CRYONICS

1st Qtr. 2002 A PUBLICATION OF THE ALCOR LIFE EXTENSION FOUNDATION Volume 23:1

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Cryonics

Vol. 23:1
1st Quarter 2002

FEATURES

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.

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Cryonics
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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 SIGNUP 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.

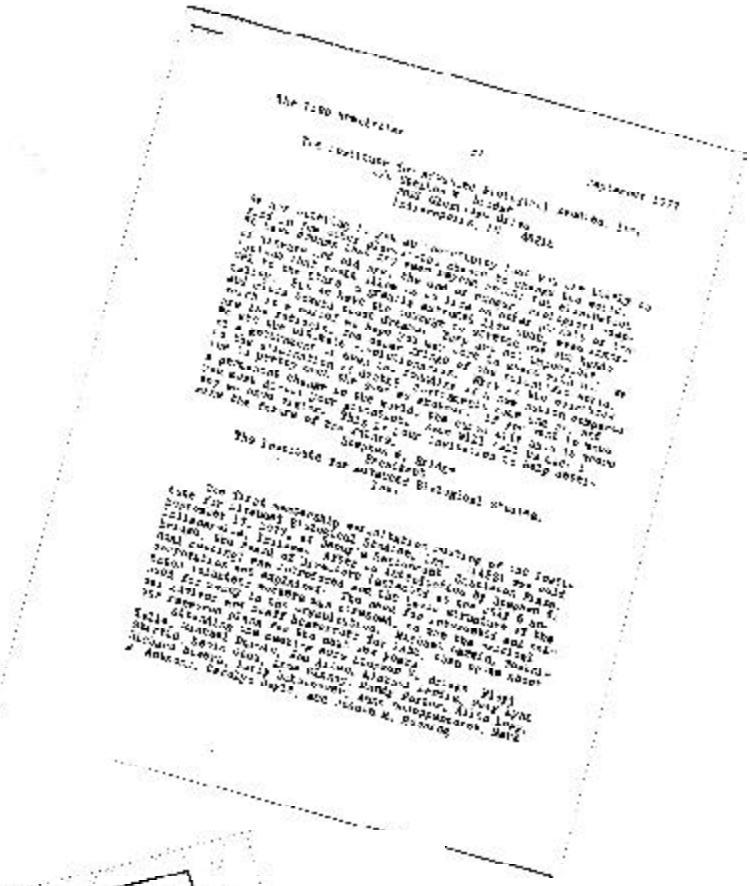
Other times we find out well after the fact that a member has undergone a medical procedure with life threatening potential.

Help us to serve you better!
Keep in touch!

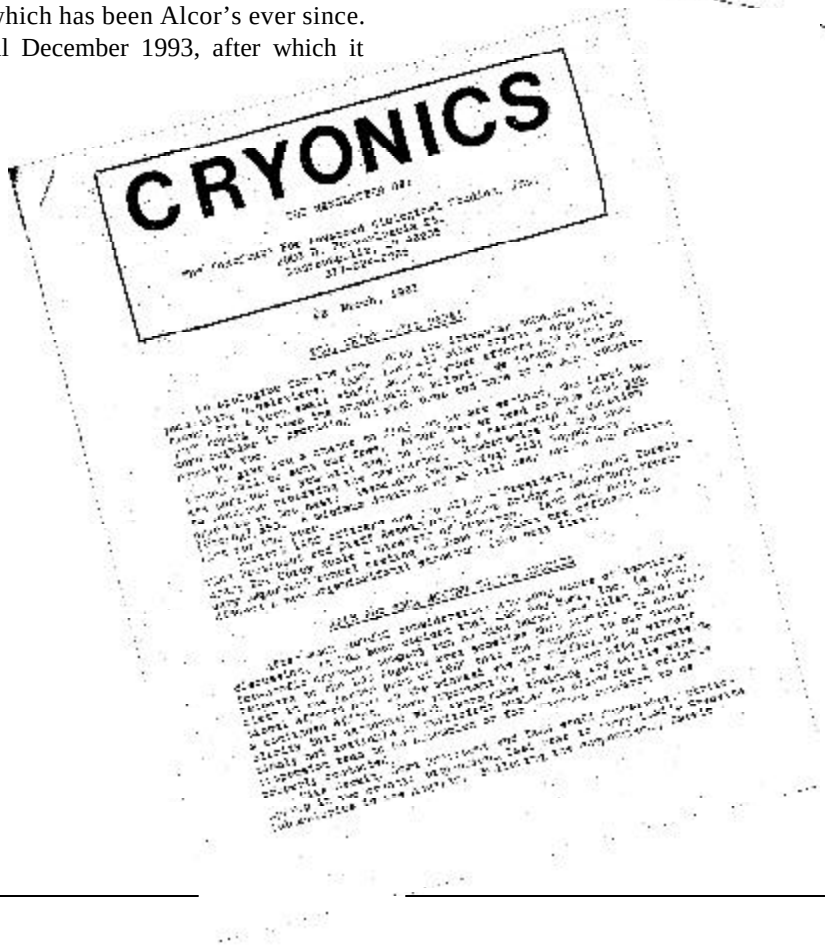
Cryonics Returns

Notes on Our Title

by Mike Perry



Like me, I think most readers will welcome our newsletter's return to its old, traditional title, *Cryonics*, after a brief experiment (two issues only, 2nd and 4th quarter 2001) with *Alcor: Reaching for Tomorrow*. It may be of interest that *Cryonics* was not what this publication was originally called. It started in September 1977 as *The IABS Newsletter*, back when it belonged not to Alcor but to the ambitiously named Institute for Advanced Biological Studies. Based in Indianapolis, Indiana, this gang of zealots included two future Alcor presidents, Mike Darwin and Steve Bridge. *The IABS Newsletter*, a few typed sheets stapled at one corner, was issued only sporadically until no. 8 appeared in March 1981 under the new title, *Cryonics*, and the schedule was upped to monthly. IABS itself merged with Alcor in the following year and bequeathed its newsletter, which has been Alcor's ever since. *Cryonics* was monthly until December 1993, after which it became quarterly.



Fear, Anger, and Hope

The Cryopreservation of Alcor Member A-1876

by

Charles Platt

Six times, now, I have participated in cryonics cases. On each occasion the experience has induced a confusing mixture of fear, anger, and hope.

My fear is caused by intimate personal contact with someone who is legally dead, reminding me uncomfortably of my own mortality. As for my anger, it derives from the frustration of struggling to rectify a massive injustice of the human condition using resources and techniques that are inadequate for the task. I'm angry that we are mortal, and I'm more angry that we are unable, so far, to make ourselves biologically immortal. To use Alan Harrington's fine phrase at the beginning of his book *The Immortalist:* "Death is is an imposition on the human race, and no longer acceptable."

My source of hope should be obvious to anyone who has signed up for cryonics. After a case is over, I allow myself the conceit of believing that I may have helped in a very modest way, with an unknown and possibly marginal chance of success, to save the mind and memories of a human being. This is what makes the fear and anger tolerable.

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The most recent case in which I was tangentially involved was that of Alcor patient A-1876, Eleanor Williams, a remarkable lady who lived in the San Francisco Bay area and fought a battle with cancer that lasted almost three years.

In 1999, Eleanor underwent surgery for a primary adenocarcinoma of the stomach. A large section of her gastrointestinal tract was removed, and she received chemotherapy. Still, she managed to continue a very active life, participating in numerous social causes and groups. Her father had been a communist who wrote an influential book on sociopolitical theory. Some of her friends described her religious views as agnostic, but she was a member of a Jewish temple and was active also in the Unitarian Church, attending their lectures, meetings, and retreats for more than a decade. In addition she underwent a croning ceremony to be certified in wicca (witchcraft). So far as we can tell, each group was unaware that Eleanor participated in the other groups. She was truly multifaceted, and initially she didn't tell many people that she had signed up for cryonics.

In 2001, a CT scan revealed that a new tumor was obstructing her large intestine. Once again she underwent surgery, which revealed additional cancer that had invaded the head of the pancreas and had surrounded the aorta. These masses could not be removed. An additional CT scan revealed several masses in the liver.

Eleanor experienced malnutrition caused by chemotherapy and her abbreviated gastrointestinal system, yet she remained stoic and insisted on continuing her social activities. She would go to church meetings even though she had to lie on the floor in order to minimize her discomfort. She became annoyed when this distressed people. She refused recommendations for pain management, such as a Fentanyl patch, and resisted suggestions that she should enter a hospice. However, her refusal to surrender to her mortality received a setback in July 2001 when she was told that she had only three weeks to live.

At this time she was a member of the American Cryonics Society (ACS) but had educated herself about cryonics by reading publications from Alcor and the Cryonics Institute. ACS had a limited ability to handle cases but was hoping that a new company named Kryos Biomedical would enter into a contract to perform hands-on procedures. Jim Yount, chief operating officer of ACS,

Eleanor Williams

suggested that Eleanor contact Kryos, and she did.

After consultation with medical advisors, the consensus at Kryos was that Eleanor's three-week prognosis was far too pessimistic. Her Karnofsky score was around 80. (This scoring system is based on simple observations yielding a number ranging from 100 for a person showing no signs of illness, down to 0 for a person who is legally dead.) When the life expectancy of a patient suffering a progressive disease is only two to four weeks, a typical Karnofsky score would be 20. Eleanor was informed that she was likely to live at least another two to three months—although survival for more than eight months would be unlikely.

She had read about vitrification and wanted to know if Kryos could provide this. She was told that Kryos hadn't finished equipping its new laboratory and could not guarantee vitrification service within Eleanor's probable life expectancy. The best that the company could offer was a more limited procedure using glycerol as the cryoprotectant.

Eleanor wanted to know if glycerolization would be adequate or if vitrification would significantly increase her chances of future resuscitation. This question created an obvious conflict of interest. Kryos urgently needed capital, and Eleanor's case could literally make the difference between the company surviving or failing. Under the circumstances, Kryos personnel refused to offer any additional advice and urged Eleanor to investigate other cryonics organizations and reach her own decision.

She said she intended to send representatives to visit Alcor, Kryos, and the Cryonics Institute. We can find no evidence that she followed through on this intention, but we do know that ultimately she joined Alcor.

Eleanor now had to deal with the dilemma that faces any cryonicist afflicted with a terminal condition. At some point, she should abandon her home and her active social life and relocate in a hospice near Alcor's facility in Scottsdale, Arizona. The question was, how long could she wait? Naturally she wanted to postpone the move for as long as possible.

In mid February, 2002, she complained of fatigue and shortness of breath and was diagnosed with a malignant pleural effusion. A tumor had penetrated the pleura (the membrane around the lungs), and a large amount of fluid was accumulating. This fluid could be removed every 24 hours by needle aspiration on an out-patient basis. However, her oncologist recommended that she should undergo pleurodesis, which entails an incision in the chest wall through which a large-diameter tube drains the fluid. Subsequently, sterile talc and an antiobiotic such as bleomycin or doxycycline are infused through the tube with the deliberate intention of causing inflammation and injury to the whole pleural surface, resulting in scarring and permanent adhesion to the lung, thus allowing no space for fluid to accumulate in the future.

Pleurodesis is seldom advised for patients who have less than a few months to live, very low functional status, or very low fluid pH. Also, while 60 percent of patients who undergo this procedure experience mild to moderate pain, the remainder must endure extreme pain. In Eleanor's case the pain turned out to be very severe indeed. An elderly lady who was already malnourished and probably dehydrated became more dehydrated, and she went into shock. Her condition was now extremely serious.

Kryos by this time had gone out of business, and its equipment had been sold. However, a new organization named Suspended Animation (SA) had been incorporated in Florida, and Alcor had adopted a new policy initiated by its new CEO, Dr. Jerry Lemler. Jerry had made a point of encouraging cooperation in cryonics and had established collaborative relationships among people who had been reluctant to work together in the past. In an effort to get the best possible care for Eleanor, he asked the principals of SA to provide technical leadership and some on-site management duties in conjunction with Alcor's California team at the San Francisco hospital where Eleanor had been admitted.

Eleanor's blood pressure was reported at 60 over 40, and she was not expected to live for more than a few hours. Steve Harris, M.D., who serves as CEO of Critical Care Research but has provided advice in many cryonics cases, contacted staff at the hospital and persuaded them to fluid-resuscitate Eleanor. This won her a temporary reprieve during which standby team members could gather their equipment and fly to San Francisco.

Alcor's California team leader, Russell Cheney, loaded his motor home with a transport kit and perfusate that he obtained from the Klockgether mortuary—the center of Alcor's Future Bound initiative in California. Russell then met an SA representative who provided additional equipment including a portable ice bath and an experimental Michigan Instruments ACDC (Alternating Compression/Decompression Thumper). Everything was loaded into a chartered aircraft that flew from Ontario, California, to San Francisco International Airport. David Hayes (of SA) and David Shipman (of Alcor) joined the team and collaborated during the subsequent standby with Bobby June, Sue Lubais, Joe Tennant (of Alcor), and Todd Soard (of SA).

When team members reached Eleanor on February 24th, her respiration rate was 22 per minute and her blood pressure was 90 over 60. Her oxygen saturation was a high 97 percent because she was receiving four liters of oxygen per minute via a nasal cannula.

Eleanor was sufficiently self-aware to state that she didn't believe she would die within 24 hours. Still, her condition was so precarious, no one wanted to fly her to a hospice near the Alcor facility. This turned out to be the last day that she was fully conscious and able to communicate well.

The team received excellent cooperation from hospital staff, who allowed all necessary equipment, including E cylinders of oxygen, to be moved into a hallway not far from the patient's

room. Subsequently, hospital staff supplied the standby team with snacks and blankets, and several staff members showed a sincere interest in cryonics.

However, the standby was extremely tense and grueling because the patient remained in a state of distress and seemed liable to die at any time. Some team members worried that her morphine drip might not be adequate and that her life was being prolonged unnecessarily by hydration ordered by her oncologist. Toward the end, she breathed with obvious difficulty because of the fluid in her lungs. Team members could not do rudimentary lab work to assess her condition because her oncologist would not allow anyone to draw blood. Basic vital signs such as blood pressure, temperature, and respiration were recorded at regular intervals but showed no discernible trend downward. During the next week, team members maintained a 24-hour vigil while Eleanor struggled to breathe. Ultimately she went into cardiac arrest with no warning at all at 7:52 Pacific Standard Time on Sunday, March 3rd, just as the standby team was changing shifts.

Hospital staff quickly summoned a physician to pronounce legal death. At 7:58, cardiopulmonary support was applied manually using an Ambu CardioPump. All meds were administered within the next two minutes, and by 8:02 Eleanor was in the portable ice bath receiving mechanical cardiopulmonary support from a Michigan Instruments Thumper. External cooling with ice and the Spray Cooling Device (SCD) was in effect by 8:09. The lungs could not be ventilated because of massive pulmonary edema, and end-tidal CO2s remained at zero throughout the entire transport phase.

Temperature probes were placed by 8:14, and a bolus of fluorocarbon at 0 degrees Celsius was administered at 8:17. The patient left the hospital at 8:28 and received another 500 cc of ice-cold fluorocarbon during transport to the mortuary in a large commercial van that had been rented and modified as an improvised ambulance.

Jim Yount of ACS had generously provided the team with oxygen cylinders owned by his organization. Additional oxygen was brought to San Francisco from Los Angeles by Bobby June in his car. The oxygen powered the Thumper while Eleanor was moved to a mortuary located less than 15 minutes away. The mortuary turned out to be excellent, and the mortician was very helpful.

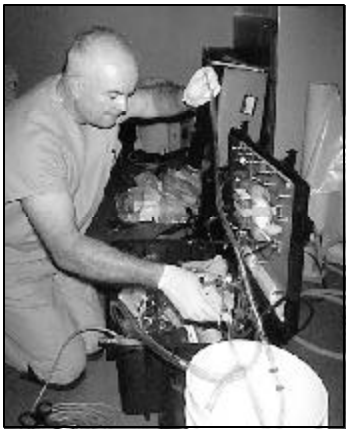
The team reached the mortuary around 8:35. Another 1.5 liters of fluorocarbon were administered at 9:30. Nasopharyngeal and oropharyngeal temperatures were now 19.9 and 19.7 respectively and fell to 16.0 and 15.5 by 9:41.

To enable blood washout, a femoral cutdown was executed by the SA team leader working with the mortician. Meanwhile, Thumper support continued without any interruption and was not discontinued until 10:25. The Thumper was of no help ventilating the patient because of the fluid in her lungs, but chest compressions did continue to induce blood circulation to the brain. When the Thumper was finally disconnected, Eleanor's naso/oro temperatures were 9.9 and 8.6 respectively. The combination of external cooling in the ice bath and fluorocarbon cooling via the lungs had reduced her core temperature from around 36 degrees Celsius at the time of death to approximately 9 degrees in just two-and-a-half hours.

No one had obtained an emergency transit permit to enable Eleanor to be moved to the facility in Scottsdale. Since Eleanor had experienced legal death on a weekend, there was no way to obtain documents to move her out of California. Reluctantly, the team decided to separate her head, since the detached cephalon could be transported legally without paperwork.

Cephalic isolation started at 11:25. Both carotids and both jugulars were raised and ligated, and the incision was deepened to the vertebrals, which were identified and ligated. The cephalon was separated at noon. It had been packed in ice throughout the procedure and was now placed in a protective plastic bag and moved into a small ice chest. Cleanup of the mortuary began at 12:15, and by 1:00 P.M. Eleanor's naso/oro temperatures were 6.7 and 7.3.

Surgery in progress at the mortuary. The patient is lying in the portable ice bath.



The ATP unit that was used at the mortuary.

Surgery in progress at the mortuary. The patient is lying in the portable ice bath.

The team took their patient to San Francisco International Airport, where a chartered jet was used to transport Eleanor to Scottsdale Air Park, only a few minutes from the Alcor facility. In Alcor's operating room, personnel were ready to perfuse her with vitrification solution.

Inside the chartered jet flying the patient from San Francisco to Scottsdale. In the foreground, the cephalon is in an ice chest with a handheld temperature monitor resting on top of it.

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My own involvement with this case began shortly after Eleanor went into shock on Sunday, February 24th, when I received a call from Hugh Hixon warning me that she was in serious condition and might be near death. Hugh felt it would be better to have too many people for a cryopreservation than too few and had been told that SA wanted me to be present as the scribe, meaning that I would log as much data as possible during the cryoprotective phase of this case. He suggested that since I live only two-and-a-half hours from Alcor, I should drive there immediately.

I called the team in San Francisco for an update on the patient's condition. They reassured me that although she had been in shock previously, she had stabilized. Everyone now believed that Eleanor was unlikely to die imminently. They promised that someone would call me if she did go into cardiac arrest, and when I received the call I would still have ample time to reach Alcor before she did, because the postmortem procedures, plus her travel time to Alcor, would total at least seven hours.

Still, the logistics and timing of cryonics cases are always problematic, and I saw several ways in which things could go wrong. Cellular coverage in my rural area is patchy. What if I happened to be out of range when someone wanted to alert me that Eleanor had suffered cardiac arrest? What if she died in the middle of the night, compelling me to make my journey to Alcor in the small hours of the morning, which would leave me feeling sleep-deprived and would make me less effective as a team member? Or what if the people in California simply forgot to call? This was unlikely, but conceivable amid the stress and urgency of postmortem procedures.

I decided to drive to Alcor, and reached the facility around 11:00 on Sunday night. After I made a quick call to San Francisco to verify that Eleanor's condition was still stable, I inflated an air mattress in a vacant room at Alcor and was asleep by midnight.

I stayed at the facility throughout the next day and the next night, calling San Francisco for updates every four to six hours. Since Eleanor's condition remained unchanged, the team encouraged me to stop waiting and go back home. On Tuesday, February 26th, I took their advice.

Each time I called the team during the next few days, I sensed their weariness as the standby wore on. By Saturday, March 2nd, the team was debating whether I should fly out to join them in San Francisco. They could certainly use a fresh, well-rested volunteer—but this plan created new logistical problems. If I went to join them in San Francisco, Eleanor might die while I was in transit, and I would arrive to find that everyone had already left the hospital. Depending on traffic and other unpredictable factors such as flight delays, I might even reach the mortuary too late. At that point I would have to make my own way back to Scottsdale via the next scheduled flight, and might find that all the procedures had been completed without me.

On Sunday morning, while I was still trying to decide what to do, I received a quick, urgent call to notify me that Eleanor had gone into cardiac arrest. The cellular connection was breaking up, but I could hear the Thumper running in the background.

Within an hour I was ready to head down to Scottsdale. Then I paused to wonder if anyone had called Brian Wowk, the biophysicist who co-developed the vitrification solution used by Alcor. If he was available, we could all benefit from his technical knowledge. I dialed his number and found that he hadn't been informed of Eleanor's death, but he was willing to drive to Scottsdale from his home in southern California. The journey should take him about six hours, and he would arrive in time to assist us.

When I reached Alcor myself, I found that the operating room was well prepared, with the exception of the LabView data acquisition system. Relatively little data had been gathered during some previous Alcor cases, and since I was to be a data gatherer in this case, I wanted to be sure that I could do a good job. I found Alcor's former consultant, Jeff Benjamin, trying to explain how he had set up the system to a new LabView programmer named Jim Medlin. Jeff's complicated explanation devolved to one simple fact: The system couldn't measure cryoprotective concentration. I didn't have the expertise to offer any help, and Hugh Hixon had other things to do.

Fortunately, Brian Wowk has extensive LabView experience and arrived in time to deal with the problem. Some of the primary data sensors are refractometers, which "look at" the perfusate as it passes through a tubing circuit. These refractometers are sensitive to temperature and have to be calibrated before perfusion begins. Brian was still rushing to complete this task when the standby team arrived at the facility, bringing Eleanor's cephalon with them.

LabView was up and running about 20 minutes later, and the delay was not considered significant, since the patient was being maintained at around 1 degree Celsius and had been washed out with organ preservation solution at the California mortuary. Her head was removed from the ice chest shortly after 6:30 P.M. (Note: All times in the remainder of this account are local to Arizona, which was on Mountain Standard Time, one hour later than Pacific Standard Time.) The cephalon was perfused with an initial rinse solution at 6:38 P.M. By 6:48, because she had been removed from the ice chest, her core temperature had risen above 4 degrees, assuming the LabView readings were correct.

She went onto closed-circuit perfusion at 6:47, and ramping of the cryoprotective agent concentration started at 7:10. Her cephalon was enclosed in an improvised cooling unit consisting of a clamshell formed by two plastic storage boxes about 18 inches square. Liquid nitrogen vapor flowed through this unit, while vitrification solution was pumped through the major vessels in her neck. Her brain was monitored via a burr hole in the top of her skull. The perfusion was largely uneventful, although it was interrupted a couple of times when the recirculating reservoir ran dry. Also, the venous return line air-locked when gravity drainage was being used, which caused the sump under the cephalon to accumulate perfusate, interrupting the smooth ramping of concentration.

I transcribed data from the LabView display by hand every ten minutes, to provide backup for the automatic data logging. I also noted any significant events. Occasionally I used my digital camera and digital camcorder to record some of the procedures.

By midnight, perfusion had been completed successfully, and the cephalon was moved into a small dewar for gradual cooling to liquid nitrogen temperature during the next eleven days. The cleanup crew started work in the operating room, and another human cryopreservation had been completed.

Alcor's operating room, with many spectators, near the beginning of cryoprotective perfusion. Photograph by Charles Platt.

The LabView data acquisition system is in the foreground. The patient is immediately behind the electronic equipment, under the lights. Photograph by Charles Platt.

Alcor's contract surgeon at work in the operating room in Scottsdale. Mathew Sullivan looks on, at right. Hugh Hixon and Jerry Lemler are in the background. Photograph by Charles Platt.

Late in the evening, when the perfusion is almost complete, Brian Wowk (left) talks with Mathew Sullivan. The five units beside Brian are roller pumps, some of which are used during cryoprotective perfusion. The video monitor displays patient data via the LabView system. Photograph by Charles Platt.

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Was the procedure a success? There's no easy answer to this question because we have no objective criteria by which success can be measured. Of course, we know that some scenarios are more damaging than others, such as a case of sudden death followed by hours of zero blood flow at room temperature. Compared with this baseline, Eleanor was extremely fortunate, receiving prompt cooling, medication, and uninterrupted cardiopulmonary support. But even in a patient who receives such prompt attention, we have no way of verifying that vitrification has been entirely successful and freezing damage has been minimized. Nor do we know exactly what happens when thermal stresses induce fracturing during the long journey down to the temperature of liquid nitrogen. We may infer from logical arguments that nanotechnology will enable cell repairs, but still this is an inference, not an observation.

What we do know is that Eleanor received excellent treatment from a team that was standing by; she cooled rapidly; there were no apparent obstructions (such as blood clots) that would have interfered with perfusion of her brain; and she was given state-of-the-art cryoprotection that should have vitrified her brain with minimal ice formation. Relative to most other cases, this case went very well.

Consequently I did allow myself some hope when I left the Alcor facility; and hope does help to mitigate the fear of death. It does nothing, however, to mitigate my anger at having to take such extreme measures, absorbing the time and goodwill and expertise of so many people because we are such fragile creatures, vulnerable to disease and the aging process. The famous lines that I learned 40 years ago, written by Dylan Thomas when his father was dying, are as relevant now as they were then:

Do not go gentle into that good night,
Old age should burn and rave at close of day;
Rage, rage against the dying of the light.

I hope I may live to see a time when death need not be a source of rage because it is no longer such a threat. l

Many thanks to the SA team leader and other members of the standby team in San Francisco: Russell Cheney, David Hayes, and David Shipman (all of whom journeyed to Alcor for the conclusion of Eleanor's case), and Bobby June, Sue Lubais, Todd Soard, and Joe Tennant. Their dedication may have given a very wonderful lady an opportunity to resume her life in the future.

Much gratitude to Steve Harris for intervening to avert the death of this patient before the standby team could arrive.

At Alcor in Scottsdale, Hugh Hixon and Mathew Sullivan set up the equipment and supplies, while Jerry Lemler, Jim Medlin, Judy Muhlstein, Dave Shumaker, Jessica Lemler Sikes, James Sikes, Brian Wowk, and myself provided assistance in the operating room.

When I participated in this case, I didn't know that I would be writing about it. Consequently, I did not take general notes and had to compile this report primarily from other people's notes and recollections. While I have tried to verify the most important facts, I was not able to do rigorous checking. In particular, I apologize if I have omitted to name anyone who participated in this case. A more technically detailed report should appear in a future issue of Cryonics *magazine. Any small errors that I have made will be corrected at that time.*

After cryoprotective perfusion, the patient's cephalon is moved to a small dewar (at bottom right) supplied with liquid nitrogen vapor from a storage cylinder (bottom left). High Hixon, in white lab coat, chats with Mike Perry, in front of video monitors that display temperature readings as cooldown continues. Brian Wowk is leaving the area, having completed his role in the procedure. Photograph by Charles Platt.

An Introduction to Classical Futurehumanism

by Rick Potvin

The Physical Immortality of Ideas and Self Are Mutually Supportive

Physical immortalists are working to accomplish longer, open-ended life spans and increased personal capabilities by working directly on life extension, suspended animation, and related technologies. But there is another kind of physical immortality that has existed for thousands of years and that will be essential to the progress of extending individual human lives indefinitely. It could be referred to as "noetic immortality."

Noetic immortality, in a Classical Humanist sense, is accomplished by discovering a new universal physical principle that contributes to the progress and well-being of future generations of mankind. Those future generations, in a Classical Humanist education system, will strive to relive the original discovery of the new physical principle as they themselves prepare to uncover still newer universal physical principles. By living in such a "simulteneity of eternity," with great minds of the past, future generations lead to yet more human expansion and success. Man's mastery over the universe leads to his increase in population and extraterrestrial progress and creates the preconditions necessary to significantly increase the human life span.

Within the context of Classical Humanism, proponents of physical immortality can acquire meaning in their lives by contributing to the success of future human generations and thus make their mark in the world, whether or not they themselves accomplish scientific immortality to any significant degree. By doing so in a Classical Humanist way, they maximize the possibilities for preserving and extending their own lives by maximizing the possibilities for promoting physical economic progress that leads to true wealth creation and political progress that recognizes human equality and that serves to limit oligarchic tendencies in society.

Conversely, people who tend toward Classical Humanist values will find physical immortalism a much more attractive idea worth working on because Classical Humanist physical immortalists are, like them, interested in noetic immortality by contributing to the success of mankind's future generations. Ordinary physical immortalists, on the other hand, consider only personal physical immortality to be of value and do not consider their participation and eternal existence in the noosphere as something of value. If an ordinary physical immortalists dies, therefore, and cryonics doesn't work, his life would have had no meaning.

Classical Humanism is a historically proven web of ideas that lays the best foundation for progress. The ideas that constitute it can be found in various times and cultures throughout human history, though they surfaced more strongly and notably at certain points. Ancient Greece and the 15th-century Italian Renaissance periods are of particular interest in this regard. Physical immortalism, on the other hand, has had few adherents. By considering physical immortalism within a Classical Humanist framework, the idea of living forever will become as natural an idea as civilization itself and, in addition, will become more quickly achievable than through any other set of social, political, or economic ideas. If cryonicists are looking for a way to increase their numbers, Classical Humanism deserves to be examined thoroughly.

The Essence of the Noosphere Is the Ability to Change the Universe

I quote from *The Economics of the Noosphere* by Lyndon H. Larouche:

"The paradigmatic essence of the noosphere is the act of cognition through which the individual mind generates a valid discovery of universal physical principle. Here lies the essence of the quality of anti-entropy specific to the noosphere, the functional distinction of noosphere from biosphere (and geosphere).

Here lies the key to mankind's unique and specific ability to change the universe."

Cryonics Can Grow by Joining in the Noetic Immortalist Movement

Classical Humanists can be said to be an existing "family" that cryonicists can join that has been working to save the world and themselves for thousands of years! They're very similar to physical immortalists in a lot of ways. They plan to increase man's power over longevity among other things. They want to build giant engineering works on the face of the Earth and are interested in the potential of magnetic levitation rail systems and development corridors to move goods and people across huge landmasses. They want to develop Mars by terraforming it!

Interestingly, they're very much concerned with the future generations of mankind. Cryonicists who have a similar view should take this as a good sign since it's essential that future generations succeed in ways that will allow our recovery and reanimation from frozen stasis, if this proves technically feasible.

These noetic immortalists are interested in making their mark in the world by becoming world-known historic figures. Most cryonicists are more interested in not dying than in making their mark. But what if making one's mark entailed increasing mankind's ability to survive, both at the civilizational level and the individual level? Cryonicists can take solace in and maximize their motivations by recognizing that by making their mark in a particular way, and by encouraging others to do so, they automatically increase their chances for living forever. The key lies in precisely what these goals are.

In Classical Humanism, the goals are very specific and measurable. We want to increase the energy flux-density of regions in order to make them habitable for human life. Then we want to increase the numbers of human beings. By applying this to the great barren regions of Eurasia and Mars, for example, we can automatically witness progress.

At the same time, by increasing our species' power to exist, we uncover universal physical principles that affect longevity in a positive manner. Noetic immortalists already understand the importance of the physical immortality of ideas, and so super-longevity and physical immortalism are mere extensions of a program they've already been conducting for millennia. We're a subset of them and have not known it.

By identifying with Classical Humanist noetic immortalists, openly, cryonicists can become more widely known as they add a new dimension to an already exciting human progress venture.

The Best of Both Worlds: Cryonicists Contributing to Future Humanity

A Classical Humanist's purpose in life is to make the world a better place to live, for this and future generations. A physical immortalist, on the other hand, wants to live forever, using life extension strategies and cryonic suspension techniques. The physical immortalist has typically not seen a reason to live for the benefit of future generations, preferring to "not die" as a way to live in eternity. He has typically viewed attempts to live forever by doing good works as a mere "cultural buffer" against the anxiety associated with death.[1]

But what if the good works that a physical immortalist could do were works that actually contributed, in concrete ways, to progress in general and, in particular, to progress in prolongevity and survivability? For the physical immortalist, he could have his cake and eat it too. This is the promise of Classical Humanism.

In a Classical Humanist modality, it is said that one "lives forever in the simulteneity of eternity" when one has discovered a new universal physical principle that forever changes the way man relates to the physical universe by increasing his power over it. When a person lives his life for the benefit of mankind by uncovering such a principle, he acquires his place in history and makes his mark.

For a physical immortalist, making a mark in the world, in the Classical Humanist sense, is exactly equivalent to increasing man's physical power over the universe—and this must, by definition, include power over the aging process and longevity in general as well as suspended animation. Therefore, by adopting Classical Humanism as a philosophical framework for prolongevity sciences, prolongevists can join forces with the rest of the Classical Humanist–minded world and achieve their objectives.

Noetic Immortality Dovetails with Physical Immortality

In *Forever for All*, Mike Perry asks, "Why are there so few immortalists, and especially cryonicists?" Maybe there are more immortalists than he realizes. Maybe if we consider "noetic immortalists" to be "physical immortalist" brothers and sisters, as part of our family, in the "simulteneity of eternity," we'll find that we're not so few after all!

Once a cryonicist feels at home with his or her new family of noetic immortalists and becomes familiar with who they are, he or she can then introduce philosophically lost human beings to this family. Insofar as an "idea" is a physical element, of the physical universe, noetic immortalists are indeed physical immortalists. Ideas are not otherworldly spiritual entities, but rather of the mind in a physical sense. We must understand the idea of an idea as Plato understood it.

In *Forever for All*, Mike Perry offers a reason for the lack of popularity of cryonics: "For most people," he writes, "[cryonics] offers a competing worldview and thus, we should expect, will be seen as a threat and a call to defend their culture. To persuade such people to accept cryonics would apparently require full conversion to a different worldview—a difficult task. On the other hand, some people do choose cryonics...."

But is cryonics a worldview that competes with Classical Humanism? No. Cryonics is an extension of the idea of longevity. Personal physical immortality is also an extension of the basic idea of longevity. Cryonicists, therefore, can best view the world

as Classical Humanists who seek to spread humanity throughout the universe and who develop technologies that enable extreme and radical longevity.

Cryonicists can be seen, by definition, as "Classical Futurehumanists." The Classical Futurehumanist seeks to emphasize personal longevity in the context of Classical Humanism. Ordinary Futurehumanists, like Transhumanists, cast aside the definitions of the uniqueness of humanity and existence in a place above the animals and any sort of A.I. But this anti-classical stance is the basis for political oligarchism. Only in classicist modes can humanism represent the kind of progress we think of as our destiny, with freedom and advance for all.

Cryonicists, therefore, can best view the world as Classical Humanists who seek to spread humanity throughout the universe and who develop technologies that enable extreme and radical longevity.

What Will Be Your Continuing Interest in the Outcome of Your Mortal Life, Later?

Classical humanists are motivated to earn their place in history by contributing to improving their species' survivability. Others, knowing they'll die, use a random "cultural anxiety buffer" of some sort.

Physical immortalists have rejected all anxiety buffers and work directly on elimination of death itself. Their assumption is that cultural anxiety buffers are mere "shields against terror and despondancy" (Perry, *Forever for All)*. In most cases, that might be true. A Classical Humanist anxiety buffer, though, is something quite different because the "shield" happens to be, at the same time, a "sword!"

To this extent, it's not appropriate to call the Classical Humanist view an anxiety buffer. Instead of guarding against the terror of death to make life worth living, the motivational sword a Classical Humanist wields explores strange new universal physical principles, creates increased energy-flux-density situations, and boldly expands the relative population density of geographical areas of the Earth where there was none before!

By wielding this sword, the Classical Humanist creates meaning for himself and earns a place in history as someone who has improved his species' ability to survive. At the same time, as a result of his Classical Humanist motivations, he has peeled back more of nature's secrets which, in turn, increase his own potential for increased life span and personal survivability.

This is why Classical Humanism will become the salvation of cryonics and prolongevity in general. It lines up philosophy with physical reality, enabling prolongevists to work with cultural forces—the component of Christianity, Judaism, Islam, and Confucianism that echo the Classical Humanist values that accord humanity proper regard—instead of trying to fight them or replace them. This is the essence of "ecumenicism."

The very meaning of life is wrapped up in the goals of Classical Humanism. Here's how Lyndon H. Larouche explains it:

"...We're all born and we're all going to die. Now, therefore, what is the meaning of life? What is the meaning of mortal life? It has a beginning and an end. Obviously, the meaning is, what it leaves behind, which is not riches—it's something much more important. What's the difference between relations between human beings and monkeys? Human beings' social relationship is based on ideas. What is the relationship of a parent to a child? When you learn, for example, what Eratosthenes did, an example I often use, in estimating the size of the Earth, from inside Egypt over 2,200 years ago, by just looking up at the sun and stars. And a child can replicate that. What is a child doing? A child is establishing a relationship, a personal relationship with Eratosthenes, not because they're repeating and honoring Eratosthenes' name or repeating the results of his measurements but because the child, in properly studying this experiment, is reliving it. The child is reliving the discovery of principle that Eratosthenes made. The child is reliving the moment inside the mind of Eratosthenes, when Eratosthenes made that discovery."[2]

Clearly, Eratosthenes has achieved a sort of physical immortality. This is the continuing interest of Eratosthenes, in reality. This is an example of noetic immortalism. By reliving and re-experiencing important discoveries, we keep the fires of brilliant minds of the past lit. This is the true starting point for physical immortalism. Classical Humanists are the inheritors and continuers of noetic immortalism, the group of people who hold man in highest regard. Physical immortalists who pick up the Classical Humanist agenda are Classical Futurehumanists. Our agendas are mutually supportive.

How Mankind Increases His Species' Power to Exist

What part of "increasing mankind's power to exist" can be disagreed with in this quote from Larouche's *Economics of the Noosphere?:*

"The essential feature of the process by which mankind increases his species' power to exist, in and over the universe, is the discovery and application of additional, validated discoveries of universal physical principle. In the experimental validation of such a discovered principle, the design of that experiment includes willful features which express the new principle being tested. Those features of a successful such experiment, then become, in turn, the model for applying the validated principle to man's willful control over nature. The class of derivatives of successful such proof-of-principle experiments is called technologies."[3]

Classical Humanism Acknowledges the Brevity of Life Span and Views Prolongevity as a Central Feature

Classical humanists acknowledge the brevity of human life span and have come up with a way to deal with that that includes all humanity. The key to this strategy lies in the proper form of state, a modern sovereign nation-state whose only reason for existence is to promote the general welfare. This is the rediscovery made in the Renaissance based on the definition of man as derived from Moses, Socrates, Plato, Philo of Alexandria, and Jesus Christ.

Man's relationship to other men and man's relationship to nature are keys to the fabric of Classical Humanism. Improvements in longevity are central to the Classical Humanist view. Classical Humanism can thus be transformed, easily, into a Classical Futurehumanism that puts the spotlight on longevity, interpreting "improvement in longevity" as "physical immortality."

How Can Cryonics Grow?

A cryonicist is a physical immortalist. There are not many of us. But there are numerous noetic immortalists who are alive today and who have lived throughout history. These are typically the people who have discovered the universal physical principles that have permitted the physical progress mankind has achieved and are themselves immortal. Noetic immortalists are and were physical immortalists to the extent that ideas are of the physical universe. Ideas are products of cognition. By becoming a noetic immortalist, you join this family and continue progress. And by joining this family, you are then able to invite other human beings to it who will continue and expand progress, progress being defined by man's increasing relative potential population density per square mile and energy-flux-density per capita.

A cryonicist is a special kind of physical immortalist. And a physical immortalist can be a special kind of noetic immortalist, the kind of noetic immortalist who understands the importance of longevity who can promote and pursue extreme longevity and, as well, promote the increase of relative potential population density on this planet and others, with Martian development high on the agenda.

By understanding one's self not as a cryonicist first, but as a noetic immortalist who is particularly interested in the prolongevist consequences of noetic immortalism, cryonicists will find a greater self-image. Others will witness the noetic immortalist vision of cryonicists and will be attracted to that vision first! This is a good thing. Once a person acquires a Classical Humanist education, by being able to relive the discoveries of universal physical principles made by great minds in history, the idea of taking longevity to its logical maximum extension becomes natural and, thus, so too does cryonics become visible as a natural extension of this process. Thus, cryonics will grow.

How do you get more people to sign up for cryonics? Classical Humanism is a much more attractive set of ideas for every human being to begin with than cryonics is. Then you emphasize the longevity aspect of discovering new universal physical principles that promote human success on the planet and in the universe. You start with saving the world. Done in a Classical Humanist way, you end up saving yourself! This is what I've coined *Classical Futurehumanism.*

A New Contextual Framework for Cryonics

Cryonicists typically rely upon the idea that physical immortality is the only kind of immortality that is possible. Most of them reject the idea of an otherworldly spiritual afterlife or an amorphous New Age nihilism. Yet there may be middle ground where the vast majority of human beings can meet with cryonicists and understand the advantage of preparing to be frozen for later recovery. This middle ground is the noosphere, where the immortality of ideas related to unlocking the secrets of nature has served humans in projecting themselves into the future, throughout all of human history. By joining hands with Classical Humanists, we become Classical Futurehumanists, and become masters of civilization as well as of self!

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Notes

* See my discussion forum Web site at http://network54.com/forum/95192 entitled "Physical Immortality, Physical Economy, and Progress." My email address is rbpotvin@webtv.net

[1] R. Michael Perry, *Forever for All: Moral Philosophy, Cryonics, and the Scientific Prospects for Immortality* (Universal Publishers, 2000), chap. 3.

[2] See the web site http://www.larouchpub.com/lar/1997/summon_moral_072797_2.html

[3] Lyndon H. Larouche, "The Economics of the Noosphere" EIR News Service (August 2001), p. 220.

Letters to the Editor

Dear *Cryonics:*

I read the essay by David Pizer "How the Mind Is the Brain" [in *Cryonics,* 4th Quarter 2001], and I have some feedback.

David Pizer confronts the old dilemma of mind versus brain. And says "awareness neuron groups activation IS what I call awareness." But I'd ask him right away: I have lots of neurons, my PC also has lots of transistors, how come I am aware of what you call awareness neuron group and not of these other neurons? His line of reasoning is based on an implicit assumption: "I *am* my higher level neurons," the neurons at the very end of the causal chain. While I very much believe what he says, I could not prove it, nor explain the relevance or deep meaning of this statement. Can he? His goal was "to prove that the mind is a physical entity and not a nonmaterial thing." While I probably agree with Mr. Pizer that folk figures such as divinities and elves do not exist, I continue to see no good reason why the workings of the mind should produce subjective experience.

I posted the following essay on a newsgroup some time ago, and it received good feedback, but it is just one more pitiful attempt at circumscribing the uncircumscribable. Here it goes.

I often ask myself, why me? There are billions of brains on this planet alone, and no one knows how many sentient beings exist in the galaxy, or in the entire universe. I share 99.8 percent of my DNA with chimps (if I remember well), and even more with any human on the planet. Granted, there is no brain that works*exactly* like mine. But the differences seem trivial. Why must I be witness to the input processing that occurs inside this particular brain?

The problem has been obscured for a long time, because no two people are exactly alike. Even identical twins end up with slightly different DNAs, and different environmental influences make them into very different people. "Everyone is different, so that is why I'm me and nobody else"—a weak thinker would tell you. When asked about the nature of these differences, they would go on to describe the various tastes and behaviors that people show. But what is making them believe these things that they are saying, is actually the shape of people's faces. They *look* different, so they *must* be different. Furthermore, I am used to seeing *this* face in the mirror, therefore I do not doubt that I *am* this person associated with this face, and I do not need to know the nature of this "association."

Consider nanotechnology. Using nanotechnology, it will be possible to arrange atoms in any desired fashion, precisely. Atomic copies will become possible. The difference between an object, and its atomic copy, will be, exactly, none. Provided that the replication process is precise and that no atoms are moved around, it will not be possible, not even in principle, to tell the difference between the two objects. It will be a foolish claim to say that the two have "differences." They will have no differences. Seems trivial, but wait. What if you made a copy of a person using the same method. Suppose it is your best friend. After the copy is made, you'd be left with two best friends (good deal). As I explained, there will be no difference between the two; being people, they'll both "feel" alive and remember to have agreed to the experiment. Either one will resent being told that "he is the copy." With time, the two would slowly become different people, for they would have different experiences. But if you duplicated your friend and before any time passed went on to destroy the original? To you, this would not have made any difference. Your friend would still remember the old times, and you could forget about the experiment and live the rest of your days without noticing a difference in your buddy. If you have uncertainties at this point, please go back and read over, because things get tough from now on.

Duplicating your friend was fun, but let's suppose you now want to duplicate yourself. At the end of the experiment, there would be two "you"s in the room. We will try to answer a few questions about their identities and the relationships between the two. First, we would be tempted to ask, who's the original, and who is the copy. We have already decided that an atomic copy leaves no room for differences—two atoms of a same element are perfectly identical. So how can it be possible that we still see things from only one pair of eyes? If we agree that there can be no difference between the original and the copy, then we must agree that seeing from only two of those resulting four eyes is suspicious. Don't start the "but they will be different people" argument. It is not relevant here. In fact, to help you get that out of the way, we have performed the experiment in a perfectly symmetrical room. Magnetic fields, thermal fluctuations, the wallpaper... everything is identical down to the smallest detail. The doors are locked. The two people in the room (you and you) will continue to have the exact same inputs from all senses; therefore, they will continue to be exact copies. It could be very difficult to create such an environment in the real world, but in virtual reality it certainly will be possible.

So you're locked in this room with your copy. At one point, a speaker located in the middle of the room announces, "One of you guys will be executed." From a third-person perspective, the execution of one of the identical copies has no negative consequences. You are identical, so the information loss is zero. Furthermore, your relatives won't miss you, because one of you will go ahead and continue your regular life. Still, I suspect, if you were in this situation you'd have a STRONG preference as to who gets executed. How can this be? The person who entered the experiment, who can now be labeled only because we have tracked their movement and we saw where they have been (we know their position history), still feels "locked" inside one body, notwithstanding the fact that a perfect copy of his substrate (body) exists.

Puzzled by this situation, I began to look for a way in which

the two people could be different. A difference that would allow me to say, Ah-ah! *that* is why I'm still me and the copy is someone else. I thought, their atoms are different—it could be that, although atoms of the same element are indistinguishable, in some way exactly which atoms are making up your body determines your identity. This theory went down the sink when I realized that every time you eat or sleep, massive numbers of atoms are replaced in your brain and body, and that I have very few of the atoms in my body that I had when I was 12; still, I feel alive and well!

Another theory was that somehow the particle history "kept track" of your identity so that smooth changes in composition could preserve a continuity of substance that allowed for one's continued subjective experience. This is fuzzy—who is keeping track and how? I have had long discussions on this topic with people from all over the world. Some believe that the information stored in the brain defines their individuality—they claim that they would not mind being executed after a perfect copy of their brain has been made functional. I cannot take their position seriously. Some other believe that what we are is a pattern of information processing—as long as that particular kind of information processing is kept functional, we won't die. Well, there are billions of analogous information processes on the planet; there were plenty before I was born too, and yet I do not remember anything that happened before I was born. I have no direct experience of other people's subjective states, even though their data processes are very similar to mine. It is my position that even if you could make a copy of yourself, even if you could give every atom the precise electron cloud distribution the original has, even replicating all possible details, you'd never see with four eyes.

This line of thought has led us to believe that even completely identical processes do not share their subjectivity. So whether we are comparing ourselves with an identical copy, or with an imperfect copy (another human being), does not really make a difference. Forget about the copy. The real mystery here is, why me? Why not you? Why am I not the person reading this, rather than the person writing this?

At each step of this meditation, we'd be tempted to say, I'm me because I'm me. Although many will answer such things, the statement contains no meaning. But I want to generalize further. If it is true that I am me, and not you, then I also want to know why am I me and not a cat. Why not a rock? Why not anything else but me, me, always me, every day, no matter what I do, I am always me. Many are eager to upload their brains on a permanent medium. I am also very eager, but I fear that the difference between me and the medium will be the same that exists between me and an atomic copy, the same that exists between me and you, the same that exists between me and a rock. I am not conscious as a rock, as you ... and possibily, not as a permanent medium.

It's time to talk about processes. The brain is just a physical process. The falling of rain is also a physical process. Pushing buttons on a calculator is a process. A rock is a process, albeit a very simple one. Actually not that simple—the temperature of all the atoms inside the rock fluctuates. And the "rock PLUS tree" system is also a process. The distance between each of the rock's atoms and each of the tree's atoms varies with time, as the tree grows and as the rock gets kicked around. Very complex system. Maybe more than your pentium chip can simulate. So there are infinitely many processes in the world, for every object, every event can be thought of as a process. The human brain is a process; you have input coming in from the eyes, it is analyzed by the brain and split into distinct objects, these objects are manipulated, the relationships extracted, the possible interactions evaluated, the results of these interactions computed and compared with all available results from past interactions. Emotions (low-level precoded instructions) are triggered, and logical thinking interacts with these instructions to create a response. This is the human black box, the brain in-out pathway, very simplified. It is a process. Inside this process, there is as much vitality, as much soul, as you can find in the distance between the rock atoms and the tree atoms. Oh, but the person speaks!! The air around their mouth vibrates! They tell us, "Oh, don't hurt me," so they must be more alive than a rock, right? But if you knew exactly how the brain is wired for that person and went step by step following the instructions that the input triggers, you'd get to the voice coming out of their mouth and still be asking yourself, so where is this consciousness. Where is this soul. The brain is a parallel machine, not a linear one, you can't just debug it with a disassembler. But that makes no difference. The person, no matter who you examine, simply does not qualify as spiritual entity. We are all mechanical processes. Whether we are deterministic or casual, I don't care. But there is no reason for us to have subjective sensations. It makes absolutely no sense, and if you do understand the meaning of these words, you will be left in a strange world. One where you actually don't exist.

I *am* my brain. I *am* a process. What does it mean to *be* a process? There are many processes out there, but there seems to be an association between the feeling of being "me" and this particular process, my brain. When one realizes how crazy this is, harming animals or lesser creatures becomes morally intolerable. It is no more crazy to postulate sentience inside an animal's mind than to postulate sentience inside a human mind. This is the source of a particular kind of morality. Although we have no scientific evidence that a subjective feeling of being alive should arise in a process like the human brain, we experience this phenomenon. We therefore know (if we are to believe what we feel) that there exists another particular state of subjectivity, one that is closely associated to that other brain (just pick one), and that cannot be separated from it. We will have to accept that all animals are conscious. Their lower intellect, the fact that they cannot "protest" cannot be used as an excuse to be intellectually weak and pretend that they do not, for instance, feel pain.

It would be very strange if only one process in the universe (our mind) was associated to some kind of experience, and all the other processes were just "dead." The most likely theory here is that **every process** is associated with some kind of subjectivity. This includes all people of all races, all animals, all things that move, and, yes, that tree-rock system, and, the rock itself. These ideas are sometimes referred to as pan-psychism. Hans Moravec,

a famous robotics scientist, has discussed them in detail in his essay "Simulation, Consciousness, Existence" (available at http://www.frc.ri.cmu.edu/~hpm/project.archive/general.articles/1998/SimConEx.98.html). Possibly the most intelligent piece of writing I have ever read, this essay explains the role of auto-interpretation. All interpretations of any process, in which conscious beings regard themselves as being conscious, actually contain conscious beings! I highly recommend this essay. What Moravec fails to explain, is the old, old question. Why this process, why me?

It seems that our first-person view of the world and the popular and useful scientific third-person view are in conflict whenever "we" ourselves become the focus of investigation. Some have tried to reconstruct physics on the base of actions and events rather than particles. I have tried something analogous—to reconstruct reality based on self, rather than on objects. It is a crazy, messy theory that may have nothing to do with reality. But it is an example of theory that *can* be created and that would put us in a very different place in the world. So here it is.

I will begin with the popular problem of "free will." When people found out that physics obeys laws, and that our mind must as well, they felt threatened. Their freedom was at stake. They just could not believe that their every move was already decided. Some rejected these protests because they were illogical—if our brain is a machine, then knowing its particle history and atomic structure would be equivalent to being able to tell what the person will do next. Free we are not, they said. But in my opinion, their theories are flawed. The simulation of thought (such as the simulation performed by the human brain) proceeds in a deterministic way. The future is already decided. There is nothing you can do about it, unless you can change the laws of physics with your thought (which would still not grant you "freedom" since the thoughts that determined how the laws would change were deterministic). However, from a first-person point of view, things are different. You have data. You make decisions. It makes no sense to say "you have no free will," for this would seem to deny the ability to analyze data and make decisions. But this ability is yours; you use it all the time. Your free will *is* the system of heuristic algorithms that decide on things. Free will means being able to decide; it does not imply that these decisions must be outside of the realm of physics. Some feel that if we really have no choice and must act the way we act, then it is not justifiable to lock people up in prisons when they misbehave. They then comfort themselves with the thought that they can't help it. But from the first-person perspective, those people *did* have a choice. They analyzed their data and made a decision that led them to damage the system. What is actually punished is their subjective decisionmaking self, their first-person subjectivity, which is, as we said, free.

This is just one more example of first-person and third-person views clashing. In the case of the atomic copy: from a third-person point of view the original you and the copied you are exactly the same. However, from the inside, you are very different. One of you is like an icon on the desktop. The other is the operating system itself. You can delete an icon and go on with life but not delete the operating system. That will destroy all data, all icons. Your personal death is equivalent to the death of the universe, and all objects contained in it. Each mind that simulates the world (or each process that can be interpreted as such), creates an inner simulated universe. First-person observations can be made on this inner universe. Third-person statements can be made on the actual outside universe. Every time "we" become the subject of investigation, this inner universe must be the area of research. Not the outside universe, in which our operating system is but a dispensable icon.

By understanding the difference between "icon" and "operating system," we can begin to probe the nature of our subjective experience. "I" is no longer a person in the world, but rather a world in itself. You, as seen from my point of view, are a part of me, and the distant galaxies of which I see only blurred snapshots on the web are also part of me. There is a world for every head, in other words. But more precisely, a world for every process, which is equivalent to an infinity of worlds. We are not meat puppets or an electrochemical reaction any more, but the entire world, with its large and curled up dimensions. "We are the whole world" must be the real meaning of having a subjective experience. Every subjectivity exists—by creating an intelligent robot we will have created an interface to a pre-existing "robot world" of a certain kind (as Moravec says—and if you have not read his essay do it before continuing). If we agree to this, uploading a brain to a permanent medium and destroying the original brain would be equivalent to making a copy of the entire contents of a universe and then nuking the original universe. If I was an innocent creature on some planet, I'd be against it.

Now this next part is hardcore so get a glass of beer. Let us consider a subjective state or sensation as a 0-dimensional point in a new set of dimensions. Let us also say that what we really are is a smooth curve defined by 0-dimensional points in this new set of dimensions. Let's call this new set of dimensions the S set (for Subjective). These dimensions can be mapped as minus infinity to plus infinity for a given number of dimensions on a cartesian diagram. Every point in the S set is equivalent to a certain subjective state (e.g., I am hot, tired and this pineapple juice aftertaste is on my tongue, plus I am typing and my wrist hurts). We have said that since we were children, our atoms have changed completely, our brains' contents have changed completely, and still we have remained conscious and "associated" to one mind. I postulate, for sake of discussion, that this is because we have followed a continuous curve in the S set of dimension, which is equivalent to saying that our subjective-experience coordinates have changed smoothly, which is equivalent to saying "we *are* this curve." The changes in conscious experience that arise smoothly and take us from childhood to old age follow a smooth line in the S set and therefore keep our life-curve intact. Sudden death is equivalent to an abrupt termination of the curve at one point. Yes, we are made up of atoms and these atoms work together to create the conscious experience, but at the same time, experience is all that counts because without it nothing can exist—

science is to the third-person point of view what the S set theory is to the first-person point of view: the two must be used together, they are just mental tools to understand the universe with its subjectivity rules.

But what I have described until now has no practical use, it is just a useless creation of my mind. Yes—but it does give us a "tool" to think about the problem. First of all it gives us a way of measuring smoothness of consciousness. If we are a curve, then let's use the mathematical knowledge on curves to find out where we stand! A curve #1 is different from a curve #2 if they have no point in common. If the curves are attached, they are both just one curve. Hence, a continuous subjective experience (life) can be had if the curve is not broken at any point—otherwise, two distinct curves would form. And so, all transitions that involve messing with our supporting process (the brain) must occur so that our perception of the world proceeds smoothly. If you go to bed, and while you sleep a copy of you is created, and you are killed without you noticing, and the copy is placed in the exact same place you occupied, then you're ok. The curve was "patched" in the point of intervention by not allowing you to notice what was being done. If this copy had a switch that allowed it to let his brain run faster and faster, but this switch was turned off at the time of replacement with the original, then the switch would be safe to turn on gradually after the replacement. Because the point of replacement was patched correctly and no discontinuity of experience was felt by the subject. Uploading one's brain, then, also seems feasible, IF the change happens gradually (the famous "progressive uploading"). How gradual this change must be, we don't know, but the rate of atom replacement that we see in normal human growth seems to be a safe bet. Since this continuity, I repeat, is a continuity of experience and sensation, abrupt replacement of functional parts (arms, neurons...) should not in principle create discontinuities, if these replacements are perfect substitutes. Changing one's memories, on the other hand, seems a good way to disrupt personal individuality, just like we would expect. What would happen then, if one made a copy of oneself, let him run around for a while, and THEN killed oneself? There are two cases. In the first case, there has been a divergence in the S set (the two accumulate different memories etc.)—in this case, the two entities will be similar but distinct, and by killing himself, the original would destroy not only the last five minutes of experience, but his entire inner universe. Just like we would expect, no "soul transfer" would happen between the dying body and the healthy copy. Second case—if divergence has not happened, you can kill yourself, IF YOU don't notice that you're doing it. Probably someone else would have to do it. Because noticing that you are dying would differentiate you from the copy and divide the curves in the multidimensional s-set, while not noticing would preserve continuity and the original's life-curve would simply be "part" of (totally included in) the copy's life-curve. Suicide would have to happen instantaneously and without causing an "I am dying" sensation (isn't this the way they do it in StarTrek??)

One more paradox we can now handle is the decomposition paradox. Which says, suppose you cut off your arm and put it back where it was with atomic precision, leaving no damaged tissue. Is that still you? Now try cutting up every cubic inch in your body and putting the pieces back together so that the ending atomic structure is exactly identical to the initial structure. Is that still you? Now you can try atom by atom, with your brain. Will you still be alive? What if time passes between the decomposition process and the rebuilding process? This S set theory claims that if you don't notice any difference (because the parts are perfectly rebuilt) after you've been put together, then you should be all right. Time passes? That's fine, as long as the subjective experience curve proceeds smoothly. As long as you make these experiments faster than you can notice that you're being messed with, and as long as you're atomically identical after the experiment, you will not die. We return to commonsense, talking about subjective experience! Now this is news! I am tempted to use calculus to describe exactly what discontinuities could look like (for example, a sudden change of trajectory could be seen as a discontinuity), but I don't know if this can have relevance.

In conclusion:

* You can be uploaded if the upload is gradual.

* The copy paradox is solved: both copies in the symmetrical room follow the same life-curve. With whose eyes do you see? Well, you can't say one or the other because the inputs are identical! In that time nobody can distinguish which body you're in, just like nobody can distinguish two curves that are completely overlapping.

* Backing up one's brain will not restore a person's life after an accident, for continuity in experience is not possible.

* Teleportation is possible, if the original never notices that he is being dematerialized and the experiential curve is kept smooth.

* Cryonics is possible—time "holes" in experience cannot interrupt the life-curve that is based on an internal experiential clock (as my last general anaesthesia confirmed).

* Experiencing other people's subjective consciousness is also possible, provided a machine is invented that can transform you smoothly into that person, and back to what you were, maintaining your memories intact and your life-curve smooth. This could work for any entity from animals to ETs although in some cases a machine may prove to be impossible to create.

The last thing that I want to say is that what I have discussed above is only one example of what one regular person can think up to explain subjective consciousness. I do not know how much of this could really be true, but it stands up well among other similarly crazy theories on consciousness. If we see things with a conservative eye, you should really not exist. Why you feel you do is a mystery, and so is the eternal question: why this process, why me?

–Curzio Vasapollo
Alcor Member
curzio@hotmail.com

Dear Cryonics:

I enjoyed Dave Pizer's article, "An Explanation of How the Mind Is the Brain" (*Cryonics*, 4th Quarter 2001). I agree with many of his conclusions, though not all of them. Dave offers a version of what is known as mind-brain identity theory, also called central-state or reductive materialism. The main premise of mind-brain identity theory, in its basic form, is that the mind and the brain are one and the same, so that, in particular, the mind is a physical object and not, for instance, a mystical essence or soul. In Dave's refinement the mind is identified with only the part of the brain that participates directly in consciousness, a portion he designates as the "awareness neuron group." Dave defends his theory against a number of objections and compares it to an alternative theory known as (machine) functionalism, in which the mind is treated as a sort of computational entity or process. The object of his article, "to show that the mind is a physical thing and not a nonmaterial thing," is presented as "a first step in bringing people to sign up for cryonic suspension." The rationale presumably is that people will be more inclined to make cryonics arrangements if the mind is accepted as a material object whose destruction after death must preclude any possibility of further awareness or an afterlife. Death, then, becomes an eternal absolute, and cryonics the only possible means of avoiding it.

As it happens, I am not an advocate of mind-brain identity theory but instead favor a version of functionalism that is elaborated in my book, *Forever for All*. The mind is not identified with a material object yet does not exist apart from matter, that is to say, in a disembodied form such as a spirit or soul. By way of a rough analogy, in my theory the mind can be compared to the pattern of colored light that is refracted or "instantiated" in a droplet of water, that is to say, a rainbow, whereas in the mind-brain theory it is the "droplet" itself. A rainbow, you will note, is not a material object yet does not exist apart from matter, as something mystical or paranormal. Just as many droplets give rise to one rainbow, it would be possible in principle for many brains to instantiate the same mind, if all functioned alike, though naturally this is unlikely in our (single) universe, at least with the sort of brains we now possess. But more generally the mind can be duplicated, with exact duplicates constituting a single entity rather than a plurality. For this reason we would not have to worry if a part of the brain were replaced with an identical part; it would still be "us," even if the whole brain were replaced and even if others like us were also created. So a person could survive after cryopreservation even if very extensive repairs had to be made, or the original tissue replaced entirely, so long as the original structure was faithfully replicated, or something that functioned equivalently was put in its place. As a more distant but still real possibility, a way is opened for resurrection of persons of the past, if duplicates can be created, so that death is not an absolute. (The resurrection possibility becomes stronger if certain properties hold, such as the existence of parallel universes.) This, in my view, does not make cryonics superfluous, but good reasons can still be offered for choosing it; a chapter of the book is devoted to this topic.

–Mike Perry

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

OOPS

Editor's Errata...

In the last volume, *Cryonics*, 4th Quarter 2001, a note was published on the inaugural Alcor Outreach Reception, accompanied by lovely and extensive photography of the event. This editor neglected to credit the hard-working photographer who showed us a glimpse of that successful and very well-attended reception—Russell Cheney. Russell captured the smiling Alcor members and their guests on untold miles of film, processed pounds of celluloid, and painstakingly identified the individuals present in every picture. Thank you, Russell, for your contribution to Alcor's historical record and our magazine.

OOPS

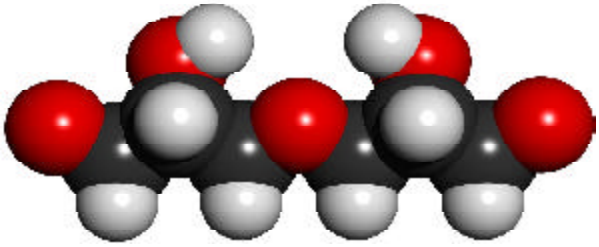
NANOMEDICINE – CRYONICS - VITRIFICATION

LONGEVITY - TISSUE ENGINEERING - THERAPEUTIC CLONING

CRYONICS ESTATE PLANNING - ANTI-AGING MEDICINE

Alcor's 5th

Extreme Life Extension Conference



November 15-17, 2002

in Newport Beach, CA

Michael West, PhD

President and CEO of Advanced Cell Technology, Dr. West has extensive academic and business experience in age-related degenerative disease, telomerase molecular biology, and human embryonic stem cells.

FEATURED SPEAKERS

Gregory Benford, PhD
Kathleen Cotter, DC
Gregory Fahy, PhD
Robert Freitas, Jr.
Steven B. Harris, MD
Rudi Hoffman
Ray Kurzweil, PhD
Jerry B. Lemler, MD
Ralph C. Merkle, PhD
Max More, PhD
Harvey Newstrom
Christine Peterson
Michael Rose, PhD
Stephen Spindler, PhD
Michael West, PhD
Brian Wowk, PhD

Ray Kurzweil, PhD

Developer of businesses in OCR, music synthesis, speech recognition, and reading technology, Dr. Kurzweil is a winner of the Lemelson-MIT Prize, the 1999 National Medal of Technology, the 1994 Dickson Prize, and numerous other awards in invention and innovation.

ALCOR

LIFE EXTENSION FOUNDATION

VISIT WWW.ALCOR.ORG
FOR UPDATED CONFERENCE INFORMATION
AND TO REGISTER ONLINE

Register by July 15, 2002 and you may win a 4-day cruise for two!

Conference Pricing

Option A) Saturday/Sunday conference including lunches and Friday Night Reception:	$475.00
Option B) Saturday/Sunday conference without lunches or Friday Night Reception:	$375.00
Option C) Optional Friday intensive tutorial including lunch:	$295.00
After September 15, 2002	add $100.00
After November 1, 2002	add $150.00

Alcor Foundation 2002 Conference Registration Form

Contact Information

Name (1):_____Pricing Options: (circle) A B C
Name (2):_____Pricing Options: (circle) A B C
Name (3):_____Pricing Options: (circle) A B C
Name (4):_____Pricing Options: (circle) A B C
Organizational Affiliation (for your badge):_____
Address:_____
City:_____State:_____Zip/Postal Code_____
Country:_____
____ Do not include my contact information on the attendee list.

Payment Information

Make checks payable to Alcor. Checks and bank drafts must be in U.S. dollars drawn on a U.S. bank.
Name as it appears on credit card:_____
Credit card number (VISA,MC, AMEX):_____Exp. Date:_____
Charge Amount:_____
Cardholder Signature:_____

_____Send me an Alcor Membership Application Form *
*Alcor will waive the normal $150 Membership Application Fee for conference attendees joining Alcor. Alcor staff will be available at the conference to assist in the sign-up process and to answer any questions you may have.

Registration Options

Phone:
Conference Line: 800-482-6791
Fax:
480-922-9027
Mail:
Alcor Life Extension Foundation
7895 E. Acoma Dr., #110
Scottsdale, AZ 85260

For Hotel Reservations Call:
Newport Beach Marriott Hotel and Tennis Club
(949) 640-4000

Wealth Preservation Trusts
...part two

by Philip J. Herbert

In November I wrote an article providing some very general information on the need for proper wealth preservation planning and the use of certain estate planning techniques unique to wealth preservation for those who have made arrangements to be placed in biostasis.

This, the second of the series of these articles will provide more specific information for those wishing to further pursue this area of planning.

Since the publication of the first article, I have had many requests from many members of Alcor to provide them with further information on these important planning matters.

Our firm has worked with many members in achieving their goals in this capacity. Our firm has developed over the process of many months of research what we believe is a Cryogenic Wealth Preservation Trust that addresses all these unique issues and provides for continuity of management of these assets through an independent trustee, trust advisor, and trust protector to ensure that said Trust continues in perpetuity to maintain the assets and best interests of the member in biostasis.

The role of these three important appointees in this Wealth Preservation Trust will be the focus of this article, and their roles are as follows: Naturally these three individuals or entities chosen are to be carefully considered and are quite important to the creator's purpose in establishing this Trust. We have developed a relationship to provide the creators of these trusts with the proper individuals or entities they will need in this capacity, and these entities are available upon request by any Alcor members.

The Trustee's role is to maintain and safeguard assets of the Trust, defend the Trust against lawsuits, and distribute the assets of the Trust pursuant to the benefit of the individual placed in biostasis. In many cases the Grantor or creator of the Trust has charitable beneficiaries earmarked for distribution of these assets as well. The Trustee has many broad powers granted under the terms of the Trust and acts in a prudent and careful fashion to safeguard the assets of the creator, to comply with all applicable Federal and State laws, and to maintain custody of the assets placed in the Trust.

The Trust Advisor's role is to act as the investment advisor and to provide the Trust with the best combination of income growth, safety of principal, and minimization of any income tax on the Trust income that can be quite substantial under current federal tax laws. The Trust Advisor making decisions regarding these matters should keep in mind that long-term growth is the overall objective of the Trust, and they should not speculate or risk the principal in any way. In this regard I have recommended that my clients fund their Trust with annuities with guaranteed returns and guarantees of principal or life insurance purchased by the Trust for their benefit. For example, $200,000 placed in a Wealth Preservation Trust that uses an annuity for an investment vehicle with a 7 percent return creates $6,400,000 in 50 years. Or a life insurance policy bought for $100,000 over the life of the creator may provide $2,000,000 in tax free principal for the Wealth Preservation Trust at the time of his or her death.

The Trust Protector's role is to ensure that the Wealth Preservation Trust created is being administered and maintained pursuant to the jurisdiction that recognizes trusts in perpetuity. This role may also include changing the location of the Trust in the event changes in the law jeopardize the continued existence of this Trust. In addition the Trust Protector may need to have the right to change Trust Advisors and Trustees. In this regard the Trust Protector must have the ability to monitor the continued biostasis or cryogenic management including the obligation to yearly inspect the current condition of the creator's human remains and have the right to change the individual or company that is monitoring or has care of the creator's remains.

These and other extremely important matters will continue to be the focus of my ongoing series of articles devoted to this area of Wealth Preservation and Planning. In the next publication, my article will focus on choosing the correct forum or jurisdiction for the creation of this Trust.

As always I welcome any comments or further questions directed to me at Philip Herbert J.D. , CEPP, Olde Colony Estate Planners, 541 S. Benbrook Road, Butler, PA 16001, at 724-482-2532, fax 949-666-5161, or e-mail at OldeColony@aol.com.

President's Report

by Jerry B. Lemler, M.D.

Major revisions are occurring at Alcor these days. Traditionally, I've shied away from using such banal phrases as "new and improved," although as we recently (February 22, 2002) celebrated our 30th birthday, this statement falls not far from the mark.

Our revamped and upgraded web site is near completion and promises to be up and running by the time you read these words. Our first-ever Marketing Director, Karla Steen, and her remarkable staff have been diligently working with John Bevens of Media Architects (a Phoenix-based advertising firm with whom we've contracted) to create a pleasing and user-friendly site, freely accessible and informative. We welcomed the 48th and 49th residents to our Patient Care Bay in March, and thanks to the generous bequeathment of a patient we suspended last year, we are on the precipice of augmenting our cryotransport and remote rescue capabilities as never before.

Dr. Ralph Merkle (Conference Chair), Board members Dr. Kat Cotter and Stephen Van Sickle, and our Marketing and Resource Center Staff (Karla Steen, Paula Lemler, Judy Muhlestein, and Anneka Repscher) have been hard at work in preparations for Alcor Foundation's 5th Extreme Life Extension Conference, to be held in Newport Beach, California, November 15–17, 2002. The roster of confirmed speakers reads like a veritable "Who's Who" in the scientific community, headlined by Dr. Michael West, CEO of Advanced Cell Technology, and Dr. Ray Kurzweil, National Medal of Technology recipient, prolific author, and developer of the first text-to-speech-synthesizer. Additionally, Alcor helped Board Member Dr. Kat Cotter promote her and Alcor member/ husband Dave Kekich's Longevity Boot Camp at the Sahara Hotel in Las Vegas, April 27–28. I joined the ranks of Dr. Max More, Dr. Cotter, Dr. Ward Dean, Dr. Chris Heward, Natasha Vita-More, Dr. Stephen Coles, Anita Banker, and Dr. Karlis Ullis as a featured speaker at this event.

I had a delightful time at our Florida Outreach Reception outside Orlando in mid February. My special thanks to my hosts (who allowed me to stay in their home), Dawn and the irrepressible Rudi Hoffman. I then drove to Ft. Lauderdale where, along with Dr. Michael Riskin, I met with Dave Shumaker, Bill Faloon, Mike Darwin, and Dave Hayes of the newly formed (for-profit) cryotransport company Suspended Animation, Inc. Our discussions were fruitful and productive, and I look forward to forging a mutually beneficial working alliance with this new organization.

We have recently received the final written report of the Advisory Committee, commissioned by Alcor some months ago, in an effort to overhaul and enhance our rescue and cryopreservation protocols and techniques. Along these lines, I have convened an Implementation Subcommittee, whose work is already in progress. The Subcommittee, chaired by Dr. Michael Riskin, is composed of myself, Hugh Hixon, Russell Cheney, Judy Muhlestein, Stephen Van Sickle, and Joe Hovey. Alcor is likely to partner (again) with SA, Inc., in the phasing in of these various upgrades. We anticipate that SA Clinical Director Mike Darwin (who expertly led the recent standby and suspension teams in the cryopreservation of A-1876), will be rewriting our cryotransport manuals as well as serving in a primary instructional role with our ACT (now known as ADR) network for our summer training sessions.

Our community service efforts continue unabated. Each semester, Joni Adams of Ontario University and Bob Fern of Mesa Community College bring their Death and Dying college classes to Alcor for a didactic session and tour of the facility. All told, we greet 80 to 100 of these mostly eager visitors per year, and their questions are typically challenging. Ms. Adams's last visit occurred on January 23, and Mr. Fern and his troop were with us on the evening of April 10.

Back on January 12, our staff paused to commemorate the 35th anniversary of the first human cryopreservation. Retired California psychologist Dr. James Bedford, who came to Alcor for long-term storage in 1991, was the first of all so-called cryonauts in our Patient Care Bay in Scottsdale. We care for Dr. Bedford at no charge, as we are honored to have not only him but his original 1967 capsule as a museum piece on premises at Alcor Central.

Our letterhead has recently been undergoing some face-lifting as well. Board Advisor, Dr. Michael Seidl, of Wilmington, Delaware, was elected (unanimously) to a term on the Alcor Board of Directors, and the Board also approved Pro-Act founder and metaculturist Natasha Vita-More and first-ever UK representative Andrew Clifford to join the ranks of Advisors to the Board. Additionally, Alcor member Dr. Antonei Csoka of Brown University in Providence, Rhode Island, has joined our Scientific Advisory Board.

Our two cryosuspensions this year, within six days of each other in early March, represented paradoxical challenges for our rescue personnel. A-1876, of San Francisco, endured an agonizingly long (8½ day) standby in a San Francisco hospital. Alcor and SA, Inc., staff and volunteers combined forces to maintain the vigil and expeditiously transport the well-known and much liked member to her current home in Scottsdale. Conversely, member A-1891, a south Florida native, was not discovered until several hours after arresting in his home. Nevertheless, his private air transport, surgery, and cooldown proceeded uneventfully.

Finally, the inaugural CryoSummit (see page 26 for details) will be held in Michigan, August 23–25. I look forward to joining Dr. Michael Riskin, Judy Muhlestein, Dr. Robert Newport, and Karla Steen in representing Alcor at this important event! l

Let the Presses Start

Membership Directory Ready!!!

Responding to your requests, a new directory for Alcor members is ready for printing. This has been an exciting project for me to prepare, and it will allow those of you who wish to meet other people interested in life extension to network with new friends and hold discussions and social events. Members who have asked that no information be released about them will not appear in this directory, and neither will members who did not return the questionnaire. It should be emphasized that none of the contents are for public consumption; this directory is strictly for the exclusive use of Alcor members only.

Several respondents gave permission to contact them electronically, but neglected to send us their preferred e-mail address. Printing of the directory will be delayed for 30 days to allow time for these individuals to contact me regarding this oversight. And, this would be a good opportunity for you to send current phone numbers. Please let me hear from you!

–Paula Lemler
paula@alcor.org

Alcor Opens Marketing Resource Center

The new Alcor Life Extension Foundation Marketing Resource Center (MRC) opened in February 2002. This facility houses the offices of the Marketing Department and in the future will provide conference, media, and family centers in addition to work spaces for visiting guests. The address for the center is Alcor MRC, 7895 East Acoma, Suite 107, Scottsdale, AZ 85260.

Karla Steen, Marketing Director of Alcor, and Paula Lemler, Manager of the MRC, are launching efforts to attract new members, upgrade our corporate image, and keep the public informed about Alcor and the cryonics option through advertising, media, and public education campaigns. And they continue to provide excellent customer service to existing Alcor members.

The preliminary focal points of the MRC are advancing Alcor's corporate image by remodeling the web site and other media for public consumption, planning the Alcor 5th Extreme Life Extension Conference to be held on November 15–17, 2002, in Newport Beach, California, and managing the media requests Alcor receives on a daily basis. The MRC is also very excited that Alcor has spent the last 30 years celebrating life through science!

The MRC is working closely with Media-Architects.net, a Phoenix-based multimedia design agency responsible for redesigning Alcor's logo, remodeling the web site, and providing Alcor with a monthly service package ensuring maximum results from the new web site. Media-Architects.net is also supplying the MRC with graphic design and production of Alcor's existing literature and display materials.

The Longevity Boot Camp, held on April 27–29, 2002, at the Sahara Hotel in Las Vegas, Nevada, was co-hosted by the MRC. Dr. Jerry Lemler, Alcor President and CEO, spoke at the conference, and the MRC set up Alcor's redesigned display booth and distributed Alcor literature and promotional items throughout the event. Alcor received a donation from the Boot Camp based on the number of Alcor attendees, and there was no charge for Alcor's participation in this conference.

In addition to other projects, Paula Lemler is heading up an effort to create a membership directory for members. This directory is in response to member requests for local Alcor contacts. We received a significant boost to this effort, as 265 Alcor members replied affirmatively to a direct mailing out of the Alcor membership base of 575. Paula has made tremendous efforts to organize this information and have it printed and available for use in a short time.

All media and tour requests coming into Alcor Central are currently being forwarded to the MRC for scheduling and infor-

mation purposes. Media groups and other guests are entering the premises through Suite 107, allowing MRC staff to sign them in, copy their credentials, and brief the media on restricted areas within our facility. Space is being provided to media personnel in the back of the MRC for camera gear, meeting and interview purposes, and a workstation. This improves relations with the press and takes some pressure off other departments within Alcor to provide interviews or other services to media personnel. Three television crews, as well as several photographers visited Alcor in March 2002, and more are expected.

The Alcor 5th Extreme Life Extension Conference, to be held in Newport Beach, California, in November 2002, is picking up momentum and is one of the main focal points of the MRC. A dedicated phone line has been installed in the MRC for the primary purpose of serving conference needs. Alcor volunteer Judy Muhlestein has been helping the marketing staff in the many details of producing and promoting this major event.

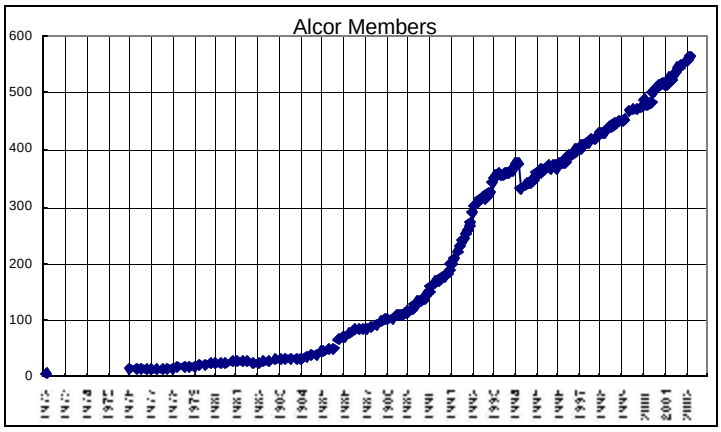
This year's keynote conference speaker is Dr. Michael West, whose name and research are currently in the global spotlight, and the impressive speaker roster is growing! The Life Extension Foundation continues to provide generous and outstanding public relations and support to Alcor through *Life Extension Magazine*. The June issue features a full-page color advertisement for Alcor with upcoming conference information included.

Beginning in April 2002, MRC staff began compiling historical brochures, photographs, news article, videos, artwork, logo, and corporate evolution showcasing Alcor's 30 years of cryonic services. This exhibit will be open at the Alcor Conference in November and will be on permanent display gallery style at the Alcor facility.

You can reach the MRC by regular mail, e-mail (either karla@alcor.org or paula@alcor.org), or by telephone at 480.905.1906, ext. 129. Your comments, concerns, and questions are always welcome.

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*.

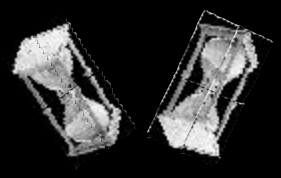


Alcor Membership Status

Alcor has 575 Suspension Members (including 107 Life Members) and 49 patients in suspension. These numbers are broken down by country below.

Country	Members	Applicants	Subscribers
Argentina	0	0	1
Australia	9	2	3
Austria	1	0	0
Brazil	1	0	0
Canada	13	4	13
France	0	0	1
Germany	3	1	2
Ireland	0	0	1
Israel	2	0	0
Italy	0	2	3
Japan	1	1	2
Korea	1	0	0
Lebanon	0	0	1

Country	Members	Applicants	Subscribers
Mexico	0	0	1
Monaco	1	0	0
Netherlands	1	2	1
Russia	0	0	3
South Africa	0	0	1
Spain	0	6	0
Sri Lanka	0	0	1
Sweden	0	0	1
Switzerland	0	0	2
Taiwan	0	0	1
U.K.	14	4	6
U.S.A.	528	68	240
TOTALS	575	90	284



You Only Go Around Twice

by Jerry B. Lemler, M.D.

Behind the CryoSummit

I first fashioned the idea of convening a unification meeting of all cryonics organizations the last time I saw Bob Ettinger. Several months ago, when I learned he was leaving his home in Scottsdale and heading back to Michigan (for what, at least to me, were self-evident reasons), he agreed to host an Alcor delegation for an informal farewell reception.

Amidst the many boxes stacked up throughout his house awaiting loading on the moving van, Mike Perry, Hugh Hixon, Jessica Lemler Sikes, Mathew Sullivan, and I spent a pleasant hour with the founder, wishing him well upon his return to the North country. I suspected at the time, and in consideration of decades of less than stellar relationships between our two organizations, this would be the last I would ever see of him. Yet, in spite of our acknowledged differences, such a notion decidedly saddened me.

But it wasn't until early this year that the CryoSummit concept crystallized in my mind, and it was prompted (once again) by an interaction with Mr. Ettinger. As a courtesy, I'd sent him a signed copy of our then-newly published monograph*Alcor Life Extension Foundation: An Introduction*. I'll tell you this, Bob is a fast reader, as evidenced by the alacrity with which he posted a very flattering review of my book on Cryonet. (The same review in its entirety recently appeared in the January–February 2002, vol. 34, nos. 1–2 publication of *The Immortalist*.) In thanking him for his favorable and generous comments, we began a private e-mail correspondence. We both (not especially surprisingly) agreed there is far more that unites than divides us, and he immediately (and enthusiastically) signed on.

Next, in sequence, Edgar Swank and Jim Yount of ACS (American Cryonics Society) agreed to participate, and when Saul Kent and Bill Faloon launched their nascent cryotransport company, Suspended Animation, Inc., CEO Dave Shumaker (an ACS member himself) offered to join the event. I did make an overture to Trans Time's president, John Rodriguez, who, although, still could be a welcome member of the ensemble, has not to date, favorably responded.

In deference to Bob Ettinger's preference to avoid long-distance travel, Michigan is the agreed site for the CryoSummit, and the meetings will take place throughout the weekend of August 23–25.

While the agendas are to be crafted by all representatives, the format will consist of four distinct programs (Friday evening, Saturday morning and afternoon, and Sunday morning), allowing each organization to chair a session. The theme for the CryoSummit will no doubt reflect our desire to seek areas of mutual cooperation, hopefully leading to sharing of information and the formation of joint ventures within our small discipline for the betterment of all our members.

The Alcor Board of Directors has been visibly enthusiastic about the CryoSummit, and, in fact, will be sending a rather robust delegation to the Detroit area this summer. Already committed to represent our foundation are Dr. Jerry Lemler, Dr. Michael Riskin, Judy Muhlestein, Dr. Robert Newport, and Karla Steen.

We'd appreciate your support in this effort. Send us your agenda ideas, or consider becoming a benefactor by helping to sponsor the event. The road less traveled may, indeed, be an enlightened path, but the journey need not be a solo one!

CryoSummit
August 23–25,
2002

Green Republicans for Cryopreservation

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

Two years ago, after attending the Fourth Alcor Life Extension Conference in Asilomar, California, my wife and I visited Muir Woods outside of San Francisco. Muir Woods, named for conservationist John Muir, is a old-growth redwood forest made a national monument by Theodore Roosevelt in 1908. The ancient trees create a sort of enclosure that makes the space feel like the inside of a cathedral. Tremendous, gently sloping pillars lead to over-arching canopies of green; the earth underneath is dark loam, and there is a surprising sparsity of undergrowth, perhaps because of the pervasive shade. The experience of the forest is simultaneously sobering and exciting, and, with the presentations of the Alcor conference still percolating in my head, left me ruminating on longevity and the possible pleasures of extended life, particularly one in the company of redwoods. As we were exiting, we visited the gift shop where we purchased a redwood seed in a can, which was "guaranteed" to germinate. Although we lived (and still do) in a townhouse, we bought the seed thinking we would plant a seedling in due course outside whatever house we eventually acquired. We still have not bought a house, the seed is still a pre-seedling and in the can, and we are still planning. When I mentioned the seed to a friend at work with whom I had previously argued, with very limited success, the values of cryopreservation, he saw the connection immediately, exclaiming, "Of course! If you're not lutefisk,[1] you're going to come back and see your tree in 500 years." Exactly right. I do plan (however optimistically) to plant a grove of redwoods and either, life-extension technology willing, watch them grow or, cryopreservation fallback and financial trust working, return one day to a mature grove. I like the fact that I am the sort of person who tries to plan and think for the long term and that I am part of an organization that helps me plan and think in terms that are not limited by ordinary human life span.

The same day I discussed the redwood seedling with my friend, Senator Orrin Hatch (R-Utah), a staunch anti-abortionist, came out in support of the use of cloned human embryos in medical research, explaining, "An important aspect of being pro-life is to support the technologies that help the living." The juxtaposition of this event with my redwood conversation with my friend started me thinking a bit more about recruitment to cryopreservation organizations, environmental conservation, political conservatism, human cloning, and the interrelationship among the foregoing. It occurred to me that there is an unexpected, and consequently unexplored and undervalued, relationship between cryonicists, conservationists, and political conservatives. All three share a common ethos of conservation—conservationists want to preserve the environment, political conservatives the geopolitical, social, and economic status quo, and cryonicists individual human identity. Moreover, I began to realize that rather than leading me to an increasingly radical world view, as I might have supposed it to, my involvement with cryopreservation has led me to a more conservative world view, one less inclined to risk bad outcomes because of the more certain personal consequences.

I cannot quite get my mind around the experience I have had, but I will do my best to articulate it. Conservatism is usually defined as an appeal to maintenance of the past (recent or distant) and/or the present status quo. The extraordinary breadth already inherent in that definition should be an early clue that there is something more than narrow political ideology at work. Broadly speaking, we might say, conservatism prefers the known to the unknown—not neurotic avoidance of all things new but preference for the tried and true over the newfangled until the newfangled itself becomes everyday. At first blush, cryonics looks like the antithesis of conservatism; it is seemingly forward looking, dependent upon the technology of the future to make its process worthwhile, and fascinated with theorizing the progression to that future and what it may be like. However, these aspects do not negate a fundamentally conservative core. Cryonics is conservative in (1) its medical agenda—"first, do no harm"; (2) in its economic agenda—secure assets in safe, trustee-overseen

[1] For reasons I have been unable to explain, my attempts to promote cryopreservation have several times prompted among my more zany friends the suggestion that once cryopreserved I will become a future delicacy. Although I remain flattered, I suspect that the comments tell me less about my gustatory value and more about the pervasive belief that, at death, something essentially human flees the body never to return, leaving simply meat.

investments; (3) in its political agenda—ultimate conservation of the past (in the form of individual preservation) and promulgation of local/global geopolitical stability as a guarantee of that conservation; and (4) in its social agenda—the preservation of people and their assets. A conservative opposes change, and I cannot think of a bigger change than death; cryonics, in proposing the preservation of human identity beyond the traditional boundary of death, inescapably allies itself with a conservative ethos. I do not put this forth to dispute that there are progressive, even radical, aspects to the cryonics movement but to dispel (in part) the idea that cryonics is *purely* liberal, libertarian, or progressive. Anything so fundamentally about preserving individuals into the future has a conservative component. Exploring this conservative component may give us places to identify otherwise unlikely allies and help us to ameliorate the slow growth in membership.

Moreover, as I mentioned before, I believe an individual's involvement with cryonics cannot help but make him or her more conservative in some ways. People who believe that they will one day die necessarily internalize the idea that their actions can (and must) have finite consequences for them. On some level, human behavior becomes grossly economic—consequences that will be deferred beyond human life-expectancy are discounted absolutely and consequences that will have a marginal impact on life expectancy or have a low chance of impact on life expectancy are deeply discounted. The more seriously I become involved with cryonics, the less able I find myself to discount consequences, long- or short-term. Long-term consequences become difficult to discount because I have a (small perhaps) expectation of having to deal with those consequences; short-term consequences and low-chance consequences become more difficult to discount because of their possible long-term effects and because of the potentially catastrophic effects on my long-term survivability of even low-probability consequences. For example, if I think I will die one day, I may be more inclined to have one more cigar, drink, or donut, to drive a little too fast on a rainy road, or to freely use water and power without an eye to sustainability—all of which have low risk of consequences to me. However, if I hope to partake of life-extension technology and/or to be successfully cryopreserved, anything that risks shortening my life (including, sadly, Krispy Kreme donuts) or bringing about my death in uncontrolled circumstances could completely frustrate my desire to partake of those alternatives, and I cannot help but think that energy/resource armageddon could frustrate the nanotech future I would need to be restored from a cryopreserved state. So, will-I nil-I, I find myself increasingly enamored of the stable, the secure, the predictable, the safe, the sure-thing.

Understanding this was to me first and foremost a revelation about the nature of the cryopreservation movement, one that explains much of the structure of and the tension in the movement. We are looking to the future but necessarily mired in the present and the past, grappling for advance but wary lest it come at the expense of the first prospect of a good chance that we have ever found. For ourselves, I believe self-consciousness of this conservative aspect of cryonics will help us to respond to its otherwise unconscious directives more skeptically and reflectively rather than reflexively. It may also help us find allies in otherwise unlikely places. Treat the following as thought experiments premised upon the observation of a conservative component in cryonics:

1. Recruit conservationists. I have always gaped at the argument, sometimes put forth, that we should conserve the environment so our children and grandchildren can benefit from it. However, since Pop probably is not even socking much away for a college fund, I doubt very much whether he has much interest in whether his grandson will be able to see a jaguar in the wild or in a zoo. However, the environmental conservation movement takes on a whole new resonance in the context of conservation*for* ourselves, when the question becomes not do we want our children to have green water and clean fields (or something like that), lions, and tigers, and bears, oh my, but do we want those things for ourselves? What could be more green than saving the redwoods, saving the whales, and saving yourself to enjoy them? Similarly, the long-term dangers associated with climactic change and disposal of radioactive waste take on even greater poignancy when they are seen as consequences with which we ourselves will deal.

2. Recruit conservatives. Orrin Hatch's support of human cloning is not an aberration in Republican ideology but the quintessence of it, placing first and foremost traditional values associated with the security of individual life and property. What could be more "family values" than the nuclear family, all signed up to be cryopreserved, wealth-preservation trusts in place, sweaters looped jauntily over their shoulders, waiting for the big chill? What could appeal more to the conservative seeking lower taxes than finding a way to "take it with you" and winning the promise of a good life still to come at the ancestral mansion, only in perpetuity? What conservative could be more authentic than the one who, more than harkening back to the past, lived through it him or herself and carried it into the future? Strom Thurmond could be senator again. Or not.

3. Recruit the middle class. We look to scientists and computer programmers as likely candidates for cryopreservation because their scientific world view may encourage them to believe that identity can be preserved, but what of the vast "silent majority," the middle-of-the road folks with 2.5 children, two-car garages, and summers at the beach? Cannot we make for them a cryonics that is another form of life or health insurance, appealing to their desire for security for their home and family? The number of intellectuals who might come to a truly valid understanding of and support for cryonics is probably limited, but the number of middle-class families who—once the door is opened—will feel the need to keep up with the Joneses by adding a new sort of insurance to their portfolio and to secure their earnings against dispersal at death should be large.

In short, consider, just for a moment now before you turn the page, the place of Green, Republican, Cryonicists in the future; it's gotta make you think. l

* I welcome discussion of these topics: mseidl@magpage.com

Robert Prehoda and *Suspended Animation*

by R. Michael Perry, Ph.D.

As a knowledgeable and articulate advocate of suspended animation research, Robert Prehoda was an important figure in the early days of cryonics. Unfortunately, his particular interests and beliefs led him to oppose the fledgling movement and, it appears, also alienated him from the scientific mainstream whose support he so earnestly courted. Much of his thinking on suspended animation and human hibernation is recorded in his 1969 book, *Suspended Animation: The Research Possibility That May Allow Man to Conquer the Limiting Chains of Time*. This was only one of several volumes he wrote offering an optimistic view of the future, one that science should make attainable in the coming decades. Here I will focus on the book and its ideas as a whole, touching lightly on the subject of his rather strident objections to cryonics, though I do include this too because of its prominence. But the topic deserves a more extended treatment and I intend to cover it in a separate article.

A few quotations from the preface highlight the position that is argued. "The complete conquest of time can be achieved only through cryogenic suspended animation—the complete cessation of all metabolic activity for an indefinite period by means which allow future reanimation." "Human hibernation and suspended animation are, in my opinion, highly desirable scientific objectives." "[T]his book is . . . intended to convince readers that a greatly expanded research effort in reduced metabolism is warranted." "Public awareness and interest must be stimulated in order to overcome the 'funding barrier.'" "Human hibernation for periods of nine months or so is almost certain to be achieved before the end of this century." "During the past five years, the public has been cruelly misled by a pseudoscientific cult which proclaims that suspended animation is possible today, that people should be frozen when they die."

The prejudice against freezing people when they die (cryonics) runs very deep despite the professed optimism about suspended animation. Prehoda felt very little confidence in the prospect of reanimating persons frozen with then-current techniques. Some of the difficulties he cites would clearly be addressable by a mature nanotechnology, but nanotechnology concepts did not gain wide currency until Eric Drexler's book, *Engines of Creation*, appeared nearly 20 years later, in 1986. Though I think there was reason to be optimistic even before the case for nanotechnology was made, Prehoda's position is understandable. It becomes more so in light of his basic objectives: *Suspended Animation* is a book with a mission, a call to action for a goal that could be reached in the foreseeable future. To endorse cryonics would have been, in effect, an admission that the called-for research might not be necessary, since people already had a reasonable chance of eventual reanimation. Instead, in denying that cryonics of the day would work, Prehoda was also insistent that it could and should be made to work, and it would be, he thought, with a well-funded, focused effort. (We have seen a resurfacing of this sort of thinking in recent years with the discussions over vitrification versus earlier approaches to cryopreservation.)

So who was Robert Prehoda? The dust jacket tells us he "is the head of an Encino, California, consulting organization specializing in technological forecasting and techno-economics studies for government and industry," and "is considered one of the pioneers in refining systematic technological forecasting." An extensive background in aerospace "has given him a thorough knowledge of some of the most intimate, often frustrating, details of American science." Finally, "[h]e has checked the findings presented in *Suspended Animation* with the leading scientists in the field of reduced metabolism." He comes across, then, not as a cutting-edge scientist himself (at least in the field of reduced metabolism), but as a popularizer and promoter, albeit a careful and knowledgeable one. Though his books all appear to be out of print, a web search of Barnes and Noble's used book section showed the following additional titles: *Designing the Future: The Role of Technological Forecasting* (1967); *Extended Youth, How Science Is Reversing the Aging Process: The Promise of*

Gerontology (1968); and *Your Next Fifty Years* (1980). He is referred to as "Dr." in the last book but "Mr." earlier.

In October 1991 I was privileged to spend an evening with Prehoda in Burbank, California, where he proved to be a generous and affable host with an evident drinking problem. Then 61, he was born in Santa Barbara, California, but of Turkish descent (his original name was Mohammed). And he still, pretty much, hewed to his long-standing line—research now, freeze later.

Despite the prejudice against cryonics, *Suspended Animation* as a whole is optimistic. The ancient dream of human immortality seems finally within reach. It will take time and money, but we can expect to see our lives greatly extended within decades. First will come human hibernation, then suspended animation, then aging control. This progression seemed natural in view of the pioneering efforts of evolution. Some mammals hibernate today, and we can take a hint from them on how to engineer this capability in humans. From there we might proceed to the much greater challenge of full suspended animation, and then go on to curing now-terminal diseases and ultimately aging itself. Confidence in this orderly progression was bolstered by the state of current research, based on solid precedents.

There is quite a history, summarized in the book, of work in extending the life of small organisms through cold or chemical means, by imitation or extension of natural mechanisms. In the natural world, certain fish, mollusks, and insects revive after cooling to subfreezing temperature, and often, partial freezing of their tissues that are protected by natural antifreeze compounds. As early as 1663, English scientist Henry Power resuscitated the vinegar eel (a small nematode worm, distantly related to the now-popular experimental subject, *C. Elegans*) after freezing overnight in a mixture of ice and salt. A rival of freezing for preservation is anabiosis, a form of reduced metabolism that does not depend on low temperature. Here nature has also achieved some success. Dried bacteria in salt deposits have been revived after an apparent dormancy of many millions of years. Closer to home is the multicellular tardigrade, a small arthropod that can reanimate after years in a desiccated state. Still closer, a vertebrate, the African lungfish, survives for months in summer buried in dried mud and nearly inactive, its needs supplied by the air it slowly breathes. Studies simulating natural conditions show that the fish is not dried out but a gelatinous, enclosing cocoon conserves its moisture, while its metabolism drops to 15 percent of normal due to a chemical mechanism. This in turn might be adapted to human use and thus reduce the dependency on either cold or dryness.

Continuing with history, the author notes how cryobiology made major advances starting with the work of Basile J. Luyet, who reported in 1938 that a high proportion of frog sperm treated with sucrose—common table sugar—would survive freezing to –192°C, four degrees above liquid nitrogen temperature. Luyet's 1940 book, *Life and Death at Low Temperatures*, coauthored with P. M. Gehenio, became a classic and helped establish cryobiology as a respected scientific discipline. (Curiously, the term *cryobiology* did not replace the more cumbersome *low temperature biology* until the late 1950s, nearly 20 years later.) It was around

"Robert W. Prehoda," Cryonics Reports 4, no. 1 (January, 1969): 8.

1940 also that Luyet introduced the concept of vitrification—complete avoidance of ice crystals and formation of a glassy solid instead—as a desired aim in the cooling process. In this way many forms of damage could be avoided. (Many years later we appear to have finally achieved vitrification of sizable tissue masses.)

Progress in freezing methods continued through the 1960s. Audrey Smith, Alan Parkes, and Christopher Polge found in 1948 that a solution of 10 percent glycerol in water could preserve cattle sperm cooled to –79°C, a discovery that quickly transformed cattle breeding. Blood was successfully preserved at liquid nitrogen temperature by Harold T. Meryman in 1955. In the early 1960s Smith and some associates preserved rabbit corneas at cryogenic temperatures and successfully reimplanted them. Perhaps the most spectacular successes were those of Isamu Suda's group who reported in 1965 that they had chilled cat brains to –20°C for more than six months and, on rewarming, recorded nearly normal-looking brain wave patterns. Still, the problems were formidable, particularly where entire creatures were involved. Hamsters were partially frozen and reanimated by Smith's group, for example, and some recovered without apparent deficits. But if they were chilled more than a few degrees below the ice point they either didn't revive or didn't live long due to internal injury, including brain damage, caused by the freezing process. Much larger mammals including humans could be safely cooled and revived but the chilling had to stop above the ice point. In this case, and even with the partial freezing of creatures able to withstand it, the organisms could not be maintained long at the lower temperature—chemical activity was still going on that would soon prove lethal without intervention. Much lower temperatures still would be needed for indefinite storage in an inactive but potentially recoverable state.

How would this reversible suspended animation be achieved?

The devil's in the details, as the saying goes, and the book goes to some lengths to present the problem as it appeared on the molecular scale. A major difficulty with freezing and thawing is that a cell's proteins become denatured from freezing dehydration followed by moisture resorption during thawing. In this process the folding patterns, often very elaborate, are disrupted so a protein, though still chemically intact, can no longer perform its function in the cell. The disruption occurs because ice crystal formation removes a protective layer of water molecules. Cryoprotectants such as glycerol and dimethyl sulfoxide (DMSO) can stabilize this molecular layer and forestall the denaturization, but they are toxic in the large concentrations required. An elusive "simple new idea" is called for as a fix for the problem, and several possible avenues for research are explored. One interesting idea is the use of xenon gas as a cryoprotectant. Xenon is nontoxic, will dissolve in aqueous solutions, and will bind to water molecules, suggesting it might forestall the denaturing of proteins without the harmful side effects of glycerol or DMSO. (Xenon is also very rare and expensive. In the three decades since the book appeared it has not been significantly used as a cryoprotectant, as far as I am aware.)

Suspended animation, and its more limited cousin, hibernation, would be most useful if they could be developed, as the author repeatedly emphasizes. "Only reduced metabolism offers [humanity] the opportunity to bypass some portion of the months and years ahead to awake in a changed and better world." This would be especially significant to those suffering acute, terminal illness, but more generally too, since we all are terminally ill (with aging, if nothing else). The door to a better future for the many was an overriding concern, as indeed it should have been, but not the only advantage the author foresaw. Indeed, low-temperature reduced metabolism was already finding uses, in extending the time for open-heart surgery, for instance, and even minor improvements could be expected to lead to better medical procedures. Another possible use, when progress had reached the level of hibernation, would be in extended space voyages, to reduce the metabolic and even the psychological needs of the crew, most of whom could safely doze off for most of the travel time.

So what has happened in regard to Prehoda's predictions? In addition to human hibernation, he offers that aging control would likely be achieved "by the year 2000, or soon thereafter." The optimistic forecast of hibernation has not materialized, and time has all but run out on aging control. Closer to home, the massive research initiative into suspended animation that Prehoda tried to inspire through his book has not materialized. Those of us in the small movement he scorned are still plugging along, getting and keeping our patients chilled down and trying to interest a world still largely indifferent, if not laughing out loud. Progress is happening, nonetheless. Some of it may seem rather peripheral—advances in computer technology, for instance, which are burgeoning by "Moore's Law," yet these could have overriding importance—smarter, cheaper devices could accelerate progress on many fronts. Meanwhile, work continues on the basic problems of low-temperature preservation, even without the massive subsidies the author was stumping for. We have 21st Century Medicine, and the rival initiative of Cryonics Institute, both driven mainly by cryonicists. *We are getting there*, and those who join us have the best chance of enjoying that glorious future, when aging and disease will hopefully be history.

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TechNews

by R. Michael Perry, Ph.D.

As usual, there is a lot of ground to cover. I won't claim to have covered it all, but I've tried at least to report on the most significant advances. This time, with good reason, there is extra emphasis on cloning and tissue engineering, though not all reports pertain to these areas.

Metatheory of Aging

The baffling problem of aging is still unsolved, despite decades of research and futile attempts at devising treatments. Much has been learned, and some molecular mechanisms have been identified that appear to contribute. Life spans are lengthening, though this must be attributed to better health practices and treatments of various diseases rather than intervention at a fundamental level. The nursing homes still channel a steady stream of the frail elderly to their final resting places. The intractability of aging suggests that it has no simple explanation, but instead, many mechanisms are probably involved. Each and every one, or most, may have to be tracked down and disabled if we can hope to end it. (Ending biological aging will be no guarantee of immortality, of course, but could serve as a good start in that direction and would at least alleviate much suffering.) Making substantial inroads will, no doubt, require much in the way of hard, experimental work and lengthy testing, yet there is a place for theory, too. A better grasp of what is happening, overall, will help focus our efforts and thus should hasten our progress.

Toward this end, Leonid Gavrilov and Natalia Gavrilova, two researchers at the University of Chicago's National Opinion Research Center, Center for Aging, have devised a new theory of aging and death based on a mathematical theory of reliability developed in the 1960s. Their brainchild, really a metatheory, recalls but is separate from the old wear and tear theory of aging and has considerably more predictive power. Among the advantages are that it is able to account for specific, observed features of human mortality curves such as the exponential increase in the likelihood of dying with age (the Gompertz law), the leveling off of this increase with extreme age, and the convergence of mortality rates from different populations with age.

In bare bones the theory applies to both natural and artificial systems and allows for a wide variety of starting assumptions about component reliability and redundancy. A system consists of components connected in parallel to form modules, which in turn are connected in series. The failure of any one module causes the whole system to fail, but every component in the module must fail for the module itself to fail. The components are irreplaceable, and each has a fixed probability of failure in a given time interval. Considered as a system, the human body at least roughly fits this simple paradigm—highly redundant and failure-prone individual cells make organs (modules) that are interconnected and interdependent, for instance. Overall the system is more reliable than its individual parts (cells), but its failure is age-dependent in a way the theory can track. Naturally there are many complications not covered; many cells are replaced as the body ages, for example, though the process eventually grinds to a halt. But the predictive success of the theory suggests it could be useful, both in forecasting the effects of new proposed strategies for combating the effects of aging and also for gauging the success of practices already in use. Moreover, the theory is simple and general, so that adaptations and refinements should be relatively easy.

Megavitamin-B Doses May Slow Aging

Much has been said about the use of megavitamin doses to promote health (vitamin C to ward off colds, for instance). Vitamins in some amounts are good for you, but there is certainly reason to be skeptical about the more extravagant claims, inasmuch as no elixir of youth or universal cure has been found. Still, some remarkable things are happening, and we must remain open-minded. A claim that certain vitamins in large doses could slow the aging process is being made by a UC-Berkeley biochemist, Bruce N. Ames, who has been studying the treatment of genetic diseases with megavitamin therapy. (This in turn is defined as "the use of vitamins in amounts at least 10 times greater than the recommended daily allowance, or RDA.") A research survey by Ames's group reports some dramatic, health-improving effects from large amounts of B-vitamins such as niacin, thiamine, and pyridoxine. The vitamins were used to treat certain inborn metabolic disorders due to defective enzymes. The weakened enzymes have less ability to bind with coenzymes, which impairs the catalyzing of certain vital reactions. The vitamins increase the supply of the coenzymes, thus boosting the binding and the resulting catalysis, though the enzyme deficiencies remain. As it happens, similar deficiencies occur with normal aging, raising hopes that extra B-vitamins could help here, too. If so, this would certainly be welcome news, in view of the easy availability of such high-dose supplements, which are widely and inexpensively sold without prescription.

Human Stem Cells Make Mouse Heart Cells(!)

The announcement didn't appear in some tabloid, but at the respected web site of UniSci, and it seems to be real: from human

stem cells you can now get mouse heart cells. We live in an age of increasingly remarkable achievements and, though many more will be needed for our dream of immortality, this sort of advance seems especially exciting. We knew that stem cells were "versatile" and capable of making just about any tissue, but I'd never heard of this capacity extending over species boundaries. Now, apparently, it has, thanks to Barry Byrne and colleagues at the University of Florida's Powell Gene Therapy Center (Gainesville), along with scientists from Johns Hopkins University and the associated Osiris Therapeutics Institute (both in Baltimore). Adult cardiac tissue is problematic because, once damaged, it lacks the capacity to regenerate. Byrne's group implanted stem cells from adult human bone marrow in the coronary arteries of a strain of immunodeficient mice that couldn't reject the cells. Normally these stem cells produce human skeletal muscle but have been reported capable of giving rise to many other tissues under appropriate conditions. In this case, 14 days after implanting, some of the cells had spread through the myocardium (the heart's muscular wall), differentiated, and "become indistinguishable from the rod-shaped heart muscle cells." (The cells must still retain a human genome, however, and thus remain distinguishable at the molecular level.) The group is now investigating ways of using marrow stem cells to repair various types of heart muscle injury in animal models. In addition, they are looking into an alternative way of delivering the cells to desired targets using a method now employed in corrective gene therapy.

Human Stem Cells Make Brain Cells

Work that parallels that reported above has demonstrated that human embryonic stem cells can differentiate into (human) brain cells. A team led by Su-Chun Zhang, a UW-Madison professor of anatomy and neurology, was able to induce human embryonic stem cells to form into precursor brain cells in vitro. The cells were then implanted in the brains of newborn mice (the mouse model again!) where they further developed into distinct types of brain cells, in this case, neurons and astrocytes. The work opens the possibility of using stem cells to correct such disorders as Parkinson's disease and spinal injuries. Of special interest was the absence of tumors in the end results, suggesting that, as Zhang said, "our methods for purifying the precursor cells are pretty good."

Human Stem Cells Make Blood Vessels

In yet another triumph using a mouse model, researchers at the MIT-affiliated Whitehead Institute have induced human embryonic stem cells to form blood vessels. The precursor cells are first isolated from discarded embryos (not created from less differentiated cells, as above), then transferred to mice (in this case immunodeficient, as in the heart cell experiment, so they would not reject the implants). The cells then form into tiny vessels, including capillaries, composed of the usual endothelial tissue. Principal investigator Dr. Robert Langer thinks he can combine the new technique with an earlier one of his, involving an artificial scaffold, to produce full-size blood vessels for transplantation. Like other work with human embryos, this advance has fueled controversy, with opponents objecting that human life may be destroyed in the process and calling for the use of adult stem cells instead. But Dr. Langer notes that, despite some successes, adult cells have not so far proved as versatile and suitable for tissue engineering work as embryonic cells.

Human Embryos Cloned

Michael West
CEO, Advanced Cell Technology

Advanced Cell Technology is a small, privately funded biotechnology company in Worcester, Massachusetts. Its owner and CEO, Dr. Michael West, is a cryonics sympathizer and member of two Alcor advisory boards. He and his company are involved in research on therapeutic cloning, which seeks to develop means of replacing damaged or defective tissues in the human body through the use of embryonic stem cells or other proliferating cells that are capable of differentiating into desired tissue types. On November 25 last year, West and his team announced that they'd created short-lived human embryos starting with adult human cells—a scientific first.[1] At most the embryos consisted of only six cells, too early a stage of development to yield the sought-after stem cells, but the achievement, like many others, opens possibilities for useful things to come. It has also intensified a controversy over human cloning in which reproductive cloning—producing a live human baby—is all too often confused with therapeutic cloning, which has only the aim of alleviating the ailments of already-living humans. Many people, West himself included, are opposed to reproductive cloning at this time because of the uncertainties that still remain; for example, whether the people thus produced would suffer congenital defects. Therapeutic cloning, however, offers the potential of great benefits without the downside of creating suffering humans (rejecting the extreme view that a tiny clump of nerveless cells, an embryo at the stage at which stem cells would be harvested, is "human" or can suffer). Legislation is now being considered to ban all forms of human cloning in the United States. One hopes that good sense will prevail and convince enough of the critics that not all human cloning is on an equal footing, that some of it, at least, is not only morally unobjectionable, but even *morally mandated*, as a way to alleviate suffering and death. As New York Democratic Representative Jerrold Nadler said during House hearings last summer, "We must not say to millions of sick or injured human beings 'go ahead and die and stay paralyzed because we believe ... a clump of cells is more important than you are.'"

The following is the final paragraph of the journal paper by West's group on their successful attempt at human embryo creation (see paper by Cibelli et al. under "References"). Endnote references are here omitted; "NT" refers to nuclear transfer, the technique of producing a single-cell embryo that is capable of further development:

> "Unlike reproductive cloning (which aims to produce an entire organism), human therapeutic cloning does not seek to take development beyond the earliest preimplantation stage. Rather, the goal is to derive primordial stem cells *in vitro*, such as embryonic stem cells from the inner cell masses of blastocysts as a source of cells for regenerative therapy. Animal studies suggest that these cells may eventually play an important role in treating a wide range of human disease conditions, including diabetes, arthritis, AIDS, strokes, cancer, and neurodegenerative disorders such as Parkinson's and Alzheimer's disease. In addition to generating individual or small groups of replacement cells, there is also the possibility that these cells could be used to reconstitute more complex tissues and organs, including blood vessels, myocardial 'patches,' kidneys, and even entire hearts. NT techniques have the potential to eliminate the immune responses associated with the transplantation of these various tissues, and thus the requirement for immunosuppressive drugs and/or immunomodulatory protocols that carry the risk of serious and potentially life-threatening complications. It has therefore been suggested that the medical applications of NT may have significant merit and should be actively pursued; however, we urge that the use of NT in human reproduction is currently unwarranted."

Human Embryo Cloning Reported in China

Reports of human cloning from China, if substantiated, could establish that country, rather than the United States, as the leader in this controversial field. Lu Guangxiu of the Xiangya Medical College in Changsha, says her team has created human embryos and developed them to the blastocyst stage at which stem cells can be harvested, putting her work ahead of that of West's team reported above. Other Chinese labs are said to have made similar or possibly greater progress. None of this recent work, which is said to be for therapeutic rather than reproductive purposes, has yet been reported in peer-reviewed journals, but it is a plausible consequence of the ready availability of the necessary research materials in China. It is significant that the work has not sparked the controversy it has in Western nations, with their deep disagreements about where human life begins. As Robert Lanza of Advanced Cell Technology commented, "It takes the air out of the argument that by passing laws here we can stop the technology from moving forward."

Therapeutic Cloning Alternative

When it comes to keeping the options open, you have to credit Michael West and coworkers at Advanced Cell Technology. Their pioneering efforts in human cloning—work that stands in danger of being outlawed—is accompanied by a line of research that may make it unnecessary, at least for women of reproductive age. The alternative involves using unfertilized egg cells to create embryos without the use of sperm, a process known as parthenogenesis. Parthenogenesis had previously been achieved in mice, but now West's group has extended it to monkeys, which are much more like humans. Unlike the case with human cloning, the embryos that were created developed to the blastocyst stage that gives rise to pluripotent stem cells, which in turn are capable of developing into different tissue types. To demonstrate the latter capability, West's group was able to harvest stem cells that they chemically treated and turned into heart, muscle, and brain cells. But wait—if an embryo is produced, isn't this cloning? Not, it appears, by most definitions, because the embryo in this case cannot grow to an infant. Instead it turns into a teratoma, a kind of tumor with a salad-mix of different, disorganized tissue types; male genes are needed so a placenta can form and a normal fetus develop. Potentially the technique could have therapeutic value, but it has one serious limitation: the patient (or a genetic twin) must contribute the egg cell that is used as the starting point for the stem cells that would be harvested and implanted. Barring the case of a younger clone (!), the patient would have to be a woman of reproductive age, or possibly, an older woman who had egg cells extracted and stored earlier in life. Still, the result looks promising as a means of obtaining embryonic stem cells without the controversy that has erupted over cloning.

Therapeutic Cloning Shown to Work

Although much has been said and written about the potential benefits of therapeutic cloning, there has been little so far in the way of an actual demonstration. But now researchers at the Whitehead Institute in Cambridge, Massachusetts, have mastered a two-part technique in which a fatal ailment in mice is cured through cloning. Two separate research teams collaborated in developing the complementary parts of the procedure. One, led by Dr. Rudolf Jaenisch , used mouse skin cells to create embryos from which the stem cells were harvested. The other team, headed by Dr. George Q. Daley (and working with colleagues at Harvard Medical School) was able to induce the embryonic cells to turn into blood-forming cells. The cells were then implanted in the bone marrow of mice whose own blood-forming cells had been destroyed by radiation. In this way the mice survived what would otherwise have been a lethal defect. Hopes were raised that a similar approach could produce an inexhaustible supply of pathogen-free human blood for clinical use.

Functioning Kidneys from Stem Cells

Once again, Advanced Cell Technology is in the news, this time for reportedly creating a mammalian organ from stem cells. ACT's Robert Lanza, summarizing work done in collaboration with a group at Harvard University, announced that miniature bovine kidneys had been formed on a scaffold starting with specially conditioned stem cells, which divided and developed into the organs in question. The two-inch-long kidneys were then transplanted into genetically identical cows and produced urine. At the time of writing the work had not been reported in a peer-reviewed journal, and some scientific critics were skeptical. If confirmed, the result would not be the first case of a functioning mammalian organ being created in the laboratory. A working dog bladder was manufactured using a similar approach in 1999. But a kidney is a far more complex structure, and its creation would be a major advance toward a general capability for replacement of human organs through tissue engineering.

Cat Cloned

First a sheep, then pigs, goats, cattle, mice, and a gaur were replicated by making artificial embryos from nonreproductive adult cells. Impressive, this difficult form of cloning. It's much easier to start with embryonic cells—if you have them. But these animals are not the kind of cute, cuddly creatures one usually gets attached to, and pet lovers have not been especially prominent among cloning supporters thus far. Now, however, a kitten has been cloned, again starting from adult cells, which opens the possibility that an aging, loved pet might be recreated in an approximate form. Mark Westhusin, an associate professor at Texas A&M University's College of Veterinary Medicine, led the group that produced the feline success after nearly 200 attempts (not an unusual success rate in the difficult field of adult-cell cloning). The effort was financed by Genetic Savings & Clone, a private company whose financial benefactor, John Sperling, wanted to copy his dog, Missy, but turned to cats when this proved difficult. Named CC for carbon copy (or copy cat, or maybe cuddly clone) the female kitten was born in December, and so far seems entirely normal and healthy. Though a genetic near-duplicate of its biological mother, a calico and white tabby named Rainbow, the kitten's coloring is a bit different due to nongenetic and some minor genetic factors shaping its fetal development. But it bears much more resemblance to Rainbow than to Allie, its dark-striped surrogate mother. It is emphasized that cloned pets, though still similar, will not be exact recreations of their genetic parents. A considerable market could develop, though not immediately because of the great expense and uncertainties, including health problems that frequently afflict mammals cloned by present methods. Of more immediate interest and commercial viability would be the long-term storage of cells from which clones might be made when methods have improved. (Such cells would be stored at cryogenic temperatures, this being the only method now available for long-term storage in a form permitting recovery of function, in this case, by warming.)

Rabbits Cloned

Though not as popular as cats, rabbits too are often kept as pets, and are also important research animals. Now rabbits have been cloned from adult cells. The four bunnies in question, all females (no names have been assigned due to anticipated lab-only use), were actually born a year ago at the National Institute for Agronomical Research outside Paris. The research team that carried out the cloning is led by Jean-Paul Renard, who has been trying to clone a rabbit for three years. A decision to delay reporting was made so the health and functionality of the four animals could be assessed. On March 29 Renard announced that they were normal and had started to reproduce. Rabbits are used extensively in heart disease research and in studies relating to their immune system, which is similar to a human's. The French team wants to clone rabbits with a genetic defect similar to one that causes cystic fibrosis in humans, to better understand that chronic, fatal ailment.

Difficulties with Cloning

Despite some spectacular successes, cloning mammals is difficult enough that calling it "art" rather than "science" is surely putting it mildly. Until procedures are radically improved, such applications as the creation and use of stem cells to routinely manufacture replacement organs will be out of reach. Tales of hard luck in the cloning field are all too common. A case in point is that of Dr. Tanja Dominko, who made about 300 attempts to clone a monkey at a laboratory in Oregon. The closest she came was to create a placenta with no fetus. Most of the time the embryos that resulted were grossly abnormal, their cells having multiple nuclei, missing chromosomes, or more resemblance to cancer than to a healthy organism. Dr. Dominko is not giving up and now works for Advanced Cell Technology, which is trying to develop commercial applications for cloning.

Frozen Organ Successfully Revived

Early claims of cryopreservation and restoration of mammalian organs were never realized,[2] but now a success has been reported in the respected journal *Nature*. Rat ovaries with attached fallopian tubes and the upper segment of the uterus were successfully transplanted en bloc after overnight storage in liquid nitrogen. In one case a rat became pregnant through a transplanted ovary, to provide dramatic proof of functionality; in general, however, the transplanted organs showed impairments. The rat ovary is small—about the size of a baked bean—so that soaking in a protective solution beforehand was sufficient. For larger organs, perfusion by pumping in a solution through the vascular system, a more complex and difficult operation, would be necessary. The work was reported by Xiang Wang of Notre Dame Hospital, Montreal, Quebec, and colleagues including Roger Gosden. It is an impor-

tant step toward demonstrated, reversible cryopreservation of larger tissue masses such as human organs, though major hurdles remain. Aside from this, though, the success with this relatively simple cryopreservation increases hopes that today's cryonic suspensions will eventually prove reversible too.

Robot Companions to Help the Elderly

If you must age, it's better to have help than go it alone, isn't it? But wait—many elderly prefer to live alone and keep their independence rather than submit to institutional or other care, even when they could well use some assistance, including simply an antidote to loneliness. A possible resolution to this dilemma is robot companions like the "Pill Pets" being developed at MIT's Aging Lab, under the direction of Joe Coughlin. The brightly colored, cuddly toys display reminders about medication on a screen but additionally require attention or they electronically "die." Their needs give their owners a sense of purpose and promote emotional bonding, giving them incentives to take better care of themselves, along with advice on how to do so. Elderly women who tested them grew attached and did not want to give them back. Another concept Coughlin's team is working on is "Miss Daisy," a car with an automated assistance package that warns against possible collisions and has a night vision system.

DNA Computer Solves Hard Logic Problem

Leonard Adelman, the USC professor who developed the DNA computer in 1994, is understandably upbeat about biological molecules. "They are miraculous little machines. They store energy and information, they cut, paste and copy." In the form of DNA, he reminds us, biomolecules make computers with a number of attractive features. "They are massively parallel, compute with extremely high energy-efficiency and store enormous quantities of information." In this sort of computer, a single strand of DNA, with base pairs that can be arranged in different patterns to store information, is used to encode a problem, while other strands, easily multiplied and each stamped with its own, unique pattern, represent possible solutions. There can be trillions of these possible solutions floating in the watery molecular soup in which the computation is performed. Invalid solutions—strands of DNA that don't match—are weeded out by exploiting the binding properties of DNA, so that only matching strands encoding correct solutions are left. The matching operation is relatively fast, unlike the case with conventional computers which are forced to do lengthy, sequential searches for the same sort of data-mining. Adelman's group has now devised a DNA-based computer that has successfully solved a hard problem in logic, equivalent to searching a database of a million-plus items to find one item that meets all of 24 specified requirements. The DNA computer is still not competitive with its electronic counterpart—errors are one big, remaining problem—but it may become so with further refinements. An additional possibility is that it may be especially useful in controlling biological systems, much as electronic computers now guide artificial devices.

Lab on a Chip Detects Cancer

Currently, hospitals analyze body cells with a cytometer, a bulky device that occupies the space of several filing cabinets. A dye sticks to cancerous cells but not to healthy cells, and by its fluorescence betrays its malignant host. The analysis itself can take hours or even days and requires a dedicated technician. A new device on a chip that fits in a matchbox can perform the same analysis in only minutes or seconds. The device works by pumping the cells through a tiny channel the width of a human hair, exposing them to the dye, and using a laser to detect the fluorescence. A nanotechnology concept known as microfluidics comes into play, in which fluids in small (nanoliter or picoliter) amounts are subjected to electrical forces or pressure to induce laminar (predictable) flow. In this way materials or tiny structures such as cells can be transported to different locations within a miniaturized laboratory for desired procedures. Cytometers are mainly used for detecting and analyzing leukemias, and the new device seems especially promising as a replacement.

Self-Configuring Computer

The article in *EE Times* seemed too good to be true, and it was, but still it reported an accomplishment worth noting. "Self-configuring array enables atomic-scale fabrication," the title proclaimed. A close reading showed, however, that no atomic-scale self-configuration had actually been demonstrated but only simulated in certain essentials, using a much larger-scale and presumably conventional computer. But this too is significant, and there now appear to be some new, serious possibilities for true atomic-scale, computer self-fabrication, when certain other requirements have been met.

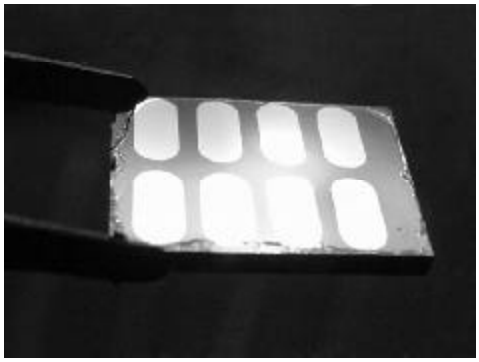
Cell Matrix Corporation, based in Salt Lake City, developed the simulated system exhibiting self-configurability. "Overall, our philosophy is to get as much computing architecture into software as possible," said company cofounder Nicholas Macias. The "cell matrix" itself is an array, or matrix, of small, identical processing units or cells. Each cell in turn incorporates a changeable memory that instructs the cell in its particular function. The behavior of a given cell additionally depends on the states of adjacent cells, so the matrix forms a cellular automaton. Since the memory of every cell can be changed, the automaton as a whole can perform in an endless variety of ways; in fact, it is computationally complete—able to do any computation a Turing machine or some other, real-life computer can do. The reconfigurability recalls an earlier technology, the field programmable gate array (FPGA), but there the elements can only be modified from the outside, that is, the device is externally controlled. In the cell matrix the cells are able to analyze and reconfigure one another automatically.

This ability could have dramatic consequences; for example,

if a computation needed extra room (for extra precision, say) the cells could reconfigure to supply it without halting the computation. Many other possible uses can be foreseen, including the ability of a complex system to evolve from a simpler one in which only a few boundary cells have been preset. One particular application would use a cell matrix to program around faults in its own physical structure, which could lower the cost of manufacture as well as enable recovery from damage. The cells in the matrix run in parallel, which could greatly speed many computations and lead to applications in artificial intelligence. The simple, repetitive nature of the cells, moreover, would especially lend itself to fabrication in three dimensions, which could be particularly important at the nanoscale. And finally, the ability of the system to self-configure could be crucial in programming a computer having atomic-scale components that are too numerous to configure in other ways. Still needed, however, is the atomic-scale technology that could implement the concept.

Flexible Solar Cells Use Nanotech

A new class of plastic, flexible solar cell is being developed by A. Paul Alivisatos and colleagues Wendy U. Huynh and Janke J. Dittmer at UC-Berkeley. As one possible application, the new cells could be painted on clothing to power wearable electronics, but some difficulties remain. So far the cells achieve only 1.7 percent efficiency—they convert less than one fiftieth of the incoming sunlight into electricity, versus the ten percent of low-grade commercial solar cells. But their creators are confident this performance can be boosted greatly. The cells use tiny, thin rods of semiconducting cadmium selenide to absorb incoming sunlight, convert it to electrical current, and pass the current from one electrode to its opposite. The rods, each around 7 nanometers in thickness and 60 in length, are embedded in a 200-nanometer-thick layer of a semiconducting plastic, poly(3-hexylthiopene) or P3HT, which in turn is sandwiched between layers of conducting material forming the electrodes. Alivisatos's team has developed a method of manufacturing the semiconducting nanorods of specified thicknesses to absorb particular wavelengths of light. Their prototype cells, still in the early stages of development, offer several avenues for improving the efficiency, such as increasing the density and improving the orientation of the nanorods, and using several layers of sandwiched material, each with a different gauge of nanorod, so that multiple wavelengths of light are absorbed. The solar cells should be easy and cheap to manufacture, bypassing the vacuum chambers and clean rooms that now drive up the cost of competing technology.



"Plastic Solar Cells," J. J. Dittmer, Alivisatos Lab/ UC-Berkeley

Human Cyborg

Is bionic man or woman soon to become a reality? Probably not, but some recent developments do at least point in that direction and raise exciting prospects for amputees and victims of paralysis. A British university professor, Dr. Kevin Warwick, has been hailed as "the first human cyborg" or person-machine combination for having wires implanted in his arm that will link his nervous system to a computer. The surgery, carried out at Radcliffe Infirmary, Oxford, England, embedded a silicon chip about three millimeters across in Warwick's left wrist; the chip's 100 hair-thin electrodes were inserted at different points in the median nerve. Connecting wires, exiting through a skin puncture, provide a link to a radio transceiver, which in turn will signal a computer. In this way it should be possible to monitor both input signals such as impulses to wiggle the fingers, and outputs such as feelings of touch or pain. If the experiment succeeds it opens the door to signal-sensing implants that could bypass spinal damage or interface with artificial devices. Para- and quadriplegics might be given feeling and movement in their disabled extremities, and similarly, amputees could control and have sensation in their artificial limbs.

Seeing Like Superman

Superman's X-ray vision is a fantasy, but a "sonic flashlight" that does much the same thing has been developed and is now being improved for clinical trials. The device uses a half-silvered mirror to combine a surface view of the patient—what we normally see with our eyes—with an ultrasound-derived, interior image, so that both images are seen in superposition. The sonic flashlight should greatly facilitate hand-eye coordination for invasive procedures that currently use ultrasound imaging, such as taking blood, inserting catheters or needles for amniocenteses, extracting biopsies, and surgery. The device was invented by Dr. George Stetten, a biomedical engineer at the University of Pittsburgh, working in collaboration with the Robotics Institute at Carnegie Mellon University.

NOTES

[1] A claim that human cloning was achieved in December 1998 at Kyunghee University Hospital in Seoul , South Korea, is now generally discounted. The new claim, unlike the earlier one, is supported by a peer-reviewed publication—the paper by Cibelli et al. (see under "References").

[2] As noted by Wang et al. in the *Nature* article (see under "References").

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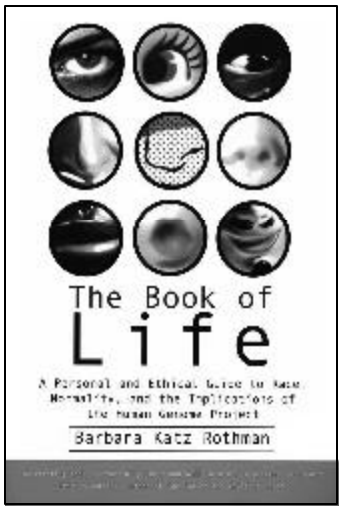
The Book of Life:

A Personal and Ethical Guide to Race, Normality, and the Implications of the Human Genome Project

By Barbara Katz Rothman

Beacon Press, 2001

Book Review by David Pizer



I found this book disturbing because Rothman's negative views are typical of many other people who are afraid of progress. Rothman is pessimistic and questions whether mankind should be tinkering with genetic science (a subset of nanotechnology). She questions whether this science will amount to anything and, if it does, whether mankind will use it for bad purposes and not good. My position is that oftentimes it is not the inability of science to discover and develop quickly that slows down the progression of science, but the government regulation, which is a reaction to public opinion, that is shaped (and misshaped) by books like this. My review comes from the position of someone who would like to see rapid advances in genetic engineering (and all of nanotechnology) for the benefits that it can bring. Overall, I found the book to be conveying the message that we should be very careful in this new area, as it focuses mainly on the negative and downplays or omits the benefits that responsible science can bring. The author warns us of this pessimistic attitude in the third full sentence of the preface: "It feels to me, in one of my rare hopeful moments that maybe we're just about cresting this hill of unbounded enthusiasm for all things genetic."

Often she writes a statement that I would disagree with, but there is no argument that goes along with it. For instance on page xii of the preface she says: "If it is really the case that we have organized our collective lives in such a way that if there is no profit to be made then there is no incentive to cure cancer, we are indeed morally bankrupt." One would expect such a statement to then be followed by an argument on why scientists and doctors should work for free or little pay, and why investors should take risks with their hard-earned money but not expect any profit in this area.

Professor Rothman tells us in the preface that she is going to show us three things:

1. The idea of the new genetics supports much that is racist in our society.

2. We should not be focusing on genetic engineering but rather on the "real cause of much illness and early death," which are environmental issues and matters of social inequality.

3. That what has been so far the major use of genetic science is "babymaking," and satisfaction is far from guaranteed. She is "bothered, worried, saddened, sometimes frightened" by a metaphor for personhood that sees us as just "information." She is going to show us how this new way of thinking is a threat to us.

One of the first arguments, in her introduction, is:

1. Seeds (genetic codes) are not the most important thing in determining what/who a person is.

2. Relationships are more important. Therefore attention in genetics is not as important as attention to social interests.

Examples given are that babies are not as independent as the genetic code position would hold, but that babies start out as part of their mothers. "That is who we are and how we got to be who we are, not separate beings that must learn to come with others, but attached beings that learn how to separate" (p. 17). "But is saving the seed [her metaphor for genetic engineering] our real problem? The threat to the land, water, air, to 'Mother Earth' is our problem. If the seeds of the earth are in danger, genetic engineering is more the cause than the solution. Diversity is being bred out: the square tomato bred in" (p. 19).

I would argue that this statement is just plain wrong and is a misunderstanding of what is trying to be done in genetic engineering. It would be more correct to say about genetic engineering that it is helping to remove the diversity of bad things like disease and other undesirable traits, and it is introducing many new, diverse, good options for us to choose from. For instance genetic engineering's aim is to introduce new strains of fruits and vegetables that are resistant to infestation and yet are larger and more nutritious and could be grown in places that they previously were unable to grow in, thereby reducing starvation in third-world countries.

Toward the end of the introduction we are told that genetics does not offer us absolute options (I would add "yet"), but it does offer us predictive power to varying degrees of accuracy or inaccuracy. And, we don't have to be experts in genetics to form moral values about how science and society should use that predictive power. One of the key issues that is brought to light on page 37 (talking about authority) is: "That was a central concern; scientists would do something to a person that would change future evolution. We would be, in a new, direct, intentional way, controlling our own evolution."

The introduction ends by telling us that in the future we will have more control over our evolution, and we are going to explore whether that is a good or bad thing.

Part One: Mapping the Past: The Macroeugenics of Race *(The new genetics supports much that is racist in our society.)*

Points she makes to support her general argument in this section are:

1. Race has always been about differences.

2. In encounters between lighter and darker people (she could not say "different races"), the lighter people did not behave well.

3. It is impossible to see races and not become involved in some kind of racism.

4. Nazis practiced eugenics and it was bad (an assumed premise). All Nazis were/are bad, so all eugenics is bad.

5. Scientists are going to use genetic science to discriminate against races even more than they have in the past.

6. American racism is probably worse, and at least much different, than racism in other parts of the world.

7. Science has never before produced a better set of facts [better than what?], and there is no reason to believe that it will now (page 57).

8. If bad people get control of the new genetic technology, they will use it for bad purposes.

9. The wrong people have control of the Human Genome Projects. Instead of scientists, they should be sociologists (perhaps like her?).

10. There is no such thing as objective diversity in the Human Genome (there isn't even a human genome).

11. The money for the Human Genome Diversity Project could be better spent elsewhere. (What I found as interesting, as a cryonicists, was where on page 99 she said: "To spend millions of dollars sampling the genes of poor people so that they (just the genes) can be preserved for future study, while the poor people themselves are not being preserved, raises obvious concerns." Bravo! Spend the money preserving the people in liquid nitrogen. Perhaps we can bring the people themselves back someday? But, alas, I don't think this is what she meant.)

12. Genetic science will lead to biological warfare by governments on their people (page 100).

13. In human history, information has been used in ways that its gatherers had not intended, and it can happen again.

14. The Human Genome Diversity Project echos the problems with the Bell Curve.

15. This work should be done by the right people. But there may not be any right people to do this work.

16. The very nature of genetics, and thinking about it, can't help but promote racism.

Her argument in more general terms is as follows:

1. We live in a racist world.

2. Racism is a tool used to acquire power over other people.

3. People of power control genetic science because it takes investment (power), and only people of power have capital to invest in these ventures.

4. Science has been used for bad things in the past, and so it probably will use the results of genetic science for bad things in the future.

Conclusion to Part 1: People of power have done even worse things than people of little power, so people of power should not have control of the Human Genome Project.

Part Two: Writing the Body: The Genetics of Illness *(We should not be focusing on genetic engineering but rather on the "real cause of much illness and early death," which are environmental issues, and social inequality.)*

In this part we learn that microeugenics is a genetics of disease, different from macroeugenics, which is about keeping gene pools free of contamination from less desirable gene pools. Her argument in Part 2 goes like this:

1. Most diseases are not caused by genetic origins. Genetic origins play only a tiny part in diseases. (Another complaint is that the media tends to misinform us about this.)

2. Even in the small amount of diseases that have genetic origins, all genetic science can do (at the present time) is predict them, and not all that accurately. Genetic science cannot cure diseases.

3. A whole lot more diseases are caused by environmental and social factors.

4. Even if genetic science could tell you that you would get a disease, it can't tell you when you will get it. Since we don't know how long a life has to be lived before it can be considered a worthwhile life, predicting genetic disorders is not of much value. It might even lead to a more pleasant life if one did not

know that some horrible disease was waiting for him/her at a certain time in his/her life.

5. Even further, we don't know what the real meaning of life is (she assumes).

6. We don't have criteria for deciding how bad a disease is. We can't tell if it would be better not to live at all or better to live with a certain disease.

7. In some cases (the example used is prostate cancer), finding and treating every case would do more harm than good.

Her conclusion in this section: We are putting too many eggs (our limited resources), into the genetic science basket, and we should be putting more of them into the social problems basket.

Part Three: Imagining the Future: The Microeugenics of Procreation *(That what has been so far the major use of genetic science is "babymaking," and satisfaction is far from guaranteed.)*

In this part we see that the potential in genetic science is curing disease, but so far, not a single person has been helped by gene therapy. We see that genetic therapy might also be helpful in accidents where there was not a genetic cause but that genetic engineering might be a cure. We are given a look at prenatal screening that, sometimes, leads to abortion. Abortions might be o.k. in incidents of health, but will results of developing genetic science lead to abortions merely because the parents want the other sex or blonde hair, or taller or shorter children? Rothman argues that people might abort because they want a different race for the child. When genetic science is advanced further, people will want to select certain traits for their children—is that good? Is it fair to the children to have the parents choose certain traits for them?

Her primary argument in Part 3 goes like this:

1. We begin by selecting against certain characteristics that would cause disease.

2. Whenever things become available to people, people use them more and more.

3. After we have the technology to remove parts we don't want, we will select for parts we do want.

4. This will lead to mass-produced supermarket-type babies.

5. Babies that don't fit the mass-production model will be aborted.

There seems to be an assumption in her argument somewhere that people planning their evolution is not as good as nature planning it; when we control our destination it is not as good as when we don't interfere.

Conclusion

Her conclusion does not seem to follow from her argument. In fact, I found it hard to identify a final conclusion from the questions she asked in the beginning of the book. Here is what I understand her final conclusions/opinions to be:

1. The meaning of life is not to be found in the genetic code.

2. Genes have no meaning without the context of a person to exist in and a community for that person to exist in.

3. DNA is not alive, so studying it instead of doing other things is a waste of resources.

4. There exists a soul. That is what a person is; not an immaterial soul in the Cartesian way but still a whole that is more than the sum of its parts and is aware of itself.

5. The reason people want to play God is that there is no way to get out of here alive. Maybe by playing God we can do something about that problem.

6. She reiterates that the money spent on genetic research could do more good if spent on social programs.

7. The marketplace is not the best way to drive research. (But she doesn't propose a better way.)

Her ultimate conclusion:

She feels that she may not know where the meaning of life is to be found, but she knows where it will not be found—not in genetic code.

My Response:

It is hard to build a counterargument to her book, because it is a conglomeration of statements, opinions, and off-point analogies. So I will just list a few points that she has overlooked and give a general rebuttal.

It is wrong to talk about the imperfections of genetic science by pointing out that it has not done that much yet. Most proponents of genetic science do not claim that what we have so far is what will be of benefit to us. It is the potential benefits of future genetic science (and nanotechnology in general) that we need to be considering. Many smart and above-reproach scientists have put their reputations behind advancing genetic science. Its potential is to predict dangerous health problems **and** to be able to offer options to remove those problems within the fetus—not destroy it. And that potential is so glorious that it would be an immoral act of the greatest nature not to develop it. The problem is that Rothman does not understand how great the potential of this technology is for mankind. She tells her readers in several places that all the scientists and experts that do understand tell her that she does not understand. Her position seems to be: lack of understanding should not stop me from voicing an opinion.

The potential of genetic science, which is a subset of the greater nanotechnology, is to help fetuses, children, and adults to overcome diseases and eventually offer cures that are not available yet and will not be available until this science is fully developed, many years from now. Although this is arguing from

(continued on page 44)

A History of Ideas about the Prolongation of Life:
The Evolution of Prolongevity Hypotheses to 1800[1]

By Gerald Gruman

Reprint, Ayer Publishing Company, 1977

Book Review by R. Michael Perry

The book I review here deals with the long history of thought about the problem of death and how it might be alleviated. It dates back to the early days of cryonics and has been reviewed both inside and outside the field before,[2] yet it is still not particularly well-known. The author, Gerald Gruman, had previously coined a word, *prolongevity*, to refer to "the significant extension of the length of life by human action." Advocates of prolongevitism have long vied with those of apologism or death acceptance, and their recorded thoughts go back to pre-Christian times in Europe and the Far East. Though concluding, in the main, with the year 1800, the book does note some later developments, including the then-infant cryonics movement, in which the author was briefly involved.[3] There is much of interest in the book if you are seeking a background to present-day thinking that death can be conquered scientifically.

An outlook that can reasonably be called scientific is not embraced by all, and this was especially true in earlier times when less was known and science was primitive, harder to access, and itself laced with superstition and misinformation. Even then, the amount of knowledge was rather considerable, if you knew where to look, though it offered little in the way of encouragement to the seeker of immortality. In this way, then, a dichotomy was enforced between reason and faith. Generally faith got the upper hand since it did offer hope of a life beyond the usual limits. However shaky its arguments may have seemed to the careful critic, its claims could not be finally discredited. Hopes in these claims were kept alive by the many who felt that the value and purpose of life would be negated by the finality of death.

Though much of the early hopes for immortality rested on outright appeals to supernatural beings, another tradition developed, particularly among some of the Taoists in China, who sought to wrest the secrets of longevity from nature. (It is interesting that Taoism favored this outlook because, as is pointed out in the book, the Taoists did not sharply distinguish "spirit" from "matter" as in the West, but saw both as forming a seamless whole, something that might be amenable to constructive intervention by the well prepared.) A systematic approach was cultivated and applied. Unfortunately, many of the premises and arguments were faulty, yielding erroneous aging "remedies" such as gold, ginseng, cinnabar, and cinnamon, along with practices acknowledging and seeking help from supernatural powers. For example, longer life might be conveyed by eating gold, an ageless and incorruptible metal! Other Taoist practices more definitely improved health and life span, such as simple exercise and good dieting. Cultivating the virtues, also strongly encouraged, might have the same effects through (as we moderns would say) reducing stress levels and providing a sense of meaning and self-worth. Indeed, this could be said of the recommended prayers and devotional exercises too; some life-extending effects could also have come from certain sexual practices that were advocated, though this was disputed. So, while there was much nonsense and the real problem of aging remained undented, at least some positive effects were achieved and a protoscience of longevity was born.

Alchemy, with its focus on transmuting other materials into gold, became associated with prolongevitism in China in pre-Christian times. By comparison, in the West there was a longstanding emphasis on acceptance of death and relatively little attention was paid to radical life extension. The theme was finally taken up by late medieval alchemists such as Roger Bacon (13th century) who actually believed that experimental tech-

niques of the time could prolong life far beyond the powers of medicine. During the Renaissance, gains were made by hygenists who, in a parallel to the earlier Taoists, advocated a simple lifestyle of good dieting and exercise. The best known of these, Luigi Cornaro, himself lived nearly a century and is noted for his optimistic outlook toward life and in living to an advanced age. Cornaro is also important for his contention that long life is open to people in general and not just a favored few with certain esoteric knowledge or other advantages.

The last major period treated in the book, the 18th-century Enlightenment, is of great significance for its emphasis on progress, a concept that had received little attention up to that time. Before it had been thought that extra-long life had already been achieved either in remote antiquity (before the biblical flood, for instance) or in faraway places, or possibly closer to home with the aid of elusive resources such as a "fountain of youth." Cornaro and other hygenists had begun to develop a new outlook, emphasizing approaches that were more commonplace and accessible (thus, we would now say, more likely to have substance at all). The new viewpoint was dramatically extended by such thinkers as Benjamin Franklin and Antoine Condorcet, who saw great possibilities for future betterment through a scientific approach. Science had by then begun to make advances in the direction of extending life. For example, Leeuwenhoek in 1702 had revived rotifers after stopping the life process through desiccation. Science clearly was progressive, and, these thinkers hypothesized, in the future should be able to secure benefits not then possible. Humanity thus might become godlike, shedding its frailty and limited life span for something unprecedented and far better. This vision still informs the modern immortalist. The evidence that it will come to pass is still in dispute, but nonetheless is substantial and growing.

Notes

[1] Gerald Gruman, "A History of Ideas about the Prolongation of Life," *Transactions of the American Philosophical Society* 56, no. 9 (December 1966). Reprint, North Stratford, N.H.: Ayer Publishing Company, Inc., 1977.

[2] A short review of the book from within the cryonics community, with Evan Cooper presumed though unnamed author, will be found in *Freeze-Wait-Reanimate* 3, no. 34 (April 1967): 9. For an "outsider" review, see Eugene Garfield, *Current Contents* 19 (August 18, 1971), http://www.garfield.library.upenn.edu/essays/V1p229y1962-73.pdf.

[3] Gruman, for example, wrote a preface to Robert Ettinger's *Prospect of Immortality* (Doubleday, 1964). The *Freeze-Wait-Reanimate* reference above reports that he was a member and advisor of Cooper's Life Extension Society.

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(continued from page 42)

authority, I will point out that besides many brilliant and respectable scientists, many astute investors are getting behind this new science. To me that is not a bad indication but a demonstration that brilliant people think it will work and are willing to risk their money on it.

Also, I would argue that history shows us that capitalism works and gets good things done when no amount of communism can. So I don't know what alternative is available to fund science other than what is working now. Rothman claims that it is wrong for people to make money off this wonderful new technology. To convince me, she needs to show me some other way to make it happen. Not some dream-world hope that lots of good people will just donate their time and money, but a real-world strategy. I know what motivates the folks with lots of money—a chance to make more.

Lastly, I would say that if mankind had followed Rothman's pessimism from day one, we would still be high in the trees, afraid to come down and take a step on solid ground, afraid to use the first tool, afraid to create the first medical advancement, and afraid to create our own biological immortality (the next good thing that can happen to humans). There is some risk to advancing technology, and those advances can be used for bad things at times, but they can also be used for good things and to overcome evil. It is not the technology that is good or bad but the people that use it. If we have faith in our system, and we think that we as a people are good people, then we should be the ones to develop technology as quickly as possible before people we know are bad beat us to it.

If mankind had not fashioned the first tools to ward off predators and procure food and shelter, then neither Rothman nor I nor any other human would be here, our ancestors eaten millions of years ago, by those animals who were not afraid of progress.

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The Unfreezing

by Robert W. Whitaker

The people at Alcor had told me to make sure the emergency room people knew I wanted to be frozen when I died, so I told them that. So they treated me like I was just terrified of dying.

I put a lot of work and some money into arranging to have myself frozen. Other people worry about their funerals, so why can't I be interested in possibly being brought back to life someday?

So I told the EMS people that I wanted to be frozen if I died. They said, "You're not going to die."

I told the emergency room nurse I wanted to be frozen when I died. He tried to comfort the poor terrified heart patient, "You're not going to die." I told the cardiologist that I wanted to be frozen when I died. He replied, comfortingly, "You're not going to die."

All this while they were dripping about a pint of painkillers into me. Maybe I sounded scared or crazy when I told them I wanted to be frozen when I died.

But I had my Alcor bracelet on and pointed to it over and over. Not one of them paid it the slightest attention.

So the last words I heard were "You're not going to die."

But they must have contacted my family and found out from them that I insisted on being frozen.

I know that because the next words I heard were from a disembodied voice saying, "You died."

Damn, I felt good, but not because I died. I lay there feeling wonderful, just great.

"You died of the heart attack, and that is the last thing you remember," the voice went on, "You have been frozen and brought back. Our heartiest congratulations."

"Right now you just lie there and feel good, and we'll take our time getting started."

Damn, I felt good!

We all wondered what it would be like when they awoke us in a future time. We had all read countless science fiction stories about people waking up in the future. In the first place, all the stories had us waking up in something like the hospital room we died in. We would come slowly back to life and say, "Where am I?"

In other words we expected to come back from freezing the way we did it in our own hospitals in our own time. That's primitive. In the future no decent person would let somebody wake up scared and dizzy.

In our discussions of the future wakening, we had left out the single most important thing about the human animal. No sci-fi writer ever seemed to give a damn how people would FEEL.

One novel about freezing and being brought back did say that they finally found a way to make everybody feel good all the time. But that happened long after the novel's hero was unfrozen. Even then making everybody happy was an afterthought, just a mention, nothing up there with the Meaning of Life.

It's amazing how your priorities change when it's YOU that feels good. I was a guy who had made the ultimate leap of faith. I had spent time and money and effort to get myself frozen in case the future could and would want me back. I had just won the biggest bet in human history.

About every question I could have asked was now about to be answered.

Yet I was in no rush.

After all, it occurred to me, this was exactly what having a big brain was all about. For a billion years we had evolved to avoid pain and death. For a billion years we had sought to obtain pleasure.

Well, I had just beaten death, and I was avoiding pain like crazy. The answers would come in their own good time. For the time being, I had the patience of the grateful dead.

Damn, I felt good!

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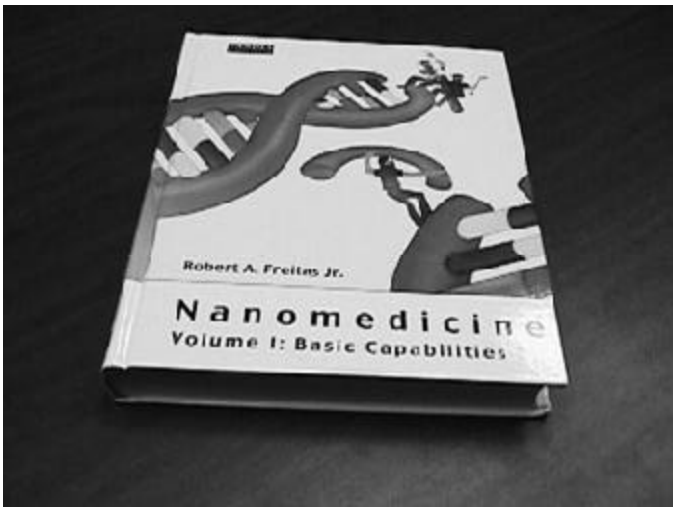

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