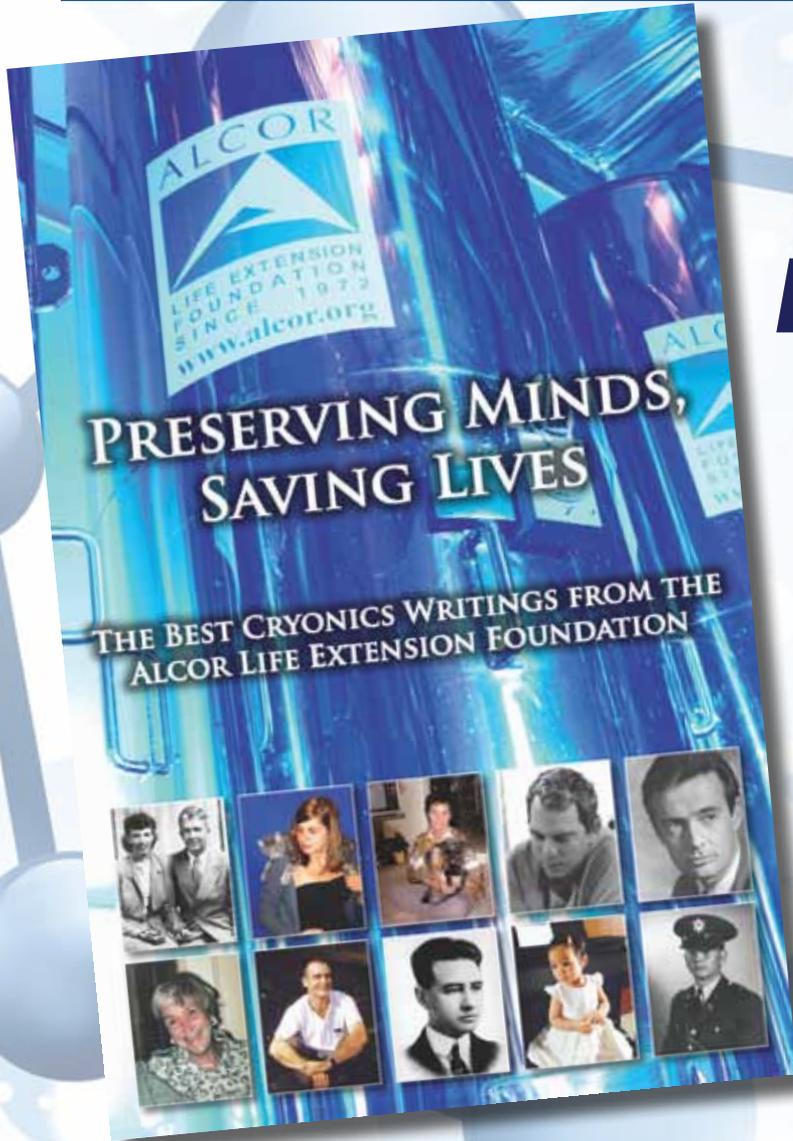


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# CRYONICS

NOVEMBER 2015 · VOLUME 36:11



## ***Preserving Minds, Savings Lives Book Released at the 2015 Alcor Conference***

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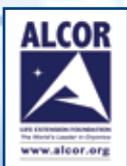
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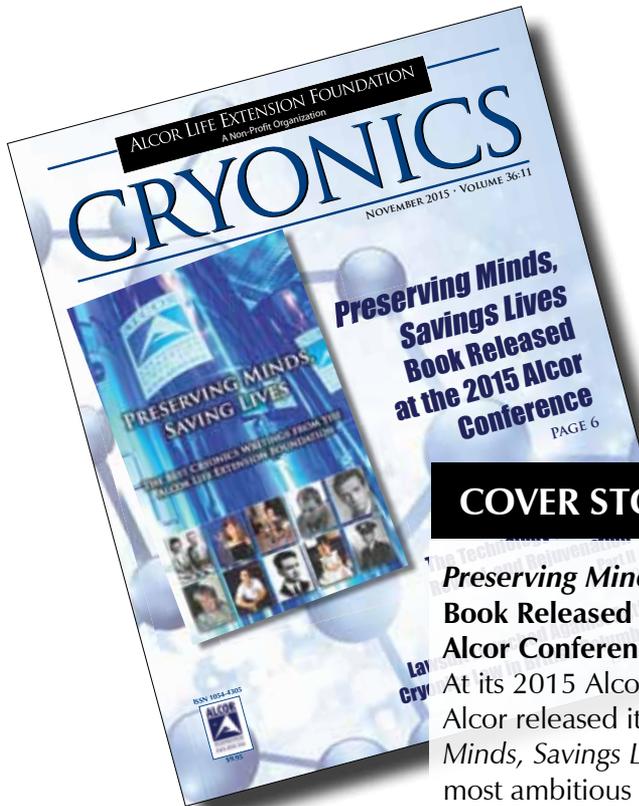
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# CRYONICS



## COVER STORY: PAGE 6

### **Preserving Minds, Savings Lives Book Released at the 2015 Alcor Conference**

At its 2015 Alcor conference, Alcor released its *Preserving Minds, Savings Lives* book, the most ambitious collection of cryonics articles ever published. Read how you can help put this book in the hands of more people and institutions.

## 5 **QUOD INCEPIMUS CONFICIEMUS** **Cryonics is NOT Mind Uploading**

A recent critical article on the MIT Technology Review website completely missed its target by conflating cryonics and mind uploading. This is not the first time critics seek to discredit cryonics by “debunking” an idea that is not a necessary component of cryonics. In this column you can read Alcor’s official response when we were asked to comment on the MIT article.

## 17 **Lawsuit Launched Against Anti-Cryonics Law in British Columbia**

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Gifts have played a fundamental role in the cryonics movement since its earliest days. Dr. James Bedford, a man whose extraordinary vision led him to become the first person to be cryopreserved, and the first to make a bequest to a cryonics organization, exemplified the determination of the early pioneers of cryonics. We invite you to follow in his footsteps, and join the James Bedford Society.

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# QUOD INCEPIMUS CONFICIEMUS

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



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## CRYONICS IS NOT MIND UPLOADING By Aschwin de Wolf

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On September 15, 2015, the MIT Technology Review published an article named “The False Science of Cryonics” that revealed how much ignorance about cryonics still exists among those that should know better (scientists, medical professionals, etc.). First of all, cryonics is not a “science” but an experimental medical procedure that is *informed* by scientific developments in disciplines such as cryobiology and neuroscience.

Semantics aside, a major flaw in the article is that it conflates mind uploading and cryonics. While some of our members may favor the possibility of “substrate-independent minds,” in its most “conservative” incarnation resuscitation will occur through repair of the *same biological* brain (or whole body) that was preserved. Complicated philosophical issues about whether a copy is “you” do not come into play in this repair scenario at all. So when Alcor was asked by a reporter to comment on the article, we submitted the following response:

The article in the MIT Technology Review rests on several mistaken assumptions. First of all, cryonics does not require or imply mind uploading. While some of our individual members are interested in this topic, the default resuscitation scenario for cryonics

patients involves molecular repair of the patient's biological brain (and body).

While we are encouraged by the rise of connectomics, the aim at Alcor is to cryopreserve *all* the fine details of the brain and even secure viability of the brain as well as we can. In fact, in our stabilization procedures we aim to keep the brain viable by contemporary medical criteria and collect data to evaluate the efficacy of our procedures.

Alcor is a charitable, non-profit, organization and we do not make a profit when we place our patients in biostasis. Also helpful to understanding the ethics and financial feasibility of cryonics for persons of ordinary means is that most people fund cryonics through an affordable, dedicated, life insurance policy, making cryonics an accessible personal choice.

We strongly disagree that without proof of human suspended animation or flawless ultrastructural preservation it is not ethical to practice cryonics. Our organization challenges the mainstream definitions of death, and we believe that perfected cryopreservation is a sufficient but not necessary condition for cryonics to succeed. As long as we have good reasons to believe that the original state of the brain can

be inferred from the damaged state, making cryonics arrangements can be a rational choice to make. To our knowledge, there are no rigorous, scientific, studies that demonstrate that today's cryonics procedures produce irreversible destruction of identity-critical information.

Information about the ultrastructural effects of the vitrification solutions we use to inhibit ice formation can be found here: <http://www.alcor.org/Library/html/newtechnology.html>

It is disappointing that scientists and professional writers put so little effort into understanding what cryonics entails and what the real technological challenges are. Unfortunately, there is essentially *no cost* to being factually wrong about cryonics. In fact, when professional cryobiologists comment on cryonics they often make claims about their own field that are factually incorrect, such as that cryonics produces intracellular freezing, or that ice-free cryopreservation of complex organs is not yet possible.

We may not be able to persuade everyone that cryonics is the prudent, conservative choice to make, but we might benefit from giving more thought to how to prevent and counter factually erroneous articles such as the one in the MIT Technology Review. ■

# PRESERVING MINDS, SAVINGS LIVES BOOK RELEASED AT THE 2015 ALCOR CONFERENCE

By Aschwin de Wolf

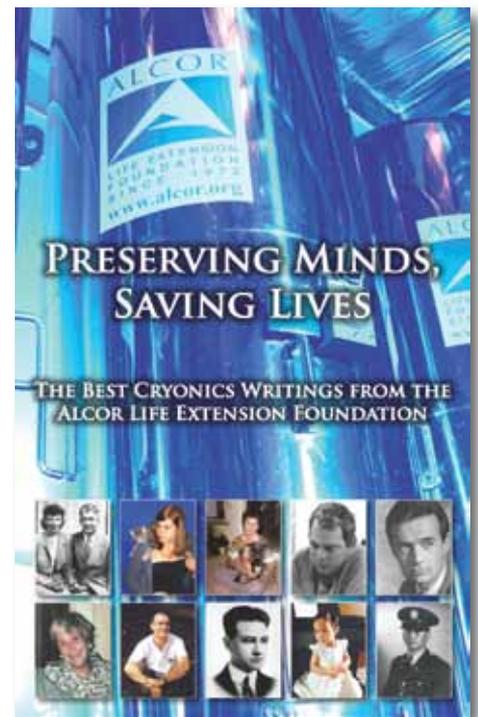
On October 11, Alcor officially presented its new book at the Alcor 2015 conference. *Preserving Minds, Saving Lives: The Best Cryonics Writings of the Alcor Life Extension Foundation*, edited by Aschwin de Wolf and Stephen Bridge, is a collection of the best writings from *Cryonics* magazine and the Alcor website written over the last 40 years. The aim of this book is not just to present a selection of our finest articles, but to serve as an introduction to the field of cryonics, and the Alcor organization in particular. As such, the book is organized so the reader can understand the arguments in favor of cryonics, read about its history, learn about the key scientific and technological breakthroughs that inform today's cryonics procedures, and examine technical proposals for the repair, resuscitation and rejuvenation of cryopreserved patients.

As the only comprehensive work about cryonics on the market today, our goal is to get this book into the hands of as many people and institutions as possible. For starters, we hope that all Alcor members purchase a copy to further deepen their knowledge of cryonics and become more knowledgeable and engaged members. We also hope that our members will purchase copies for friends and/or donate a copy

to their local library. We also encourage members and professional writers to promote the book in other publications or on the internet.

To facilitate wide distribution of the book Alcor has created a dedicated website (<http://www.alcor.org/book>) where people can order copies or purchase a copy for someone else. Alcor also offers bulk rates for members who want to purchase multiple copies of the book. An expanded Alcor information package that includes the book will be made available to the general public for those who prefer a more in-depth introduction to cryonics and Alcor.

The softcover edition of *Preserving Minds, Saving Lives* costs \$20.00. The hardcover edition costs \$35.00. An electronic edition of the book will be published in 2016. ■



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### References

1. *Public Health Nutr.* 2006 Dec;9(8A):1136-40.
2. *Am J Prev Med.* 2005 Nov;29(4):335-46.
3. *J Am Diet Assoc.* 2005 Mar;105(3):428-40.
4. *Nutrition.* 2005 Feb;21(2):131-6.
5. *Biochem Biophys Acta.* 2004 Jun 1;1682(1-3):80-91.

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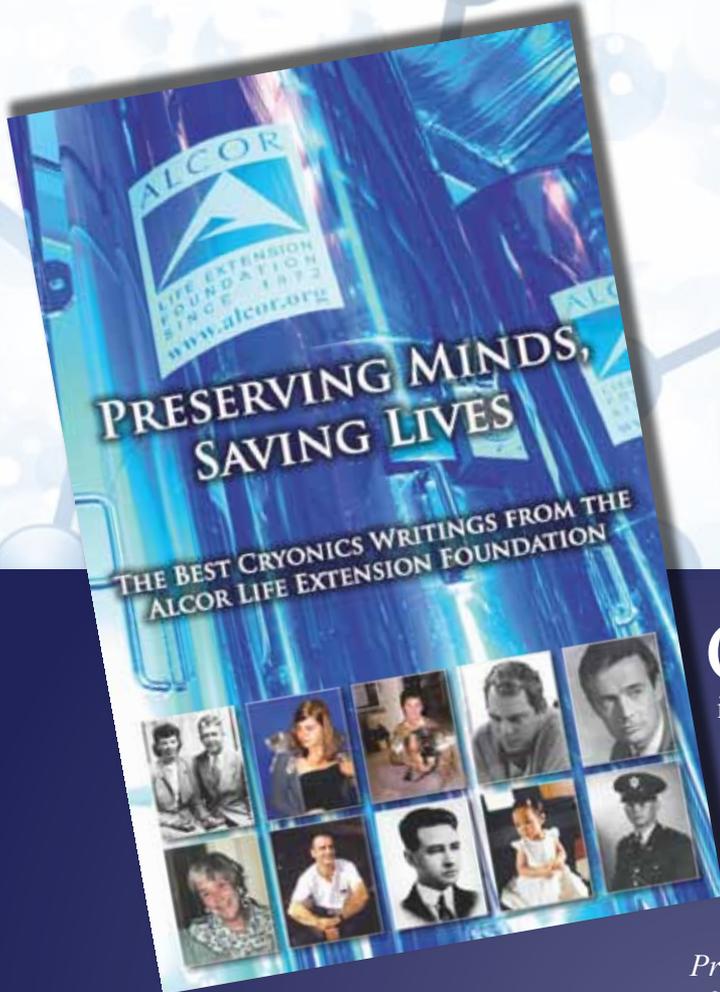
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# PRESERVING MINDS, SAVING LIVES

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– Max More, Ph.D.  
President and CEO of Alcor

Cryonics is an experimental medical procedure that uses ultra-low temperatures to put critically ill people into a state of metabolic arrest to give them access to medical advances of the future. Since its inception in the early 1960s, the practice of cryonics has moved from a theoretical concept to an evidence-based practice that uses emergency medical procedures and modern vitrification technologies to eliminate ice formation.

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This book presents some of the best cryonics writings from *Cryonics* magazine from 1981 to 2012. There are clear expositions of the rationale behind cryonics, its scientific validation, and the evolution of Alcor procedures. Also covered are repair and resuscitation scenarios, philosophical issues associated with cryonics, and debates within the cryonics community itself.

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*"Society's failure to take cryonics seriously is a tragedy that is probably costing countless lives. Alcor, notably via its magazine, is leading the fight to change that."*

– Aubrey de Grey, Ph.D.

Biomedical Gerontologist and Chief Science Officer  
of the SENS Research Foundation

*"Alcor appears to be the leading organization in the application of cryonics in medicine.*

*I'm proud to be a part of this effort."*

– Michael D. West, Ph.D.

Stem Cell Scientist and Chief Executive  
Officer of BioTime, Inc.

# THE TECHNOLOGY OF REPAIR, REVIVAL, AND REJUVENATION

## PART II

By York W. Porter

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### GREG FAHY'S PAPER: A "REALISTIC" SCENARIO FOR NANOTECHNOLOGICAL REPAIR OF THE FROZEN HUMAN BRAIN

Gregory Fahy, a well-known and respected experimental cryobiologist, received his undergraduate degree in Biology from the University of California, Irvine, and his Ph.D. in Pharmacology from the Medical College of Georgia in Augusta. With over thirty years' experience in cryopreservation, he has a rich background in his field and is certainly worth taking seriously.

Fahy, in *Cryonics: Reaching for Tomorrow*<sup>49</sup> (CRFT, Alcor Foundation, 1991, 1993), has a cryonics-friendly article entitled "A 'Realistic' Scenario for Nanotechnological Repair of the Frozen Human Brain" (listed as "Appendix B" in the table of contents). Cryonics is controversial in cryobiology, and Fahy accordingly supplied this disclaimer (just before the table of contents, 1993 edition):

I am not a promoter or advocate of either cryonics in general or Alcor in particular. I have permitted Alcor to use "Appendix B" because I feel that elevating the level of discussion between cryonicists and cryobiologists would be beneficial to both groups. Appendix B was written primarily out of intellectual curiosity in response to Dr. Ralph Merkle's paper "The Molecular Repair of the Brain." It represents my personal attempt to decide for myself whether a reasonable repair scenario can be delineated. This is simply one means of trying to find the truth. As a scientist, it is my

duty to seek the truth even if (and perhaps especially if) the truth may be unpopular.<sup>50</sup>

In another paper, "A Scientific Critique of 'Molecular Repair of the Brain'" (Alcor website<sup>51</sup>) Fahy expresses disagreement with some of Merkle's thoughts on solving this central problem in cryonics, to which Merkle replies in depth. Both Fahy's critique as well as his own thoughts are too lengthy and technical to treat in depth here, but I will summarize.

Fahy's focus throughout is on "realistic" repair scenarios which he defines as "scenarios that might actually be applied, with appropriate modifications, to the restoration of the brains in cryonic suspension."<sup>52</sup> He means to distinguish his approach from "general proofs of principle...that attempt to demonstrate general feasibility without considering documented biological problems in detail."<sup>53</sup> This implied challenge to the Merkle scenario is underscored by noting that "[n]o 'realistic' repair scenarios have previously been proposed to the knowledge of the author."<sup>54</sup>

Fahy then goes on to establish four criteria he believes are essential in dealing with repair scenarios: (1) factual basis, (2) parsimony, (3) detail, and (4) testability. As for "factual basis," one must base repair concepts on what is "known or can be inferred" about the actual injury that occurs in brains that have been subjected to cryogenic temperatures. Such knowledge would come from experimental work. "Parsimony" means to avoid making unnecessary demands of the repair task. One must certainly

address what is important but also bypass, as far as possible, what is not. "Detail" must be sufficient to determine how the important tasks will be handled. We don't want to be in the predicament of the two problem-solving scientists in the cartoon who are bent over a blackboard filled with mathematical equations and one says to the other, "then a miracle occurs!" Finally, proposed approaches must be testable, to distinguish what works from what doesn't, something of central importance in all science and technology.

After establishing the four criteria and some "ground rules" to exclude "extraneous problems" (postmortem damage, transport injury, and so on), Fahy addresses specific problems encountered in low-temperature biological work, such as perfusion damage, freezing damage, osmotically-induced cellular shrinkage, and phase transitions. Sometimes the problem is minor; otherwise, it is considered at length, as in the section on constraints on repair. Details provided include micrograph images and extensive references. (The technical and detail level here will be a challenge to some, but this is important thinking.)

In his "Scientific Critique," Fahy speaks of specific concerns he has about Merkle's viewpoint. There might not be enough "activation energy" at the low temperature to cause a needed chemical reaction. Repairs might not hold up as the temperature is increased. (For example, repaired ("renatured") proteins might denature once again.) Tissue could be damaged on warming by thermal stresses. What would be the power source of repair devices at ultra-low temperatures and how would that

power input affect the tissues themselves? If you tried to address the repair problem mainly electronically, using images of the damaged tissue to work out what ought to be there, would the processing time be prohibitive?

As for repair of cracks in tissue subjected to ultra-low temperatures:

Merkle says, on page 37, “if any cracks are present in the initial database (describing the frozen tissue) then the revised database (describing the healthy tissue) should be altered to remove these cracks.” But “removing these cracks” is a non-trivial exercise, and we are told nothing about how this might be possible. In the end, we are left only with an apparently unsupportable assertion that it should be possible. And this is the problem that cryobiologists have had with cryonics all along.<sup>55</sup>

Fahy winds up his critique on a cautionary note:

Ralph Merkle has written an excellent paper which attempts to identify important issues of the repair of frozen brains. He deserves praise for his great intellectual effort and for many of his results. From the point of view of a cryobiologist, however, Merkle’s analysis falls far short of being convincing. It is based on a number of assumptions that have dubious validity, and it fails to be specific. While the present critique by no means rules out the possibility of developing repair technology for frozen brains, it may help to clarify why the disagreements between cryonicists and cryobiologists are not likely to be settled by Merkle’s paper.<sup>56</sup>

## RALPH MERKLE REPLIES TO GREG FAHY

As indicated above, Ralph Merkle’s paper has been under continuing revision since it first appeared in 1989. The latest (and much expanded) version can be found on Merkle’s website. In his response to Fahy’s criticisms, Merkle indicated that the general approach proposed in “repair of the brain” is, roughly:

1. Digitize the frozen structure.
2. Once the database has been built, use it to determine where damaged

structures are; they can then be “repaired” electronically and thus eliminated from the database.

3. The “revised” database can then be used to help reconstruct the original “undamaged” brain.

Merkle points out that Fahy is basically erroneous when he says in his critique: “Merkle’s paper does not seek to tell us how to repair a frozen brain. It seeks only to describe peripheral issues of information content, computational speed, etc.” Merkle responds:

Dr. Fahy’s statement that these issues are “peripheral” is wrong, for they are quite central. The claim that computer power of the magnitude required will likely be available in the future is not immediately obvious. If we expect people to believe this claim, it must be supported by a careful analysis of the relevant facts.<sup>57</sup>

Merkle concludes that a simple “divide and conquer” approach, in which the human brain is “divided into pieces small enough that they can be directly analyzed...” should be sufficient.

In response to Fahy’s position that Merkle’s proposal isn’t “specific” enough, Merkle writes:

The paper did not discuss in any detail how “nanotechnology” works, but simply provided some general reasons for believing it is plausible and references for further reading. A detailed discussion of nanotechnology would require writing a rather detailed technical book.<sup>58</sup>

But, Merkle continues: “The final concern is how to build a structure with atomic precision, given the blueprint.”

Merkle later talks about six general approaches to repair. The least demanding is building an “artificial brain,” using the digitized information that was gathered from the frozen brain. He then discusses building an actual human brain. A working human brain is a “dynamic” structure, in a constant state of change, so repair efforts might well be more difficult. Merkle proposes some scenarios to provide needed stabilization:

- Synthesizing the structure at low temperature.

- Synthesizing the structure in a dehydrated state.
- Synthesizing in a normal “wet state” but stabilizing major macromolecules by cross linkages and the like.
- Synthesizing in a normal “wet state” but with:
  - minimal stabilization aimed mainly at the membranes
  - prevention of entry of oxygen/other reactive chemicals
  - allowing “harmless” diffusion to take place
- Synthesizing the brain using “the same intermediate states that are used during normal growth.”

(This last strategy aimed at working on a human brain in a “non-dynamic” or at least “reduced dynamic” state would, according to Merkle, be achievable by placing an “on-board computer” in control of cell metabolic activities, including cell division, cell shape, and cell movement.)

Merkle then deals with the “tradeoffs” of each approach, reiterates that computer analysis is fundamental, talks about chemistry at low temperatures (“Chemistry can be done at 0 Kelvin”<sup>59</sup>), discusses power sources for the repair method he proposes, and further considers time requirements for his original proposal. In summary: “Both by minimizing freezing damage and maximizing repair capabilities we will achieve the highest possible probability of success.”<sup>60</sup>

Whichever side of this very complicated discussion one finally falls on, the extensive discussions between Greg Fahy and Ralph Merkle are, to this author, the same sort of in-depth discussions that occur all the time in good and proper scientific endeavors. The constant tug, back and forth, between theoreticians and experimentalists (and theoreticians and other theoreticians and experimentalists and other experimentalists) is what fosters the progress we have been blessed with in science and technology.

Few scientists are strictly experimentalists or strictly theoreticians, most instead having training on both sides of the scientific spectrum. Still, good experimentation affects theoretical viewpoints, which in turn affect the thinking in the next round of experiments. The give and take, back and forth between the two camps results in

the best outcome overall and the best and most efficient use of scientific resources. As for which of the two talented and dedicated researchers, Merkle or Fahy, is “right” and which is “wrong,” the answer basically is “stay tuned.” Time and further research may well show that, as in Merkle’s remark about the “highest probability of success,” both camps are progressing toward the same finishing point, just from somewhat different starting points.

### ROBERT FREITAS, J.D.

Robert Freitas has had an interesting and varied career. His high school education included some college-level chemistry. His undergraduate degree was as a “double major” with a bachelor’s in both physics and psychology (1974). He then attended the University of Santa Clara Law School, receiving his *Juris Doctor* in 1978.

Maintaining a wide diversity of interests in his educational career and later, Freitas has written more than 150 papers, chapters of books, and popular articles on a wide range of topics from science to the law. One of his very interesting proposals, introduced in 1996, was a design for the so-called “respirocyte,”<sup>61</sup> an artificial blood cell that would be able to carry oxygen to the tissues and carbon dioxide away, just like a regular red blood cell.

The difference, and a very substantial one, is that the respirocyte would be vastly more efficient, able to transport 236 times more oxygen. In addition, it would be smaller and able to enter places red blood cells could not, where circulation might be restricted due to disease or injury.

Some uses of the proposed (still theoretical!) respirocyte are fairly obvious. Patients whose cardiac output was insufficient would benefit from the greatly enhanced oxygen-carrying capacity. Divers would be able to dive for greatly extended periods of time while avoiding decompression sickness (the “bends”) as well as “nitrogen narcosis,” decreased mental function which can lead to fatal error. In the case of organs and tissues needed for transplantation, respirocytes could greatly extend preservation, especially at low temperatures. The respirocyte would also be useful for trauma victims, for whom a major cause of death is bleeding. While still a theoretical concept, Freitas’s work shows both his versatility as a thinker and the great potential nanotech’s future arsenal

could have in helping the sick and injured, which might well include cryonics patients.

A later and more detailed paper of Freitas is about artificial white blood cells which he calls microbivores (“micro-eaters”).<sup>62</sup> The microbivore would be able to act as a phagocyte in the case of infectious disease processes. It is, again, an example of how nanotechnological devices may ultimately furnish health benefits to mankind beyond present measure and how existing body repair mechanisms might be greatly enhanced by intelligent design.

### RALPH MERKLE’S 1994 EFFORT TO BLEND THE TECHNOLOGY OF CRYONICS AND THE FIELD OF CRYPTOGRAPHY

In 1994 Ralph Merkle wrote a paper titled “Cryonics, Cryptography, and Maximum Likelihood Estimation.”<sup>63</sup> Eminently qualified in cryptography, Merkle uses his expertise to address problems in cryobiology and cryonics, mainly, how to fix damaged cells and tissues and thereby, of course, whole organisms. Clearly it’s a tall order to fill, with several as-yet unsolved problems: tissue fracturing, the patient’s terminal illness or injury, possible ischemic damage and/or cryoprotectant toxicity, or uneven (or absent) cryoprotectant perfusion in vital areas. “And yet,” he tells us, “the literature on freezing injury, on ischemia, and on the other damage likely caused by a cryonic suspension forced me to conclude that cryonics would almost surely work: how can this be?”<sup>64</sup>

The explanation is both intriguing and well thought-out. It begins with the fact that, like every other structure in the universe, human beings are made of molecules. As in his previous work, Merkle points out that the arrangement of the molecules is what really counts. Health and sickness, youth and old age, pain and pleasure, life and death, all depend on the arrangement of and, thereby, the interactions between the molecules of an individual person. Present day medical procedures, such as surgery, try to “rearrange things” in a crude and inefficient way. Healing isn’t really “done” by present day medicine so much as conditions are provided for the body, through its own amazing “nanotechnology,” to heal itself.

The body’s nanotechnological devices developed through countless eons by natural, unthinking processes. This arsenal

is fantastic, yet still not good enough. People get hurt, people sicken, people die. If we can enhance nature’s arsenal by intelligent design, the prospects seem virtually endless. The ability to move molecules and atoms at will and arrange them as we think best, consistent with scientific laws, would address any disease entity we can think of, including aging.

A sick patient was likely in a state of youthful good health at one time in life—or if not, others could furnish a “pattern” for what youthful good health would be. The job of medicine, as indicated previously, is then to place the “sick pattern” of the patient’s atoms and molecules in an arrangement of youthful good health using molecular manipulation tools. Those same medical tools can be employed in cryonics to rearrange the frozen tissue’s atoms and molecules in the way we see fit. We’ll no longer be restrained by the crude measures of today. If the molecules are in the “wrong” place, we can move them to the “right” place, supportive of a youthful state of health. The only necessity will be to know where the “right” place is.

The concept of nanotechnology is an amazing development in human history. The ultimate promise of it is tremendous and almost beyond measure in areas from energy to healthcare. But it isn’t limitless. It won’t help someone who, say, is vaporized in a nuclear blast, or more mundanely, cremated without some preservation of parts. If enough DNA can be found of that person through tissues deposited by accident (for example, licking the glue of an envelope to seal it) or by intent (preserved surgical specimens), then *perhaps* a clone (genetic twin) can be grown. A twin sibling isn’t you, however.

This means that enough structures must survive for future nanotechnologists to have some sort of concept of what repairs need to be made. Ideally, this would involve the ability to fully restore memories and personality structures. The worst case, as just noted, would be where nothing exists for future scientists to work from. Nanotechnology will bring great power but not omnipotence. For those undergoing cryonics procedures, however, the words of Merkle are quite heartening:

Even after many minutes or hours of ischemia and even after freezing we can still recognize the cells, trace the paths of the axons,

note where the synapses connect nerve cell to nerve cell—and this with our present rather primitive technology of light and electron microscopy (which is a far cry from what we will have in the future).<sup>65</sup>

If we can tell where things should go, then we can in principle (and eventually in practice) restore the patient to full health with their memory and personality intact.<sup>66</sup>

The key question then is when can one tell “where things should go”? And, even if this is true for those who get the best “cryonic suspension” (a two-word phrase for the procedures associated with cryonics), what of those who receive less than optimal treatment? When are things so hopeless as to warrant no action at all? How much damage is too much damage?

This is where Ralph Merkle’s considerable skills and knowledge in cryptanalysis come in. Cryptanalysis deals with unscrambling scrambled messages, trying to make sense of what appears senseless at first sight. In the case of the Enigma coding machine used by the Nazis in World War II, the task of cryptographers for the Allies was to take the Enigma-encrypted messages or “ciphertext” before them and work their way “backwards” to the unencrypted “plain text.” The Germans thought they had an unbreakable coding machine—Alan Turing and others on the Allied side proved them wrong. Cryptanalysis carried the day and played an important part in the Allied victory.

Likewise, information about someone in cryopreservation is a (somewhat) scrambled version or “ciphertext” of the “message” or “plain text” that existed before they were cryopreserved. All the changes that occurred from “before” to “after” result from known chemistry and physics. One must try to “decipher” the ciphertext to obtain the plain text. As Merkle puts it:

So the question of whether or not we can revive a person who has been frozen can be transformed into a new question: can we cryptanalyze the “encrypted message” that is the frozen person and deduce the “plain text” which is the healthy person that we wish to restore? Are the “cryptographic transformations” applied during freezing sufficient to thwart our cryptanalytic skill for all time?<sup>67</sup>

Remember again that, as was pointed out by Thomas Donaldson, the atoms and molecules comprising the cells and tissues under cryopreservation are not totally scrambled. The damage is not like an explosion, where things are tossed about willy-nilly. (And even for an explosion there is a relationship between where parts wind up and where they started out which can help in figuring out the state of things before the explosion went off.)

It is also true that any atom of a person in cryopreservation was, generally speaking, part of a known biological structure or system (like the sodium and potassium atoms that, in their exchange across a membrane, form the basis for nerve cell action) before the cryonics procedures were applied. So there is structure (and redundancy) in the human body (and, more importantly, the brain), plus our knowledge of biological structures is growing in extent and accuracy with each passing year. When it’s time to resuscitate we should have substantial clues as to where any atom or molecule “should” be. Transforming these clues into a deciphered (restored) structure could be aided by an advanced mathematical technique known as “maximum likelihood estimation,” as Merkle points out. The whole operation, he also notes, will be empowered by an expected, vast future increase in computer power. The operation might involve a series of steps of generating proposed restorations of some particular damaged tissue. The result on a given step could be tested in a computer simulation and compared with the previous results to see how “right” it is. As Merkle puts it,

If the result is more reasonable, we are moving in the right direction and should continue. If the result is less reasonable we are moving in the wrong direction and should stop and try some other direction.<sup>68</sup>

By way of analogy this can be compared with assembling a cardboard jigsaw puzzle. At the beginning the maybe thousands of pieces are all scrambled up into “ciphertext.” You want to rearrange them into “plain text”—the finished puzzle showing the beautiful picture on the box the puzzle came in. Your efforts will involve knowing what the finished product “should” look like, plus some judgment during the assembly process about whether you are going in the “right” direction.

Maybe you see that, in juxtaposing two pieces, the green border of one can’t go with the brown of the other, and you abandon that combination and try another which does work. Eventually, after enough effort, the picture on the box emerges in all its perfection and glory and can be framed and put on the wall.

This isn’t to say that the cryptographic approach to cryonics resuscitation would be invincible and able to deal with any level of damage. Merkle comments: “If there has been so much damage that we are unable to infer sufficient local structure to allow even an incremental improvement in our description of the system, then this approach will fail...”<sup>69</sup>

Contrary to the case of someone who has been cremated, there has to be part of the “jigsaw puzzle” that has survived, to provide a starting point toward solving things. Merkle puts the good news as follows:

In the case of the frozen human brain, there is typically a wealth of information about the neuronal wiring... unless the structures involved have quite literally been obliterated.

Or, as experience with erasing top secret media has demonstrated, it’s hard to get rid of information when sophisticated means of data recovery are employed. And we’ll have very sophisticated means of data recovery available to us in the future.<sup>70</sup>

(As an aside, one should also remember that the most important organ in any person is, of course, the brain, which contains the “identity” of the person. Its reconstruction with great fidelity is of paramount concern. In other tissues such as the heart, the important thing is to restore an adequately functioning replacement, not necessarily an exact copy of the original. By analogy with today’s medicine, it’s okay if a transplanted heart is pumping blood adequately and not under attack by the immune system, even if it’s not exactly like the heart that the patient was born with. The particular structure of the heart or most other organs means no more to personal identity than hair color).

## MIKHAIL SOLOVIEV’S PAPERS ON REPAIR SCENARIOS

Mikhail Soloviev holds the equivalent of a master’s degree in biophysics from St.

Petersburg State University, Russia, and has worked with the design and development of models for neurocomputers, molecular computers, and complex biological systems. In 1996 he wrote an article titled “SCRAM Reanimation,”<sup>71</sup> followed in 1998 by “A Cell Repair Algorithm.”<sup>72</sup>

SCRAM is an acronym derived from “Scanning,” “Computer Reconstruction,” and “Atomic Manufacturing.” Soloviev’s concept resembles Merkle’s proposal for the repair of a cryopreserved brain, but is expanded to consider restoring the whole body using what Soloviev calls the “MASM” or Macroscopic Atomic Scanner/Manufacturer. A main ingredient of the MASM in turn is the “nanosyringe,” a “device to capture and recognize, or release and connect, atoms.”<sup>73</sup> Essentially a kind of probe like what is used in scanning tunneling microscopes, the nanosyringe would additionally be hollow like a hypodermic needle and able to place or remove atoms.

The MASM would use an array of nanosyringes to destructively map a cryonics patient’s body, each atomic layer being removed to expose the next layer. As the layers are removed their information is stored so that afterward an ultrastructural image of the body in three dimensions is obtained (step 1). As in Merkle’s idea the resulting database is then manipulated to determine what changes in atomic position would be needed to obtain a healthy, youthful version of the body (step 2). Finally, with advanced manufacturing methods the revived, repaired and rejuvenated patient is actually constructed (step 3). For this last step either atoms similar but not identical to the original would be used, or, for those having philosophical worries, the original atoms could have been saved and would now be restored to their original positions, consistent with rejuvenation.

Soloviev’s concept is quite well thought-out, if also quite theoretical. Several calculations indicate the thickness of each atomic layer and the likely number of atoms in each layer. The time estimated to scan/ablate and also to manufacture an individual layer is set at about one-thousandth of a second. So we have another approach to the problem of cryonics resuscitation by a knowledgeable, intelligent devotee.

In the 1998 paper Soloviev tackles the task in a very similar manner but with more detail in some places and limited to the brain only. The brain would be scanned,

with surface ablation of each single layer of atoms, and a database of atomic positions built up. The brain sections would be rebuilt after determination of a healthy configuration. Some computer code in the PROLOG language helps illustrate what a “cell repair program” for a computerized repair system would look like. As in Soloviev’s previous effort, it is a serious, well thought-out if speculative scenario for how cryonics might be made to work.

### **TAD HOGG: INFORMATION STORAGE AND COMPUTATIONAL ASPECTS OF REPAIR**

In this article in *Cryonics*, 3rd Quarter 1996, Xerox PARC researcher Dr. Tad Hogg offers a succinct and accurate definition: “Cryonics is an attempt to preserve enough of a person’s body, after death by current standards, to allow future technology to restore the person to health.”<sup>74</sup> In the first part of the article, Hogg points out the regrettable facts that the procedures involved in cryonics are not damage free themselves and also not always timely. Future technology will have its work cut out in using surviving structural “clues” for high-fidelity reconstruction of the patient. Giving credit to Ralph Merkle and his 1994 paper, “The Molecular Repair of the Brain,” Hogg sizes up matters as follows:

Three distinct technical abilities are required for repair:

1. Observe, in sufficient detail, the preserved structure
2. Compute what changes need to be made
3. Manipulate the structure to make those changes

The scale of these operations (e.g., molecular or cellular) will depend on the amount of suspension damage.<sup>75</sup>

(One might also add, “and pre-suspension damage as well.”)

The second step in the above scenario, as Hogg indicates, is primarily a problem of computation. In some cases, of course, the details of a particular preserved structure should not matter; a more “generic” version would do. This we would expect for the body and most organs, which are, after all, a support system only for the “real” person, which resides in the brain. (In fact the body that a cryonics patient returns to consciousness in may be considerably enhanced or changed in constructive ways

over the original, with the same “person” still happily inside.) The brain, as we have noted, would have to be treated more carefully. We hope to recover what should be there, a unique structure that we know was present originally, from the preserved remains we start with. But, Hogg tells us, there could be a further complication:

Even when there is a unique structure, the time needed to find it by searching through the enormous set of possible structures can mean, in practice, the original structure cannot be found.<sup>76</sup>

This remains true even with much more powerful computers...with the possible exception of (so far, hypothetical) quantum computers.<sup>77</sup>

(Author’s Note: the *Wikipedia* article “Quantum Computers,” accessed Sep. 1, 2015, notes that “the development of actual quantum computers is still in its infancy.” Stay tuned, though!)

We are reasonably sure that personality traits such as memories, likes, dislikes and such are traceable and (in principle at least) recoverable from specific, detailed brain structure. The brain, unlike other organs, is not simply replaceable with a “generic” version that functions adequately in the body of the recipient. If all we could reconstruct of a person, neurally, was a generic brain that lacked the original, detailed structure, it would seem to meet Merkle’s criterion of “information theoretic death” and the person would be “gone.” (Such might follow if the original brain was lost but we still had a DNA sample, or even more primitively.) Yet having this generic structure might still be better, in some reasonable sense, than just giving up and having nothing at all. It would seem to beat the alternative of total oblivion.

We could thus imagine a scenario in which a generic brain is imprinted with basic functionality using advanced technology, relying on records of the past, which, however, are scanty in many important details. The resulting person would remember their name and even speak their native language. They might know a lot about the customs and traditions of the world they came from, how they should and shouldn’t behave, and details of advanced education or training that records suggest they once had. In many ways they might seem like the original person, able to carry on conversations and reason and

emote much as before. It is understandable, though, that people who value their personal survival would want more than just a “tabula rasa” operating system with this kind of basic functionality added.

So the question is, how much information is needed to adequately replicate a particular brain structure that is, in the case of each individual, *unique in the history of the world* due to each person’s quite individualized life experiences as they go down through the years?

The answer to the question of “how much” is, of course, “the more the better.” Not only information gathered by medical and scientific instrumentation but perhaps even more relevantly, information produced by the individual during the parts of their life when they were able to clearly recall and/or document what was happening. Artifacts such as photographs, videos, audio recordings, et cetera might diminish the task of accurate brain reconstruction.

In an example of the importance of what may seem like otherwise trivial information, this author remembers a high school teacher who gave my class a thought experiment to ponder. Suppose we were archaeologists in the future and the only artifact we found of the United States was a copper penny. What conclusions could we draw? Initially quite skeptical about this enterprise, the class gradually produced a fairly long list. The coin was copper, which meant that some sort of mining skills and industry must have existed, along with metal smelting (including high-temperature furnaces) and other metal-working skills and equipment. Some sort of drawing skills had to exist to provide the likeness of Lincoln, and writing skills due to the markings on the coin; the list goes on. One is reminded of the famous Sherlock Holmes story in which the key fact was that the watchdog didn’t bark, allowing Holmes to narrow down the otherwise enormous list of suspects to those with whom the dog was familiar. A small and seemingly unimportant detail could lead to solving an otherwise impenetrable puzzle.

As an additional nod to the concept of traditional and “low tech” personal historical records, consider that, given that audio and video recordings didn’t exist until recently, all the knowledge of ancient civilizations has come through two sources, artifacts that were found and writings that survived. (The tragedy of the destruction

of the Great Library at Alexandria can scarcely be overrated.) Ancient Romans, for example, were prolific letter writers which enabled scholars to use the “only a penny found” methodology on these letters (as well as other writings), coupled with the extensive remains of buildings and other artifacts, to construct a vivid, albeit not perfect, understanding of this ancient civilization. In these reconstructive efforts they have also obtained much information about some of the individual members of that civilization, *though those people are very long dead*.

In the case of Christianity, knowledge of the existence of its central figure, who came from an otherwise very obscure outpost of the Roman Empire, proliferated through word of mouth but also through written records transcribed decades after his life. Those records have survived for millennia and still inform us. In the case of Ancient Egypt a remarkable chain of events led to a detailed understanding through ancient records written in hieroglyphics. Knowledge of this writing system had been lost but the discovery of the Rosetta Stone with its multilingual inscriptions, in which text in hieroglyphics could be matched with equivalent, and still-understood, ancient Greek, provided the key to decipherment.

“High-tech” thinking and technology may be of vital importance in getting the “brain engine” cranking once again, yet there is definitely a place for more traditional and lower-tech options also, and in some cases, a combination of both. Hogg puts it this way:

External records can also help evaluate the quality of repair. In fact, this might be the only way to determine when a repair is complete, instead of “just” producing a similar, healthy individual. Even if it doesn’t help a particular case, this evaluation could help improve future repairs by showing what information is sufficient for repair with a given level of technology.

Other reasons to maintain records include the information’s value to you and providing your preferences for various repair options that may be, from a purely technical point of view, equally likely to work.<sup>78</sup>

In an aside to his article, Hogg provides an interesting and informative example of using a series of coins as a model for

the general problem of reconstructing (resuscitating) cryonics patients. Using a thought experiment (which could, of course, be easily replicated in real life) of restoring ten coins that were originally showing a particular sequence of heads and tails, Hogg talks about how small bits of information can greatly help the process of reconstruction. If one knows, for instance, that “the first and second coins in the row of ten must both be heads or both tails,” the original list of over a thousand possible initial configurations can be whittled down considerably (in this case by half). Further available information, such as, in this case, that “the seventh and eighth coins in the row of ten must also both be heads or both tails,” further narrows the possibilities.

In the human body, the fact that small amounts of additional information can be used in helping narrow down the original number of possibilities, could work to great advantage. Individual atoms, whether of carbon, oxygen, hydrogen, et cetera, normally belong to molecules and structures that have a particular function and position inside the organism. Even in the case of individual ions like sodium and potassium, which could be found near or in neurons, their function in the scheme of things isn’t just random but has a specific role. They are the basis for neurological activity through their exchange across the semipermeable membrane of nerve cells. The same could be said for oxygen found in certain locations, given oxygen’s utility in respiratory and metabolic functions. So, it isn’t just a case of “we found this single atom, what do we do with it?” Instead, most likely the atom was part of a system whose understanding will provide information about where the atom should go, or whether the whole system should not just be replaced with something equivalent. By continuing this kind of effort, using corrective feedback from further bits of information gathered as one goes along, successes could be verified and it could become clear that one is replicating the original set-up with reasonably high fidelity.

One may think of the general process of restoration as dealing with a large spreadsheet with a great number of individual cells or records. Any particular record may not seem very relevant at all, for example, whether someone likes to play golf or not, but, in combination with other records, a unique pattern not found in other

spreadsheets begins to emerge. Someone who likes to play golf is not rare, but let's combine this with other traits. Suppose they also love chess, like drag racing but not oval track racing, and are a moderate fan of the Dallas Cowboys football team but an avid fan of the Kentucky Wildcats college basketball team. Suppose finally that they don't like to watch professional basketball at all. Sports marketers would seize on all this information to figure what this person would likely buy and how they would

likely act. Similarly, some psychological (and therefore brain) patterns in humans may be fairly widespread, but knowing individualized information about a person, as can be provided through diaries and other personal records, can make the "database" of that person more nearly unique and, therefore, more useful in doing a high-fidelity reconstruction.

As part of this interesting, helpful paper, Hogg considers, not only what types of information could be useful in the future

restoration of cryonics patients, but also what types of storage of this information would be best: "Finally, remember one of the real benefits of external records: redundancy. Make copies, perhaps in multiple formats, to save." (Maybe we should add that, as in the case of the Rosetta stone, and perhaps using online automated language translation, make copies in several languages as well.) ■

## SOURCES (REFERRED TO IN ENDNOTES, BELOW)

- CRFT *Cryonics: Reaching For Tomorrow*, Alcor Life Extension Foundation, copyrights 1989, 1991, 1993, 4th Edition, December 1993.
- Fa1 Gregory Fahy, "A Scientific Critique of 'Molecular Repair of the Brain?'" appeared in its original form in *Cryonics*, Volume 12(2), Feb. 1991. Ralph Merkle's reply is in *Cryonics*, Volume 12 (5), May 1991. A paper with both Greg Fahy's criticisms and Ralph Merkle's reply may be read at: [www.alcor.org/Library/html/MolecularRepair-Critique.html](http://www.alcor.org/Library/html/MolecularRepair-Critique.html).
- Fa2 Gregory Fahy, "A Realistic Scenario for Nanotechnological Repair of the Frozen Human Brain," *Cryonics: Reaching For Tomorrow*, Alcor Life Extension Foundation, December 1993, Appendix B, Page A-10.
- Ho Tad Hogg, "Information Storage and Computational Aspects of Repair," *Cryonics* 16(3) (3rd Quarter 1996) 18-25.
- Me4 Ralph Merkle, "Cryonics, Cryptography, and Maximum Likelihood Estimation," [www.alcor.org/Library/html/CryonicsAndCryptography.html](http://www.alcor.org/Library/html/CryonicsAndCryptography.html) (This paper was published in the Proceedings of the First Extropy Institute Conference, held at Sunnyvale, California in 1994. Some changes have been made to this version). May also be viewed at [www.merkle.com/cryo/cryptoCryo.html](http://www.merkle.com/cryo/cryptoCryo.html).
- So1 Michael V. Soloviev, "SCRAM Reanimation," *Cryonics*, 17(1) (1st Quarter 1996) 16-18.
- So2 Michael V. Soloviev, "A Cell Repair Algorithm," *Cryonics*, 19(1) (1st Quarter 1998) 22-27.

## About The Author

**York W. Porter**, born in 1952, attended Berea College in Berea, Kentucky for two and a half years and, in Fall 1974, began working in a rural Kentucky hospital in the Department of Radiology. Diversifying through the years, Mr. Porter worked for one year on an ambulance crew and spent several years in a hospital laboratory setting, plus about a year doing respiratory therapy work. He has worked fairly continuously in the field of medical radiography, serving as a staff tech at various times in four rural Kentucky hospitals, primarily in the fields of general radiography and computed tomography. He also works on rare occasions at a Magnetic Resonance Imaging (MRI) center. He presently holds certifications as a Kentucky EMT-B, as a Licensed Radiation Operator (Kentucky's phrase for an x-ray tech), and as Medical Laboratory Scientist, ASCP(cm). He is the President of the Immortalist Society, at the time of this writing, and serves as Executive Editor of its "house publication," *Long Life Magazine*.

This article is an updated version of a chapter which appeared in the book *The Prospect of Immortality: Fifty Years Later* edited by Charles Tandy, Ph.D. Readers interested in a copy of the book may check on Amazon.com

## ENDNOTES

- |       |                                                                                                                                                                                                          |       |                                                                                                                                                     |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 49    | CRFT.                                                                                                                                                                                                    | 62    | Information on microbivores may be found at <a href="http://www.jetpress.org/volume14/freitas.htm">http://www.jetpress.org/volume14/freitas.htm</a> |
| 50    | CRFT, Disclaimer Page.                                                                                                                                                                                   |       |                                                                                                                                                     |
| 51    | Fa1.                                                                                                                                                                                                     | 63-70 | Me4.                                                                                                                                                |
| 52-54 | Fa2.                                                                                                                                                                                                     | 71    | So1.                                                                                                                                                |
| 55-60 | Fa1.                                                                                                                                                                                                     | 72    | So2.                                                                                                                                                |
| 61    | For more information on respirocites see the following link: <a href="http://www.foresight.org/Nanomedicine/Respirocites.html#design">http://www.foresight.org/Nanomedicine/Respirocites.html#design</a> | 73    | So1, 17.                                                                                                                                            |
|       |                                                                                                                                                                                                          | 74-75 | Ho, 18.                                                                                                                                             |
|       |                                                                                                                                                                                                          | 76-78 | Ho, 19.                                                                                                                                             |
|       |                                                                                                                                                                                                          | 79    | Ho, 24.                                                                                                                                             |



# LAWSUIT LAUNCHED AGAINST ANTI-CRYONICS LAW IN BRITISH COLUMBIA

By Carrie Wong

## NOTICE OF CIVIL CLAIM FILED

On July 14, 2015, The Lifespan Society of British Columbia and Keegan Macintosh launched a civil suit against the government of British Columbia with regards to the anti-cryonics law on their books. The plaintiffs, Lifespan and Keegan, challenged the constitutional validity of Section 14 in the Cremation, Interment and Funeral Services Act (CIFSA).

Section 14 of CIFSA provides as follows:

*14) A person must not offer for sale, or sell, an arrangement for the preservation or storage of human remains that is based on:*

- (a) cryonics,*
- (b) irradiation, or*
- (c) any other means of preservation of storage, by whatever name called, and that is offered, or sold, on the expectation of the resuscitation of human remains at a future time.*

I covered the legal activism against Section 14 in an August 2014 *Cryonics* article titled “Cryonics in Conflict: 25 Years of Activism.” The history of this law and the subsequent activism were covered in some detail in my last article. This article is about the current and ongoing legal battle. The complete Notice of Civil Claim launched by The Lifespan Society of British Columbia can be found on our website: [www.lifespanbc.ca](http://www.lifespanbc.ca)

Although no one has been prosecuted under this law there are hefty fines and even imprisonment for committing an offence under Section 14. Currently, this provincial law only affects the residents of B.C., but it could be setting an unacceptable legal

precedent in Canada and perhaps globally as cryonics gains popularity. Furthermore, funeral directors and other medical professionals are aware of Section 14 and as a result, it has had a chilling effect on making any kind of arrangement with regards to cryonics in this province. Our activism takes a stand against overstep of government. We do not accept this government’s attempt at regulating something they clearly do not understand. Taking a stand now will hopefully influence future regulatory bodies to do the necessary research into what they are attempting to regulate.

To paraphrase the Notice of Civil Claim: “the plaintiffs only challenge the restriction on selling cryonics services that are entered into by persons who clearly consent to the procedure and at the time of performance of the services have ceased cardio-pulmonary function.” The structure of our legal challenge is that Lifespan, on a not-for-profit basis, wishes to, but cannot, offer cryonics services to Keegan Macintosh.

In the offer for cryonics services, Lifespan would not guarantee resuscitation or exaggerate the prospects of resuscitation. This is in line with all other cryonics service providers; none of them exaggerate the prospects of resuscitation. CIFSA does not define cryonics services, but these services could range from standby and cooling to vitrification and transportation. The Lifespan Society of B.C. does not currently offer cryonics services, but intends to do so for Keegan Macintosh if they had the legal right to. Keegan is in very good health and is of sound mind and he believes on reasonable grounds that the prohibition

under Section 14 would delay and hinder his suspension causing, or threatening to cause, his information-theoretic death. Within the Civil Claim, information-theoretic death is defined as: “destruction of the information within a human (or any cognitive structure that may constitute a person) to such an extent that recovery of the original person is theoretically impossible by any physical means. The term means death that is absolutely irreversible by any technology, as distinct from clinical death.”

There are a number of Alcor and CI members within B.C. and these members legally signed up with a US company as Section 14 does not regulate companies outside of B.C. However, emergency response is still an ongoing problem in cryonics. If Lifespan offered local standby response and services, would that be considered a “cryonics arrangement” and an offence under Section 14? This is completely unclear. Our legal challenge will either force clarification of this law or defeat it. The plaintiffs seek a legal declaration that Section 14 is of no force and effect or a declaration that Section 14 does not prohibit selling or offering to sell cryonics that does not guarantee resuscitation or exaggerate the prospect of resuscitation. The words “the expectation” in Section 14 could be amended to “an exaggerated representation of the probability” of resuscitation.

The legal basis of our challenge is that Section 14, 61 and 62 of CFSA infringes upon Section 7 of the Charter of Rights and Freedoms to each of life, liberty and security of the person and are inconsistent

with the principles of fundamental justice, including arbitrariness, overbreadth and vagueness. In addition, this restriction cannot be justified in a free and democratic society pursuant to Section 1 of the Charter of Rights and Freedoms.

“The right to life is infringed as the impugned provisions deprive the individual seeking services pursuant to a Cryonics Arrangement of the possibility or probability of extending his or her life. The right to liberty is infringed as the individual seeking services pursuant to a Cryonics Arrangement is deprived of the fundamental choice of disposing of their bodies as they see fit and pursuing future health care, which is a fundamental choice. The right to security of the person is infringed as persons who wish to sell or offer to sell a Cryonics Arrangement are threatened with imprisonment and fines.”  
– Notice of Civil Claim (July 14th, 2015)

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*“Taking a stand now will hopefully influence future regulatory bodies to do the necessary research into what they are attempting to regulate.”*

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## **MEDIA FRENZY**

After filing our civil suit, there was a media storm. Keegan and I were approached by various news, radio and even TV groups. CBC, CTV News, Metro News, Global BC and other national and provincial-wide news organizations wanted to get more information about our case. In terms of media talking-points, we stuck with the civil rights angle. It’s difficult for the average person to argue against our right to do with our bodies what we want, especially after clinical death. The journalists, media personalities and radio talk-show hosts were actually pretty sympathetic to cryonics. The overwhelming majority of people who phoned into these shows supported our right to access cryonics services. Our legal activism was a great opportunity to reach out to the public and

let them know cryonics existed, and that it was available for the average person. There was one caller who expressed interest in cryonics and talked about how he first encountered it through an article in a sports magazine about how Ted Williams had been cryopreserved.

*“In my lifetime, I have witnessed the right to life, the right to die and now, the right to live again!”*  
– Caller

I am not a polished public speaker, but I managed to stick with my talking points and not say anything that the media could use to make us look strange or crazy. Earlier this year, Canadians won the right to “die with dignity” with doctor-assisted suicide. This was a high profile case that went all the way up to the Supreme Court of Canada and concluded with a victory for the civil rights camp. In an interesting twist, it was useful to tie our case to this case because they are both disputes about bodily autonomy. I argued, if people had the right to die with dignity, how could they possibly not have the right to attempt to live longer in the future? If we win this case, it will be another victory for bodily and life autonomy. After hearing all the radio responses and reading all the comments, I feel confident in saying that we had won in the court of public opinion. But how would the government respond?

## **INITIAL GOVERNMENT RESPONSE**

The government responded to our civil claim with a letter on August 7, 2015. To be clear, this letter was not a formal legal response. It was more a letter of clarification and an attempt to get us to drop our case. In the letter they reiterate that there have been no prosecutions under Section 14. In addition, they state the Attorney General’s view that the Cremation, Interment Funeral Services Act (CIFSA) is part of important consumer protection legislation. It is their view that the prohibitions are aimed at protecting the public from questionable practices in the funeral services industry.

The letter further goes on to state that “Expectation has its commonly understood meaning, and in this context means where an outcome is held out as something that is likely to happen and is therefore capable

of giving rise to reasonable expectation that it will. Since resuscitation following clinical death has been and continues to be impossible, sales holding out the likelihood or expectation of resuscitation raise a consumer protection concern.”

There are a number of problems with this response. An expectation that something will happen is not just having any likelihood that something will happen. We take the position that the probability of future resuscitation is above zero, which implies that there is some likelihood of resuscitation that is meaningful, but difficult to quantify. This is clearly different than a “high likelihood” or guaranteed resuscitation which is an exaggeration of the prospects of resuscitation.

In addition, there is little legal basis for the government’s interpretation of the word “expectation.” Someone cannot sell cryonics as a service without an implication that there is a probability above zero of the prospect of resuscitation at a later date. So we responded with a letter outlining our disagreements and called for a formal legal response.

## **GOVERNMENT’S FORMAL LEGAL RESPONSE**

The government filed the formal response to Civil Claim on September 9, 2015. They admitted that the term “expectation” is not defined in the Cremation, Interment and Funeral Services Act (CIFSA). The government defendant denies that Section 14 prohibits all sales or offers for sale of cryonics services. They deny the allegation that the scope of Section 14 is uncertain. In addition, they define “expectation” as a “strong belief that something will occur.” According to their legal counsel, the Act only intended to restrict the selling of cryonics that gives rise to an expectation that the purchaser’s remains will be resuscitated. In light of that, they state that Lifespan’s proposed activities would not trigger a violation of Section 14. So they are arguing that Lifespan’s intended activities would not be illegal. They find our claim academic and hypothetical and they do not find our proposed [cryonics] activities controversial. In a way, our claim is hypothetical, but the law has real-world

consequences. This law has a chilling effect on current cryonics arrangements with funeral directors and furthermore, it could potentially stifle any progress or innovation in cryonics services in the future.

Unfortunately, they also pointed out that Lifespan, as a non-profit organization, does not have protection under the Charter of Rights and Freedoms and cannot seek remedy under the Charter. However, Keegan Macintosh is also a plaintiff and he should get protection under Section 7 of the Charter. Their legal counsel argues that since Keegan cannot face prosecution under Section 14, his rights are not being infringed on. The problem we have with this is that, Section 14 restricts Keegan's ability to enter into cryonics arrangements with Lifespan, which restricts his ability to pursue life, liberty and security.

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*“We are uncertain how they would judge which marketing material would create “a strong belief” about future resuscitation in a person unless there was an explicit guarantee in the service provided.”*

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According to their legal counsel, they only intended to restrict cryonics services from sales based on misrepresentations about the likelihood of future resuscitation. They do not find this restriction arbitrary as this only restricts vendors who make “prescribed representation” for future resuscitation, so they do not consider this law's reach to be overbroad. In our initial Civil Claim, we state clearly that we do not have a problem with the government restricting sales based on an exaggeration of the expectation of resuscitation. However, it is unclear from Section 14 what would, in fact, constitute an “expectation” of resuscitation.

The government's legal counsel, thus far, has avoided any statements about probabilities and only focuses on

expectation as a “strong belief something will occur.” This specifically targets sales or offers that instill in the buyer a strong belief that they will be resuscitated. No cryonics providers offer cryonics arrangements by instilling in the buyer an expectation of resuscitation with a high probability in the future. We are uncertain how they would judge which marketing material would create “a strong belief” about future resuscitation in a person unless there was an explicit guarantee in the service provided. Showing two different individuals the same material about cryonics yields wildly different beliefs about their prospects of resuscitation based on their own personal belief and understanding of the world. Our initial Civil Claim is not against a prohibition on the sale of cryonics with an exaggerated prospect of resuscitation. We suggested an amendment to Section 14 that would include this clarification.

There are so few cryonics members in B.C. that it still remains a complete mystery how and why they decided to attempt to regulate this industry. Ideally we could have this law taken off the books, but that may not be on the table. It is promising that they put emphasis on the fact that Lifespan's intended services would be perfectly legal. The plaintiffs do not oppose restricting exaggerated prospects of resuscitation. If a company actually offered cryonics with a guarantee of resuscitation, it could potentially harm cryonics as a whole.

#### **WHAT COMES NEXT?**

So the next step in our legal challenge is to put this case in front of a judge to set legal precedent with a ruling. One way our case could go is the judge could side with the idea that the law only applies to an exaggeration of the prospect of resuscitation, and our case will be dismissed. With this we would have a clear legal precedent that the sale of cryonics arrangements is legal, but the exaggeration of the prospects of resuscitation is not legal in B.C. I would consider that a legal victory because no cryonics provider currently makes exaggerated claims about the prospect of resuscitation. So the law would not restrict any cryonics provider in B.C. However, the other way the case could go is that

the judge disagrees with the government lawyer's interpretation of “expectation of resuscitation” and assigns this terminology to mean that cryonics arrangements cannot be sold on the basis of any probability above zero for resuscitation. We find this problematic because it would then restrict all cryonics services, period. This would result in us being forced to either get the law itself removed or amended rather than just having a judge ruling set a legal precedent. This case is ongoing and donations would be appreciated: <http://www.lifespanbc.ca/donate> ■

**Carrie Wong** is a young Canadian cryonicist. She graduated in 2011 with degree in geology from The University of British Columbia



and worked in gold exploration for a few years. In addition to writing for *Cryonics* magazine, she is also writing for [geologyforinvestors.com](http://geologyforinvestors.com) and running a cartography business.



# REDUCE YOUR ALCOR DUES WITH THE CMS WAIVER

Alcor members pay general dues to cover Alcor's operating expenses and also make annual contributions to the Comprehensive Member Standby fund pool to cover the costs of readiness and standby. Benefits of Comprehensive Member Standby include no out-of-pocket expense for standby services at the time of need, and up to \$10,000 for relocation assistance to the Scottsdale, Arizona area.

Instead of paying \$180 per year in CMS dues, Alcor also provides members the option to cover all CMS-associated costs through life insurance or pre-payment. Members who provide an additional \$20,000 in minimum funding will no longer have to pay the \$180 CMS (Comprehensive Member Standby fund) fee. This increase in minimums is permanent (for example, if in the future Alcor were to raise the cost of a neurocryopreservation to \$90,000, the new minimum for

neurocryopreservation members under this election would be \$110,000). Once this election is made, the member cannot change back to the original minimums in the future.

To have the CMS fee waived, these are the minimums:

- **\$220,000 Whole Body Cryopreservation** (\$115,000 to the Patient Care Trust, \$60,000 for cryopreservation, \$45,000 to the CMS Fund).
- **\$100,000 Neurocryopreservation** (\$25,000 to the Patient Care Trust, \$30,000 for cryopreservation, \$45,000 to the CMS Fund).

If you have adequate funding and would like to take advantage of the CMS waiver, contact **Diane Cremeens** at [diane@alcor.org](mailto:diane@alcor.org).

## Become An Alcor Associate Member!

Supporters of Alcor who are not yet ready to make cryopreservation arrangements can become an Associate Member for \$5/month (or \$15/quarter or \$60 annually). Associate Members are members of the Alcor Life Extension Foundation who have not made cryonics arrangements but financially support the organization. Associate Members will receive:

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

To become an Associate Member send a check or money order (\$5/month or \$15/quarter or \$60 annually) to Alcor Life Extension Foundation, 7895 E. Acoma Dr., Suite 110, Scottsdale, Arizona 85260, or call Marji Klima at (480) 905-1906 ext. 101 with your credit card information.

Or you can pay online via PayPal using the following link: <http://www.alcor.org/BecomeMember/associate.html> (quarterly option is not available this way).

Associate Members can improve their chances of being cryopreserved in an emergency if they complete and provide us with a Declaration of Intent to be Cryopreserved (<http://www.alcor.org/Library/html/declarationofintent.html>). Financial provisions would still have to be made by you or someone acting for you, but the combination of Associate Membership and Declaration of Intent meets the informed consent requirement and makes it much more likely that we could move ahead in a critical situation.



# Superior-Absorbing CURCUMIN



Item # 00407

Item # 01808

**Curcumin** has turned into a nutrition **superstar** because of the enormous health-promoting effects it provides for almost every organ system.<sup>1,2</sup>

However, most curcumin extracts are neither well **absorbed** nor well retained in the body.

**Life Extension**'s curcumin supplements utilize a patented preparation of curcumin that can reach up to **7 times higher** concentration in the blood than standard curcumin.<sup>3</sup>

As the graphs on this page illustrate, the **400 mg** of curcumin in either of our formulas supply the body with the equivalent of **2,500 mg** of most commercial curcumin products.

In recent studies comparing the effects of standard curcumin against Life Extension's turmeric extracts, researchers observed:<sup>4,5</sup>

- Nearly **twice** the support for immune health and approximately **2 times** the support for healthy inflammatory response.
- Almost **double** the free radical-fighting support. A separate study indicated that curcumin extract provided powerful support for heart health.

## References

1. *Nat Sci Biol Med.* 2013 Jan-Jun;4(1):3-7.
2. *Biofactors.* 2013 Jan-Feb;39(1):2-13.
3. *Indian J Pharm Sci.* 2008 Jul-Aug;70(4):445-9.
4. *Int J Pharmacol.* 2009;5(6):333-45.
5. *Food Nutr Res.* 2009;48(3):148-52.
6. *J Med Food.* 2012 Mar;15(3):242-52.
7. *Cancer Chemother Pharmacol.* 2007;60:171-7.
8. Bioavailability study of BCM-95® in rats. Orcas International Inc.

## TWO CURCUMIN FORMULAS TO CHOOSE FROM

Those who want a curcumin stand-alone can order a bottle of 60 vegetarian capsules of **Super Bio-Curcumin**® (Item #00407) for \$38. If a customer buys four bottles, during **Super Sale** the price is reduced to **\$23.63** per bottle. Each bottle lasts a typical user **two** months.

Those seeking additional support against cell changes that promote prolonged functional inflammatory response may choose **Advanced Bio-Curcumin**® **With Ginger & Turmerones**.

While **both** of these formulas provide the superior **absorbing** curcumin, **Advanced Bio-Curcumin**® **With Ginger & Turmerones** also contains:

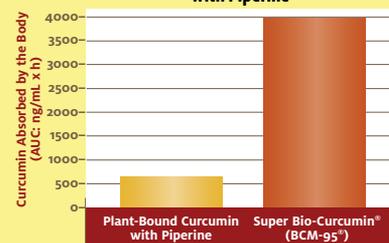
- **Turmerones** to increase the amount of curcumin inside cells.<sup>6</sup>
- **Ginger**, which provides complementary health benefits.
- **Phospholipids** that further enhance absorption.<sup>7</sup>

A bottle of 30 softgels of **Advanced Bio-Curcumin**® **With Ginger & Turmerones** (Item #01808) retails for \$30. **Super Sale** price is reduced to **\$20.25** per bottle. The suggested dose for either of these highly **absorbable** curcumin supplements is **one** capsule daily.

**CAUTION:** Do not take if you have gallbladder problems or gallstones. If you are taking anticoagulant or antiplatelet medications, or have a bleeding disorder, consult your healthcare provider before taking this product.

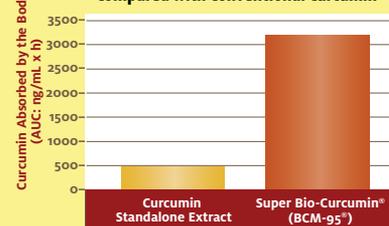
**Bio-Curcumin**® and **BCM-95**® are registered trademarks of Dolcas-Biotech, LLC. U.S. Patent Nos. 7,883,728, 7,736,679 and 7,879,373.

Compared with Plant-Bound Curcumin with Piperine<sup>3</sup>



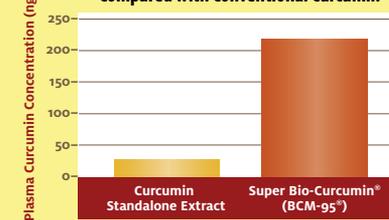
**Chart 1.** Super Bio-Curcumin® showed 6.3 times greater bioavailability (absorption and sustainability over eight hours) in humans compared with plantbound curcumin with piperine (as measured by the area under the curve [AUC] in a plot of blood levels against time, that is, the total amount of curcumin absorbed by the body over eight hours).

Absorption of Super Bio-Curcumin® in Humans Compared with Conventional Curcumin<sup>2</sup>



**Chart 2.** Super Bio-Curcumin® showed 6.9 times greater bioavailability (absorption and sustainability over eight hours) in humans compared with conventional curcumin (as measured by the area under the curve [AUC] in a plot of blood levels against time, that is, the total amount of curcumin absorbed by the body over eight hours).

Absorption of Super Bio-Curcumin® in Rats Compared with Conventional Curcumin<sup>4</sup>



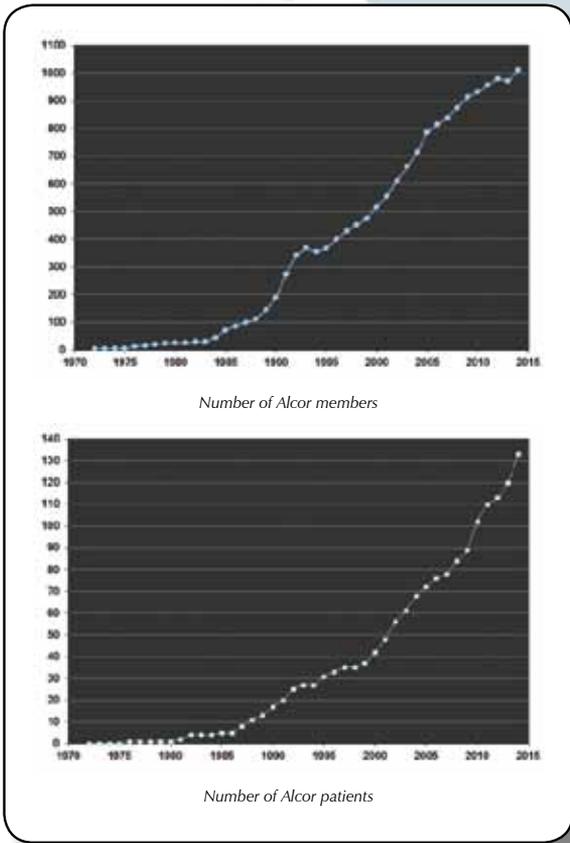
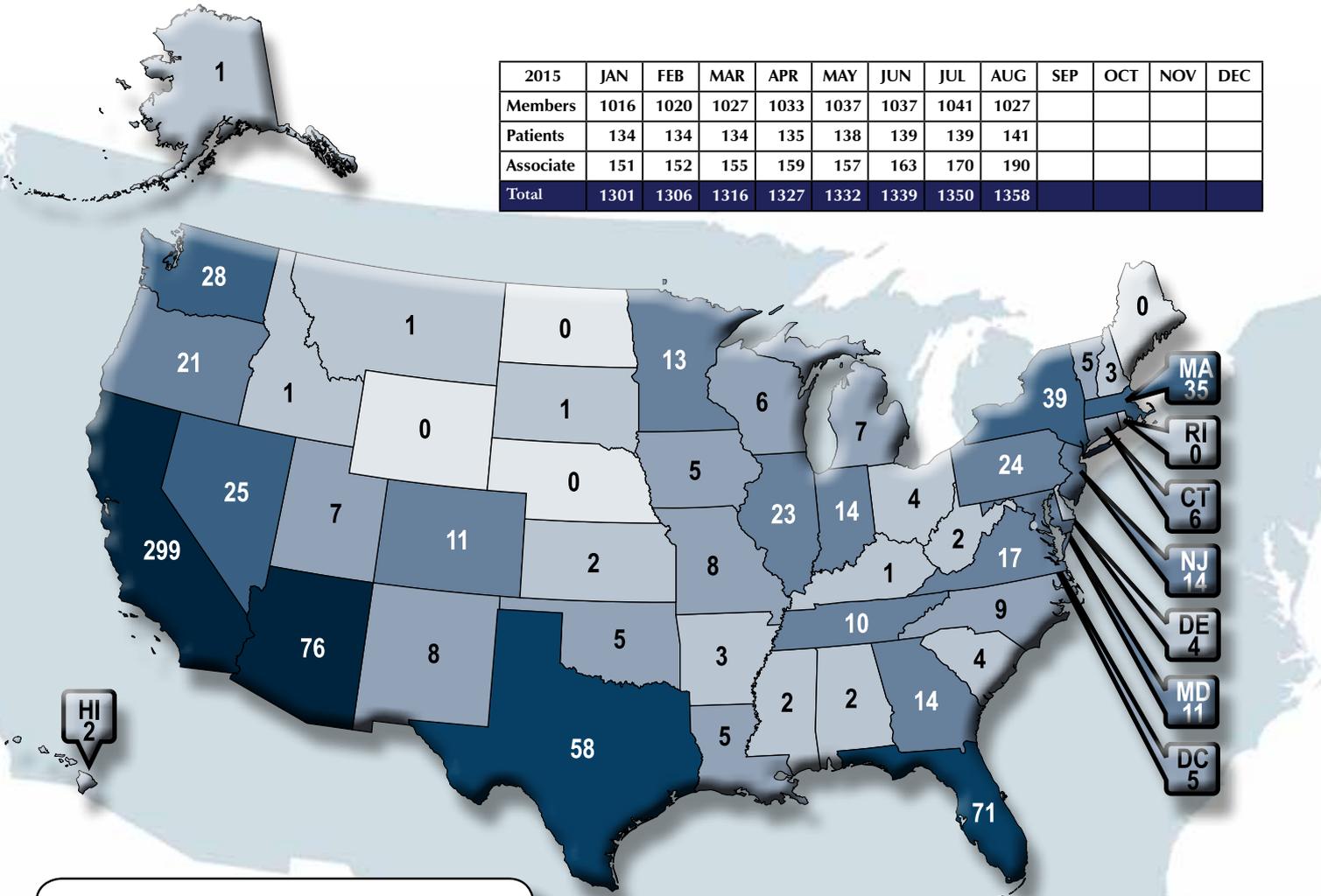
**Chart 3.** Bioavailability in rats fed with 7.8 times higher than conventional curcumin.

**Call toll-free 1-800-544-4440 to speak to a live operator (24 hours) or visit [www.LifeExtension.com](http://www.LifeExtension.com).**

These statements have not been evaluated by the Food and Drug Administration. These products are not intended to diagnose, treat, cure, or prevent any disease.

# Membership Statistics

2015	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Members	1016	1020	1027	1033	1037	1037	1041	1027				
Patients	134	134	134	135	138	139	139	141				
Associate	151	152	155	159	157	163	170	190				
<b>Total</b>	<b>1301</b>	<b>1306</b>	<b>1316</b>	<b>1327</b>	<b>1332</b>	<b>1339</b>	<b>1350</b>	<b>1358</b>				



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

### International

Country	Members	Patients
Australia	11	3
Canada	43	2
China	0	1
Germany	8	0
Hong Kong	1	0
Israel	1	1
Italy	3	0
Japan	4	0
Mexico	4	0
Monaco	1	0
Netherlands	1	0
New Zealand	1	0
Norway	1	0
Portugal	4	0
Singapore	1	0
Spain	3	1
Thailand	3	1
United Arab Emirates	1	0
United Kingdom	25	2
<b>TOTAL</b>	<b>116</b>	<b>11</b>

## Aldehyde-Stabilized Cryopreservation

Robert McIntyre and Gregory Fahy, in work supported by 21st Century Medicine (Fontana, CA) and the Brain Preservation Foundation (Cambridge, MA), have developed a new technique for preserving brain tissue with very little distortion or signs of injury. The new technique, called aldehyde-stabilized cryopreservation (ASC), demonstrates the relevance and utility of advanced cryopreservation science for the neurobiological research community. ASC is a new brain-banking technique designed to facilitate neuroanatomic research such as connectomics research, and has the unique ability to combine stable long term ice-free sample storage with excellent anatomical resolution. To demonstrate the feasibility of ASC, the researchers perfuse-fixed rabbit and pig brains with a glutaraldehyde-based fixative, then slowly perfused increasing concentrations of ethylene glycol over several hours in a manner similar to techniques used for whole organ cryopreservation. Once 65% w/v ethylene glycol was reached, they vitrified brains at  $-135^{\circ}\text{C}$  for indefinite long-term storage.

ScienceDirect  
25 Sep. 2015

<http://www.sciencedirect.com/science/article/pii/S001122401500245X>

## Self-Assembling Material Could Lead to Artificial Arteries

Researchers at Queen Mary University of London (QMUL) have developed a way of assembling organic molecules into complex tubular tissue-like structures without the use of molds or techniques like 3D printing. The study, which appeared Monday 28 September in the journal *Nature Chemistry*, describes how peptides and proteins can be used to create materials that exhibit dynamic behaviors found in biological

tissues like growth, morphogenesis, and healing. The method uses solutions of peptide and protein molecules that, upon touching each other, self-assemble to form a dynamic tissue at the point at which they meet. As the material assembles itself it can be easily guided to grow into complex shapes. This discovery could lead to the engineering of tissues like veins, arteries, or even the blood-brain barrier, which would allow scientists to study diseases such as Alzheimer's with a high level of similarity to the real tissue, which is currently impossible. The technique could also contribute to the creation of better implants, complex tissues, or more effective drug screening methods.

KurzweilAI/QMUL  
29 Sep. 2015

<http://www.kurzweilai.net/self-assembling-material-could-lead-to-artificial-arteries>

## Gene-Editing Record Smashed in Pigs

For decades, scientists and doctors have dreamed of creating a steady supply of human organs for transplantation by growing them in pigs. But concerns about rejection by the human immune system and infection by viruses embedded in the pig genome have stymied research. Now, by modifying more than 60 genes in pig embryos—ten times more than have been edited in any other animal—researchers believe they may have produced a suitable non-human organ donor. The work was presented on 5 October at a meeting of the US National Academy of Sciences (NAS) in Washington DC on human gene editing. Geneticist George Church of Harvard Medical School in Boston, Massachusetts, announced that he and colleagues had used the CRISPR/Cas9 gene-editing technology to inactivate 62 porcine endogenous retroviruses (PERVs) in pig embryos. These viruses are embedded in all pigs' genomes and cannot be treated or neutralized. It

is feared that they could cause disease in human transplant recipients.

Sara Reardon/*Nature*  
6 Oct. 2015

<http://www.nature.com/news/gene-editing-record-smashed-in-pigs-1.18525>

## Supercoiled DNA Is Far More Dynamic Than the 'Watson-Crick' Double Helix

Researchers have imaged in unprecedented detail the three-dimensional structure of supercoiled DNA, revealing that its shape is much more dynamic than the well-known double helix. Various DNA shapes, including figure-8s, were imaged using a powerful microscopy technique by researchers at the Baylor College of Medicine in the US, and then examined using supercomputer simulations run at the University of Leeds. As reported online Oct. 12 in the journal *Nature Communications*, the simulations also show the dynamic nature of DNA, which constantly wiggles and morphs into different shapes—a far cry from the commonly held idea of a rigid and static double helix structure. Improving our understanding of what DNA looks like when it is in the cell will help us to design better medicines, such as new antibiotics or more effective cancer chemotherapies. Dr. Sarah Harris from the School of Physics and Astronomy at the University of Leeds led the computer simulation research side of the study.

ScienceDaily/University of Leeds  
12 Oct. 2015

<http://www.sciencedaily.com/releases/2015/10/151012083802.htm>

## Artificial Skin That Can Send Pressure Sensations to Brain Cells

Zhenan Bao, a professor of chemical engineering at Stanford, has spent a

decade trying to develop a material that mimics skin's ability to flex and heal, while also serving as the sensor net that sends touch, temperature and pain signals to the brain. Ultimately she wants to create a flexible electronic fabric embedded with sensors that could cover a prosthetic limb and replicate some of skin's sensory functions. Bao's work, reported today in *Science*, takes another step toward her goal by replicating one aspect of touch, the sensory mechanism that enables us to distinguish the pressure difference between a limp handshake and a firm grip. "This is the first time a flexible, skin-like material has been able to detect pressure and also transmit a signal to a component of the nervous system," said Bao, who led the 17-person research team responsible for the achievement. Benjamin Tee, a recent doctoral graduate in electrical engineering; Alex Chortos, a doctoral candidate in materials science and engineering; and Andre Berndt, a postdoctoral scholar in bioengineering, were the lead authors on the *Science* paper.

ScienceDaily/Stanford University  
15 Oct. 2015

[http://www.sciencedaily.com/  
releases/2015/10/151015144707.htm](http://www.sciencedaily.com/releases/2015/10/151015144707.htm)

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## Moving Multicellular Organisms Mapped in 3-D at Single-Cell Resolution

A new microscope developed at the Howard Hughes Medical Institute's Janelia Research Campus is giving scientists a clearer, more comprehensive view of biological processes as they unfold in living animals. Called the IsoView light sheet microscope, it produces images of entire organisms, such as a zebrafish or fruit fly embryo, with enough resolution in all three dimensions that each cell appears as a distinct structure. What's more, it does so at speeds fast enough to watch cells move as a developing embryo takes shape and to monitor brain activity as it flashes through neuronal circuits. Nearly two years in development, Janelia group leader Philipp Keller says his team has built the first light microscope capable of imaging large, non-transparent specimens at sub-second temporal resolution and sub-cellular spatial resolution in all dimensions. Keller and his

team at Janelia aim to understand how a functioning nervous system emerges in an embryo. Over the last five years, they have devised several imaging technologies that make it possible to image large biological samples at high speed.

HHMI News (Howard Hughes Medical  
Institute)

26 Oct. 2015

[https://www.hhmi.org/news/  
seeing-big-picture](https://www.hhmi.org/news/seeing-big-picture)

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## Targeted Electrical Stimulation of the Brain Shows Promise as a Memory Aid

Electrical arrays implanted in the memory centers of the brain are showing promise for their ability to help patients improve their scores on memory tests, raising hope that such approaches may someday help individuals suffering from memory deficits as a result of traumatic brain injury or other pathologies. The preliminary findings, from DARPA's Restoring Active Memory (RAM) program, were presented in St. Louis on Thursday at Wait, What? A Future Technology Forum, hosted by the Agency. Just over one year into the effort, the novel approach to facilitating memory formation and recall has already been tested in a few dozen human volunteers, said program manager Justin Sanchez. The subjects in the study have neurological problems unrelated to memory loss, but volunteered to test the new neurotechnological interventions while they were undergoing brain surgery. In the study, small electrode arrays are placed in brain regions known to be involved in the formation of declarative memory, as well as in regions involved in spatial memory and navigation.

Defense Advanced Research Projects  
Agency (DARPA)

11 Sep. 2015

[http://www.darpa.mil/news-events/  
2015-09-11a](http://www.darpa.mil/news-events/2015-09-11a)

## 3D-Printed Guide Helps Regrow Complex Nerves after Injury

A national team of researchers has developed a first-of-its-kind, 3D-printed guide that helps regrow both the sensory and motor functions of complex nerves after injury. The groundbreaking research has the potential to help more than 200,000 people annually who experience nerve injuries or disease. Collaborators on the project are from the University of Minnesota, Virginia Tech, University of Maryland, Princeton University, and Johns Hopkins University. Nerve regeneration is a complex process, which makes regrowth of nerves after injury or disease very rare, according to the Mayo Clinic. Nerve damage is often permanent. Advanced 3D printing methods may now be the solution. In a new study, published today in the journal *Advanced Functional Materials*, researchers used a combination of 3D imaging and 3D printing techniques to create a custom silicone guide implanted with biochemical cues to help nerve regeneration. The guide's effectiveness was tested in the lab using rats. To achieve their results, researchers used a 3D scanner to reverse engineer the structure of a rat's sciatic nerve.

University of Minnesota

17 Sep. 2015

[http://discover.umn.edu/news/science-  
technology/3d-printed-guide-helps-  
regrow-complex-nerves-after-injury](http://discover.umn.edu/news/science-technology/3d-printed-guide-helps-regrow-complex-nerves-after-injury)

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## UK Scientists Apply for Licence to Edit Genes in Human Embryos

Scientists in London have asked permission to edit the genomes of human embryos—a request that could lead to the world's first approval of such research by a national regulatory body. Kathy Niakan, a researcher affiliated with the Francis Crick Institute, London's new £700-million (US\$1.1-billion) biomedical-research center, said on 18 September that she is proposing to use gene editing to provide "fundamental insights into early human development." In a statement released

through the Crick, Niakan said that her team wanted to use technology based on the CRISPR/Cas9 system—a recently developed technique for precisely editing genomes that has become hugely popular in the biology community. Her application was first reported by *The Guardian* newspaper. Editing the genomes of human embryos for a therapeutic use—for example, to eradicate a genetic disease—is illegal in the United Kingdom, but research work is possible under license from the Human Fertilisation and Embryology Authority (HFEA).

*Nature* / Daniel Cressey, Alison Abbott,  
Heidi Ledford  
18 Sep. 2015  
<http://www.nature.com/news/uk-scientists-apply-for-licence-to-edit-genes-in-human-embryos-1.18394#auth-2>

## Aldehyde-Stabilized Cryopreservation

Robert McIntyre and Gregory Fahy, in work supported by 21st Century Medicine (Fontana, CA) and the Brain Preservation Foundation (Cambridge, MA), have developed a new technique for preserving brain tissue with very little distortion or signs of injury. The new technique, called aldehyde-stabilized cryopreservation (ASC), demonstrates the relevance and utility of advanced cryopreservation science for the neurobiological research community. ASC is a new brain-banking technique designed to facilitate neuroanatomic research such as connectomics research, and has the unique ability to combine stable long term ice-free sample storage with excellent anatomical resolution. To demonstrate the feasibility of ASC, the researchers perfuse-fixed rabbit and pig brains with a glutaraldehyde-

based fixative, then slowly perfused increasing concentrations of ethylene glycol over several hours in a manner similar to techniques used for whole organ cryopreservation. Once 65% w/v ethylene glycol was reached, they vitrified brains at  $-135^{\circ}\text{C}$  for indefinite long-term storage.

ScienceDirect  
25 Sep. 2015  
<http://www.sciencedirect.com/science/article/pii/S001122401500245X>

## A Roadmap to Resuscitation

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

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

Jerome B. White, “**Viral-Induced Repair of Damaged Neurons with Preservation of Long-Term Information Content**,” Second Annual Conference of the Cryonics Societies of America, University of Michigan at Ann Arbor, April 11-12, 1969, by J. B. White reprinted in *Cryonics* 35:10 (October 2014), 8-17.

Michael G. Darwin, “**The Anabolocyte: A Biological Approach to Repairing Cryoinjury**,” *Life Extension*

*Magazine* (July-August 1977):80-83. Reprinted in *Cryonics* 29:4 (4th Quarter 2008),14-17.

Greg Fahy, “**A ‘Realistic’ Scenario for Nanotechnological Repair of the Frozen Human Brain**,” in Brian Wowk, Michael Darwin, eds., *Cryonics: Reaching for Tomorrow*, Alcor Life Extension Foundation, 1991.

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

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

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

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

Chana de Wolf (now Phaedra), “**Reconstructive Connectomics**,” *Cryonics* 34:7 (July 2013), 26-28.

# MEETINGS

## ABOUT THE ALCOR FOUNDATION

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

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

## ARIZONA

### FLAGSTAFF:

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

## PHOENIX

### VALLEY OF THE SUN:

This group meets monthly, usually in the third week of the month. Dates are determined by the activity or event planned. For more information or to RSVP, visit <http://cryonics.meetup.com/45/> or email Lisa Shock at [lisa@alcor.org](mailto:lisa@alcor.org).

### AT ALCOR:

Alcor Board of Directors Meetings and Facility Tours—Alcor business meetings are generally held on the first Saturday of every month starting at 11:00 AM MST. Guests are welcome to attend the fully-public board meetings. Facility tours are held every Tuesday at 10:00 AM and Friday at 2:00 PM. For more information or to schedule a tour, call Marji Klima at (877) 462-5267 x101 or email [marji@alcor.org](mailto:marji@alcor.org).

## CALIFORNIA

### LOS ANGELES:

Alcor Southern California Meetings—For information, call Peter Voss at (310) 822-4533 or e-mail him at [peter@optimal.org](mailto: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 (650) 969-1671, (650) 534-6409 or email [Mark\\_galeck@pacbell.net](mailto:Mark_galeck@pacbell.net).

## FLORIDA

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

## NEW ENGLAND

### CAMBRIDGE:

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

### PACIFIC NORTHWEST

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

## BRITISH COLUMBIA (CANADA):

The contact person for meetings in the Vancouver area is Keegan Macintosh: [keegan.macintosh@me.com](mailto:keegan.macintosh@me.com).

## OREGON:

The contact person for meetings in the Portland area is Aschwin de Wolf: [aschwin@alcor.org](mailto:aschwin@alcor.org). See also: <https://www.facebook.com/portland.life.extension>

## ALCOR PORTUGAL

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

A new group for the Austin area has been started for those interested in discussion and understanding of the relevant technologies and issues for cryopreservation, genomics, epigenetics and medical research for increased life/health span. Contact Tom Miller, 760-803-4107 or [tom@blackmagicmissileworks.com](mailto:tom@blackmagicmissileworks.com).

## JAPAN

Cryonics meetings are held monthly in Tokyo. Send queries to [grand88\(at\)yahoo.com](mailto:grand88(at)yahoo.com).

## UNITED KINGDOM

Alcor members in the UK can contact Garret Smyth at [Alcor-UK@alcor.org](mailto:Alcor-UK@alcor.org) for information about local meetings.

**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?

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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?

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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](http://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?

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Signing up for a cryopreservation is easy!

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

Not ready to make full arrangements for cryopreservation? Then **become an Associate Member** for \$5/month (or \$15/quarter or \$60 annually). Associate Members will receive:

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

To become an Associate Member send a check or money order (\$5/month or \$15/quarter or \$60 annually) to Alcor Life Extension Foundation, 7895 E. Acoma Dr., Suite 110, Scottsdale, Arizona 85260, or call Marji Klima at (480) 905-1906 ext. 101 with your credit card information. You can also pay using PayPal (and get the Declaration of Intent to Be Cryopreserved) here: <http://www.alcor.org/BecomeMember/associate.html>



**Call toll-free TODAY to start your application:**

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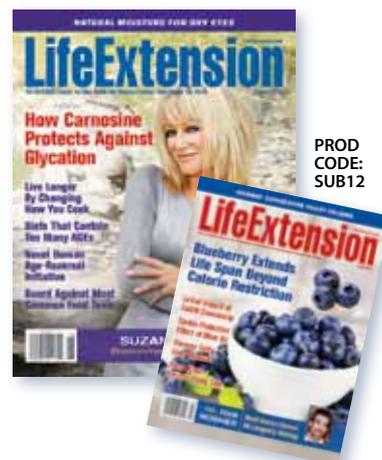


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