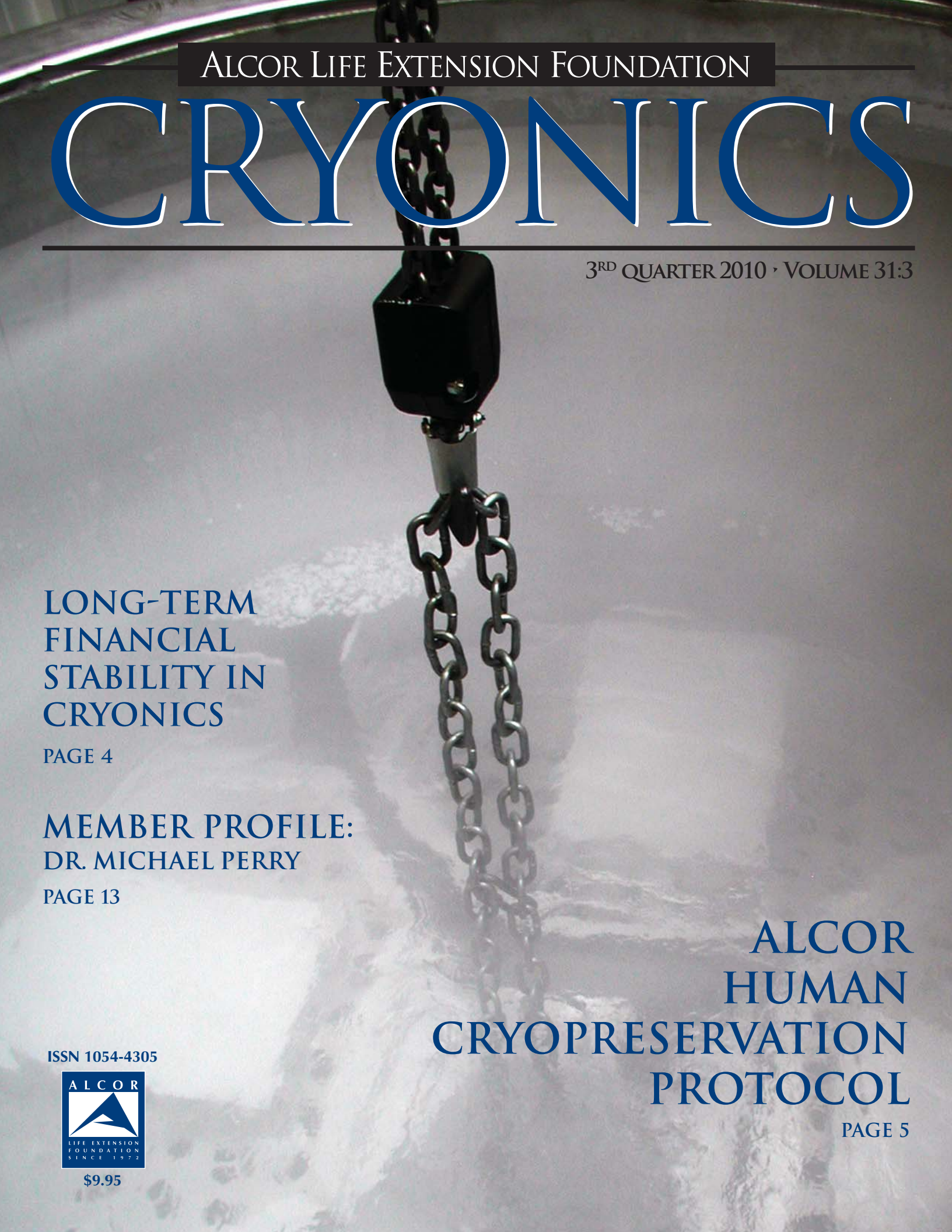

ALCOR LIFE EXTENSION FOUNDATION

CRYONICS

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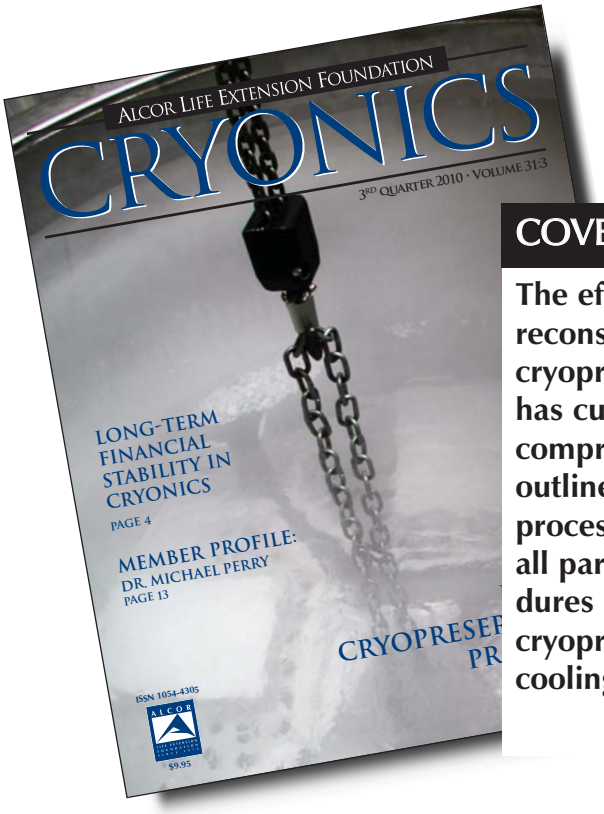

COVER STORY: PAGE 5

The effort to research and reconstruct Alcor's cryopreservation procedures has culminated in a comprehensive protocol that outlines the cryopreservation process. In this document all parts of Alcor's procedures are covered, including cryoprotective perfusion, cooling and long term care.

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FROM THE EDITOR

One of the biggest challenges in cryonics is to preserve institutional knowledge. Unlike mainstream medicine, there are no cryonics textbooks or professional-produced general guidelines to apply to this small emerging field. It is true that many of the procedures and practices in cryonics overlap with mainstream emergency medicine, extracorporeal perfusion, hypothermic organ preservation, and cryobiology research protocols. But there has not been one comprehensive work that unifies and organizes all these protocols and practices for all of the separate steps of cryonics. I am involved in an ambitious project to research, reconstruct and document the existing and recommended procedures and their rationale at Alcor.

Earlier this year, Alcor became painfully aware that it does not have a comprehensive published written protocol for the complete cryopreservation process. As a consequence, it was decided to expedite this part of the project. Of all elements of the documentation project, the protocol is a "living document" par excellence. As a consequence, the Alcor protocol that is published in this magazine will be further refined and altered as research and practical experience evolve. For those with practical and medical background it should be evident how Alcor's protocol is a combination of adapting routine medical procedures and specific considerations that pertain to cryonics patients.

Protocols and standard operating procedures do not enforce themselves. In cryonics in particular, the delivery of acceptable services benefits from a vigilant membership and periodic reviews of the quality of care. Alcor hopes that readers of this protocol will become motivated to learn about the technical details of cryonics and will become more deeply involved in the technical aspects of the organization, including the technical objectives outlined in its protocols.

This issue adds a number of contributions to the discussion about Alcor's financial stability. In recent months this discussion has moved from speculation about our challenges and solutions to more data-based analysis, culminating in a number of Board decisions to strengthen Alcor's financial future. Alcor member and nanotechnology researcher Robert Freitas has produced a very useful scenario analysis using a simple econometric model of Alcor finances. This document (http://www.tinyurl.com/alcorfinance) is too large for the magazine, but Robert has kindly submitted a brief summary of his findings and recommendations for our readers.

In recent issues we have featured member profiles of new Board members. In coming issues we will be focusing on a number of Alcor staff members. We start off with a member profile of Dr. Michael Perry. As a recognized writer on the history of cryonics and regular contributor to this magazine, Mike should need no introduction. At least as interesting is Mike's participation in Alcor's technical operations and his ambitious writings on the prospects of physical immortality. His member profile is complemented with excerpts of a revised edition of his book *Forever for All* to showcase the breadth and depth of this prolific thinker and writer.

This issue also prints a letter to the editor and a response from Alcor Director Ralph Merkle. I cannot think of a better reminder to our readers that Cryonics is glad to receive such letters or other contributions from members or interesting writers.

Aschwin de Wolf

Letter to the Editor

Alcor director Ralph Merkle very kindly took the trouble to respond to my article on underfunding. However, the insurance policies that he advocates, with an escalating face value indexed to inflation, generally don't exist anymore, according to two brokers whom I consulted. His alternative idea of insurance that allows you to increase the face value, anytime, "at the same rate" as when you bought the policy, seems to be a total fantasy. His proposal to allow financial concessions for "hardship cases" would presumably require Alcor staff to assess the situation of each prospective member, and select "those in need," even though this would be a time-consuming, contentious, and divisive process, subject to challenges. Lastly, his cheerful suggestion that reliable financing could be supplemented with unreliable financing, such as bequests, ignores the fact that weak funding arrangements have cost Alcor a lot of money in court battles with hostile relatives. Such a case occurred less than a year ago. Surely, an Alcor director could not have forgotten this expensive lesson.

(Charles Platt)

Ralph Merkle responds

While I would characterize myself as "enumerating" rather than "advocating" the various options, and while I might characterize them somewhat differently, I would like to thank Charles Platt for expressing with such eloquence their undesirable aspects. Unfortunately, the remaining options that he did not describe are not necessarily all that much better. If we reject the options he condemns, we find we must then embrace (a) terminating members who cannot afford the new rates or (b) cryopreserving them, but giving them an ever lower quality of service as inflation continues to eat away at the value of their grandfathered minimum, eventually providing only a straight freeze or (c) adopting mandatory neuropreservation for whole body patients who can no longer meet the minimums for whole body cryopreservation (which is only a possibility for about a third of Alcor's members but which would significantly reduce our financial exposure) or (d) subsidizing grandfathered members and by that act draining resources that we need to respond to the challenges that face us and increasing the risks to all of us.

We must choose between unpleasant alternatives. It would be useful to know which option or combination of options is least unpleasant – which involves exploring the unpleasantness in some detail. I expect there will continue to be discussions about the relative merit (or lack of merit) of the various possibilities for some time, and I doubt if there will ever be 100% agreement. But further discussion will hopefully help us make better decisions. ■

Long-Term Financial Stability in Cryonics

By Robert A. Freitas, Jr.

It's often quipped that getting cryopreserved is the second-worst thing that can happen to you – death without cryopreservation being the worst thing. But getting cryopreserved is actually the third-worst thing that can happen to you, not the second. The second-worst thing that can happen to you is getting cryopreserved by an organization that runs out of money before you can be revived, possibly resulting in your thawing without revival.

In early July 2010, Ralph Merkle and I were discussing his then-forthcoming article in *Cryonics* magazine on "Funding Your Cryopreservation." While Alcor is unquestionably the financially strongest organization in the cryonics industry, Ralph's article noted that current members and services were underfunded in the long term and presented a long list of possible solutions. It occurred to me that it might be worthwhile to put together a quantitative model of Alcor's finances that could be used as a testbed for considering various proposed solutions described in the article. Ralph agreed and asked me to proceed with the effort.

By early September 2010, I'd assembled an Excel spreadsheet and performed an objective analysis of Alcor finances using only publicly available information.* Non-technical readers should be forewarned – some mathematical equations are involved! The spreadsheet provides a numerical model of income and expenses and explicitly incorporates most of the policy control levers available to the Board. The study also looks at the overall long-term effects on Alcor's net revenues if you pull one or more of the levers, this way or that.

The analysis starts by creating a model of Alcor's expenses using historical data from 1990-2008. Statistical correlation is employed to predict the expense data using three independent variables: number of members, number of cryopatients, and number of cryopreservations per year. Using various assumed growth rate scenarios for these three independent variables, Alcor expenses can be projected forward 30 years into the future. The analysis continues with the creation of a similar model of Alcor's revenues based on historical data from 1990-2008. Statistical correlation is again employed to predict the revenue data using sub-models for each of Alcor's five principal consolidated revenue sources: (1) dues, (2) standby fees, (3) proceeds from cryopreservations, (4) Patient Care Trust (PCT) earnings, and (5) grants, donations and bequests. Each revenue stream can be predicted using the same three independent variables as before. This allows Alcor's revenues – and, after subtracting predicted expenses, any budget shortfalls or surpluses – to be projected forward 30 years into the future.

The analysis yielded several interesting conclusions and recommendations:

(1) Assuming dues/fees and required funding minimums are fixed at today's levels, there are no adjustments made for inflation, and the informal "grandfathering" policy remains in place, then Alcor is apparently losing money on every new member. This loss is now being covered by donations or bequests. The deficit appears to be at least $700/yr per member in 2010.

(2) Immediately adding an annual cost-of-living adjustment for ongoing inflation (~2%/yr in 2010) to Alcor dues, fees and funding minimums eliminates about one-third of the projected long-term (30-yr) budget shortfall.

(3) If inflation-adjusted dues/fees are ramped up over some reasonable period of time to a bit more than twice current levels, the other two-thirds of the projected long-term budget shortfall over the next 30 years can be eliminated. Members could be permanently "grandfathered" in this scenario.

(4) Alcor should immediately perform a bottom-up study of the actual cost of initially placing patients into cryostasis and the subsequent annual cost of long-term storage. The results of such a study would provide a rational basis for setting dues and cryopreservation funding minimums.

(5) Ideally, the bulk of Alcor's basic core expenses should be supported by membership revenues. We should try to reserve donations, grants and bequests for long-term investments such as augmenting the patient care trust fund, creating a permanent endowment fund, and research aimed at making genuine medical progress such as improving cryopreservation techniques, biological and physical research, brain studies, and ultimately supporting and developing key strategies for revival. ■

* Robert Freitas's comprehensive document *'Scenario Analysis using a Simple Econometric Model of Alcor Finances'* is available on the Alcor website at the following address: http://www.tinyurl.com/alcorfinance

ALCOR LIFE EXTENSION FOUNDATION HUMAN CRYOPRESERVATION PROTOCOL

This protocol description is adapted with permission from the chapter, *Alcor Life Extension Foundation Human Cryopreservation Protocol Guidelines,* from the book, *Human Cryopreservation Procedures.* As of December, 2010, this book is under development by authors Aschwin de Wolf and Charles Platt under contract to Alcor.

The protocol is an ideal that Alcor seeks to achieve, but that in many cases will not be possible. Obstacles preventing ideal procedures include insufficient notice of impending legal death, location of death, logistics and deployment problems, and financial constraints which are explained in more detail in the policy on Comprehensive Member Standby (CMS) on the Alcor website.

Objectives

The objective of cryonics is to stabilize critically ill patients after cardiac arrest, at cryogenic temperatures, in anticipation of future resuscitation. At Alcor, cryonics is viewed as a form of experimental critical care medicine, with members in biostasis considered patients. Because human cryopreservation is not available as an elective medical procedure, cryonics procedures can only be initiated after the pronouncement of legal death. The procedures to achieve this objective have been developed by Alcor over many years in consultation with external experts in cerebral resuscitation and tissue and organ cryopreservation.

Alcor offers whole body cryopreservation and neuro preservation. In both options the preservation of the brain as the anatomical basis of the person has the highest priority. During the initial stages of cryonics procedures the ideal objective of the Alcor protocol is to secure viability of the brain by *contemporary* biological criteria. This means that Alcor's initial stabilization procedures should not be harmful in themselves and that the reversal of these protocols should be possible in principle.

During the subsequent phase, which involves cryoprotectant perfusion and cooldown below 0 degrees Celsius to cryogenic temperatures, this objective is no longer attainable as a result of cryoprotectant toxicity and structural injury associated with thermal stress, and is replaced by the more modest objective of good ultrastructural preservation.

Non-Ideal Cases

The procedures described in this document are what is attempted under ideal logistical and biological conditions. The circumstances under which legal death occurs can be highly variable, and in many cases some or all these procedures except for cooling may be impossible. Unless members making cryopreservation arrangements express other written preferences, it is a general principle of cryonics that cryopreservation should proceed after legal death even under poor biological conditions when standard protocol procedures cannot be performed. This is done to preserve as much remaining biological information as possible because in most cases it is theoretically impossible to determine whether all brain information encoding memory and personal identity has been truly lost.

Summary of Cryonics Procedures

Alcor's cryonics protocol ideally consists of four distinct elements: (1) deployment and standby, (2) stabilization, (3) cryoprotectant perfusion, (4) cryogenic cooldown.

(1) Deployment and standby. If Alcor is notified of a pending case or emergency a standby team is deployed to the location of the patient to ensure rapid intervention after pronouncement of legal death.

(2) Stabilization. After pronouncement of legal death rapid cooling is initiated, circulation is restored, the lungs may be ventilated, and medications are administered to protect against blood clotting and keep the brain viable. In remote stabilization cases where transport to Alcor's operating room may take up to 24 hours, the blood is ideally replaced with an organ preservation solution to enhance cooling, prevent blood clotting, and protect against cold ischemia.

(3) Cryoprotectant perfusion. After arrival of the patient at the Alcor facility, the patient's blood (or organ

preservation solution) is replaced with a vitrification solution. Circulation of this solution through blood vessels at cold temperatures partially replaces water inside cells with chemicals that reduce or prevent ice crystallization during further cooldown to cryogenic temperatures.

(4) Cryogenic cooldown. After cryoprotectant perfusion the patient is gradually cooled to the temperature of liquid nitrogen for long term care. In the future, as appropriately reliable equipment becomes available, cooling may terminate and long-term maintenance may occur slightly below the glass transition temperature, to minimize structural damage.

Deployment and Standby

Alcor maintains a local emergency vehicle equipped with standby and stabilization equipment and at least one complete set of kits for remote deployment, and also has access to similar cryonics emergency vehicles maintained by Suspended Animation, Inc., in Southern California and Florida. Alcor also makes an effort to maintain basic or complete kits in regional areas with a high number of cryonics members. The organization determines allocation of standby resources through periodic review of the demographics and regional distribution of its members. To minimize the chance of late or last-minute deployment Alcor encourages members to inform the organization about their health situation and uses a color-coded member tracking system that guides deployment preparations and decisions.

Alcor materials are available for family, medical caregivers and third parties about its procedures to ensure an orderly and timely transition between pronouncement of legal death and the start of cryonics procedures. Alcor will also request medical data about the terminal patient to assist in determining the time and scope of deployment. Although Alcor does not participate in premortem treatment of the patient, Alcor may discuss with family and caregivers the medical management of the terminal patient. Alcor may also seek permission for placement of non-invasive monitoring devices.

Alcor maintains a Deployment Committee which normally includes its chief executive, Medical Response Director, and the Chief Medical Advisor. The committee is charged with assessing and defining Alcor's Comprehensive Member Standby policy, establishing standby deployment guidelines, and making real-time deployment decisions in emergency situations.

Unless unforeseen circumstances (such as a last-minute remote case) do not permit full deployment, Alcor stabilization protocol ideally requires *four team members* to be present at the start of cryonics procedures. To avoid fatigue and errors, standby team members are rotated in pairs, on a 12-hour cycle, to allow for sufficient rest and sleep. The stabilization team will typically be headed by Alcor's Medical Response Director, who is a nationally certified paramedic. Additional team members may include other Alcor staff members with EMT (emergency medical technician) training, local volunteers with cryonics stabilization training, or a Standby Team of Suspended Animation, Inc, which is composed of trained staff members and consulting professional perfusionists and surgeons. If there is insufficient notice for Alcor or Suspended Animation, Inc., to reach the location of a cryonics case before legal death, emergency stabilization may be performed entirely by local volunteer team members. At Alcor's discretion, or member choice, stabilization may also be performed entirely by Suspended Animation, Inc.

Alcor offers education and training to its members and interested medical professionals in basic human cryopreservation procedures. In addition, anyone who feels motivated to participate actively in cases may seek more advanced training. A network of volunteers and trained members may be called upon to assist in remote cases or basic logistical or stabilization tasks.

Stabilization

The objective of stabilization is to maintain viability of the brain by contemporary biological criteria after legal pronouncement of death. To achieve this purpose four different procedures are ideally employed:

1. Cardiopulmonary Support. Circulation is restored to provide oxygenated blood to the brain and to enhance cooling. Depending on specific circumstances, the lungs may be ventilated.

2. Induction of Hypothermia. The temperature of the patient is lowered to just above 0 degrees Celsius to depress metabolism.

3. Administration of Medications. Drugs are administered to improve circulation, inhibit blood clotting, and to protect the brain.

4. Blood substitution. If the patient is distant from Alcor's facilities, and if it is logistically possible to do so, the blood of the patient is substituted with an organ preservation solution to enhance cooling, prevent blood clotting, and protect against cold ischemia.

Cardiopulmonary support, induction of hypothermia, and administration of medications are initiated as quickly as possible after death is pronounced. In practice, none of these procedures alone is sufficient to maintain the brain in a viable state. To ensure that these interventions are executed concurrently, a minimum number of four team members will be present at the start of stabilization. Their tasks will include data collection for subsequent review and analysis.

Stabilization procedures end when either the temperature of the patient has been lowered close to the freezing point of water or when blood washout is started to prepare for cryoprotectant perfusion. In remote cryonics cases blood substitution is an option prior to transport to the cryonics facility.

Cardiopulmonary Support

Cardiopulmonary support (CPS) is distinguished from cardiopulmonary resuscitation (CPR) because the objective of circulation and ventilation in cryonics is not resuscitation of the patient but to prevent (additional) ischemic injury.

The three objectives of cardiopulmonary support are:

1. Restore circulation of oxygenated blood to the brain

2. Circulate medications

3. Improve the rate of external cooling

After pronouncement of legal death the patient is transferred to the portable ice bath and mechanical cardiopulmonary support is started. Mechanical devices allow for consistent and aggressive chest compressions, permitting continued CPS during transport of the patient. They also prevent fatigue of standby team members and release team members to perform other important tasks. The preferred method of cardiopulmonary support is battery-powered mechanical active-compression decompression. The second preferred option is gas-powered mechanical active-compression decompression. The third option is gas-powered conventional mechanical chest compression. When mechanical devices are not available or not functional, manual compression-decompression chest compressions should be initiated through the use of the Cardiopump. Conventional (i.e., hands only) chest compressions should only be pursued when all other options are exhausted.

In line with recent CPR guidelines, Alcor emphasizes the importance of continuous and vigorous chest compressions. Continuous chest compressions induce moderate air movement in and out of the lungs, help to mitigate the risk of reperfusion injury and hyperventilation when metabolism is depressed by hypothermia.

If medical professionals are available to place a secure airway to initiate positive pressure ventilation an inspiratory impedance threshold valve (ITV) should be placed between the endotracheal tube (or King Airway) and the oxygen source to prevent ventilations during the decompression phase of chest compressions. The goal is to maximize cardiac output. The chest compression-to-ventilation ratio is 30:2 and should be reduced to 60:2 below 32 degrees Celsius. No positive pressure ventilations should be initiated after 30 minutes of normothermic circulatory arrest.

Unless surgical expertise is available to perform surgery with minimal interruption of circulation, CPS should continue until the patient has reached a core temperature of 20 degrees Celsius to prevent ischemic injury during preparation for blood substitution or cryoprotective perfusion.

Induction of Hypothermia

External cooling of the patient should be started immediately after pronouncement of legal death to depress metabolism. The patient is moved from the bed to a portable ice bath (PIB) that contains ice and cold water to facilitate cooling during transport, and increase cooling rate. The patient should be completely immersed in ice and water with a primary emphasis on the head and areas with major surface vessels such as the neck, axilla and groin. Because the total area of contact between dry cubed ice and the patient is inevitably limited, some water is essential, to maximize heat transfer. It should cover as much of the patient's skin as possible, and is circulated via a system of perforated tubing attached to a submersible pump. Water is flowed rather than sprayed over the patient, to reduce the risk of infection via airborne droplets if the patient has a contagious disease.

Concurrent start of aggressive cardiopulmonary support increases the cooling rate by moving warm blood from the core of the patient to the surface for heat exchange. The objective of all these procedures is to achieve the fast cooling rates that are seen in cold water immersion without sacrificing cardiopulmonary support and medication administration.

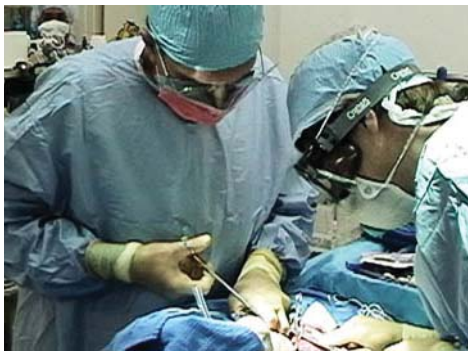
A minor degree of internal cooling during stabilization can be achieved by cooling the medications and fluids before they are administered. Mannitol should be exempted from this procedure because the solution will crystallize if it is maintained at low temperatures.

Cooling the patient should continue without interruption during transport to the funeral home or during surgical procedures. Logging the temperature of the patient is important to monitor the effects of cooling efforts and for subsequent case reporting.

Because even the fastest cooling rates cannot stay ahead of ischemic injury without circulation of oxygenated blood and administration of neuroprotective medications, induction of hypothermia cannot be a substitute for these interventions. This is particularly important during the start of stabilization procedures because energy depletion is running faster than cooling can depress metabolism.

If no ice bath is available, a heavyweight body bag can be used to surround the patient with ice without spilling and leaking.

In typical cases, the patient should not be cooled below the freezing point of water



(0 degrees Celsius). The patient may only be cooled below the freezing point of water if Alcor has made the decision that long time delays before stabilization, or expected during transport, will make cryoprotectant perfusion impossible. In such cases the patient must be held at the temperature of dry ice (–78.5 degrees Celsius), with the understanding that this will inflict very severe brain injury as a result of freezing. If a patient is frozen, special care must be taken to avoid thawing and re-freezing, which will cause even more damage. The application of dry ice without cryoprotectant perfusion (so-called "straight freezing") should be viewed as a desperation measure which cannot be reversed.

Administration of Medications

Administration of medications should be started as soon as the patient has been placed in the portable ice bath. If the patient already has a patent intravenous line in place, or if no portable ice bath is available, the administration of the first medications can start sooner. Under no circumstances should Alcor team members start or authorize the administration of medication prior to pronouncement of legal death.

Each medication falls into one of three categories:

1. Small volume medications (such as heparin and streptokinase)

2. Large volume fluids (such as hydroxyethyl starch and mannitol)

3. Fluids that require gastric administration (Maalox)

The administration of the small-volume medications and the large-volume fluids should commence at the same time. This is particularly important if the patient is severely dehydrated at the start of stabilization procedures. The simultaneous adminis-

tration of the small-volume medications and the large-volume fluids can be achieved either by pushing the small medications into the line or by establishing a second IV line.

If there is no delay between pronouncement of legal death and the start of stabilization procedures the full set of medications should be administered.

Small Volume Medications

(1) Propofol (200 mg - fixed dosage)

Propofol is a *general anesthetic* and is used for two reasons. The first reason is to reduce metabolic demand, and the second reason is to prevent the theoretical possibility of recovery of awareness due to aggressive cardiopulmonary support.

(2) Streptokinase (250,000 IU – fixed dosage)

Streptokinase is a *thrombolytic* used to break up existing blood clots that can interfere with blood circulation and cryoprotective perfusion.

(3) Heparin (100,000 IU – fixed dosage)

Heparin is an *anticoagulant* that prevents the formation of blood clots that can interfere with blood circulation and cryoprotective perfusion. Heparin loses effectiveness at low pH (pH < 6.7), so control of pH is important during a cryonics stabilization. This is why other *anticoagulants* are also important.

(4) Aspirin (300 mg –fixed dosage)

Aspirin is an *anti-inflammatory* and *anti-platelet* agent that is used to inhibit platelet aggregation.

Note: Aspirin is reconstituted with 5 ml THAM and injected into THAM bottle.

(5) Vasopressin (200 IU – fixed dosage – intermittent administration)

Vasopressin is a *vasopressor* that is used to increase blood pressure during cardiopulmonary support. There is no need to administer vasopressin if the patient's temperature is near or below +20 °C at time of administration as it is ineffective at cold temperatures.

(6) Epinephrine (30 mg – fixed dosage - intermittent administration)

Epinephrine is a *vasopressor* that is used to increase blood pressure during cardiopulmonary support. There is no need to administer epinephrine if the patient's temperature is near or below +20 °C at time of administration as it is ineffective at cold temperatures.

(7) SMT (S-methyl-isothiourea) (400 mg – fixed dosage)

SMT is a *neuroprotectant* (iNOS inhibitor) that is used to protect the brain from ischemic injury. SMT also raises blood pressure.

(8) Niacinamide (Vitamin B3) (500 mg - fixed dosage)

Niacinamide is a *neuroprotectant* (PARP inhibitor) that is used to protect the brain from ischemic injury.

(9) Kynurenine sulfate (1.5 gram – fixed dosage)

Kynurenine sulfate is a *neuroprotectant* (excitotoxicity inhbitor) that is used to protect the brain from ischemic injury.

(10) Ketorolac (7.5 to 15 mg - dosage by patient weight)

Ketorolac is a non-steroidal anti-inflammatory drug used to inhibit ischemia-induced inflammation.

(11) Gentamicin (80 mg – fixed dosage)

Gentamicin is an *antibiotic* that is used to protect the patient from microbial overgrowth during long transport times.

Large Volume Medications

(12) Vital-Oxy (formerly known as Oxynil) (70 ml or less –dosage by patient weight)

Vital-Oxy is a proprietary Critical Care Research, Inc., emulsion of the antioxidants melatonin, vitamin E (as *D-alpha tocopherol*), PBN (*alpha_Phenyl_t-Butyl_Nitrone*) and the anti-inflammatory agent carprofen.

(13) Hetastarch (250 ml – fixed dosage)

Hetastarch is a volume expander used to restore volume in dehydrated patients and increase cerebral perfusion during CPS.

(14) THAM (Tris (hydroxymethyl) aminomethane) (100 ml – fixed dosage)

THAM is a *buffer* that is used to mitigate acidosis. If aspirin is dissolved in THAM it is called THAM plus.

(15) Mannitol (500 ml of 20% solution – fixed dosage)

Mannitol is an *osmotic diuretic* agent that is used to reduce cerebral edema and increase blood volume.

Fluids That Require Gastric Administration

(16) Maalox (250 ml – fixed dosage)

Maalox is an *antacid* that is used to stabilize the pH of stomach contents to prevent erosion of the stomach wall by hydrochloric acid at low temperatures. Failure to prevent this can lead to contamination of the circulatory system with stomach contents and abdominal swelling during later perfusion.

If there is a delay of more than *one hour* after cardiac arrest, an *abbreviated* list of medications should be administered.

1. Streptokinase (250,000 IU – fixed dosage)
2. Heparin (100,000 IU – fixed dosage)
3. Tempol (if available) (5 g – fixed dosage – dissolved in citrate)
5. Gentamicin (80 mg – fixed dosage)
6. Mannitol (500 ml of 20% solution – fixed dosage)
7. Maalox (250 ml – fixed dosage)

Administration of these medications should be followed by at least ten minutes of chest compressions to distribute the medications, accompanied by surface cooling.

The vasopressors epinephrine and vasopressin should be administered intermittently to ensure higher cerebral bloodflow. The effects of vasopressor medications can be assessed through the use of end tidal CO_2 monitoring.

Maalox is not introduced to the circulatory system but to the stomach of the patient. This requires the placement of the *double-lumen* King LTS-D Airway or a designated gastric tube. Unless placement of the King LTS-D Airway is not possible, the King LTS-D Airway is the preferred method for Maalox administration because it allows for simultaneous ventilation. Maalox should only be administered through the inserted gastric tube in the rear channel of the KING LTS-D Airway if the team leader has received confirmation that the KING LTS-D has *not* been accidentally placed in the trachea. A gastric tube should only be placed by an experienced medical professional.

If Alcor is not successful in persuading the patient's caregivers to leave an IV line in place, the preferred method of medication administration is intraosseous infusion. If intraosseous infusion is not available, or contra-indicated for the patient, an experienced team member should place a periph-

eral IV line. Central IV lines should only be placed by qualified medical professionals. Techniques such as pressure infusion should only be used by those with extensive experience such as paramedics.

Preparation of the medications should start at least one hour before the estimated time of circulatory arrest or on the way to the patient if (s)he has already been pronounced. Compounds that have been prepared in-house at Alcor should be filter-sterilized prior to administration. Mannitol should be checked for crystals before administration. If there are crystals in the solution the solution should be warmed to dissolve them. If the crystals cannot be eliminated the fluid should not be introduced to the patient.

In instances where team members are uncertain about dosage, methods of administration, or other issues, they can contact Alcor's medical advisor, who should be available by phone at all times during standby, stabilization, and transport of the patient. Team members should not improvise on their own initiative.

The start of blood washout or cryoprotective perfusion should not be delayed to complete administration of medications. If administration of the remaining medications is still deemed desirable they can be added to the organ preservation solution during perfusion.

Remote blood substitution

In remote cases, blood substitution with an organ preservation solution prior to transport at hypothermic temperatures is desirable unless it is logistically impossible to do so. Remote blood substitution has the following objectives:

1. Rapid induction of ultraprofound hypothermia.

2. Prevention of clotting, red cell sludging and "no-reflow."

3. Maintaining viability of the brain during transport.

Alcor uses an Air Transportable Perfusion circuit (ATP), or, if available, the Stockert SCPC portable clinical perfusion system, to replace the blood of the patient. The organ preservation solution of choice at Alcor is MHP-2. MHP-2 is an asanguineous hyperosmolar intracellular whole body organ preservation solution.

MHP-2

Mannitol	170 mM
Adenine-HCL	0.94 mM
D-ribose	0.94 mM
Sodium bicarbonate	10 mM
Potassium chloride	28.3 mM
Calcium chloride	1 mM
Magnesium chloride	1 mM
HEPES	15 mM
Glutathione	3 mM
D-Glucose (Dextrose)	5 mM
Hydroxyethyl starch	50 g per L
Heparin	1000 I.U. per L
Insulin	40 I.U. per L
Osmolality	388-403 mOsm
pH	8.0-8.2

To facilitate rapid cooling, MHP-2 should be kept as close as possible to the freezing point of water (0 degrees Celsius). A heat exchanger built into the ATP circuit is designed to reduce the temperature to near freezing, if necessary, before the solution enters the patient. Heparin and insulin should be added to MHP-2 during extracorporeal circulation. At this point, any remaining stabilization medications (with the exception of Maalox) can be injected into the circuit as well.

Remote blood washout should only be undertaken in the absence of contra-indications for this procedure. The contra-indications for remote blood substitution range from "pre-mortem" patient pathologies to practical and logistical challenges:

Contra-indications for Remote Blood Substitution

- More than six hours since legal death occurred.
- Omitting remote blood substitution will reduce transport time significantly.
- Reaching the nearest funeral home or other location that allows blood substitution will result in excessive cardiopulmonary support times
- There are no team members with extensive experience and knowledge of cardiopulmonary bypass present on the case
- Inspection of the blood organ preservation solution (MHP2) reveals bacterial growth
- Inspection of the blood organ preservation solution composition suggests errors in perfusate composition
- The presence of systemic edema (fluid accumulation throughout the body) that may have occurred during cardiopulmonary support
- Active gastrointestinal bleeding at the time of cardiac arrest
- Prolonged splanchnic ischemia or severe abdominal swelling
- Severe pulmonary edema
- Severe cerebral edema
- Prolonged periods of warm cerebral ischemia

To facilitate a smooth transition from cardiopulmonary support to blood substitution Alcor will normally attempt to deploy a team of at least two individuals to a cooperating funeral home to set up and prime the perfusion circuit. These team members should also obtain additional ice to further cool the patient and to be used as the heat exchange medium during blood washout. In some cases (e.g., home hospice) remote blood substitution may be possible at the patient's bedside. This option should be discussed with the patient, the patient's medical surrogate, and medical caregivers in advance.

Remote blood substitution requires surgery and cannulation of the major blood vessels of the patient. The preferred procedure at Alcor is femoral-femoral cannulation. Most surgical alternatives to femoral cannulation can cause complications during cryoprotective perfusion and should only be performed by experienced surgeons in absence of the contra-indications for remote blood substitution.

Interruption of circulation should be minimized during surgery. This is particularly important if surgery is initiated when the patient's core body temperature is still close to body temperature. If extended interruptions of circulation are expected during surgery, the procedure should not be initiated until the patient's core body temperature has been lowered to 20 degrees Celsius. Cooling should never be halted during surgery; the patient should remain surrounded by ice.

As a general rule, Alcor abstains from remote blood substitution if there are no experienced clinical or research surgeons on the team (unless it is determined that a local

funeral director has the required experience to do the surgery and cannulation). Alcor's staff paramedic has received the requisite surgical training, and surgeons qualified for cryonics vascular access may also be supplied by Suspended Animation, Inc., or Critical Care Research, Inc., under contract to Alcor. If there is uncertainty or debate about the presence of any of the contra-indications, Alcor shall abstain from remote blood substitution.

Remote blood substitution should only be initiated when there is either a functional ATP or a conventional perfusion circuit present. The use of embalming pumps is not permitted because such pumps do not permit adequate control and monitoring of pressure.

The purpose of the initial stage of blood substitution is to wash out the blood of the patient. When the venous effluent of the patient indicates that the blood has been washed out (as evidenced by a clear color or no further changes in color), the ATP is switched from "open circuit" (washout) mode to "closed circuit" (recirculating) mode, and MHP-2 continues to circulate through the heat exchanger until the core temperature of the patient approaches the freezing point of water. Generally speaking, the ATP is stopped when core patient temperature falls below 5 degrees Celsius, although the procedure may be aborted before this point if there is a special advantage in doing so, such as the need to coincide with available air transport schedules. The patient should be prepared for transport after closing the surgical incisions.

If practical to do so, the patient should be weighed prior and after completion of blood substitution if this capability is available at a funeral home.

Patient Transport

For cases where the location of the patient is accessible more quickly, overall, by ground than by air, Alcor employs an emergency vehicle that maintains at least all the equipment that is available for remote stabilizations. Periodic inventory check-ups and test drives should ensure that the emergency vehicle is always immediately available for casework. In a typical local case the Alcor vehicle is parked close to the location of the patient. During standby the vehicle can also be used for drawing up medications and assembling equipment. The vehicle is equipped with a lift gate to transfer the portable ice bath into the vehicle. Parking should permit sufficient room for the lift gate to operate.

If the patient is located outside of the practical range of Alcor's emergency vehicle, the patient will be transported to Alcor's operating room by scheduled airline or, if appropriate financial arrangements have been made, by air ambulance. The patient is placed in a case for the shipment of "cadavers" (often a "Ziegler" case). The Ziegler case is insulated and placed in a box which is typically used for air shipment and should be available from any mortuary.

The standby team should take great care to ensure that the case does not leak water or body fluids because such events can result in the shipment being taken off the plane and held for inspection. To prevent leakage of body fluids, the patient should be placed in a body bag surrounded with ice inside the Ziegler case. To prevent leakage of water from melting ice, the ice should be placed in large (2.5 gallon) Zip Loc bags.

The quantity of ice should be sufficient to allow for at least 48 hours of transport. This quantity will vary according to the patient's weight and body temperature at the time of shipment, subject to the different ice restrictions imposed by different airlines. A chart may be provided for guidance on this topic.

If ice has been stored in a freezer, care should be taken that it has warmed to 0 degrees Celsius and is actively melting before packing with a cryonics patient. If a bag of ice has visible white frost on it, then it is too cold to use. Bags suspected of being too cold should be warmed by running water over them until all the ice inside is visibly wet and melting.

If airline regulations do not permit shipping the patient with water ice, hypothermia can be maintained by cold packs. Alternatively, Terra-Sorb hydrogel crystals can be mixed with bagged ice, using 2 teaspoons of hydrogel crystals per gallon of ice. This will convert liquid water into a gel that cannot leak. Like ice bags, cold packs and hydrogel ice bags should always be warmed enough that they don't have frost on them. Condensation of liquid water on bags or ice bags standing in room air is normal and expected.

At least one team member should be in the same airplane as the patient to intervene with airline personnel and serve as an advocate for the patient if there are unexpected delays or complications. Temperature of the patient should be logged during transport. This temperature logger should not be the same as the one that was used during stabilization, to prevent data from being lost during transport or handling.

Monitoring of Stabilization Procedures

A standby team should include one designated scribe. The main task of the scribe is to collect data and record observations during the case. At a minimum, the scribe should record and describe all the pertinent events during a case, including the following:

- Deployment and case preparation
- Medical data of the patient obtained from medical caregivers
- Time of pronouncement of legal death
- Start and completion of stabilization procedures
- Start and completion of cardiopulmonary support
- Start and completion of initial cooling
- Time of IV placement
- Time of administration of all the medications and fluids
- Intermittent temperature data
- Start and completion of surgery
- Start and completion of blood substitution
- Intermittent pressure data during blood substitution
- Any interruptions of procedures and unusual events
- Start and completion of preparation of the patient for transport

Nasal *and* rectal temperatures should be logged from the start of stabilization procedures until the completion of stabilization procedures.

End tidal CO_2 measurements should be collected during cardiopulmonary support. If available, a digital end-tidal CO_2 should be used because it provides more detailed infor-

mation about the efficacy of cardiopulmonary support.

If enough personnel and expertise are available, blood samples (blood gases and electrolytes) should be collected immediately after pronouncement of legal death and at intermittent points during stabilization procedures. These samples should be sent to a lab for independent analysis.

Prior to the start of blood substitution, a sample of the organ preservation solution should be collected for in-house quality assurance purposes.

It is important to note that a scribe should go beyond merely writing down numbers. All kinds of observations are valuable, and indeed they may be crucial, at a later date, in understanding what happened during a case, and why. In addition, we strongly believe that photographs and video of procedures should be created to document a case, provided that interested parties such as relatives, medical personnel, and mortuary staff permit this. While some people have expressed concern that visual materials may be stolen or placed in public forums, we feel that they can actually protect the cryonics organization and its personnel by demonstrating that procedures were carried out conscientiously. If there is anxiety about the possible theft of records, surely the answer to this problem is to protect the records from theft, rather than to stop creating records. Alcor's signup documents clearly state that cryonics is an experimental procedure. Any experimental procedure should be documented as completely as possible, so that others can learn from it, and procedures can be improved.

At a minimum, the team leader should be equipped with a voice recorder to document important events as they occur. Scribe notes and voice recordings are essential for constructing a correct timeline of the case. A separate scribe sheet is available for data collection during the terminal phase. All scribe sheets and voice recordings should be surrendered to designated Alcor representatives after completing the case, and a signed, formal acknowledgment of receipt should be obtained.

Cryoprotective Perfusion

Cryoprotective perfusion is the core procedure of Alcor's human cryopreservation protocol. Without the introduction of a vitrification solution, extensive damage to the brain should be expected. To achieve good morphological preservation of the brain, the blood (or organ preservation solution) in the patient is replaced by a vitrification solution. Alcor's vitrification solution, M22, is licensed from 21st Century Medicine, Inc. It is the least toxic vitrification solution known in peer reviewed literature for its concentration, and provides strong protection against ice formation at slow cooling rates.

M22

Dimethyl sulfoxide	22.305% w/v
Formamide	12.858%
Ethylene glycol	16.837%
N-methylformamide	3%
3-methoxy-1,2-propanediol	4%
Polyvinyl pyrrolidone K12	2.8%
X-1000 ice blocker	1%
Z-1000 ice blocker	2%

A modified version of M22 is used to mitigate edema during the perfusion of whole body patients. In both whole body and neuro patients, M22 is introduced in a hypertonic carrier solution called LM5.

LM5

Glucose	90 mM
Mannitol	45 mM
Alpha-Lactose Monohydrate	45 mM
Potassium Chloride	28.2 mM
Potassium phosphate dibasic trihydrate	7.2 mM
Gluthathione (reduced)	5 mM
Adenine HCl	1 mM
Sodium Bicarbonate	10 mM

The concentration of these LM5 solutes is the same in the base perfusate (starting perfusate), and the M22 solution that is added to the base perfusate, so that the concentration of these LM5 carrier solution solutes remains constant during the whole process of cryoprotectant perfusion.

Upon arrival at the Alcor facility, a median sternotomy should be performed to cannulate the great vessels of the heart (aorta and right atrium) for whole body patients. Vascular access surgery for whole body or neuropatients at Alcor is performed by physicians or veterinary surgeons. The first step is to wash out the blood (or prior organ preservation solution) with B1 base perfusate. B1 consists of LM5 plus 1 mM calcium chloride dehydrate, plus 2 mM magnesium chloride hexahydrate, plus a proprietary additive that reduces edema.

After this step has been completed, the concentration of M22 solutes in carrier solution should be slowly ramped up in a linear fashion by progressively adding "M22 concentrate" (1.25 times normal concentration of M22 non-carrier solutes in LM5 carrier solution) to the circulating B1 base perfusate. The objective is to linearly increase the concentration of cryoprotectants in the circulating perfusate so that the arterial concentration of M22 solutes reaches 50% of target concentration in 100 minutes. The target concentration is the concentration of M22 solutes shown in the M22 composition table above, a concentration which can be created in the laboratory for refractometer calibration purposes by diluting a sample of M22 concentrate (1.25 times concentrated M22) with a 25% additional volume of B1 base perfusate.

When the arterial cryoprotectant concentration reaches 50% of target concentration, the rate of concentrate addition should be reduced to hold the arterial concentration near 50% while the venous concentration catches up. During this time, the arterial perfusion temperature should be dropped from near +3.5 degrees Celsius to -3 degrees Celsius. When the venous effluent of M22 reaches 50% of target nominal M22 concentration as measured by manual inspection of refractive index, the concentration of M22 should be rapidly increased to between 100% and 105% of target concentration. Cryoprotective perfusion is complete when the venous effluent concentration reaches 100% of target and there is little fluctuation in the refractive index of the venous effluent. In patients with extensive ischemic injury cryoprotective perfusion should be halted when no notable gains in M22 equilibration or severe cerebral edema is observed.

In neuro patients, only the head is perfused, through the carotid arteries. This procedure permits faster cooling rates, bilateral monitoring of the brain, and has been observed to produce reduced burr hole drainage and facial edema. If there is evidence that the Circle of Willis is incomplete, or damaged, the vertebral arteries should be cannulated as well. Otherwise they are clamped. During isolated head perfusion the head is secured in a cephalic enclosure and the venous return is filtered before being partly returned to the patient.

Perfusion pressure during cryoprotective perfusion should be in the range of 100-120 mmHg. Because cryoprotectant concentration and lower temperatures both increase viscosity the pump speed needs to be reduced

a number of times in the course of perfusion. A perfusion pressure of up to 140 mmHg may be used, but may have to be reduced if brain swelling occurs. Perfusion pressures below 80 mmHg should be avoided.

In all cases, Alcor introduces its vitrification solution by ramping up the concentration of the cryoprotectant components linearly to avoid osmotic injury that would occur when cells are hit with a full-strength high molar solution. M22 concentrate is gradually introduced to a mixing reservoir where the solution is continuously mixed with the previously-perfused base perfusate B1 before it is introduced to the patient. The venous effluent is partly discarded (to maintain volume of the mixing reservoir as M22 concentrate is added) and partly returned to the mixing reservoir to ensure a linear increase of the ramp and to reduce M22 volumes. In whole body patients, the circuit should also include a cardiotomy sucker to recover lost perfusate from the patient's chest cavity. A subzero heat exchanger should be used to lower the perfusate temperature below 0 degrees Celsius. At Alcor, LabView software monitors the conduct of perfusion.

Cryoprotectant Perfusion Monitoring

Scribing and monitoring continues during cryoprotective perfusion. Collection of important data is automated, but the scribe should make an effort to document the flow of the case and record data manually, including all events that may be at all pertinent. At a minimum the scribe should record the following:

- Preparation and set-up of the cryoprotective perfusion circuit
- Time of arrival of the patient
- Time of start and completion of surgery
- Start of blood / perfusate washout
- Start of cryoprotective perfusion
- Intermittent pressure readings
- Intermittent flow readings
- Intermittent perfusate and patient temperature data
- Manual refractive index measurements
- Any interruptions of procedures and unusual events
- Completion of cryoprotective perfusion.

Visual data are even more important, during cryoprotective perfusion, than during field work. Alcor maintains a video camera that monitors events from a fixed position, but its record should be supplemented by handheld camera photographs and video showing closeup details of surgical procedures, cannulation, shrinkage of the brain visible through burr holes, and other data.

The status of the brain is visually monitored through two small holes in the skull (burr holes) made using a standard neurosurgical tool (14 mm Codman perforator). This permits observation of the osmotic response of the brain. A brain with substantial ischemic injury swells, indicating disruption of the blood brain barrier, damage to endothelial cells, or compromise of water regulation of the cells.

During cryoprotective perfusion LabView software collects cryoprotectant concentration data from inline refractometers. These measurements can be consulted to look at trends but should not be used for making decisions. Protocol decisions should be guided by manual refractive index measures that are analyzed by either benchtop refractometers or handheld digital refractometers.

If practical to do so, in neuropreservation cases the cephalon should be weighed prior and after completion of cryoprotective perfusion.

Cryogenic Cooldown

After completion or termination of cryoprotective perfusion the patient will be prepared for cryogenic cooldown. A "crackphone" is placed in contact with the surface of the brain, to sonically detect subsequent fracturing events. Whole body patients should be transferred to a large insulated cooling box, and neuro patients to a small dewar. The cooldown process is software controlled. Liquid nitrogen is injected into the cooling box or dewar and vaporizes, drawing heat from the patient. A fan circulates the vapor to further enhance cooling. The temperature is dropped rapidly to approximately 110 degrees Celsius. That temperature is held at a plateau for 12 hours to allow annealing, and is then dropped more slowly over 100 hours to minimize thermal stress and fracturing. In a neuro case the final descent from around -190 degrees Celsius to -196 degrees Celsius is achieved by gradually filling the dewar with liquid nitrogen. In whole body cases the patient is transferred to a Bigfoot dewar in a precooled sleeping bag for the final descent to liquid nitrogen temperature. Because whole body transfers are done at room temperature, good logistical preparation and minimizing transfer time is of the essence.

If cryoprotective perfusion is not possible, ice formation will start below 0 degrees Celsius. As a consequence, a slow uniform cooling rate (to minimize thermal stress caused by unequal cooling) can be maintained throughout the whole temperature range.

Temperature and crackphone data are collected by the software throughout the cooling process.

Long Term Care

After cooldown to liquid nitrogen temperature (-196 degrees Celsius) the patient is maintained in a vacuum-insulated dewar until such a time in the future when resuscitation may be deemed feasible. Long-term care dewars should be equipped with level sensors and alarms. Dewar refills should follow a systematic, documented schedule.

Debriefing and Case Reports

After participation in the case, team members are required to submit scribe sheets, recordings, and other notes to Alcor. Alcor should schedule a debriefing session with all case participants and advisors as soon as is convenient after completion of the case. The objective of debriefing is to discuss strengths and weaknesses of the case in an analytical, non-confrontational manner. The debriefing session should be documented, and a transcript should be circulated among participants to check for accuracy and completeness. Usually the debriefing document should include a list with action items to be completed. A follow-up meeting should be scheduled to determine progress on these items. These action items and their completion should also be documented in the case report.

A case report should be generated, including every pertinent detail . Alcor may decide to withhold some information to protect the privacy of the patient. Case reports should be completed within 2 months after the case and should follow a general template to allow for meaningful comparisons between cases, and meta-analysis.

After completion of the case the standby coordinator and other staff members should give priority to preparing Alcor for future cases. Equipment must be retrieved, cleaned, and refurbished, and consumable supplies must be replenished. This unglamorous routine work is obviously vital to maintaining future response capability. ■

MEMBER PROFILE:

R. MICHAEL PERRY, PH.D.

By Chana de Wolf

Self-portrait, Dec. 2009

If you have read an issue of *Cryonics* before, then you are most likely familiar with Dr. R. Michael Perry. Few people are as universally respected within the cryonics community as he, and with good reason. Working at Alcor since 1987, and serving as Patient Caretaker essentially the whole time, Dr. Perry has proved to be a dedicated cryonics activist and has provided careful watch over those Alcor members who have been preserved cryogenically for future advances in medicine. Dr. Perry's commitment to the care of Alcor patients has been steadfast – a solid role model for the responsibility we have to protect the most vulnerable and defenseless of our fellow cryonicists.

It should come as no surprise, then, that Dr. Perry has contributed to Alcor and to cryonics in countless other ways. Applying his background in mathematics and computer science, he programmed much of the software Alcor used until recently to automate cooldown to liquid nitrogen temperature. He maintains the patient logbook and does number crunching to produce case statistics, predictions of expected case load, and other analyses meaningful to Alcor's operations.

Combining technical knowledge and a well-developed intellectual philosophy about the potential of the continued progress of humanity, Dr. Perry also contributes by writing extensively about the moral issues surrounding cryonics and life extension technologies, ultimately expressing his comprehensive view in the book *Forever For All: Moral Philosophy, Cryonics, and the Scientific Prospects for Immortality* (available from Universal Publishers). He also performs writing tasks at Alcor, serves as de facto Alcor historian, and is a regular contributor to *Cryonics* magazine, where he has kept readers abreast of breaking technological news and written book reviews and other articles on a wide range of topics, including alternatives to cryonics.

Since those of us in cryonics have known him as a singularly stationary man, it may be a surprise to some that Dr. Perry ("Mike") moved around quite a bit before settling into his long career at Alcor. As the son of an Army Air Corps officer, he was born on Adak Island in the Aleutian chain in Alaska and moved from there to South Carolina, North Carolina, Virginia, and Alabama (his mother's home state) over the next dozen years. Then his father did a tour of duty in Morocco, where Mike lived from age 12 to 14. Afterward his family returned to the States, first spending a couple of years in Colorado and then to the island of Maui, Hawaii, where Mike spent his senior year of high school, graduating in 1965. There he got a summer job with a solar astronomer who had a telescope at the top of Mount Haleakala. Mike performed mathematical analysis and used the experience and other work in mathematics to prepare for his entry into the math program at the University of Chicago.

Though he now remembers an episode of *Science Fiction Theater* ("Dead Storage," 1955) as his first exposure to the idea of freezing an organism for later resuscitation, the pieces really started coming together for Mike while he was in college. "In 1965 I attended a lecture at the University of Chicago where the idea was offhandedly mentioned that some were thinking of freezing people at death for later revival. This was before anyone had actually been cryogenically preserved for this purpose, though the first attempt would occur only a few months later. I think the lecturer had heard about the freezing idea as spinoff from Robert Ettinger's book, *The Prospect of Immortality,* which had been commercially published the previous year."

Having abandoned belief in the supernatural in 1962, Mike had become acutely aware that death was a problem that needed solving, and that it probably could be solved by advanced technologies eventually. But "eventually" is a hard pill to swallow when you want to save lives. "There must be something we can do for people right now," Mike thought. Freezing them upon cardiac arrest for later reanimation was the first thing that came to mind. "At first I thought there must be something wrong with this idea, some known reason it wouldn't work, otherwise people would be doing it."

Mike's parents, Neil and Mary Perry, wedding picture, Feb. 16, 1946.

One day he overheard someone at school talking about the freezing idea with a group of people. "It became clear to me that there was no reason anyone could definitely point to for why it wouldn't work. I realized it was the logical choice to make, and I told the others right there that I was going to be frozen myself." Because it seemed so rational to him, he was surprised when no one else in the group said they were considering it. Mike spent many years after this experience asking himself if there was another rational way to overcome the problem of death but kept coming back to the idea of cryonics. "I didn't have a sense of urgency about it—I just thought vaguely that I'd make the freezing arrangements in due course. Being as young as I was and in good health I didn't think I needed to take immediate action. Now I see that was a mistake in more ways than one. You never know when you'll need the services, even if you are healthy, people die in accidents, for instance, plus there was a lot of the early cryonics history I missed out on. Someone has said to me that as far as that goes, I didn't miss much, but I've thought many times there might have been something I could have done to avert some of the disasters that happened that first decade, when so many patients were lost." In 1977 though, he was ready and did what anyone of his persuasion should do – he made cryonics arrangements.

Mike went on to obtain an M.S. (1979) and Ph.D. (1984) in Computer Science from the University of Colorado. He recalls, "Back then there was great concern over the early human freezings that had failed and been abandoned. Alcor at this time was promoting head-only freezing as a way to lower maintenance costs, plus had a policy of insisting on up-front payments for all cases, whether head-only or whole-body. This hard-headed, rational approach was reassuring, and in 1984, coincidentally, I moved to California where Alcor was based. So I changed my service provider to Alcor and signed up with them as a head-only or neuro, an arrangement I still have today."

Dr. Perry pursued a career in computers and returned briefly to Colorado, where he did programming work. But in 1987 he left Colorado for Arizona, where he briefly worked with the Society for Venturism, a cryonics-promoting organization started the previous year by David Pizer, that Mike had joined as one of the original directors. "Soon it developed that help was needed at Alcor, then located in Riverside, California, and I arrived there in May of '87, thinking perhaps I'd be there not too long before finding some sort of programming job. Alcor at that time had two people whose salaries were being paid, Hugh Hixon and Mike Darwin, and there was no provision for more. I served as a volunteer, with support from a generous benefactor, enough for basic needs."

> "More attention should be paid to the idea of low-cost alternatives to the expensive cryonics procedures that are now used, and which show signs of becoming even more expensive and harder to afford."

A few months after Mike arrived at Alcor, a crisis erupted when a member, Dora Kent, arrested at the facility with no physician present, prompting a coroner's investigation. "After that I was needed, while others were away from the facility, as they frequently were, just to answer phones and keep watch on things, since we didn't know what the authorities were planning to do. But the crisis was weathered, and Dora Kent and the other patients stayed frozen. Eventually Alcor won a legal victory that established cryonics as a legitimate practice

Alaska, 1947. Father made crib.

in California, a precedent that has helped in other jurisdictions." In 1989, with more funding available, Mike went from volunteer to paid status. "My interest in cryonics led, a little unexpectedly, to this employment at Alcor after I had obtained a Ph.D. in computer science and thought that field would be my career. I have now been working at Alcor for 23 years, starting at age 40, so cryonics has long been a way of life."

Mike notes that his employment status and responsibilities have evolved over time, though some things have remained the same. "I started out pretty much as the newly-installed patient caretaker, and have been that all along. When I arrived they had an alarm system to warn if liquid nitrogen levels were getting low, but were not doing daily checks. That was an early responsibility I had that continues today. Writing articles for the magazine and doing programming work as needed are activities that also have continued from early times. I used to be the main phone answerer; that has changed (and it's a relief). More or less, I do what circumstances call for that is within my domain of expertise, everything from helping with cooldowns to maintaining patient records, plus helping provide presence at the facility for security reasons."

Such a long career in cryonics has given Dr. Perry plenty of time to think more about eventualities. In particular, he began to think that, given adequate technologies, information can eventually be used to resuscitate all the people who have ever lived. Sound fantastic? Dr. Perry agrees. But it's not impossible, and he thinks it might even be occurring in alternate universes where parallel, similar efforts are taking place. "As a last resort," Dr. Perry speculates, "you could restore a past individual who had perished by guessing his/her brain structure and using advanced technology to recreate that individual in physical form.

Despite the fantastic complexity of what you'd have to guess and the unlikelihood that all the countless but essential details would be correct, there is a nonzero chance, under the rules of quantum physics, that you would come up with just the right answer or close enough. And somewhere in a parallel world, someone like you doing what you were doing would get it exactly right, while you in turn would also get it exactly right for the one you are recreating, someone who actually lived." Given the nascency of nanotechnology, however, and the complexities and uncertainties of the quantum approach, Dr. Perry recommends a more straightforward and practical option, such as cryonics, today.

Another eventuality that Dr. Perry has given thought to is the future. In response to those who are reluctant to make cryonics arrangements because they fear the future could be worse than today, he reminds them that "the world of the future will not just be the sort that might be dreamed up by science fiction writers to catch the interest of today's reading audience and generate some income." Instead, a world that would take the time to resuscitate cryonics patients (or other preserved individuals) is likely to be one that is "sensitized to the problems some may have in finding existence worthwhile, and should have advanced ways of helping such people."

To increase the probability of reaching that future world, Dr. Perry stresses the importance of what we can do now to improve cryopreservation and care of Alcor patients. "A starting point would be to work harder to encourage members to move close to Alcor, to better facilitate their cryopreservation when it comes, especially those who are getting older and have medical problems," he suggests. He also strongly supports technical research to improve capabilities in monitoring cryoprotection and cooldown processes, but thinks that there should also be research into ways of more quickly inhibiting deterioration after legal death, such as use of fixatives in combination with cryoprotection and cooling. "This is controversial but it hasn't been investigated as it should be," he contends. "More attention should be paid to the idea of low-cost alternatives to the expensive cryonics procedures that are now used, and which show signs of becoming even more expensive and harder to afford."

With Joker (a guard dog), Morocco, about 1960.

As his own contribution to this effort, Dr. Perry has obtained grant support for his project to analyze ischemic neural tissue. Describing the objectives of this work, he explains, "Ideally, I'm trying to document exactly what happens in brain tissue exposed to warm ischemia, construct a blow-by-blow account as it were. In addition, I am trying to develop a method of quantitatively assessing the condition of tissue exposed to warm ischemia, to determine how much damage has occurred and to better understand the sort of damage that occurs."

While the feasibility of developing methods and technologies for recording cellular changes in ischemic tissue is of great interest to Dr. Perry, he acknowledges that funding available for such research is limited. So he approached the issue from the next best starting place – analyzing electron microscope (EM) images of individual brain slices exposed to different periods of ischemia. In doing so, he has had some success in developing an algorithm that can, Dr. Perry says, "roughly estimate the amount of ischemic exposure for a given EM brain-slice image." He points out that this ischemia work is part of a larger project of his to assess the efficacy of various preservative techniques on tissue samples, with emphasis on finding lower-cost alternatives to present-day cryopreservation.

Dr. Perry's research is practical, and is in perfect alignment with his overall philosophy and actions. After over 30 years in cryonics and more than two decades at Alcor he has been involved in the history and making of cryonics as a science, as a movement, and as a community. His observations and experiences have led him to the conclusion that the greatest challenge in cryonics is not technical, social, political, or economic. Instead, Dr. Perry has determined, "I think the greatest challenge may be psychological – the level of determined dedication that will be necessary to see that people are cryopreserved and stay that way for as long as will be necessary until, as I think, resuscitations can actually happen."

With younger siblings and grandmother, about 1957.

Along the same theme, Dr. Perry strongly encourages other cryonics sympathizers to make and, importantly, to ***keep*** their cryonics arrangements. "Your life is in serious danger even if cryonics works, as I am reasonably hopeful it will," he warns. "Many people drop their arrangements long before they would need the service. Try to stay the course. Find reasons to do so, not just to benefit yourself but others and society at large. Learn to love the big picture, and all the good that it stands for, and let that love carry you forward." ■

Dr. Perry's writings relating to cryonics and immortalism are best represented in his book, Forever For All, *which can be purchased or downloaded free (as ascii) by following the links at www.universalimmortalism.org/books.htm.*

On the next page is an excerpt from a revised edition, now in progress. ➤➤

Optimizing Eternity

➢ The individual ought to endure, for a life rightly lived is never rightly ended. A final consummation and eternal oblivion are neither desirable, nor, I will argue, necessary—*or even possible*—given the nature of persons and of reality as a whole, for which modern philosophical thought and scientific research are providing some startling new insights. Persons are, in an important, informational sense, never eternally lost, and on this basis, can expect eventual resurrection and resumption of consciousness after death, albeit in settings possibly far removed from what was previously known and familiar. "Quantum resurrection awaits all of us," science popularizer Clifford Pickover proclaims, echoing a growing body of scientific opinion.[1] This optimistic conclusion follows irrespective of our good or ill fortune or conduct in this earthly life. The fabric of reality, with its endless throws of dice in shaping everything that is, and the prospect of recurring patterns on arbitrarily large scales, appears to guarantee the eventual resurrection of all who have lived. We—our copies or informational twins—must re-emerge to arguably continue "our" authentic existence, if all else fails. It is not necessarily true that all else will fail, however. Quantum resurrection, in the sense of an accidental, "ultimately lucky" process without any conscious intervention from any source, may be among the least likely—and also least desirable—mechanisms for resurrection to occur. Outcomes will in any case be influenced by our conduct here and now and in the future, as I will argue, and certain choices and courses of action are much to be preferred over others.

➢ Overall this is very good news. Death must not be seen as a final eventuality, limiting the individual existence to a finite amount of consciousness followed by eternal oblivion. Instead, additional, conscious life for each person whatever the circumstance is always the ultimate prospect. Such a prospect at its most basic does not depend on supernatural or mystical phenomena, nor on radical extensions of accepted, tested physics, nor even on special, favorable properties of our particular, visible universe that would have to hold in remote future times. Indeed, the universe could self-destruct, yet individuals must go on. Reality as a whole, jittery and unpredictable on small scales but constrained and steady on large scales, must produce recurrences of arbitrary magnitude, and this alone appears sufficient. Unlikely for the short term but ultimately unavoidable occurrences will be significant if more usual avenues fail. The permanence of the individual will follow from what I contend is all that is truly important concerning personal survival, invoking a point of view that emphasizes information rather than material objects. Survival after catastrophe will take multiple forms, weighted by probabilities. Most important, it will also extend to cases in which a recreated replica with the same information is present but is not the "original" object, if indeed the latter concept is meaningful in any absolute sense. (A good case can be made that it is not, as we shall see.)

➢ Though the outlook as I have sketched it is optimistic overall, there are boundaries that apply when reliance on supernatural and paranormal effects is discounted, as I think is appropriate and propose to do here. I do not think, for example, that prospects are realistic for presently contacting or being visited by those who have died, nor do I think such contact was accomplished in the past, notwithstanding some famous claims. With overwhelming probability resurrections of the dead—as constructs of a suitable sort—are only to be expected in settings where knowledge and capabilities are far advanced beyond our present levels. The possibility of such eventual occurrences, and the overall hopeful outlook, can nevertheless inspire us as we confront life's problems today. These problems in turn are best faced squarely and proactively, using the best approaches at hand, even if a favorable outcome may eventually happen regardless. Thus the choice of a good path in life is significant even when differing paths lead to the same, eventual goal.

➢ We live in remarkable times, even if far greater accomplishments will be needed to realize the possibilities that appear to exist. Marvels abound and many more are coming. Scientific advances should play an increasing role in shaping our destiny. Biological limitations will surely be transcended. Those who survive long enough or are born or made late enough should have the means to greatly extend their lives in good health. Those dying in the meantime can take advantage of preservative techniques which may permit their eventual reanimation, at a time when life-extending breakthroughs that occurred during their extended sleep can be applied. Life for those who die without such preservation is a more difficult problem, but a problem that reason and science can still surmount, as evidence carefully considered suggests.

➢ For those now living I advocate a stance of proactive intervention as an end-of-life choice. Death is a process, not an event. While one can expect an ultimate benefit even with a passive response this is not the best way to proceed. Instead advantages will be had by making arrangements for measures to combat the destructive changes that follow after clinical death. The best and most common choice of this nature is cryopreservation and indefinite storage of one's remains at low temperature, a practice known as cryonics. The rationale is that eventually methods will be developed to resuscitate the patient and cure any diseases or disabilities, including old age, thereby restoring a state of healthy, active life. Understandably there is widespread skepticism. No human or other large organism has yet been revived from low-temperature preservation, and the aging process and many diseases currently resist all attempts at alleviation or cure. Moreover, the cost of the procedure is high—several times that of a conventional funeral with ground burial, for the least expensive options. The cryonics possibility nevertheless offers a new and different approach to the ages-old problem of death.

[1] Pickover, Clifford A. *A Beginner's Guide to Immortality: Extraordinary People, Alien Brains, and Quantum Resurrection.* New York: Thunder's Mouth Press, 2007, 120.

RELIGION AND THE IMPLICATIONS OF RADICAL LIFE EXTENSION

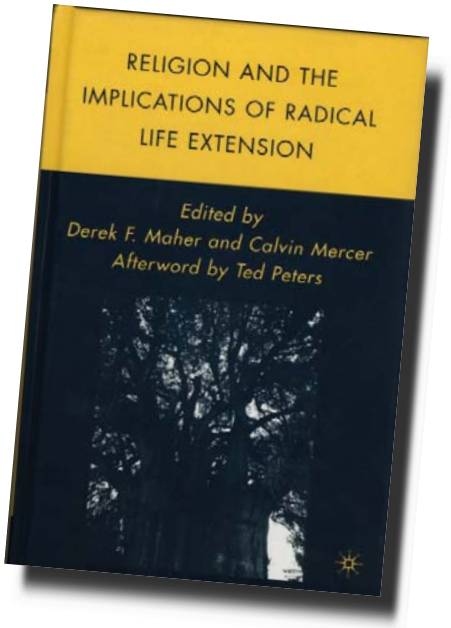
Edited by: Derek F. Maher and Calvin Mercer; Afterword by: Ted Peters
[New York: Palgrave MacMillan, 2009]

BOOK REVIEW BY MIKE PERRY

"The accompanying benefit to human life—removal of the "reproach"—is to occur here on earth rather than in some other, otherworldly domain."

Readers may remember that at Alcor's 2007 conference Calvin Mercer spoke on the topic *cryonics and religion, friends or foes?* with a basically "friendly" conclusion: the two can and should have good relations; cryonics in particular needs the support of religious people as well as scientists and others. The volume here reviewed, which Mercer coedited, addresses the related problem of whether radical life extension (RLE) would pose any difficulties for the religious. The emphasis is on ways of overcoming aging and now-terminal diseases. (Cryonics is only peripherally mentioned, perhaps in hopes of getting more responses to a less controversial if still "radical" topic.) Scholars from several of the major world religions, both Western and Eastern, weigh in with their opinions on the prospects of indefinite or even infinite life spans, and how these prospects would impact their various beliefs and traditions. Overall the responses reflect a basic optimism about any prospects of increasing human life span, however much or little it may be, together with some caveats that relate to particular traditions.

An early chapter by biomedical gerontologist Aubrey de Grey establishes that, while RLE is not yet possible, at least it is an arguable prospect in the not-too-distant future, some decades from now if not sooner. Such an outcome would have no theological implications, he argues, for "it [would] not mean we [had] in any way made whatever omnipotent beings there may be out there any less omnipotent."



A powerful following chapter by biotechnologist Pete Estep (Preston W. Estep III) considers RLE in a wider context. We are interested in a cure for aging, he maintains, and indefinite life extension; but beyond this, also life expansion. Indefinite life extension could involve such possibilities as uploading—escaping entirely the fragile body we now inhabit for something of our own design that is more durable and in other ways better (chosen very carefully of course). Life expansion could take such forms as having many individuals inhabit one "body" which might be an advanced computer. In some ways the whole could function as one being, yet individuals within could still

maintain separate identities. Death in any case is a problem humanity has all along wanted to solve, but, Estep warns, "many won't be completely satisfied with evidence-free claims about a spiritual afterlife and [will instead] underscore the importance of the quest for more tangible solutions." This does not mean Estep is negative toward all religious sentiments. Instead he takes issue with certain religious people on their own turf who try to argue for the desirability of death as part of "God's plan." He notes that Isaiah 25:8 prophesies a future time when God will have "swallowed up death forever" while in addition, "the reproach of his people shall he take away from off all the earth." Thus it is not merely the abolition of death that is foretold in this basic text of Judaism and Christianity. The accompanying benefit to human life—removal of the "reproach"—is to occur here on earth rather than in some other, otherworldly domain.

The rest of the book is largely occupied with essays about RLE from different religious perspectives, the various contributors trying to fit it into one traditional framework or another. RLE is generally seen in positive terms, but not as something all-important or even, in some cases, desirable at all. Perhaps the most enthusiastic endorsement comes from Daoism, whose spokesperson (Livia Kohn) foresees complete vindication of the "age-old contestation that death and aging are essentially avoidable." Other religious authorities are concerned that RLE would weaken beliefs in the necessity of divine intervention to alleviate the burden of mortality, something important to their respective faiths (Christianity and Islam in particular). Reformed Protestant spokespersons Nigel M. de S. Cameron and Amy Michelle DeBates see a mixed blessing. "The irony, as will be evident, of a Christian perspective on RLE is that while it is a good and proper thing to engage in the preservation of health and the prolongation of life, the net effect for the individual believer will be to put off the experience of death and, with it, the entry into eternal life." With similar caution a few others, notably from Eastern traditions such as Buddhism and Jainism, view death as an important "loosening of attachments" with the material world, something desirable if one is to attain a state of ultimate reward and bliss, and something that RLE could hinder, despite the evident benefits.

It is clear that the major religions already have an ample storehouse of beliefs and practices for addressing the psychological problem of one's mortality—they don't "need" RLE. But these approaches are evidence-free (to use Estep's terminology) and, except for believers, mythical and not to be taken literally. RLE in turn aims at an evidence-based approach to physically solving the problem of mortality. RLE and accompanying technologies would also bring very profound changes in the life of earthly intelligent beings, raising questions of just what it means or should mean to be human at all, something I think is glossed over and obscured by the traditionalists. Yet at the same time the traditionalists seem open to the possibility of viewing matters in a different light depending on the options that actually become available. They are willing to wait and see where the course of research and development will lead, which certainly is better than open hostility. ■

About the Editors

Derk F. Maher

Dr. Derek F. Maher is Director of the Religious Studies Program at East Carolina University and teaches courses on Buddhism, Islam, methodology, and religion and violence. He received his M.A. and Ph.D. from the University of Virginia in the History of Religions, with an emphasis on Indo-Tibetan Buddhism.

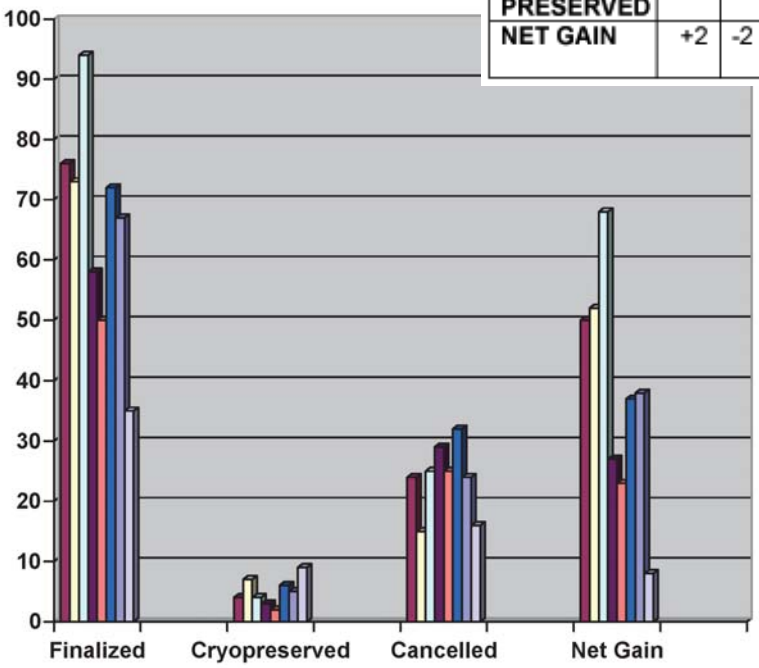
Calvin Mercer

Dr. Calvin Mercer teaches Religious Studies at East Carolina University, where he recently received a "Scholar-Teacher" award and is a director of the Multidisciplinary Studies Program. Dr. Mercer has organized panels on religion and radical life extension for annual meetings of the American Academy of Religion. He is a founding member and first chair of the academy's "Transhumanism and Religion" consultation.

Photo credits:
Derek Maher at http://www.ecu.edu/religionprogram/maher/images/maher200_301.jpg
Calvin Mercer at http://www.ecu.edu/religionprogram/mercer/images/mercer174_255.jpg

Membership Statistics

2010	01	02	03	04	05	06	07	08	09	10	11	12	
TOTAL	915	913	920	918	923	921							921
FINALIZED	6	3	8	4	6	6							33
REINSTATED	0	0	0	0	0	0							0
CANCELLED	3	3	1	4*	0	5							16
CRYO-PRESERVED	1	2	0	2	1	3							9
NET GAIN	+2	-2	+7	-2	+5	-2							8



On June 30, 2010, Alcor had 921 members on its Emergency Responsibility List. During the first three months of 2010, 6 memberships were approved, no memberships were reinstated, 5 memberships were cancelled and 3 members were cryopreserved. Overall, there was a net gain of 8 members for the year of 2010 to date.

The chart on the left displays the year-end monthly average net gain since 2002.

"Stress" Protein Could Halt Aging Process, Say Scientists

Scientists in the UK and the U.S. have discovered that a protein which responds to stress can halt the degeneration of muscle mass caused during the body's aging process. HSP10 (Heat Shock Protein), helps monitor and organize protein interactions in the body, and responds to environmental stresses, such as exercise and infection, by increasing its production inside cells. Researchers at Liverpool, in collaboration with colleagues at the University of California, found that excessive amounts of HSP10 inside mitochondria – "organs" that act as energy generators in cells – can halt the body's aging process by preserving muscle strength. Anne McArdle, from the University of Liverpool's School of Clinical Sciences, said: "We studied the role of HSP10 inside mitochondria, as it is here that unstable chemicals are produced which can harm parts of the cell. The damage caused by this is thought to play an important part in the aging process, in which skeletal muscle becomes smaller and weaker and more susceptible to stress damage. In response to these stresses HSP10 increases its levels and helps cells resist damage and recover more effectively."

ScienceDaily
5/24/10
http://www.sciencedaily.com/releases/2010/05/100524101341.htm

Stem-Cell Dental Implants Grow New Teeth Right in Your Mouth

The loss of a tooth is a minor deformity and a major pain. Although dental implants are available, the healing process can take months on end, and implants that fail to align with the ever-growing jawbone tend to fall out. If only adult teeth could be regenerated, right? According to a study published in the latest Journal of Dental Research, a new tissue regeneration technique may allow people to simply regrow a new set of pearly whites. Dr. Jeremy Mao, the Edward V. Zegarelli Professor of Dental Medicine at Columbia University Medical Center, has unveiled a growth factor-infused, three-dimensional scaffold with the potential to regenerate an anatomically correct tooth in just nine weeks from implantation. By using a procedure developed in the university's Tissue Engineering and Regenerative Medicine Laboratory, Dr. Mao can direct the body's own stem cells toward the scaffold, which is made of natural materials. Once the stem cells have colonized the scaffold, a tooth can grow in the socket and then merge with the surrounding tissue. Dr. Mao's technique not only eliminates the need to grow teeth in a Petri dish, but it is the first to achieve regeneration of anatomically correct teeth by using the body's own resources.

Popular Science
5/25/10
http://www.popsci.com/science/article/2010-05/new-technique-uses-bodys-stem-cells-regenerate-teeth

China Aims to Become Supercomputer Superpower

China is ramping up efforts to become the world's supercomputing superpower. Its Nebulae machine at the National Super Computer Center in Shenzhen, was ranked second on the biannual Top 500 supercomputer list. For the first time, a second Chinese supercomputer appears in the list of the top ten fastest machines. However, the US still dominates the list with more than half the Top 500, including the world's fastest, known as Jaguar. This Cray computer, which is owned by the Oak Ridge National Laboratory in Tennessee, has a top speed of 1.75 petaflops. (One petaflop = 1,000 trillion calculations per second.) It is used by scientists conducting research in astrophysics, climate science and nuclear energy. By comparison, China has 24 machines in the list. Its fastest has a top speed of 1.20 petaflops, more than double the speed of its previous top supercomputer, and a theoretical top speed of nearly 3 petaflops, which would make it the fastest in the world. Dawning, the company behind the fastest Chinese machine, is reportedly building an even faster machine for the National Supercomputer Center in Tianjin. It is also developing home-grown silicon chips to power the behemoths.

BBC News
5/31/10
http://news.bbc.co.uk/2/hi/technology/10181725.stm

Harvard Spinoff Promises Genome Sequencing for $30

The scramble to come up with a faster and cheaper way to sequence a genome just got a credible new contender which aims to do the job for the bargain basement rate of $30. The first time scientists sequenced a human genome, the price tag hit $3 billion. That price point has quickly plunged to about $20,000, putting sequencing genomes for the purposes of drug discovery work within the reach of biopharma companies. But this new company, a spinoff from Harvard University dubbed GnuBio, says the trick to bringing sequencing within reach of most people on the planet revolves around deciphering fragments of DNA from droplets streaming through a tiny tube. John Boyce, a veteran of Helicos, has joined with Harvard physics professor Dave Weitz and Jessica Tonani, formerly of Affymetrix, to launch the company. Initially, the company plans to ship machines that can accomplish small sequencing tasks before it launches new technology that can handle the full sequencing task. The nonprofit Ignite Institute and the Beaulieu-Saucier Pharmacogenemics Centre from the University of Montreal are first in line to receive a machine at the end of this year.

FierceBiotech Research
6/7/10
http://www.fiercebiotechresearch.com/story/harvard-spinoff-promises-genome-sequencing-30/2010-06-07?utm_medium=nl&utm_source=internal

Protein Lets Brain Repair Damage from Multiple Sclerosis, Other Disorders

A protein that helps build the brain in infants and children may aid efforts to restore damage from multiple sclerosis (MS) and other neurodegenerative diseases, researchers at Washington University School of Medicine in St. Louis have found. In a mouse model of MS, researchers found that the protein, CXCR4, is essential for repairing myelin, a protective sheath that covers nerve cell branches. MS and other disorders damage myelin, and this damage is linked to loss of the branches inside the myelin. "In MS patients, myelin repair occurs inconsistently for reasons that aren't clear," says senior author Robyn Klein, MD, PhD, associate professor of medicine and of neurobiology. "Understanding the nature of that problem is a priority because when myelin isn't repaired, the chances that an MS flare-up will inflict lasting harm seem to increase." The findings appear online in *The Proceedings of the National Academy of Sciences.*

ScienceDaily
6/7/10
http://www.sciencedaily.com/releases/2010/06/100607192727.htm

Harnessing the Immune System's Diagnostic Power

An inexpensive system for earlier disease diagnosis could save innumerable lives. It would also have a profound impact on the nation's healthcare industry, currently buckling under the strain of spiraling costs. Now Dr. Bart Legutki, a researcher at the Biodesign Institute at Arizona State University has pioneered a method for profiling the immune system, using clues provided by antibody activity to track an individual's state of health. The work was done in collaboration with Dr. Stephen Albert Johnston, director of the Institute's Center for Innovations in Medicine. The new technique, known as immunosignaturing, could provide rapid, pre-symptomatic diagnosis for a broad range of ailments, from infectious diseases to chronic afflictions to varied forms of cancer, offering the best hope for successful treatment. Immunosignaturing also shows potential as a low-cost alternative for vaccine evaluation, currently a lengthy and expensive undertaking. As Legutki explains, the immune system is exquisitely sensitive to any alterations in an individual's state of health resulting from infection or disease, registering these changes through subtle fluctuations in antibody activity.

ScienceDaily
6/8/10
http://www.sciencedaily.com/releases/2010/06/100608101015.htm

Freezing "to Death" and Living to Tell About It

How is it that some people who apparently freeze to death, with no heart rate or respiration for extended periods, can be brought back to life with no long-term negative health consequences? New findings from the laboratory of cell biologist Mark B. Roth, Ph.D., of Fred Hutchinson Cancer Research Center, may help explain the mechanics behind this widely documented phenomenon. Reporting online ahead of the July 1 print issue of Molecular Biology of the Cell, Roth, a member of the Hutchinson Center's Basic Sciences Division, and colleagues show that two widely divergent model organisms – yeast and nematodes, or garden worms – can survive hypothermia, or potentially lethal cold, if they are first put into a state of suspended animation by means of anoxia, or extreme oxygen deprivation. Roth and colleagues found that under normal conditions, yeast and nematode embryos cannot survive extreme cold. After 24 hours of exposure to temperatures just above freezing, 99 percent of the creatures expire. In contrast, if the organisms are first deprived of oxygen and thus enter a state of anoxia-induced suspended animation, 66 percent of the yeast and 97 percent of the nematode embryos will survive the cold.

ScienceDaily
6/11/10
http://www.sciencedaily.com/releases/2010/06/100610171714.htm

Tastes Like Chicken: The Quest for Fake Meat

This spring, scientists at the University of Missouri announced that after more than a decade of research, they had created the first soy product that not only can be flavored to taste like chicken but also breaks apart in your mouth the way chicken does: not too soft, not too hard, but with that ineffable chew of real flesh. When you pull apart the Missouri invention, it disjoins the way chicken does, with a few random strands of "meat" hanging loosely. The vegetarian world is buzzing about the breakthrough in Missouri. "Along with ham, chicken has always been the holy grail," says Seth Tibbott, 59, the creator of Tofurky and the dean of soy-meat inventors. Tibbott's Oregon-based Turtle Island Foods has become famous for its surprisingly full-flavored fake turkey. But Tibbott says efforts to create a credible fake chicken have foundered because of chicken's unique lean texture and its delicate flavor. ("Turkey has a gamier flavor," he says, "and it's easier to match stronger flavors.")

Time
6/14/10
http://www.time.com/time/magazine/article/0,9171,1993883,00.html

Highly Efficient Solar Cells Could Result from Quantum Dot Research

Conventional solar cell efficiency could be increased from the current limit of 30 percent to more than 60 percent, suggests new research on semiconductor nanocrystals, or quantum dots, led by chemist Xiaoyang Zhu at The University of Texas at Austin. Zhu and his colleagues report their results in this week's *Science*. The scientists have discovered a method to capture the higher energy sunlight that is lost as heat in conventional solar cells. The maximum efficiency of the silicon solar cell in use today is about 31 percent. That's because much of the energy from sunlight hitting a solar cell is too high to be turned into usable electricity. That energy, in the form of so-called "hot electrons," is lost as heat. If the higher energy sunlight, or more specifically the hot electrons, could be captured, solar-to-electric power conversion efficiency could be

increased theoretically to as high as 66 percent. "There are a few steps needed to create what I call this 'ultimate solar cell,'" says Zhu. "First, the cooling rate of hot electrons needs to be slowed down. Second, we need to be able to grab those hot electrons and use them quickly before they lose all of their energy." Zhu says that semiconductor nanocrystals, or quantum dots, are promising for these purposes.

ScienceDaily
6/18/10
http://www.sciencedaily.com/releases/2010/06/100617143930.htm

Silicon Chips to Enter World of High Speed Optical Processing

Physicists at the University of Sydney have brought silicon chips closer to performing all-optical computing and information processing that could overcome the speed limitations intrinsic to electronics, with the first report published of an on-chip all-optical temporal integrator in *Nature Communications* Jun. 20. An all-optical integrator, or lightwave capacitor, is a fundamental building block equivalent to those used in multi-functional electronic circuits. Associate Professor David Moss leads an international team which has developed the optical integrator on a CMOS compatible silicon chip. The device, a photonic chip compatible with electronic technology (CMOS), will be a key enabler of next generation fully-integrated ultrafast optical data processing technologies for many applications including ultra-fast optical information-processing, optical memory, measurement, computing systems, and real-time differential equation computing units. It is based on a passive micro-ring resonator and performs the time integral of an arbitrary optical waveform with a time resolution of a few picoseconds, corresponding to a processing speed of around 200 GHz, and with a "hold" time approaching a nanosecond.

PhysOrg.com
6/20/10
http://www.physorg.com/news196258264.html

Genes Predict Living Beyond 100

US scientists have developed a way of predicting how likely a person is to live beyond the age of 100. The breakthrough, described in the journal Science, is based on 150 genetic "signposts" found in exceptionally long-lived people. The Boston team created a mathematical model, which takes information from these signposts to work out a person's chance of reaching 100. It is based on the largest study of centenarians in the world. This is a rare trait—only one in 6,000 people in industrialized countries reaches such a ripe old age. And 90% of them are still disability free by the age of 93. The researchers now think they have cracked the genetic secret of this longevity. The team originally embarked on their study in 1995. Since then, they have scanned the genomes of 1,000 centenarians. They identified genetic markers that are "most different" between centenarians and randomly selected individuals. The research was led by Paola Sebastiani, a professor of biostatistics at Boston University, and Thomas Perls, associate professor of medicine, also at Boston University. "We tested our model in an independent set of centenarians and achieved an accuracy of 77%," explained Professor Sebastiani.

BBC News
7/1/10
http://news.bbc.co.uk/2/hi/science_and_environment/10475018.stm

"Climategate" Debunking Is (Or Should Be) Major News

There is more than a degree of poetic justice in the release of two reports exonerating the "Climategate" scientists during this brutal heat wave—especially because so many of the broadcasters and journalists who popularized the bogus scandal are trying to stay cool in stifling New York and Washington. The rest of us suffer along with them, alas, so at the very least they ought to devote as much attention to the debunking as they did to the original accusations. By restoring the reputation of the U.N.'s Intergovernmental Panel on Climate Change, the reports released by a Netherlands environmental agency and a special British investigative panel should do much to dispel the widespread doubt generated by hackers who pinched nasty e-mails from the computers of climate scientists associated with the IPCC. Or the reports would dispel doubt, if only the mainstream media showed sufficient interest in correcting the record. For what the probers found is that those embarrassing e-mails, considered in context, undermined neither the basic integrity of the scientists who authored them nor their dire conclusions about the potential impact of carbon dioxide pollution.

Salon.com
7/8/10
http://www.salon.com/news/global_warming/index.html?story=/opinion/conason/2010/07/08/climate

Nanoparticles Shrink Tumors in Mice

In cancer research, nanotechnology holds great promise for the development of targeted, localized delivery of anticancer drugs, in which only cancer cells are affected. Such targeted-therapy methods would represent a major advance over current chemotherapy, in which anticancer drugs are distributed throughout the body, attacking healthy cells along with cancer cells and causing a number of adverse side effects. By carrying out comprehensive studies on mice with human tumors, UCLA scientists have obtained results that move the research one step closer to this goal. In a paper published July 8 in the journal Small, researchers at UCLA's California NanoSystems Institute and Jonsson Comprehensive Cancer Center demonstrate that mesoporous silica nanoparticles (MSNs), tiny particles with thousands of pores, can store and deliver chemotherapeutic drugs in vivo and effectively suppress tumors in mice. The researchers also showed that MSNs accumulate almost exclusively in tumors after administration and that the nanoparticles are excreted from the body after they have delivered their chemotherapeutic drugs. The study was conducted jointly in the laboratories of UCLA professors Fuyu Tamanoi and Jeffrey Zink.

ScienceDaily
7/11/10
http://www.sciencedaily.com/releases/2010/07/100709102723.htm

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

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. Facility tours are held every Tuesday and Friday at 2:00 PM. For more information or to schedule a tour, call D'Bora Tarrant at (877) 462-5267 x 101 or email dbora@alcor.org.

CALIFORNIA

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

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

DISTRICT OF COLUMBIA

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

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 AlcorNE mailing list, please contact Bret Kulakovich at 617-824-8982, alcor@bonfireproductions.com, or on FACEBOOK via the Cryonics Special Interest Group.

OREGON

Portland:
Cryonics Oregon holds regular meetings every 2-3 months for members of cryonics organizations living in Portland and the surrounding areas. For information, please contact Chana de Wolf at chana.de.wolf@gmail.com or (503) 756-0864. http://www.cryonicsoregon.com/

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

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 $150 application fee.
Step 2: You will then be sent a set of contracts to review and sign.
Step 3: Fund your cryopreservation. While most people use life insurance to fund their cryopreservation, other forms of prepayment are also accepted. Alcor's Membership Coordinator can provide you with a list of insurance agents familiar with satisfying Alcor's current funding requirements.
Finally: After enrolling, you will wear emergency alert tags or carry a special card in your wallet. This is your confirmation that Alcor will respond immediately to an emergency call on your behalf.

Call toll-free today to start your application:

877-462-5267 ext. 132
info@alcor.org
www.alcor.org

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