ALCOR LIFE EXTENSION FOUNDATION

CRYONICS

2006 RECAP

1ST QUARTER 2007 • VOLUME 28:1

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2006 Annual Report

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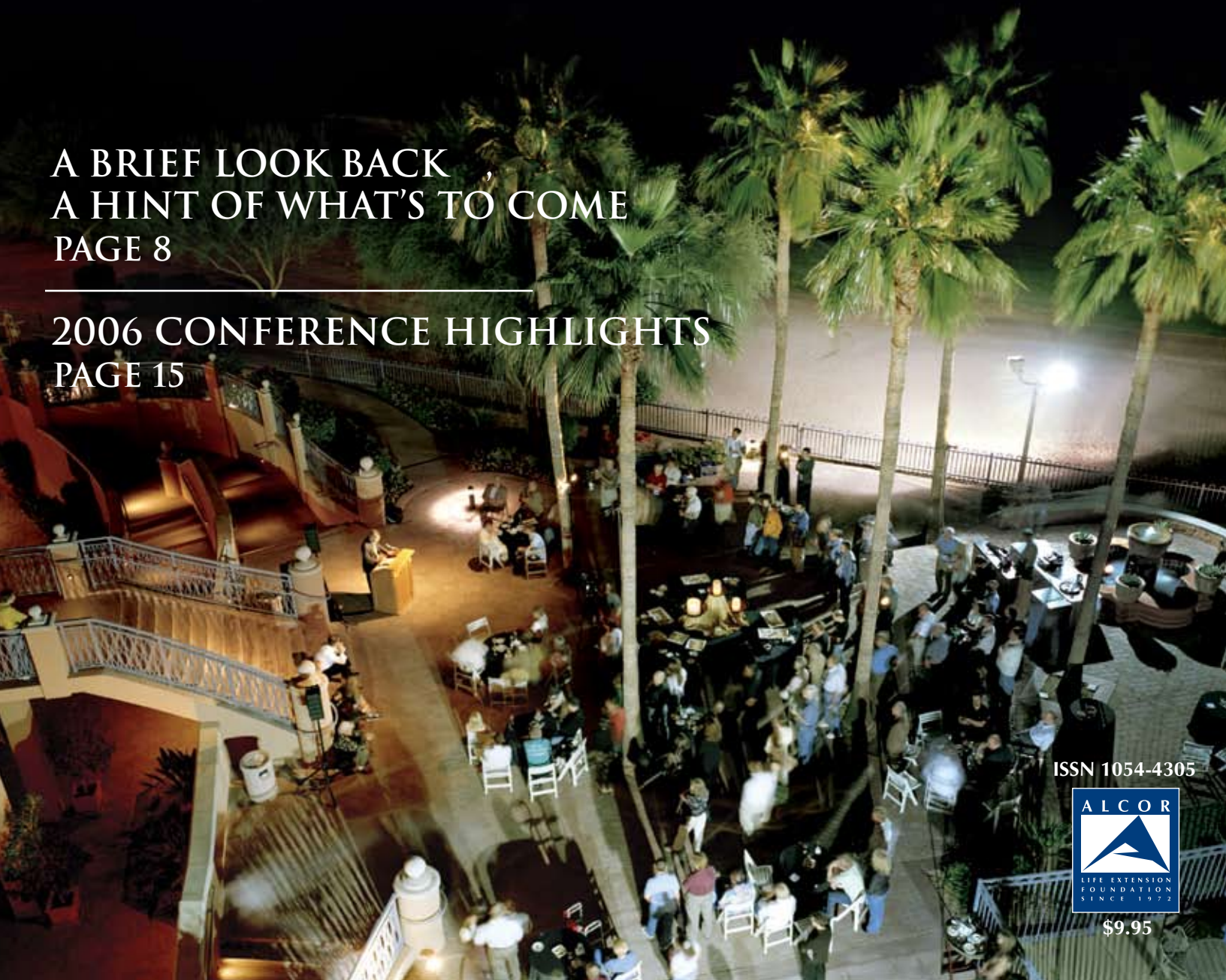

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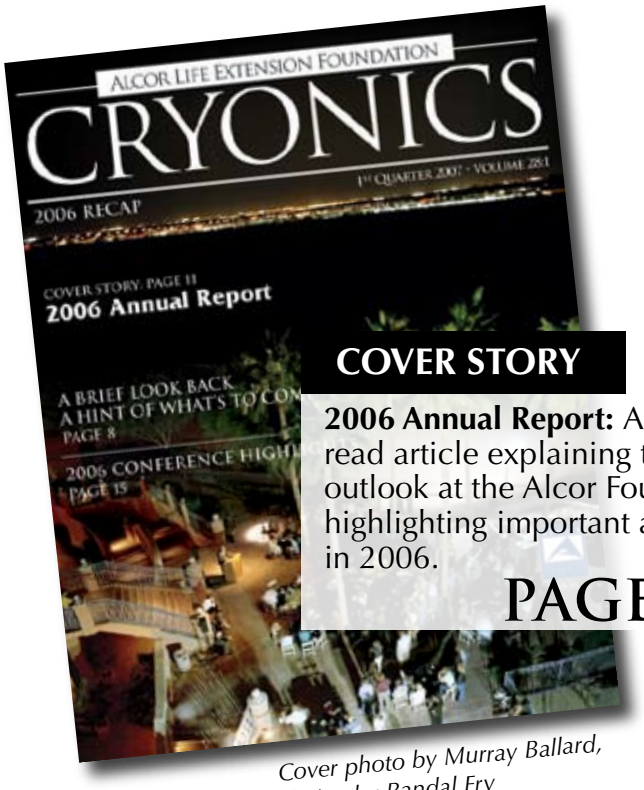

Cover photo by Murray Ballard, design by Randal Fry

COVER STORY

2006 Annual Report: A must-read article explaining the current outlook at the Alcor Foundation and highlighting important achievements in 2006.

PAGES 11-14

An Update on Recent Progress: Research and Development" in Volume 27:4 was submitted by Tanya Jones. We regret the omission.

INSIDE CRYONICS

ALCOR LIFE EXTENSION FOUNDATION
CRYONICS

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FROM THE EDITOR

What does Alcor's 2006 Annual Report tell you? After analysis of all the graphs and figures, we hope you come away with a less obvious message: Alcor is striving to keep you informed.

The Annual Report and other articles in this issue are just one way we've widened the flow of information. Who hasn't visited the best source of up-to-the minute information about happenings at Alcor, the Alcor News Blog? It's a must-have for our proactive supporters, and is usually updated weekly.

At the 2006 Conference, there were several presentations discussing important projects at Alcor and topics of relevance to Alcor members and supporters. Discussions were opened to the audience—as were the doors of our facility. And it's all happening again this year, so save the date (Oct 5-7) and visit our website for updates as the 2007 conference program shapes up.

The conference and blog are important avenues for communication with and amongst our stakeholders. Often discussions at Alcor center around the needs and wants of our members, so it is important to us that you make your voice heard. Alcor personnel regularly read sites frequented by members, such as Alcor United, to keep the organization attuned to the community as a whole. You can also share your comments via the Feedback form on our website (see "Contact Us").

We certainly enjoy getting to know one another. And what better way than to shake hands and converse? The annual conference is our chance to do just that. Flip through to page 15 to read about last year's conference… or buy a copy of the conference DVD (see inside cover). And while our 2006 Annual Report (pg. 11) gives you a clear snapshot of our operations, the details of the push forward taking place at Alcor can be found in "A Brief Look Back, A Hint of What's to Come" (pg. 8).

We hope you will close this issue feeling more informed of the steady, organization-wide progress underway, and perhaps more motivated to become an active participant.

Your avenues for staying connected:
www.alcornews.org/weblog
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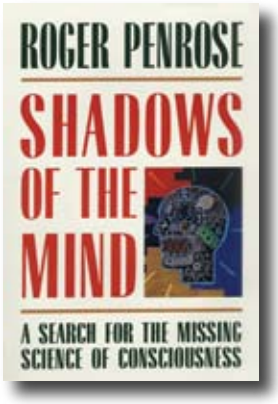
Save the Date
7th Alcor Conference-October 5-7, 2007

SHADOWS OF THE MIND: A SEARCH FOR THE MISSING SCIENCE OF CONSCIOUSNESS

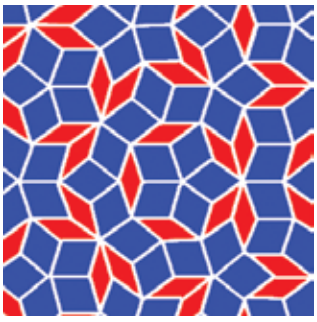
By Roger Penrose

BOOK REVIEW BY R. MICHAEL PERRY, PH.D.

The philosophical position that consciousness, including feeling, could be fully expressed in a computational device is known as strong artificial intelligence or strong AI. The device in its execution might perform tasks that on the face of it seemed to involve consciousness, such as conversing with a human in a natural language, game playing, or directing the behavior of a mobile robot as its onboard computer or artificial "mind." Weak AI, a weaker version of the AI premise, asserts that consciousness could be perfectly simulated but still may not be the genuine article; the simulated personality, despite its convincing behavior, would only be a "zombie," not actually conscious.



The issue of whether the strong or weak variety of AI—or neither—are possible is important in considerations of personal identity and survival, which in turn should have special interest to those who are future-minded. Thus life extension supporters can expect an increasing interest from the medical sector as options become feasible such as restoring or augmenting brain functions by implanting artificial devices. Revival of cryonics patients could involve repair or replacement of some brain parts, and we need to keep the philosophical issues in mind. Social, political, and economic considerations also demand we think about whether artificial devices can substitute for human talent, particularly where wisdom and good judgment are needed.



Penrose tilings such as this one have offered insight into unusual crystallographic structures known as quasicrystals.

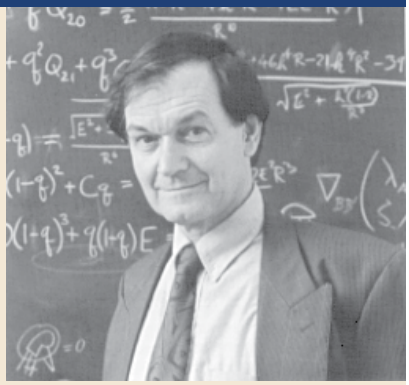
Shadows of the Mind is a follow-up to an earlier book by Penrose, *The Emperor's New Mind*, but can be read as a stand-alone. As it happens, Penrose in his writings opposes and attempts to rebut the position that either strong or weak AI is achievable computationally. Instead he raises the issue of whether consciousness might be altogether inexplicable scientifically, but also rejects this possibility. *Some* sort of scientific explanation must suffice, he is convinced, but it will have to go beyond present science, including quantum mechanics, and also, the theory of computation developed by Turing and others starting in the 1930s.

The first half of the book is devoted to rebutting the position that consciousness could be explained computationally. Penrose is of the opinion that humans think beyond the bounds of formal mathematical systems, thus beyond the capacities of any computing device, and supports this position by referencing the work of logician Kurt Gödel. Since present scientific theories of consciousness are explicable computationally, including quantum mechanics, which particularly undergirds thought processes as computation, we must search elsewhere for an explanation of consciousness.

From this starting point Penrose goes on, in the second half of the book, to consider possible ways that non-quantum effects might both occur in nature and manifest themselves in human thinking, suggesting in particular that microtubules in the cytoskeleton of the brain's neurons may play a substantial role in mental functioning, and in a manner which would depend on effects not accounted for by present quantum theory.

His arguments, however, have not found widespread support in the scientific/philosophical community, but have instead attracted able critics, including AI founder Marvin Minsky, logician Torkel Franzén, and physicist Max Tegmark, who have noted some serious difficulties. On this basis we can discount claims of strong evidence either that thinking and consciousness must be non-computational or that the working of the brain requires significant processing beyond the standard quantum level. (The brain in fact has not been shown to be a quantum device at all, in any strong or non-classical sense, though its working, like everything else we know of, does ultimately rest on quantum mechanics.)

That said, nevertheless Penrose's book is worth reading for a number of reasons. For one, it is always good to get counterarguments to prevailing opinion, even if those arguments seem shaky; sometimes it turns out the "experts" are wrong after all. Then too, Penrose's style of writing is both friendly and lucid, and his book is packed with information on everything from foundations of mathematics to quantum entanglement, all demanding little in the way of prerequisites other than reader dedication. ■



Roger Penrose

Sir Roger Penrose, Order of Merit and Fellow of the Royal Society, is an English mathematical physicist, mathematician, and philosopher of the mind. He is highly regarded for his work in mathematical physics, in particular his contributions to general relativity and cosmology. He is also a recreational mathematician, famous for Penrose tilings (see image), and is a controversial philosopher, focusing on the connection between fundamental physics and human consciousness. Born in 1931 in Colchester, England, Roger is the son of scientist Lionel S. Penrose and Margaret Leathes, and the brother of mathematician Oliver Penrose and correspondence chess grandmaster Jonathan Penrose.

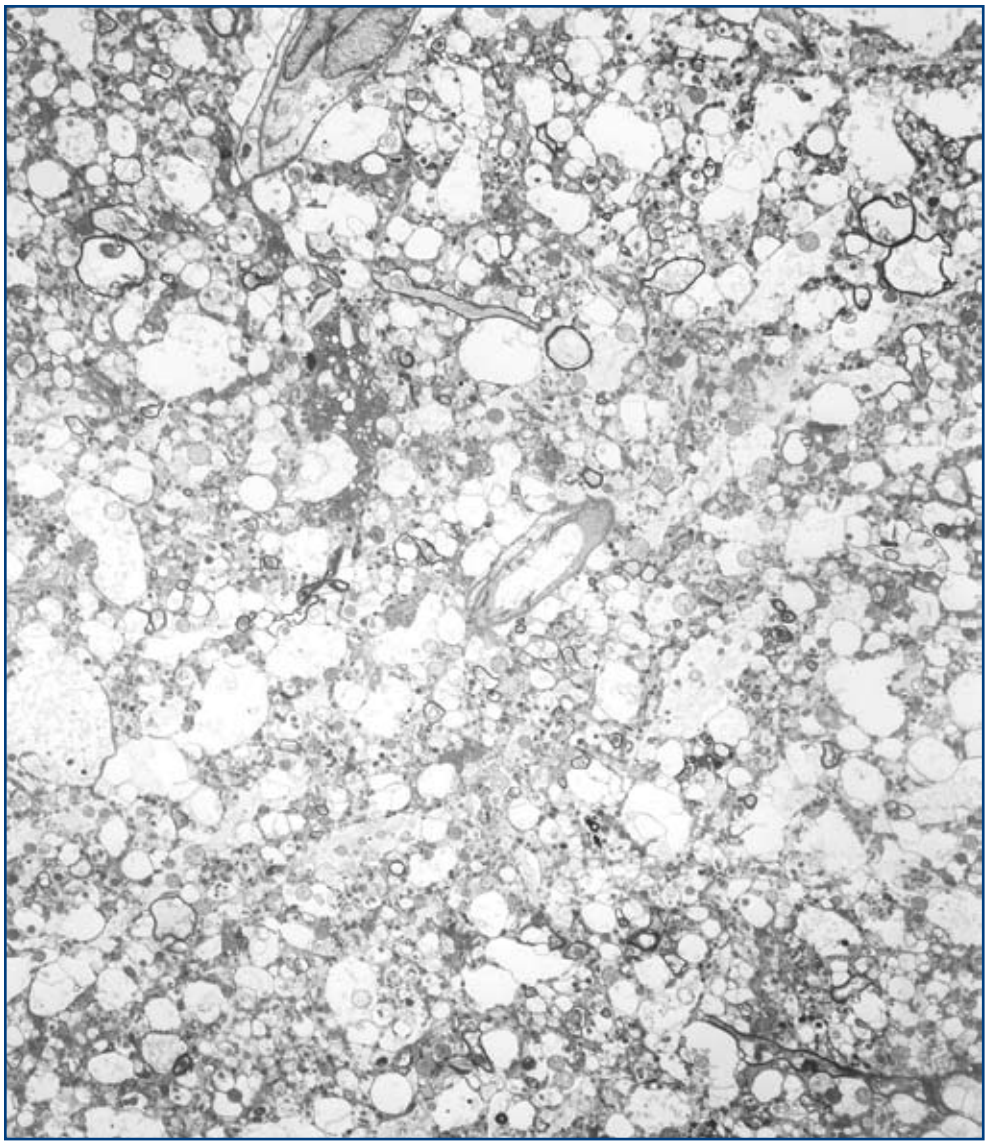
Based on an article at http://en.wikipedia.org/wiki/Roger_Penrose.

ADVANCES IN CRYOPRESERVATION

By Gregory M. Fahy, Ph.D., Chief Scientific Officer, 21st Century Medicine, Inc.

As we saw last time, vitrification has enabled successful cryopreservation of many different kinds of living systems, from single cells to whole organisms. But one of the more intriguing accomplishments to date is the successful vitrification of hippocampal slices, and this is the advance in cryopreservation we will focus on now.

The hippocampus is a complex, sensitive, and critical part of the brain. It is responsible for making sense out of incoming signals and relaying the processed signals to the cortex and other brain areas where long-term memories are deposited. The hippocampus is also responsible for finding and retrieving stored memories, and can even make and store local memories of its own. It is the first part of the brain to suffer from aging and from warm ischemia following a heart attack and resuscitation, and damage to the hippocampus can result in different degrees of amnesia. For these reasons, the hippocampus is a good place to start if one is interested in the question of whether the biology of memory can survive long-term cryopreservation. Further, if a structure as sensitive to insults as the hippocampus can survive cryopreservation, it is a good bet that most or all other brain regions can as well.



The hippocampus is an easy structure to identify and remove from the brain. Its structure and its functions have also been rather well-investigated and are reasonably well-understood. The flow of information through the hippocampus and the functions of the synapses involved are well-known, and these features and the fundamental properties of the membranes that are necessary for electrical activity can be investigated after cryopreservation in great detail to thoroughly evaluate the quality and completeness of cryopreservation. In short, the hippocampal slice is an ideal model system for studying the ability of organized brain structures to survive vitrification and rewarming.

For all of these reasons and others, I set out to create a cryopreservation program for rat hippocampal slices at the end of 1997. Dr. Robert Morin, the founder of the American Longevity Association and the chairman of the Department of Pathology at the Harbor-UCLA medical center in Torrance, California, volunteered to contribute some institutional funds to support the project, and the Institute for Neural Cryobiology raised sufficient funding from grass-roots donors to pay for the balance of the project. I wrote a research plan and got the approval of Harbor-UCLA's animal use committee, and I was able to bring in Dr. Yuri Pichugin from the former Soviet Union to do the experiments under what can only be described as ultra-Spartan conditions. With the

Figure 1: Brain slices that had been frozen and thawed (not vitrified) fared extremely poorly and were always severely damaged. This image shows a section of neuropil (axons and dendrites) after freezing and thawing in 10% glycerol, glycerol removal, and incubation at 35°C. The field shown is about 60 by 90 microns.

help of Chris Rasch, who was a very resourceful employee of 21st Century Medicine, we managed to arrange for Dr. Pichugin to learn the hippocampal slice preparation technique from local experts in the field. Finally, after all of this extensive bootstrapping, Dr. Pichugin was able to begin his work circa the middle of 1999. The project continued for two years, and was finally submitted for publication in 2005 and published in 2006 [1].

As you might conclude from this chronology, the information that came out of this project was very hard won, but it was highly worth the effort. We learned many things of great importance, but most importantly we were able to show, for the first time, that complete brain circuits extending over large distances and vital for the formation and readout of memories can be preserved with good structural integrity and viability after vitrification, rewarming, cryoprotectant removal, and exposure to approximately normal body temperature for over an hour.

In surprisingly strong contrast, frozen-thawed slices fared extremely poorly when checked after an hour of exposure to 35°C (nearly normal body temperature). It didn't matter what we used as a cryoprotectant or what the concentration of cryoprotectant was, the slices were always severely damaged after freezing and thawing (Figure 1). This may have been because Dr. Pichugin's freezing method involved cooling at 1.2°C/min after ice first formed in the sample. If this rate was high enough to cause intracellular ice formation, it would explain the injury observed, but we didn't have a chance to check this point. Suffice it to say that freezing brain tissue at more than 1°C/min should be viewed as being particularly hazardous based on our results.

Another important discovery was the importance of the carrier solution used to add and remove cryoprotectants. Exposing brain slices to 0°C (32°F) in artificial cerebrospinal fluid resulted in a 50% loss of viability (based on the ability to pump sodium and potassium ions after rewarming) within about 100 minutes, and a 75% or greater loss of viability in less than 5 hours. Similarly, holding slices at 10°C for the loading and unloading of 25% cryoprotectant was not damaging, but holding them at 0°C for the same procedure resulted in a loss of 40% or more of their ion-pumping ability. The problem of 0°C exposure went away, however, when we used RPS-2, a solution I had developed many years ago for kidney cold storage [2], as the carrier solution. With RPS-2, we could treat the slices with 50% cryoprotectant at 0°C or, even better, at -10°C, and recover up to 80% of full ion-pumping capacity.

To go the rest of the way to vitrifiable concentrations of cryoprotectant, we switched to VM3, a general-purpose 21st Century Medicine vitrification solution [3, 4], and changed the carrier to LM5, which is a version of RPS-2 that facilitates the effectiveness of the ice blockers present in VM3 [3, 4]. With VM3 in LM5, we were able to develop a method that allowed 91.5-107.9% recovery of K+/Na+ ratio after vitrification and rewarming in comparison to untreated fresh control slices. Furthermore, when the slices were examined by light or electron microscopy after more than an hour of exposure to the metabolically challenging temperature of 35°C, they looked comparable to control slices (Figure 2).

These experiments provided the first clear indication that intricate and large-scale brain structures are intrinsically capable of being recovered with very good survival after cooling to temperatures low enough for very long-term preservation. It is now possible to go on to characterize such preserved slices in depth to determine how well they can perform neurophysiologically, and whether local memory processes in the hippocampus are intact after cryopreservation. We have begun these investigations at 21st Century Medicine, but that is a topic we will have to come back to another time. ■

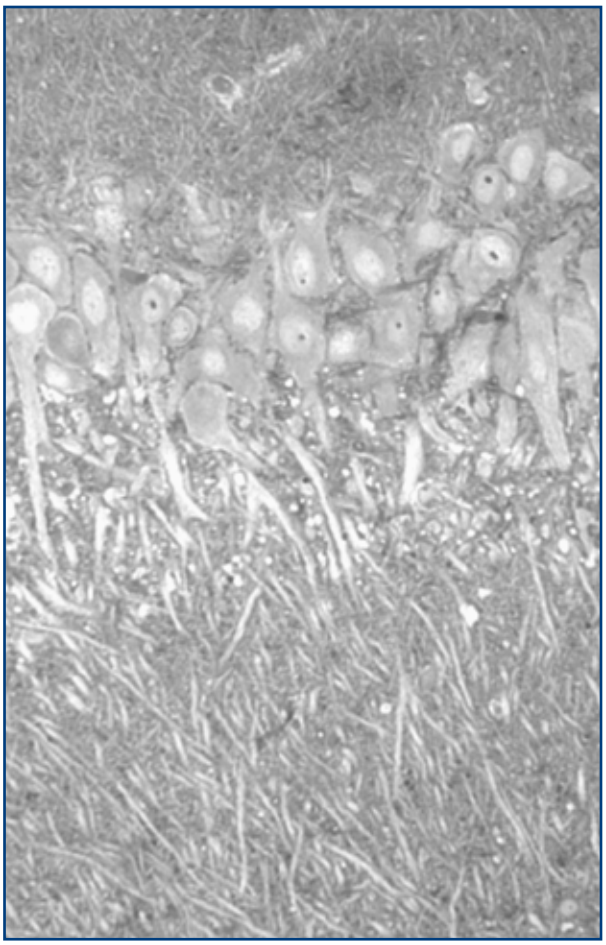


Figure 2: When vitrifiable concentrations of cryoprotectant were used, the brain slices looked comparable to control slices. This image shows CA3 cells and attendant axons (top) and dendrites (bottom) after vitrification, rewarming, VM3 removal, and incubation at 35°C. The field shown is about 165 by 260 microns.

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MEMBER PROFILE: SKIP AND JASON MARKS

By Deborah Johnson

16-year-old Jason Marks interests run from water sports to popular TV shows to genetic mapping.

"I'm one of those normal, average Joes," says the father.

"I'm just an average 16-year-old high school student," says the son.

True and not true. The son, Jason Marks, loves to jet ski, rowed on the junior varsity crew team and watches *Boston Legal*. That's pretty average. But, there's nothing "average" about seeing him shaking hands and talking to the top cryonicists in the world at the recent Alcor Conference.

His dad, Skip Marks, is a real estate investor and developer. He has a wife and two children—one boy and one girl. Average. But, where he differs from the average father and businessman is his interest in life extension. He says that a mid-life crisis spurred his interest in taking care of himself and looking for ways to live well beyond another 20 or 30 years. So, Skip spent more than a year researching anti-aging. That's when he came across cryonics and Alcor. "I investigated other organizations and Alcor was clearly the premier facility. I thought long and hard about it for about a year."

In October 2006 at the Alcor conference in Scottsdale, the senior Marks began the membership process and is now an Alcor member. According to Skip, "I intend to cryopreserve my whole family. I want to take my whole family with me." He adds optimistically that the children may not have to be cryopreserved, depending on scientific advances in anti-aging. His wife already has insurance and will join Alcor shortly and son Jason hopes to join this year. Skip says his daughter is a little too young to join right now, so they're holding off for awhile. Skip's father died at age 87 from cancer and, as he says, was "sharp as a tack." Skip regrets that anti-aging technology was not far enough along to help his father.

Jason's interest grew from his father's research. It fit right in with his keen interest in science. "I would love to come back in 100 to 200 years and see all the changes in technology. I'm fascinated by the ingenuity of the human race, how it develops and expands and evolves," he comments. "So I want to live as long as possible to see how knowledge and technology grow."

One of Jason's high school science projects looked at genetic mapping to see if it could be used to analyze and predict things like a susceptibility to asthma. As for his next steps, he says, "I'm going to pursue a major

in genetics or genomics. Then go to medical school and probably specialize in orthopedic or plastic surgery." He says he sets high goals for himself and works hard to attain them.

Studies on genetic mapping may not be the norm for high school students, but in his free time Jason really is an "average 16-year-old." He loves to roller blade and mountain bike. Just like nearly every other 16-year-old, he says he loves to drive.

Not surprisingly, Jason likes to read science fiction, fantasy and action novels. Among his favorite authors are Clive Cussler and Ann McCaffrey. When he has time to sit down and enjoy TV, he likes *Grey's Anatomy*, *Firefly*, and the Science Fiction channel.

Since the Marks live on the water in Jacksonville, Fl., water activities figure prominently into family activities. They spend a good deal of time together on their boat and enjoy scuba diving as well.

"We do a lot of scuba diving together. It's a great retreat for the family," notes Skip. Among their favorite spots are the Keys, the Florida coast and the Bahamas. Skip says the serene, crystal clear water makes these great spots for swimming, diving and just having fun together.

In addition to family activities, Skip has been playing drums since 8th grade. "In my early 20's we had a band called South of the Border Band, and we traveled around playing southern rock and roll, you know things like Leonard Skynard and Marshall Tucker." But, he says with a smile, that once he got married the band life came to an end.

The Marks are representative of a growing number of new Alcor members – families who would like to have more time together in the future and see Alcor membership as a way to pursue that desire. The Marks are now the 119th family to join Alcor.

Skip Marks and his family enjoy time together along the Jacksonville, Florida coast.

Like many other cryonicists, Skip actually hopes that he will never have to be cryopreserved. Although there are no guarantees with Alcor's experiment, Skip remains optimistic, saying, "I know the body can be repaired and that's what convinced me that cryonics would work." But, he says, "I think we're right at the cusp of medical and technological advances in anti-aging. So, I'm hoping that the envelope will expand quickly enough, and I will live a long and healthy life."

So, how do this "average" father and son handle talking about something as extraordinary as cryonics? Skip is careful about discussing cryonics with others. He says that some people are narrow-minded, with a limited knowledge of the leading edge of scientific discovery. Even the few who are more knowledgeable seem to have an ingrained mindset that classifies cryonics as bizarre. But, Skip also thinks that as science progresses the idea of cryonics will become more acceptable. "I think cryonics will snowball when science finally proves that it is possible."

Jason says he's talked to a few close friends; ones he trusts or knows are open-minded. Still, he says, they are incredulous and sometimes disturbed or threatened by the idea of cryopreservation. "Their reactions amaze me." But he's resolute. And he thinks that it's entirely possible that friends who are doubters today may sign up for the cryonics experiment in the future.

"I'm looking forward to seeing the future," says Jason. "And if it's a choice between being buried or being cryopreserved, why would I prefer being buried? The question answers itself."

You can reach Skip or Jason Marks at: skipmarks@comcast.net ■

Email us if you're interested in being profiled for *Cryonics* magazine: info@alcor.org

A BRIEF LOOK BACK, A HINT OF WHAT'S TO COME

By Tanya Jones, Alcor Chief Operating Officer

Last year began with a successful $100,000 matching grant, which brought in over $200,000 for research and development at Alcor. Throughout the year, we put that funding to good use on several important projects related to whole-body vitrification. Improvements were not limited to the technical side though. Every facet of our operations received attention; and we are looking forward to a productive 2007, where the completion of some of the projects discussed below will directly improve the quality of care we provide for all our members and patients.

Clinical Systems

On the surface, one of the simplest tasks we have in performing cryopreservations is the temperature descent during cooldown. Alcor personnel use nitrogen vapor and computer control systems to drop the patient's temperature to -196°C in two stages. The first stage is a rapid drop to -110°C, and the second stage is a 1 degree per hour drop to liquid nitrogen temperature. Cooling is fully automated, and the only maintenance required to complete this step is ensuring the nitrogen is replenished periodically and that the computer operates correctly throughout the procedure. Though this is a seemingly simple step that has remained unchanged for many years, we believe that improvements can still be made because the patients still experience fracturing during the temperature descent.

We have seen that fracturing invariably occurs in tissue rather like when dropping an ice cube into a glass of warm water. We listen for this with our acoustic monitoring system, because we know this fracturing contributes to a cryopreservation being irreversible, and listening gives us some indication of the scope of the damage. Fracturing events have begun at temperatures as high as -117°C, which is a temperature too high for long-term care, and would not adequately protect the patient against structural deterioration over the time scales we expect to be necessary for revival.

Our thoughts on how to improve the cooling stages come from studying glasses, because of the way vitrification changes the cryopreservation equation. Annealing, the process in lens crafting where heating and cooling are used to relieve strain, is one possible method for eliminating fractures that deserves close examination.

During the past year, we took a polariscope (a tool used to determine strain patterns) built by Hugh Hixon several years ago, built a test cell for samples, dedicated a small dewar for this research, and instrumented it with a web camera slightly modified to withstand the extreme cold. With this setup, we have taken photos of strain forming in cryoprotectant (see image), and we are fine-tuning the equipment before replicating it for processing multiple samples simultaneously. We will be performing regular fracturing experiments by the end of this year, in the hopes of establishing an annealing curve that will allow us to lower a patient's temperature without fracturing.

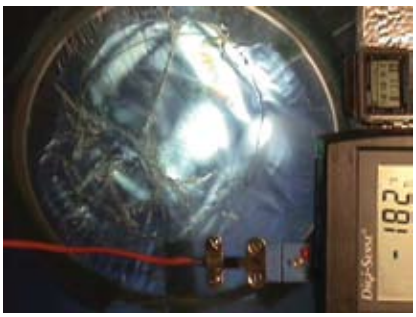


Photo shows, by polarized light, stress in cryoprotectan.

It is possible that early progress in fracture-free storage will be such that higher temperature storage becomes possible—even preferable—where patients may be cared for at a higher temperature, like -140°C or so. If that happens, we will want to have the capability to keep patients at those higher temperatures as the research in achieving fracture-free preservations in liquid nitrogen continues. Toward that end, we have commissioned a higher-temperature dewar from 21st Century Medicine, one that we expect to arrive in the first quarter of 2007. With this, we will have limited capability to maintain neuro patients at higher temperatures, in case we are unable to develop the annealing curves we desire.

Cryoprotective perfusion is another of the clinical processes that will become easier and more effective in the coming months, as we complete work on an operating room automation system. With this system, patient data will be collected automatically, though we will maintain a manual backup in case of computer problems. A computer will track all the usual parameters automatically; and for the first time, we will directly monitor parameters like vascular resistance (to determine if edema is setting in) and fluid balance (rate of water removal and the uptake of cryoprotectant). The technical staff and an outside contractor are designing control processes, so that less manual manipulation during perfusion is required. The new system will have multiple alarm levels, to warn of significant changes or deviations from the protocol quickly. Some examples of necessary alarms include low fluid levels in the reservoir, to prevent the introduction of air into the patient; fluid imbalance, which will tell us if the patient is swelling faster than the cryoprotectant is being taken up; and high or low pressures.

We have already purchased all of the equipment needed to complete this project; and once the control and data collection processes are developed, we anticipate little delay in deploying this for patients. This automated perfusion system will complement our new operating table enclosure. We have learned much from the original whole-body prototype, and we are in the process of designing and building the second-generation prototype.

Improvements to early stages of the cryopreservation procedure were not neglected either. We re-designed the air-transportable perfusion system used in a patient stabilization, because of a change made by the manufacturer of the heat exchanger and oxygenator. With the updated system, we can continue to replace a patient's blood with an organ preservation solution, using medical parameters like pressure and flow monitoring and using sterile technique, in a location far from the Alcor facility. The modifications we made will facilitate more rapid set-up of the system in field situations, will allow for simpler training methods, and will be a completely self-contained washout system. We

hope to build more of these units in 2007 and deploy them to various regions.

Regional growth is continuing; and in 2006, we held stabilization training in four new regions. In 2007, we are planning to continue the expansion to include three additional locations. Due to limited resources, primarily personnel, we will be reducing the number of training sessions to one in each of the regions this year. Local Alcor members have been doing a lot to build their skills, independently reviewing training materials (all of which were revised significantly in 2006) and even holding their own training sessions as often as monthly. We strongly appreciate everyone's hard work and will do what we can to increase our support further in the coming year.

Throughout this year, we expect to have new equipment for the training sessions, which includes our recently designed, built and tested partial liquid ventilation system, which was described in my November 9, 2006, post to Alcor's blog (www.alcornews.org/weblog). To reiterate, in case you missed it: This partial liquid ventilation system will facilitate rapid cooling while performing cardiopulmonary support during a patient stabilization. Partial liquid ventilation is a process involving the introduction of a cooled, oxygenated fluid into the lungs, where the massive surface area can facilitate extremely rapid cooling. It is called "partial ventilation", because the oxygen-carrying capacity of the fluid is insufficient to support metabolism, and so a patient has to have additional oxygen support.

Our mechanical system for partial liquid ventilation will allow us to cool patients during the critical first-minutes of the stabilization procedure, a vital capability that has the potential to improve a patient's overall cryopreservation dramatically. We expect this system to provide nearly the cooling rate of the blood washout, at an estimated half degree C per minute, with none of the invasive surgery or time delays. Our research team has prepared this device and the documentation for submission as Alcor's first patent.

The partial liquid ventilation system we designed is based on earlier work done at Critical Care Research and Biopreservation, Inc. It is simpler to deploy, requires significantly less training to operate, is less expensive, and considerably more portable than any other device patented for this purpose. Our first prototype was educational, and we are modifying the design to be even more compact and have additional pumping power. We hope to introduce this to the regional team later this year and deploy it at the earliest opportunity.

We have also taken a long, hard look at the existing stabilization kits we ship to remote locations. Because of our intention to add more equipment to the kits, we are facing a problem with regard to expanding our kit with the new equipment described above. With airline restrictions becoming stricter, especially in terms of the number of articles that may be checked and in the weight limits, we had to see what we could do about reducing the volume of supplies without compromising patient care.

Tanya Jones and Chana Williford redesign the Alcor stabilization kits sent to remote locations.

When an Alcor member is in need, we, at a minimum, send two members of the stabilization team to supplement local transport technicians. As a result, we would do well to limit the size of our emergency stabilization kit to four boxes that can be checked during flight, one of which will be the new portable ice bath and one the perfusion system. We're faced with the challenge of condensing five boxes of additional supplies into two. This redesign was started in the last quarter of 2006 and will continue through the end of the first quarter of 2007. Once complete and the kit thoroughly tested, we will begin assembling the resources to build more than a dozen of these to replace the kits already in the field and to expand into multiple new regions.

To conclude the discussion of clinical matters, we preserved three patients in 2006. We completed construction on our new patient care and operating areas, including the installation of a new bulk storage tank for liquid nitrogen. We moved the patients into the new bay, and began working on a new project to allow for the transport of patients to Alcor at significantly lower temperatures from even the most remote of regions. A nitrogen shipper of this type will reduce the impact that delays in transporting a patient across state and country lines will have on their conditions. A nitrogen shipper would obviously be of assistance in sudden death situations, where the stabilization team focuses on cooling the patient as much as possible in the shortest amount of time, but no other cryoprotective treatment is possible.

This shipper would also be extremely useful if we had a field cryoprotection system. Vitrified patients must be cooled to -110°C as soon after the conclusion of the perfusion as is possible. Traditionally, we transport patients on water ice or dry ice, which has a temperature of -79°C and is too warm for transporting a vitrified patient. If we transport the patient at too warm a temperature, we fail to prevent devitrification and subsequent freezing damage; the ice crystals that the vitrification process is designed to prevent would instead become inevitable. The nitrogen shipper will facilitate the practical development of this field vitrification capability, and it would significantly improve the quality of care that ideal, remote cases could receive. We will be looking seriously at this possibility as the shipper project moves ahead in 2007.

Internal Research Capability

In addition to building the new systems

for clinical use, we have been simultaneously developing our internal research capability. We built a cardiopulmonary bypass lab that will allow us to examine the scientific basis for cryonics. Care facilities were built from the ground up for small animals, and our protocols are being rigorously designed by our research associate for disciplined research. Once our Institutional Animal Care and Use Committee has approved the protocols, we will begin training the investigators in the new surgical and other techniques that will be required to carry out our planned experiments. Replicating a published model of cardiopulmonary bypass will be the first goal, and replicating the total body washout experiments performed by Alcor many years ago will be one of the next.

We hope to begin addressing questions like "How long can an organ preservation solution be circulated before edema begins?" before the end of the year.

Alcor's contributions to nanomedicine have been acknowledged throughout the year in several papers written by Robert A. Freitas Jr. We provided another grant for Freitas' work on medical nanotechnology, and we were not disappointed. Along with co-authors, Freitas published what might be the most comprehensive analysis of the hydrogen abstraction tool (for diamond mechanosynthesis) ever written. Read this paper in the current issue of the *Journal of Physical Chemistry*, a prestigious mainstream chemistry journal. Some of Dr. Freitas' recently published papers, which directly acknowledge Alcor's support whenever format permits, are available online.

Administrative Improvements

Administratively, we have also made changes over the course of the year. We developed a long-term plan for Alcor that begins to assess our needs for membership growth and outreach, in addition to mapping out a path for technology and research development to support a growing membership. We had no trouble in our financial management, and the accounting controls and procedural changes are working, as no further breaches have occurred since the 2005 incidents.

We resolved our final outstanding legal entanglement, the Florida battle for a patient's remains and estate instigated by the patient's daughters. With this resolution, Alcor has no existing legal issues for the first time in years. Our political situation is stable, and we have been maintaining our presence at the Capitol to minimize the risk of anything happening that will negatively affect Alcor or its members. We had input recently on a draft measure that would slightly change the anatomical gift law in Arizona, and all of our recommendations were uniformly adopted by the Senate Committee reviewing the measure.

In 2006, our membership grew by 50 members, our patient population by three; and we had 30 cancellations throughout the year, 14 of whom we cancelled for non-payment of emergency response dues. The average number of information packs we sent out each month was 164, which represents an increase of 42 per month over the 2005 figures.

We cleaned house a bit on the membership application processing; and in July 2006, 33 people were removed from the application queue because they had failed to make progress on the sign-up process for years. Our new policies will not allow the membership figures to be inflated because we are carrying only applicants that are truly moving forward and members that are meeting the financial terms of our membership contract.

Our outreach and media as a whole became more refined in 2006. Our media coverage included *Good Morning America*; CNN's *Paula Zahn Now* Show; a Barbara Walter's special that will be aired by ABC in 2007; the release of our National Geographic / Zig Zag Productions documentary; and articles in the *Wall Street Journal* and our local papers, the *Arizona Republic* and the *Scottsdale Tribune*. We had international coverage in the United Kingdom, Belgium, Germany, Switzerland, Australia, and Italy.

We saw the release of a Scientist's Open Letter on Cryonics (http://www.cryoletter.org), where numerous scientists publicly stated their support of cryonics and provided references for more information. To date, 61 members of the scientific community have signed this document.

Internally, we made so many improvements to our website and magazine that it would be hard to list them all. We're attempting to professionalize cryonics and its public perception, and this effort will continue indefinitely. Along those lines, we held our first conference in many years. The event was well-attended, with half of the participants being new to the community.

We will be holding another conference over the weekend of October 5-7, 2007. If you missed the first one, we strongly encourage you to attend this event. In 2006, we used the conference as a means for announcing multiple advances in Alcor's technical capability to the audience, and we fully expect to do the same this year.

When looking back, it's easy to see that 2006 was a full year. We had good days and bad, which is normal when you look at a significantly long time frame. We acquired some new staff, and we lost others. We gained the ground we wanted on some projects, but not others. Overall, however, the progress seen at our little organization has been positive. We're quite excited to see what 2007 will bring, and we look forward to fighting the good fight on a daily basis. ■

Dr. Freitas' Recently Published Papers:

"Pharmacytes: An Ideal Vehicle for Targeted Drug Delivery"
Robert A. Freitas Jr.

"High-level Ab Initio Studies of Hydrogen Abstraction from Prototype Hydrocarbon Systems"
Berhane Temelso, C. David Sherrill, Ralph C. Merkle, Robert A. Freitas Jr.
http://pubs.acs.org/cgi-bin/abstract.cgi/jpcafh/2006/110/i38/abs/jp061821e.htm

"Theoretical Analysis of Diamond Mechanosynthesis. Part III. Positional C2 Deposition on Diamond C(110) Surface using Si/Ge/Sn-based Dimer Placement Tools"
Peng, Robert A. Freitas Jr., Ralph C. Merkle, James R. Von Ehr, John N. Randall, George D. Skidmore
www.MolecularAssembler.com/Papers/JCTNPengFeb06.pdf

"Nanotechnology, Nanomedicine and Nanosurgery"
Robert A. Freitas Jr.
www.nanomedicine.com/Papers/IntlJSurgDec05.pdf

2006 Annual Report

Dear Members and Friends:

Alcor Life Extension Foundation is presenting its 2006 Annual Report of Operations to the membership and the general public in this issue of *Cryonics*. As a 501(c)(3) nonprofit organization, it is our obligation and responsibility to provide an accounting of the organization's financial standing. Further, this is an opportunity to give our members and friends a perspective on our successes, challenges and vision for the future.

On the success front, 2006 was an outstanding year in so many areas. For the details of Alcor's achievements in 2006, as well as some of our plans for 2007, please see the article "A Brief Look Back, A Hint of What's to Come" by our Chief Operating Officer, Tanya Jones. While that article provides the operational details at Alcor, I would like to address the over-arching philosophy that is driving our direction.

Simply stated, the master vision for Alcor is to make the significant advances and investments necessary to control the future of Alcor as an organization while taking a giant step toward improving cryopreservations. This includes conducting our own research, continuing our support of vital research by outside parties, improving operations and protocols, and ensuring a secure financial future for Alcor.

The projects you are hearing more and more about—including fracture-free storage research, whole body vitrification research, our prototype partial liquid ventilation system, the design of our cardiopulmonary bypass lab, and the redesign of our field kits—are an exercise in rebuilding our capabilities from the ground up. And a critical outcome of this rebuilding effort is the availability of quality tools that will enable our most precious resource, our valued personnel, to achieve success.

We could continue on without any significant change to how we do business. But for me, this isn't good enough, and the fastest and easiest way to improve the quality of what we do is to improve the tools we have at our disposal. This may not sound particularly exciting or glamorous, but we firmly believe that it is possible to make cryopreservations faster, better, and cheaper if we improve the material resources available to us.

It is our responsibility to make the field, and Alcor in particular, attractive to those who can advance cryonics.

To make the necessary improvements, we need two things often in short supply: people and money. Now, you might say that they are really the same—that with enough money you can hire good employees. This may be true running a Pizza Hut, but it isn't really the case for any highly technical field, and it certainly isn't the case for cryonics.

The rapid escalation of scientific advancements in every field has made the public hungry for the latest success. This level of expectation and the demand for the brightest minds makes it extremely competitive—and yes, expensive—to attract and retain quality employees to Alcor. While we all wish it wasn't so, cryonics is still just enough off the beaten path for scientists and doctors to be nervous about it. It is our responsibility to make the field, and Alcor in particular, attractive to those who can advance cryonics.

So, how do we attract the best talent to our team? Experienced scientists and medical professionals demand access to the latest tools in the industry. Without those tools, not only are they frustrated at dealing with old, unsuitable, and difficult-to-use equipment, but they also fear that they can't meet their commitments to advance cryonics research; and rightly so. Experience shows that one of the fastest and easiest ways to improve the quality of what we do is to improve the tools we have at the disposal of our research and clinical teams.

Our vision for recruiting quality medical and scientific personnel, then, begins by providing a well-equipped facility that offers prospects for productive, publishable research. Not only will research help solve real problems in human cryopreservation, but it also directly impacts our ability to continue to attract the best and brightest staff members to handle cryopreservation cases.

In the nonprofit world, conversation inevitably turns to money—the lack of it and the need for it. The truth is that it takes a lot of money just to stand our ground as an organization, much less advance the interests of our members at the desired pace. To be perfectly honest, it has been more than twelve months (February 2006) since our last case and a continual dry spell in this regard could deplete our financial reserves.

On the bright side, Alcor stepped up its fiscal responsibility to new levels during 2006. Stricter accounting protocols have been implemented and a formal annual budget was adopted. We started 2006 anticipating a net loss for the year of $200,000. While we finished the year with positive revenue, this turnaround was possible only because three cryopreservations were performed during the year, one of which was funded well-above the required cryopreservation minimum.

It is important for our members to understand that we must budget each year on a "zero case" basis; that is, we assume that no

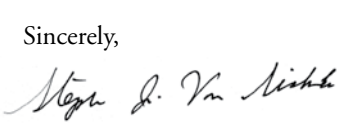
cryopreservations will be performed and thus no revenue will be generated to offset the cost of maintaining Alcor's clinical staff and facilities. We must create and implement a strategy that will fund the organization's current needs and advance our ambitious research agenda.

We are starting the 2007 year with a projected deficit of $100,000, and this loss assumes we collect an expected bequest of $200,000 which is currently in probate. It is possible that we will fare as well this year as last year, and end the year in the black. It would only take a few cryopreservation cases to do this, but the challenge lies in the fact that we can't continue to rely on uncontrollable factors to balance our budget.

We could create a balanced budget. However, we would have to downsize and our goals would be reduced to the "bare minimum." I feel very strongly that it is my job to make sure that we do not stagnate. I prefer to actively strive to improve, to build the new tools needed to train quality professionals and to continually perform research vital to our progress.

Many of our members and friends have been extremely generous in supporting our fundraising drives, and we want to take this opportunity to express our appreciation. Your donations help all of us move closer to our ultimate goal of reversible cryopreservation and life extension. In the coming year, we will keep you updated on our progress and how your donations are enabling us to meet the growing needs of our organization.

Sincerely,



Stephen J. Van Sickle

With the help of just 48 Alcor members and supporters, we have exceeded our goal of raising $25,000 for the 2006-2007 Matching Grant for Fracture Free Research & Development. These donations—totaling $29, 321—will be matched by an additional $25,000 from our anonymous donor. Your contributions will be used to understand and seek ways to prevent damaging fractures in our cryonics patients. Many donors requested privacy, so we are publicly thanking only those who have given us permission to do so:

Jimmy Adams
Linda Abrams
Kevin Brown
Sophia De Goes
Scott Dickey
James Durkin
Jeff Erdel
Reinhold Ferster
Bob Ford
Neil Freer
Graham Hipkiss
Westly Hoffman
Roy Hollis
William Kao
Michael Kelly
Richard Kritzer
Thomas Meyer
Gerald Nelson
Robert Poole
Andrew Popper
Charles Reddeck
Mirelle Rosca
Martine Rothblatt
Thomas Shapard
Garret Smyth
Robert Steiner
Samuel Thompson
Terence Ward
Daniel & Barbara Witt

2006 Financials

Income

Membership Services	$	420,817
Donations	$	368,074
Bequests	$	337,393
Cryopreservation Income	$	235,000
Income from Legal Settlement *Note 1*	$	178,500
Interest Income/Securities	$	257,404
Total Income	$	1,797,188

Expenses

Administration & Membership	$	255,634
Clinical *Note 2*	$	373,209
R&D	$	298,311
Patient Care *Note 3*	$	97,805
Professional Services	$	89,321
Insurance	$	96,118
Facilities *Note 4*	$	176,073
Legal fees reimbursed to PCP *Note 1*	$	78,500
Marketing/Outreach	$	137,025
Total Expenses	$	1,601,996
Net Income	**$**	**195,192**

Note 1: During 2006, Alcor entered into legal settlements regarding the cryopreservation and patient care of a member. The settlement of $178,500 included $78,500 in legal fees that were paid by the Patient Care Trust and thus are expensed as reimbursements.

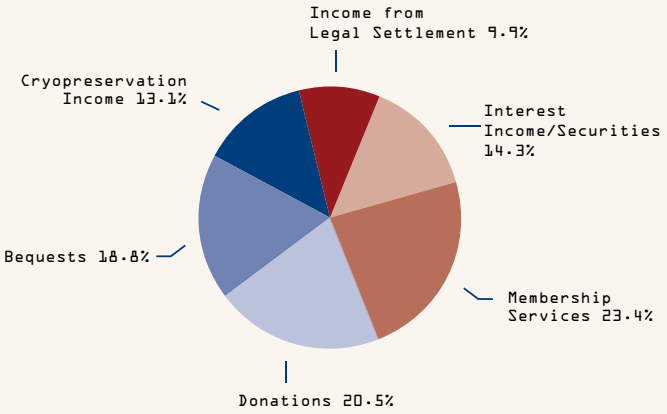
Note 2: Clinical expenses relate to the costs of cryopreservation of members.

Note 3: Patient Care expenses are those incurred to provide treatment to patients currently in cryonic suspension at Alcor's facility.

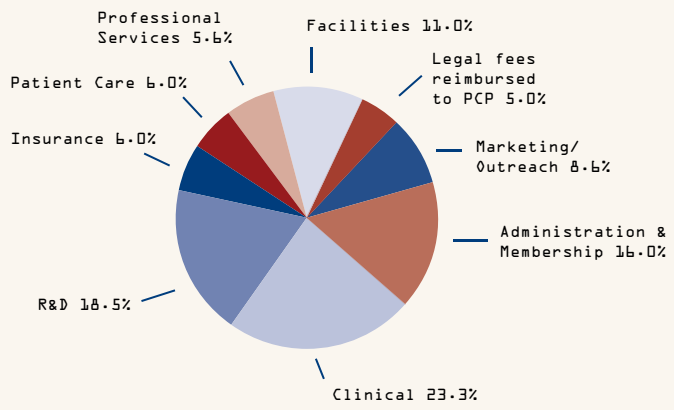
Note 4: Facilities costs increased during 2006 due to expansion of the operating room and patient care bay.

This is unofficial:

Income



Expenses



Highlights of 2006

Clinical

- Cryopreserved three patients during 2006.
- Completed build-out of new patient care bay and operating room; relocated patients to new patient care bay.
- Started developing an operating room automation system to aid in cryoprotective perfusion.
- Redesigned the air-transportable perfusion system used in a patient stabilization to allow for in-field replacement of a patient's blood with an organ preservation solution.
- Designed, built and tested partial liquid ventilation system to facilitate rapid cooling while performing cardiopulmonary support during patient stabilization.
- Began redesign of emergency stabilization kits to better meet the needs of our patients. New kits scheduled for deployment during 2007.
- Held stabilization training in four new regions.

R&D

- Built and fine-tuned test equipment in order to develop an annealing curve research protocol with ultimate goal of fracture-free cryopreservations.
- Commissioned higher-temperature dewar from 21st Century Medicine to aid in research of alternative procedures for fracture reduction or elimination.
- Built cardiopulmonary-bypass lab to examine scientific basis for cryopreservation. Research to begin in 2007.
- Provided another grant for Dr. Freitas' work on medical nanotechnology.
- Began research of nitrogen shipper for cooling of patients in the field, following field cryopreservation.
- $100,000 matching grant resulted in over $200,000 for Whole Body Vitrification Research at Alcor.

Marketing

- Release of Scientists' Open Letter on Cryonics, signed by 61 respected scientists and medical professionals.
- Media coverage from *Good Morning America*; CNN's *Paula Zahn* Now; National Geographic / Zig Zag Productions documentary; the *Wall Street Journal*, the *Arizona Republic* and *Scottsdale Tribune*; international coverage in the United Kingdom, Belgium, Germany, Switzerland, Australia, and Italy. In addition, a Barbara Walters special was filmed that will be aired by ABC in 2008.
- Held 2006 Conference in Scottsdale to record crowd.
- Revamped *Cryonics* magazine design and content.
- Website was updated regularly and experienced record traffic.

Management

- Operated on the basis of a formal budget, ending the year with a positive revenue
- Developed a 3-year plan, mapping out our long-term organizational objectives

2006-6th Alcor Conference Highlights

By Chang Williford

The 6th Alcor Conference brought together many old friends, as well as an assortment of new faces. Attendees praised the quality of the presentations, which ranged in topics from practical information about cryonics today to the supporting sciences, historical background of the industry, and visions of what the future may hold. Read on for a condensed commentary of the presentations. To access each presentation in entirety with audience questions, order your copy of the 6th Alcor Conference DVD Set. See the inside cover for ordering details.

Missed the Conference?

Purchase the conference DVD Set and get all the info.

See details on inside front cover.

Theodore C. Kraver, Ph.D. *The Early Days*

Ted Kraver started off the conference with a first-hand account of the history of cryonics. Bringing the audience "insider" information concerning the development of the earliest cryonics organizations, Dr. Kraver shared several rarely seen documents of historic value and took the audience back to the 1960s, when the scientific milieu of the era spawned technological capabilities for cryonics.

At that time, NASA's burgeoning space exploration program set the pace for scientific innovation. According to Dr. Kraver, NASA performed several cryogenic experiments in fuel tank design during the early 1960s, and early cryonicists, including Dr. Kraver, used information gathered from these experiments to design the first "cryocapsules" for long-term care of cryonics patients.

Dr. Kraver's presentation focused largely on the contributions of the first cryonics enterprise, CryoCare Equipment Company —a collaboration between Dr. Kraver and Ed Hope founded in 1965—which created the first cryocapsules. In 1967, Dr. Kraver participated in the cryopreservation of the first cryonics patient, Dr. James Bedford. The resulting "media frenzy" made cryonics the topic of myriad talk shows and newspaper columns, and *Life* magazine featured the story. Thus the first steps in cryonics were taken.

Cryonics Organizations Today Panel

Fifty percent of conference attendees were Alcor members, while the other half were not. To help everyone understand the industry as a whole, this panel offered a brief introduction to cryonics organizations active today. The panel was comprised of Ben Best (Cryonics Institute), Melody Maxim (Suspended Animation, Inc.), and Tanya Jones (Alcor Life Extension Foundation).

Cryonics Institute (CI), located in Clinton Township, Michigan, is the only other cryonics organization in the U.S. besides Alcor to provide both cryopreservation and long-term care for its patients. President Ben Best discussed membership in CI as a backup to Alcor membership and stressed the importance of cryonics organizations working together.

Suspended Animation, Inc., located in Boynton Beach, Florida, is not a membership organization, but provides standby and stabilization services to cryonics organizations. It is also involved in the improvement of stabilization and cryopreservation technologies. Melody Maxim, Perfusionist, overviewed projects underway at Suspended Animation, including stabilization equipment and two emergency transport vehicles.

Alcor Life Extension Foundation, located in Scottsdale, Arizona, is the world's longest-running cryonics organization. Tanya Jones, Chief Operating Officer, gave an extensive overview of the necessary elements of a cryonics organization, including membership, clinical readiness, and technical development. Alcor's growth in clinical readiness was presented, including several pieces of upgraded field equipment and Alcor's emergency transport vehicle. To emphasize the importance of improving stabilization networks, she described Alcor's training sessions for standby-stabilization teams held worldwide. Increased support in the medical community is furthered by producing publishable research, which Alcor is pursuing via the development of a cardiopulmonary bypass lab to test cryopreservation medications and perfusion protocols.

Cryonics Public Policy Panel

In recent years Alcor has become proactively involved in local politics. Arizona state representatives Linda Lopez (D) and Michele Reagan (R) enjoyed a lively discussion of political issues concerning cryonics. The panel discussion, moderated by Alcor public policy consultant Barry Aarons, focused on Alcor's success in battling legislation proposed in 2004 that would have inappropriately caused Alcor's operations to be regulated by the funeral industry. Both Representatives Lopez and Reagan opposed this legislation and have continued to be

supportive of Alcor's public policy objectives.

The two representatives' personal views concerning Alcor were insightful. Ms. Lopez stressed her belief that Alcor's research is important, benefits other technologies and scientific progress, and makes Arizona a focal point for biotechnology. She is enthusiastic about helping others understand Alcor's potential and relevance. Ms. Reagan's opposition to excessive government regulation of business was the major factor contributing to her opposition of the bill. Many businesses come to Arizona because of the regulation-free environment, which encourages growth.

The panel members concluded by offering specific advice for successfully discussing important topics with legislators, such as end-of-life choices. Both representatives strongly encourage polite, personal contact and one-on-one communication with legislators, which is most effective when they are not in session.

Ralph Merkle, Ph.D.
Nanotechnology and Cryonics

The renowned Dr. Ralph Merkle presented conference attendees with a frank discussion in his area of expertise: nanotechnology. "Nanotechnology will allow us to arrange atoms in any way allowed by physical law," Dr. Merkle enthused, which will have a huge impact on medical technology.

For example, imagine the impact of amazingly small and powerful computers on the order of 10^{21} bits that are the size of just a few sugar cubes. Such powerful machines, at sizes that will fit in the circulatory system, will have many astonishing medical capabilities. Currently, medicine is limited to only *assisting* cellular self-repair. The advent of molecular nanotechnology, however, will enable the direct repair of cells molecule-by-molecule.

Cryonics, according to Dr. Merkle, is the cryogenic cooling of tissues, using the best current technology, until they can be rewarmed and repaired by future technology. The procedure is simple: you select your subjects, cool them, wait a period of time, and see if medical technology in the future is capable of resuscitating them. Dr. Merkle argues that one can either be part of the experimental group (cryonics patients) or the control group (non-cryonics patients). There are only two outcomes—either cryonics will work or it won't—and there is only one way to find out for yourself what the outcome will be—participate in the experiment!

Dr. Merkle engaged the audience by explaining that cryonicists dispute the diagnosis of death, or rather, "We want a second opinion from a future physician." Problems with the diagnosis of death have always existed, and current definitions of death still suffer from uncertainty. Declaration of death is now a pragmatic decision made by physicians today that *current* technologies cannot revive

the patient. In contrast, Dr. Merkle defined death as *information theoretic death*, or the point at which "the brain is destroyed to such a degree that future technologies will not or cannot restore function." In other words, the *information* in the brain is permanently lost.

Studies documenting cryopreservation of tissues will give us clues as to whether the structure of the brain can be successfully preserved to such an extent that future nanotechnologies can repair it. But Dr. Merkle is quite confident, proclaiming, "We *will* be capable of complete structural analysis and repair at the level of atoms and molecules."

Robert A. Freitas Jr., J.D.
Nanomedicine and Medical Nanorobotics: The Path Forward

Following up Dr. Merkle's introduction to nanotechnology, Dr. Robert Freitas delved into the highly specific field of nanomedicine.

He began by defining nanomedicine as "preserving and improving human health by using molecular tools and molecular knowledge of the human body" (ref. Nanomedicine vol. 1, 1999). He then gave a multitude of images and animations, bringing to life examples of possible future nanotechnological devices and applications, as described in his series of books and papers on the topic, "Nanomedicine." Among the most interesting were: "respirocytes," or self-contained nanorobots used

in emergency treatments to release oxygen to tissues during cardiac arrest; "vasculocytes," which detect vascular lesions and form arterial bondage to debride/clean and rebuild the site; "clottocyes" to assist in blood clotting; neural monitoring nanorobots; and cell repair nanorobots such as "vasculoids," which would replace blood entirely.

Dr. Freitas admitted that such robots would be extremely complex, and spent much of the remainder of his talk describing ideas for how to build nanorobots. He noted that diamonds have "superior properties" and that stiff hydrocarbons will be most important to the building of nanorobots, so mechanosynthesis of diamond atom-by-atom at the molecular scale will be necessary to construct nanorobots.

The level of detail offered by Dr. Freitas indicates his firm grasp on what it will take to achieve his goals, and served to emphasize how very far away we still are from such technological advancements. However, his excitement regarding the prospect of nanomedicine in medical treatment, especially as it applies to cryonics, was evident and appreciated.

Aubrey de Grey, Ph.D.
SENS: A Precursor to Cryonic Revival

To those familiar with Dr. Aubrey de Grey's work, the information he presented in *SENS: A Precursor to Cryonic Revival* was an exciting mixture of his long-established ideas about postponing and defeating aging with new thoughts on how to "make a better case for the feasibility of cryonics."

Initially, Dr. de Grey spoke about the company he co-founded, Methuselah Mouse Foundation, and the Methuselah Mouse Prize (MPrize), which offers a cash reward to the scientific team that significantly increases the average lifespan of the mouse (www.mprize.org). He explained that biogerontologists understand aging quite well, but have barely begun understanding the complexity of how cells work, so stopping them from being damaged (which causes aging) is quite a tall order. Dr. de Grey's solution to the aging problem focuses on repairing the cellular damage as it occurs. His Strategies for Engineered Negligible Senescence plan (SENS) consists of several major milestones necessary for successful reversal of aging, a feat which he feels will prepare society for the awesome achievement of repairing cryonics patients.

In regards to the issue of public relations in cryonics, Dr. de Grey asks why it is difficult to "sell" cryonics to the masses. One of the reasons, he argues, is skepticism about the feasibility of reviving cryopreserved patients. He suggests arguments that amount to "2 + 2 = 4"—simple, straightforward illustrations of how advances in medicine, neuroscience, and cryobiology will ultimately lead to technologies applicable to the success of cryonics.

Dr. de Grey guesses that, at the rate of current progress, ten years from now we may have rejuvenated middle-aged mice, and that gerontologists and the public will expect the same for humans within a timeframe of a few decades. The "2 + 2" logic leading to cryonics will be hard to escape at that point. For the first time ever, one of the most oft-cited reasons people give for not signing up for cryonics will be eliminated.

Tanya Jones
Alcor's Wealth Preservation Trust

Alcor's chief operating officer, Tanya Jones, reported on the current state of Alcor's wealth preservation trust, a mechanism for enabling Alcor members to set aside assets for their potential revival. The trust is not yet

complete, but needed to be discussed since interest is so high among Alcor members.

The wealth preservation trust includes a master trust, under which each individual will have a separate "sub-trust" in their name, which segregates the trust assets. Trust assets can be released while a cryonics member is still alive if they become incapacitated and require funding for ongoing healthcare. Assets may also be released while a patient is in cryopreservation for accelerating revival, or after revival for supporting the reintegration process (e.g., education, physical therapy, and other services for social reintegration). One percent of the assets go to Alcor to support the long-term care of the patient.

To address the best interests of the patient, Alcor has developed the role of trust "protector", who serves as an advocate for cryonics patients (who can no longer speak for themselves) and who keeps an eye on trustees to ensure that the money is invested wisely. Protectors have responsibilities as well, including establishing the identity of the revived individual as the same person.

Many decisions are yet to be made at the Board level concerning how to incentivize the trust to ensure protectors and the trustees fulfill their duties. And, because Alcor has observed several instances of members' individual trusts being broken when families contest cryopreservation, the wealth preservation trust is irrevocable. Further, Alcor is taking the "strength in numbers" approach, hoping that the master trust will grow quickly enough to ensure that individual sub-trusts will be less vulnerable to external attack.

J. Storrs Hall, Ph.D.
A Door into Summer

Speculation over the state of the world into which cryonicists will enter when revived began with Dr. J. Storrs Hall's talk. Dr. Hall wanted audience members to envision some of what the future might be like upon revival, from physical modifications to reduced legal or moral restrictions. If you are revived, he said, it's safe to assume you should not be surprised to find a variety of amazing new technological capabilities (otherwise you wouldn't be there!).

Dr. Hall believes that the capabilities of future technology may not be wholly dependent upon nanotechnology, but that the control of the structure of matter at the molecular level will be necessary for recovering information from damaged brains and for building bodies around brains. Futhermore, he professes, "by the time we are able to read out the information in a cryopreserved brain, the computing power and the science necessary to build intelligent machines will be here and be cheap."

Predicting that such capabilities will lead to an intellectual revolution impacting the world as much as the industrial revolution did, he envisions machines doing all work. There will be nothing a human being can do better than a machine (including thinking), and this combination of artificial intelligence and nanotechnology will produce things that are as detailed in structure and design as life itself, at rates far faster than life is capable of in nature. "And finally," referring to the future that has so-long been promised to us, "we *will* have flying cars."

David Friedman, Ph.D.
If Life Were a lot Longer: An Economist's View

Dr. Friedman further entertained the societal issues that will be encountered if the aging problem is solved. Although necessarily speculative, Dr. Friedman immediately clarified that he intended only to make predictions for the one hundred years following the elimination of aging because "beyond a century my crystal ball goes to mist."

He started by disputing that overpopulation would be a necessary outcome of life extension because the advanced society that is capable of reversing aging should also have colonized space for housing the ever-growing population. He then imagined the many new choices that a person might have upon the elimination of aging. Would you stay in your current career permanently, or would you change careers periodically? And it is marriage still "'til death do us part?"

Dr. Friedman envisions the hypothetical person in the future as having a "life of projects," continually learning new skills and moving from one project to the next throughout the course of life. Switching partners or careers every fifty years is dependent on "whether experience is a bug or a feature." For example, if everyone switches jobs every fifty years then experience in any given field will plateau at a certain level. However, if some people stay in their chosen fields indefinitely, experience becomes a problem.

Lastly, Dr. Friedman discussed the economics of cryopreservation and the fundamental problem of ensuring that people remain interested in keeping a patient cryopreserved, reviving them, and returning their possessions. Alcor's solution to this problem includes contract law and an organization that is run by enthusiasts who want the same for themselves. But will this strategy work over one hundred years? People, boards, laws, and social norms all change. Avoiding cryopreservation through life extension, he says, is the best solution because it will protect patients from becoming old and weak in the first place and their children will live longer and have a stronger interest in their parents' long-term care.

Stephen J. Van Sickle
Technical Progress at Alcor

Steve Van Sickle, Executive Director of Alcor, updated conference attendees on the current state of research at Alcor, including investigation of the effects of ischemia (lack of blood flow) and stress-fractures on biological tissues, whole body cryopreservation research and development, and improvements to Alcor's ability to transport cryopreserved patients from extensive distances.

To begin, Mr. Van Sickle described Alcor's research findings. First, Mr. Van Sickle discussed how ischemia affects the brain over time. He presented some preliminary data from Alcor's former Research Scientist Dr. Sergey Sheleg, which indicate that structural damage to neurons is not severe until 6+ hours of ischemia.

Another challenge in cryonics is finding a way to avoid the tissue fracturing that occurs during the cryopreservation process. Alcor is currently researching the problem using polarized light and a simple web camera in a custom-built device to image the thermal stresses caused by rapid cooling.

Whole-body vitrification research is high on Alcor's research agenda, and Alcor is establishing a rat model of cardiopulmonary bypass (CPB). Mr. Van Sickle discussed the historical complications of the establishment of this model of CPB, particularly the lack of miniaturization of circuit components until very recently. Using this model, Alcor will be able to more easily and economically investigate the effects of hypothermia and cryoprotection on the whole body.

Alcor is interested in improving the perfusion of cryoprotectants and increasing cooling rates in order to reduce the toxicity of cryoprotectants used in whole body vitrification. To that end, Mr. Van Sickle announced a newly-designed cryoprotectant mixing reservoir and temperature-controlled surgical capabilities which allows for the ability to cool patients *in situ* to -100°C.

Lastly, Mr. Van Sickle documented progress made toward improvements in patient stabilization and transport, including a liquid ventilation prototype to induce rapid cooling by pumping chilled perfluorocarbons in and out of the lungs, a redesigned Portable Ice Bath (PIB), an Air Transportable Perfusion (ATP) system, and a cryogenic transport container.

Brian Wowk, Ph.D.
The Cryobiological Basis of Cryonics

Dr. Brian Wowk provided an excellent introduction to cryobiology as the field applies to cryonics while also participating in one of his favorite hobbies, dispelling cryonics myths.

Dr. Wowk dispelled such myths as "freezing bursts cells", "cryoprotectants cannot penetrate organs", and "only tiny things can be vitrified." He also shared current views of mainstream cryobiologists on cryonics (ranging from disdain to academic indifference), tissue regeneration technology, and the importance of nanomedicine for repair of the brain (the only organ that absolutely cannot be casually replaced). Ultimately, he said, "the brain is the key to reversibility of injury in future medicine."

Dr. Wowk offered the benefit of his expertise by addressing how cellular damage can be prevented for cryonics patients. Introducing cryoprotective agents vastly reduces damage to cells during the freezing process by limiting the extent of ice crystal formation. However, though individual cryopreserved cells remain intact, connections between cells are severed. For most organs, function cannot be recovered.

Dr. Gregory Fahy's proposed solution to this problem is to load the tissue with so much cryoprotectant that freezing cannot occur at any temperature: vitrification. This literally means that the liquid inside the tissue converts to a glass instead of freezing; there's no structural damage to the tissues or the delicate connections among cells. Importantly, the experiments carried out at 21st Century Medicine have demonstrated reversible vitrification and re-implantation of a rabbit kidney with subsequent long-term survival of the rabbit.

Then there is the question of whether memory is retained in a cryopreserved patient. To address this, Dr. Wowk first clears up a common misconception—that "stopping a brain kills it." Contemporary medical textbooks state that secondary memories remain intact after brain deactivation (due to anesthesia, cooling, etc.); therefore secondary memory must result from a physical or chemical alteration in synapses.

So memory can survive brain deactivation and the physical structure underlying it can be preserved by vitrification, but that's still not proof that the memories remain. Despite the successes in rabbit kidneys and the extremely good preservation of tissue, vitrification with current technology often results in loss of viability, or the ability to spontaneously recover due to biochemical injuries caused by the cryoprotective agent. So current brain cryopreservation methods are good but not reversible. Drs. Pichugin's and Fahy's recent demonstration of reversible cryoprotection in rat *brain slices* is promising, but does not prove *whole brain* cryopreservation is currently reversible. Dr. Wowk was emphatic in his assertion that we must do the research in order to achieve a demonstrably reversible cryopreservation of the brain in a suitable animal model. Perhaps this will lead to a conclusive answer as to whether memories can survive the cryopreservation process.

Dr. Wowk ended with his proposal for the logical sequence of the cryobiological study of cryonics: (1) continued improvement in structural and biochemical preservation of the brain; (2) explicit demonstration of memory preservation; (3) reversible cryopreservation of the whole brain; (4) continued improve-

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ment in structural and biochemical preservation of the rest of the body; and (5) eventually, whole body suspended animation.

Gregory M. Fahy, Ph.D.
Research Toward Whole Body Suspended Animation

Adding to the information presented by his colleague Brian Wowk, Dr. Gregory Fahy explored the outer limits of reversibility of cryopreserving whole organisms. Cryonics, he said, is a balance between trying to make cryopreservation as reversible as possible and trying to master the repair process. The parties involved (i.e., cryobiologists and nanotechnologists) are working mightily to meet in the middle, but cryobiologists would like to be able to tackle the entire problem themselves. Might it be possible to reverse cryopreservations without nanomedicine?

In principle, said Dr. Fahy, there are two paths to successful suspended animation: (1) we can perfect preservation organ by organ and then look back to see if there is a common denominator method that we can apply to the whole body, or (2) we can start investigating whole body cryopreservation in a straightforward manner. Much work has already been accomplished using the "part by part" method. Dr. Fahy reported that there has been spectacular success in preserving the guinea pig uterus. Isamu Suda's experiments on cryopreserved cat brains are also very encouraging and attest to the hardiness of mammalian nervous tissue after freezing. The most spectacular success, though, has been the preservation of dog intestine at liquid nitrogen temperatures which resumed normal functioning after transplantation.

Several mammalian tissues and organs have been reversibly preserved by vitrification, including kidneys. Dr. Fahy reported that brains vitrify consistently and that structure is astonishingly well-preserved. Electrophysiology on cryopreserved rabbit hippocampal slices by Dr. Tan of 21st Century Medicine shows promising indications of recovery of electrical responses and viability as measured by the sodium-potassium ratio assay.

Even so, vascular tissue is still a huge problem, as freezing under normal conditions may freeze over 80 percent of the water in the tissue causing rupturing. This is certainly an issue that remains to be properly addressed.

Dr. Fahy performed exploratory work on whole body vitrification a few years ago. In these experiments, three rabbits were vitrified. Dr. Fahy and his fellow researchers looked at tissue samples from these three experiments and found very little ice formation in all tissues (less than 10 percent, in most cases). They also discovered that the kidney exhibited the most ice formation, suggesting that Dr. Fahy inadvertently chose as his life's work the most difficult organ in the whole body to vitrify!

Dr. Fahy's final point was that there is still a large gap between vitrifiability and viability. While research into vitrification of single organs provides useful information, cooling and rewarming rates in the whole body are going to be vastly different. This is a huge problem that is going to take a long time to solve, but the progress made to date has been extremely encouraging. Thus, Dr. Fahy concludes that suspended animation is not an unreasonable research goal. ■

Tech News: R. Michael Perry Ph.D.

Face Transplant Woman Can Smile

The recipient of the first partial face transplant has recovered so well she can go out without people noticing her scars, her surgeon has said. Isabelle Dinoire, from Amiens, France, received the graft from a brain-dead donor after being mauled by her dog. Her surgeon, Bernard Devauchelle, said she continues to make excellent progress and that he plans to carry out more operations. Mrs. Dinoire has told him she can smile and looks like herself again.

BBC News
11/28/06
http://news.bbc.co.uk/1/hi/health/6190612.stm

Experts Crack Cancer "Gene Codes"

US scientists have cracked the entire genetic code of breast and colon cancers, offering new treatment hopes. The genetic map shows that nearly 200 mutated genes, most previously unknown, help tumors emerge, grow and spread. The discovery could also lead to better ways to diagnose cancer in its early, most treatable stages, and personalized treatments, *Science* magazine reports. The Johns Hopkins Kimmel Cancer Center says the findings suggest cancer is more complex than experts had believed. Each individual tumor appeared to have a different genetic blueprint, which could explain why cancers can behave very differently from person to person, the scientists said.

BBC News
10/28/06
http://news.bbc.co.uk/1/hi/health/5325206.stm

Shaped-beam Radiosurgery Finds Success Treating Tiniest Lung Tumors

Patients with metastatic cancer tumors in their lungs are much more likely to live disease-free if they have an experimental treatment involving shaped-beam radiosurgery rather than conventional treatment, according to a University of Rochester Medical Center study. The research, presented this week at the American Society of Therapeutic Radiology and Oncology conference in Philadelphia, offers a new option for the tens of thousands of patients annually who must cope with cancer that has spread to their lungs. Usually when the disease advances to that stage, the average survival time is 12 months and treatments are limited. In this study, some patients who were treated more than three years ago still have not had the disease spread. Shaped-beam, radiosurgery technology was originally designed for destroying brain tumors. Rochester oncologists are expanding its use to other parts of the body, studying whether it can be used to destroy other soft-tissue tumors that were previously considered untreatable. This includes tumors in the liver, adrenal glands and spine.

Science Daily
11/12/06
www.Science Daily.com/releases/2006/11/061108154429.htm

Multifunctional Nanoparticles Image and Treat Brain Tumors

Combining two promising approaches to diagnosing and treating cancer, a multidisciplinary research team at the University of Michigan has created a targeted multifunctional polymer nanoparticle that successfully images and kills brain tumors in laboratory animals. Writing in the journal Clinical Cancer Research ("Vascular targeted nanoparticles for imaging and treatment of brain tumors"), the research team, led by Brian Ross, Ph.D., Alnawaz Rehemtulla, Ph.D., Raoul Kopelman, Ph.D., and Martin Philbert, Ph.D., describes its development of a 40-nanometer-diameter polyacrylamide nanoparticle loaded with a photosensitizing agent, known as Photofrin, and iron oxide. When irradiated with laser light, Photofrin triggers the production of reactive oxygen species that destroy a wide variety of molecules within a cell. The iron oxide nanoparticles function as a magnetic resonance imaging (MRI) contrast agent.

Nanowerk News
12/4/06
www.nanowerk.com/news/newsid=1094.php

Buildup of Damaged DNA in Cells Drives Aging

The accumulation of genetic damage in our cells is a major contributor to how we age, according to a study being published Dec. 20 in the journal *Nature* by an international group of researchers. The study found that mice completely lacking a critical gene for repairing damaged DNA grow old rapidly and have physical, genetic and hormonal profiles very similar to mice that grow old naturally. Furthermore, the premature aging symptoms of the mice led to the discovery of a new type of human progeria, a rare inherited disease in which affected individuals age rapidly and die prematurely. "These progeroid mice, even though they do not live very long, have remarkably similar characteristics to normal old mice, from their physical symptoms, to their metabolic and hormonal changes and pathology, right down to the level of similar changes in gene expression," said corresponding author Jan Hoeijmakers, Ph.D., head of the department of genetics at the Erasmus Medical Center in Rotterdam, Netherlands. "This provides strong evidence that failure to repair DNA damage promotes aging…"

Eurekalert
12/20/06
www.eurekalert.org/pub_releases/2006-12/uopm-bod121406.php

Cancer-Killing Invention Also Harvests Stem Cells

Associate Professor Michael King of the University of Rochester Biomedical Engineering Department has invented a device that filters the blood for cancer and stem cells. When he captures cancer cells, he kills them. When he captures stem cells, he harvests them for later use in tissue engineering, bone marrow transplants, and other applications that treat human disease and improve health. With Nichola Charles, Jared Kanofsky, and Jane L. Liesveld of the University of Rochester, King wrote about his discoveries in *Proceedings of the ASME*, June 2006. King's team includes scientists at StemCapture, Inc., a Rochester company that bought the University patent for King's technique in November 2005 to build the

cancer-killing and stem cell-harvesting devices. The technique can be used in vivo, meaning a device is inserted in the body, or in vitro, in which case the device resides outside of the body—either way, the device kills cancer cells and captures stem cells, which grow into blood cells, bone, cartilage, and fat.

Eurekalert
1/4/07
www.eurekalert.org/pub_releases/2007-01/soea-cia010407.php

Scientists Regenerate Wing in Chick Embryo

Chop off a salamander's leg and a brand new one will sprout in no time. But most animals have lost the ability to replace missing limbs. Now, a research team at the Salk Institute for Biological Studies has been able to regenerate a wing in a chick embryo—a species not known to be able to regrow limbs—suggesting that the potential for such regeneration exists innately in all vertebrates, including humans. Their study, published in the advance online edition of *Genes and Development* on Nov. 17, demonstrates that vertebrate regeneration is under the control of the powerful Wnt signaling system: Activating it overcomes the mysterious barrier to regeneration in animals like chicks that can't normally replace missing limbs while inactivating it in animals known to be able to regenerate their limbs (frogs, zebrafish, and salamanders) shuts down their ability to replace missing legs and tails.

Science Daily
11/19/06
www.Science Daily.com/releases/2006/11/061119114814.htm

On The Cutting Edge: Carbon Nanotube Cutlery

Researchers at the National Institute of Standards and Technology (NIST) and the University of Colorado at Boulder (CU) have designed a carbon nanotube knife that, in theory, would work like a tight-wire cheese slicer. In a paper presented at the International Mechanical Engineering Congress and Exposition (Nov. 2006), the research team announced a prototype nanoknife that could, in the future, become a tabletop tool of biology, allowing scientists to cut and study cells more precisely than they can today. For years, biologists have wrestled with conventional diamond or glass knives, which cut frozen cell samples at a large angle, forcing the samples to bend and sometimes later crack. Because carbon nanotubes are extremely strong and slender in diameter, they make ideal materials for thinly cutting precise slivers of cells. In particular, scientists might use the nanoknife to make 3D images of cells and tissues for electron tomography, which requires samples less than 300 nanometers thick.

Science Daily
11/22/06
www.Science Daily.com/releases/2006/11/061122143831.htm

Web Censorship "Bypass" Unveiled

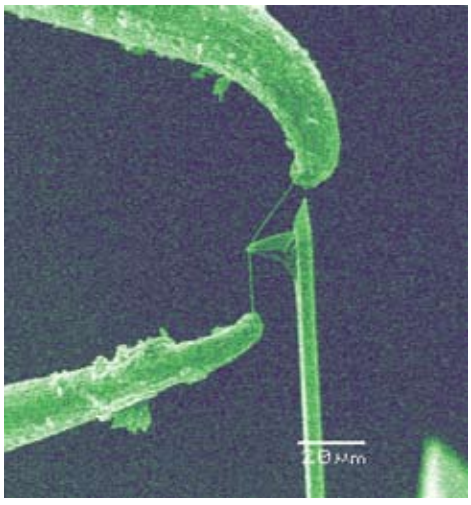
A tool has been created capable of circumventing government censorship of the web, according to researchers. The free program has been constructed to let citizens of countries with restricted web access retrieve and display web pages from anywhere. The University of Toronto's Citizen Lab software, called psiphon, was to be released on 1 December. Net censorship is a growing issue, and several countries have come under fire for blocking online access. But the Citizen Lab, which is based at the Munk Centre for International Studies at the University of Toronto, believes its program will allow surfers to bypass web censorship.

BBC News
11/27/06
http://news.bbc.co.uk/1/hi/technology/6187486.stm

3-D Digital Storage System Could Hold a Library on one Disc

Imagine taking the entire collection of historical documents at the Smithsonian National Air and Space Museum and storing it on a single DVD. University of Central Florida Chemistry Professor Kevin D. Belfield and his team have cracked a puzzle that stumped scientists for more than a dozen years. They have developed a new technology that will allow users to record and store massive amounts of data—the museum's entire collection or as many as 500 movies, for example—onto a single disc or, perhaps, a small cube. "For a while, the community has been able to record data in photochromic materials in several layers," Belfield said. "The problem was that no one could figure out how to read out the data without destroying it. But we cracked it."

Physorg.com
12/4/06
www.physorg.com/news84454118.html



Scanning electron micrograph of a prototype 'nanoknife' shows a single carbon nanotube stretched between two tungsten needles. Triangular probe is the tip of an atomic force cantilever used to determine the breaking point of the knife. (Color added for clarity, Credit: NIST/CU)

MEETINGS

About the Alcor Foundation

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

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

ARIZONA

Scottsdale:
Alcor Board of Directors Meetings—Alcor business meetings are generally held on the first Saturday of every month starting at 11:00 am MST. Guests are welcome. For more information, contact Alcor at (480) 905-1906 ext. 101.

Scottsdale/Phoenix:
Alcor Tours
Tours are held at Alcor at 2:00 pm every Tuesday and Friday.
Call Alcor (877) 462-5267 ext. 101 to schedule an appointment or email dbora@alcor.org.

CALIFORNIA

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

San Francisco Bay:
Alcor Northern California Meetings are held quarterly in January, April, July, and October. A CryoFeast is held once a year. For information on Northern California meetings, call Marek (Mark) Galecki at (408)245-4928 or email Mark_galeck@pacbell.net.

NEVADA

Las Vegas:
There are many Alcor members in the Las Vegas area. If you wish to meet and socialize, contact Katie Kars at (702) 251-1975. This group wants to get to know you!

WASHINGTON

Seattle:
For information on Northwest meetings, call Richard Gillman at (425) 641-5136 or join the e-mail group CryonicsNW at http://groups.yahoo.com/group/CryonicsNW

DISTRICT OF COLUMBIA

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

MASSACHUSETTS

Boston:
A cryonics discussion group meets the second Sunday of each month. For more information, contact David Greenstein at (508) 879-3234, e-mail: davidsgreenstein@juno.com.

TEXAS

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

UNITED KINGDOM

There is an Alcor chapter in England. Its members are working diligently to build solid emergency response, transport, and cryopreservation capability. For information about meetings, contact Andrew Clifford at andrew@banknotes.ws. See the web site at www.alcor-uk.org.

Host a Meeting in your area.

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

NEW ENGLAND

A New England area group meets regularly. For meeting dates and to be included in the group email list please contact either David Greenstein at 508-879-3234 or davegre2000@yahoo.com or Bret Kulakovich at 508-946-4626 (8am-8pm EST) or alcor@bonfireproductions.com.

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, www.alcor.org is one of the best sources of detailed introductory information about Alcor and cryonic suspension. We also invite you to request our **FREE** information package on the "Free Information" section of our website. It includes:

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- A sample of our magazine
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(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!

Step1: 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, cash prepayment is 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.

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