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CRYONICS

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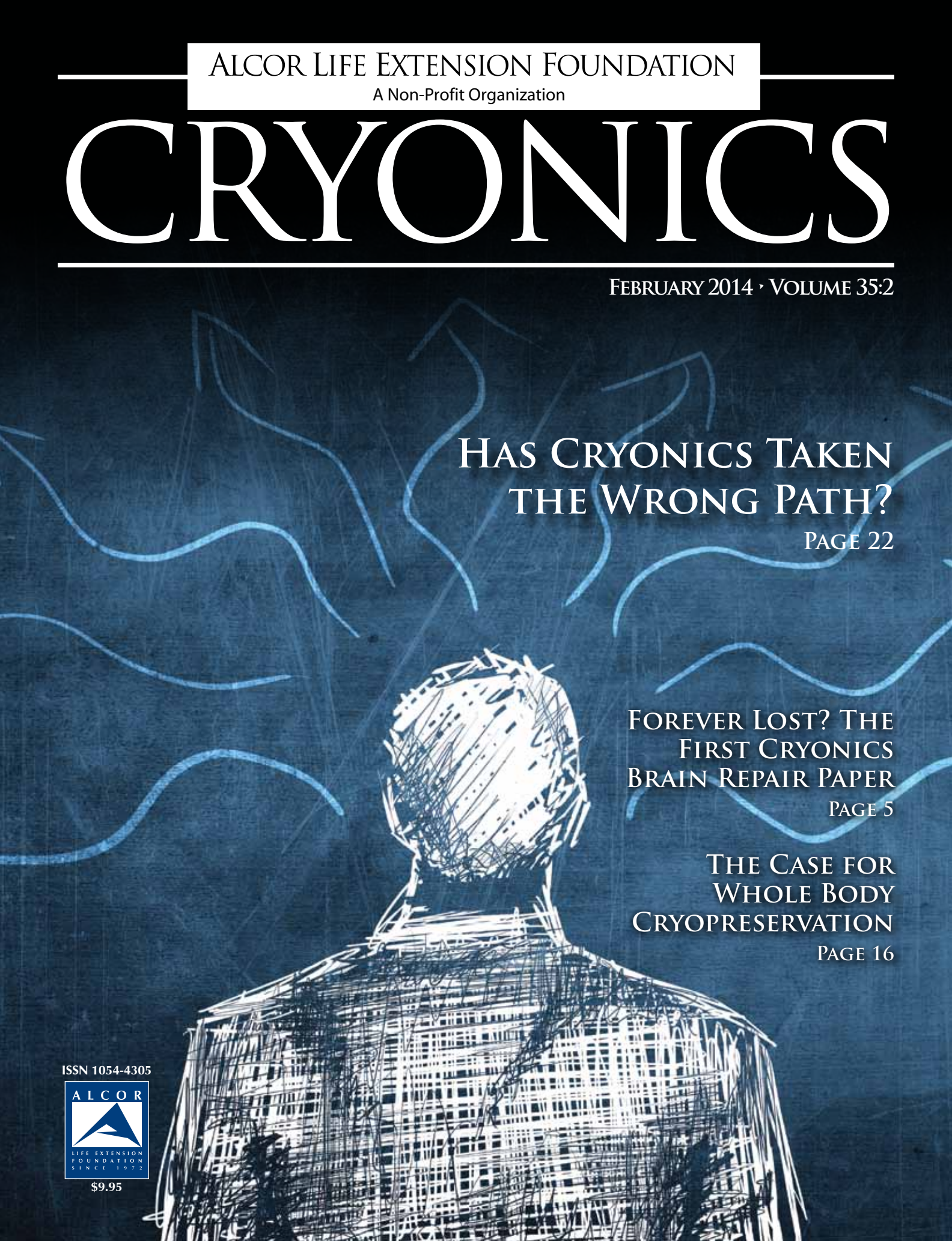

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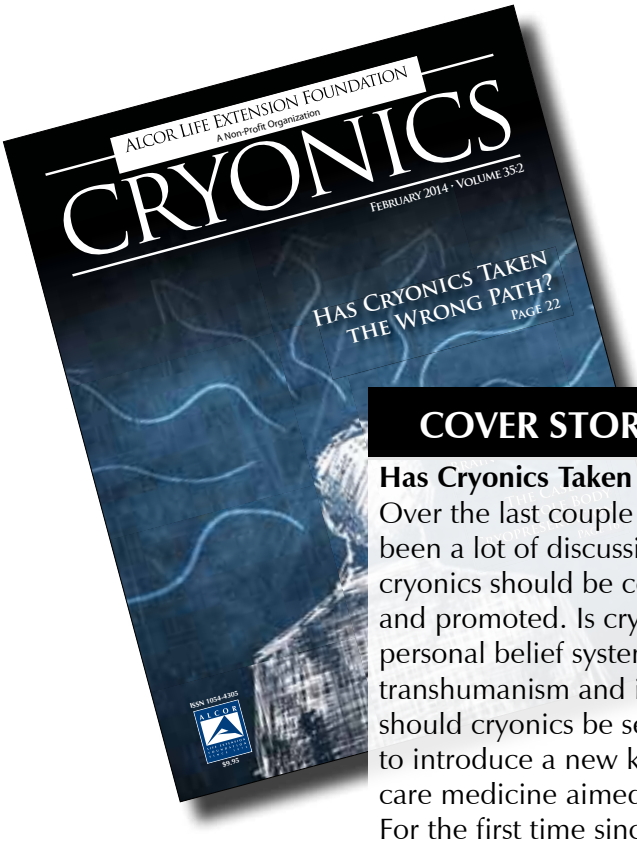

COVER STORY: PAGE 22

Has Cryonics Taken the Wrong Path?
Over the last couple of years there has been a lot of discussion about how cryonics should be conceptualized and promoted. Is cryonics part of a personal belief system that includes transhumanism and immortality, or should cryonics be seen as a proposal to introduce a new kind of critical care medicine aimed at saving lives? For the first time since its online publication in 2006, we present ex-Alcor President Steve Bridge's contribution to this debate.

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CRYONICS

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QUOD INCEPIMUS CONFICIEMUS

Photo: Cryo-Care Equipment Corporation at 2340 E. Washington St., Phoenix, AZ. Dr. Bedford's "home" in 1970 or 1971.

FOREVER LOST?
THE FIRST CRYONICS BRAIN REPAIR PAPER By Aschwin de Wolf

For more than a year now I have been trying to locate Jerome B. White's paper *"Viral Induced Repair of Damaged Neurons with Preservation of Long Term Information Content."* This paper is referred to in a number of books and articles, including Robert Ettinger's *Man into Superman* (1972), Eric Drexler's *Engines of Creation*, and Mike Darwin's biological repair proposal in his article *The Anabolocyte* (1977). Despite being recognized as the first presentation about repair of the brain of cryonics patients, I am not aware of any actual quotes or discussion of the paper, raising the question of how many authors who have referenced the paper have actually read it. The best I have been able to find is what amounts to the complete abstract of the paper in Robert Ettinger's *Man into Superman:*

> *An organic cell is a self repairing automaton, but if environmental interference exceeds a certain limit, damage will become total. Freezing can be used to halt progressive damage along with all metabolism, but means are required to restore or augment the cellular genetic control program, or enrich the environment to enhance repair ability. It has been proposed that appropriate genetic information be introduced by means of artificially constructed virus particles into a congenitally defective cell for remedy; similar means may be used for the more general case of repair. Progress has been made in many relevant areas. The repair program must use means such as protein synthesis and metabolic pathways to diagnose and repair any damage. Applied to brain neurons, this might destroy long term information content, which appears to be stored in molecular form, often suggested to be in a feedback cycle involving mRNA and protein. This information can be preserved by specifying that the repair program incorporate appropriate RNA tapes into itself upon entry and release them on termination of repair.*

Jerome B. White's paper was presented at the Second National Cryonics Conference in Ann Arbor, Michigan, in 1969. Unfortunately, only the proceedings of the First Annual Cryonics Conference in 1968 have been made available as a book. We can state with reasonable certainty, though, that White spoke on this topic at the second conference because Saul Kent briefly mentions his presentation in a review of the conference for *Cryonics Reports,* April-May 1969. Even more intriguing, the reference for this paper in *Man into Superman* includes "**reprints available** [emphasis added] from the Cryonics Society of Michigan," which provides evidence that this presentation was either transcribed or an actual paper was prepared prior to or after the conference. Notwithstanding this encouraging point, I have not been able to locate this paper so far, despite asking individuals such as Michael Darwin, Michael Perry, Stephen Bridge, and Catherine Donaldson. Could it be possible that a paper was produced and distributed on a small scale but no copies of the paper have survived? This would be a tragedy, especially in light of the fact that it was the first proposal for a cell repair machine to resuscitate cryonics patients.

"Despite being recognized as the first presentation about repair of the brain of cryonics patients, I am not aware of any actual quotes or discussion of the paper, raising the question how many authors who have referenced the paper have actually read it."

[continued on page 15]

MULTIPLE SCLEROSIS AND HUMAN ENHANCEMENT

By Chana de Wolf

Multiple sclerosis is a disease that raises a lot of interesting questions for people interested in biogerontology, human enhancement, and even cryonics. It raises questions about immunosenescence and draws attention to possible immune improvements for biological human enhancement. Biotechnologies to induce myelin repair may even be useful for the repair of cryopreserved brains. Before I discuss multiple sclerosis from these perspectives, let us take a closer look at this medical condition.

Multiple sclerosis (MS) is an inflammatory autoimmune disorder of the central nervous system that results in axonal degeneration in the brain and spinal cord. In simple terms, multiple sclerosis is a disease wherein the body's immune system attacks and damages the myelin sheath, the fatty tissue that surrounds axons in the central nervous system. The myelin sheath is important because it facilitates the conduction of electrical signals along neural pathways. Like electrical wires, neuronal axons require insulation to ensure that they are able to transmit a signal accurately and at high speeds. It is these millions of nerves that carry messages from the brain to other parts of the body and vice versa.

More specifically, MS involves the loss of oligodendrocytes, the cells responsible for creating and maintaining the myelin sheath. This results in a thinning or complete loss of myelin (i.e., demyelination) and, as the disease advances, the breakdown of the axons of neurons. A repair process, called remyelination, takes place in early phases of the disease, but the oligodendrocytes are unable to completely rebuild the cell's myelin sheath. Repeated attacks lead to successively less effective remyelinations, until a scar-like plaque is built up around the damaged axons.

The name *multiple sclerosis* refers to the scars (sclerae—better known as plaques or lesions) that form in the nervous system. These scars most commonly affect the white matter in the optic nerve, brain stem, basal ganglia, and spinal cord or white matter tracts close to the lateral ventricles of the brain. The peripheral nervous system is rarely involved. These lesions are the origin of the symptoms during an MS "attack."

In addition to immune-mediated loss of myelin, which is thought to be carried out by T lymphocytes, B lymphocytes, and macrophages, another characteristic feature of MS is inflammation caused by a class of white blood cells called T cells, a kind of lymphocyte that plays an important role in the body's defenses. In MS, T cells enter the brain via disruptions in the blood-brain barrier. The T cells recognize myelin as foreign and attack it, which is why these cells are also called "autoreactive lymphocytes."

The attack of myelin starts inflammatory processes which trigger other immune cells and the release of soluble factors like cytokines and antibodies. Further breakdown of the blood–brain barrier in turn causes a number of other damaging effects such as swelling, activation of macrophages, and more activation of cytokines and other destructive proteins. These inflammatory factors could lead to or enhance the loss of myelin, or they may cause the axon to break down completely.

Because multiple sclerosis is not selective for specific neurons, and can progress through the brain and spinal cord at random, each patient's symptoms may vary considerably. When a patient experiences an "attack" of increased disease activity, the impairment of neuronal communication can manifest as a broad spectrum of symptoms affecting sensory processing, locomotion, and cognition.

Some of the most common symptoms include: numbness and/or tingling of the limbs, like pins and needles; extreme and constant fatigue; slurring or stuttering; dragging of feet; vision problems, especially blurred vision; loss of coordination; inability to walk without veering and bumping into things; weakness; tremors; pain, especially in the legs; dizziness; and insomnia. There are many other symptoms, as well, such as loss of bowel or bladder control, the inability to process thoughts (which leads to confusion), and passing out. Some MS patients lose their vision and many lose their ability to walk. The symptoms are not necessarily the same for all patients and, in fact, an individual MS patient does not always have the same symptoms from day to day or even from minute to minute.

One of the most prevalent symptoms of MS is extreme and chronic fatigue. Assessment of fatigue in MS is difficult because it may be multifactorial, caused by immunologic abnormalities as well as other conditions that contribute to fatigue such as depression and disordered sleep (Braley and Chervin, 2010). Pharmacologic treatments such as amantadine and modafinil have shown favorable results for subjective measures of fatigue. Both drugs are well tolerated and have a mild side-effect profile (Life Extension Foundation, 2013).

It is estimated that multiple sclerosis affects approximately 85 out of every 100,000 people (Apatoff, 2002). The number of known patients is about 400,000 in the United States and about 2.5 million worldwide (Braley & Chervin, 2010). In recent years, there has been an increase of identified multiple sclerosis patients with about 50 percent more women reporting the disease. Indeed, between two and three times as many women have MS than men. Most patients are diagnosed between the ages of 20 and 50 but MS can strike at any age (National Multiple Sclerosis Society, 2013).

Incidence of multiple sclerosis varies by geographic region and certain demographic groups (Apatoff, 2002; Midgard, 2001). There is evidence that worldwide distribution of MS may be linked to latitude (Midgard, 2001). In the U.S., for instance, there is a lower rate of MS in the South than in other regions (Apatoff, 2002). Data regarding race shows 54 percent of MS patients are white, 25 percent are black and 19 percent are classified as other (Apatoff, 2002).

There are four disease courses identified in MS:

Relapsing-Remitting: Patients have clearly defined acute attacks or flare-ups that are referred to as relapses. During the relapse, the patient experiences worsening of neurologic function—the body or mind will not function properly. The relapse is followed by either partial or total recovery, called remissions, when symptoms are alleviated. About 85 percent of MS patients fall into this category (National Multiple Sclerosis Society, 2013).

Primary-Progressive: The disease slowly and consistently gets worse with no relapses or remissions. Progression of the disease occurs over time and the patient may experience temporary slight improvements of functioning. About 10 percent of MS patients fall into this category (National Multiple Sclerosis Society, 2013).

Secondary-Progressive: Patient appears to have relapsing-remitting MS, but after time the disease becomes steadily worse. There may or may not be plateaus, flare-ups, or remissions. About half the people originally diagnosed with relapsing-remitting will move into this category within 10 years (National Multiple Sclerosis Society, 2013).

Progressive-Relapsing: Quick disease progression with few, if any, remissions. About 5 percent of MS patients fall into this category at diagnosis (National Multiple Sclerosis Society, 2003).

The cause(s) of multiple sclerosis remain unknown although research suggests that both genetic and environmental factors contribute to the development of the disease (National Multiple Sclerosis Society, 2013; Compston and Coles, 2002). The current prevailing theory is that MS is a complex multifactorial disease based on a genetic susceptibility but requiring an environmental trigger, and which causes tissue damage through inflammatory/immune mechanisms. Widely varying environmental factors have been found to be associated with the disease, ranging from infectious agents to Vitamin D deficiency and smoking. The debate these days revolves primarily around whether immune pathogenesis is primary, or acts secondarily to some other trigger (Braley & Chervin, 2010).

Risk factors for multiple sclerosis include genetics and family history, though it is believed that up to 75% of MS must be attributable to non-genetic or environmental factors. Infection is one of the more widely suspected non-genetic risk factors. A commonly held theory is that viruses involved in the development of autoimmune diseases could mimic the proteins found on nerves, making those nerves a target for antibodies. The potential roles of several viruses have been investigated including herpes simplex virus (HSV), rubella, measles, mumps, and Epstein Barr virus (EBV). The strongest correlation between a virus and MS exists with EBV—virtually 100% of patients who have MS are seropositive for EBV (the rate in the general public is about 90%)—but potential causality remains strongly debated (Ludwin and Jacobson, 2011).

It is important to keep in mind that infectious agents such as viruses may, in fact, have nothing to do with causing MS. The association of a virus with MS is based on increased antibody response and may be epiphenomenal of a dysregulated global immune response. "Proving" causality will require consistent molecular findings as well as consistent results from well-controlled clinical trials of virus-specific antiviral therapies (as yet to be developed). In the end, any theory concerning causality in MS should also account for the strong association with other environmental factors such as Vitamin D deficiency and smoking. Indeed, a landmark study found that, compared to those with the highest levels of vitamin D, those with the lowest blood levels were 62% more likely to develop MS. Additionally, a literature review evaluating more than 3000 MS cases and 45,000 controls indicates that smoking increases the risk of developing MS by approximately 50% (Life Extension Foundation, 2013).

"While the myelin sheaths of these remyelated axons are not as thick as the myelin sheaths that are formed during development, remyelination can improve conduction velocity and prevent the destruction of axons."

Recently, researchers have pinpointed a specific toxin they believe may be responsible for the onset of MS. Epsilon toxin—a byproduct of the bacterium Clostridium perfringens—is able to permeate the blood-brain barrier and has been demonstrated to kill oligodendrocytes and meningeal cells. Loss of oligodendrocytes and meningeal inflammation are both part of the MS disease process, and may be triggered by exposure to epsilon toxin.

The fact that females are more susceptible to inflammatory autoimmune diseases, including multiple sclerosis, points to the potential role of hormones in the

etiology of multiple sclerosis. Interestingly, the course of disease is affected by the fluctuation of steroid hormones during the female menstrual cycle and female MS patients generally experience clinical improvements during pregnancy (Life Extension Foundation, 2013). Additionally, pregnancy appears to be *protective* against the development of MS. A study in 2012 demonstrated that women who have been pregnant two or more times had a significantly reduced risk of developing MS, while women who have had five or more pregnancies had one-twentieth the risk of developing MS compared to women who were never pregnant. (The increase in MS prevalence over the last few decades could reflect the fact that women are having fewer children.) A growing body of evidence supports the therapeutic potential of hormones (both testosterone and estrogens) in animal models of multiple sclerosis, but more research is need to understand the pathways and mechanisms underlying the beneficial effects of sex hormones on MS pathology (Gold and Voskuhl, 2009).

No single test gives a definitive diagnosis for MS, and variable symptoms and disease course make early diagnosis a challenge. Most diagnoses are presumptive and are based on the clinical symptoms seen in an acute attack. Supporting evidence of these presumptions is then sought, usually from a combination of magnetic resonance imaging (MRI) of the brain, testing the cerebrospinal fluid (CSF) for antibodies, measuring the efficiency of nerve impulse conduction, and monitoring symptoms over time.

As there is still much work to be done in understanding the nature of multiple sclerosis, a cure has yet to be discovered. Conventional medical treatment typically focuses on strategies to treat acute attacks, to slow the progression of the disease, and to treat symptoms. Corticosteriods such as methylprednisolone are the first line of defense against acute MS attacks and are administered in high doses to suppress the immune system and decrease the production of proinflammatory factors. Plasma exchange is also used to physically remove antibodies and proinflammatory factors from the blood.

The use of beta interferons is a long-standing MS treatment strategy, originally envisioned as an antiviral compound. Beta interferons reduce inflammation and slow disease progression, but the mechanism of action is poorly understood. Other immunosuppressant drugs such as Mitoxantrone and Fingolimod also slow disease progression, but are not used as first-line treatments due to their severe side effects. More recently, researchers at Oregon Health & Science University have noted that an antioxidant called MitoQ has been shown to significantly reverse symptoms in a mouse model of MS (Mao, Manczak, Shirendeb, and Reddy (2013).

Besides pharmacological treatments, MS patients may benefit from therapies (such as physical and speech therapy) and from an optimized nutritional protocol. Supplementation with Vitamin D, Omega-3 and -6 fatty acids, Vitamin E, lipoic acid, Vitamin b12, and Coenzyme Q10 appear to be of particular potential benefit (Life Extension Foundation, 2013). Until a definitive cause for MS can be defined and a cure developed, such strategies, including hormone therapy, offer possible ways to improve quality of life over the course of disease progression.

Unlike Alzheimer's disease, there does not appear to be a Mendelian variant of MS that will invariably produce the disease in people who have the gene. A somewhat puzzling variable is that MS predominantly tends to occur between the ages of 20 and 50. This appears to exclude approaching MS as a form of immunosenescence. After all, if MS would be a function of the aging immune system, we would see progressively more cases of MS as people get older (or in AIDS patients), ultimately involving many very old people. More likely, MS is a non age-related form of dysfunction of the immune system that is triggered by environmental factors (such as a viral infection). While many discussions about the role of viruses in debilitating diseases like Alzheimer's and MS still suffer from an incomplete understanding of cause and effect, it seems reasonable to conclude that enhancement of the human immune system can greatly reduce disease and improve the quality of life, even in healthy humans.

One potential treatment for MS is to induce remyelination (or inhibit processes that interfere with efficient remyelination). Stem cells can be administered to produce oligodendrocyte precursor cells to produce the oligodendrocyte glial cells that are responsible for remyelination of axons. While the myelin sheaths of these remyelated axons are not as thick as the myelin sheaths that are formed during development, remyelination can improve conduction velocity and prevent the destruction of axons. While the dominant repair strategies envisioned for cryonics involve molecular nanotechnologies that can build any biochemical structures that physical law permits, it is encouraging to know that specific stem cell therapies will be available to repair and restore myelin function in cryonics patients as damage to myelin should be expected as a result of (prolonged) ischemia and cryoprotectant toxicity.

An interesting possibility is that remyelination therapies may also be used for human enhancement if these therapies can be tweaked to improve conduction velocity in humans or to induce certain desirable physiological responses by varying the composition and strength of the myelin sheath in various parts of the central nervous system. ■

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NOTES ON THE CRYOPRESERVATION OF JAMES BEDFORD

By R. Michael Perry

The freezing of James Hiram Bedford on January 12, 1967, was a crucially important event in the early history of cryonics, because it was the first cryogenic preservation of anyone under controlled conditions with the aim of eventual reanimation—the basic goal of cryonics. (A woman had been straight-frozen with some thought of reanimation a few months before this, in April 1966, after embalming and several weeks of storage in a mortuary refrigerator.[1] Bedford's preservation, though very crude by modern cryonics standards, was more credibly the first "true" cryonics preservation since it was planned for and carried out starting with his cardiac arrest, using some attempt at perfusion with cryoprotectant, followed by immediate cooling to cryogenic temperatures.) Much has been written about this landmark event, and it may seem that "enough's been said already" but actually confusion persists, plus there are interesting details that are not usually covered. What follows is my best estimate of what happened from the sources I had access to, with the usual caveat that new evidence might change some of the conclusions, and also, that sources must be used with care and are not always accurate so that judgments once made are open to revision. There is some overlap, particularly in details of the perfusion of Dr. Bedford, with an earlier "For the Record" column,[2] but the material is mostly new.

PHOTO CREDIT: *La Reata* (Glendale Junior College, CA yearbook) 1949, 39.

James Bedford at Glendale Junior College, about 1949

A good starting point for the story is to focus on two dedicated people who were not interested in the cryonics idea for themselves at all but still played a crucial part. Raymond and Mildred Vest were Seventh-Day Adventists who believed in divine intervention in their lives and rented property in Glendale, California, from Dr. Bedford, who was a psychology professor at the local Glendale Junior College, with a side interest in real estate. Though Bedford did not share the Vests' religious preoccupation he respected them because they were honest, paid their rent on time, and also didn't smoke, reducing the risk of fire to his property. In fact they also were nice people, and developed an enduring friendship with their aloof and reserved but respectful landlord. Professionally, Raymond was a physical therapist and Mildred was a practical nurse and also a trained cook. Alternating shifts at nearby Glendale Adventist Hospital, the Vests also used their rented quarters, the ground floor of a two-story house, as a private nursing home for a small number of patients.[3]

PHOTO CREDIT: *The Youth's Instructor,* 20 Jun., 1967, 9.

Mildred and Raymond Vest

On June 28, 1966, Bedford, now a 73-year-old professor emeritus and ill with cancer, wrote a letter to Robert Ettinger. He had read Ettinger's book, *The Prospect of Immortality,* and was impressed. Following Ettinger's proposal, Bedford was interested in taking part in a freezing experiment, in which his remains would be stored at low temperature until, sometime in the future, he might be warmed again, his cancer cured, and any other debilities eliminated. He also wanted to help organize and finance a research program to advance the science of freezing organisms more generally. Ettinger corresponded and encouraged him, but others were critical and Bedford became discouraged, particularly doubting that his body was "worth rehabilitation."[4]

"It is not a question of whether you are 'worth rehabilitating,'" Ettinger firmly told him, "but whether such rehabilitation will be possible. If it is possible, it will certainly be worthwhile—for yourself, for your family, for your friends and for society. While your restoration to health and vigor cannot be guaranteed, it is a goal worth the effort." Encouraged, Bedford rallied and rededicated himself and important family members pledged their support.

Meanwhile others in California had shown interest in the freezing idea, following pioneer Evan Cooper in Washington, D.C., who had organized the Life Extension Society (LES) in December 1963, and who, independently of Ettinger, had written a book promoting what would come to be known as cryonics. One of the California enthusiasts was Robert Nelson who was interested in a more proactive organization than LES was proving to be. On December 15, 1966, the Cryonics Society of California (CSC) was organized, with Nelson as president, following the lead of the Cryonics Society of New York which had been incorporated the previous year.[5]

By late December it was clear Bedford had only a few weeks left to live and preparations began in earnest for his freezing. Nelson's group was contacted but there were problems. Not everybody wanted to be involved in something that seemed so bizarre and might show them in an unfavorable light. Bedford's physician withdrew from the project, as did a mortuary that had offered to assist and could have carried out a perfusion with cryoprotectant in place of the usual embalming solution. Nelson found a new doctor, B. Renault Able, a sympathetic Inglewood physician who had attended some of the LES meetings and had some ideas of his own about how to proceed. Two others who agreed to help were Dr. Dante Brunol (Dante Bruno-Lena), a research physician and biophysicist, and Robert Prehoda, a chemist and reduced metabolism expert. Prehoda in particular was asked to be present at the freezing on behalf of the Bedford Foundation which James Bedford had set up to conduct research into cryopreservation that would benefit society at large. In early January Bedford was moved from his home, where his wife was having increasing difficulty caring for him as his illness progressed, to the Vests' nearby residence, where they or one of them would be available around the clock.[6]

PHOTO CREDIT: B. Renault Able, *Give Us Tomorrow*, dust jacket.

B. Renault Able

Though Bedford was both their landlord and an old friend the Vests were not informed of the freezing plan, apparently to avoid any possible further complications. To them he was another terminal if special patient, to be given the usual care and close supervision until the end came, when a doctor should be present to pronounce death, but nothing more. On the morning of January 12 it was clear to Raymond that the end was very near. Dr. Able was summoned. Bedford's ashen face drained further of color and his thready pulse became imperceptible. With just minutes left the doctor arrived. He made hurried telephone calls, began artificial respiration, and called for ice. With Raymond's help cardiac massage was begun as the heartbeat ceased; heparin was injected to minimize clotting which would impede blood circulation. The time recorded on the death certificate was 1:15 p.m. Dr. Able began to explain about the plan to freeze Dr. Bedford to the incredulous Raymond. "We must keep oxygen on the brain," he said, otherwise deterioration would set in. Meanwhile, cooling was also urgent. "Bring all the ice you can." Mildred emptied the freezer, then raced from house to house outside collecting as much as neighbors would spare. The doctor packed it around his patient, and the temperature dropped lower and lower as he and Raymond alternated between giving artificial respiration and keeping the blood circulating by massaging the heart. After nearly two hours the task of lowering the temperature was complete. A scientific group would be arriving to complete the procedure, Dr. Able said, and there was nothing more for him to do, so he left.[7]

"The patient died?" Nelson was stunned when Brunol relayed the news. Knowing time was short, Nelson had been working virtually without sleep for days to line up equipment and coordinate the effort. Brunol, who would be directing the perfusion using his own equipment and a protocol he had carefully worked out, had also been racing the clock trying to get things in readiness. Ettinger had sent a cardiac compression and lung ventilation machine, the Westinghouse Iron Heart, which could keep blood circulating and tissues oxygenated while cryoprotection was underway. Ed Hope of the Cryo-Care Equipment Corporation in Phoenix, Arizona, maker of the first capsules to hold human cryopatients, sent the son Norman a shipping coffin insulated with plastic foam so the patient could be packed in dry ice for his journey out to Phoenix. There Hope and associates would place him in one of their capsules cooled with liquid nitrogen to begin his journey as a full-fledged "cryonaut."[8]

"It is not a question of whether you are 'worth rehabilitating,'" Ettinger firmly told him, "but whether such rehabilitation will be possible. If it is possible, it will certainly be worthwhile—for yourself, for your family, for your friends and for society. While your restoration to health and vigor cannot be guaranteed, it is a goal worth the effort."

Then just the evening before, Dr. Able had called and given a positive report. It appeared the patient still had about two weeks. Tomorrow, then, would not have to be such a hectic day. The preparations were nearly complete; Nelson needed to pick up a few chemicals, at a place in Los Angeles. On

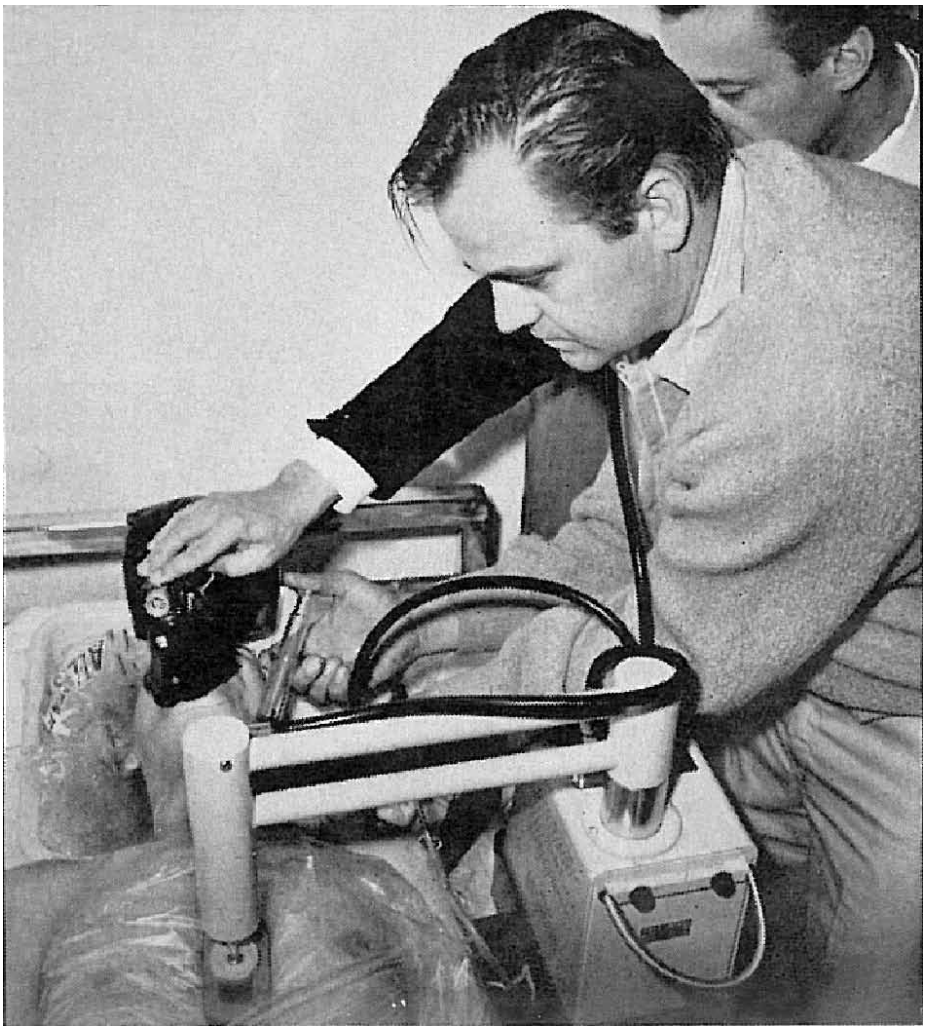

PHOTO CREDIT: *Life* 62(5) 19 (3 Feb. 1967, first version).

Robert Nelson illustrates injection of perfusate at Bedford freezing, Jan. 12, 1967; Dante Brunol (background) holds face mask of Iron Heart, whose piston is positioned over Bedford's chest.

the way there he went by a beach, parked his car, and watched the surfers for a while. Then, about 11 a.m., he went to the small espresso shop where Brunol liked to hang out and they had a brief conference. Nelson would get the chemicals. Brunol would get a couple of catheters he needed. They would meet at the coffee shop again at 2 p.m.[9]

As Nelson drove back with the chemicals, Brunol met him in the parking lot, and was now telling him it was too late, the patient was dead, they had failed. Or had they? Dr. Able had been present, and had taken preliminary steps. Maybe the situation could be salvaged—maybe. Brunol himself was not sure, saying he had wanted to be at the patient's bedside when death occurred. But Nelson convinced him they should proceed, so they hurried in their separate cars over to the Vests. When both had arrived (Nelson first by a few minutes) they started hooking up the Iron Heart. With this apparatus in place, the chest was compressed approximately sixty times per minute and oxygenated blood circulated to facilitate the perfusion of cryoprotectant.[10]

The next step was the perfusion itself. The blood was to be replaced by an antifreeze solution or cryoprotectant to reduce freezing damage to the tissues when, later, the temperature would be lowered below the ice point to the cryogenic range, in this case, ultimately to liquid nitrogen temperature, –196° Celsius. The cryoprotectant to be used, according to various sources, was a solution consisting of 15% DMSO (dimethyl sulfoxide), the active ingredient, and 85% Ringer's solution.[11] (Pure DMSO, though more "active" than the diluted form, is highly damaging to blood cells and thus would have made a poor choice of cryoprotectant which was to be injected into the blood stream.[12]) The actual perfusion would essentially be a process of pumping in perfusate and simultaneously draining out blood or blood-perfusate mixture so that gradually the blood in the body would be replaced by the protective chemical—much as is still done today in cryonics.

The only problem was that the perfusion apparatus Brunol had hastily put together and now brought with him was rather complicated and hard to get working on the short notice he had. Brunol tried or considered (exact details are unclear) but realized it would take some time—too much time, he decided. He was stymied, and wondered whether to continue at all or just give up. Dr. Able called, and when informed of the situation, insisted the perfusion begin at once. (Details are unclear, but it appears Able also took some credit for devising the protocol that would be used, whose particulars Brunol had implemented.)[13]

Just then Robert Prehoda showed up, and the upshot (again details are scanty) was that, rather than give up, a different, much inferior method of introducing the cryoprotectant would be used, in which the liquid was injected into the arteries with a syringe and circulated using the Iron Heart. The blood was not removed as the perfusion apparatus would have done, so cryoprotection would have to depend on the limited effect of dilution of the blood by the cryoprotectant. Additionally, though, there must have been some actual replacement of the blood in view of the extensive bleeding which occurred during the procedure (verified by Mike Darwin when Bedford's frozen body was examined 24 years later). Bedford had died of liver cancer which had metastasized to the lungs, leaving this tissue especially vulnerable. The constant pulsing of the Iron Heart's piston on the chest (sternum), alternately compressing and relaxing the heart to induce blood circulation, also considerably stressed the surrounding tissues and, it appears, produced extensive internal and also external bleeding (from the mouth in particular). The heparinization of the blood to inhibit clotting would also have promoted bleeding. Prehoda later summarized: "During the evening, Dr. Brunol attempted to replace the blood with a 15-percent DMSO and 85-percent Ringer's solution. The primitive equipment

did not allow a precise measurement of DMSO penetration, but the perfusion appeared to be uniform. Photographs were taken of various stages of the perfusion and freezing for the Bedford Foundation private records. The perfusion fluid temperature was below the freezing point of water and the body temperature was approximately 2°C when the perfusion was terminated."[14]

PHOTO CREDIT: *Life* 62(5) 21 (3 Feb. 1967, first version).

Dante Brunol

The perfusate solution was repeatedly injected into the body, maybe fifty to a hundred or so infusions of a few tens of cc's each, while the blood was circulated after a fashion and also leaked out as noted. The carotid arteries in the neck which supply the head, including the brain, (or one of them) were special targets of injection. Just how much perfusate got in and how much reached the brain and where it reached in the brain and elsewhere are unknown. Each injection left a puncture track through which the heparinized blood mixed with perfusate could leak and many such leakages may have accounted for the large "bruised" area noted on the upper torso and throat, during Darwin's examination. The body did not swell appreciably, so arguably the amount of induced perfusate was actually minimal and Bedford's treatment would not have been very different from a straight freeze, despite all the pains that were taken. (DMSO-based perfusate was in fact found consistently to cause edema in other early cases in which it was used, where blood was also removed in a more usual way and a substantial amount of perfusate was pumped in.)[15]

After several hours the perfusion was judged complete. Just before this Nelson had gone to Norman Bedford's home to carry the insulated container sent by Ed Hope to the Bedford residence which was a block away from the Vests'. With the perfusion complete, most of the water ice was removed, and the body was lifted off the bed it had rested on and placed on a quilt in which it was carried outside to a pickup truck. It was taken to the Bedford home, where the son Norman and his mother were now staying, and placed in the Hope container, sandwiched in between layers of dry ice. The temperature would drop to –78°C, where the body could remain for weeks without serious deterioration. It was nearly midnight when the Vests said goodbye to the team with their patient and saw them out the door. They were used to patients dying, you had to accept that if you cared for the terminally ill as they did, but still for them it had been one spooky day.[16]

Bedford spent a few days at various residences, supplied with dry ice to maintain his freezing, then was sent in his shipping container to Cryo-Care Equipment in Phoenix and encapsulated and immersed in liquid nitrogen. His journey from there is well-documented and will not be covered here. Ultimately he ended up at Alcor and is now in one of our dewars. Someday the consequential details of his perfusion should be known, as analysis of his frozen remains is carried out prior to his hopeful resuscitation.

The team that did the freezing, mainly the scientists Dante Brunol and his advisor and assistant Robert Prehoda, were acutely sensitive to the scientific criticism that might follow—their reputations and livelihood could be at stake. The odd circumstances of the perfusion and departure from Brunol's intended protocol were minimally reported.

Brunol's detailed protocol called for an "open circuit" perfusion by pumping perfusate in through catheters inserted in the femoral arteries (one artery in each leg) while blood and body fluids would exit and be discarded through similar catheters inserted in the nearby femoral veins. (An alternative procedure with perfusate pumped into veins and fluids exiting through arteries was recommended for the special task of perfusing the lungs, separate from perfusion of the rest of the body.) This protocol was printed as an appendix in Robert Nelson's recounting of the freezing, *We Froze the First Man*. It was referred to in the book as "the method" that was used, though the summary of what was actually done speaks of injections with a syringe, incongruous to the protocol, and cautions that "theory and practice are widely divided here." Details omitted are that the Iron Heart was used as a substitute for a perfusion pump in forcing (injected) perfusate through the body, and that Brunol had not wanted to proceed to begin with because the perfusion apparatus could not be used as intended. Brunol himself was embarrassed and did not like to talk about what had happened. "I only had a few days to prepare the equipment for the freezing," he reported later. … "The perfusion apparatus was not ready. … Therefore, in my opinion, the method used for Dr. Bedford was very far from being satisfactory. … So I refuse to take the responsibility. This is the reason I refused to meet the press."[17]

PHOTO CREDIT: *Cryonics Reports* 4(1) 8 (Jan. 1969).

Robert Prehoda

Overall, the underreporting of the perfusion process led eventually to accusations of deception,[18] but reticence to avoid a scientific backlash must have

seemed advisable, both to the scientists and to others such as Robert Nelson who were involved at the organizational end. This concern was underscored when a scientific advisory team that had been assembled for CSC before the Bedford case, resigned or otherwise distanced themselves when they learned that someone had actually been frozen.[19] No matter what protocol had or had not been used, human freezing was not supposed to happen until more research would put the whole enterprise on a firmer scientific footing, they insisted. (Freeze-now proponents countered that you lose the patient that way and it's better to proceed with whatever method you have rather than give up on a human life. This controversy has not yet subsided,[20] but today a patient is frozen even when no perfusion at all is possible, rather than just giving up.)

"The body did not swell up appreciably, so arguably the amount of induced perfusate was actually minimal and Bedford's treatment would not have been very different from a straight freeze, despite all the pains that were taken."

At one point during the freezing there was a break in the action, right after Prehoda showed up and a decision had been made to proceed with the perfusion-by-injections but nothing had been done yet beyond getting the Iron Heart in operation. Mrs. Vest had fixed coffee and sandwiches in an adjoining room and invited the team members in. "I think this is a very interesting and wonderful experiment," she said. "I only wish [Bedford's son, Norman] had told us about it before; we could have called you last night and told you he had only a few hours to live, but no one had told us about this."[21]

At this point Mr. Vest, who was devoutly religious like his wife, was moved to comment. "I don't think there is any reason God should not want man to extend his life by any means." Vest felt that by helping he wasn't offending God in any way, though he didn't plan to be frozen himself. A few days later, though, his attitude had turned hostile. "I don't agree with any of this and neither does my wife. [Dr. Bedford] is trying to attain immortality. When God is ready for us to die, I don't believe we should try to outwit him." Nelson reports, however, that the Vests were always on good terms with him. He spoke with them "many times since the freezing and they have reiterated their original sentiments. Perhaps they were worried about offending the pastor of their church, where [Mr. Vest] is a deacon, but [Mrs. Vest] told me that the pastor had preached a sermon vindicating practitioners of cryogenic interment and stating that God would not have made such revelations if he had not intended for man to extend his life in that way." Nelson adds: "Actually, the position of the clergy on cryogenic interment has been more encouraging than that of the scientific community."

The Bedford Foundation, despite its brave intentions, would essentially have to exhaust its funds after the freezing in a legal battle with relatives who wanted the professor thawed, contrary to his wishes expressed in his will. Any funds earmarked for the preservation and related causes would then revert to the estate, that is, to them. The will was upheld and the professor stayed frozen, but the action continued until no funds were left to revert, effectively terminating the Foundation and any research it might have done.[22]

At any rate, Bedford remains frozen and will hopefully stay that way until the great experiment is brought to a successful conclusion and he rises and walks and talks once again—or we find out this is impossible, though I for one am optimistic about his prospects. (More difficult may be the adjustment a reawakened Dr. Bedford must make on learning that so much of the world and the people he knew have, from his perspective, suddenly vanished into nothingness, to be replaced by something new and strange.) Skeptics of the workability of even this early, crude preservation might be reminded that information is relatively hard to destroy, unless such a method as burning or decay is used. Information or its lack—in this case what is encoded mainly in brain structure and defines the personality—is what will be key to a success or failure. Protocols have greatly improved since this early, nearly abortive effort, as has reporting on what actually happened. Hostility has sometimes come from the scientific community, particularly cryobiologists, and also sporadically from government agencies, over various issues, but cryonics has weathered these storms and remains vigorous if still small and marginal. Time is on our side and opportunities persist to show the world that our preoccupation is something it should take seriously. ■

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2. MP.
3. GA.
4. RE, including paragraph that follows.
5. RN1 12-33, 52-54; EC.
6. GA; RE; RP2; BF.
7. GA; RN1, 56.
8. RN1, 55, 59-60; RE; DB1.
9. RN1, 49-50.
10. RN1, 55-56; RA, 42.
11. RP1, 115; RA, 43; confirmed by Robert Prehoda, private communication (audiotaped) 24 Oct. 1991, and Robert Nelson, private communication (email) 9 Sep. 2008.
12. AW.
13. RN1, 57-58; RA, 42; Robert Nelson, private communication (email) 8 Jan. 2014.
14. RN1, 58; RN2; MD1; RE; RP1, 115-16.
15. RN2; MD1; AD; MP.
16. RN1, 59-60; GA.
17. DB1; DB2; DB3. Brunol's quoted material is a composite of quotes from the last two sources, the first from DB2, the remaining, separated by ellipses (…), alternating between DB3 and DB2.
18. MD2.
19. RN2; RP, 100-110 (Ch. 8, "The Lunatic Fringe," critical of cryonics).
20. See, for example, KH.
21. RN1, 58-59, including paragraph that follows.
22. JB.

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In addition I thank Robert Nelson for consultations in preparing this article.

[continued from page 5]

One person we cannot consult is Jerome Butler White (b. 1938) himself. The "good" news is that Mr. White has not passed away but, after a struggle with AIDS, was cryopreserved in 1994 by the American Cryonics Society (ACS) in collaboration with BioPreservation. (He is now stored at the Cryonics Institute.) Some of his other presentations include "The Technology of Cryonic Suspension," Cryonics Conference and Scientific Congress, San Francisco, 1971, and "Heat Flow in the Human Patient," Lake Tahoe Life Extension Festival, 1985.

"We can state with reasonable certainty, though, that White spoke on this topic at the second conference because Saul Kent briefly mentions his presentation in a review of the conference for Cryonics Reports, April-May 1969."

In the internet age it is hard to imagine that any information can be lost forever but we cannot rule out here that only a few individuals who have heard this presentation in 1969 are still alive today (some who have made cryonics arrangements) and that all physical copies may have been (irretrievably) lost. If that is the case, the text of this first paper on viral cell repair of cryonics patients will never be known and we can only speculate on its contents based on the abstract and any recollections of people who were present. One cannot think about this scenario and fail to reflect on the fragile nature of the personal memories stored in our own brains….

Note added by Mike Perry: Someone I know who is a prominent cryonicist thinks he has notes or text for the speech that was given by Jerry White at the 1969 Cryonics Conference. I have been waiting for the scanned document and will report when something comes to light. ■

"Could it be possible that a paper was produced and distributed on a small scale but no copies of the paper have survived?"

The Case for Whole Body Cryopreservation

By Mike O'Neal and Aschwin de Wolf

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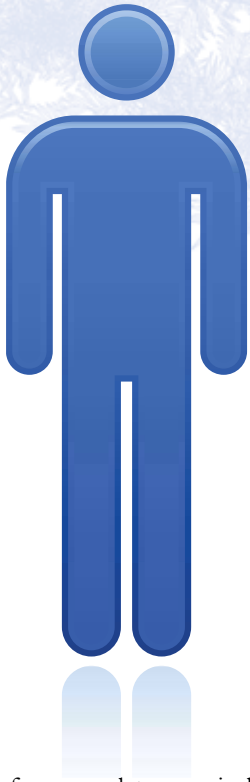

INTRODUCTION

This article presents a number of reasons for preferring whole body cryopreservations over neuro cryopreservations. For those of you who may be new to cryonics, a whole body cryopreservation, as the name implies, involves the cryopreservation and long term care of the entire patient. Neuro cryopreservations are similar to whole body, with the exception that only the patient's brain (encased within the cranium, that is to say, normally the whole head) is placed in long term care.

The intent of this article is not to dispute the validity of neuro cryopreservations. The authors believe that a neuro cryopreservation is certainly immensely preferable to no cryopreservation at all and we fully support Alcor's policy of conversion of whole body patients to neuro cryopreservation in emergency situations.

We are disturbed, however, by the ease with which many Alcor members seem to reach the conclusion that full body cryopreservation is simply a waste of liquid nitrogen and money. Of Alcor's nearly 1,000 members approximately ½ are whole bodies and ½ are "neuros."[1] Even allowing for the economics of the situation, we find it surprising that such a large percentage of Alcor members choose the neuro option.[2]

Each of us must decide for ourselves whether the additional cost of a full body cryopreservation is justified by the perceived benefits. Any informed decision can only be made after careful consideration of the benefits and costs of each option. The Alcor publication: "Neuropreservation: Advantages and Disadvantages" [2] attempts to do just this. The authors of that article, however, seem to be biased in favor of the neuro option. As evidence of this conclusion we would point out that of the 17 paragraphs in the document only 4 seem to present advantages of the whole body approach (paragraphs: 1, 9, 14, 17). To be fair, articles have appeared in this and other publications [3] which favor the whole body approach. Even Mike Darwin's excellent pro neuro cryopreservation article, "But What Will the Neighbors Think?!" [4], devotes substantial space to a balanced treatment of the questions surrounding neuro cryopreservation.

MERKLE'S WAGER REVISED

Before discussing specific technical and social arguments there is one abstract argument that can be made in favor of whole body cryopreservation that follows the same logic as Ralph Merkle's restatement of Pascal's wager in approaching cryonics. But instead of applying his argument to the rationality of choosing cryonics we will apply it to the *forms* of cryopreservation being offered.

This exercise requires us to make a number of assumptions. We need to assume that cryopreservation is conducted under optimal conditions for both cryopreservation options and that there are no other obstacles (e.g., logistical or legal) to resuscitation. The focus here is on how much information preservation is required for complete survival of the person. As can be seen in the table below, whole body cryopreservation will lead to complete survival for the simple reason that it is the most comprehensive cryopreservation option available—at least as it pertains to the person as a *physiological* being. In the case of neuropreservation, only the brain (usually contained in the head) is preserved. Regardless of how much information we need to preserve, the person who has made whole body arrangements will do fine. In the case of neuropreservation the reductionist argument about the brain sufficiently encoding identity must be correct to achieve the same outcome as whole body cryopreservation.

Now, what if we would relax our assumptions a little and allow for some degree of ischemia or brain damage during cryopreservation? It strikes us that this further strengthens the case for whole body cryopreservation because the rest of the body could be used to infer information about the non-damaged state of the brain, an option not available to neuropatients.

	NEUROPRESERVATION IS SUFFICIENT	NEUROPRESERVATION IS INSUFFICIENT
Neuropreservation	**Complete Survival**	**Incomplete Survival**
Whole Body Cryopreservation	**Complete Survival**	**Complete Survival**

WHOLE BODY CRYOPRESERVATION AND IDENTITY

First, it is by no means clear that the body does not contain information critical to the revival of the person. We do not mean by this statement that we reject the fact that the human brain holds a person's mind and personality. What we do mean is that reconstruction of the person as they were immediately prior to cryopreservation may be very difficult, or impossible, without the body.

Most everyone agrees that DNA does not completely specify a person. The argument of those who have selected neuro cryopreservation seems to be that DNA plus the information contained in the brain does specify all of the important aspects the person. But can we really be completely sure of this?

Let us consider the case of identical twins—naturally occurring clones. Since they developed from the same original cell, their DNA sequences are identical. However, twins are not exactly the same. For example, they are not always the same height and they do not have the same fingerprints. Some of these differences, such as height, may be directly attributed to environmental factors such as nutrition and health care. Other characteristics, such as fingerprints, seem less related to environmental factors and suggest that DNA programming may only specify general patterns, with the specifics arrived at in some other fashion. In fact, in recent years the study of epigenetics, which looks at how genes are switched off and on by environmental and other factors and can explain at least some of the differences in the way twins develop, has become a major research focus. Regardless of how these differences arise, it should be clear that a person's physical characteristics are not fully determined from DNA alone.

"So, what is the point?" you might ask. "Surely all of my memories plus an almost identical body would still be me." Perhaps. But what if the details of the central nervous system are not fully specified in the DNA programming?

The typical scenario for reviving a person cryopreserved using today's primitive technology involves reconstructing the person using cell by cell (or molecule by molecule) repair techniques. If whole body procedures were used, the person's entire central nervous system would be preserved. This preservation would not be perfect. There would be damage, perhaps even fractures to the spinal cord. It has been suggested [2, page 3] that because of the likelihood of these fractures there is little reason to prefer a whole body cryopreservation. This argument ignores the fact that repair of a damaged system, even a spinal cord, is likely to be much less complex, and more accurate to the original, than an unguided reconstruction based on DNA alone.

This leads us to conclude that without the original body to serve as a guide, it may not be possible to smoothly "interface" the neuropatient to a (re-grown) body. As mentioned above, the fact that "identical" twins (naturally occurring clones who share the same DNA) are not, in fact, identical proves that DNA does not fully specify our physical form. Thus it is at least plausible to postulate that the differences between our original bodies and cloned bodies may complicate the process of integrating a neuropatient's existing brain and head to a newly cloned body. Even if an approximation of the original connections can be designed, the new body may not "feel" right due to the subtle differences that are sure to exist between the original body and a re-grown one.

Of course we are not claiming that a revived neuropatient wouldn't be the same person if he or she were integrated with a cloned body. After all individuals, such as Christopher Reeves, can survive as the same person for many years after injuries that deprive them of use of their bodies—but no one would claim that these individuals' lives aren't dramatically changed by such incidents. Similarly, skills may have to be relearned by neuro patients after resuscitation. For individuals such as athletes and musicians, where exceptional physical abilities comprise a significant portion of their self-identities, relearning these skills could be tremendously frustrating. Even those of us who are far less physically talented may find relearning how to type, fly fish, ride a bike, or even walk, quite annoying.

Our second point is that the existence of the body may help reduce personality and memory loss caused by a less than perfect cryopreservation.

The physical characteristics of our bodies strongly influence who we are. Our actions also strongly influence the condition of our bodies. We can think of our bodies as a crude physical backup of lifestyle choices, and hence personality. Careful examination of our bodies can reveal the answers to many questions, such as: Did we lead a sedentary life or were we physically active? What kind of diet did we consume? What kind of physical accidents and ailments did we suffer from? What led to clinical death and how old were we when clinical death occurred?

Modern anthropologists can infer much about the lives of our ancestors, and answer many such questions, working only from the clues available from our ancestors' skeletons. How much more information could be gleaned by future experts working with advanced technology and well preserved bodies?

Many people in the cryonics movement have pointed out the need to keep records and memorabilia to back up crucial memories. While this is certainly a good idea, it should be pointed out that information of this type cannot entirely replace the information stored in our bodies, since there is always the chance that our bodies contain important information that we are unaware of. For example, a person may suffer from an undiagnosed medical condition that greatly impacts his or her life. Complete molecular preservation of the body *by definition* gives us the most complete information about the history of our body and its interaction with the brain, regardless of our current level of understanding.

Recently, research has been conducted to understand the "microbiome" and the alleged interaction between gut bacteria and the brain. One does not need to believe that the microbiome is part of the (peripheral) nervous system to recognize that its preservation (and gut bacteria in particular) may provide clues about the brain, (past) mental states, and could be useful to resolve ambiguous brain repair challenges.

One could argue that in the vast majority of cases most information available from an examination of the body would be known to the person and therefore be available in the patient's brain. Even if some memories are apparently destroyed by a poor cryopreservation, many traces of them may remain. Surely, during patient reconstruction, these partial memories will be discovered and enhanced, making whatever personality / lifestyle information that may be contained in the body redundant.

This argument overlooks the very real possibility that technologies to repair a patient's brain may be developed that do not require or provide an understanding of the personality and memory information contained in that patient's brain. This is a very important point. Reconstruction and repair of a brain does not necessarily imply access to the memories it contains.

Perhaps the best way to understand why this is true is to look at "neural net" computers. The connectionist machine or neural network is composed of a large number of simple processing elements that are highly interconnected. These elements are modeled after biological neurons, the basic components of the human brain. Information in such systems is not stored in discrete locations, as is the case in conventional computers, but instead is stored as weighted connections between large numbers of processing elements (i.e., nodes). Machines of this type are often trained to recognize and classify particular patterns.

We can imagine a neural net where the connections between nodes are represented as electrical currents that flow through wires. Our particular machine has been in storage for a long time. When it was being placed into storage some of the wires came loose from their connections. We may repair the machine by reconnecting the wires to their proper connections (assuming we can tell where the loose wires belong). After completing these repairs we should have a fully functioning machine. Of course, we have no idea what patterns it has been trained to recognize. It would, in fact, be very difficult to try to determine what the machine knows without turning it on, since its knowledge exists only as connections between nodes.

The parallels with repair of a human brain after cryopreservation are clear. Just because we can repair a brain does not mean we will understand the person contained in that brain. The point of all of this is that it is unreasonable to expect that during repair memory traces from a damaged brain will be automatically detected and enhanced. Instead, the availability of the original body may prove invaluable in helping the person to reconstruct his or her life by providing a familiar physical environment to ease the transition into resuscitation and by providing physical reminders of memories which may have been partially lost.

QUALITY OF PRESERVATION

One of the most persuasive arguments in favor of neuropreservation is that this option will produce a better cryopreservation. The reasoning here is that when the cryonics organization can exclusively focus on the brain (cephalon) a better outcome will result. Perfusion times are shorter, (abdominal) edema does not present a challenge, and, in the case of isolated head perfusion, better venous return of the cryoprotectant is possible.

A rejoinder to this argument is that one does not need to choose neuropreservation to receive these advantages. One could preferentially cryopreserve the cephalon and after this procedure cryopreserve the rest of the body. In fact, as of this writing, the default procedure at the Cryonics Institute is to perform cryoprotective perfusion with a vitrification agent for the upper body and give the rest of the body a straight freeze. At Alcor it is possible to execute a contract that provides for separate cryopreservation of the head and the body. So it is not accurate to say that one needs to exclude the cryopreservation of the body to get a superior cryopreservation.

Although it is indisputable that isolated head perfusion reduces cryoprotectant exposure time and accelerates cooling, it should be kept in mind that the (alleged) superiority of neuropreservation only holds when cryoprotection procedures remain sub-optimal. If ischemia is minimized and a cryoprotectant was developed that was non-toxic, issues such as exposure time would be less relevant. When you make cryopreservation arrangements you do not just need to assess the technology available at the present time but also consider technological advantages in the future. It should also be stressed that as more people choose whole body cryopreservation cryonics organizations have a greater incentive to perfect this procedure.

We should also mention that it is possible to get the (alleged) technical advantages of neuropreservation without the bad PR (see below) associated with this procedure if one would just preserve the brain. Whereas many people are repulsed by images of isolated heads, the sight of an isolated brain is relatively common in the media and popular science. Brain preservation reduces long-term costs even more than neuropreservation. We suspect that many people would feel more comfortable with a cryonics organization offering brain preservation than with a cryonics organization offering neuropreservation.

PUBLIC PERCEPTION OF NEUROPRESERVATION

Cryonics is a radical concept. As a group we would do well to consider the fact that no individual or organization can survive in isolation. We need the cooperation of others—doctors, lawyers, pharmaceutical companies, liquid nitrogen suppliers… the list is almost endless. Without these people, we are already dead.

The concept of neuro cryopreservation is even more radical than the idea of whole body cryopreservation. Decapitation has historically been associated with death, not life, and thus can elicit a very strong emotional reaction. This seems to characterize one of the author's [O'Neal's] family's views of cryonics. Most of his family does not object to the idea of his being cryopreserved at death. In fact, his sister has agreed to be the executor of his estate. The family's biggest concern was that he would choose the whole body option.

Most of O'Neal's family members, like the vast majority of "reasonable" people, believe that it will never be possible to restore a person from a "frozen head," and find the notion extremely repulsive.

Note use of the word "believe" in the previous sentence. The scenarios generally envisioned for the restoration of neuropatients have been described to O'Neal's family members in some detail, including the apparent necessity of nanotechnology to restore both whole body and neuropatients cryopreserved under today's imperfect conditions. They seem to intellectually understand the arguments, but at some deep emotional level they still don't "believe" it will ever be possible to restore a patient from neuro cryopreservation. At some point it seems that the energy devoted to trying to convince individuals that neuro cryopreservation is reasonable would be better spent first securing buy-in from a larger segment of the population that the underlying concept of cryopreservation itself is reasonable.

The importance of having the support, or at least acceptance, of family and friends concerning our desire for cryopreservation should not be underestimated. There are situations in which hostility towards cryonics by family members has led to substantial delays in the application of stabilization and cryopreservation protocols, and some members have even failed to enter cryopreservation at all due to the objection of family members. Members may be wise to consider whether choosing the whole body option could help ameliorate any resistance that may exist within their own families, as this could have a direct impact on their own cryopreservation.

It is also important to carefully consider the negative PR that can result from cryopreservations involving removal of the patient's head, regardless of whether the body is stored or discarded. A relatively recent example of such negative PR is the controversy surrounding the cryopreservation of baseball player Ted Williams that followed from the publication of Larry Johnson's book "Frozen." It is, of course, difficult to precisely quantify what damage, if any, Alcor experienced as a result of this episode. The authors do note that membership growth at Alcor has slowed dramatically in recent years. One could argue that the negative PR surrounding unfounded allegations about "disrespectful" treatment of William's remains—specifically his head—may be a contributing factor to reduced membership growth.

The authors' personal beliefs are that Alcor, and the entire cryonics movement, would be better served if future members were more strongly encouraged to consider the advantages of full body cryopreservations. Given the obviously deep rooted resistance to neuropreservation, why should we throw another psychological roadblock in our path? Cryonics is a hard sell as it is and expecting people to embrace the conceptual argument in favor of cryonics and also not have a visceral response to the idea of neuropreservation (and Alcor's isolated cephalon perfusion procedure in particular) makes things unnecessarily difficult. In fact, if a person's first exposure to cryonics is through a sensationalist account of a neuropreservation case a substantial number of them will no longer be in the right mindset for a dispassionate examination of the cryonics argument.

One logistical/safety argument in favor of neuropreservation is that the much smaller volume and storage container will make transfer of the patient easier in an emergency situation (such as a natural disaster). It is undeniable that it is easier to move a neuropatient (let alone an isolated brain) but this is a double-edged sword because this also means that it easier to remove or steal a patient. Past experience is not a good indicator which scenario is more likely to occur in the future.

The issue of paramount concern for each of us as individuals is to be cryopreserved at clinical death, and for cryonicists as a group is to increase public acceptance of cryonics—ultimately leading to the establishment of the right to choose cryopreservation as an elective medical procedure for critically ill patients. Once the public and the law acknowledge our right to cryopreservation, then recognition of neuro cryopreservations as a valid option will be much easier. Neuro cryopreservations could be presented as an intelligent fallback position, to be used under circumstances that preclude whole body cryopreservations, rather than as a primary option.

WHOLE BODY CRYOPRESERVATION, SUSPENDED ANIMATION, AND MEDICINE

Ultimately, the aim of a credible cryonics organization should be to perfect the cryopreservation process. If we can offer true human suspended animation, all arguments about the cryopreservation process itself causing damage will no longer be relevant in assessing the feasibility of cryonics. If we can place critically ill patients in suspended animation, the "only" challenge is to develop a cure for their disease (and, in most cases, rejuvenate them).

It is our belief that as cryopreservation techniques approach the level of true human suspended animation (no ice formation, no cryoprotectant toxicity, no fracturing, etc.) the decision to retain only the head and to discard the rest of the body will appear increasingly strange. It is unlikely that mainstream medicine will choose to adopt neuropreservation once reversible whole body cryopreservation has been achieved—at least not until ALL of the issues related to revival of neuro patients (e.g., growing a new body and integrating the patient with that body) have been fully and reliably solved. Until that level of advanced technology is achieved, the concept of "do no harm" will almost certainly yield a decision to practice cryonics in its whole body form. Even given that technology for reviving neuro patients, neuropreservation may continue to be eschewed by mainstream medicine based on the concept of avoiding any unnecessary risk to the patient or the view that neuropreservation does not constitute a "respectful' treatment of the patient.

This brings up another argument in favor of choosing whole body cryopreservation. The more popular whole body cryopreservation becomes, the more Alcor can claim to not just serve its own members but to be involved in developing human suspended animation, which may have many other applications such as long-distance space travel, military medicine, and perhaps even as an alternative for the death penalty.

NEUROPATIENTS HAVE NO FALLBACK OPTION

Another point we'd like to make in this section is that whole body patients have a fallback position that neuro patients do not. One of the primary reasons that whole body cryopreservation is more expensive than neuro cryopreservation is that substantially more money is set aside for long term care of whole body patients than for neuro patients.[3] The rationale for this is straightforward: whole body patients require more physical space inside the storage dewars and more liquid nitrogen for cooling than do neuro patients—they simply cost more to maintain.

While Alcor is very conservative in the financial assumptions used to calculate the amount of money set aside for long term patient care—assuming only an annual 2% real return on investments (return after accounting for inflation), it is always possible that these assumptions may prove to be too optimistic. For neuro patients there are few options for lower cost storage. Whole body patients, on the other hand, could always be converted to the less costly to maintain neuro state, should long term patient care funding prove inadequate to meet the actual costs incurred. In fact, Alcor cryopreservation contracts have always included a conversion to neuro provision for members selecting the whole body option.

Most Alcor officials agree that in light of the possibility that one might want to switch from neuro to whole body arrangements in the future it is wiser to get coverage sufficient for whole body cryopreservation. A welcome consequence of this is that if long-term cryopreservation and resuscitation turn out more expensive than anticipated the member would not immediately drop below the amount required for long-term care and resuscitation.

PRACTICAL CONSIDERATIONS

As mentioned in the previous section, whole body cryopreservation is substantially more expensive than neuro preservation. Currently (January 2014) Alcor charges a minimum of $80,000 for a neuro cryopreservation and $200,000 for a whole body cryopreservation. And these minimums are likely to increase in the future.

While most members fund their cryonics arrangement via life insurance, the cost of a whole body cryopreservation—equivalent to the cost of a middle / upper middle class home in many parts of the country—is substantial. As time passes and members age, the minimum cost of (whole body) cryopreservation generally increases, while the insurability of members tends to decrease—making cryopreservation expensive for the sick and elderly, and whole body cryopreservation unaffordable for many.

One of the authors, O'Neal, has encouraged Alcor to consider a number of changes to increase the affordability of whole body cryopreservations. These include: (1) allowing greater flexibility in funding options beyond life insurance and irrevocable trusts, such as bequests; and (2) adopting less conservative assumptions on the rate of return for whole body long term patient care funds compared to long term patient funds for neuro patients.

An advantage of including cryopreservation funding in a will is that, after clinical death, a member no longer has need of a house, car, or other assets. Some older members who may have substantial real assets but live on limited incomes and are no longer insurable would probably welcome the option of paying for part of their cryopreservation minimums via a bequest.

The problem with wills, of course, is that they can be easily changed by a member—often up to the moment of clinical death. Even after a member is declared legally dead, his or her will can be contested. The end result is that the money for the member's cryopreservation is not "guaranteed" in the sense that life insurance proceeds are. Since cryopreservation is an expensive undertaking and the existing organizations are relatively small they simply cannot bear the risk associated with performing cryopreservation procedures in which payment is questionable.

However, there is a middle ground that dramatically reduces risk for the cryonics provider while enabling members to cover (part of) their cryopreservation minimums via a bequest. Essentially, the upfront costs of patient stabilization, transport, cryoprotective perfusion, and cool down could be paid via a guaranteed mechanism—insurance policy, pre-payment, irrevocable trust, etc.—while the long term patient care funding (over ½ the cost of a whole body cryopreservation) could be provided via a bequest. Thus, a whole body patient could be cryopreserved with little or no financial risk to the cryonics organization as long as funds sufficient for neuro cryopreservation (including long term care) plus a small additional amount to cover possible conversion from whole body to neuro were provided by insurance, trust, or some other guaranteed means. If the additional funding required for long term whole body patient care, funded via a will or other means, were to fail to appear in a reasonable period of time the patient could simply be converted to a fully funded neuro patient.

Another potential approach for making whole body cryopreservation more affordable would be to adopt less conservative investment return projections. Instead of assuming a very low risk 2% rate of return, projecting a 4% or 5% return while adopting somewhat more aggressive investment strategies might be a reasonable strategy given the fact that whole body patients can always be converted to neuro patients should the projected rates of return fail to materialize.

Given that neuro patients do not have the luxury of a fallback position, it is critical that investments for neuros meet or exceed expectations. Because whole body patients do have the conversion to neuro option, failure to meet projected returns on investments would have far less dramatic consequences. If whole body patients' investments underperform, once a certain minimum level of funds is reached, they could be converted to fully funded neuro patients—no worse off than the other neuro patients and no financial burden on the system. Since every whole body member has already agreed to neuro conversion, no change to the existing (or past) cryopreservation agreements would be needed to implement such a policy.

CONCLUSIONS

The authors have presented an "abstract" Merkle's Wager style argument and two technical arguments for preferring whole body cryopreservations to neuro cryopreservations. The first argument described a theory that information contained in the brain and DNA is necessarily incomplete and that the information loss incurred from disposal of the majority of the body may be critical. The second argument postulated that in cases of memory loss, the existence of the body might act as a crude type of memory backup and trigger recall of partial memories that might otherwise be lost.

Four additional non-technical/social arguments were presented. First, in some cases, selection of the whole body option may increase the level of acceptance of cryonics by friends and family members—which could have a direct effect on the likelihood that a member will receive a smooth and rapid cryopreservation—and decrease the chances that his or her wishes concerning cryopreservation will be contested by antagonistic family members. Second, whole body cryopreservations appear less likely to generate the kinds of "sensational" news coverage which can lead to potentially damaging PR as was the case with Ted Williams (and much earlier Dora Kent [6]). Third, whole body patients have a backup plan that neuro patients do not, in that whole body patients can always be converted to neuros if the funds to support long term patient storage ever prove insufficient. And finally, as Alcor's cryopreservation procedures begin to approach the level of reversible human suspended animation, whole body cryopreservation will most likely become the procedure of choice in mainstream medicine.

The cost differential between whole body cryopreservation and neuro preservation was discussed and a number of approaches that Alcor might adopt to help make cryopreservation, especially whole body cryopreservation, more affordable were presented.

In the final analysis each of us must weigh the costs and benefits of both approaches. For the authors, the potential benefits of a whole body cryopreservation far outweigh the additional costs. We find whole body cryopreservations to be the most conservative form of cryopreservation. The procedure is conservative in a technical sense since it retains the maximum amount of information concerning the patient by storing the patient's body. The whole body procedure is also conservative in the social sense as it avoids the negative perceptions associated with decapitation and seems far more "reasonable" to the general public than neuro preservation. Whole body cryopreservations are also more conservative than neuro preservations in that whole body patients always have conversion to neuro as a fall back option in times of financial or other difficulties. ■

ENDNOTES

1 As of December 2013, there were 971 Alcor members. Of these 482 were whole body members (49.6%), 449 were neuro cryopreservation members (46.2%), 26 were "neuro with whole body" (2.7%), and 14 were "open option" (1.4%) – Alcor Membership Report, December 2013.

2 It should be noted that during the 24 years that have elapsed between the original version of this paper and its revision the percentage of Alcor whole body members has actually increased. In 1990 two thirds of Alcor members were neuro cryopreservation members. Today the numbers of Alcor whole body and neuro members are roughly equal.

3 As of January 2014, $25,000 is set aside for neuro patient long term care verses $115,000 for whole body patient long term care. [5]

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[4] "But What Will the Neighbors Think?!: A Discourse on the History and Rationale of Neurosuspension" by Mike Darwin, in *Cryonics*, Vol 9(10), October 1988, pages 40-55.

[5] "Alcor Cryopreservation Agreement – Schedule A: Required Costs and Cryopreservation Fund Minimums," www.alcor.org/BecomeMember/scheduleA.html.

[6] "A Timeline on the Events Surrounding the Cryonic Suspension of Dora Kent" in *Cryonics*, 9(1), January 1988, pages 1-7.

Has Cryonics taken the Wrong Path?

The unnoticed conflict between rescue technology and futurist philosophies.

By Stephen Bridge

A QUIET HERO

A friend of mine died this winter. He wasn't interested in cryonics, but what he didn't do is not the point of this essay. What he did do has saved uncounted lives, maybe including yours. The way this man went about his life has given me a clue to what I think is a major hidden problem with cryonics.

Douglas Crichlow was a year behind me at DePauw University (Greencastle, Indiana) when he arrived as a freshman in 1967. We all thought he was interesting but overly obsessed with fire trucks and ambulances. In my mind, he was just a kid who hadn't grown out of a childhood excitement, unlike me in my sophomoric sophistication. Most of Doug's conversation was about fire departments, emergency medical services, and disaster preparedness. It turned out he was amazingly well-read in these subjects. Remember, in 1967 there were few EMTs, the concept of paramedics was brand new, and CPR was only a few years old. A national training program for EMTs and paramedics didn't begin until 1970. Disaster management was not yet even a concept.

In 1967 ambulance services in all but the largest cities were provided not by hospitals or fire departments. They were provided by the local funeral homes. If you were injured in an automobile accident, the hearse took you to the hospital. The driver had no oxygen, no CPR, no remote understanding of trauma treatment. If you didn't make it to the hospital, well, you were already in the hearse. And in those days, before airbags, shock-absorbing body frames, and high seatbelt use, there were a LOT of fatalities.

Doug was a bit overweight, walked with a limp from a childhood injury, was kind of a nerd, and was a freshman who thought he knew how the world needed to be changed. But he was also amiable, a persuasive speaker, religious without being a pest about it, and well read in a wide variety of subjects. In his favorite subjects, he seemed to have read everything in print.

Doug's enthusiasm about emergency services was contagious with many students, including his roommate, Steve Collier, and several other older students, notably Derrick Warner. The three of them and several other students formed the DePauw Volunteer Fire Brigade. They even talked me into it. The local fire department scoffed at these students—until the local newspaper caught on fire and threatened to burn down Greencastle's entire downtown. 20 DePauw students showed up to haul and man hoses, fetch food for the firemen, and clean up afterward. That made a BIG impression.

By the time Doug was a senior, the DePauw Fire Brigade was an ongoing organization working on fires on campus and around the city. (It still exists today, and this initial cooperation between "town and gown" was so successful that every DePauw student now has a requirement of community service.) By this time Derrick had graduated and was living in Greencastle, so he, Steve Collier, and Doug turned their attention to the problem of no ambulance service in Putnam County. When they could not persuade the City Council, the fire department, or the hospital to begin ambulance service, they bought an ambulance on credit and started their own service, showing up at accidents. When they began saving lives, other people noticed. The organization they started, Operation Life, still provides ambulance service in Putnam County. Doug was obsessive about the details. He wrote SOPs (Standard Operating Procedures) for everything his team did. When he couldn't find training manuals for his EMTs, he called experts all over the country, and then typed up his own manual.

After the Blizzard of 1978, Doug moved to Indianapolis to become Director of Emergency Management and Civil Defense. In 1983 he formed his own consulting company and became a nationally known expert in the field of emergency preparedness. In 1985 his company organized and hosted in Indianapolis the first World Conference on Disaster & Emergency Management which attracted government, fire, police, and medical leaders from all over the United States and 20 other countries to discuss the planning, coordination, and response to major disasters such as hurricanes, earthquakes, floods, and terrorism. Unfortunately, emergency medicine wasn't able to save Doug himself. He died suddenly of cardiac arrest this year; just a week after his mother had died of cancer.

You won't find much about Doug Crichlow on the internet, although one important summary of modern disaster management approaches is available at: http://www.americancityandcounty.com/mag/government_taking_comprehensive_approach/index.html

However, hundreds of people influenced by Doug are now fire fighters, EMTs, emergency room physicians, and emergency management directors for

towns and cities all over America. He didn't invent emergency services; but if you are ever injured with your life in danger, and an ambulance with trained EMTs or paramedics shows up to rescue you—instead of a hearse and mortician, you can thank Douglas Crichlow and a handful of others like him.

"I wasn't open to ideas about changing the world until 1976 when I met a somewhat similar missionary for saving lives—Mike Darwin."

COMPARING EMS AND CRYONICS

Although I helped on the student fire department, I wasn't much under Doug's influence at college. At the time, I was deeply into my major of theatre and just not that interested in fighting fires and saving lives. In retrospect, I think I was also too ignorant about the world and not ready to notice what needed to be changed.

I wasn't open to ideas about changing the world until 1976 when I met a somewhat similar missionary for saving lives—Mike Darwin. Like Doug, Mike was well read in many areas and intensely well read in the things that interested him most: cryonics/cryobiology and emergency medicine. He had a reserve of energy that seemed inexhaustible and he could argue his points persuasively. And by 1976, there had been a couple of deaths in my family, and my mother and both grandmothers would die in the next year and a half. Mortality was sitting on my couch staring at me every night and I was ready to listen to Mike telling me there was a solution.

Today emergency medical services are available just about everywhere in the United States. Most fire fighters in Indiana are also EMTs and trained to save lives. If you want to do emergency medical work for a living, there are dozens of programs ready to give you the chance to learn. Every large city and most medium-sized ones have a disaster plan and do disaster drills. Doug and his peers have had an obvious and lasting effect on the world.

Cryonics, on the other hand, is in some ways still stuck in the 1960s. It's not popular and still looks like a cult to many people. So far it does not appear to be on its way to having a lasting effect on the world. A handful of people have labored mightily to bring forth a lot of suggestive evidence but not much proof that they can achieve what they plan. Why did EMS succeed while cryonics success has stalled?

Emergency medical services (EMS) have not been around too much longer than cryonics, yet the idea quickly moved into the mainstream of American life. The most important reason is obvious—EMTs, paramedics, ambulances, and trauma centers get immediate results. It doesn't take long to prove that the medical model saves more lives than the mortuary model. After 40 years of emergency work, EMS personnel can point to millions of rescued people, living witnesses to the success of the model. It is straightforward, easy to understand, easy to assimilate into your life. Yes, these people will still die anyway, just at older ages, unless technologies like cryonics can intervene. But cryonics has no rescued patients going on television talk shows to show that cryopreservation rescued them, and we won't have any such witnesses for decades at least. "Hey, guys, we can now preserve cells a whole lot better than we did last year," just doesn't have the same effect as living people telling how they were "miraculously" saved by the paramedics.

There is another very subtle difference that might play into the different levels of success, however—a difference in the main players. As unusual as Doug Crichlow seemed to me at that youthful stage of our lives, he was still much more in the mainstream of American life than was anyone in cryonics then—and few, if any, cryonics leaders could be said to be part of the American mainstream since that time. Doug was a moderate Republican and he became a respected and successful government leader and businessman. He had a long, loving marriage to his wife and was the devoted father of two daughters. He was a sincere Christian without being confrontational about it. He had no goal for his work other than to save lives. He treated emergency medical services as the standard service every community should provide and he didn't load the idea down with considerations of politics, religion, or race. There were no Bible verses printed on the sides of the ambulance; no "free Gospel reading with every rescue." It was just good medicine.

In contrast, just about all of the early leaders of cryonics had some combination of extreme minority views and were "outsiders" in many ways. Most could be labeled as rebels—atheist or agnostic, libertarian or Randian or even anarchist, and they usually had family relationships outside of what most Americans consider the "ordinary" way to live (one-partner, heterosexual marriage with children). A large percentage of cryonics leaders and cryonics members have been childless couples, long-term singles, or homosexual.

Even more importantly, Robert Ettinger and many others of the early advocates for cryonics proclaimed that cryonics was part of a radical change in human nature, that humans would eventually turn into something "beyond" human—immortal, omniscient, space traveling super-beings, maybe in the form of robots or computer software. The concept of cryonics as an especially advanced form of emergency rescue service became clouded in a fog of transhumanist evangelism. I have even heard people argue that they support cryonics because they think it will help to overturn religion. For an immense percentage of Americans, these concepts are bewildering or even terrifying. "Our grandchildren are not going to be human? And these people want to destroy our religion? What kind of crazy people want that?" How could we expect that people turned off by what they see as weird or offensive futurist ideas would be turned on to the concept of cryonics? Who wants to be part of a future that will be inhospitable to their beliefs and ideas—led by the people who are often gleefully telling them this?

While this was certainly not the intent of Robert Ettinger, cryonics may have veered from being a mainstream medical rescue technology almost from the beginning. "Like calls to like." Perhaps the personalities

and attitudes of cryonicists in the beginning actively put off the mainstream and only appealed to other people swimming down a narrow waterway off to the side.

It would be interesting to replay history and see what would have happened had, say, Doug Crichlow and Mike Darwin met at the right time in their lives. Would they have bonded and worked together in their common interest in saving lives? Their combined knowledge and drive could have had a dynamic effect on others. Or would their personalities and very different philosophical views have bounced them apart like the opposing poles of magnets? Would a more mainstream, Christian, family-oriented approach to cryonics have made a difference to the early success of cryonics? If Robert Ettinger had been a religious, observant Jew, could this idea have become a part of general medical culture, or even become popular with a particular sub-group of American Jews? Or is the concept itself too far beyond the mainstream to have ever appealed to the people that Doug Crichlow got involved in his grand idea? Could anyone with a personality and background much different from Robert Ettinger have even come up with the concept of cryonics?

"The concept of cryonics as an especially advanced form of emergency rescue service became clouded in a fog of transhumanist evangelism."

We were who we were, of course, and we can't go back and change that; we can only go forward from where we are. But we can become more aware of where we are. The really interesting thing is that these options still face us; although I don't think we have ever called these choices "options" before. We can still choose where we will place our focus for the next two decades—how much emphasis to place on medical rescue, how much to stick with our appeal to futurists and computer technicians, how much to appeal to the mainstream culture.

Note that these choices we have to make are not mutually exclusive. We must increase our understanding and ability to handle the medical end of cryonics. If we wish to attract more mainstream members, we want to do so without losing the futurists among us. But we need to make these decisions consciously and be aware that they are decisions.

TRANSHUMANISTS, FUTURISTS, AND CRYONICS

Would a greater emphasis on medical rescue have made cryonics more popular? How much was the public and medical involvement with cryonics damaged by its association with the concepts of physical immortality, future superhumans, expansion into space, libertarianism and anarchy, and an underlying antagonism toward religion and "traditional family values"? Would ambulance-based rescue services have been given a chance if presented with such philosophical baggage?

Mike Darwin and others liked to shock friends with scenarios of what options might exist for future humans: group sex in free fall; the ability to change genders daily or to choose the "hermaphrodite option;" the ability to make immense changes to one's brain, like implantable language chips or pleasure switches; the ability to make startling changes to one's body, like functional wings, blue fur, or replacing your skull and other bones with titanium. Keith Henson's favorite scenario was making ten thousand duplicate copies of himself and sending them out into the galaxy to explore. They would all meet in a few millennia for a party on the far side of the galaxy to share information, swap tales, and plan their move to other galaxies. It was interesting to watch the division at parties, as some people moved toward Mike, Keith, and others and as just as many moved into other rooms completely.

Of course, these very ideas attracted many people to cryonics in the early years. Many of these people didn't care about or even completely understand the basic purpose of cryonics—to save lives. They simply saw it as part of something that was interesting to talk about or possibly just as a tool that they might be able to use to get them to a future that interests them more than today's reality. And since they were most interested in the future, they often did not spend enough time in the present to focus on the hard tasks of learning physiology and chemistry, getting EMT/paramedic training, writing technical reports, evaluating procedures, doing both laboratory and literature research, and the other nitty-gritty daily details necessary to make cryonics a survival technology where success means "saving lives." Instead, too many of them (including me) focused on how to make cryonics popular, where success means "gaining members."

Now I must admit that some of these visions of the future attracted me to cryonics: Even though I had read science fiction for many years, this was the first time that I actually envisioned myself as part of the future. And in 1977, it was easy to get into cryonics "on the ground floor," to see that I could be a major part of changing the world. Cryonics was not only a solution to a problem of life and death; it was a grand adventure and a chance to defy authority (that was my generation, remember).

So I am stuck here with contemplating whether or not another pathway would have been better for the success of cryonics, while acknowledging that that pathway might well have not attracted me to cryonics at all. And I must contemplate how much the choices of my friends and myself over the past 25 years have prevented or delayed the success of cryonics, as well as how they have advanced it.

And I must further admit that an over-emphasis on future technology is probably inherent in the very concept of cryonics. We cannot rescue our cryonics members now. That can only be done by medical personnel of the future. We are attempting to move these patients through time to a hospital of the future. Before we invest our money, our time, and our very lives in such a speculative pursuit, we have to imagine the kinds of futures that will allow for success. For the limited technological and scientific understanding of most humans, however, these futures do not appear to be in any conceivable straight line from today's reality. And most people simply do

not have the imagination to conceive of how the world could change in 100 years or more. Even the writers of science fiction and futurist speculation, whom one would think would have a better grasp on the future, have trouble developing a plausible, coherent vision of a future reality, with rare exceptions.

EMS only has to rely on 30 minutes into the future, the time for transportation and for the hospital to be ready for the patient. They don't concern themselves with 100 years in the future. Perhaps we are at a point in the development of cryonics where we should put more emphasis on the first 30 minutes and less on the next 100 years.

"We can still choose where we will place our focus for the next two decades—how much emphasis to place on medical rescue, how much to stick with our appeal to futurists and computer technicians, how much to appeal to the mainstream culture."

WHERE ARE THE MEDICAL PERSONNEL?

We understand—or should understand—that cryonics is not about saving "dead people." It is about redefining the limits of "death." Cryonics is the last step of medical technology, not an alternate type of storage of the dead. "Death" means a permanent cessation of life. If a comatose patient is labeled as "brain dead" by physicians, yet eventually wakes up and resumes his life, the newspaper headline should not be, "Brain-dead patient revives!" It should be, "Patient mistakenly labeled as brain-dead revives!" Likewise, if cryonics works and these patients are eventually resuscitated to their conscious existence, then we can show that they also were "mistakenly labeled as dead."

So, where are the medical rescue personnel in cryonics? Over the past 40 years of this endeavor, perhaps no more than a dozen people who had a deep scientific understanding of the principles of cryonics have actually committed themselves to the scientific research or medical rescue aspects of cryonics. And only three of them (Jerry Leaf, Mike Darwin, and Steven Harris) started from a physical medicine background (and only Harris had an M.D.). Yes, other physicians have been members or board members, but most have had specialties in psychiatry and were involved much more in the business and promotion side of cryonics than the medical side. (Alcor has had other paramedics and nurses as employees and volunteers; but none have stayed involved long enough to provide many solid long-term contributions.)

Why have the medical people avoided cryonics? Certainly there has been little money in cryonics, especially compared to medicine. Leaf, Darwin, and Harris accumulated a lot more stress than wealth from their involvement in cryonics (approximately Stress = 100; Wealth = 0). And most medically-trained people, like most other mainstream-focused, educated people, don't want to be involved in something as "socially unacceptable" as cryonics has been over the years. The publicity for being involved in cryonics cases has been risky for several medical professionals. But this cannot explain it all. I have met many paramedics, EMTs, nurses, and physicians over the years and quite a few of them were willing to take chances in other areas of their lives, taking business risks, publicly supporting unpopular causes. Cryonics is about saving lives. Why haven't more of these people jumped into helping us?

It's a long list:

1. We still haven't done a good enough job explaining how cryonics fits into the field of medicine. Too many medically trained people don't "get" cryonics, don't see where the "life-saving" comes in.

2. Even for those medically trained people who do "get cryonics," we haven't placed our focus on the medical requirements, so these bright people don't see where their niches are.

3. Cryonicists on average have not been nearly as welcoming of medically trained people as we would like to think we have. Some Alcor administrators over the years have been actively hostile to medical people or generally hostile to bright people with new ideas. Yes, these ideas are often naive and simplistic, but none of us automatically understood the subtleties of cryonics the first time we heard about it, either. Others gave us the chance to learn. Can we do less for physicians and nurses?

   Even worse in some ways may have been people like me when I was Alcor's President. Under my leadership, we talked about needing medical personnel; but we weren't ready to receive medical volunteers and employees because we had no plan for using them. We certainly missed out on people who could have helped us. Active hostility can be attributed to the problems of an individual. But lack of preparation and the lack of a plan for bringing in new technical volunteers or employees lower the reputation of the entire organization and even cryonics in general.

4. The very fact we can't show that cryonics produces "survivors" removes some of the excitement and motivation for why most emergency personnel choose their jobs — saving lives is exciting and gives the rescuer a strong sense of pride. Many medical personnel in general get much of their sense of self-worth from helping people recover. A patient saying "thank you for helping me" is a motivation as strong as income. Waiting a century or two for the thank-yous is probably not going to provide the same emotional rush. As one medical student said to me, "I just can't get excited about patients who don't talk back."

5. Several people have written in the past that one of the biggest problems with improving cryonics techniques is that we can get very little feedback. We can't show better survival results from changing techniques, even if we tried them on animals, because the set of processes of dying, fluid replacement for cryoprotection, and cool-down to storage temperature has so many variables. And since we don't know how to revive even animals from cryopreservation, the end result of one research project can look pretty much like another. (Yes, we can show small incremental improvements in certain narrowly-defined details, but nothing that will impress people outside of cryonics.) In medicine, success or failure can be measured in terms of "who survives and for how long." We don't have that in cryonics, and it is frustrating for everyone. Why become a medical rescue person in cryonics if you can't tell if you are making a difference with your knowledge and your presence?

6. We only do 2-5 cryopreservations a year. Rescue workers can do that many rescue cases on one busy day. Emergency room physicians can have that many cases going on at the same time. Even if we had rescue personnel as full-time or part-time employees, how do we keep them busy? Giving tours? Measuring chemicals? Since we have too few suspensions, we would have to do animal research to keep people usefully occupied and to learn techniques and build teams—which is expensive and uncertain and maybe pretty useless unless you already have the medical/scientific people in place doing the planning. Many people have told cryonicists that they need to do more animal research, like Mike and Jerry used to do. The expense of research is a major difficulty, of course, but the costs may not be where you think they are. We could find the money for any individual experiment. But the federal and practical requirements for doing animal research are much more difficult to follow than they were 25 years ago. You pretty much need a full-time person just to make sure you are following all of the reporting and filing requirements, plus the requirements for animal care and handling, medical waste handling, and security of your medications. Many cities are hostile to animal research and will add extra requirements or simply refuse to permit it at all. And we must not forget that doing animal research in the same facility in which you care for your patients will subject those patients to higher risk from animal research protestors. Mike Darwin once pointed out, quite rightly, that our need to protect our patients has made cryonics organizations much more conservative and less likely to take risks than we were 25 years ago. It may be time to increase the further legal and physical separation between patient care, suspension rescue teams, and research. In order to make progress, someone has to be able to take risks.

7. Cryonics' dependence on future technologies — that might take a century or more to develop — distances the result from the action so far that the results are beyond the manageable limit of most people's imaginations. It becomes hard to take the concept seriously, and this distance probably works to take away the sense of urgency for the younger cryonicists and younger medical personnel alike.

8. Cryonics organization staff are also distanced from the results and may be willing to make and tolerate more mistakes because "our friends in the future" will take care of everything.

9. Our emphasis on telling everyone how great things will be in the future both chases people away by making us sound like a cult and takes energy and time away from what our focus should be—making sure that we are doing well enough with rescues, perfusion, and cool-down today that we can be confident we ARE saving individual lives and not merely DNA for cloning.

10. I'm not sure if this one is more cause or more effect. Jerry Leaf and Mike Darwin also had that incredibly valuable obsession with soaking up knowledge and with getting the details right that the best medical personnel have. Such obsessions are time-consuming, expensive, and annoying to those who are not similarly obsessed. This approach doesn't make for big jumps in capability because it focuses on small steps—a thousand preparations before the first small step, and a thousand more for every step after that. It's not sexy; it doesn't make for good public relations stories; it doesn't get the non-medical people excited and involved. It's hard work. I see a severe shortage of these obsessions in cryonics organizations today. It's the sort of thing that Doug Crichlow did well. And in the EMS field, it eventually impressed the medical personnel and government officials.

11. And finally, there is one possible reason that is so big that "Number 11" is inadequate to label it. This may be a difficult truth for some of us to accept—we may chase away medical personnel and other helpful people because we are so focused on ourselves.

Almost everyone who has committed themselves to working in cryonics has done so because they wanted this idea to work for them—they wanted to save their own lives. Sure, they were willing to let other people get their lives saved, too; but they

didn't get involved in order to do good for others. And therefore many cryonicists, and even cryonics organization staff, may stop well short of the maximum effort needed to make this idea work. Doug Crichlow was primarily motivated by saving the lives of other people. So are most emergency medical personnel. They never run out of people who need help and so they never run out of motivation to keep going.

We may not be able to get many medical people involved in cryonics if it remains primarily about saving ourselves. I still maintain that the decision makers, public speakers, and Directors for cryonics organizations should be suspension members of that organization. But we need to make room in cryonics for medically trained people whose major motivation it is to help others. They may be the ones who bring new knowledge and innovations and who care about the details, because it is the right way to do things. And to get these people, we must change our approach to the other problems I listed above.

WHERE DO WE GO FROM HERE?

I am not trying to promote one cryonics organization over another in this article. I write more about Alcor because I know it best. But I want to emphasize that there has never been a cryonics organization with more than 3-4 people at one time actively promoting and developing medical and scientific improvements. Even today, after four decades, no organization is better than one traffic collision away from a major loss of biomedical understanding and capability. No current organization looks marginally competent when compared to even a tiny hospital in a rural town.

Most employees and Directors of all of the cryonics organizations are people who became interested in cryonics because they are interested in the future and want to stay alive as long as possible. They became actively involved because they are responsible people and they didn't see anyone else stepping forward. But they are typically writers, business owners, attorneys, accountants, life insurance sales people, etc. with the occasional engineer or computer specialist (and one librarian) tossed into the mix. They are not medically inclined and may not appreciate the medical issues and the need for detail involved.

Today's organizations must take the initiative to make cryonics not just popular, but to make cryonics WORK. This might mean turning down interviews, spending money on research instead of ads, maybe even placing less focus on membership growth because management time and financial resources are going into upgrading our rescue capability instead.

"EMS only has to rely on 30 minutes into the future, the time for transportation and for the hospital to be ready for the patient. They don't concern themselves with 100 years in the future."

OUR CHOICES

I expect a lot of disagreement with my proposition and I encourage you members to express your opinions. We must have that discussion now. If no one is interested in follow-up to this article, then I may as well devote the rest of my days to gardening, home repair, and dusting my book collection. I always thought that my cryonics participation would return results in an increased chance of a long lifespan and adventures in the future. But I'm no longer so confident, and I'm no longer sure that I made the best decisions when I had the opportunity to lead.

Let's look at one key decision that was made a year ago as an example of the confusion we are faced with. Alcor hired a promotion/production company to produce a DVD for Alcor. It is called *The Limitless Future:* a documentary exploring mankind's quest for a long and healthy life. This production is basically a well-crafted infomercial about cryonics; very obviously aimed at making a more mainstream audience comfortable with the basic concept. I (not being mainstream) felt very uncomfortable after I saw it the first time but I didn't know why. I showed it to a young friend who had just been introduced to cryonics and who had watched the Discovery Channel documentary *(Immortality on Ice)* a couple of weeks previously. She put her finger on the problem right away—it was an attempt to appeal to the people least likely to be interested in the concept. She said that even with all of the fine camera work, narration, and intelligent heads on view, it was less interesting than one live lunch with a real cryonicist. Where was the sense of adventure, of changing the world?

So here I am in this article arguing against too much emphasis on that futurist radicalism that got me involved in the first place. But that doesn't mean I am now happy with the focus of *The Limitless Future.* I am still uncomfortable with it; but I have added a second reason—it doesn't make a good case for cryonics being a workable part of emergency medicine. But then we as cryonicists haven't given the producers anything in that direction to promote, except for a vague dream of the future.

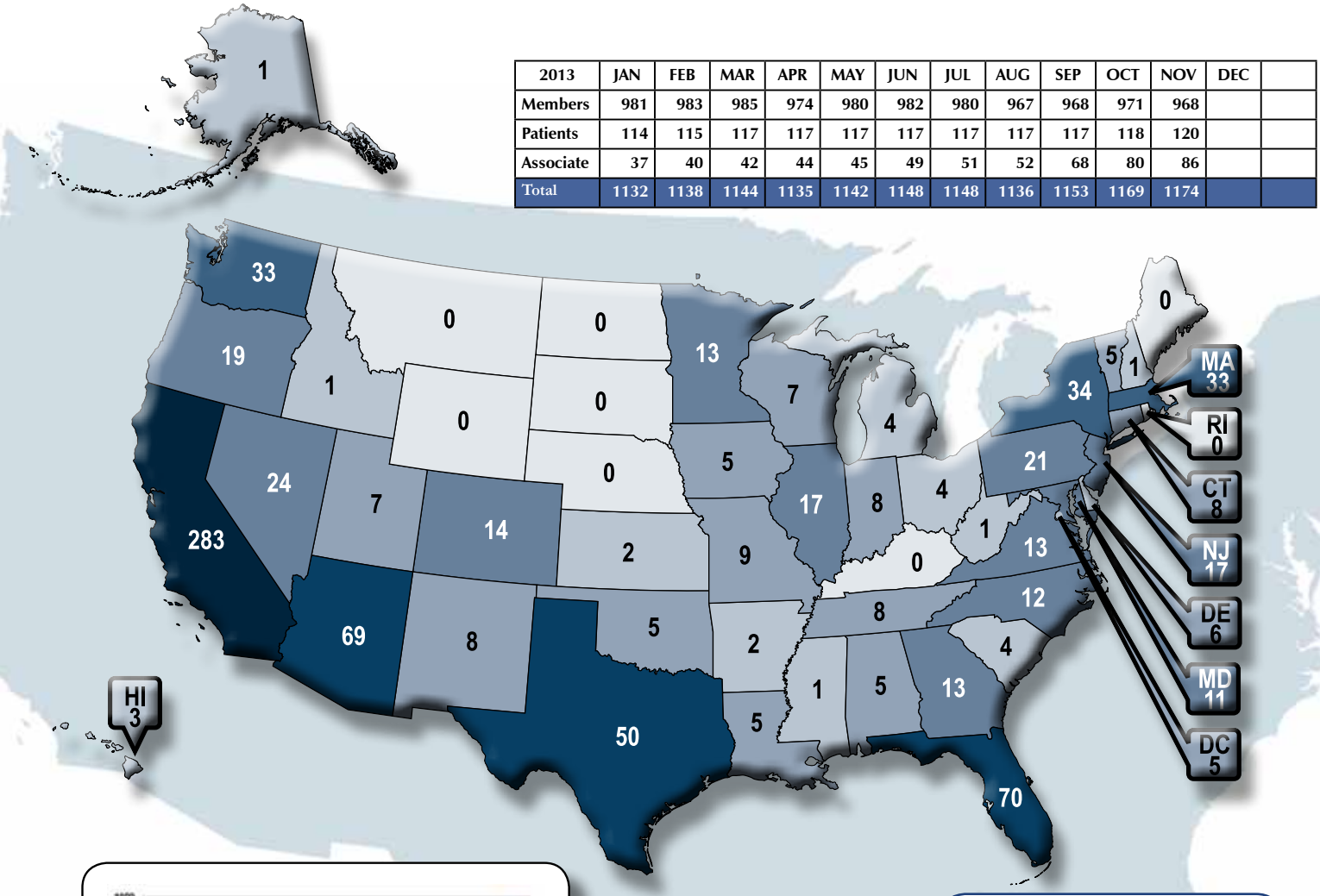
What do you say, Alcor members (and other cryonicists)? Do we put our energies into medical rescue? Do we push back all of our talk about transhumanism, uploading, the Singularity, politics, and conflicts with religion? Or do we focus on the high tech community and talk more about the future? Do we try to appeal to the mainstream of the English-speaking world? Do we try to broaden our focus beyond ourselves?

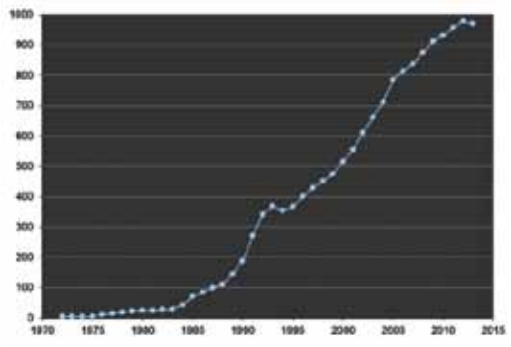
Remember, the question is not, "What do you want us to do?" The question is something that should be much more important to you—"What approach will be most effective in saving lives?"

This article was written in April, 2006, and published on the Alcor News blog on August 15, 2006. It is made available for the first time in Cryonics *magazine to stimulate further debate on this topic.* ■

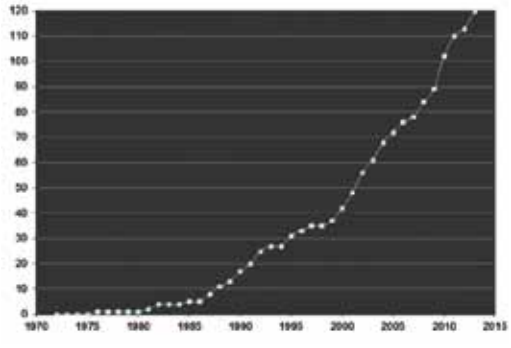
Membership Statistics

2013	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Members	981	983	985	974	980	982	980	967	968	971	968		
Patients	114	115	117	117	117	117	117	117	117	118	120		
Associate	37	40	42	44	45	49	51	52	68	80	86		
Total	1132	1138	1144	1135	1142	1148	1148	1136	1153	1169	1174		





Number of Alcor members



Number of Alcor patients

- 0 Members
- 1–4 Members
- 5–9 Members
- 10–24 Members
- 25–49 Members
- 50–74 Members
- 75+ Members

International

Country	Members	Patients
Aruba	1	0
Australia	13	3
Canada	40	2
Denmark	1	0
Germany	4	0
Israel	1	1
Italy	2	0
Japan	1	0
Lebanon	1	0
Mexico	4	0
Monaco	2	0
Netherlands	2	0
New Zealand	2	0
Norway	1	0
Portugal	4	0
Spain	2	1
Thailand	3	0
United Arab Emirates	1	0
United Kingdom	21	2
TOTAL	**107**	**9**

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VASCULAR BENEFITS OF A Mediterranean Diet

VALIDATED IN HUGE NEW STUDY

A large, rigorous study published in the ***New England Journal of Medicine*** confirmed the health benefits of those who switch to a **Mediterranean diet** rich in **omega-3 fish oil** as well as protective nutrients called polyphenols found in **olive oil**, fruits, vegetables, nuts like walnuts, and wine.[1] The study ended early because the benefits were so overwhelming, with startling benefits for vascular health, that it was considered unethical to continue to deprive the control group.[1]

In addition to the health-promoting benefits of vegetables and fruits with their abundance of polyphenol nutrients, the Mediterranean Diet group took at least **4 tablespoons** of polyphenol-rich extra-virgin **olive oil** a day.[1]

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Starting in **2005**, Life Extension members began taking a supplement (***Super Omega-3***) that provided potent concentrations of **fish oil** and **olive polyphenols** like hydroxytyrosol and oleuropein. This supplement also provided standardized **sesame lignans** to support the beneficial effect of omega-3 fatty acids in the body.[2]

Olive oil contains polyphenol nutrients that have demonstrated wide-ranging health benefits.[3-5] The recommended twice daily dose of **Super Omega-3** supplies a similar polyphenol content to that found in **4 to 6 tablespoons of olive oil.**

SUPER OMEGA-3 WITH SESAME LIGNANS AND OLIVE FRUIT EXTRACT

To ensure the purest, most stable, and easy-to-tolerate fish oil, **Super Omega-3 EPA-DHA** is *molecularly distilled.* It enjoys the highest **5-star rating** for **purity**, **quality,** and **concentration** from the renowned ***International Fish Oil Standards*** program.[6] The **sesame lignans** not only direct the omega-3s toward more effective pathways in the body, but guard the delicate fish oil from oxidation.[2,7]

A bottle containing 120 softgels of **Super Omega-3 EPA/DHA with Sesame Lignans and Olive Fruit Extract** retails for $32. If a member buys four bottles, the price is reduced to **$21** per bottle. If **10 bottles** are purchased, the cost is **$18.68** per bottle. (Item #01482)

The daily dose (four regular size softgels) of Super Omega-3 EPA /DHA with Sesame Lignans & Olive Fruit Extract provides:

EPA (eicosapentaenoic acid)	1,400 mg
DHA (docosahexaenoic acid)	1,000 mg
Olive Fruit Extract [std. to 6.5% polyphenols (39 mg), 1.73% hydroxytyrosol/tyrosol (10.4 mg), 0.5% verbascoside/oleuropein (3 mg)]	600 mg
Sesame Seed Lignan Extract	20 mg

Item #01482

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CAUTION: If you are taking anti-coagulant or anti-platelet medications, or have a bleeding disorder, consult your healthcare provider before taking this product.

Supportive but not conclusive evidence shows that consumption of EPA and DHA omega-3 fatty acids may reduce the risk of coronary heart disease. IFOS™ certification mark is a registered trademark of Nutrasource Diagnostics, Inc. These products have been tested to the quality and purity standards of the IFOS™ program conducted at Nutrasource Diagnostics, Inc.

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Turning Off the "Aging Genes"

Restricting calorie consumption is one of the few proven ways to combat aging. Though the underlying mechanism is unknown, calorie restriction has been shown to prolong lifespan in yeast, worms, flies, monkeys, and, in some studies, humans. Now Keren Yizhak, a doctoral student in Prof. Eytan Ruppin's laboratory at Tel Aviv University, and her colleagues have developed a computer algorithm that predicts which genes can be "turned off" to create the same anti-aging effect as calorie restriction. The findings, reported in *Nature Communications*, could lead to the development of new drugs to treat aging. Researchers from Bar-Ilan University collaborated on the research. "Most algorithms try to find drug targets that kill cells to treat cancer or bacterial infections," says Yizhak. "Our algorithm is the first in our field to look for drug targets not to kill cells, but to transform them from a diseased state into a healthy one." Prof. Ruppin's lab is a leader in the growing field of genome-scale metabolic modeling or GSMMs.

American Friends of Tel Aviv University
2 Jan. 2014
http://www.aftau.org/site/News2?page=NewsArticle&id=19593&news_iv_ctrl=-1

Living Brain Cells Made from Deceased Alzheimer's Patients' Brain Tissue

Scientists at The New York Stem Cell Foundation (NYSCF) Research Institute, working in collaboration with scientists from Columbia University Medical Center (CUMC), for the first time generated induced pluripotent stem (iPS) cells lines from non-cryoprotected brain tissue of patients with Alzheimer's disease. These new stem cell lines will allow researchers to "tum back the clock" and observe how Alzheimer's develops in the brain, potentially revealing the onset of the disease at a cellular level long before any symptoms associated with Alzheimer's are displayed. These reconstituted Alzheimer's cells will also provide a platform for drug testing on cells from patients that were definitively diagnosed with the disease. Until now, the only available method to definitively diagnose Alzheimer's disease that has been available to researchers is examining the brain of deceased patients. This discovery will permit scientists for the first time to compare "live" brain cells from Alzheimer's patients to the brain cells of other non-Alzheimer's patients.

NYSCF Research Institute
7 Jan. 2014
http://nyscf.org/pdfs/NYSCF%20PR%202014-01-07%20Acta%20Neuropathologica%20-%20Alzheimers%20Dura%20Matter.pdf

Support for Controversial Theory of Consciousness

A review and update of a controversial 20-year-old theory of consciousness published in *Physics of Life Reviews* claims that consciousness derives from deeper level, finer scale activities inside brain neurons. The recent discovery of quantum vibrations in "microtubules" inside brain neurons corroborates this theory, according to review authors Stuart Hameroff and Sir Roger Penrose. They suggest that EEG rhythms (brain waves) also derive from deeper level microtubule vibrations, and that from a practical standpoint, treating brain microtubule vibrations could benefit a host of mental, neurological, and cognitive conditions. The theory, called "orchestrated objective reduction" ("Orch OR"), was first put forward in the mid-1990s by Penrose (Univ. of Oxford) and Hameroff (Univ. of Arizona, Tucson). They suggested that quantum vibrational computations in microtubules were "orchestrated" ("Orch") by synaptic inputs and memory stored in microtubules, and terminated by Penrose "objective reduction" ("OR").

ScienceDaily
16 Jan. 2014
http://www.sciencedaily.com/releases/2014/01/140116085105.htm

The Symphony of Life, Revealed

Like the strings on a violin or the pipes of an organ, the proteins in the human body vibrate in different patterns, scientists have long suspected. Now, a new study provides what researchers say is the first conclusive evidence that this is true. Using a technique they developed based on terahertz near-field microscopy, scientists from the University at Buffalo and Hauptman-Woodward Medical Research Institute (HWI) have for the first time observed in detail the vibrations of lysozyme, an antibacterial protein found in many animals. The team found that the vibrations, which were previously thought to dissipate quickly, actually persist in molecules like the "ringing of a bell," said UB physics professor Andrea Markelz, PhD, who led the study. These tiny motions enable proteins to change shape quickly so they can readily bind to other proteins, a process that is necessary for the body to perform critical biological functions like absorbing oxygen, repairing cells and replicating DNA, Markelz said. The research opens the door to a whole new way of studying the basic cellular processes that enable life.

Charlotte Hsu, SUNY Buffalo
16 Jan. 2014
http://www.buffalo.edu/news/releases/2014/01/012.html

DNA Clamps Could Stop Cancer in Its Tracks

Scientists have developed a special DNA clamp to act as a diagnostic nano machine. It's capable of detecting genetic mutations responsible for causing cancers, hemophilia, sickle cell anemia and other diseases, more

efficiently than existing techniques. Not only can the clamp be used to develop more advanced screening tests, but it could also help create more efficient DNA-based nano machines for targeted drug delivery. "Our DNA clamp probes can perform very similar applications compared to molecular beacons, which are being used in many diagnostic clinics around the world since they enable the rapid, fluorescent detection of specific DNA sequences, or mutations," said Alexis Vallée-Bélisle, a Chemistry Professor at the Université de Montréal, Canada. "However, since they bind DNA using a clamp mechanism, i.e. a single DNA sequence from a patient is recognized by two DNA sequences on our clamp, they are now able to detect single point mutations with much more efficiency than molecular beacons do."

Lakshmi Sandhana, Gizmag
17 Jan. 2014
http://www.gizmag.com/dna-clamps-stop-cancer/30504/

Tiny Swimming Bio-Bots Boldly Go Where No Bot Has Swum Before

The alien world of aquatic micro-organisms just got new residents: synthetic self-propelled swimming bio-bots. A team of engineers has developed a class of tiny bio-hybrid machines that swim like sperm, the first synthetic structures that can traverse the viscous fluids of biological environments on their own. Led by Taher Saif, the University of Illinois Gutgsell Professor of mechanical science and engineering, the team published its work in the journal *Nature Communications*. "Micro-organisms have a whole world that we only glimpse through the microscope," Saif said. "This is the first time that an engineered system has reached this underworld." The bio-bots are modeled after single-celled creatures with long tails called flagella—for example, sperm. The researchers begin by creating the body of the bio-bot from a flexible polymer. Then they culture heart cells near the junction of the head and the tail. The cells self-align and synchronize to beat together, sending a wave down the tail that propels the bio-bot forward.

Liz Ahlberg, Physical Sciences Editor,
Univ. of Illinois News Bureau
17 Jan. 2014
http://news.illinois.edu/news/14/0117bio-bots_TaherSaif.html

A Roadmap to Resuscitation

Successful rejuvenation of cryonics patients will require three distinct technologies: (1) A cure for the disease that put the patient in a critical condition prior to cryopreservation; (2) biological or mechanical cell repair technologies that can reverse any injury associated with the cryopreservation process and long-term care at low temperatures; (3) rejuvenation biotechnologies that restore the patient to good health prior to resuscitation. OR it will require some entirely new approach such as (1) mapping the ultrastructure of cryopreserved brain tissue using nanotechnology, and (2) using this information to deduce the original structure and repairing, replicating or simulating tissue or structure in some viable form so the person "comes back."

The following list is a list of landmark papers and books that reflect ongoing progress towards the resuscitation of cryonics patients:

Michael G. Darwin, **"The Anabolocyte: A Biological Approach to Repairing Cryoinjury,"** *Life Extension Magazine* (July-August 1977):80-83. Reprinted in Cryonics Magazine, 2008, Issue 4.

Corey Noble, **"A 'Realistic' Scenario for Nanotechnological Repair of the Frozen Human Brain,"** in Brian Wowk, Michael Darwin, eds., *Cryonics: Reaching for Tomorrow,* Alcor Life Extension Foundation, 1991.

Ralph C. Merkle, **"The Molecular Repair of the Brain,"** *Cryonics* 15(January 1994):16-31 (Part I) & Cryonics 15(April 1994):20-32 (Part II).

Ralph C. Merkle, **"Cryonics, Cryptography, and Maximum Likelihood Estimation,"** First Extropy Institute Conference, Sunnyvale CA, 1994.

Aubrey de Grey & Michael Rae, **"Ending Aging: The Rejuvenation Breakthroughs That Could Reverse Human Aging in Our Lifetime."** St. Martin's Press, 2007

Robert A. Freitas Jr., **"Comprehensive Nanorobotic Control of Human Morbidity and Aging,"** in Gregory M. Fahy, Michael D. West, L. Stephen Coles, and Steven B. Harris, eds, *The Future of Aging: Pathways to Human Life Extension,* Springer, New York, 2010, pp. 685-805.

Chana de Wolf, **"Reconstructive Connectomics,"** *Cryonics* magazine, July 2013.

How Much Curcumin Are *You* Absorbing?

Curcumin is an active compound derived from the Indian spice **turmeric.** It has been widely acclaimed for its diverse health-promoting effects on nearly every organ system in the body,[1-6] including its support for the body's natural inflammatory response system.[7] But most curcumin is neither *absorbed* well nor *retained* well in the blood—posing a challenge to those who wish to maximize its benefits.[8]

Life Extension® took the lead in resolving this issue several years ago by introducing **Super Bio-Curcumin®** containing **BCM-95®**, a patented, *bioenhanced* preparation of curcumin that has been shown to reach up to **7 times higher concentration** in the blood than standard curcumin.[8]

Now, an exciting ***next generation*** curcumin formula has become available! The new **Advanced Bio-Curcumin® with Ginger & Turmerones** provides additional compounds that ***further*** boost absorption of curcumin's highly beneficial phytonutrients![9,10]

UNRIVALED POTENCY AND ABSORBABILITY

In addition to **BCM-95®**, this new **curcumin** formula contains:

1. Turmerones: After curcumin is extracted from turmeric, what remains is **turmeric oil** rich in compounds called **turmerones.**[11,12] Combining **BCM-95®** with a high content of **turmerones** provides health consumers with more benefical **turmeric** compounds that further multiply absorption.[9] Scientists have shown that these potent **turmerones** not only support curcumin absorption, but significantly increase the amount of curcumin **inside** the cell as well![9]

2. Ginger: Curcumin and **ginger** are close botanical relatives. Research demonstrates that they have overlapping and complementary health benefits,[13] and scientists are focusing on the therapeutic effects of *combining* these two plants.[14,15] **Advanced Bio-Curcumin® with Ginger & Turmerones** provides a supercritical extract of ginger standardized to the greatest concentration of ginger compounds—including beneficial gingerols and shogaols.

3. Phospholipids: This new curcumin formula also contains **phospholipids**, a type of emulsifying molecule known to greatly enhance absorption of poorly soluble active compounds.[10]

The powerfully enhanced bioavailability and potency of **Advanced Bio-Curcumin® with Ginger & Turmerones** is superior to conventional curcumin supplements. This product represents the most powerful and cost-effective way to supplement with—and receive the full benefits of—this very critical nutrient.

The suggested daily dosage of one softgel of **Advanced Bio-Curcumin® with Ginger & Turmerones** provides:

Turmeric Phospholipid Blend	**630 mg**
BCM-95® Bio-Curcumin Turmeric 25:1 extract (rhizome) [total curcuminoids complex with essential oils (380 mg)], Turmeric oil (rhizome) [providing 60 mg total turmerones], Phospholipids	
Ginger CO_2 extract (root)	**200 mg**
[providing 60 mg gingerols]	

Each softgel of **Advanced Bio-Curcumin® with Ginger & Turmerones** provides **400 mg** of **BCM-95® Super Bio-Curcumin** plus an array of turmerones and phospholipids.

A bottle of 30 softgels of **Advanced Bio-Curcumin® with Ginger & Turmerones** retails for $30. If a member buys four bottles, the price is reduced to **$20.25** per bottle.

Contains soybeans.

To order Life Extension® Advanced Bio-Curcumin® with Ginger & Turmerones, call 1-800-544-4440 or visit www.LifeExtension.com

Item# 01808

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MEETINGS

ABOUT THE ALCOR FOUNDATION

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

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

ARIZONA

FLAGSTAFF:

Arizona without the inferno. Cryonics group in beautiful, high-altitude Flagstaff. Two-hour drive to Alcor. Contact eric@flagstaffcryo.com for more information.

SCOTTSDALE:

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

AT ALCOR:

Alcor Board of Directors Meetings and Facility Tours—Alcor business meetings are generally held on the first Saturday of every month starting at 11:00 AM MST. Guests are welcome to attend the fully-public board meetings on odd-numbered months. Facility tours are held every Tuesday and Friday at 2:00 PM. For more information or to schedule a tour, call Marji Klima at (877) 462-5267 x101 or email marji@alcor.org.

CALIFORNIA

LOS ANGELES:

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

SAN FRANCISCO BAY:

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

FLORIDA

Central Florida Life Extension group meets once a month in the Tampa Bay area (Tampa and St. Petersburg) for discussion and socializing. The group has been active since 2007. Email arcturus12453@yahoo.com for more information.

NEW ENGLAND

CAMBRIDGE:

The New England regional group strives to meet monthly in Cambridge, MA—for information or to be added to the Alcor NE mailing list, please contact Bret Kulakovich at 617-824-8982, alcor@bonfireproductions.com, or on FACEBOOK via the Cryonics Special Interest Group.

PACIFIC NORTHWEST

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

BRITISH COLUMBIA (CANADA):

The contact person for meetings in the Vancouver area is Keegan Macintosh: keegan.macintosh@me.com.

OREGON:

The contact person for meetings in the Portland area is Aschwin de Wolf: aschwin@alcor.org

See also: https://www.facebook.com/portland.life.extension

ALCOR PORTUGAL

Alcor Portugal is working to have good stabilization and transport capabilities. The group meets every Saturday for two hours. For information about meetings, contact Nuno Martins at n-martins@n-martins.com. The Alcor Portugal website is: www.alcorportugal.com.

TEXAS

DALLAS:

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

AUSTIN/CENTRAL TEXAS:

We meet at least quarterly for training, transport kit updates, and discussion. For information: Steve Jackson, 512-447-7866, sj@sjgames.com.

UNITED KINGDOM

There is an Alcor chapter in England. For information about meetings, contact Alan Sinclair at cryoservices@yahoo.co.uk. See the web site at www.alcor-uk.org.

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

What is Cryonics?

Cryonics is an attempt to preserve and protect human life, not reverse death. It is the practice of using extreme cold to attempt to preserve the life of a person who can no longer be supported by today's medicine. Will future medicine, including mature nanotechnology, have the ability to heal at the cellular and molecular levels? Can cryonics successfully carry the cryopreserved person forward through time, for however many decades or centuries might be necessary, until the cryopreservation process can be reversed and the person restored to full health? While cryonics may sound like science fiction, there is a basis for it in real science. The complete scientific story of cryonics is seldom told in media reports, leaving cryonics widely misunderstood. We invite you to reach your own conclusions.

How do I find out more?

The Alcor Life Extension Foundation is the world leader in cryonics research and technology. Alcor is a non-profit organization located in Scottsdale, Arizona, founded in 1972. Our website is one of the best sources of detailed introductory information about Alcor and cryopreservation (www.alcor.org). We also invite you to request our FREE information package on the "Free Information" section of our website. It includes:

- A fully illustrated color brochure
- A sample of our magazine
- An application for membership and brochure explaining how to join
- And more!

Your free package should arrive in 1-2 weeks. (The complete package will be sent free in the U.S., Canada, and the United Kingdom.)

How do I enroll?

Signing up for a cryopreservation is easy!

Step 1: Fill out an application and submit it with your $90 application fee.
Step 2: You will then be sent a set of contracts to review and sign.
Step 3: Fund your cryopreservation. While most people use life insurance to fund their cryopreservation, other forms of prepayment are also accepted. Alcor's Membership Coordinator can provide you with a list of insurance agents familiar with satisfying Alcor's current funding requirements.
Finally: After enrolling, you will wear emergency alert tags or carry a special card in your wallet. This is your confirmation that Alcor will respond immediately to an emergency call on your behalf.

Not ready to make full arrangements for cryopreservation? Then **become an Associate Member** for $10/month (or $30/quarter or $120 annually). Associate Members will receive:

- *Cryonics* magazine by mail
- Discounts on Alcor conferences
- Access to post in the Alcor Member Forums
- A dollar-for-dollar credit toward full membership sign-up fees for any dues paid for Associate Membership

To become an Associate Member send a check or money order ($10/month or $30/quarter or $120 annually) to Alcor Life Extension Foundation, 7895 E. Acoma Dr., Suite 110, Scottsdale, Arizona 85260, or call Marji Klima at (480) 905-1906 ext. 101 with your credit card information. You can also pay using PayPal (and get the Declaration of Intent to Be Cryopreserved) here: http://www.alcor.org/BecomeMember/associate.html

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

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

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- Access to a toll-free phone line to speak with **knowledgeable health advisors,** including naturopathic doctors, nutritionists, and a cancer expert, about your individual health concerns. You can also receive help in developing your own personal life extension program.
- **Discounts on prescription drugs, blood tests, and pharmaceutical quality supplements** that will greatly exceed your membership dues. You'll receive a directory listing the latest vitamins and supplements, backed by scientific research and available through a unique buyers club.

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

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