CRYONICS

4th Qtr. 2002 A PUBLICATION OF THE ALCOR LIFE EXTENSION FOUNDATION Volume 23:4

Reports on Alcor's Fifth Conference on Extreme Life Extension

page 4

Ray Kurzweil and His Ramona

page 16

Dialogue between Ray Kurzweil and Eric Drexler

page 18

ALCOR
LIFE EXTENSION FOUNDATION
SINCE 1972

ISSN 1054-4305

$7.50

Cryonics

Vol. 23:4
4th Quarter 2002

COLUMNS

ALCOR UPDATE

Alcor: The Origin of Our Name

In September of 1970 Fred and Linda Chamberlain (the founders of Alcor) were asked to come up with a name for a rescue team for the now-defunct Cryonics Society of California (CSC). In view of our logical destiny (the stars), they searched through star catalogs and books on astronomy, hoping to find a star that could serve as a cryonics acronym. *Alcor,* 80 Ursae Majoris, was just what they had been looking for. It not only had some acronymic "fit" for cryonics but was also symbolic for its historical use as a test for eyesight and was located in a very well known constellation.

Alcor, a companion star of Mizar in the Big Dipper's handle, is approximately 5th magnitude, barely within the threshold of human vision. Additionally, it is quite close to Mizar from an angular standpoint, and dimmer. Only with excellent vision can one tell there are two stars rather than just one. For thousands of years, people in the Middle East have used Alcor as a critical test of visual sensitivity and focus. If you could see Alcor, you had excellent vision indeed. In the early days of cryonics, few people could see the need for a rescue team or even for cryonics itself. Symbolically then, Alcor would be a "test" of vision as regards life extension.

As an acronym, Alcor is a close if not perfect fit with *Allopathic Cryogenic Rescue.* The Chamberlains could have forced a five-word string, but these three seemed sufficient. *Allopathy* (as opposed to *Homeopathy)* is a medical perspective wherein *any treatment that improves the prognosis is valid. Cryogenic* preservation is the most powerful method known to halt the rapid, entropic disorganization of people following clinical death. *Rescue* differentiates a cryonics approach from (yet to be developed) proven suspended animation. The acronymic interpretation of Alcor is therefore *use of a cryogenic procedure, though unproven, to preserve structure and potential viability, since failing to do so allows further disorganization to occur and reduces the probability (prognosis) of reversal and reanimation at any future time.*

Some of these thoughts were presented at a CSC dinner meeting in the autumn of 1970. A number of people who have subsequently become members of the Alcor Life Extension Foundation were present at that gathering. Over the months that followed, it became increasingly evident that the leadership of CSC would not support or even tolerate a rescue team concept. Less than one year after the 1970 dinner meeting, the Chamberlains severed all ties with CSC and incorporated the "Rocky Mountain Cryonics Society" in the State of Washington. The articles and bylaws of this organization specifically provided for "Alcor Members," who were to be the core of rescue team activity. Difficulties in securing nonprofit status in Washington then led to reincorporation in California, this time under the name "Alcor Society for Solid State Hypothermia." In the late 1970s, to further broaden the organization's objectives, the present name (Alcor Life Extension Foundation) was adopted.

Despite many transitions, the symbolism of the name remains. How long will it take for more people to see that "Ashes to ashes and dust to dust" is a meaningless destiny... to see that it is possible to reach for a distant tomorrow and perhaps to attain it... to *see* Alcor for what it really is: a vehicle with which to attempt that fantastic voyage!

—Reprinted from *Cryonics,* August 1984.

Cryonics is a quarterly publication of the **Alcor Life Extension Foundation**

Editor
Lisa L. Lock
llock@winterthur.org

Volume 23:4

4th Qtr. 2002

ISSN 1054-4305

Submissions may be sent via e-mail (jlemler@alcor.org or llock@winterthur.org) in ASCII, Word, or PageMaker format. Mailed submissions should include a PC diskette with the file in any previously mentioned format (although printed text alone will be considered). All submitted media become property of the Alcor Life Extension Foundation unless accompanied by a self-addressed stamped envelope. The Alcor Life Extension Foundation assumes no responsibility for unsolicited manuscripts, photographs, or art. Send all correspondence and submissions to:

Cryonics
Alcor Life Extension Foundation
7895 E. Acoma Dr., Suite 110
Scottsdale, AZ 85260

Visit us on the Web at www.alcor.org

How to Join Alcor

Your research is finally complete. You browsed our web site (www.alcor.org), presented your questions to our Membership Administrator (jennifer@alcor.org), and toured our facility. Now you are ready to establish your membership with Alcor Foundation. Congratulations and welcome!

Upon receipt of your application for membership and application fee, Alcor will send you various membership documents (samples available upon request). After reviewing these documents, you will need to execute them in the presence of two signing witnesses. Perhaps a representative of your local bank can notarize the single document that also requires this official witness. After returning all of your documents to Alcor for approval, you can expect to receive one original copy of each for your personal records.

Most people use life insurance to fund their suspension, although cash prepayment is also acceptable. If you do not already have an insurance policy, Alcor recommends that you apply for one at your earliest convenience, as the underwriting process can last several weeks. Jennifer Chapman, Alcor Membership Administrator, can provide you with a list of insurance agents who have previously written policies for this purpose. These agents can assist you with satisfying Alcor's various funding requirements, such as naming Alcor as the owner and irrevocable beneficiary of your policy and ensuring that your benefit amount is sufficient.

With your membership documents completed and your funding approved by Alcor, you will be issued emergency identification tags engraved with your personal Suspension Number. This is your confirmation that Alcor will provide you with suspension services, should our emergency technicians ever receive a call on your behalf. Certainly, Alcor hopes that you will not need our services anytime soon, but as a member of Alcor you can feel confident that our organization will care for you and your future. Please call 480-905-1906 ext. 113 today to request your application.

TO ALL ALCOR MEMBERS AND THOSE IN THE SIGN-UP PROCESS

Please! Please! Please!

When you move, or change phone numbers (work number as well), change e-mail addresses, or undergo any medical procedure where general anesthesia is used, please inform us as far ahead of time as you can.

Too many times we have tried to contact our members and found out the contact information we have is no longer valid.

Other times we find out well after the fact that a member has undergone a medical procedure with life threatening potential.

Help us to serve you better!
Keep in touch!

The Fifth Alcor Conference on **Extreme Life Extension**

On November 15–17, 2002, leaders in life extension and cryonics came together to explore how the emerging technologies of biotechnology, nanotechnology, and cryonics will enable humans to halt and ultimately reverse aging and disease and live indefinitely.

by Ray Kurzweil

First published on KurzweilAI.net Nov. 22, 2002. Additional reporting by Sarah Black.

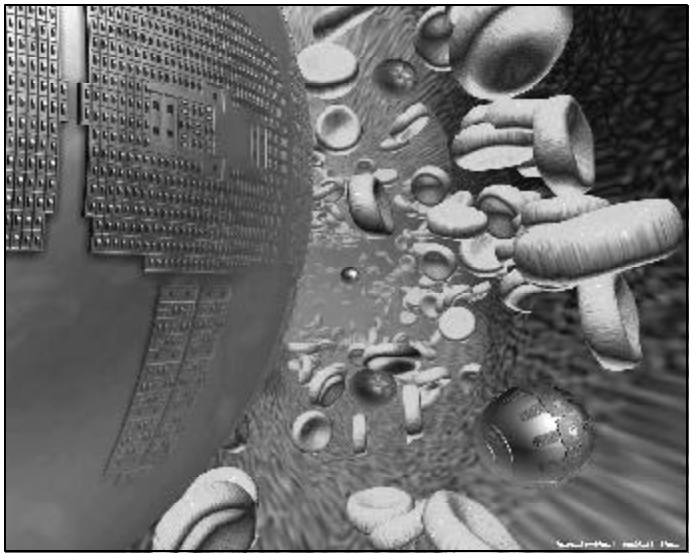
The idea that death is inevitable, which I call the "death meme," is a powerful and pervasive belief held by all humans, with the exception of a small but growing group of life extensionists. The thought leaders of this movement gathered together this past weekend [November 15–17] in Los Angeles to participate in Alcor's Fifth Extreme Life Extension Conference and share ideas on pushing back the end of life. Bringing together longevity experts, biotechnology pioneers, and futurists, the conference explored how the emerging technologies of biotechnology, nanotechnology, and cryonics will enable humans to halt and ultimately reverse aging and disease and live indefinitely.

I had the opportunity to participate in this illuminating and stimulating conference and I report herein on the highlights.

Robert Freitas

Robert Freitas is a Research Scientist at Zyvex, a nanotechnology company, and in my view the world's leading pioneer in nanomedicine. He is the author of a book by the same name and the inventor of a number of brilliant conceptual designs for medical nanorobots. In his first major presentation of his pioneering conceptual designs, Freitas began his lecture by lamenting that "natural death is the greatest human catastrophe." The tragedy of medically preventable natural deaths "imposes terrible costs on humanity, including the destruction of vast quantities of human knowledge and human capital." He predicted that "future medical technologies, especially nanomedicine, may permit us first to arrest, and later to reverse, the biological effects of aging and most of the current causes of natural death."

Freitas presented his design for "respirocytes," nanoengineered replacements for red blood cells. Although they are much smaller than biological red blood cells, an analysis of their functionality demonstrates that augmenting one's blood supply with these high pressure devices would enable a person to sit at the bottom of a pool for four hours, or to perform an Olympic sprint for 12 minutes, without taking a breath. Freitas presented a more complex blueprint for robotic "microbivores," white blood cell replacements that would be hundreds of times faster than normal white blood cells.



E-spaces / E-drenaline / X3D, courtesy of Ph. Van Nedervelde. Designer Robert Freitas.

By downloading appropriately updated software from the

Internet, these devices would be quickly effective against any type of pathogen, including bacteria, viruses, fungi, and cancer cells. Freitas also presented a new concept of a "chromosome replacement robot," which would be programmed to enter a cell nucleus and perform repairs and modifications to a person's DNA to reverse DNA transcription errors and reprogram defective genetic information. Trillions of such robots could be programmed to enter every cell in the body.

How we will get to this kind of technology was the subject of my [Ray Kurzweil's] presentation on the law of accelerating returns at the conference. Communication bandwidths, the shrinking size of technology, our knowledge of the human brain, and human knowledge in general are all accelerating. Three-dimensional molecular computing will provide the hardware for human-level "strong" AI well before 2030. The more important software insights will be gained in part from the reverse-engineering of the human brain, a process well under way. The ongoing acceleration of price-performance of computation, communication, and miniaturization will provide the technologies to create nanobots that can instrument (place sensors in) billions of neurons and interneuronal connections, greatly facilitating the development of detailed models of how human intelligence works.

Once nonbiological intelligence matches the range and subtlety of human intelligence, it will necessarily soar past it because of the continuing acceleration of information-based technologies, as well as the ability of machines to instantly share their knowledge. Intelligent nanorobots will be deeply integrated in the environment, our bodies and our brains, providing vastly extended longevity, full-immersion virtual reality incorporating all of the senses, experience "beaming," and enhanced human intelligence. The implication will be an intimate merger between the technology-creating species and the evolutionary process it spawned.

Aubrey de Grey

Aubrey de Grey, a researcher at the University of Cambridge, began his talk by citing the fact that 100,000 people die of age-related causes each day, and then quoted Bertrand Russell's statement that "some of us think this is rather a pity." (Albeit Russell was talking about nuclear war rather than aging.) De Grey described a program he has devised to approach the goal of extreme life extension "with a hard-headed, engineering frame of mind." He described his goal as "engineered negligible senescence," referring to the term "negligible senescence" that Tuck Finch introduced in 1990, defined as "the absence of a statistically detectable inverse correlation between age and remaining life expectancy."

Human society takes for granted the existence of this inverse correlation (between age and remaining life expectancy), but de Grey explained why he feels we have the knowledge close at hand to flatten out this curve. His program (to develop engineered negligible senescence) "focuses mainly on those subtle changes, the ones that accumulate throughout life and only snowball into pathology rather late. That's why 'engineered negligible senescence' is an accurate term for my goal—I aim to eliminate those subtle changes, so allowing the cell/organ/body to use its existing homeostatic prowess to maintain us in a physically un-deteriorating state indefinitely."

De Grey argued persuasively for the feasibility of this goal and described a multifaceted program to address each known area of aging, including his area of specialty in mitochondrial mutations and lysosomal aggregates. He proposed an "Institute of Biomedical Gerontology," with a budget of $100 million, to promote, coordinate, and fund the focused development of these rejuvenation biotechnologies.

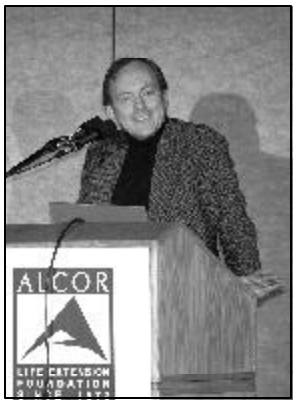
Christine Peterson

Christine Peterson, cofounder and President of the Foresight Institute, provided guidelines on how the lay person can evaluate the often conflicting advice and information on health and life extension. Christine pointed out that as knowledge becomes increasingly specialized, no one person can be an expert in every treatment intervention, so "we are all lay persons" even if we have expertise in some particular aspect of health treatment. She pointed out the destructive implications of the benign sounding creed of the medical profession, "first of all, do no harm." Because of the extremely cautious, risk-adverse orientation that this principle fosters, treatments desperately needed by millions of people are tragically suppressed or delayed.

Max More

Max More, President of the Extropy Institute, and the Futures specialist at ManyWorlds, Inc., presented what he called a "strategic scenario analysis for your second life." More described his own culture shock at having moved from England to Southern California, which led him to consider the extreme adjustment challenge for people (possibly himself) in the future being reanimated from cryonic suspension. More pointed out that "to maximize our chances of a psychologically successful revival, we have the responsibility to prepare ahead of time." Using the discipline of scenario thinking from his consulting work, More engaged in a series of thought experiments that he would encourage people to engage in who have made the decision to be cryonically suspended should they happen to die.

Michael West, President and CEO of Advanced Cell Technology, Inc., and a pioneer of therapeutic cloning, presented a compelling history of the science of cellular aging. He emphasized the remarkable stability of the immortal germ line cells, which link all cell-based life on Earth. He described the role of the telomeres, a repeating code at the end of each DNA strand, which are made shorter each time a cell divides, thereby placing a limit on the number of times a cell can replicate (the "Hayflick limit"). Once these DNA "beads" run out, a cell becomes programmed for cell death. The immortal germ line cells avoid this destruction through the use of a single enzyme called telomerase, which rebuilds the telomere chain after each cell division. This single enzyme makes the germ line cells immortal, and indeed these cells have survived from the beginning of life on Earth billions of years ago.



Michael West

This insight opens up the possibility of future gene therapies that would return cells to their youthful, telomerase-extended state. Animal experiments have shown telomerase to be relatively benign, although some experiments have resulted in increased cancer rates. There are also challenges in transferring telomerase into the cell nuclei, although the gene therapy technology required is making solid progress. West expressed confidence that new techniques would provide the ability to transfer the telomerase into the nuclei, and to overcome the cancer issue. Telomerase gene therapy holds the promise of indefinitely rejuvenating human somatic (non–germ line) cells, i.e., all human cells.

West addressed the ethical controversies surrounding stem cell therapies. He pointed out a number of inconsistencies in the ethical position of those who oppose stem cell therapies. For example, a fetus can divide in two, within the first two weeks after conception and prior to implantation in the mother's womb, to create identical twins. This demonstrates that a unique human life is not defined by a fertilized egg cell, but only by an implanted embryo. Stem cell therapies use fetal cells prior to this individuation process. West pointed out the dramatic health benefits that stem cell therapies promise, including the ability to create new cells and organs to treat a wide variety of diseases such as Parkinson's disease and heart disease. West also described promising new methodologies in the field of "human somatic cell engineering" to create new tissues with a patient's own DNA by modifying one type of cell (such as a skin cell) directly into another (such as a pancreatic Islet cell or a heart cell) without the use of fetal stem cells.

Greg Fahy, Chief Scientific Officer of 21st Century Medicine, formerly director of an organ cryopreservation program at the American Red Cross and a similar program for the Naval Medical Research Institute, described prospects for preserving organs for long periods of time. He pointed out how we now have "the ability to perfuse whole kidneys with cryoprotectants at concentrations that formerly were uniformly fatal, but which currently produce little or no injury."

Greg Fahy

The immediate goal of Fahy's research is to preserve transplant organs for substantially longer periods of time than is currently feasible. Fahy pointed out that by combining these techniques with the therapeutic cloning technologies being developed by Michael West and his colleagues, it will be possible in the future for people to keep a supply of replacements for all of their organs, to be immediately available in emergencies. He painted a picture "of the future when organs are grown, stored, and transported as easily as blood is today."

To suggest a way to make it to that future, I [Ray Kurzweil] had the opportunity to present a set of ideas to apply our current knowledge to life extension. My earlier presentation focused on the nature of human life in the 21st century, whereas this presentation described how we could live to see (and enjoy!) the century ahead. These ideas are drawn from an upcoming book, *A Short Guide to a Long Life*, which I am coauthoring with Terry Grossman, M.D., a leading longevity expert.


Ray Kurzweil

These ideas should be thought of as "a bridge to a bridge to a bridge," in that they provide the means to remain healthy and vital until the full flowering of the biotechnology revolution within 20 years, which in turn will bring us to the nanotechnology-AI (artificial intelligence) revolution ten years after that. The latter revolution will radically redefine our concept of human mortality.

I pointed out that the leading causes of death (heart disease, cancer, stroke, diabetes, kidney disease, liver disease) do not appear out of the blue. They are the end result of processes that are decades in the making. You can understand where you are personally in the progression of these processes and end (and reverse) the lethal march toward these diseases. The program that Dr. Grossman and I have devised allows you to assess how longstanding imbalances in your metabolic processes can be corrected before you "fall off the cliff." This information is not "plug and play," but the knowledge is available and can be applied through a comprehensive and concerted effort.

The nutritional program that Dr. Grossman and I recommend provides the best of the two contemporary poles of nutritional thinking. The Atkins philosophy has correctly identified

the dangers of a high-glycemic-index diet as causing imbalances in the sugar and insulin cycle, but does not focus on the equally important rebalancing of omega 3 and omega 6 fats, and cutting down on the pro-inflammatory fats in animal products. Conversely, the low-fat philosophy of Ornish and Pritikin has not placed sufficient attention on cutting down on high-glycemic-index starches. Our program recommends a moderately low level of carbohydrates, dramatic reductions in high-glycemic-index carbohydrates, as well as moderately low levels of fat, with an emphasis on the anti-inflammatory Omega-3 fats found in nuts, fish, and flaxseed.

A study of nurses showed that those nurses who ate at least a handful of nuts (one ounce) each day had 75% less heart disease than the nurses who did not eat nuts. Our program also includes aggressive supplementation to obtain optimal lipid levels, reduce inflammation, correct potential problems with the methylation (folic acid) cycle, attain and maintain an optimal weight, and maintain glucose and insulin levels in a healthy balance.

Eric Drexler

In a rare lecture, Eric Drexler, author of *Engines of Creation*, the seminal book that introduced the field two decades ago, and widely regarded as the father of nanotechnology, reflected on the state of the nanotechnology field and its prospects. Drexler pointed out that the term "nanotechnology" has broadened from his original conception, which was the precise positional control of chemical reactions to any technology that deals with measurements of less than 100 nanometers. Drexler pointed to biology as an existence proof of the feasibility of molecular machines. Our human-designed machines, Drexler pointed out, will not be restricted to the limitations of biology. He said that although the field was initially controversial, no sound criticism has emerged for his original ideas. Drexler dramatically stated, "I therefore declare victory by default."

Drexler cited the powerful analogy relating atoms and bits to nanotechnology and software. We can write a piece of software to perform a certain manipulation on several numbers. We can then use logic and loops to perform that same manipulation billions or trillions of times, even though we only have to write the software once. Similarly, we can set up nanotechnology systems to perform the same nanoscale mechanical manipulations billions or trillions of times and in billions or trillions of locations.

Drexler described the broad applicability of nanotechnology to revolutionize many areas of human endeavor. We will be able to build supercomputers that are one thousandth of the size of a human cell. We will be able to create electricity-generating solar panels at almost no cost. We will be able to build extremely inexpensive spacecraft out of diamond fiber. "The idea that our human world is limited to the Earth is going to be obsolete very soon, as soon as these technologies become available," Drexler pointed out. Indeed, all manufacturing will be revolutionized. Nanotechnology-based manufacturing will make feasible the ability to create any customized product we can define at extremely low cost from inexpensive raw materials and software.

With regard to our health, nanotechnology will be able to reconstruct and rebuild just about everything in our bodies. Nanoscale machines will enter all of our cells and proofread our DNA, patch the mitochondria, destroy pathogens, remove waste materials, and rebuild our bodies and brains in ways unimaginable today. Drexler defined this goal as "permanent health."

Drexler expressed optimism for the prospects of successful reanimation of cryonically preserved people. Nanorobots will be able to assess, analyze, and investigate the state of the preserved cells, tissues, and fluids; perform microscopic and nanoscopic repairs on every cell and connection, and remove cryopreservatives. He chided other cryonics supporters for making the "pessimistic argument" that although cryonics had only a small chance of working, this chance was better than the alternative, which provided no chance for a second life. Based on our growing knowledge and confidence in nanotechnology and emerging scenarios for applying these technologies to the reanimation task, Drexler argued that we should be expressing a valid optimism about the prospects for a healthy second life after suspension.

Drexler was asked what he thought of the prospects for optical and quantum computing. He replied that optical computers will remain bulkier than programmable molecular computers and thus are likely to remain special purpose devices. As for quantum computing, there are designs for possible room-temperature quantum computers with dozens of qubits, but the prospects for quantum computing are still not clear.

Drexler was pessimistic on the prospects for picotechnology (technology on a scale 1000 times smaller than nanotechnology). He explained that one would need the conditions of a neutron star to make this feasible, and even then there are theoretical problems getting subatomic particles to perform useful functions such as computation.

I would point out that nanotechnology also appeared unlikely until Drexler came along and showed how we could build machines that go beyond the nanomachines of nature. A future Drexler is likely to provide the conceptual designs to build machines that go beyond the picomachines of atomic nuclei and atoms.

I have that penciled in for 2072.

l

After the Dust Has Settled...

Perceptions of the Fifth Alcor Conference at Newport Beach

by
Andrew
Clifford

Like a vintage year for wine, we can safely mark 2002 as a vintage Alcor conference. One that will be remembered a long time for its defining moments, for redirecting thinking, for identifying where we are and listing the agenda ahead. This is a significant achievement, and I will list selected observations to support this.

The conference lasted three days, and many enthusiastic extreme life extensionists drifted into the Newport Marriott on Thursday evening before scheduled events. The venue was superb, located in an affluent and green segment of California, between world-class shops and golfing and boating facilities. Remote hills, ocean, blue skies, and a seemingly insect-free zone completed the picture. Ironically, those who defiantly enjoy life saw little of the attractions of Newport Beach because they were all completely distracted with the business of the conference and the social events woven through it.

Credit is due to the organizational skills of the conference coordinators. With sincere advance apologies to those unnamed—I venture to praise Russ Cheney, Judy Muhlestein, Bruce Cohen, and Paula Lemler, who I saw working from Thursday night throughout the weekend. Jerry Lemler held the fort on Friday, Michael Riskin moderated the all-important Saturday, and Mark Muhlestein officiated on Sunday. Ralph Merkle and Kat Cotter chaired the conference with panache and kept the proceedings and the relationship with the hotel on track. We also owe thanks to the sponsoring companies and to Saul Kent.

Part of the pleasure of conferences is the rare meeting of people who live and work so far apart. Many of us met friends we had not seen for five or ten years. We met people we had often communicated with by phone and e-mail but had never yet seen. And we met those of international fame such as Eric Drexler, Gregory Benford, and Ray Kurzweil. It was three days of social escapism!

It started with the Extreme Life Extension Tutorial session on Friday, which was in one of the smaller rooms calculated for the number of attendees. Needless to say it was a popular attraction, and the crowd swelled and spilled out into the corridor. Several of the main conference speakers took the floor, giving precis of their talks with some in-depth expositions just for this forum. We heard details of Alcor's initiatives on standby, professional conduct, research, and transport network. Hugh Hixon (rarely out of his khaki combat-wear) fielded a series of questions about the patient storage bay, dewars, and perfusion techniques and then was officially recognized as holding the world record for 51 cryonic suspensions. As I write this he has notched up another. We heard about recent nanotech developments, 21st Century Medicine and their research, a strategy for providing a form of immunity to cancer, discussions on neutraceuticals, and even a diversion into quantum computing.

The main conference moved at a brisk pace through the presentations—laptop and laser pen augmented. There was never a dull moment from start to finish.

- *The science of life extension is happening!* Cryonics has left the fringe for the mainstream and is now fitting into place as an enabling technology. Principles of nanotechnology were expounded further by Ralph Merkle, Robert Freitas, and Eric Drexler. Eric put the final nail in the coffin of nano-skepticism. Developments with vitrification at 21st Century Medicine were explained by Brian Wowk and Greg Fahy. Everyone was impressed with the potential viability statistics and how we are getting closer to true "suspended animation." Steve Harris's post-resuscitation cooling experiments show how brain damage can be significantly minimized with benefits for today's hospital medicine. Michael West's exposition of the state of therapeutic cloning was a highlight.

- *Near-immortality without cryonics or nanotechnology*? All credit goes to Aubrey de Grey for a confident exposition of his engineering approach for anti-aging and repair. There are seven classes of cell-related failure driving aging, yet all of them are theoretically treatable with today's technology. What is lacking then is funding and a directed research program to integrate the solutions. Arguably, in ten years time people could start receiving treatment to increase their life span to 500 years or more.

⇨*A bridge to a bridge to a bridge...* Ray Kurzweil summarized the life extensionist strategy of living one more year in order to increasingly gain more months of life span. His rapid-fire slide show of technology curves and lists of neutraceuticals had the auditorium focused on note-taking.

⇨*Death is an outrage!* Robert Freitas was eloquent in defining the waste of human knowledge equal to the destruction of three Libraries of Congress every year and economic loss at trillions of dollars. Extreme life extensionists regard death as avoidable and do not accept it until *biological death* is such that the information loss is overwelming. This fits with a later suggestion that cryonics should be redefined to mean "the freezing of **live** people for later repair."

⇨*Who wants immortality?* Incredibly, most of the world's people do not. Their view is summarized by a quote from Miss Alabama, whose grasp of tautology is awe inspiring. Michael Riskin humorously gave us the four rare personality traits required for immortalists. Narcissism is now a virtue! We heard that most people are fatalistic and apathetic; they suppress thoughts about death and they lack vision—particularly about the future. We heard Gregory Benford's sad tale of meetings with many famous science fiction writers, including Pohl, Simak, and Clarke. They all rejected the idea of cryonics, and several are now deceased. It seems that even the world's visionaries can lack vision.

⇨*Life extension in practice!* Kat Kotter raced through 50 tips for anti-aging. Some of which we already do, many of which we don't and should. Christine Peterson provided an overview of the parallel topic of personal discrimination and an evaluation of life extension protocols and neutraceuticals.

⇨*Funding life extension technologies.* The old era that was characterized by a lack of funds for life extension and cryonics has drawn to a close. Today we have initiatives from Transvio and others capable of bringing millions of dollars into this area.

Consider the implications of the following. Given the commonly used measure of 100 as the average person's IQ, it became increasingly apparent over the weekend that the average for all the people in the conference hall was considerably higher. This speaks volumes about the state of the field of extreme life extension. In today's society "Bright is Right," and we have witnessed a tour-de-force demonstration of it.

The conference ended swiftly on Sunday evening, and, like the closing of a play, we were ushered outside, parting our many ways. After one last dinner and many farewells, we got into our cars and onto planes and came back to reality. We were left with our thoughts. But what touched me the most that weekend was Gregory Benford's comment about his dear wife, who had died young and was cremated. He said, "It is hard to accept that she no longer exists in this universe."

During the conference 400,000 people on this planet died. Soon they will cease to exist in this universe. Now we know the state of the challenge facing those who are doing something about it.

l

Ralph Merkle seated behind the Alcor placard, surrounded by conference staff, Alcor staff, volunteers and a few die-hard attendees at the end of the Fifth Alcor Extreme Life Extension Conference.

Klockgether Named Recipient of First Annual Zubkoff Memorial Award

Decades of service cited by Alcor President

by Bill Haworth

Southern California mortician Joe Klockgether was named recipient of the Alcor Life Extension Foundation's first annual "Leonard N. Zubkoff Memorial Award" at a special presentation last November 16 during Alcor's Fifth Extreme Life Extension Conference held at the Marriott Resort and Tennis Club in Newport Beach, California.

Klockgether, long-time provider of suspension-related services to the foundation, was hailed by Alcor President and Chief Executive Officer, Dr. Jerry Lemler, as a "a true friend and stalwart supporter." Lemler said Klockgether's unfailing and selfless professional efforts for more than three decades had helped make success possible for many member suspensions. "Joe did it without any expectation of reward," Lemler told the conference luncheon group, adding that through the years, Klockgether has given his best effort to Alcor on numerous occasions—many of those labors he performed in less tolerant times that more than once threatened his very livelihood.

Lemler told the capacity crowd of more than 100 conference luncheon guests of Klockgether's legendary reputation among many veterans of cryonics. Alcor's CEO remarked that Klockgether, owner of Renaker-Klockgether Mortuary in Buena Park, California, had amassed "an almost limitless log of his time and professional efforts over the years to ensure California's Alcor members were facilitated for the best possible suspension procedures." Lemler heralded Klockgether as a man of humility, honesty, and unflinching readiness to be of service—quickly and quietly— whenever called upon to assist suspension teams.

The Zubkoff award was established by Alcor at Lemler's recommendation a few weeks following a tragic helicopter crash last August 29th that claimed the life of Alcor member and respected board advisor, Leonard N. Zubkoff. Preliminary reports indicated Zubkoff along with David Zampino, instructor pilot and friend, were both at the helicopter's controls when—moments after liftoff—the craft plunged into one of the Winstanley Lakes in the Misty Fiords National Monument Wilderness near Ketchikan, Alaska.

For the past eight months, Zubkoff had been actively training for his helicopter pilot's license with Zampino, who also perished in the crash. The National Transportation Safety Board (NTSB) is in charge of the crash investigation. A final report on probable cause is not expected to be released by the agency for several months.

In spite of bad weather and logistical delays that hampered the timeliest retrieval of Zubkoff's remains, Alcor ultimately was successful in achieving a successful nuero-suspension procedure, especially under what Alcor's Hugh Hixon described as "worst-case events" surrounding the accident and recovery effort. Cooperation from Alaska state officials is believed to have played an important role in Zubkoff's expedited release from a post-mortem examination in Ancorage that led to his much faster return to Alcor's Scottsdale facility for the suspension.

Zubkoff, 44, was well known to and widely respected by many Alcor members and staff. He had been a member in good standing for more than 12 years and through those years had contributed his internationally recognized computer expertise to the design and implementation of Alcor's Internet security system. He also had been a regular and major donor to the foundation.

A world-renowned computer scientist, Zubkoff earned his undergraduate degree from the University of Rochester and was a master's degree honors graduate from Carnegie-Mellon University in 1985. He had been a senior scientist for Oracle Corporation and while there was a key contributor in the development of artificial intelligence programs. Until 1998, Zubkoff was chief technical officer for VA Linux of Fremont, California, a leading company in its field, in which he also was part owner.

On hand for the award presentation was Jan Jewell, Zubkoff's former spouse, who for years remained his close friend and confidant following their marriage. Jewell, in comments during the presentation ceremony, also praised Klockgether as a "true and unsung hero." Jewell was accompanied by her present spouse, Chris, both of whom attended the three-day life extension confab as special guests of the foundation.

Klockgether, who had not been informed of the exact nature of his luncheon invitation prior to being named the Zubkoff award winner, appeared genuinely surprised when announced

Bill Haworth is Public Relations Counsel to the Alcor Life Extension Foundation.

u

For more information on Leonard N. Zubkoff, please visit his memorial web site at: www.puffin.com/puffin/lnz/leonard.htm

as the first-ever recipient. Thanking Lemler, Jewell, and all Alcor members and friends gathered for the occasion, Klockgether said he really hadn't expected the recognition. "I am as surprised as I am moved," he told the audience.

The Zubkoff award, according to Lemler, has been established as an annual recognition of one individual who selflessly gives of his or her time and talents to further the cause for cryonics. "It will not be limited to Alcor members," Lemler said, adding, "any person may qualify for consideration whose contributions to the cryonics field are notable and genuine."

Jewell told *Cryonics* magazine that Leonard would be "proud beyond telling" that the first-ever Alcor award for special recognition had been created in his name to recognize an individual whose contributions in the field of human life extension technologies—particularly cryonics—best reflect the principles that he held highest. "I know this is the kind of honor equal to his deeply-held values. If someone—no matter what his walk of life—is doing good for the right reasons, then that's all that ever mattered to him."

Left to right: ***Alcor President Jerry Lemler, Leonard N. Zubkoff Award recipient Joe Klockgether, and Jan Jewell at the award luncheon.***

The Standby Dilemma

Disturbing Consequences of an Aging Cryonics Population

by Charles Platt
Director of Suspension Services
Alcor Life Extension Foundation

The average age of Alcor members has been increasing faster than anyone realized. If the trend continues, we can expect a rapidly rising death rate that may exceed our current response capabilities.

I discovered the magnitude of this problem when I compared the birth dates of members in Alcor's database with a similar list that I acquired at the beginning of March 1998—almost five years ago. At that time I was writing an article for *Cryonics* magazine, calculating the risk of simultaneous cases. Today I'm more concerned about the sheer number of future cases.

Below I have listed some key indicators that I discovered when I wrote a simple BASIC program to parse Alcor's membership data. During the past five years:

—The total membership of Alcor has logged a net increase of 40 percent (from 426 to 599 members during the five-year period), but the number of younger members aged under 45 has increased by only 10 percent. People in their 30s and 40s used to be the high-growth age group for Alcor, but not anymore.

—The number of members in the 45–54 age group has increased by almost 65 percent, from 96 to 158.

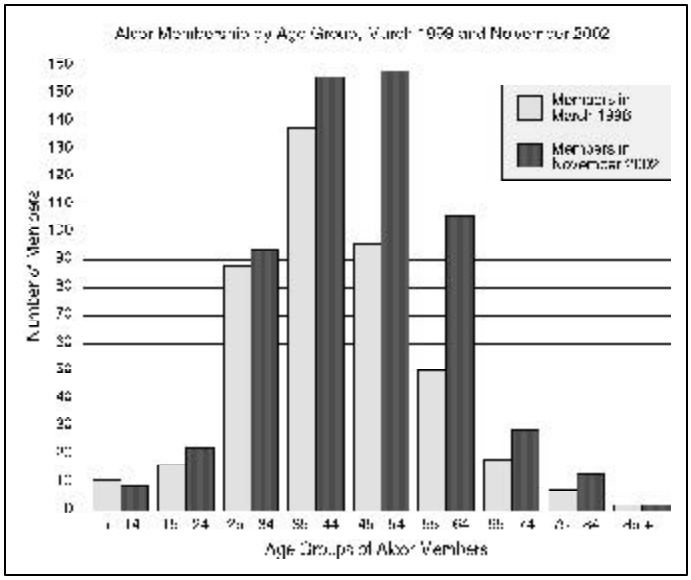
—The number of members in the 55–64 age group has increased at an astonishing rate, more than doubling from 50 to 106.

—Five years ago, we had 27 members aged 65 and over. Currently we have 44 members in that age range.

In the bar chart, the pale bars show that our population five years ago was centered around people aged 40. The dark bars indicate that the center of the age distribution is moving toward 50, while the most dramatic increase is occurring above this age.

When I saw how many older members we now have in Alcor, at first I didn't believe my own numbers. I checked them and rechecked them. I knew that during the past half-decade Alcor reacquired many former members of CryoCare Foundation, most of whom were over 40. Still, the influx from CryoCare could account for only about half of Alcor's new members in the 45 to 75 age range.

The cause of this trend is debatable, but one fact is clear. Alcor today has more people with a higher risk of dying. This has very serious implications. Can the organization respond adequately to the increasing death rate of an aging cryonics population?



Predicting our Mortality Rate

According to the most recent edition of *Statistical Abstract of the United States,* published by the U.S. Census Bureau and available on the Web, the death rate per 100,000 Americans looked like this in 1998:

Age range	Deaths per 100,000 Americans per year
15–24	194
25–34	277
35–44	475
45–54	1,074
55–64	2,238
65–74	4,136
75–84	8,259
85+	15,442

If we convert these death rates to percentages and then multiply by the number of Alcor members in each age group, we can predict the future of our own population. This is only a rough guide, since Alcor members may be healthier (or unhealthier) than Americans generally, and I have not considered the death rates in other nations where some of our members reside. Also,

the distribution of ages within each age group in Alcor may be different from the distribution in the same age groups in the population at large.

Still, I believe the table below provides a good approximate guide:

Age range	%deaths per year		Alcor members		Probable Alcor deaths per year
under 45	0.9%	x	283	=	2.5
45–54	1.1%	x	158	=	1.7
55–64	2.2%	x	106	=	2.3
65–74	4.1%	x	29	=	1.2
75–84	8.3%	x	13	=	1.1
85+	15.4%	x	2	=	0.3

If we add up the numbers in the right-hand column, we find that in our current population of about 600 members, *we should expect about nine people to die each year*.

This seems implausible. After all, just 15 years ago, Alcor had a death rate of less than 1 per year. More recently, we went for more than two years without a single member dying.

On the other hand, we have six times as many members as 15 years ago, and their average age is higher. Also, short periods where events seem to defy the laws of probability are inevitable in a relatively small population sample. In the longer term—at least until longevity research eliminates the aging process—cryonicists will be vulnerable to the same age-related diseases that afflict everyone else. Our staff and volunteers will have to deal with about one mortality every six weeks (not including last-minute cases!), and this rate will increase as our population continues to age.

I realize that this is a grim topic, but the whole purpose of cryonics is to defeat death. We can't hope to achieve our goals if we're not willing to face facts.

Even More Standbys

Before I outline some coping strategies, I have to add another piece of bad news: The number of standbys per year is likely to increase even faster than the number of deaths per year. This is another consequence of our disproportionate number of members over 45.

Americans aged under 45 are more likely to die in a car crash than in a hospital bed. Accidents are the leading cause of death in this age group, and in such cases Alcor does not deploy a standby team. If most of our members were under 45, standbys would not be a significant concern.

In cases that are more predictable, we feel an obligation to perform a standby so that our team can take action as quickly as possible after legal death is pronounced. Since elderly people are more likely to suffer from progressive illnesses that provide advance warning of mortality, the number of standbys will tend to increase as the average age of our membership increases—even if the total number of members remains the same.

This is only the first part of the problem. Another factor is that older people are likely to undergo medical procedures that are life-threatening but not necessarily fatal. Thus, a standby may end happily with the patient getting better and going home. Naturally we prefer this outcome; our whole endeavor is based on a desire to extend human life. On the other hand, we may find that each Alcor member requires two or more standbys, of which only the last will end in cryopreservation.

While heart disease remains the number one cause of death in the United States, surgical intervention often adds many years to the patient's life. During 1998, according to the U.S. Census Bureau, there were 1,271,000 successful cardiac catheterizations, 1,069,000 successful operations to remove a coronary artery obstruction, and 571,000 successful coronary artery bypass grafts. The number of operations to remove an artery obstruction tripled between 1990 and 1999.

Since we might expect cryonicists to be more aware of death than most people, we might expect that they would follow a diet-and-exercise regimen that would minimize the risk of heart disease. Alas, this isn't always the case. One of Alcor's officers and two of our full-time staff have undergone successful surgery for circulatory-related problems during the past three years. Suppose you were facing such a procedure yourself. Wouldn't you feel tempted to ask for (and pay for) a standby, just in case?

In 2002 alone, Alcor performed three "elective standbys" that ended when the patients recovered. I'm glad we were able to do this, but I'm concerned that if this type of standby proliferates, the demand will overwhelm us.

To understand why the standby issue is so challenging, consider the history of standbys and the way in which they are run today. Many people simply do not realize how big a challenge it is to establish a standby in a remote location and transport the patient back to Scottsdale.

How Standbys Evolved

Alcor was the first cryonics organization to provide standbys and is still the only one that offers this service. Back in the 1980s, Jerry Leaf initiated the concept with his MALSS, or Mobile Advanced Life Support System. It resembled a hospital gurney with an ice bath on top and resuscitation equipment underneath.

Leaf proposed that the MALSS could be deployed via Alcor's ambulance to the bedside of a dying patient so that the patient could be cooled and would receive metabolic support as quickly as possible. The concept was compelling, since it promised to minimize the brain damage that tends to be caused by lack of postmortem blood flow at normal body temperature.

For patients beyond the range of Alcor's ambulance, Alcor's former Director of Research, Mike Darwin, assembled transportable equipment that could be deployed on-site. As these capabilities increased, so did the size of the "standby kit." By 1994, when Darwin was an independent contractor serving members of the American Cryonics Society and CryoCare Foundation, his military-style transport boxes had proliferated to the point

where they would barely fit into a van-sized ambulance.

When Fred and Linda Chamberlain took control of Alcor in the 1990s, they reassessed standby procedures. Facility engineer Hugh Hixon created a blood washout system that would fit in a suitcase, while the portable ice bath was minimized to the point where it would fit in another suitcase.

Still, today the Alcor team lugs more than 300 separate items into the field, from hypodermic syringes to oxygen regulators. Many items are consumables that must be reordered after every case. Other items require sterilization and repacking. Tubing packs have to be remade from the raw materials. One person at Alcor, Mathew Sullivan, manages these tasks.

A typical modern standby requires more than a dozen heavy transport boxes, which team members check in as airline baggage. When we flew out for a standby in Houston in October of this year, the airline broke the locks on all the boxes and inspected everything by hand. We were fortunate that most of our supplies arrived with no delay and minimal loss or damage. Next time, we may not be so lucky.

At the destination, team members keep in touch with one another via cell phones as they learn the layout of the area, rent vehicles and motel rooms, and locate a cooperative mortuary where postmortem procedures can be carried out. The mortuary can also be used as a staging area where the team can move essential items into a van, which serves as an improvised ambulance.

Some members of the team will try to find a local supplier of welding equipment, so that they can rent massive oxygen cylinders to power the Thumper—a cardiopulmonary support system that is mounted on the side of the ice bath. Other members must establish contact with the hospice or hospital where the patient is located. Some hospitals are cooperative; some are not. Some doctors hate the idea of "cryonics amateurs"; others want to follow the wishes of the patient. Ideally, the ice bath and medications are moved into the hospital, but this is not always possible. Negotiations require a mix of persuasiveness, insistence, and diplomacy.

The team must find a place to park the van within easy reach of the hospital. They must assess the patient's condition and then start waiting, usually in 12-hour shifts. As any ICU nurse will tell you, death is not predictable. Several years ago, when I was the president of CryoCare Foundation, I flew from New York to California, having been warned that a patient only had a week to live. Six weeks later he was still active and cheerful, defying all predictions of his imminent demise.

The uncertainties of a standby, coupled with its logistical demands, can have human consequences. Team members may become irritable or unreliable because of stress or lack of sleep. Relatives may resent the presence of the team. Patients themselves may be problematic. I have been on two standbys where the patients simply changed their minds and decided they didn't want to be cryopreserved after all, at which point all the equipment was dismantled and removed, and everyone went home.

Even when a standby concludes with a successful transport back to Alcor and a good-quality cryopreservation, the saga isn't over. Cleaning up after a standby can take days or even weeks. Out in the field, the van has to be stripped of its equipment, and the equipment has to be transported back to Scottsdale where it is sorted, cleaned, and repackaged. Mathew Sullivan checks the inventory and restocks every shipping container. Some items may have been damaged, while others may be missing. Everything has to be verified before it can go out to another standby.

The conclusion should be obvious. A standby is a major logistical event, and Alcor simply doesn't have enough people to enable this on a frequent basis.

New Standby Policies

While Fred and Linda Chamberlain were active in Alcor, they took two major steps to confront the standby problem. First, they trained numerous "ACTs" (Alcor Cryotransport Technicians; renamed ADRs [Anatomical Donor Recovery team members] in 2001) all over the country. These volunteers were offered major discounts—as much as 85 percent—off lifetime membership dues.

Second, the Chamberlains instituted a controversial policy to restrict standby privileges. They would allow only three days of "free" standby service during each member's lifetime. Additional days would incur substantial fees, which would be charged to the member's credit card. If the member didn't give Alcor a credit card number and didn't make any other financial arrangements, the standby team would not respond, and the member would receive no help until legal death had occurred.

This was an unpopular policy, and most Alcor members seem to have ignored it. Either they skipped the warnings in the *Alcor Phoenix,* or they couldn't bring themselves to believe what they read. This created an awful situation in which people were relying on a support system that didn't exist anymore.

Then the organization went through its strange, serendipitous, two-year period in which no one died. Many of Alcor's ACTs never had an opportunity to practice the skills they had learned, and everyone tended to be lulled into a false sense of security.

Today, the remaining ADRs are still receiving their membership discounts and are still theoretically available to help on standbys, even though some live in remote locations from which they have never been called to a case. Others have lost interest and have let their memberships lapse. When I became Director of Standby Services, I had difficulty contacting some ADRs. The system had largely fallen into disuse. While I saw its weaknesses, I realized that my only immediate option was to try to revive it.

Solving the Standby Problem

Fifteen years ago, Alcor had fewer than 100 members, according to an issue of *Cryonics* magazine dated April 1987, and standbys were so infrequent, there was no shortage of unpaid volunteers willing to lend a hand.

Today the situation is reversed. Most of our members are older, less willing to go out on standby work, and more likely to need standbys themselves. Meanwhile, the probable death rate has increased by a factor of 10.

Personally I still feel committed to the standby concept because it offers the best chance of minimizing damage to the patient. I see only one strategy to sustain this system: We must supplement it with medical professionals while encouraging our members to take the initiative so that they are less likely to need standby service.

Here are the steps that I believe are inevitable:

1. Regain contact with as many ADRs as possible, to assist us during the transition period.
2. Pay standby personnel for each successful training session and each day of field work. I prefer this result-oriented approach to the policy of reducing membership dues indefinitely, which can create a feeling of entitlement. In instances where Alcor has promised dues reductions, it must honor that obligation, but:
3. If some ADRs are not willing to be actively involved anymore, Alcor may wish to revoke their membership discounts.
4. We must find paramedics who are available and willing to participate on standbys.
5. Early next year, I hope to organize a training course for our ADRs and paramedics, teaching them our current cryonics protocol.
6. In the future, we need to find ways to simplify the protocol and reduce the massive amount of equipment that has to be transported into the field. Various innovations have been proposed. The portable ice bath is particularly problematic, since its full version is unwieldy, and it increases the risk of infection when a patient has a communicable disease such as hepatitis C. The Thumper is also problematic because it consumes large volumes of oxygen, which become a major fire hazard. We need a better way to accomplish rapid cooling with cardiopulmonary support.
7. Alcor must do more to encourage relocation. When one of our members suffers an illness that has a predictably fatal outcome, I believe the member should feel an obligation to move near our facility. This is in the member's own interests because even if a remote standby is executed flawlessly, it still entails significant transport time, and every additional hour increases the risk of brain damage.

   Since cancer patients are willing to fly thousands of miles in search of alternative treatments, shouldn't cryonics patients be willing to travel? Alcor may consider offering financial incentives to encourage this.
8. Looking farther ahead, we may establish a location near our facility that will serve as a home-hospice. This concept has been proposed in the past, but the proposals were premature. As Alcor grows bigger and the average age of the membership increases, it begins to seem more plausible. For legal reasons, it should be managed by an organization that is friendly to Alcor, but separate from Alcor. We must never give outsiders the misleading impression that we are *encouraging* people to die.
9. Alcor may also consider regional treatment areas. Centralized management of standbys is going to become difficult as our membership increases. Sooner or later—as I predicted in *Cryonics* magazine almost five years ago—we will find ourselves trying to cope with simultaneous or overlapping cases. A distributed network will be better able to deal with this.

Your Role in Alcor Standbys

When the first cryonics organizations were founded in the late 1960s, they were supported by donations and run by volunteers. Almost 40 years later, we're more financially secure but still in the early-adopter phase. Some people see cryonics as a business where consumers pay dues and receive a service, but this is not a realistic worldview. Cryonics is still evolving, is still an experimental procedure, and still needs help from the few people who have realized that the concept makes sense.

I've made no secret that standbys can be challenging. On the other hand, they do have an upside. Personally I enjoy many aspects of the challenge because it makes me feel good to overcome problems. Also I have learned far more about medicine, human psychology, life, and death than if I had avoided participating actively. Best of all, even when I play a relatively minor role, I feel great satisfaction when a patient makes a successful journey into cryopreservation.

I believe that anyone seriously interested in cryonics should experience at least one standby—and you don't need medical training to do so. Valuable assets include intelligence, common sense, social skills, and willingness to learn.

Self-interest also plays a part. If you become actively involved, you will acquire friends who may be helpful in an emergency. While Alcor itself responds with equal speed and determination in every case, you may feel some added reassurance if you supplement Alcor's service with your own personal support network.

If you have any interest in participating, e-mail me directly at cplatt@usa.com. You will be especially valuable if you are able to travel at short notice (naturally, your expenses will be paid, in addition to a daily participation fee). We also need people who live in the major concentrations of cryonicists: southern California, northern California, Florida, New York, Washington D.C., and Boston. Key people with basic skills can be especially helpful in Canada and locations overseas.

I must admit, I've always been phobic about hospitals myself, and I hate to see people die. But I'm still willing to go out and do what I can to help Alcor members receive the best treatment we know how to provide.

And you?

l

Note:

Source code for the program that processed Alcor's birth dates is available at www.charlesplatt.com/demographics, and I encourage anyone to check it to verify my math.

Two members have not supplied Alcor with their birth dates, and remain unrepresented in the demographic calculations. Their absence has no measurable effect on the overall conclusions.

Ramona

Questions and Answers

Originally published February 22, 2001. Published on KurzweilAI.net February 22, 2001.

Ramona's alter ego (Raymond Kurzweil) says that Ramona and the technology behind her is a step in the progression of our species from real reality to virtual reality.

by Ray Kurzweil

What is the presentation about that you made at TED11?

I transformed myself into Ramona, my female alter ego. She is the first live virtual recording and performing artist. She is a demonstration that "you can be who you want to be" in virtual reality. We all have personalities within us that are difficult if not impossible to express with our real-world bodies and in real-world environments. Yet in virtual reality, we can express ourselves in new ways. We can go where we want to go. We can even "have been" who we want to have been, and be with whom we want to be with. Ultimately, virtual reality will be fully competitive with real reality in terms of the level of realism, while offering profound new ways to explore the world and to interact with one another.

I've always found myself attracted to female performers, and I realized that I not only wanted to be with them, but wanted to be them. This is not a matter of gender confusion; having other gender personae in our fantasies is integral to our ability to relate romantically to the opposite sex. These personalities are there in all of us but up to now have existed only in our imagination. Virtual reality provides the opportunity to express ourselves in important new ways.

My presentation pushes the state of the art in real-time virtual reality transformation and is intended as a harbinger of things to come. Although real-time cartoon characters have been created before, this is the first time that motion capture and real-time image rendering technologies have been combined in a performance setting to create real-time photorealistic virtual performers. It is the first time that someone has given a singing performance in front of a live audience while being transformed into someone else. It is also the first time that a dancer has danced in a live performance while being transformed into someone else.

Real-time motion capture and photorealistic image transformation has obvious application to the entertainment world, but will ultimately profoundly affect the everyday world. By 2009, we will all have ubiquitous, full-immersion, shared, visual-auditory virtual reality environments. We will have images written directly to our retinas from our eyeglasses and contact lenses, high-resolution motion capture of our bodies through automatic detection of our electromagnetic fields, and very-high-bandwidth wireless connection to the Internet at all times. Go-

ing to a web site will mean entering a virtual reality environment where you can visit other people. It will be just like being there, at least as far as seeing and hearing is concerned. Of course, keep in mind that the people you meet in these virtual reality environments may have very different appearances and personalities in real reality. Ultimately, we will regard these virtual personalities as just as real and important as the one we portray in real reality.

By 2029, we will have nanobots, blood-cell-sized robots, traveling through the capillaries of our brains communicating wirelessly directly with our biological neurons. This type of technology, called "neuron transistors," has already been demonstrated. Billions of nanobots can be communicating with our biological brains and with one another, all on a wireless local area network. This will enable shared virtual reality environments incorporating all of the senses. With this technology, we will be able to meet one another and engage in any type of interaction, from business negotiations to sexual and sensual encounters, in any type of environment, from recreations of earthly places to fantastic imaginary locales.

"Experience Beamers" will beam their entire flow of sensory experience as well as their emotions onto the Web just as people beam their images from their web cams today. You'll be able to plug in and experience what it is like to be someone else, à la "Being John Malkovich," as well as relive interesting archived experiences.

Like any other technology, virtual reality is not emerging fully formed in one instant. Today, it has obvious limitations. I need dozens of computers and three-quarters of an 18-wheel truck worth of equipment to transform myself into Ramona and perform with my virtual dancers in virtual environments. But I can describe today how by the end of this decade, full-immersion, visual-auditory virtual reality will be ubiquitous, woven into our clothing, and highly realistic. Ultimately, virtual reality will offer everything real reality offers and a lot more. By the middle of this century, we will be spending most of our time in virtual reality environments.

The word "virtual" may be unfortunate because it implies that the experiences and environments aren't "real." But we've already had one form of virtual reality for over a century. The telephone is auditory virtual reality, and that's exactly how nineteenth-century enthusiasts viewed it. It would not be correct to say that interactions we have with one another on the telephone aren't "real." Rather, interacting with other real people over the phone represents an important extension of our ability to relate to one another. When we can add all of the other senses to these interactions, it will be another profound way to have real experiences with other real people.

When I transform myself into Ramona, I do feel empowered to express myself as a new personality. I feel that I am doing more than just playing a role, I am expressing my female alter ego, and I do find it liberating. I had a vision of who she was, and what she looked like, and with the help of dozens of brilliant people, I feel she expresses my original conception.

How will Ramona, or this technology, change our lives? Why is it so revolutionary?

The ultimate significance is as a step in the progression of our species from real reality to virtual reality. Thousands of years ago, written scrolls enabled ideas to travel from one place to another. A century ago, the telephone provided auditory virtual reality. Today, the technology behind Ramona represents an early manifestation of full immersion visual-auditory virtual reality. Within a few decades, we will be able to do anything with anyone in virtual environments that rival and even exceed the realism of real reality. It will enable us to have profound new experiences and to express ourselves in new ways.

l

Ramona is the photorealistic avatar host of KurzweilAI.net. She's also the first live virtual performing and recording artist. Read about her history, check out her pictures, and listen to her songs!

Dialogue between RAY KURZWEIL and ERIC DREXLER

What it would take to achieve successful cryonics reanimation of a fully functioning human brain, with memories intact? A conversation at the recent Alcor Conference on Extreme Life Extension between Ray Kurzweil and Eric Drexler sparked an e-mail discussion of this question. They agreed that despite the challenges, the brain's functions and memories can be represented surprisingly compactly, suggesting that successful reanimation of the brain may be achievable.

November 23, 2002

Ray Kurzweil: Eric, I greatly enjoyed our brief opportunity to share ideas (difficulty of adding bits to quantum computing, cryonics reanimation, etc.). Also, it was exciting to hear your insightful perspective on the field you founded, now that it's gone—from what was regarded in the mainstream anyway as beyond-the-fringe speculation—to, well, mainstream science and engineering.

I had a few questions and/or comments (depending on whether I'm understanding what you said correctly). Your lecture had a very high idea density, so I may have misheard some details.

With regard to cryonics reanimation, I fully agree with you that preserving structure (i.e., information) is the key requirement, that it is not necessary to preserve cellular functionality. I have every confidence that nanobots will be able to go in and fix every cell, indeed every little machine in every cell. The key is to preserve the information. And I'll also grant that we could lose some of the information; after all, we lose some information every day of our lives anyway. But the primary information needs to be preserved. So we need to ask, what are the types of information required?

One is to identify the neuron cells, including their type. This is the easiest requirement. Unless the cryonics process has made a complete mess of things, the cells should be identifiable. By the time reanimation is feasible, we will fully understand the types of neurons and be able to readily identify them from the slightest clues. These neurons (or their equivalents) could then all be reconstructed.

The second requirement is the interconnections. This morphology is one key aspect of our knowledge and experience. We know that the brain is continually adding and pruning connections; it's a primary aspect of its learning and self-organizing principle of operation. The interconnections are much finer than the neurons themselves (for example, with current brain imaging techniques, we can typically see the neurons but we do not yet clearly see the interneuronal connections). Again, I believe it's likely that this can be preserved, provided that the vitrification has been done quickly enough. It would not be necessary that the connections be functional or even fully evident, as long as it can be inferred where they were. And it would be okay if some fraction were not identifiable.

It's the third requirement that concerns me; the neurotransmitter concentrations, which are contained in structures that are finer yet than the interneuronal connections. These are, in my view, also critical aspects of the brain's learning process. We see the analogue of the neurotransmitter concentrations in the simplified neural net models that I use routinely in my pattern recognition work. The learning of the net is reflected in the connection weights as well as the connection topology (some neural net methods allow for self-organization of the topology, some do not, but all provide for self-organization of the weights). Without the weights, the net has no competence.

If the very-fine-resolution neurotransmitter concentrations are not identifiable, the downside is not equivalent to merely an amnesia patient who has lost his memory of his name, profession, family members, etc. Our learning, reflected as it is in both interneuronal connection topology and neurotransmitter concentration patterns, underlies knowledge that is far broader than these routine forms of memory, including our "knowledge" of language, how to think, how to recognize objects, how to eat, how to walk and perform all of our skills, etc. Loss of this information would result in a brain with no competence at all. It would be worse than a newborn's brain, which is at least designed to begin reorganizing itself. A brain with the connections intact but none of the neurotransmitter concentrations would have no competence of any kind and a connection pattern that would be too specific to relearn all of these skills and basic knowledge.

It's not clear whether the current vitrification-preservation process maintains this vital type of information. We could readily conduct an experiment to find out. We could vitrify the brain of a mouse and then do a destructive scan while still vitrified to see if the neurotransmitter concentrations are still evident. We could also confirm that the connections are evident as well.

The type of long-term memory that an amnesia patient has lost is just one type of knowledge in the brain. At the deepest

level, the brain's self-organizing paradigm underlies our knowledge and all competency that we have gained since our fetal days (even prior to birth).

As a second issue, you said something about it being sufficient to just have preserved the big toe or the nose to reconstruct the brain. I'm not sure what you meant by that. Clearly none of the brain structure is revealed by body parts outside the brain. The only conceivable way one could restore a brain from the toe would be from the genome, which one can discover from any cell. And indeed, one could grow a brain from the genome. This would be, however, a fetal brain, which is a genetic clone of the original person, equivalent to an identical twin (displaced in time). One could even provide a learning and maturing experience for this brain in which the usual 20 odd years were sped up to 20 days or less, but this would still be just a biological clone, not the original person.

Finally, you said (if I heard you correctly) that the amount of information in the brain (presumably needed for reanimation) is about 1 gigabyte. My own estimates are quite different. It is true that genetic information is very low, although as I discussed above, genetic information is not at all sufficient to recreate a person. The genome has about 0.8 gigabytes of information. There is massive redundancy, however. For example, the sequence "ALU" is repeated 300,000 times. If one compresses the genome using standard data compression to remove redundancy, estimates are that one can achieve about 30 to 1 lossless compression, which brings us down to about 25 megabytes. About half of that comprises the brain, or about 12 megabytes. That's the initial design plan.

If we consider the amount of information in a mature human brain, however, we have about 10^{11} neurons with 10^3 average fan-out of connections, for an estimated total of 10^{14} connections. For each connection, we need to specify (i) the neurons that this connection is connected to, (ii) some information about its pathway as the pathway affects analog aspects of its electrochemical information processing, and (iii) the neurotransmitter concentrations in associated synapses. If we estimate about 10^2 bytes of information to encode these details (which may be low), we have 10^{16} bytes, considerably more than the 10^9 bytes that you mentioned.

One might ask: How do we get from 10^7 bytes that specify the brain in the genome to 10^{16} bytes in the mature brain? This is not hard to understand, since we do this type of meaningful data expansion routinely in our self-organizing software paradigms. For example, a genetic algorithm can be efficiently coded, but in turn creates data far greater in size than itself using a stochastic process, which in turn self-organizes in response to a complex environment (the problem space). The result of this process is meaningful information far greater than the original program. We know that this is exactly how the creation of the brain works. The genome specifies initially semi-random interneuronal connection wiring patterns in specific regions of the brain (random within certain constraints and rules), and these patterns (along with the neurotransmitter-concentration levels) then undergo their own internal evolutionary process to self-organize to reflect the interactions of that person with their experiences and environment. That is how we get from 10^7 bytes of brain specification in the genome to 10^{16} bytes of information in a mature brain. I think 10^9 bytes is a significant underestimate of the amount of information required to reanimate a mature human brain.

I'd be interested in your own reflections on these thoughts,

With my best wishes.

Eric Drexler: Ray—Thanks for your comments and questions. Our thinking seems closely parallel on most points.

Regarding neurotransmitters, I think it is best to focus not on the molecules themselves and their concentrations, but rather on the machinery that synthesizes, transports, releases, senses, and recycles them. The state of this machinery must closely track long-term functional changes (i.e, long-term memory or LTM), and much of this machinery is an integral part of synaptic structure.

Regarding my toe-based reconstruction scenario [creating a brain from a bit of tissue containing intact DNA—Ed.], this is indeed no better than genetically based reconstruction together with loading of more-or-less default skills and memories—corresponding to a peculiar but profound state of amnesia. My point was merely that even this worst-case outcome is still what modern medicine would label a success: the patient walks out the door in good health. (Note that neurosurgeons seldom ask whether the patient who walks out is "the same patient" as the one who walked in.) Most of us wouldn't look forward to such an outcome, of course, and we expect much better when suspension occurs under good conditions.

Information-theoretic content of long-term memory

Regarding the information content of the brain, both the input and output data sets for reconstruction must indeed be vastly larger than a gigabyte, for the reasons you outline. The lower number [10^9] corresponds to an estimate of the information-theoretic content of human long-term memory found (according to Marvin Minsky) by researchers at Bell Labs. They tried various methods to get information into and out of human LTM, and couldn't find learning rates above a few bits per second. Integrated over a life span, this yields the above number. If this is so, it suggests that information storage in the brain is indeed massively redundant, perhaps for powerful function-enabling reasons. (Identifying redundancy this way, of course, gives no hint of how to construct a compression and decompression algorithm.)

Best wishes,

with thanks for all you've done,

P.S. A Google search yields a discussion of the Bell Labs result by, yes, Ralph Merkle: http://www.merkle.com/humanMemory.html

Ray Kurzweil: Okay, I think we're converging on some commonality.

On the neurotransmitter concentration level issue, you wrote: "Regarding neurotransmitters, I think it is best to focus not on the molecules themselves and their concentrations, but rather on the machinery that synthesizes, transports, releases, senses, and

recycles them. The state of this machinery must closely track long-term functional changes (i.e, LTM), and much of this machinery is an integral part of synaptic structure."

I would compare the "machinery" to any other memory machinery. If we have the design for a bit of memory in a DRAM system, then we basically know the mechanics for the other bits. It is true that in the brain there are hundreds of different mechanisms that we could call memory, but each of these mechanisms is repeated many millions of times. This machinery, however, is not something we would need to infer from the preserved brain of a suspended patient. By the time reanimation is feasible, we will have long since reverse-engineered these basic mechanisms of the human brain and thus would know them all. What we do need specifically for a particular patient is the state of that person's memory (again, memory referring to all skills). The state of my memory is not the same as that of someone else, so that is the whole point of preserving my brain.

And that state is contained in at least two forms: the interneuronal connection patterns (which we know is part of how the brain retains knowledge and is not a fixed structure) and the neurotransmitter concentration levels in the approximately 10^{14} synapses.

My concern is that this memory state information (particularly the neurotransmitter concentration levels) may not be retained by current methods. However, this is testable right now. We don't have to wait 40 to 50 years to find this out. I think it should be a high priority to do this experiment on a mouse brain as I suggested above (for animal lovers, we could use a sick mouse).

You appear to be alluding to a somewhat different approach, which is to extract the "LTM," which is likely to be a far more compact structure than the thousands of trillions of bytes represented by the connection and neurotransmitter patterns (CNP). As I discuss below, I agree that the LTM is far more compact. However, we are not extracting an efficient LTM during cryopreservation, so the only way to obtain it during cryo-reanimation would be to retain its inefficient representation in the CNP.

You bring up some interesting and important issues when you wrote, "Regarding my toe-based reconstruction scenario, this is indeed no better than genetically based reconstruction together with loading of more-or-less default skills and memories—corresponding to a peculiar but profound state of amnesia. My point was merely that even this worst-case outcome is still what modern medicine would label a success: the patient walks out the door in good health."

I agree that this would be feasible by the time reanimation is feasible. The means for "loading" these "default skills and memories" is likely to be along the lines that I described above, to use "a learning and maturing experience for this brain in which the usual 20 odd years were sped up to 20 days or less." Since the human brain as currently designed does not allow for explicit "loading" of memories and skills, these attributes need to be gained from experience using the brain's self-organizing approach. Thus we would have to use this type of experience-based approach. Nevertheless, the result you describe could be achieved. We could even include in these "loaded" (or learned) "skills and memories," the memory of having been the original person who was cryonically suspended, including having made the decision to be suspended, having become ill, and so on.

False reanimation

And this process would indeed appear to be a successful reanimation. The doctors would point to the "reanimated' patient as the proof in the pudding. Interviews of this patient would reveal that he was very happy with the process, delighted that he made the decision to be cryonically suspended, grateful to Alcor and the doctors for their successful reanimation of him, and so on.

But this would be a false reanimation. This is clearly not the same person that was suspended. His "memories" of having made the decision to be suspended four or five decades earlier would be false memories. Given the technology available at this time, it would be feasible to create entirely new humans from a genetic code and an experience / learning loading program (which simulates the learning in a much higher speed substrate to create a design for the new person). So creating a new person would not be unusual. So all this process has accomplished is to create an entirely new person who happens to share the genetic code with the person who was originally suspended. It's not the same person.

One might ask, "Who cares?" Well no one would care except for the originally suspended person. And he, after all, is not around to care. But as we look to cryonic suspension as a means towards providing a "second chance," we should care now about this potential scenario.

It brings up an issue which I have been concerned with, which is "false" reanimations.

Now one could even raise this issue (of a false reanimation) if the reanimated person does have the exact CNP of the original. One could take the philosophical position that this is still a different person. An argument for that is that once this technology is feasible, you could scan my CNP (perhaps while I'm sleeping) and create a CNP-identical copy of me. If you then come to me in the morning and say "good news, Ray, we successfully created your precise CNP-exact copy, we won't be needing your old body and brain anymore," I may beg to differ. I would wish the new Ray well, but feel that he's a different person. After all, I would still be here.

So even if I'm not still here, by the force of this thought experiment, he's still a different person. As you and I discussed at the reception, if we are using the preserved person as a data repository, then it would be feasible to create more than one "reanimated" person. If they can't all be the original person, then perhaps none of them are.

However, you might say that this argument is a subtle philosophical one, and that, after all, our actual particles are changing all the time anyway. But the scenario you described of creating a new person with the same genetic code, but with a very different CNP created through a learning simulation, is not just a matter of a subtle philosophical argument. This is clearly a different person. We have examples of this today in the case of identical

twins. No one would say to an identical twin, "we don't need you anymore because, after all, we still have your twin."

I would regard this scenario of a "false" reanimation as one of the potential failure modes of cryonics.

Reverse-engineering the brain

Finally, on the issue of the LTM (long-term memory), I think this is a good point and an interesting perspective. I agree that an efficient implementation of the knowledge in a human brain (and I am referring here to knowledge in the broadest sense as not just classical long-term memory, but all of our skills and competencies) would be far more compact that the 10^{16} bytes I have estimated for its actual implementation.

As we understand biological mechanisms in a variety of domains, we find that we can redesign them (as we reverse engineer their functionality) with about 10^6 greater efficiency. Although biological evolution was remarkable in its ingenuity, it did get stuck in particular paradigms.

It's actually not permanently stuck in that its method of getting unstuck is to have one of its products, homo sapiens, discover and redesign these mechanisms.

We can point out several good examples of this comparison of our human-engineered mechanisms to biological ones. One good example is Rob Freitas's design for robotic blood cells, which are many orders of magnitude more efficient than their biological counterparts.

Another example is the reverse engineering of the human auditory system by Lloyd Watts and his colleagues. They have found that implementing the algorithms in software from the reverse engineering of specific brain regions requires about a factor of 10^6 less computation than the theoretical potential of the brain regions being emulated.

Another good example is the extraordinarily slow computing speed of the interneuronal connections, which have about a 5 millisecond reset time. Today's conventional electronic circuits are already 100 million (10^8) times faster. Three-dimensional molecular circuits (e.g., nanotube-based circuitry) would be at least 10^9 times faster. Thus if we built a human brain equivalent with the same number of simulated neurons and connections (not just simulating the human brain with a smaller number of units that are operating at higher speeds), the resulting nanotube-based brain would operate at least 10^9 times faster than its biological counterpart.

Some of the inefficiency of the encoding of information in the human brain has a positive utility in that memory appears to have some holographic properties (meaningful information being distributed through a region), and this helps protect the information. It explains the usually gradual (as opposed to catastrophic) degradation of human memory and skill. But most of the inefficiency is not useful holographic encoding, but just this inherent inefficiency of biological mechanisms. My own estimate of this factor is around 10^6, which would reduce the LTM from my estimate of 10^{16} for the actual implementation to around 10^{10} for an efficient representation, but that is close enough to your and Minsky's estimate of 10^9 bytes.

However, as you point out, we don't know the compression/decompression algorithm and are not in any event preserving this efficient representation of the LTM with the suspended patients. So we do need to preserve the inefficient representation.

With deep appreciation for your own contributions,

Eric Drexler: With respect to inferring memory state, the neurotransmitter-handling machinery in a synapse differs profoundly from the circuit structure in a DRAM cell. Memory cells in a chip are all functionally identical, each able to store and report different data from millisecond to millisecond; synapses in a brain are structurally diverse, and their differences encode relatively stable information. Charge stored in a DRAM cell varies without changes in its stable structure; long-term neurotransmitter levels in a synapse vary as a result of changes in its stable structure. The quantities of different enzymes, transport molecules, and so forth, determine the neurotransmitter properties relevant to LTM, hence neurotransmitter levels per se needn't be preserved.

My discussion of the apparent information-theoretic size of human LTM wasn't intended to suggest that such a compressed representation can or should be extracted from the detailed data describing brain structures. I expect that any restoration process will work with these far larger and more detailed data sets, without any great degree of intermediate compression. Nonetheless, the apparently huge gap between the essential mental information to be preserved and the vastly more detailed structural information is reassuring—and suggests that *false* reanimation, while possible, shouldn't be expected when suspension occurs under good conditions. (Current medical practice has analogous problems of false life-saving, but these don't define the field.)

Ray Kurzweil: I'd like to thank you for an engaging dialogue. I think we've converged to a pretty close common vision of these future scenarios. Your point is well taken that human memory (for all of its purposes), to the extent that it involves the neurotransmitters, is likely to be redundantly encoded. I agree that differences in the levels of certain molecules are likely to be also reflected in other differences, including structural differences. Most biological mechanisms that we do understand tend to have redundant information storage (although not all; some single-bit changes in the DNA can be catastrophic). I would point out, however, that we don't yet understand the synaptic structures sufficiently to be fully confident that the differences in neurotransmitter levels that we need (for reanimation) are all redundantly indicated by structural changes. However, all of this can be tested with today's technology, and I would suggest that this would be worthwhile.

I also agree that "the apparently huge gap between the essential mental information to be preserved and the vastly more detailed structural information is reassuring." This is one example in which the inefficiency of biology is helpful.

Eric Drexler: Thank you, Ray. I agree that we've found good agreement, and I also enjoyed the interchange. l

Alcor Completes Its Seventh Case* in 2002

by Charles Platt

In May 1990, Alcor signed up a self-made 31-year-old businessman in Florida whose favorite activities were golfing and fishing. In this account, I'll refer to him by his Alcor bracelet number: A-1235.

Tragically, when he was only a few years over 40, he developed a tumor in his mouth that spread progressively to his neck and the surrounding skin. Earlier this year, after radiation treatments were unsuccessful, he was told that no conventional cure was possible.

Many cryonicists are stubborn, and A-1235 was no exception. This had worked to his advantage initially—his stubbornness caused him to reject the inevitability of death. But now that he had terminal cancer, his stubbornness jeopardized his chance of successful cryopreservation. He simply refused to believe that he was going to die. When we suggested that he should consider relocating nearer to Alcor, he adamantly rejected the idea. In fact, he didn't even want to speak to us.

Fortunately his wife is a truly exceptional person. Although she is a Catholic, she embraced her husband's belief in cryonics and was determined that if he wanted to be cryopreserved, he should receive the best possible treatment.

By the middle of this year, the cancer had progressed to the point where A-1235 could not travel easily. Merely maintaining his head in a normal posture could cause him severe pain. His wife, however, made arrangements for an air ambulance to fly him to Scottsdale, and she found a house that she could rent just ten minutes north of Alcor's facility. She took these initiatives entirely on her own and presented them to her husband as a fait-accompli.

They moved to Arizona at the beginning of October. On October 15, Alcor CEO Jerry Lemler, M.D. accompanied A-1235 and his wife to a local oncologist who confirmed that no further treatment was possible and recommended an IV line. Easy intravenous access can be important to terminal cancer patients, since it facilitates delivery of painkillers. IV access is doubly important for cryopatients because we hope to supply medications as rapidly as possible after death is pronounced, and finding a vein in a patient who has no pulse and virtually no blood pressure can be impossible. Still, A-1235 remained as stubborn as ever: He refused to have an IV installed. He still seemed to feel that he wasn't going to die.

By October 18, he was enrolled in a home-hospice program. The hospice administrators turned out to be exceptionally helpful and promised that if the patient experienced cardiac arrest and his wife called the hospice, the hospice staff would pronounce death over the phone, enabling us to transport the patient to Alcor immediately.

This combination of factors would enable an unprecedentedly short transport time. Since all our medical and technical advisors agree that the single biggest factor increasing the risk of brain damage is a prolonged period of zero blood flow at a relatively warm temperature, we were excited that we would be able to give A-1235 rapid treatment. On the other hand, we were now under exceptional pressure to respond promptly. Our operating room had to be ready at a moment's notice. Our surgeon had to arrive at Alcor within 15 minutes of being called, day or night. Our other local staff also had to be immediately available. We needed two people, minimum, to drive the Alcor ambulance to the patient's home as soon as death was pronounced. I spent a total of about ten nights camping out at the Alcor facility so that I could respond with Hugh Hixon without any delay.

We would have preferred to do a standby at the patient's home, where there were two guest rooms, but this was impossible for several reasons. First, A-1235 had stated in his sign-up documents that he did not want, and would not pay for, a standby. Second, his wife told us she felt our presence in the house would be intrusive. And third, we had no idea when A-1235 might be likely to die.

His tumor was dangerously close to his left carotid artery, raising the possibility that it could erode the artery and cause a catastrophic hemorrage. In this scenario, death would be rapid, with no warning. On the other hand, if the artery was not eroded, the patient could live for many more weeks. None of his major organs had been affected, and there was no sign of infection. Apart from the terrible damage that the cancer had inflicted on

his neck, he seemed alert and active.

On November 14, I visited the patient and found him still surprisingly lively and cheerful. Yet the hospice nurse whom I met at the house was skeptical about his prospects. She noted his substantial weight loss and a rash of new tumors around his neck and shoulder and guessed he would die before Thanksgiving. The only good news was that she didn't believe a hemorrage was likely. If it was going to happen, it would have happened already.

Meanwhile, during this visit, A-1235 talked casually about visiting Alcor to have a look around the facility. He seemed to have disassociated himself from his condition, as if the wound in his neck belonged to somebody else. He still refused an IV and still acted as if he didn't expect to die.

At Alcor, I mapped contingency plans. Our first priority is always to inject heparin, to minimize blood clotting; but if we had too much trouble achieving a successful postmortem intravenous injection (as I expected), we wouldn't want to waste time. We would move the patient directly to the ambulance, into the ice bath, and then rush the patient to Alcor, where (I hoped) a surgeon would be ready to expose a vein so that medications could be injected directly into it. We would then do chest compressions, ideally at the same time that the surgeon turned his attention to raising the carotids for cryoprotective perfusion. This scenario didn't please me, because it contained too many unknowns. How much blood clotting would occur during even the short transport, plus the time taken for surgical exposure of a vein? When we commenced surgery on the neck, would we even be able to cannulate the right carotid, which was probably embedded in the tumor mass?

By November 21, the patient's condition had deteriorated. He was semiconscious for most of each day and barely responsive. His blood pressure was still a reasonably healthy 130 over 80, but the hospice nurse told me, "I feel he is getting ready to die. I don't think it will be long, now."

The next day, when I visited the house, the nurse reported that blood pressure had fallen to 99 over 73, and oxygen saturation (a measurement of oxygen in the blood) varied between 84 and 87. (A normal value is above 93.) Also, significantly, his temperature, measured tympanically, had risen to 100.4. But he was still able to stand up and step on a bathroom scale when I asked him to do so, and he was lucid and responsive when we raised the question, yet again, of allowing an IV line.

This time, his wife, who had power of attorney for health care, was extremely insistent. Finally A-1235 agreed that IV access could be installed. But it was now Friday afternoon. The patient's doctor would have to request the IV, and the patient would normally have to visit a hospital as an outpatient—which was now out of the question. The hospice nurse recommended a service that would perform the procedure in the home, but when I called the service, they denied that they would do this. We realized that we would not be able to get what we wanted over the weekend.

The next day, Saturday, I called Tanya Jones, a former director of suspension services at Alcor, and asked her to join us. She promised to fly in the next day. Tanya has managed at least 15 cryonics cases for Alcor, and has done a lot of work in the operating room. I needed her experienced assistance.

By Sunday, November 24, the patient's oxygen saturation had fallen as low as 76. There was still no evidence of infection, but as the hospice nurse put it, "Something is going on here." I sensed that after almost two months, we were now near the end.

On Monday and Tuesday, with help from Tanya and from Dr. Jerry Lemler, we attempted repeatedly to get an IV installed. Eventually we began to suspect that the service was reluctant to comply because they had learned that the primary purpose of the IV would be to facilitate postmortem cryonics medications. Either way, we were still unable to get what we wanted.

On Wednesday, November 27, oxygen saturation was still in the mid-70s, the patient's urine was brown, his temperature was 104, and his pulse rate was up at 150. Clearly, this condition was unsustainable. After a discussion with Tanya, the patient's wife reversed her former decision and allowed myself, Tanya, and Hugh Hixon to relocate at her home. We parked Alcor's ambulance at the end of the street, just a minute's walk away, and made ourselves comfortable in the guest rooms.

By 7 p.m. the patient's temperature was up to 106, and Tanya drew and mixed our three most important postmortem medications. Meanwhile the patient's wife called for a hospice nurse, because A-1235 was now moaning gently, and she was concerned that he was in distress.

When the nurse arrived, I quickly explained our procedures, and she understood immediately. "It's just like resuscitation," she said, with a shrug. She started discussing the best way for us to inject medications postmortem. During this discussion, A-1235 started breathing erratically. He had previously exhibited apnea, but this was worse. As I watched him, he ceased breathing entirely. The nurse immediately pronounced legal death. "Are you sure?" I cautioned her. She applied her stethoscope and found no heartbeat. The time was approximately 8:20 p.m.

In accordance with the plan that we had established previously, Hugh attempted to do a "subclavian stick"—accessing a vein near the collarbone—while I ran out to fetch the ambulance. I backed it into the driveway of the house, then realized that I had allowed insufficient room to get the MARC (Alcor's Mobile Advanced Recovery Cart) out of the rear of the vehicle. I turned the key to restart the ambulance—and nothing happened.

I had always dreaded this kind of situation. My first encounter with the Alcor ambulance had been back in 1993, when I drove it to collect a patient from the county coroner in Los Angeles. The venerable vehicle had not improved with age. Many times, Alcor personnel had discussed replacing it—yet there had always been a higher financial priority. And, to be fair, the vehicle had always responded. It had never failed to start, until now.

I ran into the house, where I was surprised and pleased to find that Hugh had managed to inject all three medications, while Tanya was doing chest compressions with a hand-held CardioPump, and the patient's wife was in another room, being

comforted by the hospice nurse. I told Hugh that the ambulance was immobilized. He went outside, and I took over the CardioPump. Tanya retrieved our stretcher—a plastic board of the type that is normally used to retrieve mountain climbers from remote areas. We managed to move the patient onto the board and strapped him quickly into position. Dr. Jerry Lemler arrived to assist us.

Hugh failed to restart the ambulance, but fortunately we had alternate transportation available. Less than 15 minutes later, our patient was at the Alcor facility.

All our staff had received emergency calls, and they were ready at the facility. Surgery commenced on the patient's neck, and we were astonished to find that the right carotid had been completely subsumed by the tumor. The blood vessel simply was not there anymore. Our surgeon, who has had a long career in brain surgery, told us that he had seen such cases. In a relatively young patient, one carotid can gradually take over the entire task of supplying blood to the whole brain.

Probably for the first time in Alcor's history, we perfused a patient through only his left carotid. Surprisingly, the results were excellent. We achieved almost unprecedented flow, and there was no sign of blood clotting. We saw no evidence of asymmetry in the two burr holes. We reached the terminal temperature an hour before we reached terminal perfusate concentration. So far as we could tell, the overall results were very good.

u

Like all cryonics cases, this one was full of unexpected reversals and surprises. I would never have expected the Catholic wife of a long-time Alcor member to be the prime force impelling him to receive the best possible cryopreservation, even to the extent of chartering an air ambulance at huge expense, despite his repeated denials that he needed to move. I still feel amazed by the strength and devotion of this remarkable woman.

The close proximity that she enabled was a mixed blessing. The patient reached our operating room with great rapidity—about half an hour after death was pronounced—yet this moment had been preceded by many weeks in which Alcor personnel had to be almost instantly available on a 24-hour basis. By contrast, when we do a remote standby, we know that we have at least six hours to gather everyone at the facility and make the operating room ready to receive the patient.

Personally, I feel a bit too old to be sleeping on a camping pad at Alcor; yet in a case where we were going to be counting minutes instead of hours, I wasn't willing to stay in a nearby motel. In the future, we plan to establish a crew room at the Alcor facility to enable staff to sleep on-site if necessary.

The fault in our ambulance has been fixed, and we immediately acquired another vehicle that can provide temporary backup service for patient transport if necessary. Funds have been allocated to buy a permanent replacement for the ambulance. Never again will we be in a position where we depend on one vehicle.

Our experience in this case will make us better able to respond to nearby cases in the future. In fact, I am more convinced than ever that the only rational option for a terminal cryonics patient is to relocate near the Alcor facility. Alcor's unique attribute is its dedication to minimize brain injury. Reducing the transport time from hours to minutes is the single most important step you can take toward this goal.

Unfortunately, a choice that seems rational to an Alcor member today may not seem acceptable to the same person in the future. Patient A-1235 would not have relocated until it was too late if his very wonderful wife hadn't insisted upon it. He couldn't bring himself to believe that he would die in his early 40s, and his denial is not unique. Any of us might fall into the same behavioral trap, no matter how rational we think we will be.

The lesson, here, is clear: All terminal patients are likely to rely on the good will, commonsense, and devotion of people close to them. We should take note and plan accordingly.

My thanks to everyone who assisted Alcor at various times in this case: Keith Edic, William Faloon, John Grigg, Dr. Steve Harris, Hugh Hixon, Joe Hovey, Tanya Jones, Bobby June, Dr. Jose Kanshepolsky, Dr. Jerry Lemler, Paula Lemler, Mike Perry, Mike Read, Dr. Michael Riskin, Steve Rude, Jerry Searcy, James Sikes, Jessica Sikes, and Mathew Sullivan.

* Editor's note: Alcor completed its 8th case on December 20, 2002. Details to follow in next issue of *Cryonics.*

l

Editor's Errata...

In the last volume, *Cryonics*, 3rd Quarter 2002, the article on page 21 in the gray box under the heading "Alcor in the Media Spotlight" was incorrectly attributed to Jessica Sikes. The author of the piece was Jennifer Chapman, Membership Administrator at Alcor. My apologies to both.

ALCOR Update

President's Report

by Jerry B. Lemler, M.D.

You've likely grown weary of reading my saying (in each issue of *Cryonics*) how busy and productive we've been around here. Hey, but this time I **really** mean it!

Alcor's Fifth Extreme Life Extension Conference in Newport Beach, California, November 14 to 17 was a huge scientific and collegial success, in which we signed up no less than five new members (with several others likely to follow), directly on account of the event! Keynoter Michael West was nothing short of sensational, while the participants were treated to the likes of Ray Kurzweil, Aubrey deGrey, Eric Drexler, Gregory Benford, Brian Wowk, Christine Peterson, Max More, Greg Fahy, Rob Freitas, and a host of other knowledgeable and articulate presenters.

One of the absolute highlights of the weekend was the presentation of the first annual Leonard N. Zubkoff Memorial Award, named in honor of our great departed Board Advisor and friend. I had the distinct privilege of presiding over the ceremonies during which the award was presented. Mary Naples, Leonard's cryonics insurance agent and friend, addressed the audience, commenting on Leonard's commitment to Alcor, while honored guest Jan Jewell, Leonard's long time closest friend, eulogized this great man, bringing tears to more than just Jan herself. The Conference Committee selected as the inaugural recipient of the Zubkoff Award, Buena Park (California) mortician Joe Klockgether, citing his many selfless accomplishments over the decades on behalf of our foundation.

My gratitude is extended to Conference Chair Ralph Merkle and Co-Chair Kat Cotter for their tireless efforts to ensure this convocation would be such a memorable event for the attendees, speakers, workers, and volunteers alike. Kudos also go to Conference staff members Judy Muhlestein, Bill Haworth, Jessica Sikes, Russell Cheney, Paula Lemler, Anneka Repscher, and our host of volunteers for a job well done. Thank you all so much!

Some conference highlights are presented in this issue of *Cryonics*, while full coverage of the event will be forthcoming in our first issue of 2003. If you can believe it, the Conference Committee conducted a two-hour wrap-up meeting on Thursday evening, November 21, at which time plans were discussed regarding the Sixth Extreme Life Extension Conference, tentatively to be held in the Phoenix area in June of 2004.

Awhile ago I was invited by Dave Pizer to give the opening address at the celebration of the completion of his new Creekside Lodge, near Mayer, Arizona. I was joined by several Alcor staff members and volunteers for this event. Trudy and Dave have done themselves proud in constructing a beautiful lodge, along with a string of nicely appointed cabins situated next to a creek, with a large stable and an observatory for stargazing free from the city lights of the Phoenix area. Dave's plans call for the (eventual) establishment of a community of likeminded futurists to populate

the resort; the Ventureville concept first conceived years ago. I have little doubt he will succeed. The annual Arizona CryoFeast (December 15) was also held at Creekside.

The most exciting news, though, since my last report to you, was the approval by our Board of Directors of Charles Platt's ambitious ($342,000) spending proposal, aimed at securing and maintaining technical and logistical competence and standardization of our suspension capabilities and protocols. This expenditure represents the single largest sum of funds our Board has ever allocated for such purposes, and the wheels are already in motion to propel this multifaceted plan into action. Charles himself will be describing the rationale behind the proposal's concept, as well as providing us all periodic reports on the progress of its implementation.

While we have, to be sure, certainly experienced our fair share of growing pains this past year, 2003 promises to be nothing short of extraordinary for Alcor, given the foundation we have erected these past 12 months.

I hope you all have a joyous holiday season, and please stay vertical throughout the new year!

l

OUT OF TOUCH WITH ALCOR?

If you'd like to know what's happening at Alcor, we've launched a new service to keep you instantly informed. Alcor News is an e-mail system that will send you short bulletins on a regular basis (typically about once a week). While in-depth articles about Alcor will still appear here in *Cryonics* magazine, news briefs will reach you via e-mail.
It's free, but, you have to subscribe!
Subscribing is easy. Just visit

⇨ http://www.AlcorNews.com

and follow the instructions. Or send e-mail to alcornews-request@alcornews.org, with the single word Subscribe in the subject line. You will receive a message asking you to confirm that you are subscribing. Reply to the message, and you're all set!

Note: Our server protects your e-mail address from being harvested by spambots. Your identity will be protected. We will not share your address with anyone else. The only e-mail we send you will be Alcor News.

Alcor Membership Status

Alcor has 605 Suspension Members (including 104 Life Members) and 51 patients in suspension. These numbers are broken down by country below.

Country	Members	Applicants	Subscribers
Argentina	0	0	1
Australia	9	1	3
Austria	1	0	0
Brazil	1	0	0
Canada	15	6	12
China	1	0	0
France	0	0	1
Germany	4	0	2
Ireland	0	0	1
Israel	1	0	0
Italy	0	2	3
Japan	0	1	2
Lebanon	0	0	1

Country	Members	Applicants	Subscribers
Mexico	0	0	1
Monaco	1	0	0
Netherlands	1	0	1
Russia	0	0	3
South Africa	0	0	1
Spain	2	4	0
Sri Lanka	0	0	1
Sweden	0	0	1
Switzerland	0	0	2
Taiwan	0	0	1
U.K.	14	3	6
U.S.A.	555	72	243
TOTALS	605	89	286

Membership Update

This is a historical graph of Alcor's membership growth. Our current plans are to provide an updated version in each issue of *Cryonics.*

Where There's a Will, There's a ***Way***

by Ava Phillipson, M.D.

Cryonics is a process that is already used as an alternative to burial and cremation. It is predicated upon current medical, computer, and nanotechnological sciences that are advancing at an exponential rate.

It is too late to put the genii back in the bottle. With every passing year, the general population becomes more familiar with the procedure. Unfortunately, they do not understand what it really means. There is a pervasive feeling that cryonics is more science fiction than science fact and, even worse, that the entire concept is a hoax. It is not surprising then, that the idea of being frozen and placed in a cylinder triggers nightmares. Placing their bodies into the hands of strangers and then giving those strangers the right to perform unusual procedures is terrifying at a primal level. There is no greater fear than absolute loss of control.

People take years to determine how they want to be treated after death. It is generally something that involves personal beliefs, family, finances, and possibly religion. It is never an easy decision and is often one that people don't want to think about at all. But history and experience have reinforced two ways of committing a body to its final resting place. At this point it is clear to see why people have not responded in greater numbers to the astounding breakthrough of biostasis and the attendant science of nanotechnology.

Modifying the negative image of cryonics is the first order of business. It is absolutely essential to replace fears with friendly and familiar ideas. This will instantly make cryostasis more psychologically accessible and certainly more acceptable in general terms. Positive reinforcement can be achieved in myriad ways and disseminated on many levels. We must consistently and quietly alter popular perceptions.

The first shift could be something as simple as avoiding clinical terminology whenever possible. In many cases common words with positive connotations could be substituted for colder and more threatening ones. "Hibernation," for example, sounds so much more positive than "freezing bodies." "Hibernation" suggests a long sleep from which we will awaken—rested, alert, and rejuvenated. We would be eager and capable of continuing our lives with loved ones as well as our brother and sister cryonauts. We may even have a family member waiting for us as we awaken from our temporal journey.

It is one thing to understand what we must do to facilitate these changes and quite another to actually make them happen. I would like to develop focus groups to learn about the most challenging issues. What must we do to overcome preconceptions and make biostasis the wonderful, modern, and user-friendly alternative when it is time to make decisions about our mortality? Which role models do we use to focus positive attention on the radically new and emerging field of life extension (which has actually been around for more than 30 years?)

I would also like to offer hands-on workshops where future cryonauts can learn about the science of cryonics as well as the processes we expect to play a crucial role in revival. Another aspect of these classes would be to determine and foster individual strengths and talents, reinforce and improve memory, and encourage creativity. Honing observational skills also produces a concomitant heightened awareness of sensory stimuli. We may learn to see with an artist's eye, or at least a detective's, and thus alter our critical thinking and creative abilities permanently.

Most important, we are changing the way we think as we lay down deeper neural pathways and maximize our ability to awaken with memories and skills intact. We will have developed an unshakable sense of place and time. Our clients will think of biostasis as a fait accompli.

Why would a person who has only a passing knowledge of cryonics want to become involved in these seminars? One person may want to satisfy simple curiosity. Another may recognize that we are providing cutting-edge skills that could put him far ahead of business or social competitors. No one disputes that knowledge has always been power. Remember, we are focusing on sharpening marketable skills for the future as well as right now. Self-improvement in all its forms is an extremely lucrative market and could bring in substantial funding for Alcor.

There is one other dimension that I think solidifies my previous assertions. The people who seriously consider cryonics ate for the most part keeping themselves in good shape. They know how to take care of themselves and practice healthy living on a daily basis. They have also read studies on actors that increase longevity—one of which is keeping the mind active—learning! What better impetus is there to become an active participant in our workshops? We will help you live longer so that you may live forever.

I would love to see previously mentioned topics integrated with up-to-the-minute presentations involving wellness, preven-

(continued on page 40)

The (Cryonics) Grand Opening of Creekside Preserve/Ventureville

by John Grigg

The grand opening of Creekside Preserve resort was held on Sunday, October 27, 2002, at the Creekside Lodge in Mayer, Arizona. The Creekside resort is presently open to the general public including cryonicists (of course!), but it is the hope of many that a special cryonics *community* ("Ventureville") can be completed here in reasonable time (more on that below).

Lodge of the Creekside Preserve, where the gathering was held.

The cryonics gathering, hosted by David and Trudy Pizer and me (John Grigg), proved to be a fun and intimate gathering. Seeing many old friends and acquaintances was something I had looked forward to, especially Dr. Mike Perry, due to his dry sense of humor, intelligence, and keen powers of observation. Later, at lunch time, I must admit to being surprised at Mike's healthy appetite! We had a variety of foodstuffs to match the culinary interests and/or dietary requirements of our guests.

Before the event officially got started, a lone deer worked its way down the hillside on the opposite side of the creek. We watched from the elevated porch as this beautiful creature carefully hopped from bush to rock until it was at the creek for a drink. Then it carefully worked its way back over the hill and was gone. Mr. Pizer pointed out that often guests will be able to see a herd of deer or javelina (wild native pigs), or other animals and birds come to the creek for water.

Some attendees.* From left: *Jerry Searcy, John Grigg, Bien Brandt-Erichsen, David Brandt-Erichsen.

Beginning the event, Mr. Pizer and I gave a tour of Creekside starting with the main lodge. Our visitors had already seen the great room with its beautiful western furniture, large fireplace, and western artwork, so we started at the basement level to view the gymnasium and the conference room. The conference room holds 100 to 120 people, and the possibility of using it for Alcor meetings instantly flashed in the minds of some of those present.

Next, with Albert, Mr. Pizer's great, ebony-coated great dane padding powerfully in the lead, we headed out to the cabins. Their upscale quality impressed everyone, and as usual the bright red, heart-shaped, hot tub/jacuzzis got everyone's approval! Creature comforts such as a microwave oven, cable TV, mini-fridge, gas fireplace, and even a dimmer light make each cabin very inviting. Some of them have a king-sized bed; others have two double beds and no jacuzzi. We also have two cabins that can accommodate handicapped guests. We stood out on one of the cabin porches that overlooks the beautiful creek site as Mr. Pizer explained about the area. The natural beauty has been preserved, and it is a wonderful experience to spend time on those large, covered porches.

Hot tub/Jacuzzi

Next we hiked further around the property; the first stop was the stables. These are in a big barn with a large, lighted sign encouraging passing motorists to "bring your horse." That got a laugh from the group!

After the equestrian excursion we hiked to the top of the tallest hill on the 34-acre site. The observatory Mr. Pizer has built there was a big hit with our guests, as I thought it would be. They oohed and ahhed at the powerful, 12-inch Schmidt-Cassegrain telescope, and Jerry Searcy quickly volunteered to be our resident visiting astronomer!

The observatory. John Grigg (left) and Hugh Hixon prepare to inspect.

We were on the high ground looking down at the lodge. It was then that Mr. Pizer shared with us his vision for a complete community where a cryonicist can come to live among others with similar interests and beliefs. First he noted that, when possible, he will build 30 or so more cabins to increase the profits of the resort part of the community and provide a financial base for the cryonics interests. Next he pointed to a low, flat hill and said a recreation center would be built there, a large building with a gym, meeting rooms, a club house, and a swimming pool that was half inside the building and half outside. It will be open for both the Creekside guests and the Ventureville residents. It will have places for cryonicists to relax, play, work, and study. Some day, the Venturists would like to build a library and a cryonics museum in the area.

Some hikers.* From left: *David Pizer, Mike Perry, Hugh Hixon, Bill Haworth, Joe Hovey.

Mr. Pizer then pointed in another direction. About 20 apartment units and some private houses would be erected there. He emphasized his desire to make these affordable to those who would want to come here, but also to have large homes for those who could afford them.

With my mind's eye I could actually see what he was describing. Some of you may have to wait several years, but I've already "checked out" Ventureville! Mr. Pizer really wants a place where cryonicists can find the kind of intellectual and social stimulation they crave. It will be a community where we will work together to advance the cause of cryonics, and an end to death, based on whatever talents we have to offer.

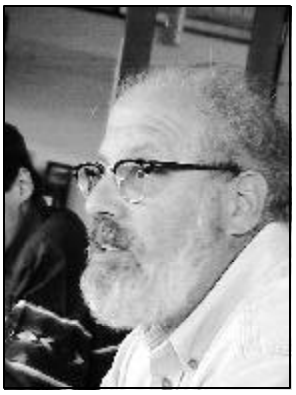
While hiking down the trail Mr. Pizer continued to tell Dr. Lemler his plans for Ventureville. In return Dr. Lemler shared his insights and ideas. I felt very privileged to be there walking with them, taking it all in. It was a beautiful morning. It had been raining the night before; now the sun was peeking out. The raindrops glistened on the leaves of the trees and bushes, giving them a twinkling, magical appearance. Some of the moss on the granite boulders was wet and seemed fluorescent. The whole desert was clean and bright and with the feast to the eye and drink of the conversation it was a high point for all in attendance.

Later, I went off for a hike with Bill Haworth, Alcor's new public relations consultant. I enjoyed getting to know him—this former Marine Corps officer is quite an interesting guy. We ended up braving some barbed wire to reach the top of a hill and noticed a large "mystery rock" on a nearby prominence, suggesting a Mayan ruin. It was a magnificent view, and after taking each other's pictures, we trekked back.

By lunchtime a nice-sized group had formed in our dining room. Old friends got reacquainted as they sampled our buffet. It was exciting sharing thoughts and ideas with Dr. Lemler, his wife, and others.

Mrs. Lemler gave me some tips on being a successful gardener. Thank you! I will certainly need it. Both she and her husband told me about a trip they took to Alaska (my former home), and how much they had enjoyed it. I shared with Dr. Lemler my thoughts about Arcosanti and how it would be good to develop possibly synergistic relations with them. Arcosanti, as some of you may know, is a community of people who have environmental concerns. They live their philosophy in a setting designed to emphasize it. It is also a popular tourist stop and is about ten miles from Creekside. (By the way, besides Arcosanti, Creekside is centrally located near Prescott, Sedona, Jerome [a real ghost town], and Flagstaff—all great tourist stops in northern Arizona. We are also not too far from the Grand Canyon, Meteor Crater, and the Petrified Forest.)

We stayed in the dining room to hear Dr. Lemler's presentation. He started out by thanking David Pizer for his hospitality and the beautiful place he had built. Then he told us of the new plan to have standby service available to all Alcor members at no extra cost to them if they sign up by June 2003! The old days of having to have a big bank account to cover the cost of extended-length standby teams are soon to be over. There were caveats in his presentation that would depend on how the Alcor Board felt.



Dr. Lemler delivers his talk.

Next, Dr. Lemler shared how only the night before he had come to a firm decision to have the Alcor equivalent of a "Ronald McDonald" house. This will eventually mean a dying person can

(continued on page 40)

Views from Members:
Examining the Morality of Cryonics

by David Pizer

Cryonics is a technology and philosophy that is associated with the highest of all ethical goals. I will lead you to the logical conclusion that it is immoral not to opt for cryonic suspension and the goals it potentially leads to—that to reject cryonic suspension is to reject existence and all that stems from existence, which is everything, because without existence there is nothing.

In this work I will show that:

1. All value emanates from being alive.
2. To have morality, we must first have life. Life causes morality.
3. Since it is moral to seek morality, it is the highest morality to seek the cause of morality, which is life.
4. If life can have any morality, long life, or eternal life, can have the most morality.
5. If it is moral to strive for life, then it is immoral not to.
6. Cryonics is striving for life.
7. Therefore, it is immoral not to opt for cryonics.

ASSUMPTIONS

In order to narrow my focus to one specific question, "Is cryonics moral?" there needs to be some assumptions before I get to the main part of this work. This work assumes one wants life for moral purposes and then the following assumptions:

Assume cryonics will work and it is a first step in a process to obtain immortality.

This work is not an investigation as to whether cryonics *will* work; this work is an investigation as to whether it is moral to opt for cryonics, or immoral not to opt for cryonics. In order to question the morality of cryonics to the fullest, we need to assume it will be successful.

This work is an examination of ethics as they presently pertain to issues relevant to all the intentions of cryonics. At present, the intention of cryonic suspension is to increase the life of terminal patients who have run out of other options:

1. To hold the body in biostasis (by administering cryoprotectants followed by controlled freezing and long-term storage)
2. To then take the patient (frozen people are called "patients") to the future, where future doctors may be able to revive the patient by curing the thing that caused the original legal death and repairing the damage done in the freezing process
3. In addition, it is assumed that the technology to revive people suspended by today's techniques will be beyond technology needed to reverse aging. So the assumption in cryonics is that if they can reanimate patients someday, they will also be able to restore patients to youthful vigor.
4. Taking this assumption to its ultimate conclusion, if disease and aging can be controlled in the human body, the human body is then virtually, biologically immortal.
5. And so the final assumption about cryonics working is that the cryonics patient will eventually become biologically immortal in a youthful, healthy, beautiful body, and barring an accident, lives virtually forever.

Even if we don't assume it will work, if we just assume it might work, it is still moral to opt for cryonics.

At the present time no one on earth can tell you if cryonics will or will not work. The ultimate answer to that question can only come in the future when technology has been advanced beyond what it is now and the future technology of reanimation and nanotechnology-repair can be used on people being frozen with today's technology. In this work, I want to show that since we cannot know the outcome until we get to the future, opting for cryonics is the moral default position. Not opting for cryonics, not opting for other potential life-saving techniques, therefore can be looked at as a form of suicide, perhaps passive. As mentioned, we don't know at the present time if the people who are being suspended through cryonics will be reanimated in the future and brought back to life, but it is more certain that people who are buried or cremated in these times will be more difficult (probably impossible) to revive in the future than people who are frozen.

Assume cryonics is paid for by the patient.

This investigation assumes that the person who is opting for cryonics is using his/her own money. I am not arguing in this work that governments should pay for cryonic suspensions. However, I do think that a reasonable argument could be made regarding governments paying for cryonic suspensions for their citizens. In some cases, cryonics would allow the sickly, terminal person to opt for an early death in order to be in better condition at time of freezing.

This would allow the government to pull the plug and hold the patient for future, less-expensive treatment that might restore the patient to perfect health and make him/her once again a productive, tax-paying member of that society.

There are many possible government-sponsored cryonic suspension scenarios where the revived person could then pay an additional part of their earnings for so many years in sort of a revival of the indentured servant program of years ago.

But at present, most people can afford to pay for their own cryonic suspension, which can be arranged for the average person for less then the cost of a smoking or drinking habit. The technology that will be needed to repair people being frozen at present is called nanotechnology. It is projected that when fully developed, nanotechnology holds the promise of performing what we would today call "medical miracles" and do so for a fraction of the cost of most major medical procedures in today's medicine.

The fact that at present individuals are paying for their own cryonic suspensions is not a major detraction, and even if the suspensions were being paid for by charities or governments, I would like to eliminate the possible objection that the money could be used better elsewhere. Since there are many preventable deaths going on at present, including starvation, an objector could make a reasonable argument that if cryonics was paid for by charities or governments, there might be other things that could be done with the limited resources that would bring about more good.

An objection to the "Money does more good if spent somewhere else" objection could be: if cryonics saves just one life and that leads to eternal life, and money spent elsewhere saves many lives but just for a few decades each, then the one cryonics-eternal life is more valuable since it contains more total years of saved human life.

Assume that without cryonics biological death, at present, is a known certainty.

There have been criticisms that cryonics is making decisions based on unknowns. But in fact the opposite is true. If a person does not make arrangements for cryonic suspension he/she knows that he/she will die someday and will be buried to rot underground or cremated and turned into ashes. Certainty of death is one of the known facts. My assumption here is that it is better to have an unknown chance at more life than a known certainty of ceasing to exist.

Assume that cryonics technology will be developed along with other advances in technology, and not all by itself.

Opponents have also expressed fears that advancements in cryonics that lead to, and are a part of, the intention to achieve biological immortality will also lead to overcrowding and other ills here on Earth. In response I would point out that overcrowding has always been a problem and that necessity is the mother of invention. Humans have been migrating for centuries. Soon we will be crowded on this Earth. That puts pressure on us to create technology to make life better here **and** to create technology for some of us to live off the planet.

This article assumes the type of technology that will be needed to end aging and bring biological immortality must be beyond the technology to support billions more people on Earth and in a better fashion then we live now. Just the shift from carbon-based energy to renewable sources alone will make a huge difference in the environment. For this work let us also assume that it is inevitable that humans will leave planet Earth and populate other areas of space if we are to survive at all. Space is big enough to hold all the people we can make for as long as they want to live.

Assume that even if we don't freeze people today and bring them back in the future, people will still be working on technology that will eventually make them biologically immortal. So whatever problems (if any) that will bring, humanity will have to deal with them regardless of whether people of today opt for cryonics.

I would point out that at the rate we are multiplying we will reach a certain limit where the additional people will have to live off planet whether cryonics works or not. If cryonics works and we vastly extend human life spans, that time will just arrive a little sooner. Stopping cryonics will not remove that problem, so that potential problem is not a good reason to stop cryonics.

Assume each person should be autonomous.

I will assume that to advocate against biological immortality is to hold the position of being the one to put a limit on how long your neighbor should live. That is the ultimate example of playing God in a bad way, and I do not think any moral person would want to limit the life of another innocent person. Where would you draw the line and start killing healthy, happy, biologically immortal people—at 100 years of life, 1,000 years, 1,000,000? Rather than talk of limiting lives, responsible people should talk and work for ways to improve the living conditions here on Earth and eventually find ways for us to colonize space.

Assume life in the future will be good and so ending life is bad.

If we have a right to exist and we can figure out how to have biological immortality, then the opponents of this are obligated to show that it is morally permissable to set a time when happy, innocent people must be put to death. For to deny people the right to extend their lives has the same effect as killing them.

Final word on assumptions:

To repeat, my assumptions may or may not turn out to be valid. But keep in mind that I make these assumptions in this work in order to fully examine the question, "Is it moral to opt for cryonics at legal death, or immoral not to?" If my opponents could successfully repudiate my conclusions using these assumptions, then their position would be stronger than if they did not include these assumptions.

Before I get to the main argument, I will briefly:

1. Discuss some traditional ethical theories in "Traditional Theories For Judging Morality."
2. Give a brief explanation of cryonics in "What Is Cryonics?"
3. Although the main purpose here is not to argue that cryonics will work, I will give a brief explanation as to why those who opt for cryonics think it will work in "Why

Legal Death Is Not Biological Death and Why Cryonics Might Work."

Having briefly explained the three points above, I will move into my main argument with the points below:

4. I will explain why opting for cryonics is moral and examine the goals of cryonics under the light of prevailing moral theories in:
   4a. *Examining Cryonics under Traditional Forms of Morality.*
   4b. *Where Does the Value of Life Come From?*
   4c. *What Is the Necessary Condition for Morality?*
5. I will argue why refusing cryonics for one's self, and talking others out of cryonics, is immoral in:
   5a. *Why Opting for Cryonics Is Moral.*
   5b. *Why Not Opting for Cryonics Is Immoral.*

CREDITS

Some of the ideas published here come from a seminar at Arizona State University led by Professor J. Gereboff. I am grateful to him for reading drafts of this work and pointing out problems and giving me suggestions but mostly for allowing me to focus on my own agenda, which I hold to be of the ultimate concern. However, any errors in this work are mine. This class helped me to decide to investigate the morality of cryonics from the positions of assuming the existence of an eternal heavenly afterlife and assuming it does not exist.

At this point, I would like to state that I do not think cryonics and some religious instruction are mutually exclusive. I have tried to do the logic correctly so that in either case, if there is a heavenly afterlife, or there is not, it turns out that the same conclusion is valid for either case. What I am attempting to do in this work is show that whether life is a gift from God **or** if life is a prize from accidental evolution, that life is a prerequisite for morality, and so it is moral to opt for life as it is moral to opt for morality.

---

1. Traditional Theories for Judging Morality.

First I would like to very briefly discuss some of the tools I will use to use to examine my argument, they are my interpretation of the established ethical theories or methods for judging the merit of various moral positions. They are deontology, consequentialism, and the sanctity of life doctrine. Deontology includes principles of autonomy and justice. Consequentialism includes principles of beneficence and nonmaleficence. I will also look at sanctity of life and other traditional religious doctrines. Be apprised that I intend to look at these in new light and consider previously unconsidered possible ramifications.

A quick definition of deontology might show that it examines the moral value (right or wrong) of various actions, and it uses considerations of responsibility or obligation to urge one to act in a way that will protect the rights and interests of others. It assumes intrinsic dignity and worth of other persons. Deontology is not supposed to be based on the consequences of actions. (However, I don't think any complete and truly moral consideration, when applied in real life, can completely escape consequences.) It is concerned with the motivation and logic that leads to actions.

Deontology considers "rightness" to be respect for persons and actions that are fair. Kant's "categorical imperative" would be a deontological principle (Act only in a way that you would will that act to be a universal law, and always treat people as an end and not as a means).

Consequentialism attempts to determine the moral value of an act based only on the consequences. Consequentialism considers "rightness" as the amount of good that comes from an act (goodness being things like pleasure, good health, longevity, and absence of pain). Utilitarianism—actions are right to the degree that they promote happiness—is a version of consequentialism. But consequentialism uses more than utilitarianism to interpret the good.

The sanctity of life doctrine holds that since life is a gift from God, it is sacred and has boundless value. This would seem to mean that people who believe in the sanctity of life are mandated to take steps to attempt to prolong that life as long as possible. Glannon gives us the instance, "For example, the Jewish *Halachic* tradition follows Torah's teaching that every moment of life is intrinsically valuable, which suggests that no life-sustaining treatment can ever be futile." Although not all Jewish people hold such views, there is a history in Judaism, and many other religions, that saving or preserving life is a good thing.

---

2. What Is Cryonics?

When I use the term *cryonics*, I am referring to biological stasis of the human body, especially and mainly the brain, through freezing (although any method of preserving the body that has the potential of being reversible in the future could be included). At present optimal "cryonic suspension" is considered achieved if a body is frozen at legal death with minimal ischemic damage. At the temperature of liquid nitrogen, there is virtually no biological decay. Decomposition of the body is arrested while the search for new technology goes on. The condition of a body frozen for a thousand years is in no worse shape than a body frozen for one year. So time is on the side of the frozen person—they don't get any worse, but technology to save them gets better.

A reasonable person would have to conclude that if the human race continues for 100 years on its present scale, the growth rate of the introduction of new technology will be even greater than it is now, as technology is shown to be growing at an exponential rate. Certainly if 100 years is not long enough to obtain the goals of cryonics, 1,000 years is, or 10,000 years. The frozen person has no feeling of the passing of time. If he/she is alive, he/she may be in a sort of dreamless sleep. If it turns out that cryonics works, the cryonaut may have the sensation of dying and almost immediately thereafter have the sensation of being revived. However many years that passed during suspension will not be experienced. For the adventure-seeking cryonics traveler to the future, waking up in 1,000 years might be more fun than waking up in only 100 years, where even more changes in hu-

man nature will have taken place.

Lastly, cryonics assumes the frozen person is alive, or at the least, is not dead. We cannot bring back people who are biologically (really) dead—only God, if He exists, can do that. But even now we can bring back people who are not breathing and who do not have any heartbeat. We do that everyday with CPR. We bring back people (mostly children) who have gone without breathing or heartbeat for almost an hour in cases of certain surgeries and in some cases where children fall into very cold water. Cold arrests deterioration. Cryonics, if it turns out it works, is not magic. It is just one more well-thought-out scientific theory that has not been proven true or false yet.

---

3. Why Legal Death Is Not Biological Death and Why There Is a Chance That Cryonics Might Work.

A common definition for legal death is cessation of heartbeat. When your heart stops beating, you are legally dead. But all (or most of) the cells in your body are probably still alive. Your organs are probably still alive also. They don't die the second your heart stops beating; they die at differing rates. We know this because doctors remove organs from people who are legally dead and transplant them in sick people, and the organs continue to function in the new person—so the organs were not biologically dead when the donor was declared legally dead.

We also know that frozen cells are not dead. We know this because human cells are routinely frozen and when later revived they continue to live. A typical example is that of the frozen fertilized human egg. There are many humans alive today that started out as a fertilized egg that was frozen and stored for some time in liquid nitrogen and later revived and put in a womb and grown to birth. Preserving a limited amount of cells is not a guarantee that cryonics *will* work, but it is an indication that it *might* work. This, coupled with the fact that people who are not cryonically suspended today will not be revived by other humans, produces the following situation: Sign up for cryonics and you *might* be brought back in the future; do not sign up for cryonics and you *will not* be brought back in the future, unless God exists and you have earned a heavenly afterlife.

As some cryonicists have suggested, cryonics is an experiment to avoid being dead forever. Do you want to be in the experimental group or the control group? Be aware that there is no penalty for trying cryonics. If it doesn't work you are still only as dead as if you had not tried it—you can't be doubly dead as a penalty for trying. Since not opting for cryonics will guarantee your permanent death, you have everything to gain and nothing to lose by trying. We might treat cryonic suspension as similar to an operation to remove a tumor that is certain to kill you if you don't have it removed. The operation might be successful. But it might not. Knowing that it might save your life and that you have nothing to lose in opting for it is all you need to know to make a choice. This is a good place to repeat that there is a certainty involved with cryonics, it is certain that if you die and are not cryonically suspended, scientists in the future are not going to bring you back.

These facts, along with the fact that there is no law of physics saying that cryonics will not work, are reasons to assume that cryonics might work. And when I talk about the morality of opting for cryonic suspension, I am talking about the morality of trying to avoid permanent biological death, of choosing to attempt to extend life past death. Whether it works or not is not the point in determining its morality at this stage. The facts suggest that it might work, that it has more than a zero chance of working, and since there is no proof that it will not work, that if you don't do it you will be dead for sure, this seems to lead to an early conclusion that there is no moral reason not to try it. But we will look further into this.

4a. *Examining Cryonics under Traditional Forms of Morality.*
4b. *Where Does the Value of Life Come From?*
4c. *What Is the Necessary Condition for Morality?*

Opting for cryonics is trying for a good quality of life in the future over otherwise certain death. It is grasping for the most heroic means presently available to try to save life, often when every other medical option has failed. So the success of my argument is going to rest on if I can show that it is always best to try to attain good quality life. (Remember, there is built into the assumption of successful cryonics that the technology to reanimate the patient is developed to a state that the life that results will be healthy and of good quality.)

I think the necessary ingredients of a moral system are:

1. To have a moral system there must first be moral agents.
2. To be a moral agent, one must have life.
3. A dead person cannot be moral or immoral. (The very term "a dead person" does not make sense because if a living person becomes dead, then he/she is no longer a person. So "dead person" is as meaningless as saying a "dead nothing.")

We judge the total value of a life by two main qualities: morality and happiness. Happiness is important to the person living the life. If a life is full of sadness and suffering and has no joy or pleasure, it may not be worth living to the person who lives it.

Morality is important to those affected by the person living the life, and perhaps also to the person living the life. If the person's life is one of high moral value it probably benefits others. The best life would be one where the person was happy and moral. That would produce good things for the person living the life and the others involved.

One method of measuring the value of life is a system something like this:

For one year of happiness, we would give the count of one.
For one year of morality, we would add one.
For a year of unhappiness or a year of immorality, we would deduct one for each.

So, for example, a person who lived 50 happy years and 40 moral years, and 10 unhappy years and 5 immoral years would be given a positive number to evaluate the quality of his/her life. (In this case +90 -15 = +75 net.)

This formula can be adjusted by increasing or decreasing the numbers to reflect the amount of happiness or morality, or the amount of unhappiness or immorality, in each year—or by playing with the numbers in other ways. I am not trying to create a way to measure the quality of a life exactly but I am trying to show that in most common ways of measuring a life, the amount of happy and moral years and just how happy and moral they are, are what are often used to determine if a life is/was worth living.

But one cannot have happiness nor be moral if one does not exist. Conversely, for each year of happiness and morality the worth of a life becomes more valuable. If a person lived a happy and moral life for 100 years, those who measure life in this way would say that it had been a very very good life, better than a shorter life of the same morality and happiness per year.

But even a whole planet full of people living 100 years of this valued life each cannot begin to match the value of just one eternal life that is eternally happy and moral when measured in this way. So we can see that striving for biological immortality is a very good thing to do if person intends to be, and does become, both happy and moral forever.

With biological immortality and all the new technology that will accompany it, the odds are that people will be very happy as they live further into the future. With immortality there is also some incentive to be moral because if a rational person realizes he/she is going to live forever, he/she will want to live in a 100% moral world to achieve the most happiness, and so being moral one's self is the first step in producing that completely moral world.

So we come to the conclusion that when measured with the tools used today (happiness and morality), adding years of happiness and morality to life increases its value to the person living the life and to those others who live at the same time. Seen in this way, cryonics seems to be very moral.

What are the deontological considerations of opting for cryonics?

What gives live value?

What are the necessary conditions for deontology?

The Dictionary of Philosophy by Peter A. Angeles describes deontology as "moral duty," "the study of the concept of duty and its related concepts." So we need to ask from a deontological point of view if there is a duty to preserve life. A "duty" implies a duty *to* someone. That duty can be to others or it can be to yourself.

In order to fulfill a duty, one must have life. You cannot continue to do your duty if you don't exist. You might do something now that will cause things to happen later that will be considered fulfilling one's duty, but still, you must have life to continue to do this duty.

When one sets out to do good work, to have lasting meaning that work should not be temporary. If Joe sets out to do a duty to help homeless children and does it for a month and then quits, we would say that Joe did his duty for awhile, but is not doing it now. If Joe did his duty for a month and then died, we would still say that Joe did his duty for awhile but is not doing it now.

If doing your duty for a certain time is a good thing and the more you do your duty the better it is, then doing your duty forever, in theory, is the best one can do. To achieve immortality to do one's duty forever must be the highest one can accomplish. To not try for ways to achieve that shows a lack of respect to one's duty.

As long as a person is alive and trying to stay alive, he/she is respecting his/her life. Allowing life to end, to give up the one last chance to preserve life by making the decision not to opt for cryonics when biological death is imminent could be viewed as a lack of respect for life and therefore a lack of respect for duty.

If you respect something, you value it. If you value something, you try to preserve it. The more you value the item, the harder you try to preserve it. There is an old saying, "Actions speak louder than words," and acting to preserve your life, be it exercising, eating a good diet, not smoking, and all the other things one can do to preserve his/her life are actions that show that a person values and respects his/her life. Whether life is planned by a greater force or a mere accident, it has value, and there is a (deontological) duty to preserve value. There is no value without life. In order to have any form of deontology, we must first have life. Therefore there is a permanent duty to preserve life so that all other duties can be fulfilled.

If life is not an accident and is a gift from God, then a person has a duty to respect and preserve that gift. If you receive a valuable gift and do not respect and preserve it, that is considered immoral. So if life has value, to not try every measure to preserve one's life, no matter how that life was formed, is surely immoral.

If life is to have any value at all, even if life is only a prize from the blind chance of evolution, then once a person has been lucky enough to have evolved into existence and finds himself/herself alive, he/she has a duty to respect and preserve that life. To do otherwise would be to express the conviction that life has no value. If anything has any value, any moral worth at all, then there is a duty to preserve that value from those who are the recipients of that value. So the conclusion here is that for any duty to exist, that duty is dependent on the holder of that duty to exist, so the primary and utmost duty is for one to exist.

As we leave our deontological discussion, we might ask what is the meaning of life? In the past (unless it turns out that God exists and there is more to life than what we can see from our position here on Earth), the meaning of life has been to pass on abstract genetic information. Life was not even for the benefit of the persons who temporally had it; they were the containers for abstract information to be passed on. The meaning of life has been for one animal or person to grow to breeding age and then by breeding and helping the offspring grow to breeding age, be able to pass on different repeating bits of information (genes).

If this is all the meaning of life has been, then morality in the past was a sham. It was morality of things that were tempo-

rary and fleeting as mortal people have been. There was no permanent morality and therefore no real morality. For morality to be real, it must be permanent. But now we have a chance to change all that and create real morality. We have a chance to change the meaning of life—to make life really mean what temporary people have historically thought it meant and what humans have always wanted it to mean—that there *can be* a permanent value and eternal morality to life. We can do that only by becoming immortal. Anything short of immortality is still only temporary. Temporary morality and temporary value and temporary happiness can never come close to the worth of eternal happiness, permanent value, and infinite morality, which can come only with immortality.

Religions figured out long ago that the only way to have real value, morality, and happiness would be to have eternal life. I would like to point out that the religious philosophy that it is moral to live your temporary life (here on Earth) in such a manner as to achieve immortality (in a place they call heaven) is a philosophical concept of the highest complexity and yet its meaning is self explanatory. To live a certain amount of years in happiness and morality to achieve eternal happiness and morality is a proposition that should appeal to even those with little understanding of mathematics. That is why most religions posit that a person's duty in this life is to live in such a way as to obtain eternal life because it was determined long ago that temporary life has only temporary meaning. To give real meaning to life, life must continue to exist. So most religions hold that a person has a duty to do things to try to obtain eternal life.

What are the consequential considerations of opting for cryonics?

We begin our examination of consequential considerations with a recap from the section above:

1. If life is worth living at all, it is worth living forever.
2. If life is a gift from God, the receiver has a responsibility to preserve that life.
3. If life is a prize from evolution, if life is to have any moral value, the holder has a responsibility to preserve that life.
4. So whether life is a gift from God or an accident of blind chance, there is a duty to preserve life.

Now we look at what the consequences of trying to preserve life versus not trying to preserve life are. Glannon tells us that "beneficence and nonmaleficence are at bottom consequentialist principles, concerned with treating patients in such a way as to bring about outcomes that will be beneficial and not harmful to them." "Consequentialism, on the other hand, determines the rightness or wrongness of an action is solely a function of its consequences. It is a forward-looking ethical theory in the sense that it looks beyond the action itself."

Conseqentialism would describe "right" as producing the most good, and good as the most pleasure minus the most harm or pain. Sometimes we take actions in the present and we do not know for sure what the outcome will be. In those cases, we do what we think will bring the best consequences. For instance if we take the example of a patient who has a 100 percent chance of death in a few days without a major surgery and a 95+ percent chance of recovery if he/she has the surgery, we hold that the intentions of having the surgery are good, and in this example (since the patient had a 100 percent chance of dying without the surgery) there was nothing to lose by opting for it.

In looking at the potential consequences of cryonics we can see that the odds of restoring someone to life in the future (whatever the actual numbers may be) are in general higher for a person who has recently suffered legal death if that someone has been cryonically suspended than if he/she has been buried and is rotting away or has been cremated and turned into ashes where the odds are probably zero that scientists can revive the buried or cremated person in the future. The consequences of opting for cryonics give a patient more chances for more life.

The intentions of cryonic suspension are to cause certain future consequences for a person who has suffered legal death, those consequences hopefully will be to save his/her life. I think we would all agree that to have a chance to save a life and restore it to perfect health is better than to have no chance at all. Because in some cases, having that chance will make the difference in obtaining the good outcome and avoiding the bad outcome. For example, let us say you were forced to hold a six shot revolver, with six bullets in it, to your head and pull the trigger (if you didn't your family would be killed and then so would you, but if you did, your family would be spared), you have no chance to avoid the bullet in this case.

But let us say the evil person allowed you two pistols—one with six bullets and one with five bullets and an empty chamber. And the rest of the conditions were the same. I hold that it would be good to opt for the pistol with the one empty chamber. The consequences are that it gives you more of a chance to obtain more life than does the one with no empty chamber. So having a chance at something good is more good than not having that chance. The immediate consequences of cryonics is that it gives one a chance to preserve life that one does not have without it, so from a position of consequentialism, it is moral to opt for cryonics.

Realizing that by opting for cryonics you have nothing to lose and everything to gain, let us examine what the four possible outcomes for eternal life might be:

1. Heavenly eternal life exists after this life.
2. There is no heavenly eternal life.
3. Cryonics will work and lead to biological immortality.
4. Cryonics will not work.

Today you have two possible choices dealing with cryonics, you can get cryonically suspended at legal death or you can reject cryonics. In this example I am going to assume that you accept that existing is good and not existing is bad and you want to live forever (here or in heaven if it exists) and that you don't want to be dead forever, and that in all cases you are living a moral life and doing what is necessary to achieve a heavenly life if one exists. Let's assume that you choose cryonics. Here are the possible outcomes:

1. If you opt for cryonics and it turns out that God exists and heavenly eternal life is possible:

   If life is a gift from God as in this scenario, then trying to protect that life by opting for cryonics may just be the highest form of respect one can display to Him that gave you that gift of life. If God exists and is in charge, when He is ready to take you to heaven you will go there; by the very definition of God, He has that power to overcome cryonics or any other man-made technology. It doesn't matter whether you opted for cryonics or not, except that opting for cryonics may be the extra moral act one can do to tip the scales and to show to God by your actions how much you appreciate His gift of life.

2. If it turns out that there is no heavenly afterlife, there are several possible outcomes from your possible actions:
   A. You do not opt for cryonics and you soon become dead forever.
   B. You opt for cryonics and it does not work and you become dead forever.
   C. You opt for cryonics and it works and you live forever!
   D. You don't opt for cryonics, there is no heaven, it turns out that cryonics works, but you are dead forever when you could have been alive forever—this is by far the worst outcome.

We see from a consequential approach that no matter how it turns out, you have everything to gain by opting for cryonics and nothing to lose. When a potential situation offers one huge possible gain and no chance for losses, it is immoral not to try for that gain.

If you have nothing to lose by opting for cryonics, and if you have a chance to gain everything, and if having life is a prerequisite for having morality, then the only moral position can be to opt for cryonics; it would appear to be immoral not to.

Examining sanctity of life and other religious ethical positions and how they might reflect on cryonics.

There have been many religious traditions espousing long life as a good thing. Helping others to live long lives has a long religious history, as in the "Heal the sick, and raise the dead" command found in the Book of Matthew in the Bible.

"Sanctity" has several meanings. Its religious meaning would be to make something holy or pure. It also has a secular meaning where it means to respect something and try to make it better if that can be done.

I have already pointed out that trying to make yourself immortal shows how much you respect life. An opponent could argue that is not the best way, that the best way is to follow some religious instruction. Most of the different religions offer instruction on how to achieve a heavenly immortality, the trouble is that many of them are different and some of them are mutually exclusive. So we are faced with the problem of trying to choose how to pick "The Correct Religion," if one exists. Cryonics, if it works, gives a person more time to try to find the correct religion and find out how to lead the required life to obtain eternal heavenly life, if that is possible.

But if God does not exist and life is just to create a temporary vehicle so that genes can pass on genetic codes using many short-lived "code-holders" (such as people and other animals), and if the perpetuation of combinations of numbers is at the expense of mortal creatures and will continue for all eternity if we don't do something about it, then the only way to sanctify life is to make yourself immortal so that you are the thing that continues to exist and are you not just a throw-away container for combinations of numbers.

5a. Why Opting for Cryonics Is Moral.
5b. Why Not Opting for Cryonics May Be Immoral.

First let us examine what is moral and what is immoral conduct when one is discussing cryonics with other people. Consider the scenario where cryonics does not work and you encouraged someone to opt for it. If during their life the dread of death was minimized by their belief that they had a chance to avoid death, then no harm was done. Consider next the case where cryonics works and leads to biological immortality and you encouraged someone to opt for it. Then you have done that person the greatest benefit that one person can do for another. You have contributed to their obtaining eternal life—the ultimate and highest or all moral acts.

On the other hand, let us say that cryonics works and you discouraged that person from opting for it. If you had encouraged them, they would have been suspended and eventually obtained eternal life, but because of you they rejected it and now they are dead forever. You have committed the ultimate immoral act. You have helped to rob a person of eternal life.

One way to try to get a handle on just how bad this would be is to remember how much evil Hitler caused. For the sake of trying to understand just how terrible this would be, let us assume Hitler killed 10,000,000 people. (You can use any number short of infinity). Lets say that each person he killed had a projected amount of life left of 50 years each. Then we would say that Hitler robbed people collectively of 500,000,000 years of life. But the person who robs one other of their immortality, has robbed them of so much more.

I realize this is not the only way to figure moral costs in the area of morality computation, but it is interesting to look at these numbers. What I want to point out here is that discouraging someone from opting for something of which you do not know the outcome may turn out to have been a very evil thing. And no one alive on Earth now can know whether cryonics will work or not.

(continued on page 38)

The Vicious Circle

by Michael R. Seidl, Ph.D., J.D.

Lately it has become clear to me that Alcor is caught in a vicious circle, stressful and demanding for its staff, officers, and directors, but ultimately happy for its members and the cryonics community. The number of suspensions has increased (eight so far this year as I write this), the public awareness of cryonics has been heightened (although different people dispute the short- and long-term effects of such publicity, if any), and Alcor has been systematically upgrading its standby, response, and suspension capabilities. Alcor has always advocated the most medical model of cryosuspension: we are not providing long-term storage for the dead in the hope of miraculous future technology; we are rushing the *clinically* dead (and, in optimum cases, theoretically revivable) to cryosuspension, always working toward minimizing ischemic and suspension damage and, in fact, toward suspended animation reversible without the need for advanced molecular nanotechnology. The vicious circle (and it is a happy vicious circle, ultimately) is that the more suspensions we perform, the more we improve our procedures, the more assets available for capital and response upgrades, the more we professionalize our organization, then the more suspensions we will be called upon to perform, the more we will be compelled to improve our procedures, to seek funds for capital and response upgrades, and to professionalize our organization. We are in a self-improvement spiral. The better we get, the better we are expected to be, and the better we become.

The positive consequences of this spiral are enormous—every day, literally, we are getting better and better. In recent months (as previously announced in other fora), and in the almost-ordinary course, Alcor has performed eight suspensions, organized and held its Fifth Annual Conference (thanks to the efforts of conference co-chairs Ralph Merkle and Kat Cotter), weathered the storm of publicity surrounding the purported Ted Williams suspension, and begun its first ever organized capital campaign. In the out-of-the-ordinary course, Alcor has undergone an independent examination of its suspension protocols and begun implementing the recommendations. Alcor's officers and management have proposed, and the Alcor Board of Directors has approved, improvements to our standby program, capital upgrades for standby and rapid-response in multiple locations, and the hiring of new personnel to oversee and implement these upgrades. Thanks to the tireless efforts of its staff and its president, Dr. Jerry Lemler, Alcor has sought and received heretofore unimagined cooperation from hospice and hospital personnel and transformed itself increasingly from the "garage band" of the medical world into a rapid-response medical team.

The difficulties associated with these developments are similarly enormous. Each standby and suspension taxes existing personnel with the emotional burdens associated with a death and suspension as well as diverting their time from other efforts. Alcor does not have a full team of standby/suspension personnel performing solely that function (there are too few, so far, in a year to make that fiscally viable), so Alcor's personnel, augmented by volunteers, do double duty—their normal, day-to-day work, plus standbys and suspensions when they arise. The more often standbys and suspensions arise, the more often our people are diverted from their day-to-day jobs. While there will come a break-even point when the number of suspensions and standbys make it possible to employ a team solely dedicated to that purpose, we are not there yet; now we simply have dedicated staff and volunteers doing double duty.

Moreover, the economic demands of increasing professionalization and improvement to our procedures are great. Alcor receives operational and capital funds from three principal sources—annual dues, suspension funding (collected post-mortem, usually from life insurance), and contributions. Portions of dues and suspension funding, of course, are dedicated to suspension, standby, and storage costs, leaving less available for operations and upgrades; donations are often directed and limited in their possible application. Thus, although dues and suspension minimums may seem high (although affordable when paid for through insurance), Alcor has little left over to dedicate to growth and improvement. As we make the transition from a

smaller to a larger and increasingly professional and medical organization, we increasingly grapple for the funds we need to implement the future we can see. Needs for new budget lines—such as hiring someone to handle the public relations issues surrounding the reputed Ted Williams suspension and hiring contract medical personnel to supplement overtaxed Alcor personnel at standbys—arise unexpectedly, and increasingly, as we grow. Furthermore, because we have historically grandfathered suspension minimums and because suspensions under new minimums will lag behind the old ones as a result of mortality rates, our funding always lags behind our performance. Now, more than ever, Alcor hopes for its members to overfund, where possible, and to remember it in their wills and contributions.

The benefits of this rapid growth and professionalization are great—our suspensions improve, and we move closer and closer to the gold standard of true suspended animation. However, there dangers beyond the fiscal and operational growing pains identified above. In the short term, Alcor faces criticism and challenge from members and personnel who have long thought of it as a smaller, almost "family" organization; as we transition to a larger, more professional organization, some people feel control, involvement, and understanding slipping away, and that makes them uncomfortable. Alcor is moving from an organization so small that effectively everyone interested in what was going on knew or could obtain that information easily to an enterprise already large enough that information demands alone (independent from membership applications) could occupy a staff member full time. Recent additions to *Cryonics* in the form of Alcor reports and the creation of Alcor News by Director of Suspension Services Charles Platt (to subscribe to this e-mail newsletter, which will be issued as need arises, go to www.alcornews.org) are designed to address the effectively new needs of a large membership for news. But the underlying problem is not solvable and must simply be accepted. Just as, 75 years ago, we began giving up the friend-of-the-family, housecall-making country doctor for an increasingly professionalized medical community network of doctors and hospitals with varied specialties and skills, so now we see the same progression with Alcor. We are trading some of the folksy friendliness for what we hope will be a better cryosuspension future; the transition from the country doctor was not easy (indeed, many still lament his passing), and this transition will not be easy either. Individually and collectively, we must accept—or begin to accept—that cryonics has already grown too big and too professional for any one person to have the control or influence that was wielded in the past and that we are all becoming less the pals of the country doctor we may have been and more patients in cryosuspension network.

In the long term, the risks are even greater. As the cryosuspension work performed by Alcor becomes increasingly professionalized, medicalized, and normalized, the same sorts of risk that attend the medical profession will begin to attend cryosuspension. We have only barely begun to articulate the concept of "cryonics malpractice"—under what circumstances the standards of care, suspension, and storage will be considered satisfied or violated. However, we can be sure that scrupulous survivors and estate representatives will seek to hold us to those standards for the good of our patients, and unscrupulous survivors and estate representatives, unhappy with estate distributions, will seek recoveries based on purported violations of such standards. The more professional and medical we become—the better we do our work—the more we risk challenge for the way our work is done.

In short, in even the short time of my involvement with Alcor, I have seen this vicious circle send us spinning faster and faster. We are ever better at what we do, and it costs us ever more. The potential benefits—and the accompanying risks—are ever greater. It is a vicious circle of self improvement; it is a thrilling time to be associated with Alcor.

* I welcome comments on these issues and others related to cryonics at mseidl@magpage.com

l

(Morality—continued from page 36)

In conclusion, I have tried to show that (for the cryonicist who wants to be moral):

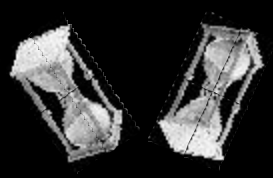
1. Only a person that exists can be moral.
   To exist one must have life.
   Therefore: To have morality, we must first have life.

2. Since it is always moral to opt for morality;
   Since life is a prerequisite for morality;
   It is always moral to opt for life.

3. Morality is dependent on life;
   Less life has less of the same types of morality.
   More life has more of the same types of morality
   More morality is more moral than less of the same morality;
   Therefore, more life is more moral than less life.

4. If it is moral to strive for more life, then it is immoral not to.
   Therefore, it is immoral not to strive for more life.
   Cryonics is striving for more life
   Therefore: Not opting for cryonics is immoral.

l



You Only Go Around Twice

by Jerry B. Lemler, M.D.

Down by the Old Main Stream

From the moment I first arrived at Alcor (initially hired as Medical Director) in February 2001, I've stated one of my goals was to swell our ranks with unapologetic immortalists. Though I've been quite successful in this effort with my own family members (wife, daughter, son-in-law, brother), I must candidly admit I have been a resounding failure, by and large, outside the Lemler clan. Regrettably, no one I have conversed with seems at all surprised by this confession.

Any number of "outsiders" I've talked with in person, on the phone, or by e-mail, claim to be able to sell the world on cryonics and Alcor. Their enthusiasm ought to be infectious, yet, after they stumble around for awhile, they (universally) throw up their hands in inevitable frustration. As we know, skepticism can problematically lead to cynicism—not a healthy virtue for cryonicists or unbelievers alike.

This discontent was, at least for me, very recently rekindled by learning of the death of a dear friend from years ago in my L.A. (Lower Alabama) days of the 1980s. At the not-so-ancient age of 57, Bill had been diagnosed with terminal myeloma, two years prior to our initial meeting. He was a tall, athletic, robust man, a former college varsity basketball star turned multi-millionaire commercial real estate mogul, who had a heart of gold for his fellow man. Most folks who are philanthropists want their name to be prominently displayed on whatever visible entity they donate, be it a hospital wing or an apple. Not so with Bill. He freely gave to a variety of charitable causes anonymously, and he was no less generous with his less fortunate friends and employees.

Bill also had the means to fly all over the world, seeking any and all potential cures for his affliction. And he did just that, including submitting himself for a number of experimental protocols. He and his no less remarkable wife Marilyn invested more money than you and I are likely to earn in a lifetime, chasing after a miracle. In the end, 17 years later, the fountain of life ran dry for him.

If there were any two people on the planet I wanted to spare from the agony of death, it would have been this couple. I'm not a particular believer in the hard sell, mind you, but I've never been more persistent than in this case, with, as you can surmise, nothing but absolute rejection to show for all my good faith efforts. As I'm fond of saying, these folks had both the gray matter and the green matter to respond favorably and get themselves signed up. However, they didn't. And now, I'll never see Bill again, and eventually it's near certain one day Marilyn, as well.

My good friend and colleague, Alcor Board Chairman, Dr. Michael Riskin, spoke from the podium at our Newport Beach Conference, sharing with the audience his four-point theory of attributes unique to (most all) Alcor members. Paraphrasing Michael, he argues:

1. We possess no pre-existing belief or concept that satisfactorily deals with death.
2. Fulfilling whatever inner need, we enjoy being part of a ridiculed minority.
3. We maintain such an intense disgust and horror of the thought of permanent death that we are willing to bear any price the future may bring, no matter how grim or painful.
4. We are blessed (cursed?) with an extreme degree of narcissism, such that the very concept of existence is meaningless without our being there to know it.

I've heard this recitation before from Michael. Though I desperately want him to be wrong in his formulation, I am growing ever more conscious of the notion he may well be not far off the mark. But, even if I (we) accept what our Board Chairman postulates, should it alter our approach in attracting new recruits to add to our membership roster?

Other highly placed individuals within our organization have written in these pages about the essence of this dilemma, with varied suggestions for its rectification. Michael Seidl, Charles Platt, and Bob Newport come immediately to mind. None of these learned gentlemen argue for a quick fix simple solution either. I, too, don't believe it exists, anyway. Furthermore, I think there's a limit as to how much credence can be ascribed to any one individual's moment of decision to sign on with us. In my own case, it was an overpoweringly trigger impulse immediately following an epiphany (by reading *Engines of Creation)*. I've heard of other similar cases, though they aren't usually laced with such alacrity.

One can never know with certainty how to plant the seeds that will augur a circumscribed personal revelation. As Malcolm Gladwell averred in his best-selling book, *The Tipping Point*, it frequently requires the fortuitous, unavoidable collision of forces to propel an idea (product, philosophy) into the public's consciousness, and even then it may not "tip" (become widely accepted).

The easy way out would be to forfeit our opportunity altogether. We could then (quite readily) adopt an existentialist position, much like Camus in *The Stranger*, whose opening lines entice us with, "Mother died today. Or, was it the day before?" Regrettably or otherwise, this archetype doesn't quite fit our cryonicist mantra. Though inviting, it's just a bit too snug.

So, what exactly shall we do? This question is not glibly shrouded in a rhetorical sense. It has substantial relevance for our existence now as an organization and in the future as potentially a collection of individuals who paid a hefty price and want to win a very large, against improbable odds, wager.

So, if we cannot meander along the road more traveled, must we ostracize ourselves to the point of malignant interactions with the larger elements with of our society? After all, when I began my tenure with Alcor, I quickly realized what a unique (some would argue strange) group of individuals I had joined. Now, I'm one of "them" (a "Unique," like Alvin), and I arch my back in defiance when any of us are assailed by a so-called outsider. But, we're already card-carrying members of the totem. Perhaps my ability to discern those who are not and effectively relate to them has (inevitably?) suffered. While I may have engineered the elimination of our formerly held, widely acknowledged bunker mentality, perhaps we're nonetheless still inhabiting the bunker itself. Geez! What do you think, Archie?

l

(Where There's a Will—continued from page 27)

tive medicine, nutrition, fitness, and the very active study of life extension. These seminars could easily be held at Alcor, at universities, at medical research facilities, and at wonderful spas across the country. Perhaps even a cruise could work to our advantage. We are offering marketing directors a coup. We are defining a win-win situation. All parties benefit from positive publicity, from the prestige of hosting an international scientific seminar, and from the exposure of their facilities and services to people that would otherwise be unaware of them.

Increased revenue and the prospect of future sales make everyone an enthusiastic Alcor supporter. Also, for many reasons, Alcor would become a friendly household name. It will have entered the mainstream as an educational foundation supporting the sciences. This powerful new status would quickly supersede an traces of pseudo-science attached to cryonics.

It is my express desire to coordinate this new social network. By creating a comfortable, familiar organization that is always ready to welcome its members, we will establish a far-reaching client base. By providing a nurturing environment where understanding, cooperation, concerns, hopes, and dreams are shared by people with a common desire to assure Alcor's success, we will have created a self-fulfilling prophecy. As soon as we form our extended family, we will have built a permanent living bridge into the future.

This symbiotic link between company and client offers a service that embraces a completely new corporate paradigm. I do not know of any other institution that has utilized such a pervasive and personalized program. If anyone is aware of a similar system and would like to share this information, please contact me through Alcor.

l

(Creekside—continued from page 29)

come to an Alcor hospice and bring the whole family along! Mr. Pizer pointed out this will really increase the number of people who, by getting the support they and their family need, will actually get suspended.

Dr. Lemler in his talk asked Mr. Pizer if he would help in finding Alcor a suitable property for this endeavor, and in any other way he could. Mr. Pizer responded that he would either help Alcor find a property in the Scottsdale/Phoenix area or would entertain discussions for having that facility in, or near, Creekside/Ventureville, if that is what the Alcor Board wanted. It was brought out by Mr. Pizer and Dr. Lemler that when a person becomes terminal they do not want to leave their home and go to a strange place to die. If there was a retirement center and hospice in or near Creekside/Ventureville, people could come and visit while healthy and when the dying time came, they would be going to a place they were familiar with and would therefore probably be more comfortable. It was also emphasized that a person is likely to get a better suspension if he/she deanimates near Alcor.

It was an excellent and very heartfelt speech. At its conclusion Dr. Lemler was met by energetic applause. I knew at that point this was no ordinary little cryonics gathering!

Overall, it was a wonderful experience for me. I got to know many of the Alcor staff much better. And networking among us and our guests will, I'm sure, bear much fruit down the road. It was sad to see everyone leave, but at least Dr. Perry and I had taken a lot of pictures to remember the day!

My personal thanks to everyone who came, and I hope those of you who couldn't make it for whatever reason this time will be able to attend our next one! l

(All photos by Mike Perry except "Hikers," by John Grigg.)

Remembering Allen McDaniels

by R. Michael Perry, Ph.D.

Allen McDaniels is all but forgotten by today's cryonicists, but for a brief time in the mid-1970s this talented Alcor advisor and then president helped bring credibility and medical skills to the tiny organization. His involvement seems also to have helped reverse a dangerous slump into which the still-fledgling cryonics movement had fallen. Cryonics had started up in the 1960s with such events as the founding of Evan Cooper's Life Extension Society (December 1963), the publication of Ettinger's *Prospect of Immortality* (June 1964), and the freezing of James Bedford (January 1967). For a few years a heady optimism prevailed, then hard realities began taking their toll. The number of frozen patients grew, but funding, generally provided by relatives who often did not have a strong personal interest in the process, increasingly ran out. As time passed, the supporting relatives either lost interest altogether, or, in some cases, turned into angry litigants and attacked the organization they once supported. Most of the early suspensions were terminated, and the principal organizations folded.

The Alcor Society for Solid State Hypothermia, later to be known as Alcor Life Extension Foundation, had been started in 1972 by Fred and Linda Chamberlain when they became uneasy with Robert Nelson's failing organization, the Cryonics Society of California. (This organization in turn would suffer a disastrous collapse in which nine patients thawed and perished at its facility in Chatsworth, and relatives sued and collected some $400,000 in damages.) For the first few years, Alcor consisted of only a handful of people, its primary focus being to provide suspension services when they should be needed for Fred's ailing father, Fred Jr. (Fred himself was actually Fred III.) Allen McDaniels, M.D., became a member of Alcor's Advisory Board in September 1975 and soon was Director of Research. The man had an impressive background, which seems especially significant in view of the small scale of Alcor's operations at the time.

An alumnus of the University of Oregon, McDaniels completed his undergraduate work in 1964, received a fellowship in experimental psychology in 1966, and graduated in 1970 as a Doctor of Medicine. As an undergraduate he belonged to Pi Mu Epsilon, a national mathematics honorary society. He was a director and House Manager of the Students Cooperative Association, Inc., a cooperative living organization with annual revenues of $60,000 and up to 80 customers per year. In 1971, having obtained his medical degree, he was licensed and registered to practice medicine and surgery in Texas. The same year he became Technical Associate of Terraqua Products, Inc., and Terraqua Ltd., both of San Pedro, California. His work with these organizations involved water purification and seafood preservation systems: product research and development, production implementation, quality control, testing, certification, and market research. His book, *Water—What's in It for You?* was published in 1972; another publication, coauthored with D. Rasnake and titled *Protect Your Lungs: Even if You Smoke or Inhale Smog*, appeared in 1974. In 1972 he began work in human nutrition and in the following year extended this interest to the philosophy of science. Two ambitious projects, "A Survey of the History of the Principle of Least Action," and "General Theory of Integration: A Prospectus," were launched in 1974.

In the following year McDaniels went further, to play a major role in the new field of cryonics, the practice of preserving the dying for later reanimation, if such should prove possible. A document signed September 29, 1975, states, "I, Allen McDaniels, M.D., being licensed to practice medicine, do agree to affiliate myself with the Alcor Society for Solid State Hypothermia, ... as a member of its Advisory Board. ... To the extent permitted by my professional schedule and other commitments, I will take an active role in the Society's research concerning the viability of living matter under conditions of extremely low temperatures, which is understood to include the acceptance of Anatomical Gifts or Anatomical Donations as defined under ... the Anatomical Gift Act of the California Health and Safety Code. ... Due to my professional interests in the research to be conducted by the Society, it is understood that my compensation may be less than would be usual in my general practice or profession." Presumably some "personal interests" accompanied the "professional" ones—at any rate his commitment, to all appearances, was genuine and generous. This is underscored by a memo of McDaniels a short time later, November 21, regarding "quali-

fications to do live animal research under Los Angeles City, Los Angeles County and federal statutes." He had contacted officials and determined essential details such as requirements for housing and care of the research animals.[1]

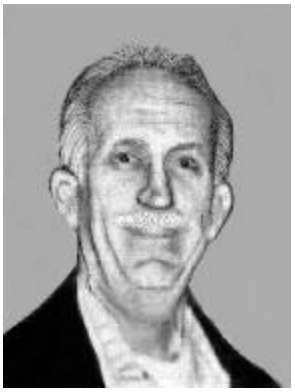
The next year saw perhaps the most significant event of Alcor's early history. Fred Jr. deanimated and was suspended July 16, 1976.[2] Slides of the suspension show McDaniels in his lab coat, busily working alongside Fred, Linda, and others on this long-anticipated if somber occasion. The careful preparations and, for the time, high technical level underscored the seriousness and dedication that had emerged in cryonics, in spite of the failures noted earlier. The suspension itself was the first in which the head only was preserved (the "neuro" option), with the logical but controversial rationale that replacing the rest of the body at a future date should be no more difficult than restoring the brain to a functioning state. (More recently this position has gained support through successes with cloning of mammals and tissue engineering; entire organisms, including all organs and body parts, can now be created from single cells.) Neuropreservation had been advocated as early as 1965 by cryonics pioneer Evan Cooper but had been shunned by cryonics organizations due to a "yuk" factor.[3] But by now the expense and difficulty of doing whole-body suspensions, and even more important, of maintaining them long-term, had become disturbingly clear, and the neuro possibility was increasingly gaining favor. (Whole-body advocates, in fairness, also recognized the difficulties and called for more secure suspension arrangements while continuing to insist that whole-body suspensions be offered, as they still are today.)

Allen McDaniels at the suspension of Fred Chamberlain Jr., 1976 (Alcor files).

It was not long after this suspension—possibly on August 29, when a general meeting was scheduled—that McDaniels was voted by the Alcor Board as president, replacing Linda Chamberlain, who had previously alternated with Fred in the post. As an immediate policy McDaniels advocated direct referrals from members as a way to increase membership. The logic was as simple as it was audacious: if each member could secure just one new member per year, membership would double, so that after ten years over a thousandfold increase would be achieved. McDaniels also continued as Alcor's Research Director and was actively planning an experimentation program, which was to have commenced by the end of the year. The initial efforts were to have focused on control and variation of cryoprotective procedures, with a later study of tissue viability under the different protocols, and finally, confirmation of the findings through work with other laboratories.[4]

Unfortunately, little if any of this ambitious effort materialized, nor did membership growth approach anything like the annual doubling that had first seemed feasible. A few months later *Alcor News* reported that, effective June 12, 1977, McDaniels had resigned as President "due to pressures from his work load," to be succeeded by Laurence Gale. McDaniels was to continue with Alcor in an advisory capacity, but his subsequent involvement was minimal and must have soon ended altogether.[5]

Mike Darwin in 2001 recalled seeing McDaniels in St. Louis, Missouri, in June 1981. The occasion was the annual meeting of the Society for Cryobiology. "Allen and I spoke at some length in the St. Louis Arch high above the Mississippi River. ... He had come to solid religious conclusions about survival of the soul after death. He had attended some workshop or seminar where he had a transcendental experience which convinced him of the immortality of the spirit and thus he no longer felt cryonics was personally necessary. He was, as he always had been, a sincere, decent man who was pursuing work he believed would genuinely help other people as well make a living for himself." McDaniels had by then become one of the world's largest suppliers of cryobanked human skin, used as a temporary dressing for burn victims. Mike also noted, "in the years after this meeting I heard nothing but good things about Dr. McDaniels from a broad [core] section of the medical community." Psychiatry, another of the healing arts McDaniels practiced, seems to have contributed to this high reputation.[6]



McDaniels in 2000. (See http://www.medicalacupuncture.org/aama_marf/newsletter/newsarchive/newsmay00/newsmay1.htm)

Rumors that McDaniels died some years ago are interestingly (and happily) groundless. I found him alive and well (November 2002); he has been involved in medical acupuncture since the 1980s and now operates a clinic in San Pedro. Another interest is with environmental protection and conservation; McDaniels is president of R-Ranch Conservancy, which is devoted to preserving an area of California wilderness. Quoting his words from the web site: "We, the owners of R-Ranch in the Sequoias, acknowledge our relationship with this land—its soil, water, forest, air, animals and Native American artifacts. We desire to enjoy the land for recreational purposes so long as we maintain its integrity, stability and beauty for the present and for future generations." When I contacted him by e-mail he had nothing to say about his past involvement in cryonics or Alcor but thanked me for interest in his work on water, adding, "I am writing a treatise on water and health, but publication is probably a few years away."

To many of us in cryonics, a case such as that of Allen McDaniels is unsettling. Early on he was interested but then ex-

(continued on page 54)

The Posthuman Future

By Francis Fukuyama

Farrar, Straus & Giroux, 2002

Book Review by R. Michael Perry

As the future approaches we are confronted with choices and possibilities never before encountered outside imaginative fiction: gene therapy, person-machine interfaces, tissue engineering, nanoscale devices, and many others. The prospect is raised of greatly enhanced personal control over our lives. How well we live—as well as how long—will, by growing appearances, be amenable to voluntary choices rather than left to the whims of nature or chance. Increasingly we are approaching a "posthuman" future. Life spans, we hope, will be greatly increased and debilities rolled back to the near vanishing point. The individual will become an enduring feature rather than being subject to deterioration and death after a few decades, as has been the lot of humankind up to now. There will be new and unprecedented opportunities for personal development, so that we must increasingly confront the issues of what we, as individuals, really would like to become and how much of our past legacy should be retained. Many welcome the new possibilities, but many others fear we are going too far too fast. Neither point of view can be dismissed out of hand, even though, as cryonicists and immortalists, our sympathies lie strongly with those who are striving to push back the limits on life.

One authority whose views contrast with the immortalist position is the well-known historical philosopher and bioethicist, Francis Fukuyama. In his 1992 book, *The End of History and the Last Man*, he stated that "we cannot picture to ourselves a world that is *essentially* different from the present one, and at the same time better."[1] On the plus side, Fukuyama foresaw not the end of the world as such but, substantially, the end of political struggle, as liberal democracies replaced totalitarian regimes following the collapse of Soviet communism. He optimistically imagined a world of plenty and comfort where war would be no more, but he also cautioned that humans may be less fulfilled by the very success, as history becomes, relatively speaking, uneventful and boring. By way of contrast, hard conflicts and coping have historically provided meaning to many, particularly certain individuals who especially want "recognition" and seek it by in some way besting a determined opposition. (Recognition, largely synonymous with status, is also an important marker for reproductive success, so it is not surprising how much it is craved and pursued.) The "conflicts" could, of course, be peaceful and constructive but need not be and all too often have not been.

Fukuyama had little thought for the idea of humanity making substantial improvements in its own physical nature through advancing technology, a prospect we immortalists take as almost self-evident. Thus his focus seems deadeningly limited and myopic, and we immediately take issue with his quote above. A world without death, disease, and inherited stupidity would indeed be "different" in some essential respects and, we think, "at the same time better." We can and do "picture to ourselves" such a world. We take very seriously the prospect of its coming into being for we hope to personally take part and benefit. We are furthering the aim of a personal role, as best we can, through our practice of cryonics and our advocacy of constructive change.

A decade later Fukuyama, still alive and well, has come to realize that indeed humanity could change in fundamental ways through technology. It is no great surprise that his overall reaction is not positive but fearful and pessimistic. This is clear enough in *The Posthuman Future*, a recent sequel to his earlier book, even though he does grant the possibility of benefits. But the emphasis is for restraint on genetic modifications and other possible alterations of the human organism.

Progress in extending life and its quality, notes Fukuyama, will not merely impact those making voluntary choices but will affect others, including the unborn. Prospective parents, for example, could choose specific traits for their children. Indeed, this is already being done through genetic screening that, for

example, allows the sex of the child to be predetermined. More effective and predictable methods of shaping the unborn can be expected. Such "chosen" offspring will then exert an influence independent of those who decided to bring them here. This brings out what is clearly an important distinction in viewpoints. Some, and especially immortalists, are more concerned with the effects of new technologies on themselves and others able to choose or reject them. Others, like Fukuyama himself, focus more collectively on the human population as a whole. The collectivists, who by nature are less concerned about extending their own and others' lives, seem naturally also more critical of the new technologies and their use. (But individualists, and again, especially immortalists, are far from unconcerned about humanity as a whole, since their anticipated stake in the future, a personal one, is to be shared with others.)

Currently there is lively, sometimes bitter, debate among proponents and opponents of the various emerging technologies and their possible uses. Certain "conservatives," for example, call for a ban on all human cloning experiments, whether for reproductive or therapeutic purposes, and more generally would restrict the use of technologies that could significantly alter the human constitution, even when the immediate effects are beneficial. Their rationale is that such changes could, and likely will, have long-term, negative consequences that will more than offset any short-term gains.

Fukuyama we have to approach with care, for though conservative he is not a mindless Luddite or a religious extremist. He does not call for an outright ban on all cloning experiments, but he does argue for increased government controls, which, he thinks, should address the broad spectrum of biotechnological research and its applications. His grounding is philosophical and humanitarian rather than religious in a dogmatic sense. Humanity, he thinks, has a well-defined "human nature" that has served us well in the millennia of our existence so far and thus must be respected at all times. Medicine must limit itself to "therapy" and not stray into "enhancement." He would, for example, favor treatments to cure mental retardation but not to transform "normal" people into unprecedented geniuses. A key word is *unprecedented*. What was must, in the main, remain: a world without end, of, by, and for the species homo sapiens.

To raise a simple objection (not the only one), it is not clear how Fukuyama would treat the problem of non-uniformity. Any species, including our own, is far from homogeneous but normally will contain individuals at both ends of any bell curve of measured characteristics, including intelligence or overall sense of well-being (assuming the latter can be quantified, as no doubt it can). In particular, it is normal for a certain fraction of the population to be subnormal. Even if you only treat such cases you shift the bell curve, changing the characteristics of the whole and upgrading the qualifications of "subnormal" itself. Cases formerly at the low end of "normal" may now fall into the "treatable" range. Enhancement of the whole is not avoided, only slowed, by such an approach.

To focus his arguments, near the beginning Fukuyama cites two famous works of fiction that serve as models throughout: Orwell's *1984*, and Huxley's *Brave New World*. These, particularly the latter, offer dystopic visions of a future Fukuyama hopes to avoid through government regulation. Ironically, *1984* itself describes a "big brother" totalitarian society that would, by appearances, provide an excellent foundation for the sort of controls Fukuyama proposes. (Huxley's book was, in fact, a satire of the Soviet Union's tightly regulated society.) Fukuyama does not endorse totalitarianism but does think government should play a role in limiting freedom of choice, when it could affect the future of the human species. *Brave New World* especially is relevant, he thinks, because it well delineates the sort of threat posed by biotechnology, namely that changes will be willingly accepted that ought not to be. The problem with speculative fiction of this sort is that it is not simply an impartial attempt to reckon with future probabilities. Other elements come into play, such as entertainment value and, more basically, the likelihood of contributing to the author's livelihood. This, I think, forces an inherent bias toward "interesting" plots involving peculiar hardships and dangers, something Fukuyama seems to overlook.

Still I think the thoughtful immortalist will acknowledge that there is reason for concern and will at least give Fukuyama and his ilk a hearing. When, for example, choices are made for people yet-to-be, who cannot themselves give consent or voice opinions, problems certainly could arise, particularly when the options are new and unprecedented, as today. The human species could indeed be nudged into developmental pathways quite different from the roads traveled up to now—with much faster changes in the bargain. We immortalists, however, show our differences with the likes of Fukuyama in our optimism about some of the pathways. We are not so attached to humanity "as it is" but again imagine a world substantially better. Its realization, we think, will come about by careful, constructive efforts, some of which we happily note are ongoing today. We feel these efforts should continue rather than attempts being made to stifle them.

The question arises as to whether controls such as Fukuyama advocates are possible at all. He thinks so, and cites the example of nuclear weapons, whose development and deployment have so far been limited to a few governments. But there are big differences between medical and other intentionally beneficial technologies and nukes, one being, in the former case, a sizable and widespread fraction of the human population that favors their use and hopes it will increase. Another is that the groups now developing these technologies are clearly distinct from the military- and government-dominated sector that is mainly pursuing weapons of mass destruction. I think, in balance, it is unlikely the sort of controls Fukuyama advocates can be made effective. Even if they could be instated throughout the United States and other Western nations, there is the Far East, where interest in biotech is lively and certain Western impediments, such as religious beliefs about the "souls" of early-stage embryos, are subdued. Serious researchers in any one part of the world could, if need be, move to more favorable jurisdictions elsewhere.

(continued on page 54)

TechNews

by Gina Miller with R. Michael Perry, Ph.D.

National Nanotech Research and Development Act

U.S. Sen. Fritz Hollings, Chairman of the Senate Commerce, Science and Transportation Committee, announced that the Committee, by voice vote, favorably reported S. 2945, the Nanotechnology Research and Development Act. The bill was introduced on September 17, 2002 by Sen. Ron Wyden (D-Ore.). The legislation authorizes creation of a coordinated, inter-agency "National Nanotechnology Research Program." This will support long-term research and development in nanoscience and engineering, and balance research objectives with ethical and societal concerns. About $446 million is earmarked, with a portion of that to come from existing money located elsewhere in the federal budget. Last year, the government spent $463 on nanotechnology.

(Senate Committee on Commerce, Science and Transportation) http://commerce.senate.gov/~commerce/press/02/2002919726.html (Cnet 9/16/02) http://news.com.com/2100-1023-958089.html?tag=cd_mh (ZDNet India 9/17/02) http://www.zdnetindia.com/biztech/enterprise/technologies/stories/66335.html [NGN 9/18/02; MP].

Nanotubes Could Reduce CO_2 Emissions

A team led by scientists at Carnegie Mellon University said Monday that carbon nanotubes, which are straw-like structures with walls a single atom thick, could filter gases much more quickly than current systems. The atoms of carbon nanotubes are arranged so that they offer practically no friction to passing gas molecules, said David Sholl, a professor of chemical engineering at Carnegie Mellon. Such smooth surfaces mean the tubes theoretically can transport gas through a membrane at rates that are orders of magnitude greater than current microporous substances used in gas separation, Sholl told United Press International.

(UPI 9/16/02) http://www.upi.com/view.cfm?StoryID=20020916-044639-9775r [NGN 9/18/02].

Computer System Solves Problems by Tricking Computers

A Virginia Tech researcher has come up with a computer technology he calls "Weaves" that allows a programmer to use a code in any programming language and convert it to a form similar to object-oriented programming. Weaves technology is used to create a virtual world that tricks the software into thinking it is in the real world.

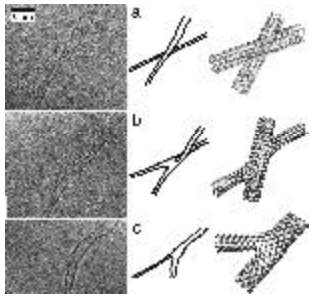
(EurekAlert 9/16/02) http://www.eurekalert.org/pub_releases/2002-09/vt-ncs091602.php [NGN 9/18/02].

Nanotechnology Expected to Extend Moore's Law

Moore's Law will get a new lease on life through this decade because of nanotechnology, the Intel Developers Forum was told on Thursday. Sunlin Chou, senior vice president and head of Intel's Technology and Manufacturing group, said new materials and chip structures possible with nanotechnology will continue the doubling of transistor count on die every 24 months that Moore postulated decades ago. "The people who think Moore's Law will end assume that materials and structures won't change. They are constantly changing and will keep Moore's Law going for a lot longer," he said.

(EE Times 9/13/02) http://www.electronicstimes.com/tech/news/OEG20020912S0039 [NGN 9/18/02].

Nano-Welding Creates Tiny Junctions



Researchers have discovered how to weld together single-walled carbon nanotubes, pure carbon cylinders with remarkable electronic properties. The discovery could pave the way for controlled fabrication of molecular circuits and nanotube networks. Pulickel Ajayan, professor of materials science at Rensselaer Polytechnic Institute in Troy, N.Y., and his colleagues in Germany, Mexico, the U.K., and Belgium used irradiation and heat to form the welded junctions.

(RPI 9/16/02) http://www.rpi.edu/web/News/press_releases/2002/ajayanwelding.html [NGN 9/18/02].

Nanoelectronics Website

Jupitermedia Corporation (Nasdaq: JUPM) (formerly INT Media Group) today announced the re-launch of NanotechPlanet.com as NanoelectronicsPlanet.com (http://www.nanoelectronicsplanet.com) - the first Web site devoted to in-depth coverage of the nanoelectronics industry. The company also announced the launch of Nanoelectronics Planet Conference & Expo, which will be held November 18-19, 2002 in New York City.

(Stockhouse Australia 9/17/02) http://www.stockhouse.com/news/news.asp?tick=JUPM&newsid=1287045 [NGN 9/18/02].

Better Carbon Nanotubes

(CNI) [profile] Carbon Nanotechnologies Inc. announced Sept. 16 that it has developed an improved form of single-wall carbon nanotubes. The BuckyPearl(TM) form of single-wall carbon nanotubes can be handled more easily in extruders and other polymer-processing equipment that directly blends single-wall carbon nanotubes with polymers and other materials for a vari-

ety of end uses. "This is a significant advance in the development of carbon nanotechnology," said Ron Liotta, senior vice president of CNI. "BuckyPearl single-wall carbon nanotubes are easier to process, yet retain the extraordinary performance properties of Buckytubes. Several of our industrial partners are testing the material in a variety of applications."
(Nano Investor News 9/16/02) http://www.nanoinvestornews.com/modules.php?name=News&file=article&sid=782 [NGN 9/18/02].

Movies of Molecular Interactions
Scientists at the Lawrence Berkeley National Laboratory (Berkeley Lab) have produced the first ever action movies starring individual water molecules on a metal surface. The ending was a surprise even to the producers. Movie Included/via Real Player-(Berkeley Lab 9/12/02) http://www.lbl.gov/Science-Articles/Archive/MSD-action-movies-Salmeron.html [NGN 9/18/02].

New DNA Separation Method Could Bring Faster DNA Fingerprinting
Cornell University researchers have demonstrated a novel method of separating DNA molecules by length. The technique might eventually be used to create chips or other microscopic devices to automate and speed up gene sequencing and DNA fingerprinting. The method, which uses a previously discovered entropic recoil force, has better resolution—that is, better ability to distinguish different lengths—than others tried so far, the researchers say. They separated DNA strands of two different lengths, using their own nanofabricated device, and demonstrated that modifications would make it possible to separate strands of many different lengths.
(Cornell News 9/23/02) http://www.news.cornell.edu/releases/Sept02/entropicSeparation.ws.html [NGN 9/30/02].

Startup Aims at Intersection of Neural Nets and Nanotech
A startup company led by Alex Nugent as president and chief technology officer, is attempting to combine innovatively two leading edge technologies to secure its future position. Nugent and KnowmTech LLC are focused on the reconfigurable assembly of neural networks constructed using nanometer-dimension conductors, such as carbon nanotubes, suspended in a dielectric solution. The basis of KnowmTech's efforts is a concept referred to as a "Knowm" [pronounced "gnome"], with which it should be able to build and reconfigure very high complexity artificial neural networks.
(EETimes 9/19/02) http://www.eet.com/at/news/OEG20020918S0012 [NGN 9/30/02].

Physicists Thrown for a Loop
Experimental results released this year by the Department of Energy's Jefferson Lab in Newport News, Va., have upturned the normally placid world of nuclear physics with the suggestion that protons, the positively charged particles found in the center of every atom, aren't round. Instead, they seem somewhat elliptical. The round proton has been a staple of textbooks for 40 years, tied to the theory that protons and neutrons are built of three smaller particles called "quarks" slowly bubbling inside their interiors. What difference does it make whether protons are round or elliptical? Plenty, physicists say. Adjustments in protons and neutrons could affect scientific understanding of the magnetic "spin" of atoms. Scientists hope to use "spintronics" in future computers and tiny "nano-scale" devices. Understanding the fundamental shape of particles will affect those application's success.
(Yahoo! News 9/23/02) http://story.news.yahoo.com/news?tmpl=story&u=/usatoday/20020923/en_usatoday /4470983 [NGN 9/30/02].

Inventor Foresees Implanted Sensors Aiding Brain Functions
Using deliberately provocative predictions, speech-recognition pioneer Ray Kurzweil said that by 2030 nanosensors could be injected into the human bloodstream, implanted microchips could amplify or supplant some brain functions, and individuals could share memories and inner experiences by "beaming" them electronically to others.
(EETimes 9/26/02) http://www.eet.com/at/news/OEG20020926S0013 [NGN 9/30/02].

Famed Nanotech Researcher Axed
A star researcher in electronics at Bell Labs has been fired after an outside review committee found he falsified experimental data. The committee concluded that Jan Hendrik Schon, 32, made up or altered data at least 16 times between 1998 and 2001, the first case of scientific fraud in the 77-year history of the Nobel Prize-winning laboratory, Lucent said Wednesday. Bell Labs, which used to be part of AT&T, is the research arm of Lucent Technologies.
(Wired 9/25/02) http://www.wired.com/news/technology/0,1282,55391,00.html [NGN 9/30/02].

GaN Nanowire Laser Emits First Light
Researchers develop the first GaN nanowire laser and report their findings in a recent issue of Nature Materials. US researchers have observed lasing in gallium nitride (GaN) nanowires for the first time. The team from the University of California says that its tiny UV-emitting lasers may find uses in lab-on-a-chip systems and in high-density data storage.
(Nanotechweb 9/24/02) http://nanotechweb.org/articles/news/1/9/17/1 [NGN 9/30/02].

Millionaires Lining Up to Buy Personal Gene Maps
A service to map a person's entire genetic code is being offered by America's genome entrepreneur Craig Venter, according to the London Sunday Times. The newspaper said that for £400,000 (US$621,500), a person would get details of their entire genetic code within 1 week. "Armed with such information, the individual would be able to check for mutations linked with illnesses such as cancer and Alzheimer's," the Sunday Times reported.

(ABCnews 9/23/02) http://abcnews.go.com/wire/Living/reuters20020923_392.html [NGN 9/30/02].

(Interview) Questions and Answers with James Talton

Dr. James Talton, PhD, is a researcher and businessman who has founded four companies to date. His latest company, Nanotherapeutics, is aiming to develop novel techniques for using nanotechnology to aid in the delivery of hard-to-deliver drugs and proteins.

(Nanomagazine.com 9/15/02) http://www.nanomagazine.com/2002_09_15 [NGN 9/30/02].

9-11 Drives Advances in Nanotechnology

Demand increases for devices that monitor water, air. The events of Sept. 11 have focused awareness, increased funding and accelerated the commercialization of micro- and nanotechnology devices that can sense minute traces of chemical, biological and nuclear agents in the air or water, according to business leaders and researchers. Homeland security will not be viable unless without microsystems. Microsystems will enable homeland security," said Marion Scott, director of microsystems, science, technology and components at Sandia National Laboratories in Albuquerque, N.M. "We're really looking at the commercial sector to provide the large volumes we need."

(Detroit news 9/27/02) http://www.detnews.com/2002/technology/0209/27/b02-598145.htm [NGN 9/30/02].

New, Fast, Scanning Probe Microscope

Imago Scientific Instruments, US, has won $7 m (Euro 7.16 m) to develop its LEAP microscope. The company claims that the local electrode atom-probe device can collect data 1000 times as fast as previous atom-probe designs, enabling its use in process monitoring. "Imago has a working prototype of the LEAP microscope and we've been able to demonstrate applications in our target markets," said Thomas Kelly, Imago chairman. "Our investors recognize the value of having a product ready for market and potential customers lined up for first sales." Imago says that the LEAP microscope has a resolution of 0.5 nm in three dimensions and provides 3D atomic-scale topographic imaging and 3D atomic-scale compositional and structural information.

(Nanotechweb 9/02) http://nanotechweb.org/articles/news/1/9/19/1 [NGN 9/30/02].

Nanoparticles Protect against Disease

Study Shows BioSante Pharmaceuticals, Inc.'s (BTPH) CAP Nanoparticles Induce Immunity And Protection From Herpes. BioSante Pharmaceuticals, Inc. today announced results of a study that found its patented calcium phosphate nanoparticles (CAP) vaccine adjuvant to be an effective mucosal adjuvant capable of inducing mucosal immunity and protection against herpes infection. The study was published in the September issue of the journal Clinical and Diagnostic Laboratory Immunology.

(NanoInvestornews 9/28/02) http://www.nanoinvestornews.com/modules.php?name=News&file=article&sid=817[NGN 9/30/02].

Diamond Used to Break the Mold

Japanese team has developed a technique to build diamond molds for what it calls nanoimprint lithography (NIL) to try to print rather than image features on chips. As chips shrink, resist patterning on silicon wafers becomes increasingly critical. The team says NIL offers nanometre features over large areas with high throughput. The combined team of researchers from the University of Tokyo and a Japanese Electrotechnical Laboratory in Ibaraki has developed a fine patterning technique for diamond that makes it a suitable candidate for use as a NIL mould.

(SiliconStrategies 9/18/02) http://www.siliconstrategies.com/story/OEG20020918S0003 [NGN 9/30/02].

House Gets Own Nanotech Legislation to Consider

One month after the Senate Commerce Committee passed legislation promoting nanotechnology funding and development, Rep. Mike Honda, D-Calif., introduced the Nanoscience and Nanotechnology Advisory Board Act on Thursday. The bill, H.R. 5669, would establish an independent advisory board comprised of leaders from industry and academia to advise the President and Congress on research investment strategy, policy, objectives and oversight related to the government's National Nanotechnology Initiative (NNI).

(DC Internet 10/18/02) http://dc.internet.com/news/article.php/1484461 [NGN 10/18/02].

Nano-Machines Get Some Fresh Air

For nanometer-sized machines, air is so thick it saps their energy. That means most contraptions must be confined to vacuum chambers. But now physicists report that a little laser light can help nanomachines operate in open air. The advance could open the way for ultrasensitive biodetectors.

(inSight 10/2/02) http://www.academicpress.com/inscight/10012002/graphb.htm [NGN 10/18/02].

Key Molecular Electronic Component Synthesized

University of Chicago chemists have successfully synthesized an electronic component the size of a single molecule that could prove crucial in the continuing push to miniaturize electronic devices. The component, called a molecular diode, restricts current flow to one direction between electronic devices. In the semiconductor industry these components, called p-n junctions, form half of a transistor. Man-Kit Ng, a 2002 Ph.D. in Chemistry, and Luping Yu, Professor in Chemistry, describe their diode in the Oct. 2 issue of the journal Angewandte Chemie and online Sept. 12 in the Journal of the American Chemical Society.

(aScribe 10/1/02) http://www.ascribe.org/cgi-bin/spew4th.pl?ascribeid=20021001.133336&time=21%2004%20PDT&year=2002&public=1 [NGN 10/18/02].

Advances in Materials Science Excite Professor

Arthur J. Freeman, an oft-quoted expert in quantum modeling, sees the most exciting days ahead in the field to which he has dedicated more than 40 years of work. The reason? An oppor-

tune convergence of affordable supercomputing, breakthroughs in nanotechnology, and a new field of study called computational materials science.
(The Sun Times 10/16/02) http://www.suntimes.com/output/zinescene/cst-fin-ecol16.html [NGN 10/18/02].

Bacteria Trained to Build Circuit
Bacteria lay bricks on nano scale building site. Bacteria have found a new vocation—as nanoscale construction workers. Such bugs might form microbial machines that could repair wounds or build microscopic electrical circuits. Tetsuo Kondo of the Forestry and Forest Products Research Institute in Ibaraki, and his colleagues, used a grooved film to train the bacterium Acetobacter xylinum to exude neat ribbons of a biological building material—cellulose1. The bug laid down strips at a rate of 4,000ths of a millimetre per minute.
(Nature Science Update 10/8/02) http://www.nature.com/nsu/021007/021007-1.html [NGN 10/18/02].

IBM Grows Nanotube Patterns on Silicon Wafers
IBM Corp. has grown catalyst-free nanotube networks on silicon carbide substrates, the company said last week. With atomic-force microscopy verifying the results, researchers at the T.J. Watson Research Center set up grids of nanotubes (in rows and columns), bringing the promise of nanotube transistors arrayed across silicon chips one step closer to reality, IBM said.
(EETimes 9/30/02) http://www.eet.com/at/news/OEG20020930S0013 [NGN 10/18/02].

Nanocylinders Open Way to Polymer Electronics
International team of scientists succeeds in synthesizing new supramolecular materials for optoelectronics from organic crystals and polymers. A team of German and American scientists have succeeded in combining conventional organic molecules and conductive polymers to form highly symmetric, structured materials with new electronic properties. After the attachment of specific functional groups, the disc-like or ring-shaped organic molecules organize into highly symmetric cylinders, three nanometers in thickness and 50-100 nanometers in length, just like a roll of coins.
(MaxPlanck Society-Press Release- 10/2/02) http://www.mpg.de/news02/news0223.htm [NGN 10/18/02].

Diffraction Gradient Lithography Aids Nanofluidics
Small fluidic structures are important tools in the emerging field of bionanotechnology, but it can be difficult to stretch out long molecules such as DNA so that they can enter the nano-sized channels. Now, researchers from Princeton University, US, have developed a relatively cheap technique for making devices that gradually uncoil the molecules before guiding them into the channels.
(nanotechweb.org 10/11/02) http://nanotechweb.org/articles/news/1/10/9/1 [NGN 10/18/02].

Super Cell Phone Only Needs Battery
It would send and receive faxes and video and have the processing power of a personal computer. The cell phone of the future would be on the market today but for one hitch: the battery. So Martin and his team are making progress on a new approach: Batteries inspired by the emerging field of nanotechnology. The research could both improve the small batteries used in portable electronics and lead to truly miniscule power packs for so called "microelectromechanical" machines, or MEMS, devices. In the first year of a five-year collaborative effort with three other institutions funded by a $5 million grant from the U.S. Office of Naval Research, the research is showing progress toward its goal of creating a three-dimensional, millimeter-sized battery.
(EurekAlert 10/10/02) http://www.eurekalert.org/pub_releases/2002-10/uof-ab101002.php [NGN 10/18/02].

Brain on a Chip
Researchers in California have found a way to keep slices of living brain alive for weeks, which could soon become a powerful tool for testing new drugs. The mini-brain consists of a glass chip containing tens of thousands of interconnected living brain cells, taken from rats or mice.
(EurekAlert 10/16/02) http://www.eurekalert.org/pub_releases/2002-10/ns-boa101602.php [NGN 10/18/02].

Phlesch Bubble Awarded Nanotechnology Prize
Phlesch Bubble has been awarded the IMM Computational Nanotechnology Prize (Simulation category) for their animation of a working respirocyte (a hypothetical artificial red blood cell). David Forrest, President of the Institute for Molecular Manufacturing, commented about the animation: "The judges were very impressed with the quality of (the) work, the level of detail, and the fidelity to the physics of fluid motion in the bloodstream and the biological environment of the respirocyte. The operation of the respirocyte was communicated with clarity, attention to detail, scientific accuracy, and high visual impact."
(Nanotech-now.com 10/17/02) http://nanotech-now.com/phleschbubble-release-10172002.htm [NGN 10/18/02].

Polymers Self-Assemble to Form 2.5-Nm Diode
A diode measuring just 2.5 nanometers was recently demonstrated by University of Chicago professor Luping Yu, who called it the world's smallest. The operation of the polymer-based p-n junction diode, synthesized using organic chemistry by postdoctoral assistant Man-Kit Ng, was verified with a scanning tunneling microscope.
(EETimes 10/16/02) http://www.eet.com/at/news/OEG20021015S0040 [NGN 10/18/02].

Nanotechs Called to Duty at Picatinny
Several nanotechnology companies will be aiding in the development of smaller—but just as lethal—weapons at Picatinny Arsenal, officials said Friday. The military base reached six partnership agreements—two with businesses, the other four with

universities—to help launch a Manufacturing, Research, Development and Education Center for Nanotechnologies, said Picatinny officials, who have dubbed the center "Nano Valley." The center is being funded by $9.5 million in federal grants received over the past two years. It will be spread out among several of the 1,000 buildings at the 6,500-acre arsenal.
(Daily Record News 10/26/02) http://www.dailyrecord.com/news/02/10/26/news7-nano.htm [NGN 10/29/02].

Nanoscale Ion Pump
Researchers have created a nanoscale ion pump by punching a tiny hole in a plastic sheet and applying an oscillating electric field. Their modeling indicates that the single conical pore works like a ratchet, according to the 4 November print issue of PRL. The group hopes that the device will eventually help explain ion pumps and channels in biological cells, the inspirations for their work. Micron-sized beads have already been pushed "uphill," against electrochemical forces, through specially shaped small holes. Zuzanna Siwy of the Institute for Heavy Ion Research (GSI) in Darmstadt, Germany, and Andrzej Fulinski of Jagellonian University in Krakow wanted to take the next step and pump single ions through nanosized pores.
(Physical Review Focus 10/23/02- to appear in the Nov. 4 02, paper issue) http://focus.aps.org/v10/st19.html [NGN 10/29/02].

The Drive toward Intel "Everywhere"
Intel says it wants to update the majority of its semiconductor lineup by the end of 2004 to better reflect emerging know-how like nanotechnology. The Santa Clara, Calif.-based chip making giant said it would focus on 90-nanometer process technology to advance its next generation of processors like it's next Pentium release—Prescott.
(internet.com 10/23/02) http://www.internetnews.com/infra/article.php/1487471 [NGN 10/29/02].

IBM Builds Circuit with Carbon Monoxide Modules
The smallest circuit yet could mean big advances for processing power. Just as a falling apple spurred Isaac Newton's discovery of gravity, toppling dominoes have inspired researchers to build the world's smallest computer circuits. Scientists at IBM's Almaden Research Centre in San Jose, California, have built and operated working computer circuits at a nanoscale using an innovative approach in which individual molecules stream across an atomic surface like toppling dominoes.
(ZDnet10/25/02) http://c.moreover.com/click/here.pl?j50433760&w=501400; Or read the CNN report at: http://www.cnn.com/2002/TECH/biztech/10/25/ibm.nanotechnology.reut/index.html [NGN 10/29/02].

Scientific Breakthrough No Ordinary Yarn
A Chinese research team have found new approaches to pull carbon nanotubes into continuous yarns up to 30 centimetres long—an achievement that may facilitate mankind's manipulation of matter atom by atom in the future. The breakthrough was made by Jiang Kaili and his colleagues at Beijing-based Tsinghua University in May, the latest issue of science magazine Nature stated. Jiang described the carbon nanotube yarns as thin ribbons composed of parallel threads that have diameters in the range of several hundred nanometres, with the width of the yarn roughly depending on the number of threads in it.
(China Daily 10/26/02) http://www1.chinadaily.com.cn/hk/2002-10-26/91319.html [NGN 10/29/02].

Sugar Coating Insulates Molecular Wires
A team of scientists from University College London, Cambridge University and Oxford University in the UK, and Humboldt University Berlin, Germany, has used supramolecular chemistry to insulate molecular wires made from conducting polymer molecules. Coating the molecules with ring-like sugars called cyclodextrins improved their light-emitting properties.
(nanotechweb.org 10/23/02) http://nanotechweb.org/articles/news/1/10/18/1 [NGN 10/29/02].

Gene Tweaking Safely Doubles Life Span
A US team has doubled the lifespan of the nematode worm with no apparent physiological side effects. The key to what appears to be uncompromised longevity is to silence a gene involved in ageing at just the right point in a worm's life cycle. In previous work involving interfering with the gene, longer life was only achieved at the cost of a loss of ability to reproduce in C. elegans. "But knocking down the gene after the worms reach adulthood increases their life span without affecting their reproduction," says Cynthia Kenyon at the University of California, San Francisco, who led the research.
(New Scientist 10/24/02) http://www.newscientist.com/news/news.jsp?id=ns99992969 [NGN 10/29/02].

New Nanoparticle Coating Mimics Dolphin Skin
Researchers at Washington University in St. Louis are seeking to splice RNA-docking molecules to a novel breed of nanoparticles—specially structured "nanocages"—for on-the-mark, stay-put delivery of diagnostic and disease-fighting agents. Said nanoparticles, dubbed knedels for their similarity to a popular Polish dumpling, also hold promise for other, non-medical payoffs (e. g., as a foil to maritime fouling). (Washington University 10/27/02) http://news-info.wustl.edu/news/casw/wooley.html. [NGN 10/29/02]

Israel on Cutting Edge of Nanotech Revolution
Good things come in small packages. And, in this case, they come in microscopic packages of one-millionth of a millimeter. This is nanoworld, where a DNA string is a veritable giant, and a single cell is unthinkably huge. This is the last frontier of chemistry, one step before sliding into physics... And, the Israeli scientific and business community is at the forefront of this emerging field. Israel is widely recognized one of the leading powers in nanotechnological research, with one team, led by Reshef Tenne of Weizmann Institute of Science in Rehovot, recently

being nominated for the World Technology Award alongside teams from IBM, Harvard and MIT.
(Israel21c via Israel High-Tech Investor Magazine 2002, 10/28/02) http://www.israel21c.org/bin/en.jsp?enPage=BlankPage&enDisplay=view&enDispWhat=object&enDispWho=Articles%5El214&enZone=technology &enVersion=0& [NGN 10/29/02].

Neutron Holography
Neutron holography with atomic-scale resolution has been performed, for the first time, with an "inside-detector" approach. Holography generally includes a source of illuminating waves, an object to be imaged, and a detector or film in which waves direct from the source interfere with waves scattered from parts of the object. The interference pattern, stored in the detector medium, is later read out (and a 3D image of the object viewed) by sending waves into the detector.
(AIPS 10/15/02) http://www.aip.org/enews/physnews/2002/split/609-1.html [NGN 10/29/02].

Hybrid Plastics' Nanomaterials: From Inner Molars to Outer Space
Hybrid Plastics is working with several partners to roll out a rather impressive little molecule with a plethora of possible applications. Pentron Corp., a dental supply firm, announced a dental bonding agent called NanoBond, based on Hybrid's POSS technology and NASA is testing versions of Hybrid's plastics on the exterior of the International Space Station.
(Small Times 10/28/02) http://www.smalltimes.com/document_display.cfm?document_id=4904 [NGN 10/29/02].

Nanotubes Hang Tough
Tiny nanotubes form super-tough material when glued together. By sandwiching tiny but super-tough carbon nanotubes between layers of polymer, researchers have created a revolutionary material that is six times stronger than conventional carbon-fibre composites and as hard as some ultrahard ceramic materials used in engineering. An international team led by Nicholas Kotov of Oklahoma State University in Stillwater say their new material could be used in space engineering or for long-lasting medical implants. Because the composite is completely organic (carbon-based), it is as lightweight as traditional carbon-fibre materials.
(Nature 10/14/02) http://www.nature.com/nsu/021007/021007-13.html [NGN 10/29/02].

Nanomachine-Based 'Smart' Paints for Combat Vehicles?
U.S. Army experts are trying to embed microscopic electromechanical machines in paint that could detect and heal cracks and corrosion in the bodies of combat vehicles, as well as give vehicles the chameleon-like quality of rapidly altering camouflage to blend in with changing operating environments. Officials of the Army Tank-automotive and Armaments Command's Armament Research, Development and Engineering Center (TACOM-ARDEC) at Picatinny Arsenal, N.J., are working with scientists at the New Jersey Institute of Technology in Newark, N.J., to develop nanotechnology-based "smart" coatings for Army vehicles and other material.
(Military & Aerospace Electronics, October 2002) http://mae.pennnet.com/Articles/Article_Display.cfm?Section=Articles&Subsection=Display&ARTICLE_ID=158414 [NGN 10/29/02].

Wear Your Nanotech Attitude to Work
You are at a party and somebody jostles you and knocks your drink, or maybe some chutney or chocolate sauce, onto your cool Rs 1,000-plus cotton shirt you bought for the occasion and ruins it. Your worst fears have come true. But such fears could soon be history, thanks to nanotechnology. US-based Nano-Tex, LLC, which is using this revolutionary new technology to create, change and improve textiles at the molecular level, has introduced products that markedly improve the performance of everyday fabric like cotton. And six months into their global commercial introduction, one of these products is available in India—in Arvind Brands' flagship formalwear brand Arrow.
(Times of India 10/24/02) http://timesofindia.indiatimes.com/cms.dll/articleshow?artid=26200196 [NGN 10/29/02].

More Uniform "Buckytubes"
Duke University chemists report they have made a significant advance toward producing tiny hollow tubes of carbon atoms, called "nanotubes," with electronic properties reliable enough to use in molecular-sized circuits. In a report posted Oct. 28, 2002, in the online version of the Journal of the American Chemical Society, the Duke group described a method to synthesize starting catalytic "nanocluster" particles of identical size that, in turn, can foster the growth of carbon nanotubes that vary in size far less than those produced previously.
(EurekAlert 10/28/02) http://www.eurekalert.org/pub_releases/2002-10/du-dr102802.php [NGN 10/29/02].

New Technique Reveals Structure of Films with High Resolution
Scientists have developed and tested a new imaging technique that reveals the atomic structure of thin films with unprecedented resolution. The technique showns very precisely how the atoms of the first layers of a film rearrange under the action of the substrate on which the film is grown. "This technique directly provides a very precise image of atomic positions within a film and at the interface between a film and a substrate," says Ron Pindak, a physicist at the National Synchrotron Light Source (NSLS) at the U.S. Department of Energy's Brookhaven National Laboratory and one of the authors of a study reported in the October issue of Nature Materials.
(Brookhaven National Laboratory press release 10/29/02) http://www.bnl.gov/bnlweb/pubaf/pr/2002/bnlpr102902.htm [NGN 10/29/02].

Tailor-Made Cancer Drugs: Wave of the Future?
A Washington University chemist offers radical new strategy in fight against cancer. Today, even the best cancer treatments kill

about as many healthy cells as they do cancer cells but John-Stephen A. Taylor, Ph.D., professor of chemistry at Washington University in St. Louis, has a plan to improve that ratio. Over the last several years, Taylor has begun to lay the conceptual and experimental groundwork for a radical new strategy for chemotherapy—one that turns existing drugs into medicinal "smart bombs," if you will. In related work, Taylor said he will be using overexpressed RNA sequences to help target drugs in research with Washington University colleague Karen Wooley, Ph.D., associate professor of chemistry, and other collaborators. The group hopes to splice Taylor's RNA-docking molecules to Wooley's new breed of nanoparticles for on-the-mark, stay-put delivery of diagnostic and disease-fighting agents.
(Washington University 10/27/02) http://news-info.wustl.edu/news/casw/taylor.html [NGN 10/29/02].

Nanomechanic Devices Sniff out Whisky
Back in the mid-1980s the inventors of the atomic force microscope (AFM)—a device that profiles surfaces by scanning them with a sharp probe mounted on a cantilever beam—probably never imagined that one day sensors based on AFM technology would be able to "smell" whisky. But now cantilever-based nanomechanic devices can do all this and more. Liz Kalaugher reports.
(Nanotechweb October 2002) http://nanotechweb.org/articles/feature/1/10/4/1 [NGN 10/29/02].

Samples to Prove Quantum Dot Process
Nanoco Ltd., a start-up spun out of the U.K.'s University of Manchester, is not only shipping multi-gram quantities of quantum dots, it's also giving away free samples. The company calls its quantum dots "NanoDots," and it uses a patented process to make standard dots or dots made to custom specifications. The process Nanoco has patented uses a unique "single source" precursor that does not rely on the toxic, flammable and unstable materials used in the "double source" process.
(Nanoelectronicsplanet 10/23/02) http://www.nanoelectronicsplanet.com/nanochannels/products/article/0,4028,10460_1486891,00.html [NGN 10/29/02].

Molecular Wheel Gets a Brake
Switch turns microscopic motor on and off. Scientists have redesigned one of nature's molecular machines to make the world's smallest switchable motor. The rotating machine can be turned on and off like a pocket fan—but it is only about 14 millionths of a millimetre across. The invention brings mechanical devices made from single molecules a step closer. Such machines might form part of electronic circuits, carry out delicate surgery on cells or gather solar energy.
(Nature Science Update 11/2/02) http://www.nature.com/nsu/021028/021028-3.html [NGN 11/7/02].

Federal Money for Nanotech Initiative
Ben Franklin Technology Partners of Southeastern Pennsylvania said Friday it has received a $600,000 earmark from the U.S. Department of Education to develop an associate degree program in nanotechnology involving a number of area colleges.
(Philadelphia Business Journal 11/1/02) http://philadelphia.bizjournals.com/philadelphia/stories/2002/10/28/daily67.html [NGN 11/7/02].

Next Generation Data Storage on the Nanometer-Scale
Imagine having all of the information recorded on a stack of 1,540 CDs on a disk the size of a single CD. Or visualize having all of the information recorded on a stack of 154 CDs written on a one-inch square chip. New probe microscopy techniques and new organic materials could be combined in the next generation data storage technology - which will be nanometer-scale technology with probable major impact on related storage technologies, University of Arizona optical scientists say.
(Cosmicverse News 10/31/02) http://www.cosmiverse.com/news/tech/1002/tech10310203.html [NGN 11/7/02].

Nanoparticles Save Paper
A sprinkling of slaked lime conserves old documents. Tiny particles of a strong alkali are helping preserve historical documents. Piero Baglioni of the University of Florence and his coworkers have treated manuscripts dating back to the fourteenth century with a sprinkling of calcium hydroxide grains just 200 millionths of a millimetre across. The nanoparticles of what is commonly called slaked lime penetrate between paper's fibres. They combat the ravages of acids introduced when paper is made, without altering documents' apperance. The technique is cheap and green and could also be used on canvas.
(Nature Science Update 10/22/02) http://www.nature.com/nsu/021021/021021-1.html [NGN 11/7/02].

Speed Reader
Craig Venter sequenced the genome in record time, ushering in a new era of drug discovery. Next step: fast, cheap scans of your DNA that you can take home. The gene guru J. Craig Venter stunned the scientific world in 2000 when his company, Celera Genomics, deciphered the entire human genetic code in little more than two years with an R&D Budget of $270 million. A consortium of U.S. government researchers took 13 years and spent $2.5 billion to reach the same finish line. (The government says it spent only $300 million on the actual sequencing of the genome.) But Venter says that even his rapid-fire breakthrough didn't come nearly fast enough.
(*Forbes* via Yahoo 10/30/02) http://biz.yahoo.com/fo/021030/speed_reader_2.html [NGN 11/7/02].

Nanotech Critics Could Stifle Progress
Nanotechnology, the process of manipulating matter on an atomic or molecular scale, has been a staple of science fiction for a decade. Now it's beginning to break out into real science, and some technology critics are already starting to complain. If they're listened to, the most important technology of the 21st century

may be strangled in its crib.
(Fox News Channel 10/31/02) http://www.foxnews.com/story/0,2933,67119,00.html [NGN 11/7/02].

Nanocrystals, Quantum Dots, and Nature's Own Assembly Line
Chemist Paul Alivisatos's pioneering research into tiny nanocrystals and nanorods is paying off in big ways. Chemically pure clusters of anywhere from 100 to 100,000 atoms, Alivisatos's nanocrystals and nanorods have myriad applications that impact the macroworld—from tagging biological samples for genetic analysis and drug discovery to the creation of plastic solar cells that can be painted onto any surface.
(Berkeley College of Engineering 11/1/02) http://www.coe.berkeley.edu/labnotes/1102/alivisatos.html [NGN 11/7/02].

Supercomputer for a Day
Thousands of computers across Canada have been interconnected to create a supercomputer that only operated for a day. The 1,360 processor strong supercomputer was used to tackle a problem in computational chemistry that would otherwise take years to complete...Professor Schaeffer said the supercomputer could be used up to three days of every month, helping Canadian scientists tackle problems in climate prediction, genomics, protein folding and nanotechnology.
(BBC 11/6/02) http://news.bbc.co.uk/1/hi/technology/2400811.stm [NGN 11/7/02].

Magnetism Viewed at Atomic Level
Scientists and engineers build the transistors that run televisions, radios and similar electronic devices based on the moving electric charges of electrons. But the electron also has another key property: a magnetic "spin" that scientists believe could be exploited to develop faster, smaller and more efficient devices. The first step is to determine the magnetic properties of materials that could be used to create futuristic nanoscale devices, a task that has escaped scientists until now. (Ohio university 11/6/02) http://www.ohio.edu/researchnews/science/nanotech_02.html. [NGN 11/7/02]

Silicon Light Emission Improved Dramatically
Silicon is ideal for electronic applications, but its inability to emit light has limited its potential for optical processing. Now researchers at STMicroelectronics in Italy have increased silicon's light-emitting efficiency by a factor of a hundred, making silicon competitive with conventional light-emitting semiconductors such as gallium arsenide. This advance, achieved by adding rare-earth metals to silicon, will allow optical and electrical functions to be combined on a single silicon chip. Researchers at ST's Corporate Technology R&D Organization in Catania, Sicily, carried out the work. They implanted ions of rare-earth metals such as erbium and cerium into a layer of silicon rich oxide (silicon dioxide enriched with silicon nanocrystals 1-2 nanometres in diameter). The frequency of the light emitted by the silicon depended on which metal was chosen.
(Physics Web 11/5/02) http://physicsweb.org/article/news/6/11/2 [NGN 11/7/02].

One-Way Transport in Quantum Dots
Rectifiers are devices that only allow movement in one direction. Examples include self-winding wristwatches and rectifiers in electrical circuits. Even though the exact mechanism is different for each, all rectifiers share a common principle: the rectification is based on an asymmetry in the system that makes it much easier for motion to occur in one direction than another...Now Keiji Ono of Tokyo University in Japan and co-workers have developed an entirely different rectification mechanism in which the spin of the electrons plays a crucial role (K Ono et al. 2002 Science 297 1313-1317). Their quantum rectifier, which consists of two weakly coupled quantum dots, has two important advantages: it is fully controllable and it is capable of blocking current entirely in one direction.
(nanotechweb.org 11/01/02) http://nanotechweb.org/articles/feature/1/11/1/1 [NGN 11/7/02].

Thinner Chips with Everything
Engineers have crossed a symbolic barrier with a new way to make microchips with transistors that are a thousand times smaller than the width of a human hair or as small as a flu virus. The 90-nanometre width is regarded as a major milestone because scientists believe it will eventually lead to the production of transistors with atomic level dimensions.
(BBC 11/6/02) http://news.bbc.co.uk/2/hi/technology/2404599.stm [NGN 11/7/02].

Nanotechnology News TV
Finally, someone with vision has stepped to the fore and is launching a revolutionary news service all about Nanotechnology. I would like to direct you to the new streaming video news program web site that is just about to launch—see http://www.nanonews.tv/ Take a look at the short video segments, located under "Nano in the AM"—the password for the demonstration segments is "nano"
(Rocky Rawstern Nanotechnology Now 11/6/02) http://nanotechnow.com/nano-news-tv.htm [NGN 11/7/02].

Researchers Stamp Out Polymer Nanowires
A team of scientists has used micromoulding in capillaries and soft-embossing to stamp out nanowires and nanodots from conducting and semiconducting polymers.
(nanotechweb.org 11/7/02) http://nanotechweb.org/articles/news/1/11/4/1 [NGN 11/7/02].

Nanodiagnostic Chip to Debut
NANOBIOTECH Sdn Bhd, the tentatively-named joint venture company between Open Source Systems Sdn Bhd (OSS) and US-based Nano DiagnostiX Inc, plans to produce a working prototype of a nanodiagnostic microarray chip within six months.

"Within a year, the chip is expected to hit the US and the European markets, of which command about 70 to 80 per cent of the worldwide microarray chip market," Open Source Systems Sdn Bhd's founder, chairman, and chief executive Azman Firdaus Shafii informs Business Computing recently. However, no target revenue was given.
(NSTP e-media 11/8/02) http://www.nst.com.my/TECH/BizComp/NewsAnalysis/20021106120259/wartrevamp [NGN 11/7/02].

Quantum Dot Launches First Bio-Nanotechnology Product
Quantum Dot Corporation (QDC), the leader in quantum dot biotechnology applications, announced Nov. 14 the launch of its first Qdot(TM) product. The Qdot(TM) 605 Streptavidin Conjugate, the first in a line of Qdot products, enables dramatic improvements in a wide range of bio-sensing applications.
(Business Wire 11/14/02) http://www.businesswire.com/cgi-bin/f_headline.cgi?bw.111402/223180430 [NGN 11/18/02].

An Innovation Recession?
Amid tough times, lab chiefs say research is still moving forward.
(ABC News 11/11/02) http://www.abcnews.go.com/sections/business/DailyNews/innovation_021111.html [NGN 11/18/02].

Bay Area Firms, People, Win "Scientific American 50"
Ten Bay Area-based firms and people made the grade for outstanding achievement in progressive science and technology, according to Scientific American magazine first "Scientific American 50" awards. Visit the link to view the winners—including two nanoscale winners.
(San Francisco Business Times 11/11/02) http://sanfrancisco.bizjournals.com/sanfrancisco/stories/2002/11/11/daily17.html [NGN 11/18/02].

Molecular Film on Liquid Mercury Reveals New Properties
A team of scientists from the U.S. Department of Energy's Brookhaven National Laboratory, Harvard University, and Bar-Ilan University in Israel have grown ultrathin films made of organic molecules on the surface of liquid mercury. The results, reported in the November 15, 2002, issue of Science, reveal a series of new molecular structures that could lead to novel applications in nanotechnology, which involves manipulating materials at the atomic scale.
(BNL 11/14/02) http://www.bnl.gov/bnlweb/pubaf/pr/2002/bnlpr111402.htm [NGN 11/18/02].

UT to Reap Money from Dow Partnership
The University of Texas will get a percentage of the revenue from a drug technology collaboration between UT and Dow Chemical Co., the Midland, Mich.-based chemical and pharmaceutical company announced...UT researchers have discovered methods using nanotechnology to break drugs into extremely small particles, making them more soluble. Nanotechnology is the science of developing materials from minute particles to improve conventional products.
(San Francisco Business Times 11/12/02) http://austin.bizjournals.com/austin/stories/2002/11/11/daily12.html [NGN 11/18/02].

NIST Keeps You in Position in Space and Time
Phoning home from 93 billion miles away—only E.T. and other science fiction characters can do that. But with the help of National Institute of Standards and Technology (NIST) know-how, reality soon may catch up with imagination... The prototype NIST device acts as a mechanical filter that generates very straight lines by screening out all other motions. Primarily intended for use in the delicate assembly and alignment of optoelectronic devices and applications in micro- and nano-manufacturing, the micro-positioner in a different application offers a promising means for meeting the demanding range, mass and power requirements for the RISE.
(Space Daily 11/15/02) http://www.spacedaily.com/news/astro-navigation-02c.html [NGN 11/18/02].

CMP Self-Aligns Carbon Nanofiber Cathodes
Researchers at Oak Ridge National Laboratory and the University of Tennessee in the US have used chemical mechanical polishing (CMP) to make gated field-emission devices with single carbon nanofiber cathodes. The technique has the advantage that it self-aligns the carbon nanofibre with the aperture and does not need complex photolithographic equipment.
(nanotechweb.org 11/15/02) http://nanotechweb.org/articles/news/1/11/11/1 [NGN 11/18/02].

STMicro Shows Dual-Function DNA Analysis Chip
STMicroelectronics demonstrated a dual-function microfluidic chip that can both amplify DNA and analyze the results of the reaction at the recent Chips-to-Hits conference here. The MEMS system was created as a spin-off from inkjet print heads, which are essentially a silicon-based microfluidic technology. Tiny samples of DNA go through a temperature cycle that doubles the amount of genetic material in the sample each time, and the results are piped into another area of the chip containing gold electrodes with specific DNA strands attached. A match is detected optically, offering a single-chip solution for bedside medical diagnostics.
(EETimes 11/11/02) http://www.eet.com/at/news/OEG20021108S0017 [NGN 11/18/02].

Lotus Effect Shakes Off Dirt
The lotus—a flowering wetland plant native to Asia - may not, at first glance, be of interest to the nanotechnologist. But researchers at German chemical company BASF are developing a spray-on coating that mimics the way lotus leaves repel water droplets and particles of dirt.
(nanotechweb 11/8/02) http://nanotechweb.org/articles/news/1/11/5/1 [NGN 11/18/02].

Systems on a Chip
From wall plug to nano circuit, power chips go hand-in-hand with system on a chip (SOC) technology. SOC companies are coming out with strong predictions, claiming that the entire signal path (digital + analog + memory) and even a full GSM system—including power management—will be integrated in the next few years. However, the reality is that this up-integration march, fueled by nano scale lithography (minimum features less than 100nm), ends up defining the product's own technology boundaries: the higher the number of transistors on a chip, the lower their voltage and the more fragile their technology. At the 0.13um juncture, for example, the SOC processes work at voltages in the range of 1-2V!
(PlanetAnalog.com 11/16/02) http://www.planetanalog.com/features/OEG20021113S0045 [NGN 11/18/02].

HP Wins Molecular Electronics Patent
HP has received a US patent that covers "chemically synthesized and assembled electronic devices". The patent describes a scalable chemical process for making devices based on electrically switchable molecules positioned between crossed wires just a few atoms wide.
(nanotechweb.org 11/13/02) http://nanotechweb.org/articles/news/1/11/8/1 [NGN 11/18/02].

BioTrove Eyes 'Giant Leap' in Drug-Discovery Process
Two products aim to cut down time, cost of drug development. On the fourth floor of Pfizer Inc's Memorial Drive research facility, BioTrove Inc. is quietly making nanotechnology a reality. Nanotechnology promises to speed up the drug-discovery process by reducing assays to a fraction of their present size. Though still a nascent field, the market is ripe for it, said Colin Brenan, president and CEO of BioTrove.
(Boston Business Journal 11/18/02) http://boston.bizjournals.com/boston/stories/2002/11/18/story7.html [NGN 11/18/02].

Editor's note:
NGN: Nanogirl News, by Gina Miller.
MP: items selected and lightly edited by Mike Perry.

l

(Fukuyama—continued from page 44)

Some further comments are in order about the immortalist view of future humanity as compared to the thinking expressed in Fukuyama's book. In both cases the best possible outcome is sought. But we immortalists are committed to the position that, in at least one important respect, a radical change is necessary: the predictable decline to death known as the aging process, and its associated, progressive infirmities, must come to a halt. It is a basic part of being human, but another basic part is the longing to escape this imposition forever. The problem, we think, is addressable through technology either now under development or foreseeable as an outgrowth of present efforts. These efforts deserve our support and encouragement, not suffocation by misguided regulations, however they may be rationalized or even well-intended. Fukuyama offers a viewpoint in which the human species, in its present form, is to be perpetuated, which means that aging and death must continue without substantial change. We instead would continue ourselves as living individuals, in time to outgrow the static confines of our present species, to form a new and glorious, enduring family. We must seek this goal most carefully and diligently, for it surely is our rightful destiny.

1. Roger Kimball, "Francis Fukuyama & the end of history" from *The New Criterion Online:* http://www.newcriterion.com/archive/10/feb92/fukuyama.htm, quoted from Francis Fukuyama, *The End of History and the Last Man* (New York: Farrar, Straus & Giroux, 2002).

l

(McDaniels—continued from page 42)

perienced a religious conversion that, with its promise of an afterlife, seems to have obviated any sense of a need for such a practice as cryonics. Yet religious people are not indifferent to death but also seek to prolong their stay in this world, and are likewise interested in extending the lives of others. Some religious people do choose cryonics, as do some who, like McDaniels, have a special appreciation for the natural environment and the healing professions. So we can hope that the life-affirming nature of cryonics will be seen and taken seriously by others of a religious, humanistic, and naturalistic bent. For this to happen on any sizable scale, we clearly must make substantial progress, both in the technical and promotional fields.

I thank Mike Darwin for consultation while writing this article.
1. Alcor files, unpublished.
2. *Alcor News,* issues no. 4 (August 1976).
3. Michael Perry, "For the Record," *Cryonics* 12 no. 3 (March 1991): 5.
4. *Alcor News,* no. 5 (September 1976).
5. *Alcor News,* no. 12 (June 1977).
6. Michael Darwin, Cryonet #17319 (19 August 2001), http://www.cryonet.org/cgi-bin/dsp.cgi?msg=17319.

l

Letters to the Editor

Letters to the editors are most welcome on all topics, including counterpoint on previously published materials and suggestions as to future content. We especially invite questions about cryotransport (cryonics) that are original and far-reaching. If you are seeking information about Alcor, please consult our web site, at www.alcor.org. If you have questions about developmental programs within Alcor, you may stir us into talking about them even sooner than we might have otherwise. If your letter is lengthy and involved, we may use it as a separate article and may ask you to expand it. We need your ideas, your personal visions. This is the place to start.

Please send letters and/or articles to: llock@winterthur.org.

Update your wardrobe today!

Alcor has merchandise available featuring the new Alcor logo!

Please visit the Alcor Gifts section of our web site at www.alcor.org or contact the Marketing Resource Center at 480.905.1906, ext. 129 to order.

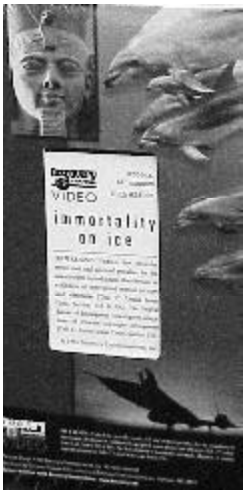
Baseball caps $12
Khaki with black embroidery
Black with white embroidery

T-shirts (short sleeve) $10
Small, medium, large, X-large, XX-large
White, black, or blue

T-shirts (long sleeve) $15
Small, medium, large, X-large, XX-large
White, black, or blue

Immortality on Ice (the video)

By the Discovery Channel.
About 60 minutes run time.
Popular introductory tape.
$25.00 plus S&H.




4th Qtr. 97


1st Qtr. 98


2nd Qtr. 98


3rd Qtr. 98


4th Qtr. 98


1st Qtr. 99

Cover Art by Tim Hubley !

Over the last several years, Tim Hubley has provided this magazine with some of the most beautiful and creative CGI art we've ever seen. Now Tim is selling a *limited run (only 20 copies each!)* of matted 8.5" x 11" color ink-jet prints of these images (without all the messy text added in layout) for only $15.00, plus shipping and handling.

To order your prints, contact Tim Hubley through e-mail at:

102647.446@compuserve.com.

MOVING?

Let us know about it!
Call 1-480-905-1906 and ask for Joe Hovey.

Don't miss even *one* issue of *Cryonics*

Do You Have Your Copy of *The First Immortal* Yet?

Alcor is selling a limited quantity of copies signed by the author, James Halperin.

Don't miss out—order yours ***today***! **Signed Hardback: $34.95**
Unsigned Hardback: $24.95 Paperback (unsigned): $6.99

Send check or money order to the Alcor Foundation, 7895 E. Acoma Dr., Suite 110, Scottsdale, AZ 85260. With Visa or Mastercard, call 1-480-905-1906.

Advertisements

Cryonics *reserves the right to accept or reject ads at our own discretion and assumes no responsibility for their content or the consequences of answering these advertisements. Please e-mail editor Lisa Lock at LLOCK@winterthur.org for ad rates and space availability.*

NanoTechnology Magazine

NanoTechnology Magazine is your window into the emerging technology whose awesome power mankind will acquire, for good or evil, very early in this new century. Everything will change radically...the industrial revolution was just a preview. Find out about the millions already spent by government and private labs on the atomic manipulation of matter. Follow monthly discoveries toward the evolution of the technology sure to dominate the 21st. century. Prepare yourself mentally with ***NanoTechnology Magazine***.

1-year subscription: $38.40
(check, M.O., or Credit Card).

NanoTechnology Magazine
4451 Sierra Dr.
Honolulu, HI 96816
(808) 737-0628 fax (808) 739-5145
http://planet-hawaii.com/nanozine

PERIASTRON

Publishing for immortalists since 1990
Now both a newsletter and a book!

***PERIASTRON, the bimonthly newsletter, keeps you up on scientific and technical advances bearing on cryotransport. Only $3.00 per issue. Try it for one issue, you'll like it!**

***A GUIDE TO ANTIAGING DRUGS, the book, tells you both the good and bad of each one. And it can be updated as we learn more! Send for free brochure.**

PERIASTRON PUBLISHING
PO Box 208, O'Connor ACT 2602, Australia

E-mail:73647.1215@compuserve.com

Fund CryoTransport
Affordably with Life Insurance

Rudi Hoffman
Certified Financial Planner

Alcor member since 1994

International Insurance, Investments, Financial Services, Mutual Funds, Insurance, Annuities, Living Trusts

$120,000	20 Year Level, Renewable Term
Age 35	$16.30 per month
Age 45	$29.26 per month
Age 55	$60.26 per month

Leave message on 800 voice mail for quote.

P.O. Box 290549, Port Orange, FL 32127
E-mail: rudihoffma@aol.com
1-800-749-3773

The Venturist promotes immortalist philosophy. For free sample write: The Venturists; 15111 N. Hayden Rd., Ste. 160-169, Scottsdale, AZ 85260. Also visit our web site at http://www.venturist.org

For more than 12 years, Mary Naples has underwritten more insurance policies for cryotransport funding than any other insurance agent. If you're looking for fast, dependable, informative service, call Mary today!

Mary E. Naples, CLU, ChFC
2400 Kehoe Avenue
San Mateo, CA 94403
800/645-3338

E-Mail:
mnaples@ft.newyorklife.com