

ALCOR LIFE EXTENSION FOUNDATION

CRYONICS

1ST QUARTER 2011 · VOLUME 32:1

SUSPENDED
ANIMATION:
THE COMPANY
PAGE 13

DEFICIENCIES IN THE SENS
APPROACH TO REJUVENATION

PAGE 8

MEMBER PROFILE: PETER VOSS

PAGE 10

ISSN 1054-4305



\$9.95

Improve Your Odds of a Good Cryopreservation

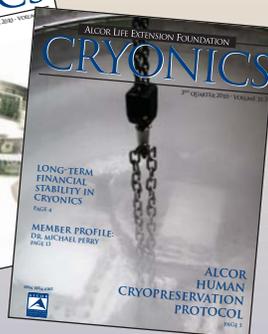
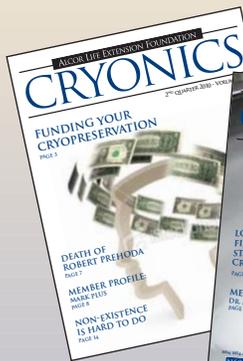
You have your cryonics funding and contracts in place but have you considered other steps you can take to prevent problems down the road?

- 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.



Subscribe to the Paper Edition of *Cryonics*



Subscriptions to the paper edition of *Cryonics* magazine (including shipping) are available for 1, 2 and 3 years from Alcor.

If you live in the United States, a subscription for one year costs \$39, two years \$69, three years \$99. If you live in another country, a subscription for one year costs \$99, two years \$179, three years \$239.

Call 877-462-5267 x101 or visit <http://www.alcor.org/magazine>

Individual copies are available for \$9.95 (plus shipping) at: <http://www.magcloud.com/user/alcor>

ALCOR LIFE EXTENSION FOUNDATION

CRYONICS

1ST QUARTER 2011 · VOLUME 32:1



Cover Photo: Automated whole body vitrification experiments at SA

COVER STORY: PAGE 13

Suspended Animation General Manager Catherine Baldwin provides an update about the cryonics company Suspended Animation. The objective of Suspended Animation is to research and develop state of the art standby and stabilization technologies. You will also read about how Alcor members can arrange for a Suspended Animation-controlled standby and the company's upcoming cryonics technology conference in May 2011.

8 Deficiencies in the SENS Approach to Rejuvenation

Cryonics Institute President Ben Best takes a critical look at Strategies for Engineered Negligible Senescence (SENS), the program that aims at human rejuvenation by reversing damage, and identifies a number of problems. In particular, he argues that SENS neglects one of the major causes of aging, nuclear DNA damage.

10 Member Profile: Peter Voss

Chana de Wolf writes about Alcor member Peter Voss, who has lived in Germany, South Africa and now works in the United States as an artificial intelligence researcher. Peter is one of the driving forces behind Alcor's Southern California Emergency Response team. His member profile is followed by a short interview about his personal experience with caloric restriction.

CONTENTS

- 3 CEO update
- 6 Quarterly Readiness Update
- 16 Book Review: *The Future of Aging: Pathways to Human Life Extension*
Cryonics magazine editor Aschwin de Wolf reviews Gregory M. Fahy's recent massive collection of interventive gerontology articles to obtain a better understanding about the prospects for halting or reversing aging in humans.
- 19 Membership Statistics

Editorial Board

Saul Kent
Ralph Merkle, Ph.D.
Brian Wowk, Ph.D.

Editor

Aschwin de Wolf

Art Director

Jill Grasse

Contributing Writers

Catherine Baldwin
Ben Best
Aaron Drake
Max More, Ph.D.
Mike Perry, Ph.D.
Aschwin de Wolf
Chana de Wolf

Copyright 2011
by Alcor Life Extension Foundation
All rights reserved.
Reproduction, in whole or part,
without permission is prohibited.

Cryonics Magazine is published quarterly.

To subscribe to the paper edition:
call 480.905.1906 x101
or visit the magazine website:
<http://www.alcor.org/magazine/>

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/>

FROM THE EDITOR

As we start the year 2011, I am glad to announce that *Cryonics* magazine is back on track on its publishing schedule and has completed the transition to an electronic publication. The new *Cryonics* magazine website is now online at www.alcor.org/magazine and will not just be making the magazine and selected articles available in a variety of formats, but will also be publishing web exclusives and classic articles from past issues, and alert the reader to other important publishing events pertaining to cryonics. The new web format also allows us to publish individual Tech News items in a timelier manner.

We understand that some of our readers prefer the classic paper format and Alcor has sent a letter to all members with instructions on how to start an Alcor-administered subscription to the paper edition of the magazine. Paper subscriptions can also be started on the magazine website, which accepts PayPal and the major credit cards. Individual copies can be purchased at www.magcloud.com/user/alcor

Alcor welcomes our new CEO, Max More. Max has a long history in publishing on topics related to cryonics, life extension and technological progress and we are looking forward to his contributions to this magazine. In this issue you will find his first quarterly CEO update.

This issue collects a number of pieces on the topic of aging and rejuvenation. Reversal of the aging process is one of the necessary components for the resuscitation of most cryonics patients and our members have a strong interest in this topic.

Cryonics magazine is proud to publish an article by the President of the Cryonics Institute on deficiencies in the SENS approach to rejuvenation. Ben Best claims that two of the Strategies for Engineered Negligible Senescence do not constitute *repair* and that SENS does not do justice to nuclear DNA damage as a cause of (brain) aging.

For my own contribution, I read Greg Fahy's new 866 page collection of papers on interventive gerontology, *The Future of Aging: Pathways to Human Life Extension*, from cover to cover for a review.

The practice of caloric restriction is one of the few strategies to delay the debilitating effects of aging that has survived careful experimental scrutiny in many animal species. It is therefore not surprising that a disproportionate number of cryonics members practice this diet with the expectation that such benefits will accrue to humans as well. In our member profile we will meet Alcor member Peter Voss, who practices caloric restriction and who has been quite active in growing and maintaining Alcor's Southern California standby and stabilization capabilities.

In recent years Alcor has successfully collaborated with the cryonics company Suspended Animation to improve its response capabilities. Suspended Animation General Manager Catherine Baldwin writes about the objectives of the organization and informs Alcor members how they can arrange a Suspended Animation-controlled standby. Starting with this issue, you will also see quarterly updates about Alcor's own standby and stabilization capabilities.

In January 2011, Alcor had more than 1,000 Facebook fans. If you have a Facebook account, please join the Alcor page and help us grow to 2,000 fans:
<http://www.facebook.com/alcor.life.extension.foundation>

Aschwin de Wolf

CEO Update

By Max More



Some organizations build vehicles. Others develop software. Alcor aims to allow its members to beat death. (I say “beat” not “cheat” because, of course, death isn’t a person with any kind of legitimate claim.) Other forms of life extension also aim to beat death and we’re all for them. Thirty years ago I was quite hopeful that, by now, we would have made major progress toward that goal. But we haven’t. That fact is one of the major reasons why I applied for the job of Alcor president and CEO. We probably won’t find a cure for aging very soon. Many of us need another path to the future. Cryonics seems to be the only plausible option.

Heading up an organization that aims to beat death and which is responsible to almost a thousand people for helping them do so is a challenging job. Much of the outside world doesn’t understand the rationale for cryopreservation and so often either ridicules or dismisses us. In addition, too often people within cryonics let personalities interfere with progress. This explains why, along with the many congratulations I received for being given this job, I also heard quite a few commiserations. But so far – despite some nasty attacks by those hostile to Alcor and the cryopreservation enterprise – the job has been challenging but engaging. For that, in large part, I want to thank Alcor’s fine staff and its dedicated, super-smart, and highly informed board of directors.

The Alcor of today is recognizable as the Alcor that I joined back in 1986, but it’s also quite different. Most obviously, it’s grown and become more sophisticated both in its technology and operations. When I joined almost 25 years ago, I was the 67th member. Only six people were awaiting the future in the dewars.

Walking in the door when I came to meet the staff, before being offered the job, I was immediately reminded that I was returning home. Just to the left of the entrance is a display of covers from past issues of *Cryonics* magazine. The January 1988 issue was devoted to Dora Kent, with whose cryopreservation I had assisted. Below that was the cover of the 4th Quarter 1994 issue, asking “When is Death?” referring to my article, “The Terminus of the Self.”

Seeing that led me to look up when I first wrote for the magazine, which turned out to be November 1986, with “Cryonics in Britain”. Some of you may remember that I went on to write Immortalist Philosophy columns from 1987 into the mid-1990s, including “Possibility and Prediction”, “The Third State,” “Meaning and Mortality,” “Deathism and Immortalism,” “Personal Continuity, Death, and Cryonics.”

Forgive me if this reminiscence seems self-indulgent. My point is that while I may be new to the job, I am far from new to Alcor. For a quarter of a century I’ve been on the same journey. Many of you know me, but many do not. Those in both groups should understand that I’m here to work with the rest of the Alcor team to maintain and develop the best possible cryopreservation organization for you and for ourselves. You and I have the same goal, so please never hesitate to contact me if you have concerns, suggestions, complaints, or requests that could improve our security, stability, capability, or growth. Expect a new era of openness. In addition to welcoming your input, *Cryonics* magazine will tell you more about what’s going on at Alcor, with regular updates from staff.

And now for something completely different.

This is my very first update as Alcor’s president and CEO. As such, I would like it to stay with a positive tone. However, I’m finding that hard to do. Just a couple of days ago, we learned of a long-time Alcor member who died eight months ago. His two closest relatives, both daughters, signed the Relative’s Affidavit to support his cryopreservation, yet told us nothing about his death. Given his financial arrangements, it seems highly likely that they turned their back on their father’s explicit and long-confirmed wishes – and set aside their personal commitment – in order to gain financially from his death.

Let me state that again: The people to whom our member gave life allowed him to die in order to grab some money. (It wasn’t even a large amount; it was modest in comparison to the funding of many members.) As a result of this (which is not the first sad occurrence of this type), we will be looking closely at the language of the funding part of the agreement to see how we might structure the agreement to prevent greedy relatives from profiting by ignoring the explicitly stated wishes of Alcor members.

The lesson for the rest of us: It may be hard to imagine close relatives ignoring our strongly-held desire to be cryopreserved. Surely they wouldn’t fail to inform Alcor – especially if they explicitly agreed to do so? Surely they wouldn’t be swayed by the possibility of some extra money? Alas, they just might. Perhaps not if you died tomorrow, but perhaps after years have gone by and they find it easy to forget your desires and their assent.

You can do better to ward off this prospect in a couple of ways. First, you must be sure to set up relationships with non-relatives to support your wishes for cryopreservation. Don’t rely on relatives with a

financial interest in your non-cryo-preservation. Second, think very carefully about how you specify your funds to be distributed in the event that you cannot be cryopreserved. Avoid creating financial incentives to fail to report your clinical death. Provide for relatives through separate mechanisms. If your cryopreservation is not possible, then either specify that all the funds go to Alcor's PCT, Endowment Fund, or research, or to some other organization that is aligned with your values.

Funding levels and Alcor's growth or contraction: With the recent rise in the whole body funding requirement and in dues, we are all concerned about the possibility of losing members and experiencing a period of negative growth in the membership total. In January 2011, Alcor did indeed experience a net loss of members. There were six cancellations. However, only one was due in part to higher dues and rates; that person also had other issues, including wanting exceptional arrangements that were unacceptable to us. None of the other five cited higher costs. Three or four of them allowed their insurance policies to lapse, but are likely to renew their membership. Obviously future months could be different, but so far the increases have not resulted in significant cancellations.

You will certainly be hearing more about the need to increase your cryopreservation funding. A large majority of Alcor members are funded at levels below the current *minimum* required amounts. That is not a sustainable position. Please note the word *minimum*. If you have funding of \$80,000 for neuro or \$200,000 for whole body, that does not mean you should rest easy. Future costs could and almost certainly will continue to rise as new and better processes become available and/or inflation takes its toll. In addition, we have no accurate way to account for the cost of revival and rehabilitation.

The Alcor board (and myself) are still considering the matter of what to do about members who signed up in years past at funding levels well below today's minimums. Decisions on this crucial matter will be pondered and analyzed at length. No overly rapid decision will be made. The input of all Alcor members is welcome on the issue of how to protect the organization, patients already in cryopreservation, and members who will be cryopreserved, in the light of widespread underfunding.

Improved financial controls: Alcor goes to considerable lengths to ensure the security of the Patient Care Trust Fund. Other funds and accounts (such as the bank account and money market accounts for reserve funds) have less money in them, but could still be targets for misappropriation. In years past, banks would support security by requiring two signatures for withdrawals. That option has practically disappeared. By putting some pressure on Alcor's bank, we have been able to institute other options, including "positive pay" and other security measures.

Infrastructure: Have you tried to call Alcor recently? Were you frustrated by the menu system? Did you find yourself unable to leave a message at all? For years, Alcor leased a phone system. More recently that system was purchased. Unfortunately the timing of the purchase turned out badly, since the phone system died this week, leaving the voice mail system inoperable. (The emergency number continued to function.) Mitel met with us at very short notice to go over our options. We had a newly leased system installed early in the week of February 7-11. The new system has more functionality and flexibility as well as reliability and longevity.

Another infrastructure issue of importance and moderate urgency is improving the database. I am not at all satisfied with the security and resilience of Alcor's database equipment. We will be looking into options including remote storage as well as improvements to the design and functionality of the database software.

Anticipation: In January, I asked several members of the cryopreservation team to engage in a scenario exercise with me. Aaron Drake took the lead in taking us through the cryopreservation scenario. This both re-familiarized me with the likely chain of events and revealed a couple of issues that led to discussions for improvements or areas of caution. Everyone seemed to agree that the exercise was valuable, and we will conduct more scenario exercises using different assumptions to improve our readiness for a wide range of challenging situations that can arise in a deployment.

Also involving the anticipation of possible future challenges, I observed that the population is getting fatter and that existing equipment (such as ice baths and transport equipment) may be unable to accommodate very large patients. That consideration will be observed in all future equipment design.

Other items: Alcor members and other observers like to know what happens in each of our cryopreservation cases, and reports of those cases serve a valuable informational and educational role. I set about reading recent reports only to find that most of the recent cases had not been fully written up as reports. My goal is to remove the bottleneck by reducing the approval steps required to get the reports completed. Within 24 hours of the new policy, Aaron was able to immediately complete and post a new report. Reports on two other cryopreservations can be expected later this month (after Aaron returns from a full-time, week-long course to renew his certification as a paramedic).

Aaron and I are working to renew the program of regional group training. I met with Aaron and Steve Graber to discuss improving training and support of local groups. We now have a schedule, and I will be talking with leaders of all the regional groups to assess their needs and listen to their concerns and plans. If you are involved in one of those groups, don't wait for me to call you if you have something to say or ask.

Mike Perry will lead a project to update Alcor's online literature and the materials we send out to inquirers. Some of this material hasn't been updated in years and no longer fully reflects current practice and knowledge. For instance, one piece says that we apply vitrification only in neuro cases; that hasn't been true for years.

Saul Kent arranged for me to visit both Critical Care Research and 21st Century Medicine in California. I was given highly informative tours of both and was able to speak with the principals, most of whom I hadn't seen in years. The trip also afforded me the opportunity to talk with Catherine Baldwin, General Manager of Suspended Animation.

I will be giving a cryonics talk at the SENS5 conference, organized by Aubrey de Grey, in Cambridge, England (August 31 to September 3, 2011). I will also be speaking at the May Suspended Animation conference – please plan to attend and let me meet you and talk with you. ■

Max More

President and Chief Executive Officer

Member Communications Director Job Opening at Alcor

A new position called the **Member Communications Director (MCD)** has opened at Alcor.

The Member Communications Director's job will be to communicate with Alcor's members by email, by telephone, and in person for multiple purposes, among which are:

1. To find out more about the member, including such information as the member's health condition, occupation, work background, interests, family, and aspirations.
2. To determine whether the member wishes to engage in volunteer activities on behalf of Alcor and, if the member wishes to do so, to provide the member with a variety of ways in which the member can volunteer.
3. To answer the member's questions about Alcor.
4. To determine whether the member has left assets to be distributed to Alcor after death via a will, trust, or other document. If the member has done so, the MCD will offer to evaluate, in cooperation with attorneys of Alcor's choosing, whether the legal documents in which the bequest has been made have been executed in a manner that will do the job effectively and, if not, to help correct them.
5. To determine the member's general degree of wealth and whether the member has any interest in donating money (or other assets) or in leaving a bequest to Alcor. If the member is interested in making a donation, the MCD will provide the member with a

variety of projects that need funding via tax-exempt donations. If the member is interested in making a bequest, the MCD will offer, in cooperation with attorneys of Alcor's choosing, to help the member in executing a will, trust, or other legal document to accomplish the bequest with attorneys of Alcor's choosing if it is appropriate to do so.

Qualifications:

The MCD should be an Alcor member who is (or becomes) knowledgeable about Alcor and issues in cryonics, is articulate in talking to members, and is sensitive enough to know when to push forward when members make it clear that they want to help Alcor or want help from Alcor. The MCD should also be able, in cooperation with others of Alcor's choosing, to prepare written information to help answer questions asked by members.

Compensation:

The salary for the MCD is \$60K plus benefits per year. This salary plus relocation expenses has been guaranteed for one year by the Life Extension Foundation (LEF). After one year, the Member Communication Director's continued employment at Alcor will be dependent upon his or her job performance.

Applications for the Member Communications Director should be mailed to:

D'Bora Tarrant
Alcor Life Extension Foundation
7895 Acoma Drive, Suite 110
Scottsdale, Arizona 85260
or send email to D'Bora Tarrant at:
dbora@alcor.org

California Response Team and Critical Care Research

- **October** – Torrance, CA standby with members of the Southern California Response Team
- **Sept** – Iowa deployment with members of the Arizona Response Team

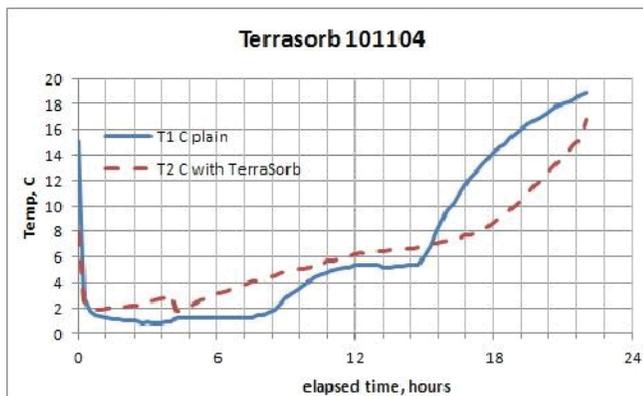
Gel Ice Tests

When the Aviation and Transportation Security Act was signed into law in 2001, the articles were to be integrated over numerous years to allow individuals and companies time to adjust to the new rules. Through this transition, Alcor has seen numerous impacts on the most time sensitive component of our business – airline travel with our patients who await vitrification.

Many airlines are no longer allowing “wet” ice for human remains shipments. Depending on our departure city, this can severely limit the travel options available to us. There is concern that the most stringent TSA rules, yet to be implemented, will not allow “wet” ice on any airline. The most common replacement is the “blue” ice packs. These are not a good substitute for Alcor as the additional weight of the packs would typically exceed our total weight allowance. Further, these packs are warm when purchased and finding a way to freeze the quantity that we need is challenging and the actual cooling takes significant time that we typically do not have.

As a result, we started researching ways to create “gel” ice – the stuff inside the packs. Different formulas were identified that could work, however the challenge was still in getting the product cold. We identified a hydrogel product, under the name TerraSorb, that would congeal when mixed with water. This product was marketed under the concept of keeping plant soil moist for an extended period of time. We tested different ratios of water and product until we came up with a suitable mix. Then we mixed it with ice, instead of water, and received similar results. As the ice melted, the run-off would convert to gel. This solved both of our problems: a gel product that would satisfy the airline requirements; and an easy way to cool it to the desired temperature

To confirm our data, we performed a test comparing a standard 1 gallon bag of ice (8 lbs.) to an identical bag of ice that included a corresponding ratio of hydrogel.



The following graph shows the positive results of that test. The plan is to include this product in our response kits so it is available for use when the shipping options are limited.

Upcoming Response Team trainings and meetings

- **Laughlin, NV** – Feb. 23rd & 24th, 2011
- **Arizona** – March 19th, 2011, Contact Aaron Drake, aaron@alcor.org
- **Pacific Northwest (Portland)** – May 7th & 8th, 2011, Contact Aschwin de Wolf, aschwin@alcor.org

of the supplies and medications have been fully organized into Pelican cases for each of the response teams, along with inventory diagrams.

Previously, one would have to sift through the kit(s) to find the item they were looking for. This was especially difficult for regional team members as they do not work with the kits on a regular basis and are not familiar with the whereabouts of the contents. The consistency this organization creates will be beneficial to any team member who responds and has to work with whichever team kit is present at the patient’s bed side.

Currently, the new response kits are located in Southern California, Northern California, Pacific Northwest, Arizona and



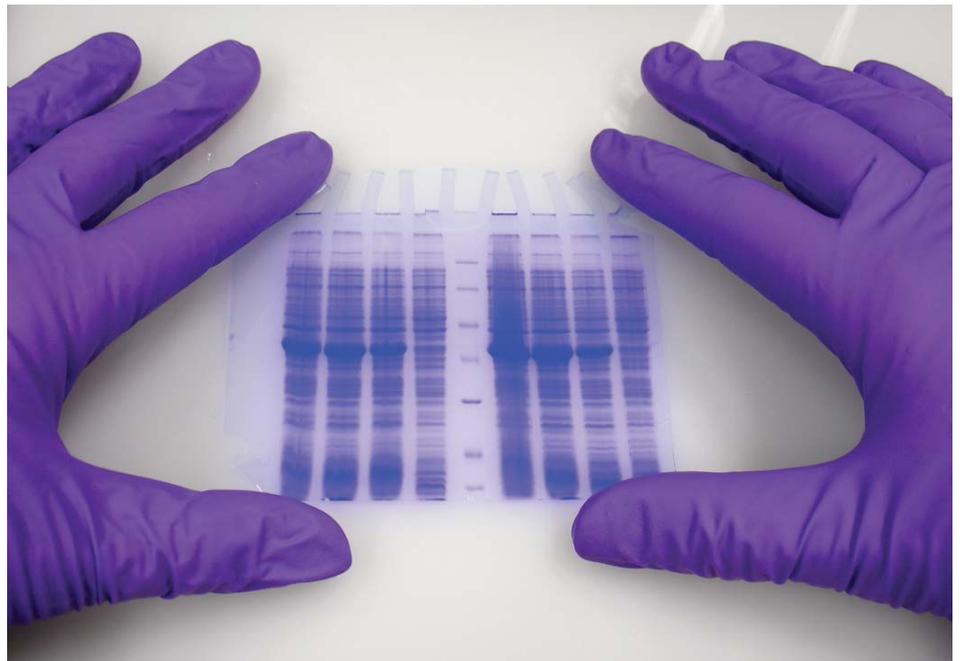
Response Team Kits

The final step in redesigning the response team kits has been completed. All

at Terasem in Florida. The Laughlin, Texas and New England teams should be receiving their new kits soon. ■

Deficiencies in the SENS Approach to Rejuvenation

By Ben Best



I am an ardent supporter of Dr. Aubrey de Grey and his work to advance rejuvenation science. The man is priceless and unique in his concepts, brilliance, dedication, organizational abilities, and networking skill. His impact on anti-aging science has been powerful. I have attended all four of the conferences he has organized at Cambridge University in England. For the February 2006 issue of LIFE EXTENSION magazine I interviewed Dr. de Grey, and for the December 2007 issue of LIFE EXTENSION I wrote a review of ENDING AGING, the book he co-authored with Michael Rae.

~~~~~  
It is hard to believe that it could be a coincidence that the most notorious “accelerated aging” diseases are due to defective DNA repair.  
~~~~~

Dr. de Grey asserts that aging is the result of seven kinds of damage – and that technologies that repair all seven types of damage will result in rejuvenation. His seven-fold program for damage repair is called SENS: “Strategies for Engineered Negligible Senescence.” Dr. de Grey asserts

that repairing aging damage is a more effective approach than attempting to slow or prevent aging, and I agree with him. Being an ardent supporter of SENS has not stopped me from simultaneously being a critic of aspects of his program that I think are flawed or deficient. I will attempt to outline some of my criticisms in simple language, assuming that my readers have some knowledge of basic science.

Two SENS strategies cannot justly be described as damage-repair, in my opinion. To protect mitochondrial DNA from free radical damage he wants to make copies of mitochondrial DNA in the nucleus – and import the resulting proteins back into the mitochondria. I would call this an attempt to slow or prevent aging – it cannot be called repair.

Similarly, SENS aims to eliminate cancer by deletion of genes that contribute to cancer, specifically telomerase and ALT (Alternate Lengthening of Telomeres) genes. I am not convinced that this is the best way to eliminate cancer, and I do not believe that deleting cancer-producing genes can properly be called damage-repair.

My criticisms about a procrustean attempt to force two strategies into a model purporting to only be concerned with damage and repair is minor, however, compared to a more fundamental concern that I have that a significant form of aging damage may be being ignored by SENS. I have written a review expressing my concern entitled “Nuclear DNA Damage as a Direct

Cause of Aging” that was published in the June 2009 issue of the peer-reviewed journal *Rejuvenation Research*, [note 1] a journal of which Dr. de Grey is Editor-in-Chief. A PDF of my review is available in the life extension section of my website BENBEST.COM. Those interested in all the citations for claims I will make in this essay are encouraged to read my review. In this essay, I limit my citations to only a few critical articles.

There are many types of DNA damage, but for the purposes of this essay I will focus on breakage of both DNA strands – resulting in a gap in a chromosome. There are two mechanisms for repairing double-strand DNA breaks: Homologous Recombination (HR) and Non-Homologous End-Joining (NHEJ). HR usually results in perfect repair, but HR can only operate when cells are dividing. NHEJ is the more frequent form of double-strand break repair, but it is error-prone. NHEJ is the only DNA repair mechanism available for non-dividing cells. Even in cells that divide, 75% of double-strand breaks are repaired by NHEJ. [note 2]

It is hard to believe that it could be a coincidence that the most notorious “accelerated aging” diseases are due to defective DNA repair. The two most prominent of these diseases are Werner’s syndrome (“adult progeria”) and Hutchinson-Gilford syndrome (“childhood progeria”), both of which are caused by defective nuclear DNA repair, mainly HR. In both diseases the

“aging phenotype” is apparently due to high levels of apoptosis and cellular senescence. Apoptosis (“cell suicide”) and cellular senescence (cessation of cell division) are both mechanisms that are induced in cells experiencing nuclear DNA damage that the cell is unable to repair. It is not surprising that victims suffering massive depletion of properly functioning cells should exhibit “accelerated aging”. Mice that are genetically altered to show increased apoptosis and cellular senescence also show an “accelerated aging phenotype.”

Elimination of senescent cells and stem-cell replenishment of cells depleted in tissues by this elimination – as well as depleted by apoptosis – are part of SENS. But these strategies are only applicable to cells that divide – not to non-dividing cells such as neurons. Cryonicists are acutely aware that organs – and even whole bodies – can be replaced, but brains (neurons, axons, dendrites, and synapses, particularly) must be preserved if we are not to lose memory and personal identity. The ability of future medicine to replace all organs and tissues other than the brain would render most of SENS unnecessary – except for the brain.

There is considerable evidence of a significant role for DNA damage in brain aging. There are nearly twice as many double-strand nuclear DNA breaks in the cerebral cortex of adult (180 days) rats as in young rats (4 days) – and old (over 780 days) rats have more than twice the double-strand breaks as adult rats. [note 3] Adult rats show a 28% decrease in NHEJ activity in the cerebral cortex neurons compared to neonatal rats – and old rats show a 40% decrease. [note 4] Declining NHEJ activity with age is at least partially due to ATP decline and cellular damage that SENS is intended to fix. But even if NHEJ activity did not decline with age, nuclear DNA damage in neurons will increase at least in part because NHEJ is so error-prone.

Nuclear DNA damage typically leads to mutation or DNA repair – or apoptosis or cellular senescence when DNA repair fails (a mechanism that is believed to have evolved for protection against cancer). But not all DNA damage is repaired, and NHEJ repair is often defective. Accumulating DNA damage and mutation can lead to increasingly dysfunctional cells.

Cancer is due to nuclear DNA damage, mutations, and epimutations. Dr. de Grey has written that “only cancer matters” for mutation and epimutation to nuclear DNA. His mutation terminology does not even acknowledge DNA damage. He has assumed that damaged DNA either is or becomes a mutation. He has assumed that DNA damage that does not become a mutation is either repaired – or leads to apoptosis or cellular senescence.

~~~~~  
 “The ability of future  
 medicine to replace all  
 organs and tissues  
 other than the brain  
 would render most of  
 SENS unnecessary –  
 except for the brain.”  
 ~~~~~

Dr. de Grey has made the claim that evolution has required such strong defenses against cancer that residual mutation (and, implicitly, DNA damage) is negligible. But cancer incidence increases exponentially with age up to age 80, so it is likely that the residual increases exponentially at the same time.

As recently as the 1980s it was widely believed that normal aging is associated with extensive neuron loss. Now it is established that functional decline in the aging brain is associated with increased neural dysfunction rather than neurodegeneration. [note 5] This neural dysfunction may or may not be mostly due to cellular damage that SENS is intended to fix – including causes of declining NHEJ activity. How much neuron dysfunction associated with aging is due to accumulating mutations or unreparable nuclear DNA damage is unknown. SENS assumes without proof that nuclear DNA damage and mutation is negligible as a cause of aging (apart from cancer, apoptosis, and cellular senescence). This may be right or it may be wrong. I believe that without definitive proof, nothing should be assumed, and active investigation to determine the facts should not be neglected.

I believe the situation is not hopeless if nuclear DNA damage proves to be a significant cause of brain aging. Future molecular technologies for detection and repair of nuclear DNA damage could be significantly better than natural DNA repair enzymes. And, to simplify the required effort, the DNA repair technologies could be restricted to genes that are actively transcribed in neurons, rather than needing to repair the whole genome. ■

Notes References

- 1: Best BP. Nuclear DNA damage as a direct cause of aging. Rejuvenation Res. 2009 Jun;12(3):199-208.
- 2: Mao Z, Bozzella M, Seluanov A, Gorbunova V. Comparison of nonhomologous end joining and homologous recombination in human cells. DNA Repair (Amst). 2008 Oct 1;7(10):1765-71.
- 3: Bennett-Baker PE, Wilkowski J, Burke DT. Age-associated activation of epigenetically repressed genes in the mouse. Genetics. 2003 Dec;165(4):2055-62.
- 4: Vyjayanti VN, Rao KS. DNA double strand break repair in brain: reduced NHEJ activity in aging rat neurons. Neurosci Lett. 2006 Jan 23;393(1):18-22.
- 5: Morrison JH, Hof PR. Life and death of neurons in the aging brain. Science. 1997 Oct 17;278(5337):412-9.



About the Author

Ben Best

Ben Best is President of the Cryonics Institute. Ben has bachelor’s degrees in pharmacy, physics, computing science, and business. His website BENBEST.COM contains extensive writings on almost every aspect of life extension, as well as numerous other subjects.



Voss has been an Alcor member since 1995.

MEMBER PROFILE:

PETER VOSS

By Chana de Wolf

Peter Voss' father had an adventurous spirit. He moved the Voss family from their home country of Germany to South Africa when Peter was only 12 in search of a more exciting and rewarding life. The year was 1966, and South Africa's unstructured society promised a kind of freedom the Voss patriarch wished for his children, Peter and Barbara, to enjoy.

And Peter did enjoy life in South Africa. For 29 years, he lived and learned, worked and played there. He developed a passion for philosophers such as Bertrand Russell and Ayn Rand alongside a thirst for knowledge and a hope for technological progress (not to mention a love for the thrill and excitement of riding a motorcycle). Always interested in computers and technology, he started an Enterprise Resource Planning (ERP) software company in 1979. But as Peter continued to cultivate interests that others in South Africa did not generally share, he naturally desired the companionship of like minds. He had long realized that, for the most part, he could find them in the United States.

It should come as no surprise that the adventurous Voss spirit reared its head in the face of this situation. And what would any life-loving adventurer do but follow his dreams? Peter had always wanted to travel and get to know America. After selling his company, he found himself with some time and money on his hands – a perfect opportunity for an extended holiday in the U.S.A.

Peter landed in Los Angeles in 1995, where he quickly delved into the local activities of interest. It was at a skeptics conference he attended early in his itinerary that he met Abe Heward (son of the late aging researcher, Chris Heward), and thereby was introduced to Max More and Natasha Vita-More. Dr. More had founded the Extropy Institute, and was an influential thinker, speaker, writer, and transhumanist activist. Peter remembers, "When I first arrived in the U.S. in 1995 I was fortunate to almost immediately get an introduction to Max More and Natasha Vita-More. This led to me getting a crash-course on things extropian: nano-tech, advanced A.I., calorie restriction and other life-extension technologies, and of course,



A love for motorcycles begins. Peter as a young man, showing off his first bike in South Africa, 1970.

cryonics. This was a very exciting and highly stimulating period in my life."

So, at the age of 41, the second grand adventure of Peter Voss' life began. Grasping the opportunity to network and collaborate with a wealth of smart people, he made the decision to stay in the U.S. permanently, and soon was calling the bustling metropolis of Los Angeles "home." He fondly recalls coming to the U.S. as "a journey of discovery," where he was amazed by the opportunities, technology, and expertise available. The culmination of his varied interests, new contacts, and novel living environment led Peter naturally to become involved in research and development in the



A wild and free Peter stands still long enough for a passport photo in 1974.

field of artificial general intelligence (AGI). “Anything related to extreme technology was very obvious to me to be interested in,” he explains.

Sharing ideas with Dr. More and other extropians and transhumanists had also quickly brought a new topic into Peter’s life – cryonics. Although he had never really heard or thought about it before coming to the U.S., Peter’s consideration of cryonics was brief but thorough. He reports that, “It didn’t take me long [to join Alcor]. After reading up on and discussing cryonics with several smart people, it seemed totally obvious to me that I wanted this extra chance at an indefinite life-span. After a trip to Alcor and meeting the team there I soon signed up.”

Since becoming a member, Peter says he has become “more aware of the (really long-term) risks of certain of my activities, such as travelling overseas and motorcycling.” Over the years, he has also become involved with promoting and supporting Alcor, most notably by completing standby and stabilization training and contributing his services to the Southern California Emergency Response team since 1998. Helping on about ten cryopreservations has given Peter a very visceral appreciation of both “how crucial and how limited current stabilization methods are.”

Now, after many years and lots of thinking and discussion with other cryonists, Peter has come to the conclusion that public apathy is the strongest challenge to cryonics. Like his friend Max More (who was recently appointed CEO of Alcor), Peter knows that the only way to progress is to exist, and the only way to exist is to evolve. This simple strategy, as natural as it may be, is harder to implement than most people appreciate, in light of the social and political struggles surrounding the rate of technological progress and the goals and desires of those affecting that progress. Peter describes his primary concern as the social risks of public apathy and resistance – that cryonics might be outlawed, or that there may even be terrorist acts against cryonics organizations or cryonists. Additionally, he acknowledges his worries that embezzlement of funds and other fiscal issues may lead Alcor and other cryonics organizations into bankruptcy. “These are much bigger risks than the ‘risk’ of cryonics not working,” Peter comments.

Again, Peter’s recipe for the continued existence of cryonics involves spreading the word. Boosting membership and further improving rapid response and cryopreservation capabilities are at the top of his list for areas of Alcor’s program that he would like to see developed over the next 5-10 years. “I think Alcor management should focus on growth,” he suggests. “More members are a desirable thing – we aren’t sustainable with such a small membership base.”

Furthermore, as coordinator of the Southern California Emergency Response team for many years, Peter understands the value of local support and would like to see other regions develop strong, fast teams of cryonics volunteers and professionals who can be on hand to stabilize patients before transport to Alcor’s facility in Scottsdale, AZ. But he stresses that those who have received a terminal diagnosis and have some time to put their affairs in order are best served by relocating to the Phoenix area, thereby reducing their transport time and ischemic damage prior to cryopreservation. Of the cases he has participated in, Peter laments, “I find the number of people who are terminally ill and who don’t go to Phoenix [from Los Angeles] disturbing.”

Besides contributing to cryonics by being public about it and participating in local Southern California cases, Peter’s ambition is that his work in the field of artificial general intelligence will be useful as well. “I hope to be able to advance this technology to the point where it can meaningfully help to develop reversible cryopreservation technology,” he explains.

In the meantime, Peter continues to expand his horizons by pursuing interests such as philosophy, rational ethics, life extension, cutting-edge technology, learning, and meeting smart people. And though most life extensionists say “no thank you” to any risky activities, Peter still enjoys the thrill of fast cars and motorcycling. Guess that Voss spirit just can’t be quashed.



Posing with Bonnie Magee (now Alcor’s Finance Director) at Convergence08.

Caloric Restriction Q&A with Peter Voss

Although not mentioned explicitly in Peter's profile, the major life extension strategy that Peter promotes and practices himself is caloric restriction (CR). Caloric restriction is a dietary regimen that restricts caloric intake in order to slow the aging process. Since Peter has practiced caloric restriction for many years, we decided to ask him a few questions about his experience.

Q: How long have you been practicing caloric restriction?

A: When I came to the U.S. [in 1995] and got involved in everything here [CR] came part and parcel with the other ideas I was encountering at the time.

Q: What motivated you to do caloric restriction?

A: The chance of extending my life and avoiding cryonics!

Q: What is the hardest part of maintaining a low calorie diet?

A: Oh, it hasn't been hard at all for many years now – basically because I've turned it from a negative into a positive in my life and just see it in terms of how it benefits me. Not as some horrible diet where you force and deprive yourself, but as a permanent change and enhancement to my lifestyle. Then it actually becomes quite easy and brings good things to life, like a greater appreciation for food and paying better attention to what I eat. Initially, though, the hard thing was figuring out how to do it the right way!

Q: Did you experience any positive or negative effects?

A: The biggest thing is that I get cold more easily. Initially, I lost weight too quickly and found it uncomfortable to sit [due to loss of fat "padding"]. Another effect has been lowered testosterone and thereby a lower libido, but I think I actually had too much testosterone before. I was more aggressive and had a higher sex drive, but caloric restriction has mellowed me out.

Q: What is your opinion on caloric restriction mimetics?

A: I don't think there's really any evidence that they've found anything yet that works.

Q: Do you practice any other life extension strategies?

A: I undergo extensive medical screening and testing when I can afford it to keep track of where I am standing. I gave up on supplementation altogether – supplements that are touted one minute often turn out to have awful side effects. I practice CRON (caloric restriction with optimal nutrition) to get all the nutrients I need through my lifestyle, not through supplementation.

Q: What do you think is the most credible approach to achieving meaningful rejuvenation in humans?

A: At the moment I like Aubrey de Grey's general approach very much – trying to repair damage seems the most promising approach. If I had any spare money I'd give it to SENS (Strategies for Engineered Negligible Senescence). ■

SUSPENDED ANIMATION: THE COMPANY

By Catherine Baldwin, General Manager, Suspended Animation, Inc.



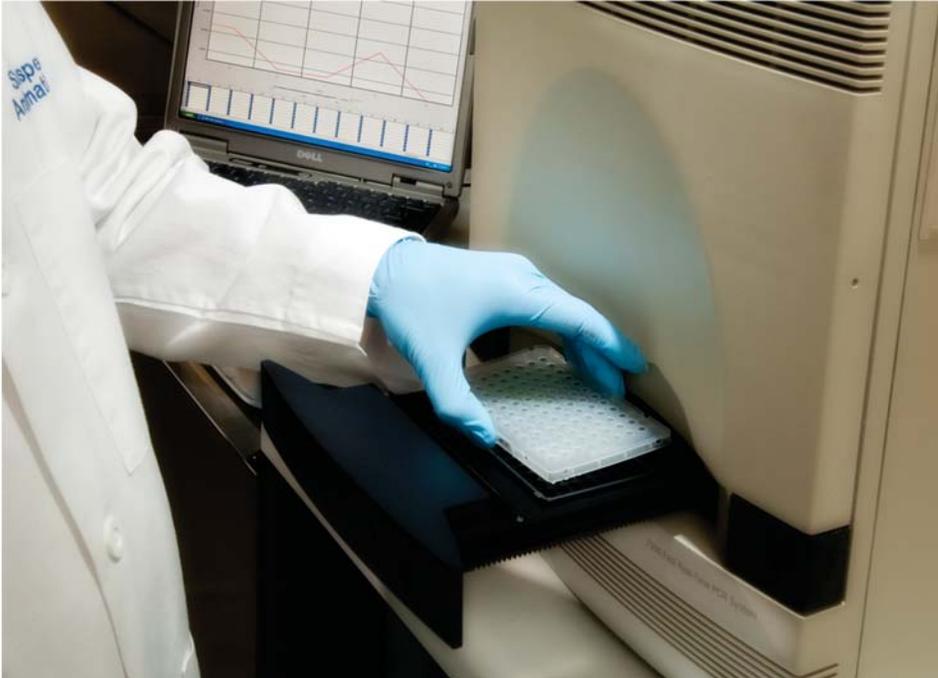
The Suspended Animation, Inc. facility in Boynton Beach, FL.

Alcor Life Extension members now have access to nationwide standby, stabilization and transport services provided by teams of medical professionals through Suspended Animation, Inc., but some Alcor members may be unfamiliar with Suspended Animation, the company.

Founded in 2002, Suspended Animation, Inc. (SA) serves cryonicists in the continental United States from all cryonics companies through contracts with individuals and their membership and long-term care organizations. SA is not a membership organization and does not offer long-term cryonics care, but instead focuses its efforts on research and development of superior equipment and services for cryonics.

Over the years, SA has developed or modified a variety of equipment suitable for air travel and used for cryonics applications, including portable ice-baths, custom stabilization kits and two patient care and transport vehicles now deployed in California and Florida. SA's current research and development projects are an automated, air-transportable liquid ventilation device (in conjunction with Critical Care Research) for rapid cooling of cryonics patients; an automated whole body vitrification system (based on a proprietary 21st Century Medicine, Inc. system currently used in animal research), and using cell death gene expression profiling to evaluate existing and new cryonics stabilization strategies.

At its facility in Boynton Beach, Florida, SA conducts both research and comprehensive training on the stabilization care of cryonics patients. These standby, stabilization and transport procedures are designed



Using a polymerase chain reaction machine (RT-PCR) to perform cell death gene expression studies.

to preserve and protect the patient from the ischemic damage and cell death that occur after pronouncement. Medical professionals from across the country come to learn SA's cryonics patient stabilization protocol and procedures from SA's experienced staff. Working in the classroom and then on large animal models, trainees get real-time, hands-on experience and immediately apply what

respond exclusively to SA's cryonics patients. SA's contract medical personnel also contribute to SA's research, train new team members and help ensure that SA is kept up-to-date on the latest equipment and techniques available that can be adapted to provide the best care possible for cryonics stabilization patients. Just one example of this is SA's adoption of the medical device

~~~~~  
 “Over the years, SA has developed or modified a variety of equipment suitable for air travel and used for cryonics applications, including portable ice-baths, custom stabilization kits and two patient care and transport vehicles now deployed in California and Florida.”  
 ~~~~~

they have learned. They also receive periodic training updates on new equipment and procedures.

Those trained then contract to work with SA. Cardiovascular surgeons and cardiac perfusionists are on-call 24/7 to

known as the Stockert SCPC mini-bypass system that serves as the air-transportable perfusion system used by SA.

Perfusing a cryonics patient with cold organ preservation solution is a critical component, if not the most critical part, of

the stabilization procedure. Rapid cooling helps limit the cellular damage that occurs post-pronouncement until the patient can be transported to Alcor to undergo cryoprotective perfusion and cooling to cryogenic temperatures. Other parts of the stabilization protocol, like applying circulating ice water and infusing cold medications, slowly lower body and brain temperature a few degrees with good cardiopulmonary support. But by surgically accessing a patient's large blood vessels and connecting these to a cardiac bypass machine that replaces warm blood with cold preservation solution, a patient's temperature can be dropped to near zero degrees Celsius in about an hour. To do this safely requires careful control of fluid flow, pressures, temperature and avoidance of any air bubbles that could injure the patient. In the top cardiac care centers around the world, cardiac perfusionists use the Stockert SCPC device to manage the blood flow of patients undergoing surgery requiring cardiac bypass. The machine electronically monitors and controls all critical parameters and has built in alarms and backup systems. Combined with a skilled perfusionist, the SCPC system helps to ensure the safest and best perfusion for cardiac patients, and now, for cryonics patients served by SA, including Alcor members.

Alcor's written agreement with SA formalizes a long-standing cooperative relationship between the two organizations. The contract defines three kinds of responses available to Alcor members from SA.

First, an “SA-Assisted Alcor Standby” that is initiated, managed and controlled by Alcor but where Alcor may be able to contract individually with some SA team members to assist in standing by for and stabilizing an Alcor member.

The second kind of response is an “Alcor-Requested SA Standby.” This is a standby for an Alcor member that is initiated by Alcor but subcontracted to SA, which then manages and controls all aspects of the standby and stabilization of the Alcor member.

The third kind of response is an “SA Standby.” This is SA standby service requested in advance and designated in writing by an Alcor member, using a simple, witnessed form letter. A copy of the form letter is available here: <http://www.sus->



SA uses the Stockert SCPC mini-bypass machine to perform washout and cold perfusion for cryonics patients.

pendedinc.com/Alcor/SampleSASelectionLetter.pdf The standby is subcontracted to SA, which then manages and controls all aspects of the standby and stabilization of the Alcor member.

Under the agreement, in the event of an “Alcor-Requested SA Standby” or an “SA Standby,” SA will send its team and equipment to stand by at the Alcor member’s bedside. SA has five cardiovascular surgeons, five cardiac perfusionists and more than two dozen physician assistants,

nurses, paramedics and emergency medical technicians to respond to cryonics patients in need.

If the member is pronounced “dead,” these medical professionals will leap into action to provide cardiopulmonary support, rapidly infuse protective medications and perform the surgery and perfusion necessary to bring the member’s body temperature down to near zero degrees Celsius. They will also manage the paperwork and bureaucracy necessary to

expedite transportation and ensure the patient’s swift delivery to Alcor while maintaining a cold, stable temperature. ■

SA’s latest R&D as well as its facilities and personnel will be showcased, along with many other advances, in its conference, *Suspended Animation: The Company and the Goal*, May 20-22, 2011 in Fort Lauderdale, Florida. The conference will feature speakers from Critical Care Research, 21st Century Medicine, Alcor, Nanofactory Collaboration, Timeship and others. More information and registration information is available on SA’s website, www.suspendedinc.com or by calling SA’s Conference Manager, Kelly Kingston, at 800-984-0914. Private tours of SA can be scheduled year round by calling the same telephone number.



About the Author

Catherine Baldwin

Catherine Baldwin is the General Manager of Suspended Animation, Inc. A native of California, her background includes a bachelor’s degree from Grinnell College in Cell and Molecular Biology with research interests in the molecular mechanisms of ischemia and reperfusion injury and hypoxia and thermoregulation. Catherine also holds a bachelor’s degree in English from Grinnell and master’s certification in New Venture Creation in High Technology from the Haas School of Business at UC Berkeley and in science writing from UC Santa Cruz.

The Future of Aging: Pathways to Human Life Extension

Author: Gregory M. Fahy (Editor in Chief), Michael D. West (Associate Editor), L. Stephen Coles (Associate Editor), Steven B. Harris (Associate Editor), 866 p, Springer 2010

BOOK REVIEW BY ASCHWIN DE WOLF

~~~~~  
“Mitteldorf outlines a case for the theory that evolution has selected aging for its own sake and presents experimental findings that falsify other explanations for aging such as wear-and-tear and metabolic trade-offs.”  
~~~~~

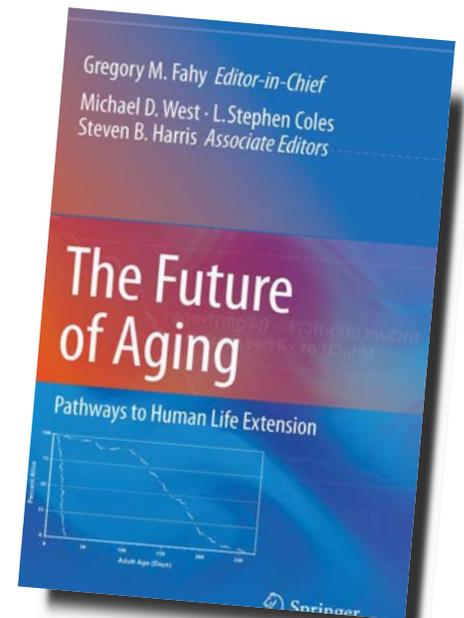
Editor-in-chief, cryobiologist, and aging researcher Gregory M. Fahy and his associate editors Michael D. West, L. Stephen Cole and Steven B. Harris have compiled what might be the most impressive collection of articles on interventional gerontology to date in their 866 page collection *The Future of Aging: Pathways to Human Life Extension*. The book is divided into 2 parts. The first part includes general, scientific, social and philosophical perspectives on life extension. The second part is a collection of proposed interventions, which are organized in chronological order, starting with the (projected) earliest interventions first. Of course, such an organization of the materials necessitates a subjective estimation of when such technologies will be available and is bound to be controversial. The collection closes with a number of appendices about contemporary anti-aging funding and projects (SENS, Manhattan Beach Project).

I have read the book with the following two questions in mind:

1. Which approaches for increasing the maximum life span show clear near-term potential?
2. Is meaningful rejuvenation possible without advanced cell repair technologies?

What follows are my comments on selected chapters of the book.

I cannot say that I am a big fan of Ray Kurzweil's work. His general introduction to life extension, "Bridges to Life," co-written with Terry Grossman, starts out on a restrained note, discussing the benefits of



caloric restriction, exercise, basic supplementation, and predictive genomics. But it then ratchets up into bold claims about the future that rest on controversial premises: about biology and health following the same path as information technology; about the technical feasibility of molecular nanotechnology; and about the nature of mind. One thing that remains a mystery to me is how such an accelerating pace of anti-aging technologies could be validated considering the relatively long life expectancy of humans. Presumably we are expected to adopt a lot of these technologies based on their theoretical merits, success in animal studies, or short-term effects in humans.

Associate Editor Stephen Cole contributes a chapter on the ethical basis for using human embryonic stem cells. I suspect that his argument in favor of these

therapies relies on adopting a definition of personhood that has more far-reaching, and more controversial, consequences than just permitting the use of human embryonic stem cells. One of the most disconcerting aspects of the bioethical debate on stem cell research is that many of its advocates seem to feel that if they do not see an ethical case against it, government funding for such research should be permitted. In essence, this means that opponents of embryonic stem cell research are obliged to financially support it as well. This is a recipe for further aggravating what has already become a passionate political debate.

As someone with relatively limited exposure to the biogerontology literature I should be cautious in singling out one technical contribution for high praise, but Joshua Mitteldorf's chapter on the evolutionary origins of aging is one of the best and most inspiring articles in the field of aging research I have read and worth the hefty price of the book alone. Mitteldorf outlines a case for the theory that evolution has selected aging *for its own sake* and presents experimental findings that falsify other explanations for aging such as wear-and-tear and metabolic trade-offs. That aging is firmly under genetic control may appear the most pessimistic finding in terms of the prospects of halting aging but in fact allows for the manipulation of a number of selected upstream interventions that can inhibit or mitigate these programs.

It is clear from this ambitious book that cryobiologist Greg Fahy also has a strong interest in biogerontology but nothing prepared me for the encyclopedic knowledge that he displays in his lengthy chapter on the precedents for the biological control of aging. Fahy's chapter further corroborates the view that aging is under genetic control. He also reviews a great number of beneficial mutations and interventions in animals and humans that can extend lifespan. Reading all these inspiring examples, however, I found myself faced with the same kind of despair as when reading about all the neuroprotective interventions in stroke and cardiac arrest. There is great uncertainty how such interventions would fare in humans (or other animals) and, more specific to the objective of human life

extension, how we ourselves can ascertain that there are no long-term adverse consequences. Fahy does not run away from the most formidable challenge of all, rejuvenation of the brain without losing identity-critical information, but points out that identity-critical information might be retained despite the turnover and replacement of components that a meaningful life extension program for the brain would most likely require. Fortunately, people who make cryonics arrangements can feel a little better about this issue because their survival is not dependent on safe technologies becoming available in their lifetime.

~~~~~  
"Presumably we are expected to adopt a lot of these technologies based on their theoretical merits, success in animal studies, or short-term effects in humans."  
~~~~~

Zheng Sui's report on using high potency granulocytes to cure cancer in mice is one of the more exciting chapters in the book and a fine example of the role of chance discoveries in biomedical research (Zheng by accident discovered a mouse innately resistant to cancer). With substantial support of the Life Extension Foundation and other private donors, Sui is aggressively pursuing Leukocyte Infusion Therapy (LIFT) human trials instead of pursuing the torturous path of trying to illuminate the biochemical and molecular mechanisms that drive the successful results in mice. I should mention that a unique concern for cryonists is that eliminating cancer in the absence of other effective anti-aging technologies could increase the likelihood of dying as result of identity-threatening insults such as cardio-vascular complications, ischemic stroke, or Alzheimer's disease.

I must admit being somewhat disappointed in the chapter about "evolutionary nutrigenomics" by Michael Rose and his collaborators. Michael Rose has always struck

me as one of the more level-headed and empirical aging researchers, and his work with fruit flies is a resounding demonstration of using evolutionary tools to investigate and combat aging. His short contribution to this book reads more as a quickly thrown together status update of their company, Genescent, than a rigorous treatment of the issues. Dispersed throughout the text are a number of interesting perspectives on alternative approaches to aging research and the validation of anti-aging interventions, but these issues are not discussed in much detail. Michael Rose's work is of great interest, but this chapter is neither a good introduction to his work nor an in-depth treatment of the practical applications of his research.

Anthony Atala's chapter, "Life Extension by Tissue and Organ Replacement," is a fascinating update on the current status and potential of regenerative medicine and tissue engineering. Unlike most of the chapters in this book, the author reports a number of examples of successful clinical applications. It is a good example of how working *with* nature (instead of trying to improve upon it) can have meaningful near-term benefits. Unfortunately, there is no discussion of the progress in regenerative medicine for the brain. Obviously, such strategies cannot involve a simple replacement of the brain with a newly grown brain but selected repair technologies can play an important role in brain-damaging diseases and insults. The inclusion of "life extension" in the chapter title seems somewhat artificial to me because there is no distinct treatment about how tissue and organ replacement will be expected to contribute to life extension. Additionally, there is little discussion of *contemporary* artificial and mechanical alternatives to organs (or biological structural components) in this chapter, or in any other chapters in the book, which I think is a minor oversight.

Robert J. Shmookler Reis and Joan E. McEwen contribute a chapter about identifying genes that can extend longevity. Their discussion of the prospects for mammals includes the sobering observation that "many of the gains we can attain by a single mutation in the simpler organism may already have been incorporated in the course of achieving our present longevities." Then

again, unless aging is firmly under genetic control in simple organisms but the result of wear and tear in humans there should be (unique) approaches in humans that should confer similar benefits as well.

The publication of this book came to my attention when I learned about Robert Freitas's contribution, "Comprehensive Nanorobotic Control of Human Morbidity," so I was quite interested in reading this final chapter of the book. I am not qualified to comment on the technical aspects of his vision of nanotechnology. I think it is fair to say, though, that if resuscitation of cryonics patients is possible they will most likely be resuscitated in a future that has nanomedical capabilities resembling those that are outlined in this chapter. For this reason alone, this chapter should be of great interest to readers of this magazine. Of particular interest is the discussion of cell repair technologies and brain rejuvenation, a topic of great interest to cryonics. Freitas devotes considerable space discussing how anti-aging strategies like SENS can be achieved with medical nanorobots but the chapter falls short of offering a distinct exposition of a nanomedical approach to aging and rejuvenation. With such profound molecular capabilities one would think that such an approach would not just consist of updating existing biotechnological approaches to eliminate aging related damage with more powerful tools. I think that the distinct capabilities that molecular technologies have to offer would have benefitted from a more extensive discussion of their transformative capabilities. In particular, the section on nanorobot-mediated rejuvenation could have benefitted from a more rigorous treatment of the question of how these interventions would produce actual *rejuvenation*. Rejuvenation will be a practical requirement for most cryonics patients and it would be interesting to see a more detailed technical discussion of this topic.

Robert Freitas introduces the phrase NENS (Nanomedically Engineered Negligible Senescence) for his vision of how the goals of SENS can be achieved through nanomedicine. This raises an important question: is there any reason to believe that

the timeline for "conventional" SENS will be different from the timeline for mature molecular medicine? It is hard to tell, but one could argue that the development of mature nanotechnology is more comprehensive than any strategies designed to deal with the causes or effects of the aging process. So why not just fund the work of biological and mechanical molecular nanotechnologists to accelerate meaningful re-design of the human organism? I think that the best answer is that our current state of knowledge does not justify giving a privileged position to any particular approach and having these visions of the future compete may be the best hope that we have for seeing meaningful rejuvenation and the resuscitation of cryonics patients in the future.

If there is one serious omission in this impressive collection of articles it is a more comprehensive chapter on the topic of biomarkers of aging in humans. As reiterated throughout this review, the gold standard and most rigorous determination of the efficacy of anti-aging therapies and interventions is to empirically determine whether they increase maximum human lifespan. For obvious reasons, most medical professionals and healthcare consumers are pressed to make decisions based on less rigorous criteria and the development of a set of reliable biomarkers of aging is highly desirable. Of course, the most rigorous case for successful biomarkers would require the same kind of long-term studies, leading to an infinite regress problem. How to break out of this predicament while retaining a framework to make rational decisions about life extension technologies is not a trivial problem and can be the topic of a whole new volume of articles. Interestingly enough, one of the most insightful perspectives on this issue is given in Appendix A by SENS researcher Michael Rae when he points out that therapies aimed at *rejuvenation* can be tested at much more rapid timescales than therapies to retard the aging process or increase the maximum lifespan.

Michael Rae also notes that SENS's "engineering heuristic" is well established in other fields of biomedicine. It is certainly

the case that aging research could benefit from a stronger emphasis on solving problems and repairing damage instead of completely trying to understand the underlying pathologies but it also needs to be pointed out that the engineering approach has not fared much better in areas of research that are notoriously resistant to effective solutions such as neuroprotection in stroke. Ultimately, the SENS approach cannot completely escape studying the mechanisms and metabolic pathways involved when treatments are compared and side-effects are studied. In this sense, the difference between SENS and alternative approaches is a matter of degree, not principle.

I think that the editors are justified in claiming that the prospects for solving the aging challenge have never looked better. A close inspection of all the chapters, however, shows that no significant interventions in the aging process in humans are available now, and I doubt they will become available in the near future. And even if the aging process can be eliminated, there will still be medical conditions and accidents that require placing a person in cryostasis until effective treatment is available. For the foreseeable future there is good reason to agree with Thomas Donaldson's advice* that making cryonics arrangements is the most fundamental and sensible decision one can make in order to reap the benefits of powerful future life extension therapies. ■



About the Author

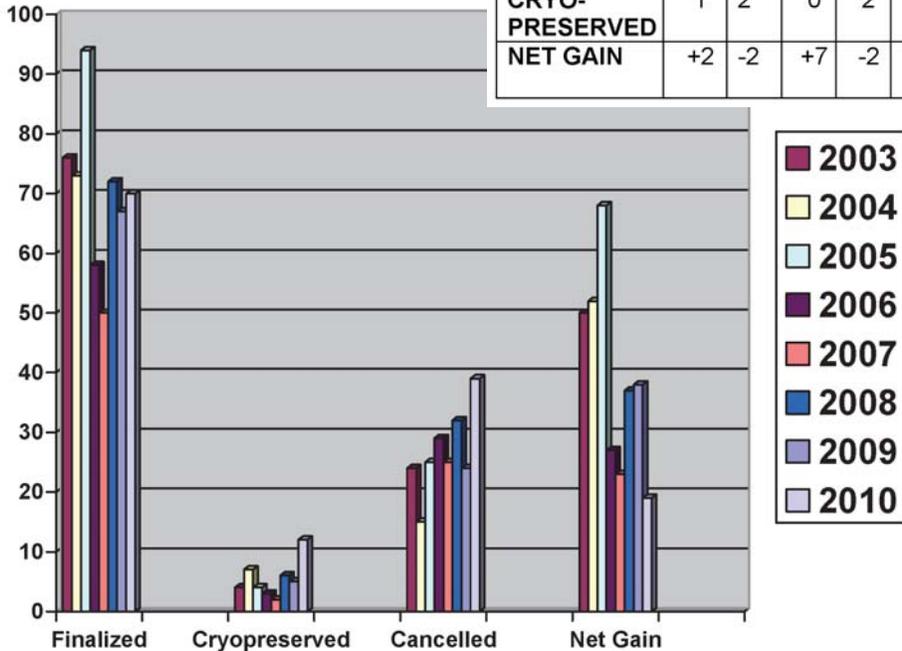
Aschwin de Wolf

Aschwin de Wolf is the editor of Cryonics magazine, advisor to the Alcor Board of Directors and researcher at Advanced Neural Biosciences, Inc. He also writes for the blog Depressed Metabolism: <http://www.depressedmetabolism.com/>

*Thomas Donaldson - Why Cryonics Will Probably Help You More Than Antiaging Physical Immortality 2(4) 28-29 (4th Q 2004) <http://www.depressedmetabolism.com/why-cryonics-will-probably-help-you-more-than-antiaging/>

Membership Statistics

2010	01	02	03	04	05	06	07	08	09	10	11	12	
TOTAL	915	913	920	918	923	921	924	929	926	925	927	932	932
FINALIZED	6	3	8	4	6	6	7	6	2	4	6	7	65
REINSTATED	0	0	0	0	0	0	0	2	1	1	0	1	5
CANCELLED	3	3	1	4*	0	5	4	3	4	6	4	2	39
CRYO-PRESERVED	1	2	0	2	1	3	0	0	2	0	0	1	12
NET GAIN	+2	-2	+7	-2	+5	-2	+3	+5	-3	-1	+2	+5	19



On December 31, 2010, Alcor had 932 members on its Emergency Responsibility List. Sixty-five (65) memberships were approved during 2010, five (5) memberships were reinstated, thirty-nine (39) memberships were cancelled and twelve (12) members were cryopreserved. Overall, there was a net gain of nineteen (19) members this year.

The chart on the left displays the year-end monthly average net gain since 2002.

Take a look at the ALCOR BLOG

<http://www.alcor.org/blog/>

Your source for news about:

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

Alcor Life
Extension
Foundation is on

facebook

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

<http://www.facebook.com/alcor.life.extension.foundation>

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



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

Scottsdale:

This group meets the third Friday of each month and gatherings are hosted at a home near Alcor. To RSVP, visit <http://cryonics.meetup.com/45/>.

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. Facility tours are held every Tuesday and Friday at 2:00 PM. For more information or to schedule a tour, call D'Bora Tarrant at (877) 462-5267 x 101 or email dbora@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 (408) 245-4928 or email Mark_galeck@pacbell.net.

DISTRICT OF COLUMBIA

Life Extension Society, Inc. is a cryonics and life extension group with members from Washington, D.C., Virginia, and Maryland. Meetings are held monthly. Contact Secretary Keith Lynch at kfl@keithlynch.net. For information on LES, see our web site at www.keithlynch.net/les.

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 AlcorNE mailing list, please contact Bret Kulakovich at 617-824-8982, alcor@bonfireproductions.com, or on FACEBOOK via the Cryonics Special Interest Group.

PACIFIC NORTHWEST

Cryonics Northwest holds regular meetings for members of all cryonics organizations living in the Pacific Northwest.

For information about upcoming meetings and events go to: <http://www.cryonicsnw.org/> and <http://www.facebook.com/cryonics.northwest>

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

Oregon:

The contact person for meetings in the Portland area is Chana de Wolf: chana.de.wolf@gmail.com

Washington:

The contact person for meetings in the Seattle area is Regina Pancake: rpancake@gmail.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.

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 \$240 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.

Call toll-free today to start your application:

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





Will You Be Alive and Healthy 10...20...30 Years from now?

Your best chance at achieving future immortality is to protect your precious health now so you can benefit from future medical breakthroughs. Staying informed about the latest health discoveries can mean the difference between life and premature death.

And the **Life Extension Foundation** can be your passport to the future. As the largest anti-aging organization in the world, we are dedicated to finding scientific ways to prevent disease, slow aging, and eventually stop death.

For more than two decades, Life Extension has been at the forefront of the movement to support revolutionary anti-aging research that is taking us closer to our goal of extending the healthy human life span indefinitely. We inform our members about path-breaking therapies to help keep them healthy and alive.

Join today and you'll receive these life-prolonging benefits:

- **A subscription to *Life Extension* magazine** (\$59.88 yearly newsstand value)...Over 100 full-color pages every month are filled with medical research findings, scientific reports, and practical guidance about using diet, nutrients, hormones, and drugs to prevent disease and slow aging.
- Access to a toll-free phone line to speak with **knowledgeable health advisors**, including naturopathic doctors, nutritionists, and a cancer expert, about your individual health concerns. You can also receive help in developing your own personal life extension program.
- **Discounts on prescription drugs, blood tests, and pharmaceutical quality supplements** that will greatly exceed

your membership dues. You'll receive a directory listing the latest vitamins and supplements, backed by scientific research and available through a unique buyers club.

FREE BONUS!

- ***Disease Prevention and Treatment* book** (\$49.95 cover price) ...this hardbound fourth edition provides novel information on complementary therapies for 133 diseases and illnesses—from Alzheimer's disease to cancer, from arthritis to heart disease—that is based on thousands of scientific studies.

Life Extension Foundation funds advanced vitrification and gene-chip research. Your \$75 membership fee helps support scientific projects that could literally save your life.

Call 1-866-820-4967 today.

LIVE
Healthier & Longer

LifeExtensionSM
FOUNDATION

Join today. Call toll-free 1-866-820-4967. Or visit www.lef.org/pim