics was "in his blood" and he wanted it for himself and his whole family. (His younger daughter, Debbie, did become interested and now is a director of the Cryonics Institute.) Involvement in CSNY led to associations with some of the people already there, particularly Ed Kuhrt, Paul Hurst, Nick DeBlasio, and Pauline Mandell. In the mid-1970s Kuhrt, a private investigator, was retained by an insurance company to look into this strange "cryonics" group to see if they were fraudulently selling insurance for people to pay for their cryopreservation. As a member himself of CSNY he was able to assure his client that the cryonics organization was legitimate.[3]

DeBlasio, Hurst, and Mandell meanwhile had had relatives cryopreserved and stored at CSNY's facilities. Unfortunately there were disagreements with CSNY that led the three with Bull and Kuhrt to attempt alternate arrangements for cryonics services. (Curtis Henderson cited various complaints: that he was overcharging for his services, that liquid nitrogen levels were too low, that there were cigarette butts on the floor and other signs of disrespect, that people wondered "why didn't I get them on the last TV show.") Three organizations were formed. Cryo-Crypt, with Kuhrt as president and Bull as treasurer, was to provide a cryonics storage alternative to CSNY's services which were through its sister organization CryoSpan. An old church was purchased and a vault dug under it in 1971, which would house the patients. When people got wind of it, however, it provoked outrage, as Henderson remembered. "Halloween night, the local citizens all gathered around this church with torches. That was the end of their operation …" A second organization, the Society for Advancement of Cryonic Sciences (SACS) was to conduct research, while a third, Cryonics Unlimited, would be a nonprofit membership organization, similar to CSNY itself. These efforts however were short-lived and no one was cryopreserved or stored. Pauline Mandell had her frozen son Steven sent to Robert Nelson's facility in Chatsworth, California, where eventually he was thawed and lost. (According to Curtis Henderson and Robert Nelson, Mandell never made payments to either of them for the maintenance of her son.) Nick DeBlasio, with the help of Nelson, set up his own storage facility in a cemetery in Butler, New Jersey, where his wife Ann would be stored, joined eventually by another patient. Paul Hurst decided to discontinue the maintenance of his father, Paul Sr., and had him buried.[4]

For a few years apparently things went well at the DeBlasio facility. John Bull helped Curtis Henderson with a case in 1974 (renting a truck with a hydraulic lift for transport) that is still being maintained at Alcor. Then in August 1978 a leak developed in the tall upright capsule that stored DeBlasio's two patients. John helped get it fixed. The patients inside were safely removed and stored on dry ice then returned to the repaired capsule and all was well. Unfortunately, there was more trouble of this sort which brought about the thawing and decomposition of the patients and the termination of the whole operation by August 1980. John did what he could to assist in removing the bodies and in other ways make the best of a bad situation (helped by Curtis Henderson and then Mike Darwin). Before this, in 1979, John is mentioned as a participant in CANYC, a newly-established New York City branch of the Michigan-based Cryonics Association (CA, now the Immortalist Society, IS). As CSNY became moribund and ceased its operations, John gravitated over to Robert Ettinger's Michigan-based Cryonics Institute (CI), the sister organization of IS that handled actual cryopreservations.[5]

Around 1994 John sold his vending machine business and moved with his wife to Florida. By then he was involved in another profession, real estate, buying and renovating houses and handling mortgages. He remained active in this occupation until he was cryopreserved. In 1996 he became editor of *The Immortalist* (now *Long Life Magazine*), the newsletter of IS and CI, and continued in this role until 2012. Here his quiet dedication shows in how the issues came out regularly without much fanfare, not as easy as it may sound. He became Vice President of the Immortalist Society in December 2005, on the 87th birthday of Robert Ettinger, the previous office-holder, and continued in this post until his cryopreservation. He also served on the board of directors of the American Cryonics Society (ACS).[6]

Helping with the DeBlasio case, late 1970s. From left: Curtis Henderson, John Bull, Nick Deblasio. The dry ice box will or did store the two patients while repairs were made on the capsule. (Courtesy: Debbie Fleming)

An incident in April 2004 showed once again John's commitment and willingness to be of service to others. Some ACS patients, ten humans and five pets, were being stored at the CryoSpan facility in Rancho Cucamonga, California. But CryoSpan was winding down its operations and transferring its patients. Some would go to Alcor, those that had been handled by CryoCare Corporation, while the others, from ACS, would go to CI in Michigan. When John was contacted he readily agreed to help in this move, which involved three others: John Day, Andy Zawacki, and Dan Wilson. Zawacki and Wilson, it turned out, drove the truck with the patients and Bull and Day trailed behind in a "chase" vehicle—a backup in case of trouble. The total distance from Rancho Cucamonga to Clinton Township, Michigan was over 2,260 miles, longer than other patient transports (such as Alcor's from Riverside, California to Scottsdale, Arizona in 1994). As it happened, one of the trucks did break down—but it was the chase truck—the transmission went kaput, and the two Johns had to spend an extra day in Salt Lake City waiting for another rental truck before continuing east. The two others went on safely and delivered their precious cargo to the CI facility in Michigan, where these patients still rest. John was 74 then but performed energetically and generously, trading off driving with the much younger Day at roughly two-hour intervals.[7]

In all we owe a great debt to someone of quiet dedication and courage like John Bull. Over more than four decades he remained steadfast in his commitment to the cause of defeating death through the technology of cryopreservation. Aside from the technical difficulties cryonics is controversial and it takes nerve to buck public opinion and openly endorse and promote it. It will not be easy to see it all through and make this practice work as intended, to furnish a pathway to future medicine and eventual resuscitation. We will need others like John, and we must encourage their participation to keep our enterprise moving forward. ■

SOURCES:

AR1. 1930 U.S. Federal Census, Manhattan, New York, N.Y., roll 1548, page 1A, Enumeration District 0295; FHL microfilm 2341283 (Ancestry.com).

AR2. 1940 U.S. Federal Census, Hempstead, Nassau, N.Y., roll T627_2690, page 19B, Enumeration District 30-197. (Ancestry.com).

AR3. Year: 1955; Arrival: *New York, New York;* Microfilm Serial: T715; Microfilm Roll: *8661*; Line: 2; Page Number: *415*. (Ancestry.com).

BB. Ben Best, "News and Views," *The Immortalist* Jan.-Feb. 2006, 3.

DF1. Debbie Fleming, message to CI mailing list 23 Jan. 2014.

DF2. Debbie Fleming, private communications 28 Feb.-31 Mar. 2013.

NB. Nevora Bull, private communication 24 Mar. 2013.

JY. Jim Yount, "A Really Interesting Road Trip," *Long Life,* 1Q 2014, 15-17, 25.

MP1. R. Michael Perry, "For the Record," *Cryonics* Aug. 2013, 18-22 (has additional references).

MP2. R. Michael Perry, "For the Record," *Cryonics* Nov. 2013, 6-10 (has additional references).

MP3. R. Michael Perry, "For the Record," *Cryonics* Dec. 2013, 14-20 (has additional references).

SN. Unattributed, "Frozen Burial a Hot Issue in Middle Island," *Sunday News* (Long Island area, NY) 7 Nov. 1971, Q40.

REFERENCES

1. DF1, DF2.

2. AR1, AR2, AR3, NB.

3. NB, DB2, MP1, MP2, MP3.

4. MP1, MP2, SN, MP3.

5. MP3.

6. NB, BB; dates of editorship inferred from *The Immortalist,* Jul.-Aug. 1996 and Nov.-Dec. 1996, and *Long Life,* Mar.-Apr. 2012 and May-Jun. 2012.

7. JY.

COOLER MINDS PREVAIL

SMALL ANIMAL WHOLE BODY CRYOPRESERVATION: PAST AND FUTURE

By Chana de Wolf

PART 1

In this installment of Cooler Minds Prevail, we will talk at length about resuscitation of non-hibernating rodents from circulatory arrest at ultraprofound hypothermic and high subzero temperatures. This will set the stage for developing a model for whole body cryopreservation.

Prior work in hypothermia began in the early 1900s, but because cardiac and respiratory arrest were observed in the animals around 15°C, researchers assumed they were irreversibly dead and made few attempts to resuscitate them from temperatures below this point.

Then came a thermophysiologist named Radoslav K. Andjus working in the Physiology Department at the University of Belgrade after World War II. Since the university's library had been destroyed in an air raid, he was unaware of the "conventional wisdom" that the lethal body temperature of rats was 15°C, and quickly developed a method of reviving animals from temperatures between 0 and 2°C.

His technique, published in 1951, was surprisingly simple. First, he lowered the core body temperatures of rats from physiological (37°C) to around 20°C by enclosing them in glass jars which were then placed in a refrigerator (with the rats re-breathing their own expired air, a method of inducing anesthesia via carbon dioxide inhalation). To further cool the rats, they were packed in crushed ice until colonic temperatures reached about 1°C. They were held at this temperature for 40-50 minutes before resuscitation was attempted.

Andjus first attempted to rewarm the entire body at once in a hot bath, but these animals failed to revive. He quickly determined that the circulation must first be re-established by applying heat locally to the cardiac area before rewarming the whole body. He did so by heating a spatula in the flame of a Bunsen burner and applying it to the chest wall over the heart. Artificial respirations were also given throughout the resuscitation attempt.

While this method was successful, the rate of success (only 20% of rats lived more than 24 hours) left something to be desired. A high proportion of the rats which regained heart beat and respiration died during subsequent warming of the whole body or within a few hours or days of regaining normal body temperature and behavior. When Andjus met Audrey U. Smith, they collaborated in 1955 to determine whether the reanimation failures and high mortality rate after initial success were the result of damage during cooling or due to imperfections of the reanimation protocol. They began by comparing Andjus' initial cardiac heating method to an alternative method employing a high-intensity lamp to project focused light on the chest wall. They found that the easier technique of focusing a powerful beam of light from a projection lamp was even better—76% of these rats survived more than 24 hours, and 68% survived more than 66 days.

In both protocols, rats were cooled according to the previously described method of placing an animal in a jar and then putting the vessel in a refrigerator. Once rats were cool and lethargic, they were immersed in dishes of melting ice and buried under crushed ice. They remained under ice for exactly 1 hour from the time colonic temperature reached 15°C and for approximately 40 minutes after it had reached 6°C. In general, respiration ceased soon after ice immersion, the heart beat slowed suddenly between 13 and 10°C, and final heart beats were observed at or above 8°C. The rats were removed from ice with body temperatures between 0 and 1.8°C.

When attempting resuscitation using the spatula method, the spatula was warmed in a Bunsen flame and applied as frequently as 20 times per minute. When the first heart beat was observed, artificial respiration began using a small hand-bulb attached to tubing inserted into the nostrils. Local cardiac heating was performed less frequently as heart rhythm became regular, and was discontinued when heart rate increased spontaneously. At 10-11°C the animal's neck was heated under hot tap water and artificial respiration was continued until spontaneous breathing resumed.

When attempting resuscitation using a beam of light, the rats were placed on a platform under a duralite shield with an aperture that allowed for focusing of the light on the praecordium. The intensity of the light/heat could be controlled by changing the variac setting. The neck was warmed under the light beam when colonic temperature reached 10-12°C and artificial respiration was given until spontaneous

breathing resumed. Rewarming of the whole body in both protocols occurred by placing the rats in a 37°C water bath until they could maintain normal posture, at which point they were transferred to an incubator for short-term recovery, then to a warm cupboard for long-term care.

Results obtained by the spatula method were similar to those obtained in Andjus' initial experiments. Out of 25 rats, 4 exhibited irregular heartbeats and then succumbed, 4 exhibited regular heart beats but no spontaneous breathing and were dead within an hour, 6 exhibited spontaneous breathing but no reflexes and died in the 37°C bath, 5 exhibited an apparently complete recovery and died within 24 hours, and only 5 survived for more than 66 days.

Results obtained by the beam of light method were better. Using the initial protocol, which involved a large number of changes in variac settings at lower intensities over the course of warming, 11 of 25 rats survived more than 66 days. Modifications to start at a higher intensity and reduce the number of changes in variac settings resulted in 17 of 25 rats surviving more than 66 days, representing a long-term survival rate of 68%. In addition, far fewer (2) delayed deaths occurred using this protocol.

Andjus and Smith speculate about the importance of proper cardiac warming for successful reanimation from ultraprofound hypothermia in their discussion of these landmark experiments:

> *It is likely that the method of reanimation is of great importance. When an animal with a deep body temperature of 0-2°C is transferred to a hot bath at +45°C as in the experiments of Lutz (1950) the skin and superficial tissues must rewarm rapidly and experience anoxia for many minutes before the heart is warm enough to beat and provide an adequate circulation. If, on the other hand, the heart is rewarmed first and a circulation established before the temperature of the bulk of the body rises, the degree and duration of tissue anoxia may be greatly reduced.*

They go on to anticipate improvements in their method beyond those already achieved:

> *It was remarkable that the revival rate in our experiments was increased from 20 to 75% when local heating on the surface of the chest wall was superseded by heating with a beam of light. The amount of heat penetrating to the anterior surface of the heart was undoubtedly increased when the chest wall was irradiated, but the oesophageal thermocouple showed that the temperature of the posterior aspect of the heart lagged behind. These results suggest that a more efficient method for rewarming the heart rapidly should make it possible to revive all rats from body temperatures between 0 and 1°C.*

Thus began a steady stream of experiments in hypothermic resuscitation, primarily as a means of determining the best method for resuscitating victims of accidental cooling or freezing and to facilitate the use of hypothermia in cardiac surgery.

Andjus and Smith were delighted that they had managed to modify Andjus' chest-wall heating technique from using a hot metal spatula to using a focused beam of light in order to preferentially warm the heart before warming the whole body. This modification resulted in a substantially larger percentage of rats fully recovering from ultraprofound hypothermic temperatures as well as a significant reduction in the number of delayed deaths after partial recovery. However, some delayed deaths still occurred, and Andjus and Smith speculated that these were likely due to the inevitable burns caused by these techniques. So Andjus collaborated with J.E. Lovelock to further refine the protocol in an attempt to eliminate peripheral tissue damage during heating, as described in their 1955 article in the Journal of Physiology[1].

This was accomplished by using a microwave diathermy apparatus "powered by a 500 W continuous wave magnetron operating at a frequency of 3000 Mc/s feeding into an H01 mode waveguide." An aperture was created in an extension of the waveguide and the animal was placed underneath for preferential heating of the heart. Rise in temperature varied across different parts of the body and was steepest in the left side of the chest.

Cooling was carried out in the same manner described previously, and reanimation procedures began when the animal's colonic temperature was between 0 and 1°C. In a first series of experiments, warming was carried out using microwave diathermy and artificial respiration was given by means of a hand bulb and tubing inserted into the nostrils and discontinued after spontaneous breathing was reestablished. When the animal reached 15°C it was then placed in a 40°C water bath for whole body rewarming to 33°C, whereupon it was placed in an incubator for 3 days before being transferred to long-term care in the animal facility.

This first series of experiments resulted in an 80% full recovery rate—already a 5% improvement on the focused light beam method. However, the strong focus of microwaves through the aperture still resulted in occasional burns to the chest wall. With another slight modification to the protocol (the use of a horn radiator to produce a more even field distribution of microwaves), the recovery rate reached 100% and no burns were observed.

Since they appeared to have perfected the method, they performed an exploratory experiment on one rat, cooling it and reanimating it a total of 10 times (each experiment separated by 2-10 days) using the Series II microwave diathermy technique. This rat also recovered fully each time.

From an initial full recovery rate of 20% using the hot spatula method to a 100% recovery rate using microwave diathermy, Andjus demonstrated his grasp of the issues involved in resuscitating rats from ultraprofound hypothermia and a singular dedication to overcoming obstacles. Because of his primary interest in applying these resuscitation techniques to victims of accidental hypothermia and freezing, the road ahead was clear: now that he had a method for reanimating rats that had reached 0–2°C, he next wanted to know the time limits to resuscitation (how long can a rat be held at these temperatures and still be successfully revived?), the effects of multiple coolings and reanimations, and – the ultimate question – whether a rat could be *frozen* and then resuscitated. ■

REFERENCES FOR PART I

1. Andjus R.K. and Lovelock J.E. (1955). Reanimation of rats from body temperatures between 0 and 1°C by microwave diathermy. *Journal of Physiology,* 128(3): 541-546.

3 Recent Cryonics-related Novels: the Good, the Decent, and the Ugly

By Steve Bridge

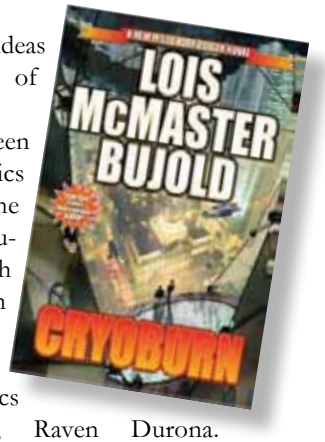
We can be pleased that cryonics has entered the consciousness of writers these days enough so that it shows up frequently as a plot point in an increasing number of novels. Here I will discuss two books in some detail and one very briefly.

Cryoburn by Lois McMaster Bujold, Baen Books, 2010

Lois McMaster Bujold is one of the most popular current authors of science fiction and fantasy, with five Hugo Awards and three Nebula Awards among her many honors. Her most popular series is the Vorkosigan Saga, thirteen books dealing with the adventures of Miles Vorkosigan and his family of the planet Barrayar. Miles was born with major birth defects because of a poison attack on his parents, when his mother was pregnant with him. All survived, but Miles is stunted physically with brittle bones, making the military career expected by his family tradition seemingly impossible. Miles compensates with high intelligence and a hyperactive personality and eventually becomes a brilliant military commander of a mercenary force. After a number of adventures, he is forced to retire and becomes an Imperial Auditor—a trouble-shooter and investigator for his cousin, the Emperor of Barrayar.

I first met Lois McMaster Bujold around 1987, right after her first three books were published. She had come to Indianapolis to read at our local science fiction club. Many of us became big fans of her work, and over the years, through meetings at science fiction conventions, we became friendly acquaintances. Sometime around 1990 I gave her Alcor literature and discussed cryonics with her. In 1994 this paid off when cryonics was included in her impressive Hugo Award-winning novel, *Mirror Dance* (Baen Books). In that book, cryopreservation is a military rescue technique for severely injured combat personnel. Miles Vorkosigan is such a dynamic character that he takes over every scene he appears in, and Bujold needed a way to get Miles out of the way so she could concentrate on his very different clone brother, Mark. While trying to rescue Mark and other troops, Miles gets hit in the chest with a projectile and gets quickly placed into cryopreservation (and revived by the end of the novel). This event turned out to have major benefits in the growth of Miles in later books in the series, making him more thoughtful and more risk adverse—to a level only 5 times greater than most people. As time goes by, Miles frequently refers to the changes in his life resulting from having survived his own death.

Cryonics has been bouncing around in Bujold's subconscious for a lot of years since then. Now it bursts out again in *Cryoburn* (Baen Books, 2010), a remarkably thoughtful novel about a planet whose entire economy and government is built around cryonics, much like the way Ancient Egypt was focused on mummification. I say "remarkably thoughtful" not because it is unusual for Bujold (it is not), but because there has never been more than a handful of cryonics-oriented novels that contain any original ideas or deep levels of thought.



Miles has been sent to a cryonics conference on the planet of Kibou-daini, along with his Armsman (security guard/assistant) Roic, and a cryonics revival expert, Raven Durona. One of the major cryonics companies on Kibou-daini is preparing to start a cryonics business on one of the planets that Barrayar rules, and Emperor Gregor thinks that some deeper conspiracy is taking place. And of course, since novels require a plot, it is. Miles gets kidnapped, escapes, and gets lost in the Cryocombs—vast underground storage buildings for cryopreserved patients. He is rescued by a 12 year old boy, Jin, who takes him to his hideout in an abandoned building—or formerly abandoned. It is now the home of a truly underground (i.e., *secret*) cryonics facility, handling the preservations of those unlucky enough not to afford cryonics in this society. Jin's father died in an accident without benefit of cryopreservation, and his mother was a political activist with evidence of the deeper conspiracy, kidnapped and forced

into the freezing units by the conspirators. Complications follow.

I'm not going to spend more time on the plot and characters, partly because I don't want to spoil the story for you, but mostly because that's not why you are reading *Cryonics* magazine. You want to know how Bujold integrates cryonics into her story and if you will enjoy reading the book or will be tempted to throw it against the wall.

First, don't throw the book; you might break the CD-ROM that comes with it. In a stroke of marketing creativity (or perhaps "seizure" of creativity—we'll see what the results are), Baen Books has included with the 1st printing a free CD-ROM that contains the complete text of *Cryoburn*—as well as the complete text of 12 other Bujold novels set in this universe, plus several short stories, interviews, speeches, critical discussions, and *The Vorkosigan Companion,* a fine non-fiction book by others about Bujold's writing. The only Miles-oriented novel not included is *Memory*, chronologically the 9th book in the series, accidentally left out through a production error. The text on the CD is included in several different formats and can be downloaded (but not shared or sold) to various e-readers or to your computer. The visual quality is excellent. If you like reading books in e-format, this could be the most cost-effective purchase you ever make.

The economy of Kibou-daini is almost completely built around cryonics. Those with the financial means plan their savings around cryopreservation instead of retirement funds; and those who cannot afford it envy the ones who can. Cryonics is close to being a mature technology by this time. The preservations can be done in a reliable manner by trained people and a good cryo-treatment can be reversed when the cause of death can be corrected. But since there would be no story without conflict, there are some imperfections—reasonable ones, I think. In Bujold's universe, aging reversal has not been developed as successfully as has been cryopreservation reversal and treatment of disease and basic injury. Suspension revivals are usually done on fairly young people. I might think that real life will turn out the opposite, that aging reversal will come before reliable cryonics revivals; but we don't have either one today and the point is arguable. Besides, it is Bujold's book.

The real problems are not technical, however. Bujold has wisely noticed that even if cryopreservation and other future medical technologies become commonplace, the world will still be run by fallible and corruptible human beings. The futurist writer and cryonicist FM-2030 used to say that human nature would change with increasing health, prosperity, and education, and that maybe by the year 2030 (hence, his chosen name) there would be a new enlightenment for all—no racism, no poverty, no war. I never agreed with him, to his disappointment. Bujold also assumes human nature will not change that radically.

Human beings have evolved to be competitive and hierarchical. No matter how much wealth is available, many people will still want more than the other guy. If you survive into a distant future, there will still be someone who will try to take advantage of you; someone who will be happy to see you fail; someone who will profit from your success; someone else who will profit from your failure.

The interesting political twist that Bujold adds is that, since the cryopreserved individuals are not fully "dead," they still have voting rights (in the company and in the government), vested in their heirs until the patient is revived. But, since everyone needs money for their own suspension, people often assign (for a fee) their voting rights as a proxy to a cryonics corporation (the "cryocorps"—pun fully intended by Bujold). After millions of people have been preserved, the cryocorps have enough votes in their pockets to elect the government and set economic policy that favors them. Of course, those votes depend on the owners of the votes remaining at very low temperatures, so the cryocorps aren't in an overwhelming hurry to solve the aging problem and bring everyone back to full participation.

There are several more layers to this scheme, and I'm sure that the clever among you could think of plenty more. It's an intriguing set-up.

I do appreciate cleverness in a good writer, and Bujold has that quality in depth. I admire her dialogue, characters, and plot twists. I think she may be the best writer of believable characters in the field of science fiction, maybe the best ever. The character growth of Miles through this series of books is remarkable. Even her minor characters feel real enough for us to imagine that they have a life and a story beyond the bounds of the book at hand. And she gets the little details right, not just the technical details, which she handles much better than Star Trek techno babble, but the human bits.

For example, the different cryocorps try to appeal mostly to the young professionals, but each trying for different market segments—hi-rollers, romantics, history lovers. They are like Las Vegas casinos. There is a nice bit about trying to figure how to enhance the immune system of someone who needs to be revived in a hasty, extra-legal manner. When she has characters argue about the morality of life extension and cryonics, the arguments of both sides sound sincere and honest, like the real arguments we have had dozens of times.

While all of this is done in a fair manner, her interviews for this book suggest that Bujold herself is not a cryonicist. I am pleased that she has taken pains in these interviews to state that she believes cryonicists are sincere and thoughtful, with a lot of smart, technical people involved. She thinks cryonics might work—but she is not sure if she is in favor of it. There is a quote from the book, "Such as a whole society of people who become so wrapped up in avoiding death, they forgot to be alive?"

It's a fair question. We don't know what changes that truly successful suspended animation would produce in human society or how financially successful cryonics companies would behave. (Sorry, but what to do with too much success is a problem we would love to have but can barely imagine here in the backward year of 2014.) But then we really don't know much about the mindset and changes in human interaction that were caused by the fixation on mummification that developed in Ancient Egypt, either.

And as a writer, Bujold (and her hero Miles) cannot be totally against the idea of cryonics, because it saved the life of her

hero, gave her more books, and allowed her to think about the meaning of a second chance at life. (Bujold has also spoken about feeling "reborn" many years ago after a divorce, following a difficult marriage, so there may be some additional symbolism going on here.)

Since I have read all of Bujold's books, some of them several times, I may not be able to predict how much readers would enjoy *Cryoburn* if it is their first exposure to Miles Vorkosigan. Bujold is actually quite adept at creating self-supporting books in her series, although it is inevitable that many hints from earlier adventures slide into the story. And character development is so essential to Bujold's writing that enjoyment of the series (and admiration for the author) is likely to build higher if started at the beginning, or at least if you read *Mirror Dance,* her earlier cryonics-related novel in the series.

From my viewpoint, this is one fine novel. It is not as powerful as the two or three best in the series, perhaps, but like both Miles and Bujold, it is a more mature, thoughtful work. I was pleased to read it and even more pleased to re-read it. Like the work of all great authors, Bujold's novels get better in re-reading. I would be interested to hear from any of you who try this as your first Vorkosigan book.

Frozen in Time by Ali Sparkes (Egmont, 2010 in USA; Oxford University Press, 2009 in UK)

Cryonics sometimes shows up in children's science fiction, too, and this is a mostly pleasing example, if you can overlook the unfortunately simplistic portrayal of the technology involved. This is an example of a common usage of cryonics—a technology for sending characters from the past to the future (often our "present") so they can be amazed at how much has changed—and so the reader can have the ironic appreciation of how different the world is today from some distant past time.

In 2010, British siblings Ben and Rachel discover a strange vault underground in their back yard. Inside the vault are two children and a dog in suspended animation. A couple of button pushes and the subjects are revived, thinking they have been asleep for a day or two—in 1956. It seems that their father was a government scientist secretly working on suspended animation in his spare time and had already put the children in suspension a few times for short periods, just to make sure it worked. (We're going to ignore the ethics here, dubious even for 1956.) It also turns out that Freddy and Polly, the revived children, are the great aunt and uncle of Ben and Rachel. And finally, it seems that British and Russian government agents are still trying to find out what happened to their children and their father.

Freddy and Polly are "typical" 1956 British children—which in this case means that Freddy is a condescending sexist pig—although very polite, and Polly is in training to be a British combination of June Cleaver and Betty Crocker—although very brave. Humorous misunderstandings ensue, the government agents close in with the standard chase scenes, and nick-of-time rescuers save the day.

Frozen in Time isn't great, but as fiction it is competent. The benefits for cryonicists are that cryonics is talked about as a valuable life-saving technology, and children could get the idea that people really can adjust to the sudden change of being shifted to the future.

Thaw by Rick Jasper. (Darby Creek, 2010).

And now for "the Ugly."

Thaw is part of a recent series of High-Interest, Low-Reading-Level short novels, apparently trying to reach reluctant teenage readers with easy horror stories about vampires, aliens, and frozen-revived zombie killers. Really. A cult leader and his followers were frozen as punishment but the son of the cult leader has revived them so they can continue their destiny to rule the world. Or something like that. The plot, characters, and writing are all dreadful. Buy this only if you are the ultimate complete collector of cryonics marginalia; but don't read it. My IQ dropped 10 points for a week after reading it. ■

ADVANCED

Resveratrol Formula

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**.

Since then, we have identified additional compounds that simulate calorie restriction's ability to trigger youthful ***gene expression***—the process by which genes transmit signals that slow certain aspects of aging.

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

1. *Cell.* 2006 Dec 15;127(6):1109-22.
2. *Endocrinology.* 2008 Jan;149(1):84-92.
3. *Crit Care Med.* 2004 Oct;32(10):2097-103.
4. *J Agric Food Chem.* 1999 Apr;47(4):1416-21.
5. *Arch Pharm Res.* 2002 Oct;25(5):561-71.
6. *Nutr Cancer.* 1999;35(1):80-6.
7. *Anticancer Agents Med Chem.* 2006 Sep;6(5):389-406.
8. *Nature.* 2006 Nov 16;444(7117):337-42.
9. *Nature.* 2004 Aug 5;430(7000):686-9.
10. *Xenobiotica.* 2000 Sep;30(9):857-66

High-Potency Resveratrol with Synergistic Activators

Life Extension® members 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.

A bottle containing 60 vegetarian capsules of **Optimized Resveratrol with Synergistic Grape-Berry Actives** retails for $46. If a member buys four bottles, the price is reduced to **$31** per bottle. The suggested dose of one capsule a day provides:

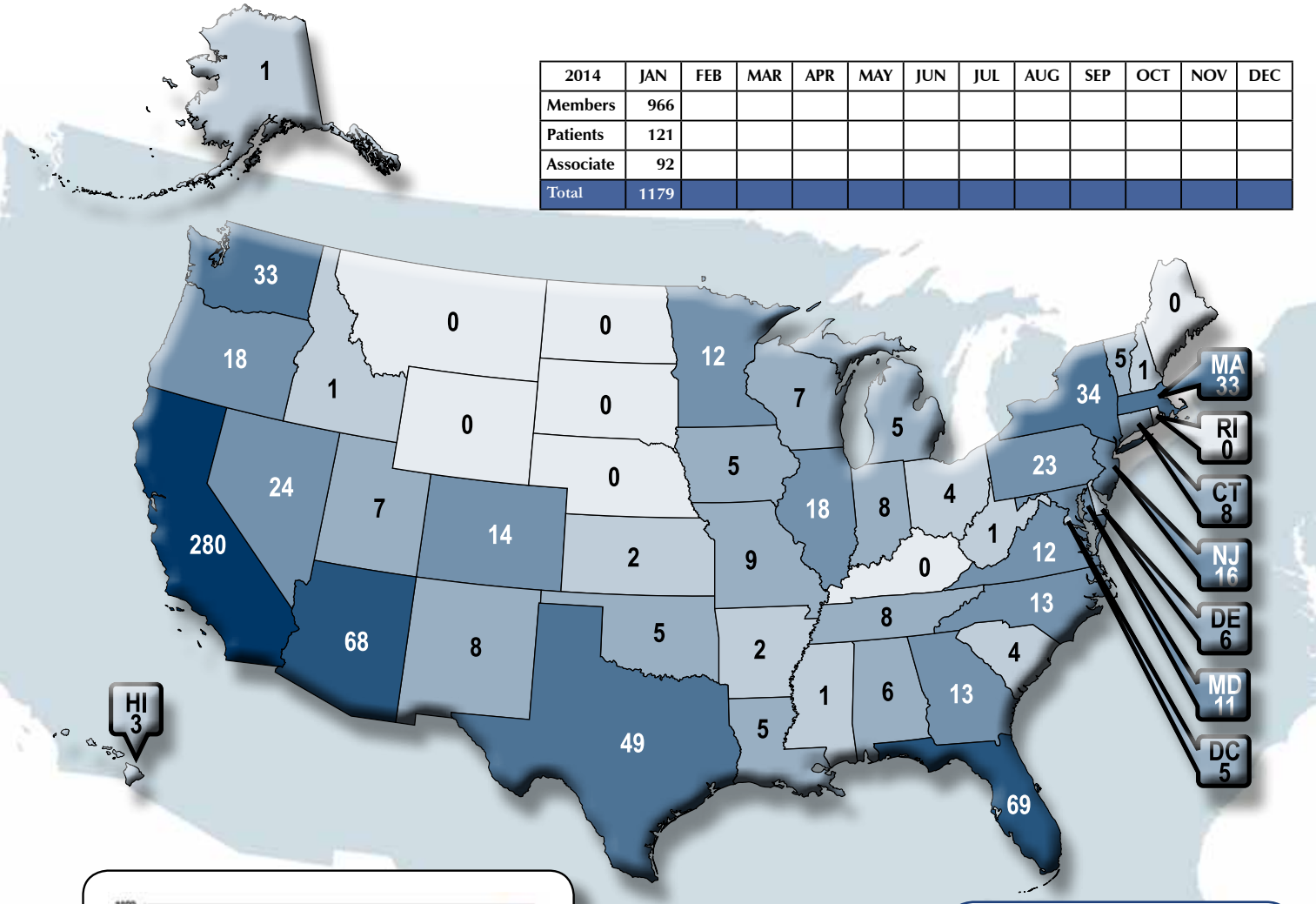
The suggested dose of one capsule a day provides:	
Trans-Resveratrol	250 mg
Grape-Berry Actives	85 mg
Quercetin	60 mg
Trans-Pterostilbene	0.5 mg
Fisetin	10 mg

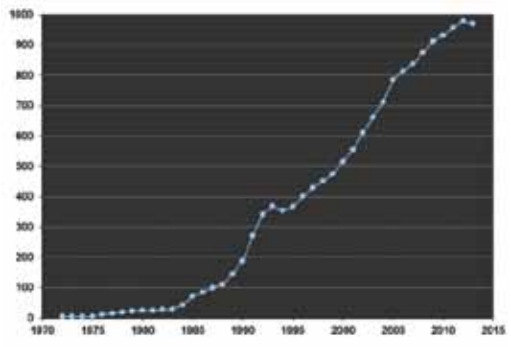
To order Optimized Resveratrol with Synergistic Grape-Berry Actives, call 1-800-544-4440 or visit www.LifeExtension.com
Be sure to mention code PIM401X.

502.60D.0414

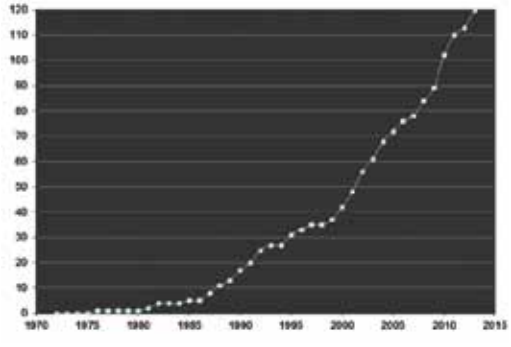
Membership Statistics

2014	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Members	966											
Patients	121											
Associate	92											
Total	1179											





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
Aruba	2	3
Australia	13	2
Canada	42	0
Germany	4	0
Israel	1	1
Italy	2	0
Japan	1	0
Lebanon	1	0
Mexico	4	0
Monaco	2	0
Netherlands	2	0
New Zealand	2	0
Norway	1	0
Portugal	4	0
Spain	3	1
Thailand	3	0
United Arab Emirates	1	0
United Kingdom	21	2
TOTAL	**109**	**9**

Biostasis for the Unwealthy:

Are We Doing Enough?

By R. Michael Perry

A few months ago I was contacted by a former long-time Alcor member, now living in Nevada, who had had to drop his arrangements for financial reasons. (He then became an associate member.) The man was 69 years old, retired, and living (meagerly) on Social Security. A pet of his had been cryopreserved at Alcor in the 1990s. The main immediate problem, however, was not with the man himself. His 88-year-old mother, also living in the same household on a retirement income, had signed a document expressing a wish for cryopreservation, and was now ailing. Together the two had insufficient funds for even the least expensive cryopreservation options.

As for current prices: Alcor charges $200,000 for a whole-body preservation in the U.S. and $80,000 for a neuro or head-only. The other major U.S. cryonics organization, The Cryonics Institute, charges a minimum of $28,000 for a whole-body preservation, with neuro or brain-only not allowed. Recently another U.S. organization, Oregon Cryonics, has begun offering brain-only cryopreservation for $14,000. The Russian organization KrioRus charges $36,000 for whole-body preservation and $12,000 for both neuro and brain-only (but then you have to arrange shipment of the patient to Russia, an additional expense of probably several thousand dollars and a long journey).

The mother arrested in December. The decision made seemed the best under the circumstances, given that the man was acting essentially on his own. The body was embalmed (initial stabilization), with the usual formalin as the main fixative, and with emphasis on the brain, then the brain was removed by a pathologist and stored, again in formalin fixative. (The possibility of using a fixative other than the mortuary standard, formalin, even incorporating cryoprotectant, was considered but events outpaced such thoughts.) From there it is hoped that funding can be raised so that cryogenic storage at a public facility will become possible. This procedure could be preceded by cryoprotectant perfusion by slow diffusion, as has happened for some Alcor brain-only cases. (In particular a relative of mine who arrested after an accident was handled this way, after an initial mandatory autopsy and fixation-preservation of the brain.) Overall, the hope is to arrange for cryopreservation at a total cost, including the mortuary work, of $15,000 or less, which is far less than is currently charged by either of the two main U.S. cryonics organizations (Alcor, Cryonics Institute).

The cryonics premise is a simple one. By preserving a patient's remains at clinical death well enough for a long enough time it should be possible to bring to bear future technologies which might reverse deleterious changes and restore the patient to a healthy, functioning state. The question then arises of what procedures (if any) will provide adequate preservation for the future resuscitation option and whether, in particular, any inexpensive, satisfactory alternatives exist to what otherwise for many are prohibitively expensive procedures. Unfortunately, our knowledge is limited, both in terms of how well we are preserving structures and how well we must preserve them. How memories are stored in the brain, particularly the long-term memories that would be especially important to retain a sense of personal identity, is not fully known. The uncertainties are enough to sustain interest in the best possible procedures, with research programs targeted toward ever-better procedures. (The quest might end or lose much of its force if reversible suspended animation could be demonstrated but this prospect on the scale of a large mammalian organ does not appear imminent.) In general the quest for ever-better procedures is a good one but another consideration is the cost of a procedure. Pursuit of the best does not guarantee the cheapest, but may accomplish the opposite. The best procedure in the world will not help you if you have to pass it up due to cost considerations.

In general the would-be cryonicist wants to know if the best *affordable* procedure will be adequate, one day, to the goal of healthy resuscitation. The wealthy may opt for what is the best available, state-of-the-art procedure, but for those of more limited means, the issue becomes whether a given procedure appears to be good enough that it might be adequate. Any procedure that cannot obviously be ruled out may be of interest, chemical preservation in particular, which can show ultrastructural preservation apparently comparable to that achieved with high-quality cryopreservation using vitrification. (See figs. 1-2; fig. 1 uses formalin fixation as is commonly available in a mortuary, but also osmium tetroxide which is not commonly available and will

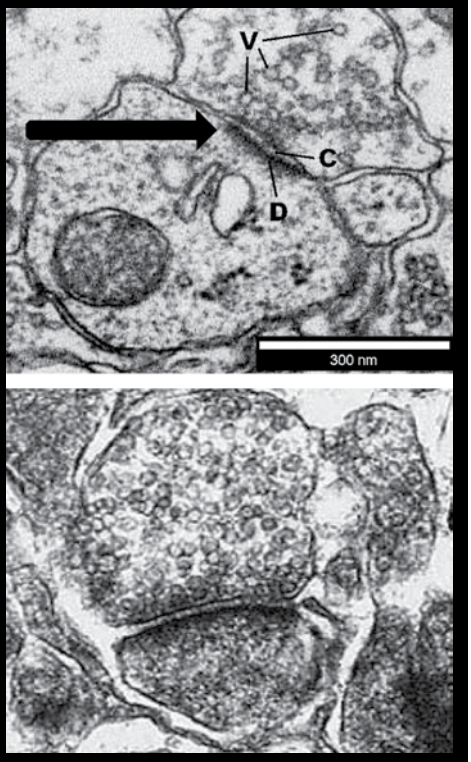


FIGURE 1 & 2

Figure 1 (courtesy of Narayanan Kasthuri and Kenneth Hayworth) shows a 38-nanometer thick tissue slice of aldehyde- and osmium-fixed mouse brain cortex embedded in epon resin and sectioned and collected on Harvard's Automatic Tape Collecting Lathe Ultramicrotome (ATLUM). This scanning electron microscope (SEM) contrast-reversed image shows synapse (large arrow), synaptic vesicles (V), synaptic cleft (C) separating presynaptic and postsynaptic membranes, and postsynaptic density (D). Brain ultrastructure, including synapses which are believed important for encoding memory, appears to be well-preserved. Figure 2 (courtesy of 21st Century Medicine), showing a SEM image of a rabbit brain synapse perfused with M22 (a vitrification solution) for 60 minutes, shows comparable ultrastructure preservation. (Source: R. Michael Perry, "The Road Less Traveled: Alternatives to Cryonics," Cryonics, 3rd Quarter, 2007, 21-24.)

stabilize lipids and provide contrast for electron microscopy. Substantial fixation will also occur without the osmium, however.) Today there is a cryonics company (Oregon Cryonics) that will store a human brain in fixative *indefinitely* for $900. To engage this service the client must ship the brain which must have been previously fixed. For about $6,000 it would be possible to do embalming, fixation, and shipment for storage as in the Nevada case above. (To date the final steps of shipment and placement in long-term storage have not been carried out. The brain is being generously maintained in a laboratory free of charge; it is understood that this is temporary while more permanent storage is being arranged.) Such an option could provide one avenue for eventual cryogenic storage for someone of very limited means. As is anticipated in the Nevada case, additional funding would be sought over a period of time to eventually complete the additional step of cryogenic storage.

The question then arises, should Alcor be involved in assisting hardship cases in which brain-only preservation is used, and possibly fixation as a way to "buy time" until cryogenic storage can be paid for and arranged? I for one would like to see this happen. Alcor might then become known *both* for high-end cryonics procedures that cost accordingly and much lower-cost procedures which would still offer a realistic hope. There are a number of possibilities in terms of how low-cost, brain-only procedures would be carried out. For such a procedure there would not be the usual team present for standby or perfusion of cryoprotectant. But cryoprotectant could still be introduced. One way would be to prepare in advance so that the fixative used by the mortuary in the initial stabilization (if this is the route taken) also contained cryoprotectant. In this case both fixative and cryoprotectant might be rapidly perfused into the brain using the usual vasculature. (Carotid perfusion would normally be better for the brain than the more usual embalming perfusion using the femoral arteries.) If cryoprotectant could not be introduced during this early stage it could still be introduced later by slow diffusion, as has happened with some Alcor cases (my relative in particular; this required several months to complete). Under more favorable circumstances funds might be available immediately to go to the step of cryopreservation and the brain might be straight-frozen without fixation or cryoprotection—or better, cryoprotection instead of fixation could be performed in a mortuary setting with expenses comparable to conventional embalming.

Clearly a number of possibilities exist for low-cost preservation options involving the brain only. Alcor members facing financial hardship and others of limited means could benefit. Alcor has done brain-only preservations before, but only on a case-by-case basis and not as a standard option that members could choose. Is it not time to reconsider? ■

Sources for price quotes:

KrioRus
old.kriorus.ru/en

Alcor Life Extension Foundation
www.alcor.org

The Cryonics Institute
www.cryonics.org

Oregon Cryonics
www.oregoncryo.com

Optical Nano-Tweezers Control Nano-Objects

Invented in Bell Labs in the 1980s, optical tweezers have changed forever the fields of both biology and quantum optics. The technique has considerable limitations, however, one of which is its inability to directly trap objects smaller than a few hundreds of nanometers. This drawback prompted the pursuit of new approaches of nano-tweezers based on plasmonics, capable of trapping nano-scale objects such as proteins or nanoparticles without overheating and damaging the specimen. A few years ago, ICFO researchers demonstrated that, by focusing light on a very small gold nano-structure lying on a glass surface which acts as a nano-lens, one can trap a specimen at the vicinity of the metal where the light is concentrated. This however did not enable any 3D manipulation needed for practical applications. Now researchers at ICFO have taken this a crucial step further by trapping and 3D displacement of specimens as small as a few tens of nanometers using an extremely small, non-invasive laser intensity.

ICFO / ScienceDaily
2 Mar 2014
http://www.sciencedaily.com/releases/2014/03/140302143626.htm

The Power of Light: Super-Resolution Laser Machining Possible

A newly discovered natural phenomenon shows that light could be used to pick apart a substance atom by atom, with new avenues for nano-scale diamond devices, as identified this week by Australian researchers in *Nature Communications*. "Lasers are known to be very precise at cutting and drilling materials on a small scale—less than the width of a human hair, in fact—but on the atomic scale they have notoriously poor resolution," says lead researcher Associate Professor Richard Mildren. Through their research, Mildren and Macquarie University colleagues Andrew Lehmann and Carlo Bradac have now discovered that it is possible to remove atoms from a surface, using ultraviolet lasers, and confining the interaction to the atomic scale. "So far we have used the technique to demonstrate structures in diamond of size about 20 nanometers, which is the size of large molecules," says Mildren. "However, the technique looks highly promising for doing much better, enabling manipulation of surfaces with the ultimate single atom precision…."

Macquarie University Newsroom
5 March 2014
http://mq.edu.au/newsroom/2014/03/05/the-power-of-light-super-resolution-laser-machining-possible/

3D Printing of Tissue with Blood Vessels

Using a custom-built four-head 3-D printer and a "disappearing" ink, materials scientist Jennifer Lewis and her team created a patch of tissue containing skin cells and biological structural material interwoven with blood-vessel-like structures. All prior regenerative tissue projects have run up against the same wall when trying to build thicker and more complex tissues: a lack of blood vessels. Lewis's group solved the problem by creating hollow, tube-like structures within a mesh of printed cells using an "ink" that liquefies as it cools. The tissue is built by the 3-D printer in layers. A gelatin-based ink acts as extracellular matrix—the structural mix of proteins and other biological molecules that surrounds cells in the body. Two other inks contained the gelatin material and either mouse or human skin cells. All these inks are viscous enough to maintain their structure after being laid down by the printer. A third ink with counterintuitive behavior helped the team create the hollow tubes. This ink has a Jell-O-like consistency at room temperature, but when cooled it liquefies.

Next Big Future
6 Mar 2014
http://nextbigfuture.com/2014/03/3d-printing-of-tissue-with-blood.html

Researchers Write Languages to Design Synthetic Living Systems

Researchers at Virginia Tech and the Massachusetts Institute of Technology have used a computer-aided design tool to create genetic languages to guide the design of biological systems. Known as GenoCAD, the open-source software was developed at the Virginia Bioinformatics Institute at Virginia Tech to help synthetic biologists capture biological rules to engineer organisms that produce useful products or health-care solutions from inexpensive, renewable materials. GenoCAD helps researchers in the design of protein expression vectors, artificial gene networks, and other genetic constructs, essentially combining engineering approaches with biology. Synthetic biologists have an increasingly large library of naturally derived and synthetic parts at their disposal to design and build living systems. These parts are the words of a DNA language and the "grammar" a set of design rules governing the language. It has to be expressive enough to allow scientists to generate a broad range of constructs, but it has to be focused enough to limit the possibilities of designing faulty constructs.

Virginia Tech News
13 Mar 2014
http://www.vtnews.vt.edu/articles/2014/03/031314-vbi-peccoudgenocad.html

New DNA-Editing Technology Spawns Bold UC Initiative

The University of California, Berkeley, and UC San Francisco are launching the Innovative Genomics Initiative (IGI) to lead a revolution in genetic engineering based on a new technology already generating novel strategies for gene therapy and the genetic study of disease. The Li Ka Shing Foundation has provided a $10 million gift to support the initiative, establishing the Li Ka Shing Center for Genomic Engineering and an affiliated faculty chair at UC Berkeley. The two universities also will provide $2 million in start-up funds. At the core of the initiative is a revolutionary technology discovered two years ago at UC Berkeley by Jennifer A. Doudna, executive director of the initiative and the new faculty chair. The technology, precision "DNA scissors" referred to as CRISPR/Cas9, has exploded in popularity since it was first published in June 2012 and is at the heart of at least three start-ups and several heavily-attended international meetings. Scientists have referred to it as the "holy grail" of genetic engineering and a "jaw-dropping" breakthrough in the fight against genetic disease.

Robert Sanders, UC Berkeley
18 Mar 2014
https://newscenter.berkeley.edu/2014/03/18/new-dna-editing-technology-spawns-bold-uc-initiative/

Stem Cells Created from a Drop of Blood

Scientists at A*STAR's Institute of Molecular and Cell Biology (IMCB; Singapore) have developed a method to generate human induced pluripotent stem cells (hiPSCs) from a single drop of finger-pricked blood. The method also enables donors to collect their own blood samples, which they can then send to a laboratory for further processing. The easy access to blood samples using the new technique could potentially boost the recruitment of greater numbers and diversities of donors, and could lead to the establishment of large-scale hiPSC banks. By genetic reprogramming, matured human cells, usually blood cells, can be transformed into hiPSCs. As hiPSCs exhibit properties remarkably similar to human embryonic stem cells, they are invaluable resources for basic research, drug discovery and cell therapy. In countries like Japan, USA and UK, a number of hiPSC bank initiatives have sprung up to make hiPSCs available for stem cell research and medical studies.

ScienceDaily
20 Mar 2014
http://www.sciencedaily.com/releases/2014/03/140320101320.htm

Engineers Design 'Living Materials'

Inspired by natural materials such as bone—a matrix of minerals and other substances, including living cells—MIT engineers have coaxed bacterial cells to produce biofilms that can incorporate nonliving materials, such as gold nanoparticles and quantum dots. These "living materials" combine the advantages of live cells, which respond to their environment, produce complex biological molecules, and span multiple length scales, with the benefits of nonliving materials, which add functions such as conducting electricity or emitting light. The new materials represent a simple demonstration of the power of this approach, which could one day be used to design more complex devices such as solar cells, self-healing materials, or diagnostic sensors, says Timothy Lu, an assistant professor of electrical engineering and biological engineering. Lu is the senior author of a paper describing the living functional materials in the March 23 issue of *Nature Materials*.

MIT News
23 Mar. 2014
http://web.mit.edu/newsoffice/2014/engineers-design-living-materials.html

A Step Forward in Adult Vertebrate Tissue Regeneration

The reason why some animals can regenerate tissues after severe organ loss or amputation while others, such as humans, cannot renew some structures has always intrigued scientists. In a study now published in *PLOS ONE*, a research group from Instituto Gulbenkian de Ciência (IGC, Portugal) led by Joaquín Rodríguez León provided new clues to solve this central question by investigating regeneration in an adult vertebrate model: the zebrafish. It was known that zebrafish is able to regenerate organs, and that electrical currents may play a role in this process, but the exact mechanisms are still unclear. Using both biophysical and molecular approaches, the researchers have shown, for the first time, that zebrafish regenerates its caudal fin by a process that involves a specific channel in the cell membrane, called V-ATPase, that pumps hydrogen ions (H+) out of the cells generating an electrical current. Understanding these mechanisms underlying adult tissue regeneration may be instrumental for the development of new therapeutic strategies.

Instituto Gulbenkian de Ciencia / Eurekalert
27 Mar 2014
http://www.eurekalert.org/pub_releases/2014-03/igdc-tgo032714.php

Bio-Printing Tissues for Cheaper, Faster Drug Testing

Bio-printed tissues can help better predict and test whether a drug will be effective on people and at less cost, researchers at the University of British Columbia Department of Electrical and Computer Engineering and spinoff Aspect Biosystems hope to prove. Ultimately, this work could also lead to growing organs for human transplant. Developing a new drug costs upward of $4 billion, a fee that gets passed on to patients, according to the researchers. Even after extensive testing in the lab and on animals, only a handful

of drugs are successful enough to go to clinical trial in humans. Astonishingly, the failure rate of drugs in clinical trials is 90 per cent because humans and animals often respond differently. This expensive process can take over a decade. "There are 200 ways to cure pulmonary fibrosis in mice but not a single cure for the disease in humans," says Sam Wadsworth, co-founder and director of biology of Aspect Biosystems. He and his colleagues have discovered a technique for growing 3D human airway tissues that almost exactly replicate the lung wall.

Kurzweil AI
28 Mar 2014
http://www.kurzweilai.net/bio-printing-tissues-for-cheaper-faster-drug-testing

First Comprehensive Roadmap of the Mammalian Brain

Researchers from the Allen Institute for Brain Science have published the Allen Mouse Brain Connectivity Atlas, the first comprehensive, large-scale data set on how the brain of a mammal is wired, described in their paper in *Nature*. The mouse brain's 75 million neurons are arranged in a structure roughly similar to the human brain's approximately 100 billion neurons, so they provide a powerful model system for understanding how nerve cells of the human brain connect, process, and encode information, say Allen Institute researchers. (The only species for which we have a complete wiring diagram is the simple microscopic worm *C. elegans*—a far simpler system, with only 302 neurons.) Scientists at the Allen Institute set out to create a wiring diagram of the brain—also known as a "connectome"—to illustrate short and long-range connections, using genetically engineered viruses to trace and illuminate individual neurons. To get a truly comprehensive view, scientists collected imaging data at resolutions smaller than a micron (millionth of a meter) from more than 1,700 mouse brains.

Kurzweil AI News
3 Apr 2014
http://www.kurzweilai.net/first-comprehensive-roadmap-of-the-mammalian-brain

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:

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

Corey Noble, **"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 de Wolf, **"Reconstructive Connectomics,"** *Cryonics* magazine, July 2013.

Preserving Minds, Saving Lives: 35 Years of the Best Cryonics Writing of The Alcor Life Extension Foundation

Available for Pre-Order NOW!

Featuring stimulating articles from the pages of CRYONICS Magazine by Steven Harris, Hugh Hixon, Saul Kent, Mike Darwin, Stephen Bridge, Thomas Donaldson, Aschwin de Wolf, Brian Wowk, Michael Perry, Ralph Merkle, and many others.

Here are some of the classic articles that shaped cryonics thought and Alcor policy over the past three decades.

Why We are Cryonicists
Notes on the First Human Freezing
Dear Dr. Bedford
How Cryoprotectants Work
How Cold is Cold Enough?
The Death of Death in Cryonics
The Society for The Recovery of Persons Apparently Dead
Frozen Souls: Can A Religious Person Choose Cryonics?
But What Will the Neighbors Think?!
Systems for Intermediate Temperature Storage for Fracture Reduction and Avoidance

You can't really understand cryonics today unless you can appreciate how we got here. The philosophy, the history, the science and technology, the debates, the PEOPLE of cryonics—it's all here in one indispensable volume. The book will be published in 2014.

Quantity: _____ Hardcover @ $35.00 _____Quality paperback @ $20.00 = $ _____

Add $3.00 for Shipping ($15.00 for non-US/Canada orders) = $ _____

TOTAL: $

CREDIT CARD INFORMATION

Card type: ❑ Discover ❑ Visa ❑ MasterCard ❑ AMEX

Name on card: _____ Billing Zip Code: _____

Credit card number: _____ Expiration date: _____

Signature: _____

SHIPPING INFORMATION

Name: _____

Address: _____ City: _____ State: _____ Zip: _____

Phone: _____ Email: _____

(Optional)

Send this form to:
Alcor Life Extension Foundation
7895 East Acoma Drive Suite 110
Scottsdale, Arizona 85260.
You can also order via PayPal by sending payment to bonnie@alcor.org. or by calling Alcor at 1-877-462-5267 Ext. 114

How Much Curcumin Are *You* Absorbing?

Curcumin is an active compound derived from the Indian spice **turmeric.** It has been widely acclaimed for its diverse health-promoting effects on nearly every organ system in the body,[1-6] including its support for the body's natural inflammatory response system.[7] But most curcumin is neither *absorbed* well nor *retained* well in the blood—posing a challenge to those who wish to maximize its benefits.[8]

Life Extension® took the lead in resolving this issue several years ago by introducing **Super Bio-Curcumin®** containing **BCM-95®**, a patented, *bioenhanced* preparation of curcumin that has been shown to reach up to **7 times higher concentration** in the blood than standard curcumin.[8]

Now, an exciting ***next generation*** curcumin formula has become available! The new **Advanced Bio-Curcumin® with Ginger & Turmerones** provides additional compounds that ***further*** boost absorption of curcumin's highly beneficial phytonutrients![9,10]

UNRIVALED POTENCY AND ABSORBABILITY

In addition to **BCM-95®**, this new **curcumin** formula contains:

1. Turmerones: After curcumin is extracted from turmeric, what remains is **turmeric oil** rich in compounds called **turmerones.**[11,12] Combining **BCM-95®** with a high content of **turmerones** provides health consumers with more benefical **turmeric** compounds that further multiply absorption.[9] Scientists have shown that these potent **turmerones** not only support curcumin absorption, but significantly increase the amount of curcumin **inside** the cell as well![9]

2. Ginger: Curcumin and **ginger** are close botanical relatives. Research demonstrates that they have overlapping and complementary health benefits,[13] and scientists are focusing on the therapeutic effects of *combining* these two plants.[14,15] **Advanced Bio-Curcumin® with Ginger & Turmerones** provides a supercritical extract of ginger standardized to the greatest concentration of ginger compounds—including beneficial gingerols and shogaols.

3. Phospholipids: This new curcumin formula also contains **phospholipids**, a type of emulsifying molecule known to greatly enhance absorption of poorly soluble active compounds.[10]

The powerfully enhanced bioavailability and potency of **Advanced Bio-Curcumin® with Ginger & Turmerones** is superior to conventional curcumin supplements. This product represents the most powerful and cost-effective way to supplement with—and receive the full benefits of—this very critical nutrient.

The suggested daily dosage of one softgel of **Advanced Bio-Curcumin® with Ginger & Turmerones** provides:

Turmeric Phospholipid Blend BCM-95® Bio-Curcumin Turmeric 25:1 extract (rhizome) [total curcuminoids complex with essential oils (380 mg)], Turmeric oil (rhizome) [providing 60 mg total turmerones], Phospholipids	**630 mg**
Ginger CO_2 extract (root) [providing 60 mg gingerols]	**200 mg**

Each softgel of **Advanced Bio-Curcumin® with Ginger & Turmerones** provides **400 mg** of **BCM-95® Super Bio-Curcumin** plus an array of turmerones and phospholipids.

A bottle of 30 softgels of **Advanced Bio-Curcumin® with Ginger & Turmerones** retails for $30. If a member buys four bottles, the price is reduced to **$20.25** per bottle.

Item# 01808

Contains soybeans.

To order Life Extension® Advanced Bio-Curcumin® with Ginger & Turmerones, call 1-800-544-4440 or visit www.LifeExtension.com Be sure to mention code PIM401X

References

1. *Adv Exp Med Biol.* 2007;595:197-212.
2. *Biofactors.* 2013 Jan-Feb;39(1):2-13.
3. *Clin Exp Pharmacol Physiol.* 2012 Mar;39(3):283-99.
4. *Adv Exp Med Biol.* 2007;595:1-75.
5. *Trends Pharmacol Sci.* 2009 Feb;30(2):85-94.
6. *Curr Drug Targets.* 2011 Mar 1;12(3):332-47.
7. *J Clin Immunol.* 2007 Jan;27(1):19-35.
8. *Indian J Pharm Sci.* 2008 Jul-Aug;70(4):445-9.
9. *J Med Food.* 2012 Mar;15(3):242-52.
10. *Cancer Chemother Pharmacol.* 2007;60:171-7.
11. *J Agric Food Chem.* 1999 Oct;47(10):4297-300.
12. *Z Naturforsch C.* 2001 Jan-Feb;56(1-2):40-4.
13. *Osteoarth Cartilage.* 2003 Nov;11(11):783-9.
14. *Wound Repair Regen.* 2009 May-Jun;17(3):360-6.
15. Available at: http://www.umassmed.edu/hema_oncology/MDSinfo/curcuminandgingerol.aspx. Accessed September 25, 2013.

Caution: Do not take if you have gallbladder problems or gallstones. If you are taking anti-coagulant or anti-platelet medications, or have a bleeding disorder, contact your healthcare practitioner before taking this product.

502-6001 1414

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 first Saturday of every month starting at 11:00 AM MST. Guests are welcome to attend the fully-public board meetings on odd-numbered months. Facility tours are held every Tuesday 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) 969-1671, (650) 534-6409 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/.

BRITISH COLUMBIA (CANADA):

The contact person for meetings in the Vancouver area is Keegan Macintosh: keegan.macintosh@me.com.

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

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.

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:

We meet at least quarterly for training, transport kit updates, and discussion. For information: Steve Jackson, 512-447-7866, sj@sjgames.com.

UNITED KINGDOM

There is an Alcor chapter in England. For information about meetings, contact Alan Sinclair at cryoservices@yahoo.co.uk. See the web site at www.alcor-uk.org.

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 $10/month (or $30/quarter or $120 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 ($10/month or $30/quarter or $120 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

ALCOR
LIFE EXTENSION FOUNDATION
SINCE 1972

Call toll-free TODAY to start your application:

877-462-5267 ext. 132 • info@alcor.org • www.alcor.org

You're going to great lengths to avoid death.
Why not do something to prolong life.

Join the Life Extension Foundation® now so you can live a longer, healthier life. We'll give you all the support you need, starting with cutting-edge medical information.

You get it three ways. Through our monthly ***Life Extension*** **Magazine®**... filled with cutting-edge research findings and global medical breakthroughs even your doctors may not know about. Through our ***Disease Prevention and Treatment*** book, filled with breakthrough protocols on over 130 different diseases of aging. And with free phone access to our **knowledgeable Health Advisors** (naturopaths, nurses, nutritionists, even personal trainers). They're available every day of the year to address your health concerns and guide you in structuring a personal regimen of diet, exercise and nutritional supplements designed to extend your life healthy life span.

As a Life Extension® member, you'll save far more than money with **preventive blood screening** to head off health problems ... and **advanced nutritional supplements** that are light-years ahead of the commercial marketplace. These are formulas guaranteed for purity, potency and efficacy that you simply won't find anywhere else. All formulated to keep your body functioning youthfully for more years than you ever thought possible.

So while you're busy planning for the future, try spending a moment to prolong it. Call **1-866-820-4967** toll-free or visit **www.lef.org/pim** to join the Life Extension Foundation now.

LifeExtension®
Foundation for Longer Life

1-866-820-4967 • www.lef.org/pim

502.60G1 0314

Your $75 annual membership dues will fund innovative anti-aging research that will ultimately benefit you.