

ALCOR LIFE EXTENSION FOUNDATION

# CRYONICS

2007 RECAP

1<sup>ST</sup> QUARTER 2008 · VOLUME 29:1

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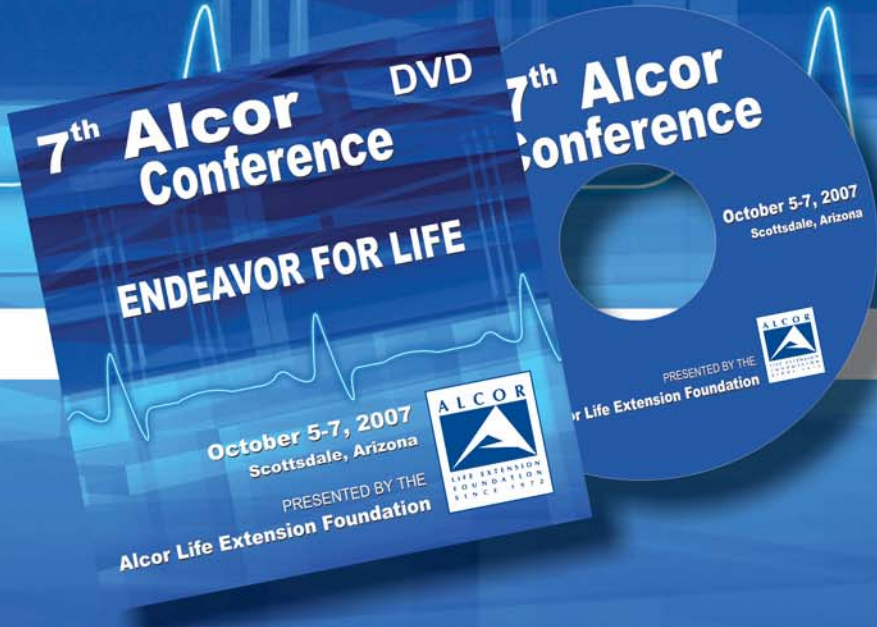
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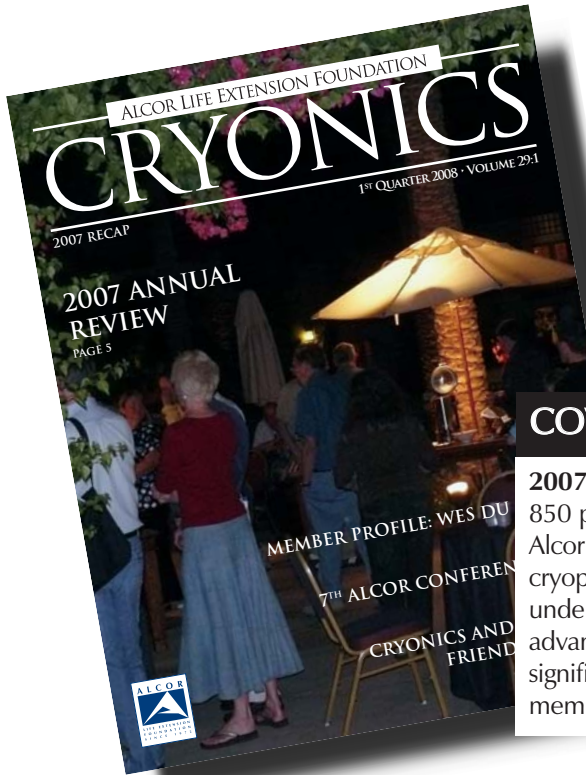
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# CRYONICS

1<sup>ST</sup> QUARTER 2008 • VOLUME 29:1

Cover shows opening reception at the 7th Alcor conference. Photo by Brian Harris.

## COVER STORY: PAGE 5

**2007 Annual Review:** Today, over 850 people in the world rely on the Alcor Life Extension Foundation for cryopreservation services. Enrich your understanding of present-day clinical advancements with the potential to significantly benefit Alcor's growing membership base in years to come.

### 3 Member Profile: Wes Du Charme

Wes Du Charme – psychologist, author and barber shop quartet singer – celebrates his thirteenth year as an Alcor member in June 2008. An active retiree, his interests are varied as he strives to live a happy, healthy lifestyle. Find out if you have anything in common.

### 13 7<sup>th</sup> Alcor

#### Conference Recap

Miss the 7th Alcor Conference held in October 2007? One of the attendees, Richard Leis, Jr., shares his candid commentary on a host of rousing presentations, including a former Alcor president, a world-renowned stem cell researcher, a life extension expert and many others.



## INSIDE CRYONICS

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### 19 Cryonics and Religion: Friends or Foes?

The cryonics community recognizes the importance and challenge of being understood by the general public. Religion plays a substantial role in our diverse society and may seem to some to be at odds with many facets of scientific advancement. Meet one theologian who feels the ultimate success of cryonics is contingent upon the support of more than just great scientific minds.

### 22 Book Review: *Ending*

**Agging** Likened to a good detective novel, *Ending Aging* allures the reader into a real-life tale of the mysteries of aging. The author, Dr. Aubrey de Grey, has been the center of controversy since proposing a systematic path for scientifically reversing aging. Some dismiss his ideas as simply flawed. But is a “first design” expected to be perfect?

### 23 Tech News

What do 100 billion neurons and memory have in common? Could calorie-restriction practitioners soon get the same life extension benefit from a pill? Is there a miracle gene that prevents cancer and slows aging? Find out in this issue of Tech News.



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# FROM THE EDITOR

In this issue of *Cryonics* magazine, an accounting of the Alcor Foundation's standing and present-day operational challenges and achievements is offered in our 2007 Annual Review. The past year's efforts have been concentrated upon transitioning Alcor into an organization capable of a higher quality of clinical care for a growing membership. This can be a difficult balance when coupled with maintaining the day-in and day-out needs of the organization, and our work is far from over. The comprehensive annual report (pg. 5) explains how our members stand to benefit from the master vision driving Alcor's present activities, with our heavy emphasis on expediting the application of cold to our patients. The Alcor management team invites you to carefully read the report and submit thoughtful comments.

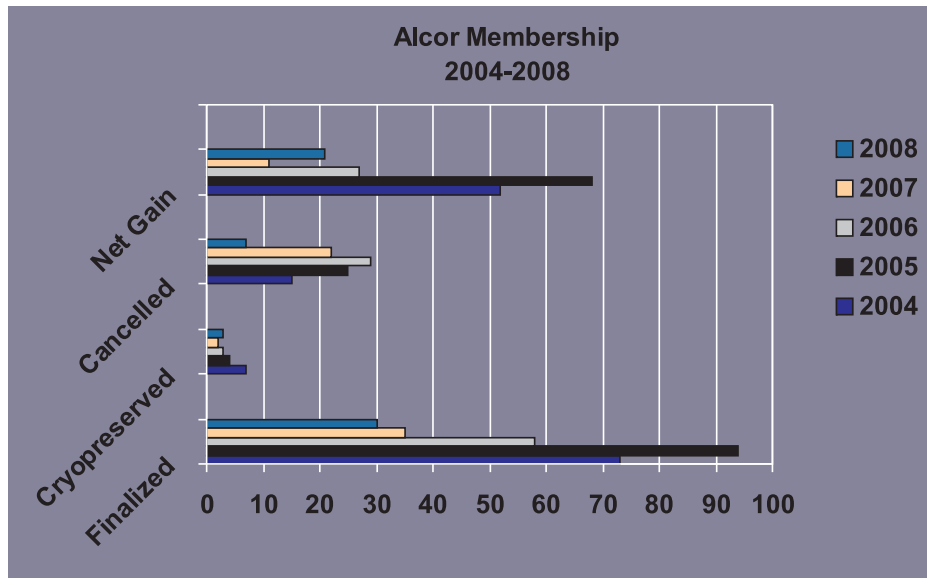
Alongside the annual review is a recap of the 7th Alcor conference (pg. 13) as written by one of the 130 attendees. He is now a proud member of the Alcor Foundation, but he sat amongst the nearly 50 percent of "potential members" in the audience last October. I hope you enjoy his candid commentary.

The conference delved into some challenging topics. Among them was a talk titled "Cryonics and Religion: Friends or Foes?" (pg. 19), which reflected on opening the channels of communication for the betterment of all. Another important channel of communication exists between Alcor leaders and the organization's members. To that end, a panel of board members addressed questions from the audience during the conference. I invite you to watch the exchange by ordering your copy of the 7th Alcor conference DVD set for a special price today (see inside front cover).

*Dr. Ravin Jain was welcomed to the Alcor Board of Directors in November.*



Dr. Ravin Jain is a neurologist practicing in the Los Angeles area and also serves as Assistant Clinical Professor of Neurology at the UCLA School of Medicine. He attended Northwestern University, where he graduated Phi Beta Kappa with a double major in geology and integrated sciences. He received his M.D. from Baylor College of Medicine. He has been a member of Alcor since 1989 and a member of the Alcor Medical Advisory Board since 1999.



Membership data as of April 30, 2008

# MEMBER PROFILE:

## WES DU CHARME

By Chana de Wolf



Wes jokingly regards the cold Idaho winters as a cryonics training program.

Wes Du Charme dedicated his early life to understanding how people work together. After obtaining a Ph.D. in Experimental Psychology from the University of Michigan in 1969 he entered the field of industrial and organizational (I/O) psychology, which seeks to influence productivity and satisfaction in the workplace by utilizing psychological theories and research methods. It was with the logical mindset required of such an occupation that Wes first read K. Eric Drexler's book, *Engines of Creation*, in 1990. Though he had heard of cryonics before, he had never seriously considered it for more than a few moments. Confronted with Drexler's evidence for the inevitability of human manipulation of matter at the molecular scale, Wes recalls that, "suddenly, cryonics made sense."

And suddenly, Wes was on a mission. As a researcher and writer who had "always been interested in what the future will hold," Wes embarked on a quest to inform himself and others of the possibilities for dramatically extended lifespan. After extensive investigation into both nanotechnology and cryonics,

and six months devoted to writing, Wes published a book in 1995 called *Becoming Immortal: Nanotechnology, You, and the Demise of Death* about nanotechnology-driven possibilities for extending life and resuscitating cryonics patients. Motivated by his desire to live a long life and see the future and to obtain credibility as the author of a book about cryonics, Wes joined the cryonics experiment as an Alcor member that same year.

I/O psychologists are by definition interested in organizational or group behavior, and Wes's concerns about the future of cryonics leave no question that he is intensely interested in the underlying psychological issues surrounding the subject. He wonders, why do some see so clearly, and thus feel so passionately, the need for cryonics while others so easily dismiss it? Worse still, why do so few people accept rational arguments in favor of cryonics? "Obviously," Wes declares, "we would all be safer if cryonics were more popular. We are all more at risk because the idea is not well known and is not well accepted. There are many ways things can go astray even in the best of circumstances."



Wes with his wife, Ida, who is also an Alcor member.



The answer to this problem: membership growth. "I think significantly increasing our membership is the key to almost everything else. More members would translate into more dollars, which would allow us to develop along many fronts including publicity, marketing, lobbying, and research. Now, if I only knew how to increase membership...."

By his own admission, his efforts at recruiting more Alcor members, even after having written a book on the subject, have been less than stellar. "I was already married by the time I first learned about cryonics, and my wife became interested through me." Unfortunately, other than his wife Ida, none of his friends or family have become members, keeping a safe distance in the camp of the "generally supportive." Wes feels that Alcor should devote more of its energy and resources toward marketing to encourage growth because "a larger organization has more clout, more resources, and more options for its members."

Now retired from his job in academia, his leisure activities include reading, keeping up with nanotechnological developments, and playing tennis several times a week. He also serves on committees in the small town of Rathdrum, Idaho, and is currently president of "Friends of Rathdrum Mountain," a conservation group in the area.



*Wes sharing time with his mother and wife.*

Perhaps his most ambitious pastime over the past three years has been running a website designed to help other retirees find interesting new leisure activities. The site uses questionnaire/profile matching to direct customers to the most appropriate leisure activities from a database of over 1200 activities ([decisiontimetools.com](http://decisiontimetools.com)). His background in psychology and interest in cryonics have taught him that "living a healthy, happy

lifestyle might add significantly more than just a few months or years to my lifespan." By doing what he can to extend healthy lifespan now, Wes hopes to take advantage of medical advances that will significantly improve that capability in the future. Speaking most fondly of his favorite hobby, singing in a barber-shop group, Wes chuckles, "We always say that barbershoppers live, on average, seven years longer than the rest of the population. I'm not sure that's true, but I'll take every bit of help I can get!" ■

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*"We always say that barbershoppers live, on average, seven years longer than the rest of the population."*

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*Wes can be contacted at:  
[wesducharme@roadrunner.com](mailto:wesducharme@roadrunner.com)*



*Wes (second from left) prepares to deliver a singing valentine with his barber shop quartet.*

# 2005 2006 2007 2008 2009 Annual Review

By Tanya Jones

At the beginning of 2008, nearly 840 people were relying on Alcor for cryopreservation. We take this responsibility quite seriously. Our current management team, which has been at the helm for two and a half years, carefully considered a strategic course for improving all facets of the operation. This long, hard, organization-wide look at the state of things was necessary because many operational aspects had languished or been ignored or actively declined in value to our membership. From this analysis, the idea of a new Alcor emerged, as did a plan to transition ourselves toward that new state of being.

The Alcor we imagined would provide superior cryopreservation technology using newly designed clinical equipment with more sophisticated capabilities. It would not rely solely on outside organizations to decide what research was useful and when it should be performed. Instead, it would decide what and when to investigate the particular problems in cryonics and would perform this research in-house, with the ultimate goal being peer-reviewed publication and validation of our cryopreservation protocols. Technical development would focus entirely upon bringing research results to our members in the form of improved stabilization and vitrification capabilities.

The Alcor we envisioned would increase our exposure to and interaction with great community thinkers, become an active participant in relevant conferences around the world and once again host a regular conference of its own. Fiscal responsibility, improved member relations, and proactive public education would continue to be at the forefront of the organization's goals.

Today, that Alcor is increasingly becoming a reality. In 2007, we actively pursued our strategic vision and gained ground on many fronts, including technical development, membership administration, community outreach and support, and our new research program.

We invite you to read this annual report highlighting Alcor's recent progress. We hope you come away with a greater understanding of why the present direction was chosen and how it benefits you, our members and supporters.

## PATIENT CRYOPRESERVATIONS

Cryopreserving members is the number two priority in Alcor's mission statement, just behind caring for its current patients and just ahead of restoring all patients to good health. We ambitiously launched several projects over the past few years aiming to improve Alcor's cryopreservation services, including the preliminary stabilization, the application of our vitrification protocol, and even the deep cooling to liquid nitrogen temperatures. Before moving on to the specific changes we are making to our capability, let's review the cryopreservation procedures performed in 2007.

We preserved two Alcor members this year, one long-time member and one last-minute case. We also preserved three companion animals this year. Two cats and one dog joined our patient population.

The first cryopreservation was a northern California member who succumbed to cancer after years of fighting. Our team was on alert – hours after we completed a reconnaissance to assess the situation and its particular needs, the member died suddenly. The regional team responded quickly, and the patient's husband performed exceedingly well in the difficult circumstance. She received a successful vitrification, and we transferred her to the patient care bay in February.

Our second was a last-minute case from Canada. The Board, in large part, accepted the case because of the patient's clear written directives. We became involved in a legal dispute over the disposition of this patient's estate, after an estranged sister stepped forward to object to the patient's wishes when she learned of his death in July 2007. We have retained Canadian counsel to pursue this mat-

ter and will report in greater detail when a resolution is reached.

Throughout the course of the year, we experienced 121 activations of our emergency response system. Of these, 108 were not emergencies, but instead were hang-ups, dead air, wrong numbers or solicitations. Five calls came from members or on behalf of members, with three of those calls regarding companion animals. Eight calls were generated by non-member emergencies. Ironically, neither of our two cryopreservations this year was triggered by our emergency response system. In each case, individual staff members were called directly.

## IMPROVING STABILIZATION CAPABILITY

Improving the care provided to patients in the critical first minutes of a cryopreservation case (known as the "stabilization" phase) was an obvious starting point for Alcor's efforts. The success of the stabilization phase sets the stage for the overall case outcome and is contingent upon two main essentials: trained individuals and effective equipment. Team members must be trained to carry out the tasks for which the kits have been designed. These tasks include: cardiopulmonary support, airway management, medication administration, femoral surgery, and perfusion. Much of the equipment is off-the-shelf medical equipment, but much is of custom design and manufacture.

### *Redesigning Emergency Response Kits*

Taking active steps to improve the stabilization capability required taking an extensive look at the kits we deploy to remote patients' bedsides. The kits have grown over the years, and the inventory had become cumbersome and difficult to use in an actual emergency. We debated the difference between being prepared and being over-prepared.

Our regional kits have been irregularly updated with new devices that have been



added to Alcor's local kit and transport vehicle; and many supplies are out of date, which does not meet the levels of professionalism or effective care that we desire. As a result, we redesigned the stabilization kit to meet our evolving standards. After deciding upon the necessary kit contents, associated inventory management protocols were developed in 2007 to prevent the kits from again becoming unwieldy. These protocols will update expiring medications and supplies, ensure changes to the kit contents are distributed correctly to all the regions, and replace kits after use.



*Alcor's emergency response kits will be reduced from several boxes (right) to just a few (left) to optimize their usefulness in an emergency.*

In the first quarter of 2008, we will begin construction of these new kits. We hired former southern California Regional Coordinator Regina Pancake to assist with readiness issues, and Regina has already begun re-organizing the facility spaces where kit construction will occur. It is our intention to assemble a total of fifteen: seven kits for the existing regions, four for expansion, two as spares for restoring capability after a case, and two dedicated training kits (which will contain additional equipment like mannequins, intubation trainers, and more). Building this many kits at one time will strain the space we have available, but we are confident the effort will be worth it. Building this many kits also requires we have sufficient confidence in and inventory of the customized items, like the portable ice bath.

### **Portable Ice Bath**

One example of equipment designed and built internally is the portable ice bath (PIB), and it is our first line of defense in a successful stabilization. Cooling is at the forefront of

stabilization priorities, as every ten degree Celsius drop in temperature cuts the metabolic demand of tissue in half. Literally, half the damage occurs. With the PIB, we can cover a patient in ice, reducing their temperature using surface cooling methods. Though it is not the most rapid method of cooling, it is easily deployable, inexpensive, and still effective.

The portable ice baths we currently have deployed in the field are ineffective. They are flimsy, difficult to move (requiring a gurney), and do not provide an easy means for ensuring a patient remains covered in ice. In 2007, we developed a new design that would resolve all these problems.

Our new PIB was based on the commercially-available emergency rescue baskets used to airlift injured hikers off a mountain. Modifications include building an upper rail (to ensure a patient can be completely covered in ice), adding wheels, constructing a base for our mechanical chest compression device, and manufacturing an insulated liner and cover (see picture).

Though the first prototype had a few problems, they were all minor. We are confident the new ice bath has met all of our design specifications; and by the time you read this, we will have begun construction on the next 14 units.



*The ice bath used to rapidly cool Alcor's patients was designed to be airline-transportable, lightweight, effective and relatively easy to build, as well as easy to assemble in the field.*

The level of improvement this new ice bath represents is hard to describe, so we can only show it to you. Our improvements include making it mobile and able to hold not just the patient and large quantities of ice, but also adding an IV pole for large-volume medication administration and a base for the mechanical chest compression device we use to maintain circulation. Our PIB will be able to go up and down small sets of stairs, over

gravel or grass, and easily over any interior terrain. The insulated liner doubles as insulation for the patient during transport and more than triples the time a patient in transit will remain at near zero temperatures.

### **Air-Transportable Perfusion System**

Our air-transportable perfusion system (ATP) is also in flux. We use this to replace the blood with a short-term organ preservation solution prior to transporting a patient to Alcor for vitrification. We take this step during stabilization, because transport times are often long, and the solution protects the tissues in the case of delayed vitrification. (The solutions we use are similar to those used by hospitals when transporting an organ for transplant, though the blood washout is more complex because we wash out all the blood, not just an organ or two.) A blood washout also provides us with the means to cool a patient rapidly to just above zero Celsius.

With our new stabilization kit, we want to be able to put two emergency responders on an airplane, armed with everything they need to stabilize a patient. This necessitated looking at our ATP carefully, in addition to everything else, because three shipping containers were dedicated to this one task. Furthermore, our current ATP is difficult to operate, takes significant time to prepare for use, and requires highly specialized training. Though our redesign does not resolve the training requirement, the new version is intended to be quicker to set up and easier to use.

The main design change was to eliminate a peristaltic tubing pump and replace it with a custom-engineered centrifugal blood pump. In addition to significant reductions in both cost and weight, the centrifugal pump offers two advantages for patients. The circuit is self-limiting on pressure, which means the patient cannot be dangerously over-pressurized. Large boluses of air are simply not passable by the system, which means large air emboli will cause the pump to spin in place without moving any fluid. Effectively, this is an emergency shutoff valve, which alerts the surgical team to the need to clear the circuit of air before proceeding further.

The main procedural changes are that the perfusion system and the washout solution will be completely assembled prior to deployment, so that the only connections that need to be made prior to use are the cooling source and the patient. Priming the pump should take less time, due to some of the changes we've made, and we anticipate less than ten



minutes will be required to prepare for a stabilization with this system. We are having some difficulty finding an appropriate controller for the system, which has slowed this project. We have tested several alternatives and will be testing more.

Assuming no significant changes occur in the final stages of this development, we will have achieved our goal of reducing the number of shipping containers required for the ATP, because we will have managed to combine the circuit, washout solution and surgical supplies into one case, while remaining within airline weight limits.

### **Partial Liquid Ventilation**

In addition to redesigning existing equipment, Alcor undertook the longer-range goal of building *new* equipment to improve upon present practices. That's where the partial liquid ventilation system comes in. Partial liquid ventilation involves the introduction of perflouroucarbon – a cooled, oxygenated liquid – into the lungs, where the massive surface area can facilitate extremely rapid cooling throughout the body. It is expected to provide nearly the cooling rate of blood washout at an estimated half degree Celsius per minute, without invasive surgery or time delays.

It is critical for this system to work well with the chest compressions that are standard in patient stabilizations; and our design still needs more work. Progress was made however, when we completed custom fabrication of a heat exchanger that makes the unit more efficient than previous prototypes (which means the unit will be more portable than before and less expensive, because less of the costly perflouroucarbon will be required). Although this system has recently not received the rigorous attention it deserves, it is a high priority project. We intend to complete the design phases and test the device in 2008.

### **Training Regional Teams**

As mentioned briefly above, having the equipment to stabilize a patient is only one aspect of the improvements needed. Trained personnel must be on-hand to implement our protocol. Once again, we held several stabilization training sessions for members around the world, introducing them to (or refreshing their memories on) aspects of the protocol, including: cardiopulmonary support, Alcor's medication protocol, the importance of rapid cooling, and the theory behind our washout procedures. Aside from the standard locations of northern and southern California, Nevada

and Florida, we held classes in New England for the first time in many years and in western Canada for the very first time.

We have not been happy with the primarily theoretical nature of the training sessions. In the last half of the year, we halted training as we dug vigorously into our redesign of the stabilization capability. With significant changes in production, it seemed a poor trade-off for the team members to be trained in protocols that are in transition, using training methods that are largely ineffective. Several of the regional groups, primarily southern California and the United Kingdom, continue to host regular training sessions independently. We encourage this practice, even though the protocols will be changing.

It is just about time to restore training. In 2008, we will be building a second operating room, one that will provide an environment for equipment testing and realistic team training. We are replicating the operating room, because training will be more intensive and we do not wish to compromise our ability to provide member cryopreservations in an emergency. Advancing our training program requires a second set of all surgical tools and supplies, development of new training lectures for parts of the protocol that are impossible to teach in a classroom environment (like surgery or perfusion), and contracting local professionals to assist with the teaching.

### **Funding Improved Stabilizations**

Thus far, the improvements to Alcor's stabilization procedures have been funded by general operating income or, in the case of technical development, by the research fund. To aid with future costs, the Board authorized the use of comprehensive member standby (CMS) funds for improving stabilization capability. Alcor launched the CMS program in 2005 ("standby" and "stabilization" are largely interchangeable terms) to ensure that all eligible members would receive a standby when the need arose. Each mem-

ber in the US and Canada contributes to the CMS fund and will receive stabilization care without incurring any additional charge at the time of need.

Given that the CMS funds are needed on an emergency basis to send team members and stabilization equipment to a remote location, we are limiting the funding that may be withdrawn to improve readiness. The Board established a lower boundary based on the *maximum* projected number of stabilizations for an upcoming year and a high average of standby and stabilization costs over the past three years (the only years for which accurate financial information is available). Currently, the CMS fund contains approximately \$380,000, which means we have enough to reasonably cover the anticipated cost of stabilization and standby for all eligible members and still fund some of the upgrades we desire. We do not anticipate using CMS funding for regional team training at this time, though it could be used for that purpose in the future.

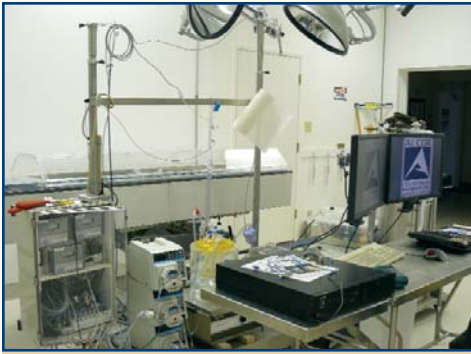
### **IMPROVING VITRIFICATION TECHNOLOGY**

Cryoprotective perfusion follows the patient stabilization and is only performed in our Scottsdale lab. The goal is vitrification, which minimizes the formation of ice during cooling. It is the step where cryoprotectants remove water from the body, and when successful, the overall tissue damage during cryopreservation is significantly reduced. As cryoprotectants are introduced, temperature, pressure, and cryoprotectant concentration data are continuously monitored and controlled.

Since the first operating room was built for cryopreservation purposes, perfusion has



Equipment for automation of the perfusion process includes (from left to right): a chiller, a main pump, a mixing reservoir and pumps for addition and removal of cryoprotectants.



Now nearing the testing phase, the advanced cryoprotection perfusion system is comprised of two basic parts: the patient enclosure (rear) and the computer controls.



This panel shows some of the many connections the computer will automatically monitor and control during the perfusion process.



The patient enclosure cools the patient during surgery using nitrogen vapor and a cooling stage for the base.

been done manually. Technicians monitored flow rates and pressures, manually added and removed fluid from the circuit, adjusted temperatures – everything has been subject to human error. The system we are building today will eliminate much of the risk of error through automation of the perfusion process.

### **Advanced Cryoprotective Perfusion System**

Our advanced cryoprotection system is com-

prised of two basic parts, the patient enclosure and the computer-controlled perfusion system. The patient enclosure is the more straightforward of the two parts, though it was not without engineering challenges of its own. We designed the enclosure to model patient pods used in long-term care, so that we can make sure a patient will fit before the cryoprotection even begins.

In our current patient enclosure, nitrogen vapor circulates around the patient to keep them at a cool -3 degrees C. It is difficult for our surgeons to operate with the vapor flowing, so we stop this during surgery and use it only once the surgery is complete. Our new enclosure makes this delay in external cooling unnecessary. The entire base of the enclosure is a cooling stage, and nitrogen will circulate across the patient's body (instead of in the current head-to-toe configuration). Fans will automatically stop only in the sections where the surgeons are operating and automatically start up again when the enclosure is closed. We added lights to the inside of the enclosure, which will improve visibility both during the surgery and during cryoprotection. A wide range of cooling will be possible, from the current +3 degrees C of a blood washout, to a -3 degrees C in vitrification, and potentially to a post-vitrification temperature of -110 degrees C.

We based the computer-controlled perfusion systems on our established protocol. Control parameters exist for pressure, temperature, and flow. We are also adding a new parameter: fluid balance. Fluid balance will be a strong indication of how well the cryoprotectant is being taken up by the patient's tissues. It should give us warning of edema before it gets out of hand (which happens in cases with long transit times) and will be a good indication as to whether target vitrification goals will be achievable in a case. Though the main system will be automated, there is a manual override for every control aspect in the system.

Having a computer behind the system will result in unprecedented amounts of data collection. Analysis and direct comparisons between similar cases will become possible for the first time in cryonics history. No longer will evaluations be guesswork or hypothesis, especially as our cardiopulmonary bypass lab becomes more advanced. An identical cryoprotection protocol will be implemented in each case, and any deviations from protocol will be automatically recorded. Changes that are made to the protocol will

also be measurable, as we will have clear documentation about what was changed and why, and the data will tell us much about the impact of any changes (assuming significant, observable changes actually occur).

We also plan to investigate the effectiveness of our new system to cool a patient rapidly to just above the glass transition temperature (the temperature at which ice formation begins and where thermal stresses can cause fracturing of the tissue). The cryoprotectant is toxic at higher temperatures, and investigating methods to cool more quickly will be beneficial to our patients. Providing this first-stage cooling in the operating room will reduce the time a patient spends at those higher temperatures and ensure the patient is at a safer temperature for transfer to the patient care bay for second-stage cooling and long-term care.

Our new system will be the most advanced human cryopreservation system in the world, with complete integration and control of the relevant cryopreservation parameters, cooling, operator feedback, safety systems, and graceful failure modes. We are excited about completing this system and look forward to its rigorous testing, because we are confident it will improve the quality a cryoprotections for all members for whom cryoprotection is possible.

### **COOLING AND PATIENT CARE**

After a patient is cryoprotected, we cool them to liquid nitrogen temperature over the course of days. In 2007, Alcor replicated its cool-down system to backup the present system, should it fail or should multiple simultaneous cool-downs be required. We did not take the time to improve this existing system, as we intend to modify it heavily after the completion of our advanced cryoprotective perfusion system.

#### ***Intermediate Temperature Storage***

During cooling, we listen for the tissue fracturing events that have been identified as one particular type of cryopreservation damage. Preventing this damage is desirable, but we have not yet found the way to do that. If we could make just a little progress toward that goal, then it becomes possible to care for patients at higher temperatures.

We started the year with a successful matching grant of \$50,000 for research into alternative storage, something we call intermediate temperature storage (ITS) for cryopreserved patients. An ITS system would allow tissue to be stored at temperatures higher than liquid nitrogen (-196 degrees C), which could



one day mean elimination of the currently inevitable fracturing that occurs. Unfortunately, fracturing events begin to occur in cryopreservation patients at temperatures that are significantly higher than those where safe storage can occur. ITS systems, as currently conceived, would not solve that problem.

Nevertheless, we worked on a prototype system for imaging stresses as they occur, in the hopes of developing an annealing curve for cooling that would prevent fractures. The prototype used cross-polarizing lenses to view the stresses, because it is both non-invasive and non-destructive. The device, modified several times, never quite achieved its goal. After a disappointing sequence of setbacks, the design process returned to square one. Consequently, this project has been on hold for a while. We do anticipate returning our attention to this project in 2008 and will report on it when that time comes.

A final note on ITS, in 2006 we ordered and made a \$15,000 down payment on a fully-functional intermediate temperature storage system from 21st Century Medicine. The unit, once received, will be tested with the ultimate goal of using it for patient care.

### Patient Care

Over the years, Alcor has continually emphasized the importance of protecting the patients in its care. Alcor's Board and management must *always* proceed with the patients' best interests at heart. Patient care, the most stable aspect of operations, didn't see much activity this year. We take that as a good sign.

At the end of 2007, Alcor's dewars held 78 patients as they quietly did their job. Three dewars manufactured this year did not pass Alcor's rigorous testing, which revealed that nitrogen will "boil-off" or evaporate too quickly. Furthermore, our very first dewar (BF-1) delivered to Alcor over 15 years ago finally failed after years of use as a bulk nitrogen storage tank, a use for which it was not intended. We returned BF-1 and one of the new Bigfoots to the manufacturer for repair.

Testing BF-1 upon its return, we found it boiled off more than 100 liters per day, where 9-15 liters is the norm. Troubleshooting the problem revealed water in the interior of the dewar where it should not have been. We attached a vacuum pump and a heater to boil out the water in an attempt to repair the problem. An internal temperature of 210 degrees C was achieved, and the water was removed over the course of four months. Vacuum

pressure reduced to 2 microns and held steady for more than a month. Once this lengthy process was complete, the dewar boiled off less than ten liters per day when half full. A full dewar boils off slightly faster than a partially full one does, but this result makes the refurbished BF-1 one of the more efficient dewars in our patient care bay.

With the addition of our new dewars, it became necessary to extend our fill manifold to accommodate additional dewars. We also added oxygen sensor alarms to the patient care bay. These alarms activate with any drop in the percentage of oxygen in the air and trigger both flashing lights and loud noises to alert staff to the increased risk.

### EXTENDING OUR RESEARCH PROGRAM

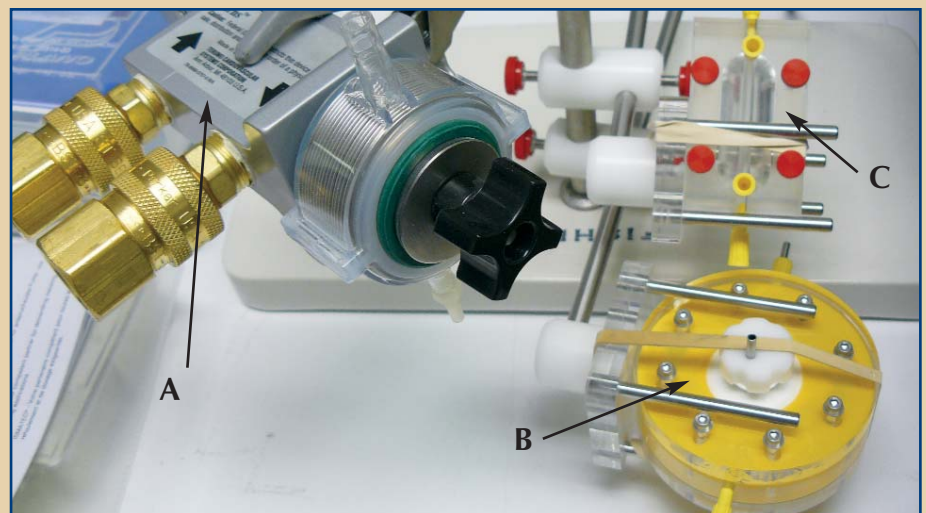
A crucial aspect to improving cryopreservation procedures is appropriate research.

Unfortunately, few labs in the world perform the kinds of experiments we need to validate our protocols. We are quite proud of the work done in 2007 to develop internal research capability, so that we can direct experimental work towards achieving our specific goals for improved cryopreservation procedures. Much of the effort went into developing the infrastructure necessary to support a sustainable research program, including building a lab from the ground up. This lab contains specialized equipment necessary to replicate the operating room environment, such as a surgical table, an animal enclosure, and a cooling stage.

We selected the rat model for our new lab, because it is small, simple and inexpensive. More experiments can be conducted in shorter amounts of time, which would help us make more progress in less time. A cardiopulmonary bypass model for the rat is a relative-



*In 2007, Alcor constructed a cardiopulmonary research lab and established the necessary policies and guidelines under an Institutional Care and Use Committee.*



*Research equipment in Alcor's animal lab include a heat exchanger for cooling and rewarming the animal (A), an oxygenator for oxygenating the animal during surgery (B), and a venous reservoir for holding blood or cryoprotectants (C).*

ly new development, which in turn also means that publication is eminently possible once the model is established.

### IACUC Activities

Throughout the construction of our cardiopulmonary lab, we set our standards high. Though rat research is not federally regulated, we chose to employ standards similar to those for regulated animals. Toward that goal, we established an Institutional Care and Use Committee (IACUC) to oversee ethical and regulatory requirements for the humane treatment of animals used in our work, all animals not just the ones required by law. The IACUC has members comprising the following roles: a Chairperson, an attending veterinarian, an institutional official, an individual with a non-scientific background, and an unaffiliated member of the community.

Throughout the year, our IACUC approved standard policies, guidelines and program of veterinary care dictated by regulatory requirements, and they approved the first research protocol, *Recovery Model of Cardiopulmonary Bypass in the Rat*. The IACUC created a standard to which all Alcor research will adhere.

Our annual USDA (the federal organization that oversees animal research) inspection came in February, and Alcor was in compliance with all federal mandates. We received a special verbal note that our aggressive improvement, and in particular our written documentation, were commendable.

We completed the construction of care facilities for both large and small animals, and surgical training has begun for the research staff. The American Association of Animal Laboratory Science is providing additional training to all members of the IACUC, the research staff, interns, and animal care specialists.

Alcor is presently seeking a researcher who can pursue its research objectives. The first objective will be to firmly establish that the cardiopulmonary bypass system is functioning properly. The research team will then investigate the point at which an animal becomes unrecoverable from the perfusion process and the rates at which cell structures deteriorate under normothermic and hypothermic conditions. Although the results will not be exactly applicable to human cases, they will allow insight into aspects of our cryopreservation protocols that deserve closer examination.

### SUPPORTING NANOMEDICAL RESEARCH

During 2007, we continued our grant support for Robert Freitas, author of

*Nanomedicine* and the leading researcher in this field. Freitas is one of the most prolific authors and theoreticians in nanotechnology today, and the body of work generated with our (and others') recent financial support has been impressive. His publications presented the first technical description of a cell repair nanorobot; analysis of a diamondoid mechanosynthesis tooltip; definitions of computational tasks required by nanorobots; and development of an R&D roadmap for medical nanorobots, nanofactories, and diamondoid mechanosynthesis. Freitas even wrote a chapter for Greg Fahy's book project, currently titled "The Future of Aging: Pathways to Human Life Extension," which makes the complete technical case for nanorobotic-based life extension and anti-aging treatments.

### FINANCIAL REVIEW

Over the past couple of years, we've worked hard to gain better control of our finances. Control processes, improvements to billing and collections procedures, reductions in spending and careful management of our resources by the staff are proving effective techniques for ensuring sustainable operations.

Our 2007 budget was effective in predicting our cash flow situation. Income was estimated well, especially on the membership side, with 97.3% accuracy for the year. Overall expenses tracked to 97.4%. Direct PCT expenses tracked well for the year-to-date nitrogen costs, at 96.7%; and some of the anticipated repairs proved unnecessary. Office expenses and overhead were 84% and 91% of 2007 estimates respectively. Legal fees were 97.7% of estimates, total professional fees were at 97.7%, and research and development costs were 113% of estimated values.

We had few unanticipated expenses, though we did choose to renovate our lab spaces to make working in those areas more efficient. We also had some unanticipated legal expenses associated with the preservation of patient A-2309, the last-minute case

from Canada, and some additional expenses related to the probate proceedings for patient A-1097 whom we cryopreserved in 2006. Unanticipated expenses amounted to about \$40,000, which represents less than 3% of the annual income.

In developing the 2008 budget, we assumed no cases will be performed, which is designed to represent a probable worst-case income scenario for the organization. This is proving to be a useful approach, given that 2007 only saw two cryopreservations – including one for which the patient's estate has not yet paid because of the legal dispute. We already know this is not the case for 2008, which has already seen four cryopreservations, and our bottom line has not been significantly affected. Our income has generally covered our expenses in these cases.

### Accounting Controls

In addition to operating with an effective budget, we continue to follow the financial controls implemented a few years ago to reduce the risk of embezzlement. These con-

	2007	2006	2005
<b>Income</b>			
Membership Activities	\$ 369,794	\$ 355,172	\$ 287,828
Donations	\$ 234,397	\$ 383,329	\$ 316,621
Bequests	\$ 230,326	\$ 337,393	\$ 254,399
Cryopreservations	\$ 135,790	\$ 235,582	\$ 94,198
Investment and Rental	\$ 304,281	\$ 258,405	\$ 231,420
Other	\$ 46,388	\$ 67,898	\$ 26,134
<i>subtotal</i>	\$ 1,320,976	\$ 1,637,779	\$ 1,210,600
<b>Expenses</b>			
Personnel	\$ 484,422	\$ 446,043	\$ 508,985
Legal and Professional Fees	\$ 129,658	\$ 186,013	\$ 201,123
Membership / Marketing	\$ 119,033	\$ 152,097	\$ 92,369
Office / Overhead	\$ 241,729	\$ 318,227	\$ 414,561
R&D	\$ 159,547	\$ 155,470	\$ 36,991
Cryopreservations	\$ 61,057	\$ 264,908	\$ 222,091
Direct Patient Care	\$ 35,438	\$ 57,527	not avail.
Other	\$ 125,750	\$ 109,312	\$ 106,478
<i>subtotal</i>	\$ 1,356,633	\$ 1,689,596	\$ 1,582,598
<b>Net</b>	<b>-\$35,657</b>	<b>-\$51,817</b>	<b>-\$371,998</b>
<b>Expenses Covered by Revenue</b>			
% covered by membership	27.26%	21.02%	18.19%
% by donations	17.28%	22.69%	20.01%
% by bequests	16.98%	19.97%	16.07%
% by cryopreservations	10.01%	13.94%	5.95%
% by investment and rental	22.43%	15.29%	14.62%
% by other	3.42%	4.02%	1.65%
<b>total</b>	<b>97.37%</b>	<b>96.93%</b>	<b>76.49%</b>
<b>Total Expense by Program Class</b>			
Personnel	35.71%	26.40%	32.16%
Legal and Professional Fees	9.56%	11.01%	12.71%
Membership / Marketing	8.77%	9.00%	5.84%
Office / Overhead	17.82%	18.83%	26.19%
R&D	11.76%	9.20%	2.34%
Cryopreservations	4.50%	15.68%	14.03%
Patient Care	2.61%	3.40%	not avail.
Other	9.27%	6.47%	6.73%
<b>total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>



trols, implemented as the result of past thefts, are working. However, our management team recognizes these controls may be insufficient to provide our members with any real sense of comfort. One of the best ways to ensure accurate and honest financial reporting is to hire accounting firms to prepare annual statements (Enron-like scandals notwithstanding). Our relationship with our accounting firm had been deteriorating for some time, and we went through nearly all of 2007 without receiving the annual review for 2005. Given the inexcusable lateness and excessive cost of our incomplete reports, we decided it was time to hire a new accounting firm.

Over the course of about six months, Alcor staff handled the screening of candidate firms and the interviews of their representatives. The Board established an Audit Committee to review competing proposals. Upon the recommendation of the Audit Committee, the Board of Directors chose in December 2007 to hire the firm of Mayer Hoffman McCann (MHM) to provide accounting services.

During our discussions with the various firms, we emphasized that Alcor intends to upgrade the quality of financial accounting we provide to our membership and the public. We discussed strategies for raising the bar on our fiscal management until an annual audit is customary. We explained our unconventional tracking of patient care liabilities – the ones that reflect our moral and fiscal responsibilities to the patients in our care. The MHM representatives had done their homework and had found a comparable situation within more conventional accounting practices that will prove helpful.

We have begun by tasking MHM with a standard review of the 2006 financials so that they can become accustomed to our book-keeping practices. For 2007, we intend to take the next step in rigorous reporting, by having them prepare a balance sheet audit. That level of review should allow us to identify and correct any deficiencies in our tracking of assets. Subsequently at the close of 2008, we hope to commission a full audit.

Easing in the direction of an annual audit, rather than launching directly into one, will allow all participants to become familiar with the requirements and will allow us to ensure our accounting systems contain the necessary information and controls that will permit such rigorous evaluation. It will also introduce the staff to the requirements of an audit as an annual activity. It is no small mat-

ter for our small staff to incorporate this into our regular duties. Furthermore as a California corporation, we will someday be required to have an annual audit under the California Non-Profit Accountability Act. This requires revenue of more than two million dollars a year, a threshold which Alcor has not yet reached; but by preparing in advance, we will already be in compliance once we reach that level.

With these changes, we are looking forward to promoting greater personal and professional confidence in Alcor's financial reporting and accountability in upcoming years.

## BYLAWS REVISED

A long-overdue revision to the corporate bylaws took place this year. Most of the changes were administrative in nature, made largely to improve clarity and do not materially affect operations. Here is a review of the changes:

- The Board removed the requirement for an amendment to the Bylaws in order to change the principal office and changed the office's address to our Scottsdale location.
- References to "Suspension Membership" were amended to include the current terminology of "Cryopreservation Membership".
- The day and time of the monthly Board meetings was changed from Sunday at 1:00 pm MST to Saturday at 11:00 am MST.
- The annual election of Directors continues to be in September, but the election process description was revised to be at the sitting Board's discretion.
- The indemnification clause for Directors, Officers, employees, and other agents was edited heavily for clarity. It continues to state that persons acting on behalf of Alcor are indemnified against expenses actually and reasonably incurred in both civil and criminal actions.
- A section was added authorizing the creation of an Audit Committee.

None of these modifications altered our primary mission in any way. They are simply a reflection of the amount of time that passed since we last reviewed our corporate bylaws. If you'd like to see the bylaws for yourself, they are posted on Alcor's website (see links on page 12).

## MEMBERSHIP AND OUTREACH

Membership growth is important to us. It signifies growing confidence in cryonics and in Alcor as a whole. Our marketing efforts at this time focus on personal selling, but high-quality media coverage, participation in community conferences and events, and a growing subscriber base to our magazine have all contributed to growth in our membership. While 2007 saw less growth than desired, the year ended on an encouraging note, with 22 new applications. At the end of 2007, our membership figures were:

- 815 members → 838 members (2.8% growth)
- 74 patients → 78 patients (5.4% growth)
- 73 applications submitted in 2007
- 129 info packs distributed (on avg.) each month

Fifteen applicants withdrew from the membership process or were cancelled prior to completion of their arrangements. Twenty-five members cancelled their Alcor arrangements as well. This is an improvement compared to the 2006 figures of 42 withdrawn applications and 30 membership cancellations. Alcor approved or reinstated 50 memberships in 2007, which compares to 60 in 2006.

### *Toll-free Calls from Canada*

Members in Canada now have access to Alcor's toll-free number. Tackling this project at the request of several Canadian members, we uncovered several problems with our various communications carriers. Those problems were eventually resolved, and in turn led to a consolidation of our telecom carriers. Consolidation appears to be saving Alcor thousands of dollars every year in overhead.

### *Billing System*

We implemented a new billing system as well this year, one that initially caused some problems with member invoicing. At one point, many members were switched to an email-based invoice, and they were not getting their bills for multiple reasons, like incorrect email addresses and invoices being caught in spam filters. Emailed invoices are now supplemental to postal mailings.

### *Membership Directory*

Our membership has grown significantly since Alcor last published a membership directory. Since many of our members ask for

local contacts periodically, we decided it was once again time to compile a list. After contacting everyone via email and postal mail, we received 335 responses from members stating their willingness to be included. The directory was printed and mailed, and since then we have received several inquiries about people who were not included or who had missed our attempts to contact them. In order to ensure that this remains an accurate means of finding other cryonicists, we intend to release an updated version each year. This allows us to include anyone we missed on this initial publication, to add new members, and to update any information that has changed.

### 2007 Conference

We once again held a conference in Scottsdale, and it was well attended by both members and non. Our speaker roster included Dr. Michael West of Advanced Cell Technology speaking on prospects for regenerative medicine; Dr. Chris Heward of Kronos Science Laboratory who discussed the preliminary results of Kronos's Longevity Study; Dr. Calvin Mercer of East Carolina University who addressed aspects of religion and how they might relate to cryonics; and a fascinating panel on critical care medicine and cryonics. Additionally, presentations covered the current and future state of cryopreservation technologies, which are a must for any Alcor member wishing to remain informed about developments.

Even spaced, as it was, between other community events, we had a respectable number of people in the audience. Two attendees chose to execute their membership paperwork during the weekend, and many more came to see old friends and to meet new ones. Overall, we consider the conference to have been a success and look forward to beginning work on our next one, which will be held in 2009. See the 2007 Conference Recap in this issue for more details.

### COMMUNITY INVOLVEMENT

A few years ago, we became entangled in a legislative matter, whereby a bill was introduced in the Arizona House of Representatives to regulate cryonics as a funeral practice without access to the Uniform Anatomical Gift Act (the federal regulations authorizing us to accept our patients for research). This bill was drafted and discussed long before Alcor, as the target of the legislation, was even informed of its existence. When we learned of the matter, we hired a

lobbyist and launched a defense that was ultimately successful. It was not a pleasant introduction to politics. Since then, we've maintained our lobbyist who monitors the goings on at the Legislature, looking closely at any proposed legislation that might affect our patients or our mission.

That policy – of remaining aware of our politicians – was shown to be helpful earlier this year, when State Senator Carolyn Allen introduced a bill intended to overhaul Arizona's Revised Uniform Anatomical Gift Act. Hers was not a malicious act, but it had the potential to influence Alcor directly. We reviewed the proposed changes and submitted our recommendations for how the wording might read in order to protect Alcor's status and mission. Alcor's lobbyist, Barry Aarons, had this to say as the bill was being heard in the Senate Health Committee:

*"With Senator Carolyn Allen's leadership and at her direction, Alcor worked out amended language to SB1099 (the Arizona Revised Uniform Anatomical Gift Act) with Arizona Uniform Laws Commissioner Jim Bush that will preserve the authority that Alcor currently has as an anatomical donee. Senator Allen conducted open stakeholder meetings and was the source of encouragement for a consensus to be reached."*

Stakeholder discussions were useful, and the bill passed the Senate Health Committee review process. It passed the Senate vote unanimously (of all voting Senators). It passed the House with a vote of 50 for and 10 against. The governor signed the changes into law on July 2, 2007.

### MEDIA EXPOSURE

We continue to tighten access to Alcor by the media. This was a policy implemented by management about two years ago, with the intent being to improve the quality of media coverage of Alcor and its mission. In 2007, we provided fewer interviews to the media, and we believe the policy has resulted in less sensationalistic and more accurate reporting.

Highlights of media coverage in 2007 include (see links):

- Local Channel 12 (NBC affiliate) interview that resulted in some of the most balanced and thorough coverage of cryonics to date
- An article in the *Arizona Business Magazine*
- Interviewed for an article in *Newsweek* magazine

- Participation in an episode of *Modern Marvels*, a History channel production, about the use of cold in science, medicine and manufacturing

Alcor personnel also made presentations at multiple conferences, including:

- Suspended Animation's Advances in Human Cryopreservation
- World Transhumanist Association's conference in Chicago, IL
- Foresight Institute's Vision Weekend
- The Terasem Movement's First Annual Colloquium on the Law of Transhuman Persons
- Calorie Restriction Society conference, Singularity Summit, and Dragon-Con had Alcor literature available to attendees.

### CONCLUSION

This annual report should give you a good sense of Alcor's ambitions for 2008. Our present emphasis continues to be upon improving the tools at our disposal to provide quality care to Alcor's members. Many aspects of Alcor's operations continue to need improvement, and we're pleased to report our progress in 2007 toward more efficient remote response in the field, never-before-seen advancements in the operating room and exciting research that will further our understanding in years to come. These are but a small fraction of the areas of growth we intend for the organization, and we look forward to sharing more of that vision with you in coming months. ■

Please address comments to:  
alcormanagement@alcor.org

### LINKS

#### Bylaws:

<http://www.alcor.org/Library/html/bylaws.html>

#### Comprehensive Member Standby:

<http://www.alcor.org/BecomeMember/standby.html>

#### Financial Statements:

<http://www.alcor.org/Library/index.html#alcorfoundation>

#### News Media Stories:

<http://www.alcor.org/press/newsstories.html>





## 7<sup>th</sup> Alcor Conference Recap

By Richard Leis, Jr.

In a graveyard, dirt and sorrow reside with rot hidden by little more than fading flowers, expensive coffins and shallow depths. Death hangs in the air. The graveyard is a solemn place, or at the very most morbidly curious. Alcor is no graveyard.

On a warm Sunday on October 7, 2007, in Scottsdale, Arizona, Alcor opened its doors for an open house, capping off a weekend of talks during the 7th Alcor Conference. Outside in the parking lot was a buffet: shredded meat on rolls, vegetarian lasagna, a salad dripping with dressing, and peach cobbler. Speakers, audience members from the conference, Alcor staff and Alcor members, some with children, gathered around tables for pleasant discussions, networking, and family time. This was not a solemn place. Instead, it was a very happy one, despite the clinically dead just inside the Alcor facility.

Alcor calls itself a “life extension foundation.” Whether or not cryonics works, Alcor offers something coffins and cremation urns cannot. While those repositories for human remains are traditional and final, the dewars of Alcor are shiny and metal, standing tall and cold in the hopefully-labeled Patient Care Bay. They stand as symbols of technology and optimism for the future. Here death is reduced to a temporary legal and cultural existence if only science and technology continue their rapid progress forward to eventual repair and recovery. For cryonics proponents, where there is such hope, optimism and steady progress, there is no graveyard.

These perceptions are only a small part of what I gained that weekend in October. What follows is a snapshot of my experience at the 7th Alcor Conference, an experience that has since convinced me to become a proud member of the Alcor Life Extension Foundation.

### Steve Bridge *Why We Are Here and Where We Are Going*

A former Alcor president, Steve Bridge, opened up the conference with a straightforward question: Why are we here? His answer: Alive = Good. Dead = Bad.

Over the past 100 years, technology and medicine have improved our ability to revive people who were previously considered clinically dead. Although there is no proof that cryonics will succeed, the cryonics industry, along with other lines of research and tech-

nology trends, suggests recovery after a time in cryopreservation is at least a possibility. To cryopreserve someone is to use low-temperature technology to keep the patient in an unchanging, frozen state. Cryonics seeks to add as little damage as possible to the person’s body while preserving the patient for possible recovery in the future when the appropriate technologies are available.

Instead of freezing the body, Alcor uses vitrification, that is, a glassy “freeze” that greatly reduces the damage ice crystals would cause to cells. Much of Bridge’s talk addressed general technology advancements, membership in the Alcor program, and funding and research topics.

He discussed that Alcor is developing its facilities, procedures, and financial backing. Bridge believes that Alcor needs to spend more time and money on research now, to improve the technology. While Alcor has in the past been distracted by talking about a positive future into which people might wish to be revived, he suggests a return to focus on the present. There are so many questions whose answers must come through laboratory research.

Also of importance are legal issues; ways to make the organization stable financially; offering services to a national membership; whether or not the technology is truly preserving memory and the basic essence of a person; how to grow the membership; and how to attract technical and professional employees and researchers.



Steve Bridge takes questions with the help of emcee Susan Fonseca-Klein.

**Commentary:** Bridge's talk served as both a recap of Alcor's history and cryonics overall, and an inspirational talk to the members in the audience. He hopes that members will participate in a discussion of the issues, rather than passively listening. The facts provided were straightforward, with an emphasis on bluntness and the work that needs to be done. I think it is important that Alcor continue to state that this technology is unproven. No promises are being made, and this full disclosure should help lessen the impact of those who argue that Alcor is a scam and/or a cult. Joining Alcor is a choice, one informed by what we know and what we need to find out.

### **Brian Wowk, Ph.D.** **Common Questions about** **Cryobiology and Cryonics**

Brian Wowk discussed cryobiology, the field of cold tolerance in nature and cryopreservation of biological material. In nature, organisms survive freezing temperatures by ice avoidance and ice tolerance, using cellular "antifreeze." By studying these organisms, researchers hope to apply their findings to improving cryonics for humans.

The use of cryoprotectants allows cells to be stored at low temperature indefinitely, with minimal damage. Tissues and organs have been successfully resuscitated from a cryopreserved state, demonstrating the technology on short-term time scales and in a limited scope.

Researchers have developed synthetic molecules based on antifreeze proteins in some organisms that are improved with ice blockers that prevent ice formation. Wowk works with organs, such as rabbit kidneys, to develop better cryoprotectants. The organ is



*Brian Wowk speaks about the science behind cryonics.*

vitrified. Biochemical reactions can then be monitored to determine if they have slowed down enough to suggest little change over not just hours, but thousands of years.

Wowk then spent some time describing the process of cryonics in humans. Much time is involved, time in which the body can further decay. Every moment is precious to place the body in stasis as rapidly as possible and stop biochemical reactions.

One question very important to researchers and Alcor members alike is whether or not memory is truly preserved during cryopreservation. Research to date suggests that the "basic machinery" of memory is in fact preserved, but preservation of the actual memories themselves is not clear. Even though vitrification causes less damage than freezing, there are still problems, including tissue fracturing and toxicity of cryoprotectants.

**Commentary:** One of the visuals used by Wowk was an image of solutions and organs with and without cryoprotectants at -125 degrees Celsius. On the left was a typical frozen liquid, appearing opaque and crystallized. On the right was a see-through vitrified liquid and a pristine-looking organ. Very effective. To the layperson, though, this focus on the desirability of vitrification versus freezing may come across as technobabble. The use of images is helpful, but what would be truly inspiring would be vitrified organs that have been returned to a functioning state. Some work has gone into this, with warming of tissues to determine the extent of damage.

Like transhumanism and other related topics, cryonics is in need of more effective marketing to spread the idea. For members of Alcor, a talk like this is probably effective, but it will not convince the layperson to sign up for Alcor services and cryonics upon their death. For people who have already signed up, what is the point of this type of talk? I think members might actually be more interested in the cutting edge of the technology and near-term improvements.

Theoretically, recovery appears to be possible. However, there are so many details yet to be researched. I have a new appreciation for Steve Bridge's insistence that much more research is required to further explore cryonics.

Wowk addressed the ethics of cryonics when revival from a cryopreserved state has not yet been proven. I have personally never understood the ethical problems, because postmortem there really are none. What happens to the body will not, obviously, matter to the person who is dead. If there is little

chance of recovery, it is still more than burial and cremation offer.

### **Stephen Van Sickle** **Research Directions at Alcor**

The next speaker from Alcor was Stephen Van Sickle, Executive Director, discussing the direction of research at Alcor.

There was a long period when Alcor did not conduct much research of its own, focusing instead on services and membership growth. However, eventually Alcor leaders decided that in-house research could definitely help the institution.



*Following his talk, Stephen Van Sickle (far right) enjoyed a conversation with Ralph Merkle (middle) and others.*

Van Sickle said that research is important because it brings in "key personnel" and provides valuable training to Alcor employees. Alcor chooses issues to research that specifically relate to technology and procedures used so that they can be improved.

In years past, Alcor experimented on dogs. Now they are using a rat model because of the reduced complexity, time, labor and expense. A laboratory has been built around this research direction. One of the complications has been developing equipment appropriate for the size of a rat, compared to established equipment for humans.

With the rat model, Alcor will begin developing experiments surrounding the effects of cryoprotection, ischemia, and hypothermia. For example, Alcor will try to determine the level of cryoprotectants that is most effective for eventual recovery. Van Sickle emphasized that research in cryogenics will not likely lead to a sudden breakthrough in cryonics and that "incremental progress is what is needed."

Another line of research important to Alcor is how to minimize tissue fracturing



during the vitrification process. Fracturing is measured by an acoustic sensor placed on the head to listen for fracturing events in the brain. With experiments in the laboratory, they hope to look at the stresses involved to try to minimize them with future protocols. One possible technique to be tested is warming up the body very briefly during the cryopreservation process to relieve stresses, then resuming the cooldown.

**Commentary:** There has been a lot of focus in the first few talks about the importance of research at Alcor. Instead of simply providing just a body-preservation service, they seek to improve the technology while hoping to prove the theory of cryonics. They are now laying the groundwork for the necessary research.

The Alcor philosophy of “slow and steady” progress sounds like an approach anyone doing research should take. Research can be tedious, long, and arduous, but it remains absolutely necessary for progress.

### **Tanya Jones** *Improving Cryopreservation Technology at Alcor*

Tanya Jones is the COO of Alcor. She has participated in over half of the members’ cryopreservations. She talked about her ideas for improving cryopreservation technology at Alcor.

The moment the heart stops and legal death begins, Alcor must act quickly to stabilize the brain and body. This is most effective when Alcor is on “standby” and is near the patient before death. The logistics for transferring human remains to Arizona are extensive, so Alcor must pay close attention to every detail.

Research will help improve the cryonics process at every level, from standby to long-term care. The automated whole-body perfu-

sion system now under development will improve Alcor’s abilities in the operating room. Until now much of the perfusion process has been manual. The new system will remove the guesswork during cryoprotection of a patient by monitoring and controlling changes to temperature, pressure, flow, and cryoprotectant uptake. The new technology will allow more data to be gathered with reports automatically generated, thus, advancing the industry’s knowledge base.

Besides equipment improvements, procedures for training Alcor’s worldwide first responders are also being revised. With Alcor membership currently around 800 people, new regional support groups are being set up so that more Alcor members have efficient bedside care. Training will be improved by bringing people to Alcor for hands-on experience with cadavers or large animals.

**Commentary:** It is always great to hear about new technologies being tested or implemented that will improve efficiency, data gathering and report generation. Even the tables and pods have been improved, including fans, ways of making sure the person will fit, and other additions and design modifications. Other improvements include a better ice bath with improved insulation, potentially keeping a person at 0 degrees for up to five days; tools for drawing out the blood; cooling via the lungs; smaller and more portable perfusion equipment; and new safety features. The stabilization kits used in the field are being revised and reduced in size.

### **Ralph Merkle, Ph.D.** *Molecular Nanotechnology and the Repair of Cryopreserved Patients*

Nanotechnology. Once only an obscure buzzword among fringe techno-progressives, nanotechnology has emerged both as a multi-billion dollar industry and a controversial one that could lead, according to some, to a prosperous future of plenty or, according to others, the destruction of Earth. The word has become increasingly tied to modern, market-available structures measured in nanometers and included in goods to provide properties not possible with larger-scale materials.

Originally, however, nanotechnology referred to something now called molecular manufacturing. These are

nano-sized devices that can, among other capabilities, manipulate individual atoms and perform computation. This technology is an important area of inquiry for those interested in cryonics because it could be the very technology used to restore cryopreserved individuals to a healthy state.

Ralph Merkle is a noted expert in the field of nanotechnology. His definition of nanotechnology includes the arrangement of atoms in “most of the ways permitted by physical law,” getting them in the right place, and decreasing manufacturing costs to not much more than the cost of the associated raw materials and energy. Important to cryonics is the ability to position atoms where needed, in hopes of repairing damage and rebuilding healthy bodies.

Diamond is a suggested material for building the required tools. By making use of just a select few elements such as hydrogen, carbon, and germanium, nearly limitless types of structures could theoretically be created. To support this idea, Merkle and Robert A. Freitas Jr. have been exploring minimal toolsets using simulation software. The nine tools they propose involve molecules that can perform particular functions. For example, a hydrogen donation tool could deposit hydrogen atoms where necessary. Merkle recommends exploring his proposed reactions using more detailed simulations and experiments. The results should lead to more specific proposals for actually beginning to build tools and nanostructures.

Eventually, molecular manufacturing is expected to lead to robotic arms, 8-bit computers, and other parts for devices smaller than, say, the mitochondrion of a human cell. Merkle estimates that a sugar-cube-sized computer created by molecular manufacturing advances would have more computing power than all that exists in the world today, “almost a billion Pentiums in parallel.”

This radical reduction in size and increase in ability would lead to nanomedicine and the ability to revive cryopreserved patients, by repairing at the sub-cellular scale. However, appropriate funding is needed to conduct the necessary experiments. Since molecular manufacturing is a capability that will take several decades to develop, long-term-thinking investors are necessary.

**Commentary:** Fantastic speaker. It is helpful to create a blueprint by which others can design their own experiments.



*Tanya Jones, along with all Alcor staff members, was warmly welcomed at the opening reception.*

**Michael West, Ph.D.**  
***Immortal Cells: The Prospect of Regenerative Medicine***

Another approach to recovery of cryonics patients, or treatment of people who are still living, is regenerative medicine, that is, the ability to use stem cells to rebuild tissues.

The biology of aging remains a mystery, and West provided a history of thoughts on aging, including a reference to August Weismann who in 1891 predicted that cell division in somatic cells is finite. His research, however, was ignored. Researchers have since determined that the finiteness, now known as the Hayflick limit, is caused by a “clock” which “ticks” by the progressive shortening of telomeres on the tips of the chromosomes of DNA as a consequence of multiple cell divisions. The germline cells, on the other hand, maintain their telomere length by a substance they produce known as telomerase. West and his research team tried to take the telomerase in germline cells and apply it to somatic cells so they too would maintain their telomere length and thus escape the Hayflick limit. According to West “it worked!”

A much-sought reservoir of “immortal cells” turned out to be human embryonic stem cells. These cells, even in the laboratory, will differentiate into a wide range of tissues. According to West, nuclear transfer does reset the “aging clock,” despite the common belief that research had showed it was not so, as with Dolly the cloned sheep who is commonly believed to have been “born old.”

Where is the field of stem cell research currently at? West and his company are working on technology to sort stem cell precursors for various mature tissues.



*Michael West makes an enthusiastic point during his talk about stem cells and regenerative medicine.*

**Commentary:** Recent research into the environment of stem cells, as opposed to stem cells themselves, suggested you cannot simply inject stem cells into the body, especially an older body, and hope they regenerate and rebuild the necessary tissues. Particular factors in the environment of these stem cells appear to be important for allowing or inducing the cells to do what they need to do, according to researchers like Irina Conboy. West said that there are definitely unanswered questions, but so many promising avenues of research indicate that something good will come from all this.

**Aubrey de Grey, Ph.D.**  
***Is it Politically Safe for a Biologist to Support Cryonics Publicly?***

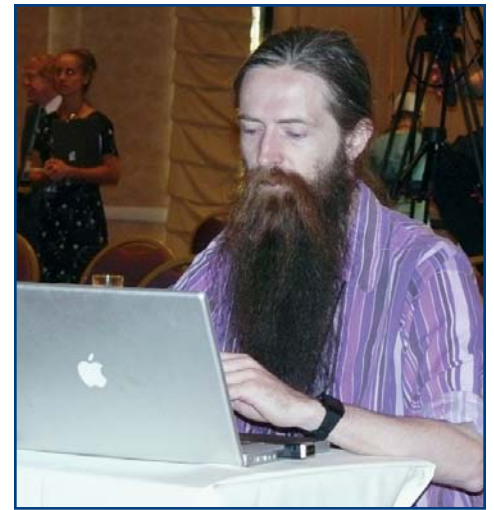
Does Aubrey de Grey really need an introduction at this point? His public proposal for repairing and reversing the damage of aging, SENS, and his public admission of being an Alcor member were the topics he enthusiastically discussed.

According to de Grey, it is an important decision for a scientist to admit to supporting cryonics. A public acknowledgment of support can affect one’s professional work. One of the dangers of admitting support is that it may be harder to obtain funding for one’s work.

De Grey expressed his thoughts about how a scientist who publicly supports cryonics could educate the public. As other speakers have emphasized, legal death is only a convenience and the definition of death needs constant review as technologies advance. Some people who were legally dead have in fact been revived, and the public should be educated on that topic. Brain death is itself a complicated concept. Not only can a person be legally dead, they can be legally alive but functionally brain dead, for example through dementia. So there are a lot of considerations to communicate during outreach.

Cryonics supporters can also provide ethical leadership. They can demystify death and cryonics, promote cryonics as a life-saving attempt, and provide facts for a useful ethical debate. Some people find cryonics “yucky” but a straightforward approach by scientists, rather than using anger or ridicule, could be especially effective in demystifying the perception of cryonics.

De Grey may be one of those lucky few who do not have to worry about the dangers of supporting cryonics and believes he made the right decision to go public about his sup-



*Aubrey de Grey makes some notes during the conference.*

port of cryonics. He hopes to work with the other lucky few until there is a tipping point toward broader acceptance of cryonics.

**Commentary:** Leaders are important to any movement, and technologies themselves can be movements when tied to ideas like radical life extension. Cryonics support can be positively affected by people standing up and admitting they support the idea. But what will be sacrificed by standing up and standing behind such ideas? And how does one in the public eye appropriately talk about cryonics? These are important questions, and I think a review of how other movements address their own topics may be helpful.

**Alcor Board of Directors Panel**

Stephen Van Sickle; Ralph Merkle, Ph.D.; Michael R. Seidl, Ph.D., J.D.; and Brian Wowk, Ph.D. of the Alcor Board of Directors answered questions from the audience for the last session of the day.

Questions were asked about the current state of Alcor’s finances. Alcor receives equal parts of its income from membership dues, bequests, and donations or grants. At the current number of members (approximately 800) Alcor cannot pursue all its desired endeavors. Employees must wear many hats to cover all the administrative and technical tasks required. Better fundraising was a popular suggestion by Board members when asked how the organization could improve.

“Alcor will always muddle through,” said Van Sickle, stressing that this was both a strength and a weakness.

The cost of caring for Alcor’s patients is expected to remain stable over the next few





*The Alcor Board of Directors panel addressed some challenging questions from the audience.*

decades, but operations costs are generally less stable. With more members, Alcor could benefit from economies of scale, but exactly how does Alcor gain new membership? Rudi Hoffman, a certified estate planner who helps people secure life insurance for membership with Alcor, suggested growing the membership through networking. An online map would make it easy for Alcor members and potential members to connect.

In response to a member question submitted to the emcee, Susan Fonseca-Klein, Alcor does not intend to open up voting to the membership for its board of directors.

Finally, Van Sickle briefly discussed a wealth preservation trust that would better protect a member's estate after death. Alcor's lawyers are trying to develop this type of arrangement, but it may take many years to implement.

**Commentary:** A minor few members were relatively emotional about the statement regarding membership voting for directors. Otherwise, it appears (from a show of hands) that most members are happy with the board and how the board continues to choose its own members.

### **Cryonics and Critical Care Medicine Panel**

This panel included Alcor's Tanya Jones, critical care physician David Crippen, and bioethicist Leslie Whetstine, and was moderated by Aschwin de Wolf. The panelists focused heavily on the various definitions of death, including legal and biological. A diagnosis of brain death is required for organ procurement, an industry with similarities to cryonics. However, determining death is difficult. Death is a continuum and it is hard to determine exactly when "information theo-

retic" death occurs. These difficulties and complexities require skilled negotiation between Alcor personnel and the treating hospital.

Alcor prefers pronouncement based on cardiac death versus pronouncement based on brain death. Whetstine argued, however, that cardiac death is problematic because the heart may be dead when the brain is not. Eventually, Jones envisions a time when the first steps of cryopreservation will have transitioned from an after-death procedure to a medical procedure requiring trained medical personnel.

**Commentary:** The inclusion of a bioethicist in the panel added some drama to the proceedings. Whetstine appeared to be arguing (and this is a vast oversimplification of her argument) that it is okay to declare someone dead if their heart stopped, but it is wrong if you then want to cryopreserve the patient.

So when is a patient dead? When is it okay to cryopreserve a person? Right now, Alcor must work within a legal and cultural framework that does not view cryonics as feasible and where the definition of death is changing. Jones believes Alcor will need to go on the offensive, instead of waiting to be attacked. Whetstine was argumentative, but I found her arguments unclear. She obviously finds cryonics problematic, but she kept repeating things

like "but then they are not really dead" and "that is not death." She believes the definition of death needs to be changed.

Some Alcor members were concerned about how their own personal wishes would affect decisions made upon their death. Crippen felt that physicians generally honor their patients' wishes, but Whetstine felt patients' consent should not be part of a declaration of death. Crippen said Alcor members need to get over thinking of patient consent as something that trumps legal and cultural issues.

Both Jones and Crippen believe that the framework will need to change for cryonics to be more acceptable. Alcor, said Jones, must be open about their program to ensure a more positive future for Alcor.

### **Steve Harris, M.D.**

#### ***Rapid Hypothermia Induction Methods and Brain Oxygen Requirements in Resuscitation and Cryonics***

Steven Harris is a researcher developing rapid body cooling technologies important to both cryonics and emerging medical care treatments. Hypothermia induced by lowering the body temperature by 4 degrees Celsius in five minutes could allow sufficient time for medical care workers to treat a patient, say, after a stab wound or other life-threatening injury.

The potential usefulness of post-resuscitation hypothermia was discovered by accident in 1980 in work with dogs. Brain damage could be prevented and the animal resuscitated after clinical death. The first human clinical



*Tanya Jones, David Crippen, M.D., and Leslie Whetstine, Ph.D. (left to right) had a lively discussion broaching issues of cryonics and critical care medicine.*

cal trials failed because it took too long to start cooling the patient's body. Two other trials have been positive, including resuscitation of cardiac arrest patients.

Harris is working on a technology to rapidly cool the body using cold perfluorocarbon liquid lung lavage. Harris has been able to lower the temperature 5.3 degrees in 5 minutes in a dog. The next day, the dog was up and active again.

**Commentary:** This is an incredibly exciting technology, but Harris seemed to be very pessimistic about popularizing it. According to Harris, because of short-life patents and socialism, new resuscitation technologies are difficult to develop and spread. There were a lot of technical details in the talk, and the speaker had to skip over many of them when time ran out. He ended with a video of a dog that appeared to be fine 24 hours after use of the technology.

### Calvin Mercer, Ph.D.

#### ***Cryonics and Religion: Friends or Foes?***

Cryonics, Mercer believes, will require support from more than just scientists, including religious people. How the discussion will play out among the groups, according to Mercer, will include debates between liberal and conservative viewpoints, anthropocentric versus theocentric beliefs, materialism versus the supernatural, pragmatic versus dogmatic outlooks, and revisionists versus traditionalists. Mercer believes some will embrace radical life extension and others will be torn between their beliefs and their desire to get "being a good Christian right" to avoid going to Hell.

Mercer seeks to generate discussion about radical life extension among liberal religious people and someday among conservative religious people, starting with academics. He provided two examples of success, including sessions held at a religious conference and a book he's writing.

**Commentary:** Some religious unbelievers may feel a discussion of "cryonics and religion" is out of place, like "cryonics and unicorns." However, I do understand that the majority of people are religious or spiritual. Mercer presented this talk as an academic, rather than a theologian.

### Christine Peterson

#### ***Life Extension: Good News, Bad News, Surprising News***

Christine Peterson spends about half time studying life extension as an enthusiast.

She began by stating that terminology matters. Which terms are best: life extension, health extension, anti-aging, longevity, immortality, or permanent health?

Since we are made of meat, we enjoy the pleasures of life, but we end up aging and dying. Life extension enthusiasts want a means to extend life, but nothing like that exists now. The challenges are several. Medical doctors, researchers, and the FDA are not highly interested in life extension. In addition there are the basic difficulties of understanding the biology of aging and carrying out research and development of ways to extend healthy lifespan.

Peterson provided a list of things that will help buy some time until radical life extension technologies are available:

- stress reduction
- physical risk reduction
- mood improvement
- sleep, in a very dark room
- sex
- laughter
- biomarker testing
- calorie restriction
- reducing "inflammaging"
- supplements
- movement
- uploading
- biostasis (cryonics)

**Commentary:** Peterson noted that it is important to get life insurance for cryonics, even if a person does not plan to sign up for cryonics until later. Death or illness can be unexpected, and cryonics remains a last option if other life extension efforts do not work out.

### Chris Heward, Ph.D.

#### ***The Kronos Longitudinal Aging Study: The Measurement of Human Aging***

Chris Heward described his work on the Kronos Longitudinal Aging Study (KLAS) as a measurement of human aging. Kronos Science Laboratory is a research institution in Phoenix, Arizona.

Heward showed a graph of life expectancy at birth versus at age 65. While life expectancy at birth has shown significant improvement, life expectancy at age 65 has

not. Humans peak around age 20 followed by a downhill degeneration to death.

Once measures affecting life expectancy can be developed, potential interventions can be tested against these biomarkers for effectiveness. At Kronos, data from a variety of tests is collected in a database. For most Kronos participants, this includes one or two data collection events, although longitudinal studies require repeat testing over many years.

One of the best known biochemical biomarkers Kronos has found for aging is DHEA-SO4. The lower the level, the older the person. When comparing a variety of biomarkers, little correlation is discernible suggesting aging is not just one underlying problem, but multiple.

Kronos' approach to aging is to assess and prevent age-related health problems far in advance of their normal occurrence. The Kronos team focuses on the top killers, like cardiovascular disease, and look for oxidative stress, with the goal of devising a plan for prevention. They have conducted studies related to Alzheimer's Disease and seek to correct misinformation about hormonal replacement therapy.

**Commentary:** In addition to the details of the Kronos studies, Heward provided nutrition and health advice. He suggested being fit but not too lean. Exercise is important, but there appears to be a cutoff around age 80, after which exercise has little further benefit. He also suggested fish oil, especially for Americans, as an important supplement for decreasing cardiovascular risk. ■

*Photos credit: Brian Harris*



*Chana de Wolf gives a tour of Alcor's emergency response capability.*





# Cryonics and Religion: *Friends or Foes?*

By Calvin Mercer, Ph.D.

I recently presented a talk at the 7th Alcor Conference to an intelligent and receptive audience. A session on religion may seem out of place at an Alcor conference that is largely scientific, with presentations on “rapid hypothermia induction methods” and the like. And in academic conferences, I usually follow someone who has just discussed “Greco-Roman Religious Concepts in Rabbinic Law,” “Tantric Readings of Court Poetry,” or something like that. Those are actual titles from the program book of a recent conference of religion scholars.

The cryonics movement recognizes, perhaps increasingly so, the importance and challenge of being understood by the general public. The culture into which the conversation about cryonics is being spoken is a diverse culture where religion plays an important role. Alcor and the larger life extension movement are wise to pay attention to the mindset and language of this culture. If only the scientists in the world give cryonics favor and support, then cryonics is not going to fare very well. Thinking about these kinds of questions is important for membership recruitment, for favor at the state house, and for funding.

My task is to reflect on the question of cryonics and religion in a way that may help you communicate life extension and cryonics beyond those who are already convinced of its worth and help you think about how religious people might interpret life extension science. I see cryonics as part of the larger life extension movement, and so many of my comments will

be applicable to life extension science in general. I focus my remarks on Christianity, because that is predominant in the culture where the science is unfolding.

Challenges await those in the life extension community who want to gain a hearing from religious people. However, the challenges are worth confronting. Religious symbols and attendant ideas are powerful and go to the heart of how people of faith have constructed themselves as an identity. Symbols are like a lever, you move them and you move the minds and hearts of millions of people in our culture. There will be—already is—resistance, but the payoff from thoughtful, respectful engagement can be significant, I say, for both science and religion.

The relationship between science and religion is one scholarly context of my remarks. I need not say too much about this, but I want you to know that the discussion of science and religion in the academy is a vigorous and growing field of inquiry. That is one context, at the academic level, in which the discussion about life extension will take place.

The relationship between religion and science can range from conflict to integration, with dialogue a moderate way forward. Christianity’s conservative elements have often resisted new insights and information from the scientific world. Well-known examples of conflict are Galileo and, in modern times, the Scopes trial, a fight about evolution that continues under the guise of intelligent design. More recently, there is the opposition from the reli-

gious right to stem cell research. So history suggests that opposition will arise.

Religion needs to be nimble. What I mean by that is taking old—“eternal” if you will—principles and applying them to new and changing circumstances. That keeps religion vital and relevant, without losing those aspects of religion that can contribute to society. However, we can go further and say that religion is nimble. It does change. It does evolve to take account of developing human culture. Clearly, all religions have evolved over time—Buddhism came out of Hinduism, Christianity came out of Judaism, and Protestantism came out of Roman Catholicism.

Contra some authors (e.g., Bill McKibben, *Enough: Staying Human in an Engineered Age*; New York: Owl Books, 2003), I think the development of life extension technologies is inevitable. I contend that it is to their benefit for thoughtful religious people to have a serious conversation about this science, in order to evolve religion in a way that preserves religion’s core principles and applies them in a helpful way to the developing science.

I agree with James Hughes, from the Institute for Ethics and Emerging Technology, in a recent Metanexus Institute *Global Spiral* article (“The Compatibility of Religious and Transhumanist Views of Metaphysics, Suffering, Virtue and Transcendence in an Enhanced Future”), that bioconservative and transhumanist wings are going to show up in all the world’s religions. To extend his remark, I think it is going to be messy. We will see some strange

bedfellows, at least in Christianity. In the conservative wing we will have both bioconservative and longevity enthusiasts, and in the liberal wing we will get both camps as well.

How this will play out is only an educated guess at this point. We need social science data on attitudes toward cryonics across religious groupings. Until we have that, we must speculate about how the discussion might unfold. Consider Christianity. It is a vast religion, with a range of theological positions. More accurately, adherents of the Christian religion show up on a continuum with fundamentalism on the right and liberalism on the left.

## LIBERAL RELIGION

On the left, liberals tend to be anthropocentric, that is, optimistic about human capability, believing that God, however they understand that term—and they understand it in a wide variety of ways—works through the natural world. Liberals are thisworldly, more occupied with present problems like human suffering. They are pragmatic, interested in what works, in what solves human problems and meets human needs. Liberals are revisionist; they see the necessity for revising and updating traditional notions in light of changing circumstances—what I am calling theologically nimble. (I have adapted these broad descriptions from George C. Bedell, Leo Sandon, Jr., and Charles T. Wellborn, *Religion in America*; New York: Macmillan, 1975; pp. 207-209) Clearly, someone with this profile is predisposed, as far as religion goes, to accept the scientific advancement offered by life extension technology.

For the good news on the liberal side, here are a couple of examples in which I am involved. The American Academy of Religion (AAR) is the world's largest society of academics who teach or research topics related to religion. The recent annual meeting, held jointly with another religion society, brought nearly 10,000 scholars together. The scholars in this group who are Christians are most likely to be of a moderate to liberal theological persuasion. Liberal Christianity is friendly to science, open to its contributions. Liberal Christian scholars themselves use critical methods in their scholarship. Through their networks, teaching, and writings these academics wield influence on the general public.

At the 2006 annual meeting of the AAR, I organized a panel of scholars from various religions to address the implications of significant life extension on the religion they research. Aubrey de Grey gave a presentation of the science for the panel. To have this

topic on the national meeting program was an important step in generating conversation in this academic context. I was pleased when the AAR approved another session for our November 2007 meeting. This year we focused our panel on eschatology—how religions envision the future and how various eschatological scenarios relate to emerging technology's vision of life extension. Dr. de Grey was again our science panelist. I am optimistic that life extension will increasingly be discussed in this important and influential group of academics.

Recently, a colleague of mine and I obtained a contract from a major publisher, Palgrave Macmillan, to co-edit a book of original articles written by scholars of various religions about the implications of life extension technology. Dr. de Grey is writing the chapter that introduces the science. This will be the first such book of its kind, and I intend for this publication to serve as a vehicle for initiating a wider conversation in the major religions.

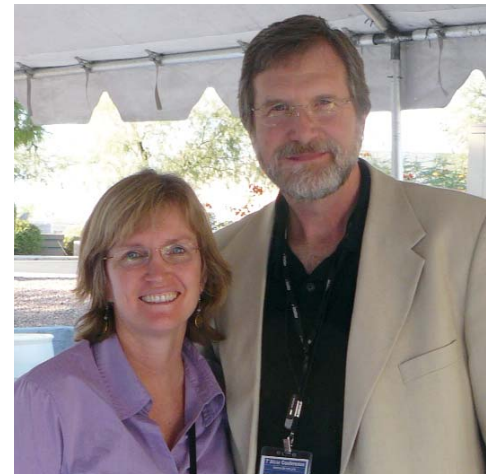
That is some of the good news, although we are still very far away from where we need to be with this conversation.

One of the toughest challenges in gaining acceptance for life extension programs from liberal people of faith is confronting skepticism about universal access. Liberals are concerned that life extension technology is going to be a privilege of the wealthy, politically powerful class. Liberal, progressive Christianity, from its roots in the ancient Hebrew prophetic movement to the modern liberation theologies of Latin American, black, and feminist origins, has a history of struggling for the poor and disenfranchised. The degree to which academic and liberal religionists support life extension and cryonics will depend largely on how successful their questions about justice are addressed.

## CONSERVATIVE RELIGION

On the right side of the continuum, we have conservatives, and there are different types. Fundamentalists are more to the right than evangelicals. It has been said that a fundamentalist is an evangelical who is mad about something, a saying that highlights the degrees of conservatism and the different levels of activism on public issues.

Religious conservatives are theocentric and have a low view of human beings as being sinful and weak. Conservatives are otherworldly, that is, emphasizing the reality and importance of the realm above and beyond the natural, such as heaven and hell. Generally opposed to change, conservatives value religious under-



Calvin is shown here with his wife, Susan, at the 7<sup>th</sup> Alcor Conference Open House.

standing handed down from previous generations. They tend to be dogmatic, committed to certain indisputable beliefs that are not open for questioning, modification, or debate, because the doctrines are supernaturally revealed. Conservatives are not open to science when it is thought to contradict the supernatural revelation they believe they have received from God. (Again, I have adapted these broad descriptions from George C. Bedell, Leo Sandon, Jr., and Charles T. Wellborn, *Religion in America*; New York: Macmillan, 1975; pp. 207-209)

Currently, the religious right is focused on their usual concerns about gay marriage, evolution, flag burning, and so on. However, when the life extension story breaks into the broader culture, the religious right is going to have something to say about it, and I think the reaction could split in several ways.

For sure, there will be opposition in the form of the usual objections, such as the claim that life extension advocates are playing God. For conservatives, this and other concerns will be grounded in a general suspicion of science. However, I think it is going to be more complicated for conservatives than with most other issues where conservatives tend to see things in black and white. John Warwick Montgomery, in a 1990 article (“Cryonics and Orthodoxy”) on the Alcor website, printed in the evangelical magazine *Christianity Today*, said serious theologians of cryonics will be developed by the “truly progressive evangelical theologians.” I would not go that far, but I think a significant segment of conservative Christianity is going to embrace life extension.

Most of my work is as a historian of religion, but I am also trained in clinical psychology, practiced part-time for a decade, and use this method for studying religious behavior.



Specifically, I appropriate Aaron Beck's cognitive therapy model to analyze fundamentalism. If I am right in my identification of the fundamental cognitive schema that drives many conservative religious folk, then they are going to be torn between their suspicion of science on the one hand and, on the other hand, the deep schema, involving fear, that could lead them to be open to life extension.

In a manuscript almost completed, I argue that the fundamentalist schema is: "If I don't get it right, I'm not a Christian, and I will go to hell." In addition to whatever nervousness fundamentalists have about dying by virtue of being a human being with a survival instinct, there is an added concern by the fundamentalist Christian who believes they will go to hell if they do not "get it right." So life extension is going to gain some support from conservative Christians who want to stay here until they are sure they get it right.

## RESURRECTION

How all Christians, and especially conservative Christians, respond to this science is going to depend in part on how certain symbols and doctrines are processed in light of life extension.

Let us briefly experiment with the Christian doctrine of resurrection. This is a challenging one to tackle, because it can get quite complicated, and I do not think the connection with life extension is necessarily easy to make. However, resurrection is a central theological notion in Christianity, and it goes to the heart of the matter with regard to the concerns of the life extension community. If resurrection can be understood in a way that brings Christian theology, on this point, in dialogue (maybe even integration) with life extension science, then the payoff both for the religion and the cause of life extension in gaining a hearing in this religious community could be significant.

In an article posted on the Alcor website ("Why a Religious Person Can Choose Cryonics"), Steve Bridge says cryonics is not about bringing the dead back to life and it is not about performing miracles. I agree with both statements. Both are accurate and it is wise for the cryonics movement to claim their members are still alive as patients. However, I want to interpret death and resurrection in a way that may allow Christians, especially conservative Christians, who participate in the life extension movement to think about life extension and cryonics in these terms.

The Greek word *anastasis* is composed of two words, the preposition *ana*, "up," and then, *stasis*, the word for "stand." In the Greek world

*anastasis* can have shades of meaning—raise up and, sometimes, to awaken or to recover. It has even been used to refer to repairing walls. In the early Christian texts, there are several kinds of raisings. There is the resuscitation of the dead—as they understood dead, where Jesus raises someone from the dead and life goes on pretty much as before. As an example, Jesus raised Lazarus from what they understood to be dead.

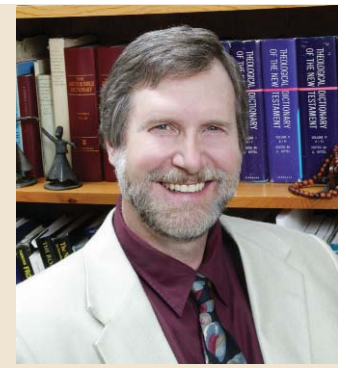
This resuscitation from the dead is distinguished from resurrection which results in a transformed body that is qualitatively different from the body before the resurrection. Here, life does not continue as before, rather it continues in a transformed body with new possibilities. In his transformed body, Jesus appeared and disappeared and moved through doors. Transhumanists would like that, maybe. But even here resurrection continues the physical dimension of the person—i.e., the physical structure of the brain, if you will, that encodes memories and personality. Resurrection in the sense of a transformed body, whether it is Jesus or the believer at the end of time, preserves the memories and personality of the resurrected person.

The transformation entailed in resurrection of the body is different from the idea of an immortal soul that came into Christian teaching from the Hellenistic world. Resurrection of the body is based on the Jewish notion of psychosomatic unity of the human being. In Jewish thought, we do not have a soul, we are soul. So the transformed state retains, in some sense, the physical dimension.

Both of these kinds of raisings—resuscitation of the dead and resurrection of the body—can be applied to cryonics, whether the scenario is standing someone up (to play on the Greek word) in pretty much the same kind of body they had before, except that the cancer is now cured, or transforming the body with robotics and nanotechnology-driven medicine.

It may seem that in arguing for resurrection I am saying that in life extension and in cryonics death is overcome. I am not saying that. Rather, I want to apply information theoretic death to what the ancient world called death. I am reinterpreting "death" there too. If in 2008 blood stops flowing to my brain and I am not dead, according to the information theoretic criterion, that would also be true for someone in first century Palestine, until the brain structure is lost.

It seems to me that resurrection, usually understood as overcoming death, could be expanded to include extending life eternally. Life extension technologies, including cryonics, may be able to extend life indefinitely.



Calvin Mercer, Ph.D.

Dr. Mercer teaches religious studies at East Carolina University. He is co-editing a book to be published in 2009 by Palgrave Macmillan Press, *Religion and the Implications of Radical Life Extension*, covering the religious implications of radical life extension science. Dr. Mercer is a frequent speaker on this topic. This article is a slight revision of his presentation at the October 2007 Alcor Conference.

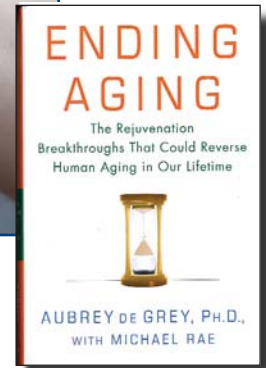
Remember, science and religion are sometimes in conflict and sometimes in dialogue. Eternal (i.e., resurrection) and indefinite (i.e., life extension technology) are not the same, but it seems to me they are close enough that they can have a dialogue, and dialogue is what I would like to facilitate between the life extension and religious communities.

Alcor, as a scientific organization, does not take a theological position on cryonics. Alcor's members, of course, are free to interpret cryonics in whatever philosophical or maybe theological way that makes sense to them. I have speculated on how some members of one religion might do this with one doctrine. Hindus are going to have their own take on this with their notion of the transmigration of the soul. Buddhists, with their pragmatic approach to suffering expressed in the Four Noble Truths, are going to weigh in from another perspective.

You think being a cryonics member is interesting now. Just wait until the Alcor Conference where you are sitting at the banquet table with a half dozen atheists or agnostics. But now there is a Hindu pantheist, a Zen Buddhist mediator, a Mormon transhumanist (they now have an organization and a website), a fundamentalist Christian, and a liberal Christian. And the discussion between the last two, if they are even talking to one another (and they usually don't), is more heated than even the debate between the theist and atheist at the table. ■

# ENDING AGING:

*The Rejuvenation Breakthroughs That Could Reverse Human Aging In Our Lifetime*



**Author: Aubrey de Grey, Ph.D., with Michael Rae**

**(New York: St. Martin's Press, 2007)**

## BOOK REVIEW BY DAVID BRANDT-ERICHSEN

*Ending Aging* is the most pathfinding book I have read so far this century — it presents nothing less than a complete scientific roadmap to eliminating the effects of human aging. Most books with titles similar to this are long on wishful thinking and short on hard science, but considering who authored this book I had good reason to suspect that it might be different, and indeed it was.

Before *Ending Aging* was published, it was not very easy to discover the significance of Dr. de Grey's contributions to this field. This was attempted in a fascinating British television documentary about de Grey called *Do You Want to Live Forever?* (This has not yet been shown in the U.S. but you can see the full 75-minute program online on Google Video by searching for the title.) The documentary, however, did not explain the science behind his thinking, so did not provide a way for me to judge the validity of his ideas. He does have a website that briefly describes his plan, called Strategies for Engineered Negligible Senescence or SENS ([www.sens.org](http://www.sens.org)), but as he himself states, his ideas really require book-length treatment to explain.

Fortunately, that book is now available — and the book is more exciting than the best detective novel, as the mysteries of aging are gradually unraveled, the results of the latest studies are revealed, and the bio-engineering strategies for actually reversing the effects of aging are systematically developed. The book is written so a person without any science background can understand it, yet is detailed enough to communicate the ideas to scientists as well. This can be a fine line to tread, and the book does a pretty good job of it.

There is no point in trying to summarize the book's ideas in a mere review. Suffice it to say that it presents aging as a genetic disorder which can, should, and will be defeated, and, for the first time, describes a detailed path by which that might be accomplished. If you want a summary you could look at the SENS website, but to really understand the ideas there is likely no substitute for reading the book.

That *Ending Aging* is a book full of brilliant ideas I have no doubt. But the real question is: Are they correct? To that question I do have a few doubts — but in a certain sense this does not matter because both science and engineering are self-correcting as more knowledge and better techniques are obtained. What de Grey describes in this book are engineering strategies based on understood bioscience and biotechnology. It is exceedingly rare for engineering development of complex technology to follow a smooth path that closely conforms to the first design. Rather, engineers have to build a little and test a little, over and over, until they get a final design that works in the real world. But that does not diminish the importance of the first design. We knew, for example, that a space shuttle could be built long before we went through various iterative designs to produce an actual working shuttle. De Grey's breakthrough contribution is to create a detailed "first design" for ending aging, far beyond what anybody has done before.

De Grey's ideas are controversial in the scientific community. This is as it should be — it is constant criticism and testing that weed out the good scientific ideas from the

bad ones. Ultimately, only time will tell how valid his ideas are. In 2005 and 2006, MIT's *Technology Review* offered a \$20,000 prize for any scientist that could convince an independent panel of biotechnology experts that de Grey's ideas were shown to be invalid. The prize went uncollected, although this, of course, does not mean that the ideas have been shown to be valid either.

Writing this at 60 years old, do I believe that de Grey's plan to reverse the effects of aging will be a clinical reality in time to do me any good personally (i.e. before I need to resort to cryopreservation)? My answer to that is a firm "No." In my own field of work as a research tech in molecular genetics, I am acutely aware of how long it takes to turn biological theory into benchtop reality, let alone clinical application. While an undergraduate in biological science I became excited about the theoretically sound idea of using viruses as vectors to introduce genes into humans to treat a wide range of conditions. Over 40 years later, the prospect of using gene therapy techniques in widespread clinical application still remains a dream for the future, and de Grey's plan is immensely more complicated than that.

This book is a very effective argument against the idea that aging and death are natural parts of life that should be accepted as such. That philosophy might seem appropriate to those who believe there is no other choice. But it would be difficult for anybody to read this book without concluding that in the future there will indeed be another choice, and that the coming end of aging can be measured in decades rather than centuries. ■





## Brain's Memory Capacity Less Than Thought

If you can't remember where you left the car keys, take comfort in a new study that suggests the brain's memory capacity may be far lower than once thought. About 100 billion neurons, or brain cells, make up the average adult's brain, but the computer-based discovery shows our memory isn't based simply on neuron numbers. Instead, the limited amount of connections a neuron can make to other neurons may cut memory capacity. Co-author Peter Latham, a neuroscientist at University College London, and his colleague's findings are detailed online in the journal *PLoS Computational Biology*.

MSNBC  
9/14/07

<http://www.msnbc.msn.com/id/20775068/>

## New Understanding of Basic Units of Memory

A molecular "recycling plant" permits nerve cells in the brain to carry out two seemingly contradictory functions – changeable enough to record new experiences, yet permanent enough to maintain memories over time. The discovery of this molecular recycling plant, detailed in a study appearing early online Sept. 19 in the journal *Neuron*, provides new insights into the functioning of the basic units of learning and memory. Individual memories are "burned onto" hundreds of receptors that are constantly in motion around nerve synapses—gaps between individual nerve cells crucial for signals to travel throughout the brain. According to the study's leader, Duke

University Medical Center neurobiologist Michael Ehlers, M.D., Ph.D., these receptors are constantly moving around the synapse and often times they disappear or escape. Ehlers discovered that a specific set of molecules catch these elusive receptors, take them to the recycling plant where they are reprocessed and returned to the synapse intact.

ScienceDaily  
9/24/07

<http://www.sciencedaily.com/releases/2007/09/070919123138.htm>

## Genes Found That Slow Both Aging and Cancer

Researchers have identified a batch of genes that not only prevent cancer but slow the aging process in worms and say they are now looking to see if the genes have the same properties in humans. Many of the genes in the worms are already known to have counterparts in humans, and the team at the University of California, San Francisco, says they hope to better understand some of the processes that cause both aging and cancer. Drugs that mimic the effects of these genes might help people both avoid cancer and also live longer, they wrote in the Oct. 14 issue of the journal *Nature Genetics*. Biologist Cynthia Kenyon is perhaps best known for discovering that a change in just one gene, called *daf-2*, could double the life span of small roundworms called *Caenorhabditis elegans*. "There is a widely held view that any mechanism that slows aging would probably stimulate tumor growth," Kenyon said in a statement. "But we found many genes that increase life span, but slow tumor growth. Humans have versions of many of these genes ..."

MSNBC  
10/15/07

<http://www.msnbc.msn.com/id/21305223/>

## Healthier Mouse Could Hold Clues to Human Aging

A study by scientists at University College London shows that mice lacking the insulin receptor substrate IRS-1 are more resistant to

aging than normal mice. The research adds to a growing body of work showing the importance of insulin signaling pathways as an aging mechanism in mammals—and potentially humans. The study, published in *The FASEB Journal*, shows that mice lacking IRS-1 had an average lifespan increase of 20 percent when compared to normal mice. In female mice lacking IRS-1 this figure was even higher, averaging 30 percent. While the expected life-span for a mouse is about 25 months, one of the IRS-1 deficient mice in this research lived for 38 months—66 percent longer than a normal mouse. As well as living longer, the mice without IRS-1 also experienced better health than the normal mice as they aged. Professor Dominic Withers works with the UCL Centre for Research on Ageing and is lead author of the study.

ScienceDaily  
10/23/07

<http://www.sciencedaily.com/releases/2007/10/071022120229.htm>

## U.S. Study Finds Potential New Ways to Fight Aging

Researchers said September 20 they had found more ways to activate the body's own anti-aging defenses – perhaps with a pill that could fight multiple diseases at once. Their study, published in the journal *Cell*, helps explain why animals fed very low-calorie diets live longer, but it also offers new ways to try to replicate the effects of these diets using a pill instead of hunger, the researchers said. "What we are



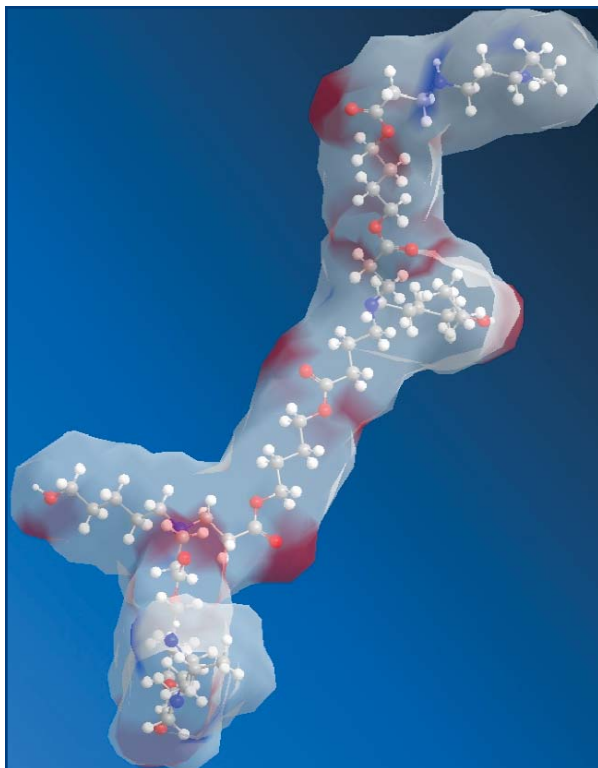
talking about is potentially having one pill that prevents and even cures many diseases at once,” said David Sinclair, a pathologist at Harvard Medical School who helped lead the research. Sinclair helped found a company that is working on drugs based on this research, Sirtris Pharmaceuticals.

Reuters.com  
9/20/07

<http://www.reuters.com/article/healthNews/idUSN2040775520070920>

## Making Gene Therapy Safer: Delivering Genes via Polymers

In work that could lead to safe and effective techniques for gene therapy, MIT researchers have found a way to fine-tune the ability of biodegradable polymers to deliver genes. Gene therapy, which involves inserting new genes into patients’ cells to fight diseases, holds great promise but has yet to realize its full potential, in part because of safety concerns over the conventional technique of using viruses to carry the genes. The new MIT work, published this week in *Advanced Materials*, focuses on creating gene carriers



Structure of a piece of biodegradable polymer, which could be used to deliver disease-fighting genes. Such materials could circumvent the risks associated with using viruses to carry genes. (Credit: Jordan Green/MIT)

from synthetic, non-viral materials. The team is led by Daniel Anderson, research associate in MIT’s Center for Cancer Research.

ScienceDaily  
9/16/07

<http://www.sciencedaily.com/releases/2007/09/070907095614.htm>

## Cat Joins Exclusive Genome Club

A pedigree cat called Cinnamon has made scientific history by becoming the first feline to have its DNA decoded. The domestic cat now joins the select club of mammals whose genome has been deciphered, including dogs, chimps, rats, mice, cows and people. The genome map is expected to shed light on both feline and human disease. Cats get hundreds of illnesses similar to human ones, including a feline version of HIV, known as FIV, and a hereditary form of blindness. Cinnamon, a four-year-old Abyssinian cat, has retinitis pigmentosa, a degenerative eye disease, also found in humans, which can lead to blindness. Earlier this year, with the help of the sequence, scientists found the gene change, or mutation, that causes the condition in cats. Dr Stephen O’Brien of the US National Cancer Institute spearheaded the project.

BBC News  
11/1/07

<http://news.bbc.co.uk/2/hi/science/nature/7073194.stm>

## Protein Folding Network Enters Record Books

A project that harnesses the spare processing power of Sony’s PlayStation 3 (PS3) to help understand the cause of diseases has entered the record books. Guinness World Records has recognized folding@home (FAH) as the world’s most powerful distributed computing network. FAH has signed up nearly 700,000 PS3s to examine how the shape of proteins affect diseases such as Alzheimer’s. The network has more than one petaflop of computing power—the equivalent of 1,000 trillion calculations per second.

BBC News  
11/2/07

<http://news.bbc.co.uk/2/hi/technology/7074547.stm>

## Quantum Computing Possibilities Enhanced With New Material

Scientists at Florida State University’s National High Magnetic Field Laboratory and the university’s Department of Chemistry and Biochemistry have introduced a new material that could be to computers of the future what silicon is to the computers of today. The material—a compound made from the elements potassium, niobium and oxygen, along with chromium ions—could provide a technological breakthrough that leads to the development of new quantum computing technologies. Quantum computers would harness the power of atoms and molecules to perform memory and processing tasks on a scale far beyond those of current computers. “The field of quantum information technology is in its infancy, and our work is another step forward in this fascinating field,” said Saritha Nellutla, a postdoctoral associate at the magnet lab and lead author of the paper published in *Physical Review Letters*.

ScienceDaily  
10/9/07

<http://www.sciencedaily.com/releases/2007/10/071008103647.htm>

## Tiny Chips Flash Memory Advance

Electronics giant Samsung has shown off what it claims is the world’s most powerful chip for use in memory cards. The 64 gigabit (Gb) chips could be used to make 128 gigabyte memory cards, commonly used in MP3 players, capable of holding the equivalent of 80 DVDs. The chips are built using circuits with a minimum feature size of just 30 nanometers. Rival firm Toshiba has said it is also working with similar technology. Both firms will release products in 2009.

BBC News  
10/23/07

<http://news.bbc.co.uk/2/hi/technology/7057717.stm>



# WHAT IS CRYONICS?

Cryonics is an attempt to preserve and protect the gift of human life, not reverse death. It is the speculative practice of using extreme cold 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](http://www.alcor.org)). We also invite you to request our **FREE** information package on the "Free Information" section of our website. It includes:

- A 30-minute DVD documentary "The Limitless Future"
- 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 \$150 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:**

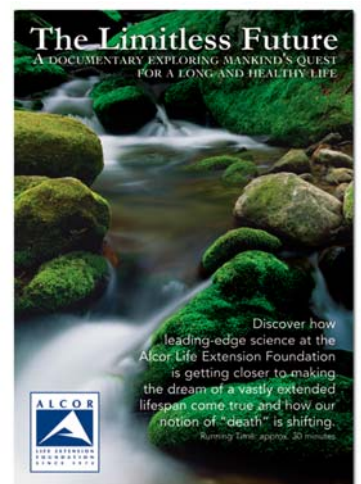
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- Access to a toll-free phone line to speak with **knowledgeable health advisors**, including naturopathic doctors, nutritionists, and a cancer expert, about your individual health concerns. You can also receive help in developing your own personal 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.

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