

ALCOR LIFE EXTENSION FOUNDATION

A Non-Profit Organization

CRYONICS

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RUSSIAN SCIENTIFIC COSMISM: A PRELUDE TO MODERN IMMORTALISM

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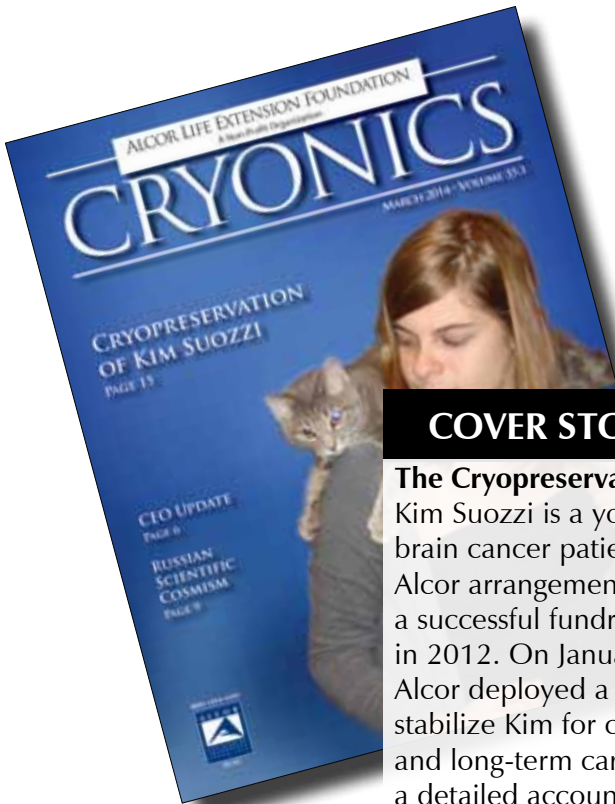
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CRYONICS



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The Cryopreservation of Kim Suozzi

Kim Suozzi is a young terminal brain cancer patient who made Alcor arrangements after launching a successful fundraising campaign in 2012. On January 17, 2013 Alcor deployed a standby team to stabilize Kim for cryopreservation and long-term care. This report is a detailed account of the case in which data are discussed and future recommendations are made.

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What is low cost cryonics? Are there enough people to benefit from it? What kind of procedures would low cost cryonics entail? How can we scientifically validate such an option? Cryonics magazine editor Aschwin de Wolf reviews this relevant topic.

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Russian Scientific Cosmism: A Prelude to Modern Immortalism

Mike Perry discusses the philosophical movement called "Cosmism": which aimed to seek the "religious" objective of immortality through scientific means. Also discussed is the pioneering critical care medicine researcher Vladimir Negovsky and his relationship with cryonics.

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2014 Annual Giving Program

Alcor provides a wide array of services for you the member, and the general public. We inform and educate, we protect and preserve, and we strive to remain at the forefront of cryonics technology.

Since its founding, Alcor has relied on member support to maintain its mission and attract new members. Your support, regardless of size, can provide a better future for all cryonicists. **Please act now.**

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Donations may be made via the Donations button on the Alcor website or by contacting Alcor's Finance Director, Bonnie Magee, at bonnie@alcor.org. Your donation may be made as a lump sum or divided into easy monthly payments. ■

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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.

The James Bedford Society recognizes those who make a bequest of any size to the Alcor Life Extension Foundation. If you have already provided a gift for Alcor in your estate, please send a copy of your relevant documents to Alcor's Finance Director, Bonnie Magee.

If you'd like to learn more about setting up a bequest, send an email to bonnie@alcor.org or call 480-905-1906 x114 to discuss your gift. ■



QUOD INCEPIMUS CONFICIEMUS



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

LOW COST CRYONICS By Aschwin de Wolf

Over the years some cryonics proponents have expressed interest and support for offering an inexpensive form of cryonics. Before discussing what such a form of cryonics might entail I first would like to briefly address the question of whether the idea of low cost cryonics is a solution to a non-existent problem. After all, for low cost cryonics to make sense, there must be a substantial number of people being priced out of cryonics arrangements who would make arrangements if it were more affordable. For this to occur a person must not only not be able to afford Alcor's services but also not be able to afford the Cryonics Institute's either. As far as I am aware, this problem is mostly confined to people who are basically uninsurable due to a medical condition or advanced age, or who wish to cryopreserve someone else where funding is insufficient.

In some cases, however, people who have found themselves priced out of cryonics arrangements have been the beneficiary of fund raising campaigns within the cryonics community. While it may not be possible to provide funding for all such cases, this development does raise the question of how many people who had a strong public desire to be cryopreserved did not get their wishes honored. The major reason to advocate low cost cryonics is to bring the service within the reach of more people. Thus it is important to understand how many people are actually excluded from being cryopreserved due

to financial challenges. If access to cryonics is mostly a non-issue one might argue that strategies to simply aim at more people making cryonics arrangements can be more effective than offering lower priced options.

There are roughly three areas where cost savings can be realized in cryonics: (a) long term care costs, (b) cryoprotection, and (c) standby and stabilization. It is not possible to do justice to all the potential cost savings in these areas so let me briefly discuss the major themes.

While it is reasonable to assume that some long term care costs can be reduced by reducing expenses associated with running a cryonics organization (staff, administrative costs, rent) the bulk of long-term care expenses arise from the need to keep patients in cryopreservation until resuscitation efforts will be possible. If there is one thing we have learned since the early days of cryonics it is that it is not wise to compromise on demanding pre-payment (life insurance or cash) or to use wildly optimistic growth assumptions for these funds. A pay-as-you-go system would not just subject many patients to premature thawing but also endanger the reputation of the field of cryonics as a whole.

This mostly leaves cryoprotection and standby services as potential cost saving measures. Clearly, offering standby and stabilization without subsequent cryoprotection would be an incoherent approach because attempts to preserve the viability of the brain would be followed by straight

freezing. Offering sophisticated cryoprotection procedures without standby is not particularly logical either because optimal cryopreservation requires rapid stabilization and cooling after clinical death. To really realize substantial cost savings a cryonics organization would need to *exclude* both standby and cryoprotection from its protocol and focus on the isolated brain. Is it responsible for a cryonics organization to offer such a form of low cost cryonics? It is hard to answer this question because it is difficult to predict how much damage is still compatible with inferring the original state of the brain. One research program, however, that could give us preliminary answers to such questions is *reconstructive connectomics*. We can model these low cost cryonics protocols and then see if we can recognize or reconstruct the original structure of the brain using either conventional electron microscopy or more recent 3D brain mapping technologies. If this project provides reasons for optimism there is a strong ethical argument for an organization to offer this service.

In short, the most credible realization of "low cost cryonics" would entail a financially conservative cryonics organization that offers secure, isolated-brain cryopreservation without standby and without the state-of-the-art cryoprotection now done at Alcor with a trained team, though a less training-intensive, inexpensive, method of cryoprotection (immersion of the brain in cryoprotectant after chemical fixation) might still be possible. ■

CEO Update

By Max More



GROWTH IN MEMBERSHIP

We are now in the process of positioning a full kit in Canada in the Toronto area. Alcor has a number of members in and around Toronto and (relatively) nearby Montreal. This is important because, in the event of an emergency, we do not want to have to worry about delays at customs. We will be storing cryoprotectant in a refrigerator that is now on-site, along with medications, a portable ice bath, Thumper, neuro dry ice shipper, and other supplies.

Since we will then be in a position to offer a better response to Canadian members than any other organization, we hope to grow our membership across the border.

I have had a couple of meetings with active Alcor members to develop a full marketing/outreach plan. This is taking tighter shape, allowing me to approach members in search of funding. As part of this effort, a mutual friend arranged for me to receive a complimentary consultation on ideas to target public awareness around cryonics. The discussion was stimulating and has led to me think that instead of focusing on technically-sophisticated individuals, we might do better to target explorers and adventurous types.

Filming, editing, and promotion of videos for the Alcor Cryonics YouTube channel continues. My response to the uninformed critical video by popular science presenter Michio Kaku has now received 35,316 views. Interestingly and unusually, almost everyone watched the entire video. When Kaku recently held a Q&A session online, we brought his and

his viewers' attention to that unanswered response. The most-recently promoted video—"Is Cryonics 'Cheating Death'"—has received 23,581 views.

Newly completed videos that are either online right now or will be in the next few days:

- When will cryopreserved patients be revived?
- What happens to the soul after cryopreservation?
- How do you prevent damage from ice crystals?

The most recent batch of FAQ videos already filmed and currently being edited:

- How do I know your organization is for real?
- How do I sign up for Associate Membership?
- What can I do to optimize my chances of being cryopreserved under good conditions?
- What is neurocryopreservation?
- Why do people choose neuro-cryopreservation?

In planning additional videos, I consulted with Aaron and we decided that we should create a video for doctors and hospitals to explain our procedures and how to work with us for the patient's benefit. We will also revise the current letter on this topic, which could be more effective. We may secure more cooperation by asking for less, by offering rewards for facilitating the patient's wishes, and by explaining how

their cooperation reduces their exposure to legal risks.

At the start of February, I returned from a brief trip to Southern California to give an invited talk to the Centennial Futures Conference at Fullerton College. Although the organizer suggested I talk on "transhumanism and singularity," I devoted a good part of my talk to life extension and cryonics. Cryonics also drew the majority of questions during the joint discussion session and at the reception following. Questioners were pleasantly friendly and curious, with not one person being hostile or dismissing or ridiculing what we do.

After my talk, I joined the previous speaker—Brian Kennedy, CEO of the Buck Institute for Research on Aging—for an impromptu dialog followed by questions from the audience. This also went very well, both of us being largely in agreement on the topics we discussed (including the economic benefits of extending healthy lives, the state and future of regenerative medicine, and so on).

Peter Voss was kind enough to allow Media Architects to take photos and video of members at his recent 60th birthday celebration. This is to be used in testimonials and for a new website design (which will use more images of members, especially couples and families). Thanks to all of you who participated.

Other marketing and promotion efforts underway include a fresh design for the website, creation of testimonial videos, and infographics that can be used during tours, at conference booths, and online. We are also printing special cards to hand out when I give talks, entitling the bearer

to a free one-year Associate Membership. I will conduct the first test of their effectiveness this weekend after my talk at the Transhuman Visions conference.

Proposal to cut top rate of membership dues by 10%: Too many members continue to find our member dues burdensome. We continue to lose members for non-payment. The board agreed to reduce dues by 5% at the start of this year, from \$620 to \$590 (on top of which members pay \$180 in CMS fees). I believe we can and *should* do more. I believe we should reduce dues—for those paying the full rate with no discount as student, family member, or long-term—by another 10%, rounded to \$60/year.

What would this cost Alcor in lost revenue for operations? We don't know. On the implausible assumption that such a reduction made zero difference to member retention and zero difference to new-member acquisition, we would lose \$33,480 per year. (Currently, there are 558 members paying \$620/year. $558 \times \$60 = \$33,480$.) The amount currently in Alcor's bank account and reserve fund could cover this for over 38 years. The checking account alone would cover it for over 16 years. That's plenty of time to reverse the cut if it clearly wasn't working out. I must also note that our checking plus reserve funds have been *growing* over the last few years while we *lose* existing members.

If this reduction in cost made a modest difference to member retention and to growth in new members, that cut could partially or fully pay for itself. We have been losing members at a disturbing rate since dues have been raised (in 2010 and 2011). We lost 65 members in 2013. Assume 20 of those would have stayed (or 15, plus 5 additional new members). In three years, the reduction in cost would pay for itself. After that, we would come out ahead—and by an increasing amount as growth compounded.

There has been resistance to reducing dues if it means the structural budget is not balanced. But the structural budget counts zero “unpredictable” income, even though it is entirely predictable that there will be income that cannot be predicted for any *specific short period* of time. In the meantime,



CT scanning of A-1117 and three companion animals

the actual budget keeps ending up in the black and Alcor's bank accounts continue to swell while we lose members due to high costs.

I believe the precautionary approach to Alcor's finances—in which all “unpredictable” income in any one year is ignored in the budget—has gone too far and that we are killing growth—and thereby harming finances. If we had been clearly spending more and more as more revenue came in, the strongly precautionary approach would make sense. But that is not the case. I have been cutting expenses over the last three years.

FUNDRAISING

Alcor now accepts donations in Bitcoins: <http://www.alcor.org/donate/bitcoin.html>

Thank you to members who made donations to Alcor so far this year. Those contributions support operations, enable us to engage in more active marketing and growth efforts, and fund more research. Most recently, we have been fortunate enough to receive a contribution from Androkliis Polemnis that came to about \$46,000. This donation was unusual in that

it was made in the form of a digital currency called NXT. We converted one million NXT into bitcoins and then immediately into US dollars.

ROBUSTNESS

Exploding LR-40: One of our 40 year-old small LR-40 dewars failed. The vacuum layer gave out and blew material high into the air. Fortunately, Hugh and Mike had noticed warning signs, including rapid boil-off and an ice ring, and removed the pets that were stored in that unit. I tasked Steve Graber (with input from Hugh) with looking into replacements for the other very old LR-40s. These aluminum units are apparently no longer available and will be replaced with steel dewars.

In December, we held a simulated perfusion scenario in the operating room. The aim is to further train Steve to be able to take over for Hugh, if necessary. Steve did very well, even as I prompted Hugh to throw him some problems to solve. The simulation was video recorded for later review. Since this was a simulation of a whole body perfusion situation, we will follow up in the next couple of weeks with a neuro patient perfusion simulation.

At the February board meeting, the board of directors adopted a formal conflict of interest policy.

RESEARCH

On February 8th, Hugh Hixon, Mike Perry, and I went to a nearby medical imaging facility to get CT scans of our most recent neuro patient A-1117 (consent having been provided) along with three animal companions. All four were covered in the cost of a single scan. The human patient appeared to have been perfused very effectively. More details will appear after Steve has reviewed the data CDs provided to us. In addition, new research by Advanced Neural Biosciences and funded by Alcor is about to enter its fourth phase. We are also conducting an in-house research project. This is testing the persistence of task memory after cryopreserving then rewarming microscopic worms, *C. elegans*.



The LR-40 dewar that failed

FINANCES

The goal of achieving structural financial balance has been achieved but I will continue to pay attention to maintaining our new, stronger financial position. Two recent changes will further improve the budget. First, we are moving our offsite data backup to a less expensive (and better) provider. Second, we have just replaced seven ancient and very inefficient air

conditioning units with new 13 seer units. Cost savings have already started and are expected to be substantial over the years. The reduction in electricity costs should be significantly greater than from the insulation that we added in late 2011.

The relentless quest to control and reduce costs continues. We recently confirmed that we will save significantly on Alcor's staff health insurance bill. It is unclear whether this is an unexpected result of the Affordable Care Act or a recovery from the large increase in rates of last year (although the current savings are significantly more than the previous rise). We are also saving by changing our existing phone system and eliminating one bill in the process.

The 2012 financial statements are on website. Alcor is the only cryonics organization to have their financial statements reviewed by an independent accountant.

OTHER

Reaching us by phone: Several people have complained that, when they call Alcor, it's difficult to get through to a person. Calling in as if I were unfamiliar with the organization and phone system, I found that the introductory message was too long and slowly recited. It isn't really difficult to get to the directory but does require some patience. However, if the person you try doesn't answer the phone, you had to go back to the directory. (And callers who are at a computer don't think to look at the Staff page for extension numbers.)

Some callers who try one or two staff members and don't get through assume that no one is in and give up. In fact, someone is *always* in. They either haven't tried the right extension or that person is already on a call or is away from their desk.

However, rather than blame connection problems on the caller, we have made some changes—and welcome further feedback to refine the system. These include a new phone system that allows new options for dealing with calls. One handy feature sends an email so that we can listen to messages online if we are away from our desks. In addition, the system is now set to allow a caller to immediately talk to someone. If that person (our front office administrator)

is away, the call will be forwarded to others. Who those others are depends on the time of day.

Full-spinal option? Here's an idea that's bound to be unpopular with many but which might be appreciated by some: Storage costs for whole body members are a problem for many. We have members who are significantly underfunded for WB but who are adamantly unwilling to switch to neuro. If you are one of those individuals, how would you feel about an option that allowed you to take along everything except your legs? Plenty of people today manage well without the use of their legs, especially as prosthetics continue to improve. And how plausible is it to believe that we will be able to revive patients, repair billions of neurons and other cells, and reverse the aging process but *not* be able to regenerate legs?

If we offered this “full spinal” option that maintains the entire spine and all of the body apart from legs, we could store two almost-whole body patients in the same space as one now. The current allocation of \$115,000 for storage of WB patients may be too low—unless we find other ways to cut costs. But this proposal would halve those costs for those who chose it. See Steve Graber's board report for more information on the storage space.

Yes, there are objections. Additional surgery would be involved. Public perception might be less than optimal. But what if this option were offered only to current WB members who are seriously underfunded and refuse to switch to neuro? Or offer it as a private, unpublicized option for new members with limited means? Or only to WB members who become underfunded and cannot raise their funding?

New in-house notary public: It was convenient to have our own in-house notary public when D'Bora was here. I talked to Marji (who used to be a notary), and she is renewing her notary qualification. She expects to be authorized for this purpose around mid-March.

Finally, a milestone to note: Alcor moved to Arizona 20 years ago as of February 21. ■

RUSSIAN SCIENTIFIC COSMISM: A PRELUDE TO MODERN IMMORTALISM

By R. Michael Perry



The modern cryonics movement seems mainly an American phenomenon, along with the attendant attitude that the problem of death, like other problems confronting the human species, should be addressed scientifically and in some way resolved on that basis. Russia, however, is a country with a long history of serious thinking about issues of life and death, with science not overlooked, and in some ways has a more developed tradition in scientific approaches than its American counterpart. Here we take a look at a number of Russian and Russian-near-abroad thinkers and scientists, mainly of the early to mid-twentieth century, who were prominent in a tradition known as *Cosmism*. The basic premise of Cosmism is that the human species should seize control of its own destiny and shape its own future using logic, reason, science and technology, all rightly inspired. Science is emphasized, but also a spiritual dimension. Where Einstein famously said, “Science without religion is lame, religion without science is blind,”¹ Cosmist thinking, rightly understood, would turn this around: “Science without religion is blind, religion without science is lame.” The difference is that the Cosmist approach is intensely proactive, though also reverent. We must take action, action to make life what it ought to be, even for the hardest problems, rather than placing hopes in outside powers to do the tough parts for us. To do it right, though, we must be very well motivated.

Today life is burdened by death and misery. That unhappy state must end and

the way to make it end lies within ourselves. Science—particularly, what has not been developed yet but can be developed by our diligent efforts—can make it possible. But science alone is not enough, nor its offshoot, technology—these will not supply the values to motivate such a course of action. What we need in addition is an appropriate infusion of “religion,” the state of being grasped by an ultimate concern, as Paul Tillich aptly phrased it, that will serve as our guide and motivating force. (With this definition religion does not necessarily invoke beliefs in the supernatural, but does demand a commitment to matters of ultimate significance and thus rises above the usual political and social movements.) Without this, “science is blind” and might still serve to amass information about the world and even help in our quest to satisfy our material wants while keeping the environment green—but to what real transcendent purpose? Religion, again invoking Tillich’s perceptive characterization, must *not* be construed as a non-overlapping magisterium to science, separate as oil is from water, but must employ science to achieve the aims it informs us are the right and proper ones for our betterment and our destiny. Otherwise it must be forever lame and hobbled in its rightful work, focused on passive pieties and comforting myths which indeed are all too often thought to comprise its essence.

Such was the rationale that in varying degrees infused a motley group of Russians and colleagues starting with N. F. Fedorov

in the nineteenth century. The Cosmists, as they would eventually be called, included religious thinkers who were not so much concerned with technical salvation as with harmonizing religious beliefs and practices with a scientific outlook. But in addition to these there were scientific Cosmists who were more focused on science-based technology as a road to salvation and in some cases were atheists. This second group is mainly our subject here. Much of this information comes from a recent book, *Russian Cosmism*, by George Young, who has an interesting story, summarized later, about how he came to be an authority on this topic. We continue with biographical sketches of some of the more prominent scientific Cosmists.

Nikolai Fedorov started the movement that would later be known as Cosmism. He was a strange combination of a forward-thinking, scientific speculative philosopher and a conservative religious believer who sought to uphold ancient traditions of human destiny. Born in a small village in Tambov Province in south European Russia, he spent much of his early career as an itinerant schoolteacher and his later years as the librarian in the Chertkov Library, later part of the Rumiantsev Museum, in Moscow, where he had access to much scientific and technical literature. His lifestyle was a study in self-denial and a benevolent otherworldliness. He never married. He lived alone in a room the size of a closet with no furniture and only a humpbacked trunk for a bed.

His food consisted of hard rolls and tea, supplemented occasionally by an old piece of cheese or dried fish. He spent nothing on entertainments or luxuries. His salary was meager.



Fedorov (1829-1903).²

Nevertheless he consistently aided penniless students, even as he resolutely turned down positions of greater authority and income. And, though he possessed no degrees, his knowledge was encyclopedic; authorities from many fields consulted him as an equal or superior. At the museum Fedorov had contact with many of the leading intellectuals of the day, along with younger scholars whom he befriended and instructed without pay. The most famous of his pupils was the pioneering Soviet space scientist Konstantin Tsiolkovsky, whom we'll meet shortly.

Fedorov was deeply concerned about the problems of human existence, and saw injustices pressing from many sides. Much of this concern no doubt stemmed from personal experience. The illegitimate son of a Russian nobleman, Fedorov early experienced disruption as his family was broken up and he went to live with an uncle. He received a good education though it stopped short of an advanced degree, and then had to fend for himself, lacking the privileges legitimate noble birth would have conferred. Fedorov became concerned about the problems of hunger, war, and lack of feelings of kinship among humanity. Above all he felt the need, somehow, to redress the problem of death.

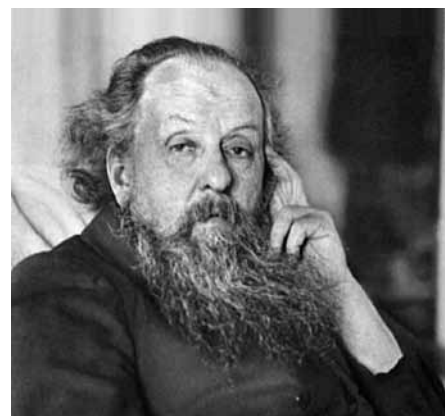
He then hit upon a fantastic idea: to use the powers of science to solve all of humanity's problems, including even the

problem of death. The latter goal in fact became the cornerstone of his whole program: he proposed nothing short of scientifically restoring to life everyone who had ever died. In doing this he did not sever ties with his Russian Orthodox faith, but felt it a moral obligation for humanity to use its God-given powers in solving this one great problem, from which the solution of other problems would follow.

Resurrection in fact was seen as the great "common task" that would unite humankind in a society of eternal kinship, a position that was defended at great length in his writings. The happy outcome would be cosmic in scope. "The whole Universe will consist of innumerable worlds of immense heavenly space, with their multitudes united with those of the resurrected generations, who for innumerable centuries have been swallowed up by the Earth."³ Though it would restore the bad along with the good, Fedorov regarded an evil nature as a curable affliction; thus everyone would benefit in the end. The methods he proposed for resurrection, if they have any validity, are no more implementable today than they were in his time. (For example, by accurately tracking the motions of particles one could determine their positions in former times and, by actual repositioning, restore the atoms in a deceased individual to their former places, effectively returning that person to life.⁴) But Fedorov's insistence that science can and should address this problem, however difficult it might prove to be, inspired a small circle of devotees, and has gained a further audience in more recent times. The modern cryonics movement can be seen as a distant echo of this thinking, in which the goal, if not resurrecting *all* the dead, is at least resuscitating the *clinically dead* who were well-enough preserved. There is also ongoing speculation, informed by recent scientific and philosophical thinking, about whether technology could ever advance enough to finally realize Fedorov's project in full, in some reasonable sense.⁵

Made nearly deaf for life by a childhood bout with scarlet fever, **Konstantin Tsiolkovsky** was shy and withdrawn but gifted and spent much time reading books in his father's library. Still, he fell behind in studies at school due to his hearing problem, so in 1873 the plucky teenager left his home in the village of Kaluga and headed for Moscow. There he met the

librarian Fedorov, who took him under wing, helped with finances, and patiently offered instruction and reference material. Tsiolkovsky tells us, "It is no exaggeration to say that for me he took the place of university professors, with whom I had no association." After three years of study with Fedorov Tsiolkovsky returned to his village and with further preparation passed the qualifying examination for science teachers in 1879. He began to teach in schools in the same general area where Fedorov had taught twenty years before. On the side he started keeping notebooks of his ideas on space flight and rocketry, including mathematical work that solved some of the basic problems such as how much fuel would be needed to overcome the earth's gravitational pull, how to gyroscopically stabilize a spacecraft, and how to cool the combustion chamber with ingredients from the fuel itself. He also constructed model atmospheric craft and built wind tunnels to test them. He wrote papers that would lay the foundation for launching the first artificial earth satellite, the Soviet Sputnik I, in 1957. In the words of intellectual historian Michael Holquist, "Tsiolkovsky was the first to do most of the things necessary to make, launch, and sustain life inside rockets as we now know them."



Tsiolkovsky (1857-1935).⁶

In addition to hard science Tsiolkovsky devoted much effort to popularizing the idea of space flight, writing science fiction and philosophical essays, the latter exploring ideas about possible extraterrestrial civilizations and survival in some form after death. "I am not only a materialist but also a panpsychist, recognizing the sensitivity of the entire Universe. I consider

this characteristic inseparable from matter. Everything is alive, but with the condition that we consider living only that which possesses a sufficiently strong sense of feeling. Since everything that is matter can, under favorable circumstances, convert to an organic state, then we can conditionally say that inorganic matter is in embryo (potentially) living..”

The life of the universe that is found everywhere must contain advanced beings that are beyond our level. “Throughout the cosmos extend social organizations governed by a ‘president’ of varying merits. One is higher than another, and in this way there is no fixed limit to personal or individual development. ... According to how much the mind expands, knowledge may increase and reveal to it a Universe that is greater and greater.” Each being also contains within it an “atom spirit” that persists over infinite time, past as well as future. After death and a period of dormancy it may find itself in a new brain though unaware of its past life (which some of us would say is no real survival). “In dying one says farewell forever to one’s circumstances. After all, they are in the brain, but the brain is decomposing. New circumstances will arise when the atom spirit finds itself in another brain. That new brain will provide circumstances, but different ones, having no connection to the previous ones.”

In contrast to Fedorov, then, Tsiolkovsky did not think a true resurrection of a deceased individual with memories of a past life would happen. Fedorov also posited that future resurrected beings would have imperfections eliminated or cured. Less appealing is Tsiolkovsky’s viewpoint that less desirable persons would simply be eliminated at the start. No details are offered for this “cosmic cleansing” but apparently it would be in the hands of future scientific geniuses, again not entirely reassuring. Tsiolkovsky still is highly respected as a cofounder of Cosmism, in part because of his contributions to space flight which is seen as the beginning of humanity’s elevation to cosmic status.

Alongside Fedorov and Tsiolkovsky, **Vladimir Vernadsky** is ranked in the triumvirate of Cosmist founders. He is chiefly remembered for his theory of the earth’s development, from a geosphere (inanimate matter) to a biosphere (living things in their usual activities) and finally



Vernadsky (1863-1945).⁷

to a noosphere, dominated by intelligence. This is to be understood as a progressive transition. Just as life transformed the geosphere into the biosphere, intelligence, starting with the human species, will transform the biosphere into the noosphere, as is increasingly clear as our progress continues. These ideas did not originate with Vernadsky but he developed them in a body of scientific and philosophical literature that occupies a prominent place in Cosmist thinking today.

Professionally, Vernadsky was a mineralogist and geochemist, but actually contributed to many fields, including atomic energy. Though an intensely patriotic Russian, he was sometimes an outspoken critic of the Soviet system (and the Czarist system before that) and was arrested briefly by the Stalin regime but then allowed to continue his researches whose value was appreciated. Near the end of his life, in 1944, with World War II raging, he recognized the promise and the peril that splitting the atom could bring. “In the geological history of the biosphere, a great future lies open to mankind, if he will accept it and will not use his reasoning powers and his labor for self-destruction.” Seeing the end of the war as a time for the emergence of the noosphere, he was guardedly optimistic. “The noosphere is a new geological phenomenon on our planet. In it for the first time mankind becomes a major geological force. Mankind can

and must transform his habitat by his labor and thought, transform it radically in comparison to its previous state. Before mankind wider and wider possibilities are opening. And perhaps my grandchild’s generation will glimpse their flourishing..”

One consequence of the noosphere will be “autotrophy,” in which the biosphere is no longer required to support the human species but humans adapt so that, for example, energy can be obtained directly from sunlight. Vernadsky thus foresees humanity developing into a postbiological form, no longer *homo sapiens*, so that the horizons of the noosphere would become unlimited. (Actually Fedorov anticipated this idea also.⁸) It is an interesting question how such an outcome might affect the history of the cosmos. Cosmologists today are happy to engage in predicting the “ultimate fate” of the universe based on various constraining assumptions but usually do not consider the possible role of intelligent life in shaping the long-term prospects. In effect they assume the “cosmosphere” must be just a scaled-up geosphere, with life at best reduced to insignificance in its overall effect, rather than being the governing noosphere that Vernadsky and others would postulate. Intelligence is inherently unpredictable, though, so the real fate of the universe may be quite different from what most theorists have imagined, and, perhaps, more in line with our ideas of a good outcome, in view of our vested interest in such an outcome.

A sickly but brilliant child who was privately educated at his family’s country estate, **Alexander Chizhevsky** emerged as a man of many talents, interests, and sensitivities. One early contact was Tsiolkovsky. “I remember his enormous erudition and exceptional breadth as a human being; he often expressed thoughts absolutely out of the ordinary about the future of mankind, thoughts about which you couldn’t read or hear anywhere else..” An accomplished poet and painter, Chizhevsky became best known for scientific and technical accomplishments ranging from an air purification device to studies of blood circulation. Another line of work, heliobiology, dealt with the claimed effects of solar pulsations on human life and aroused great controversy in the hazardous setting of Stalin’s Soviet Union. Chizhevsky was accused of mysticism, occultism, and general irrationality, and

finally, in 1942, arrested as an “Enemy Under the Mask of a Scientist.” For this state-defined crime he would spend sixteen years in prison or exile, until finally being rehabilitated in 1958.



Chizhevsky (1897-1964).⁹

In prison Chizhevsky was not always on good terms with his keepers, but, though sometimes in detention for offending them, he continued to paint, write poetry, and do scientific research as far as time and circumstances would allow. Once he was dragged from a punishment cell barely alive because he was the only one available who might be able to stop a cholera epidemic then sweeping the prison camp. And, using bleaching powder and other crude remedies, he did manage to stop it. As a reward he was allowed to set up a laboratory which, again though crude, allowed him to carry out important studies of blood movement that eventually won accolades from the Soviet Academy of Sciences.

“In general,” writes Young, “Chizhevsky’s work can be seen as an attempt to discover and define a single governing principle for the entire cosmos, an early twentieth-century Russian equivalent to Ken Wilbur’s ‘Theory of Everything’ or Stephen Hawking’s ‘M Theory.’” Chizhevsky saw two overarching disciplines then emerging in science. One was a “science of matter” in which physics, chemistry, and astronomy were becoming united. The

other, a “science of human culture,” was forging a union of the social sciences and the humanities. As a further logical step Chizhevsky foresaw and believed to be the task of himself and others a merging of both these endeavors into a science of everything. For Chizhevsky, it meant that his focus was not on how humanity could affect the cosmos so much as how the cosmos might affect humanity.

In this way he became the founder of heliobiology, the scientific field that studies the effect of variations in solar activity on earthly life. As he put it: “As soon as the sun-spot activity approaches its maximum, the number of important mass historical events, taken as a whole, increases, approaching its maximum during the sun-spot maximum and decreasing to its minimum during the epochs of the sun-spot minimum.” In particular he gave partial credit to sunspot activity for bringing on the October, 1917 revolution that put the Bolsheviks in power. Such an attribution was not popular with the resulting Soviet government, which wanted to give full credit to the great comrades Lenin and Stalin, the working classes, and historical inevitability. Today the sunspot theory is still controversial though it is clear that solar variations must have *some* effect, such as on the growth of plant life including crops. But right or wrong, one must have the *right* to be wrong, that is, to express views that may turn out to be incorrect. This is an important part of the creative process especially in highly speculative endeavors where an approach might yield great benefits though there is no guarantee of success.

Born in the Smilavichy region of what is now Belarus, **Vasily Kuprevich** spent much of his childhood on the estate of a certain Count Lubinsky in the town of Orsha, where his father worked as a forester. There the youngster acquired a love of nature and laid foundations for his later career as a botanist. He attended naval cadet school starting at age sixteen, underwent two years of officer training, and served on a Baltic-Sea destroyer in World War I until he was wounded and demobilized in 1918. For some years after that he was a village schoolteacher; in spare time he studied science and began writing papers based on his research. Lacking wealth, he would benefit from a state-sponsored education program that led to further career advances

starting in the 1930s. In 1952 he became head of the Byelorussian Academy of Sciences, a post he occupied until his death. He made important contributions to the understanding of photosynthesis and plant nutrition. He catalogued mushrooms and other fungi and investigated the healing properties of plants. Later in his career he turned to the more controversial study of aging in plants, then aging more generally. Eventually Kuprevich concluded that aging in humans is not inevitable. “Having invented death, nature should also show us how to combat it.”



Kuprevich (1897-1969).¹⁰

Kuprevich updates Fedorov to deny that death is permanently inherent in nature. Though death is an established part of the evolutionary process, with the development of the noosphere we can proceed to overcome it using reason in place of nature’s unconscious imperatives. Like Fedorov, however, Kuprevich contends that the first step to indefinite longevity is to overcome attitudes of resistance to the concept and bring about a change of orientation. He reminds us that major scientific advances usually start with assurances that “it cannot be done.” The scientific establishment can be formidable in its opposition to the use of its own methods to tackle a problem that seems too difficult. In this case however one actually has an ally in the wider community, where myth, legend, and popular religion point to the possibility of extreme longevity and help mute resistance to the sort of reasoned approach Kuprevich and other scientific Cosmists would advocate.

The ability of an organism to repair and renew itself is a basic part of nature, Kuprevich notes. In humans this ability continues indefinitely in some parts of the body (fingernails, skin, liver) but not more generally. Science, then, must find how to universalize this process and extend it indefinitely. "Organisms lost the ability to renew 'worn out' cells not because in their nature they are unable to reproduce without limit. This ability was simply lost as a result of natural selection, and the life of a hypothetically immortal individual then shortened a span whose length was no longer of use to the species." Though a shortened life-span might further the reproductive process, with the full flowering of the noosphere humankind will not simply be another reproducing species but a new life form altogether, with individuals living indefinitely; thus different rules must apply.

As for actual research, opportunities were limited both by the primitive state of knowledge and by the opposition of those who considered life extension to be a pseudoscience and its advocates crackpots. Kuprevich like other Cosmists was able to bear the brunt of criticism and not abandon his quest. In particular in his research he identified cases in which parents who both had a certain genetic defect produced a child without the defect. "It is possible that similar paths can be found to eliminate the defects that occur in the elements of cells in the process of self-renewal." But of course we must learn what aging actually is. "If it is a disease, then it can be cured. If it is programmed in a gene, then the program needs to be changed."

Vladimir Negovsky is not found in Young's book and does not seem to have authored any significant writings on Cosmism. Yet he made an important, pioneering technical advance that was very "Cosmist," in finding a method of reversing "death"—in this case clinical death signaled by cardiac and respiratory arrest. Also, unlike the others, he showed interest in cryonics and is mentioned in some early cryonics newsletters.

Born in Kozelst, Chernygov region of Ukraine (then part of the Russian Empire) Negovsky grew up in a family of teachers, with many brothers and sisters. In 1933 he graduated from the Second Medical Institute in Moscow and started working as a physician. In 1936 he founded the first

laboratory in the world that focused on restoring vital processes after clinical death, starting with animal models. In this and related efforts he deserves the main credit for creating the science of reanimatology or resuscitation medicine. In 1943, with World War II raging, Dr. Negovsky formed front-line resuscitation teams that restored vital functions to more than 40 clinically dead wounded men. That year he also presented his doctoral thesis, on the "pathophysiology and reversal of death."



Negovsky (1909-2003).¹¹

With the end of World War II the United States and the Soviet Union became locked in the confrontational struggle known as the Cold War. The standoff divided the two nations and their allies along an "Iron Curtain" which limited contacts between scientists in the respective groups. Negovsky and associates meanwhile extended their researches into reversing cardiac arrest with electrical defibrillation and used electroencephalography to monitor brain activity "during different patterns of dying and resuscitation." In 1961 at the International Conference of Traumatologists Negovsky proposed the term *reanimatology* for his new medical science, which had twin goals of prevention and therapy for terminal conditions and clinical death. It was noted that this choice of terminology is more reasonable than the commonly used Western terms *resuscitation* and *intensive care* because it focuses on "anima"—the mind or spirit—to indicate that resuscitation efforts must aim for recovering the full personality in functioning form. Additionally it focuses

on "ology" which indicates a science while the others refer to methods.

As the 1960s ran their course there was a gradual thaw in relations between the United States and the Soviet Union. Negovsky was in the forefront of scientists who sought and reciprocated contacts between the two sides. He even had contact with the early cryonics movement. In 1971 Anatole Dolinoff of the Cryonics Society of France visited the eminent scientist in Moscow, where he found him favorable to cryonics as well as a gracious host. "I know very well the resistance and skepticism of which physicians are capable," Negovsky told his guest. "My work was ignored for a long time. Most physicians will think your enterprise lunatic. But I have confidence in the future of science. I find your goal interesting, and that is why I remain in correspondence with you. I desire to receive all publications concerning human preservation by cold, and I shall be present at the foundation of the European Cryonics Corporation."¹²

Unfortunately, the hoped-for European Cryonics Corporation would not materialize. Negovsky, who appears to have had a strong sensitivity to the unequal levels of wealth and privilege in the world, came to have serious reservations about cryonics, based on his perceptions of its cost. "Only the very wealthy can afford it. And for these riches they are trying to buy eternity. How human relations must be distorted in a society which in fact abandons the idea of equality even in the face of death."¹³ Negovsky died in 2003 and, like the others before him on this list, was not cryopreserved.

COSMISM, CRYONICS, AND GEORGE YOUNG

A few years after the passing of Negovsky the first cryonics organization outside the U.S., KrioRus, was started in Russia. It offers a complete range of preservation options (whole-body, head-only, brain-only) mostly at lower prices than its U.S. competitors. Its advocates include a new group of Russian Cosmists who are scientific immortalists in a more immediate sense than their predecessors.¹⁴ For, being cryonicists, they are focused for the first time on the idea of preventing the destruction of the physical basis of identity after presently irreversible clinical death, as a possible pathway to

immortality. Their story will have to be told elsewhere.

George Young, who first wrote a book about Fedorov then authored the study on Russian Cosmism that was the main reference for this article, relates that his introduction to Fedorov was rather accidental. It came about in 1964 when, in a graduate school course at Yale University, he and other students had to pick and report on a topic related in some way to the writer Dostoevsky. Young's name was last on the list alphabetically which meant he was also the last to choose. The better-known topics had already been selected and he was left with only two alternatives, one of which was Fedorov. This led in time to his 1979 book on Fedorov, yet, while admiring this thinker for his strength and boldness, found he "was not a proponent of Fedorov's teachings." Later with the 2012 book on Cosmism his attitude "has not changed significantly." In addition in the book's preface he issues a "mental health warning": "fascinating as they are, at least to me, all the Cosmists were and are highly controversial—some would say even kooky—thinkers, recommended for mature audiences only."¹⁵



George Young

Presumably this applies to the present-day Cosmists who advocate cryonics. One hopes for the miracle that Dr. Young will rethink his position, at least on this one option. ■

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CRYOPRESERVATION OF KIM SUOZZI (PATIENT A-2643)

By Chana de Wolf

INTRODUCTION

The last comprehensive review of Alcor's current cryopreservation protocol, including a detailed description of changes since 1990, was provided in the case report for Patient A-1097 (2007). The only change in neuropreservation protocol since 2007 is the removal of a cold carotid flush to selectively cool the head prior to cephalic isolation (which was a one-time experiment). The current protocol is to cool the entire patient to a temperature compatible with cessation of CPS prior to cephalic isolation and cannulation of the carotids for subsequent washout and cryoprotection. The standard protocol was used in the current case.

MEMBERSHIP APPROVAL

Kim completed membership documents, including Consent for Cryopreservation, Last Will and Testament of Human Remains (Authorization of Anatomical Donation), Emergency Standby Provisions, and a Cryopreservation Agreement between Kim Suozzi and Alcor Life Extension Foundation on October 12, 2012. The agreement was approved by the Board of Directors and executed on October 31, 2012, due to special circumstances related to the charitable funding of this case.

MEDICAL HISTORY

Born June 10, 1989, Kim Suozzi was a 21 year old college student when she experienced a focal seizure in March 2011. Follow-up revealed a high grade malignancy and surgery was scheduled immediately and performed five days later. The post-surgical pathology report confirmed the presence of (Grade IV) Glioblastoma multiforme (GBM), a type of malignant brain tumor,

in the left frontoparietal area. This tumor was removed during surgery and Kim was monitored for recurrence afterward. A local recurrence (in the same location) would have indicated another surgical resection. Unfortunately, recurrence occurred 10 cm from the original tumor site, in the left cerebral peduncle of the brain stem, rendering the tumor inoperable.

Kim and her power of attorney focused their efforts on curing her cancer, but decided that if that did not work they would preserve her brain, as much as possible, from the advancing tumor. Several additional experimental treatments were undertaken by Kim over the following 22 months. Unfortunately, Alcor is not in possession of detailed records regarding the number, type, or efficacy of these treatments, but ultimately, they were all unsuccessful. In early January 2013 Kim attempted to gain access to a new clinical trial but was denied, spurring her decision to come to Scottsdale to enter hospice care near Alcor.

A physician's visit in St. Louis, Missouri, on January 3, 2013, noted normal vital signs and the ability to walk short distances with assistance, but that Kim suffered from periods of confusion and could only respond to questions with "yes" or "no." She was approved for travel to Arizona.

On January 4, 2013, Alcor received an emergency text at 01:11 that Kim was "near death" and planned to travel by airplane to Phoenix that day. Upon contacting Kim's boyfriend, Alcor's Medical Response Director found that the situation wasn't quite as dire as it sounded, but that they had lost his direct phone number and decided to call the emergency number to make contact with Alcor as soon as possible.

AGONAL PHASE

Kim arrived in Phoenix with her boyfriend (who was also her medical power of attorney) on the morning of January 4, 2013, and checked into a local hotel to await hospice evaluation. Alcor's Medical Response Director visited that evening and observed that Kim was unable to communicate verbally and could only respond to very simple questions by nodding her head. She indicated that she had had a continuous low grade headache for several days and other pain, but could not specify where.

A hospice nurse arrived during Alcor's Medical Response Director's visit to announce that Kim was approved for hospice inpatient admission. This was surprising news because the hospice had not yet performed her intake evaluation nor received her medical history. The nurse took Kim's vital signs before leaving, which were normal.

Kim was admitted to hospice on January 5, 2013. Upon visiting later that day, Alcor's Medical Response Director noted her condition to be greatly improved compared to his observation the day before. She was alert, sitting up and speaking full sentences in conversation with visitors. She was unable to recall the previous day and did not remember meeting Alcor's Medical Response Director or the hospice intake nurse. She continued to experience headaches that were not alleviated by medication. She enjoyed her last food and drinking fluids on this date.

The hospice medical director examined Kim on January 7, 2013. Her vital signs were normal and she was alert but not as talkative as she was upon admission. His opinion was that, based on her current

condition, she could live for quite a while longer and that the ability to keep her in hospice would depend on how strictly she would adhere to her decision to voluntarily stop eating and drinking (VSED).

Physical assessments continued in hospice as Kim experienced an alternation of “good days” and “bad days.” A good day consisted of texting on her phone, playing video games, petting her cat, and limited verbal communication. A bad day was one spent sleeping and suffering from an intractable headache. After one week in hospice without food or drink, Kim’s family was advised that she would soon be discharged until she became more comatose. That same evening (January 12, 2013), Kim had a very restless night. The hospice delayed her discharge to allow the family time to find a suitable location.

Upon discharge and relocation to a condominium near Alcor on January 15, 2013, Kim appeared comatose and emaciated. Her blood pressure (102/68) and oxygen saturation (97%) were normal, but heart rate (112) was elevated and respiratory rate (9/min, with periods of apnea) was depressed. She showed obvious signs of dehydration, such as skin tenting, and weighed 90 pounds—a loss of 24 pounds in 10 days. Extremities were cool but no mottling of the skin was observed.

Nurses noted another significant change in Kim’s condition on January 16, 2013. Her heart rate had risen to 178 while blood pressure dropped to 92/70 and oxygen saturation to 92%. Respiratory rate remained depressed at 9/min with apnea and she was noted as completely unresponsive.

Kim’s family was awoken by a pulse oximeter alarm on the morning of January 17, 2013. Her boyfriend called the hospice at 05:54 to request a nurse. He reported that Kim’s breathing was erratic and observed what he later assumed to be her last breath during that call. He was advised that a nurse would arrive within 20 minutes, but the nurse did not arrive until 06:59. Death was pronounced at 07:00.

PREPARATION AND DEPLOYMENT

After her arrival in Scottsdale, Arizona, Alcor’s Medical Response Director

visited Kim frequently in order to monitor her condition and to provide ongoing updates to the stabilization team. After some transient improvement upon admission to the hospice, Kim afterward declined food and hydration. On January 16, hospice nurses notified Alcor to another significant change in Kim’s condition and stated that legal death was imminent.

Standby was formally initiated on January 16. Initially, three Alcor staff members were available for standby, with two additional volunteers en route to Arizona to be available the next day. The transport vehicle was prepared and brought on-site following a Deployment Committee meeting.

Alcor’s Medical Response Director received a call from Kim’s boyfriend at 05:57, immediately after he had called the hospice to request a nurse. He stated that Kim’s breathing was very erratic, but later assumed that she was in respiratory arrest at this time, since he had last observed a breath followed by complete relaxation at approximately 05:55.

Alcor’s Medical Response Director arrived at Kim’s location at 06:10 and the remaining stabilization, surgical, and cryoprotective perfusion team members were notified of the need to mobilize immediately. Another stabilization team member arrived at 06:25, and two more arrived at 06:45.

STABILIZATION

Because the stabilization team arrived before the hospice nurse, Kim’s family placed ice bags around her head and chest and allowed the team to prepare the ice bath, the Lucas 2 mechanical chest compression device, and medications on-site in anticipation of the nurse’s imminent arrival and pronouncement.

The hospice nurse did not arrive until 06:59—more than one hour after notification of Kim’s condition. Kim was pronounced at 07:00 and placed in the ice bath on top of a layer of ice and the Lucas positioned appropriately. Mechanical chest compressions were started at 07:03 and additional ice was added to the ice bath to surround Kim.

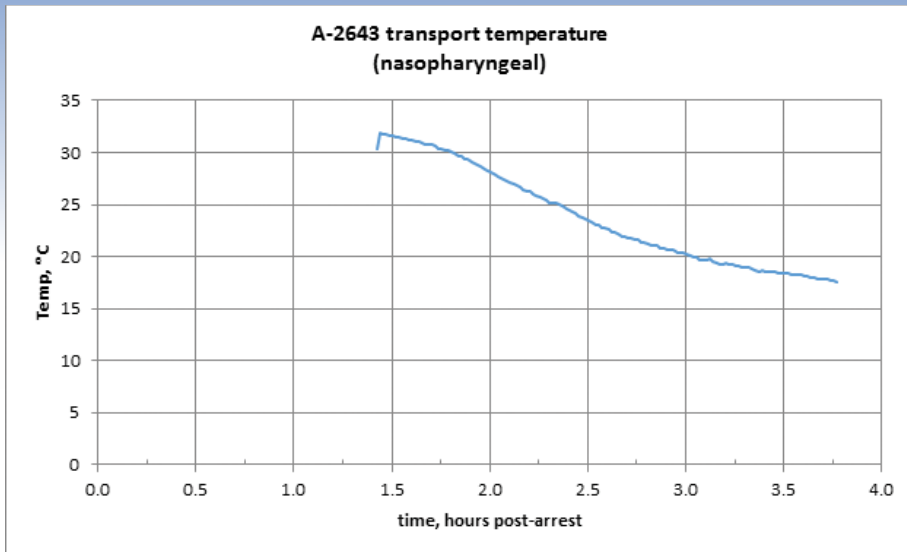
Two team members established IV access using the Bone Injection Gun and began pushing medications. The first medication, propofol, was administered at 07:06 via the left tibial (LT) line to reduce cerebral metabolism, immediately followed by streptokinase to dissolve existing blood clots. A second line was established in the right tibial (RT) plateau at 07:07 through which epinephrine was administered via a syringe pump beginning at 07:09. At the same time, administration of the VitalOxy neuroprotectant cocktail was begun via the LT line.

A secure airway was established with the King airway device at 07:13 and manual ventilations (6-8 per minute, room air) commenced with an Ambu bag valve mask. A nasopharyngeal thermocouple was placed in the left nostril at 07:19 and stapled in place to prevent accidental removal. The temperature data logger had been found to be inoperable and a team member left the room at 07:19 to look for batteries in the transport vehicle.

At 07:20 the Lucas 2 stopped working and a team member performed manual chest compressions while the battery was replaced. At 07:25 the Lucas was restarted and the data logger batteries were replaced. The data logger was set to collect nasopharyngeal temperature data once per minute. The initial left nasopharyngeal temperature reading at 07:25 was 31.4°C.

With all equipment now in working order, Kim was moved (within the PIB) from the condo at 07:28 and loaded onto the transport vehicle at 07:30. Administration of medications continued during transport. Upon arrival at Alcor at 07:45 a few medications still remained to be given, so Kim remained in the vehicle until administration was completed at 07:51. The Detailed Timeline box shows medications administered during the course of stabilization.

At 07:53 the PIB was unloaded from the transport vehicle and brought into the operating room. Mechanical chest compressions continued in order to further reduce temperature prior to cephalic isolation. Nasopharyngeal temperature was 29.0°C at 07:54. The SCCD was applied at 08:10.



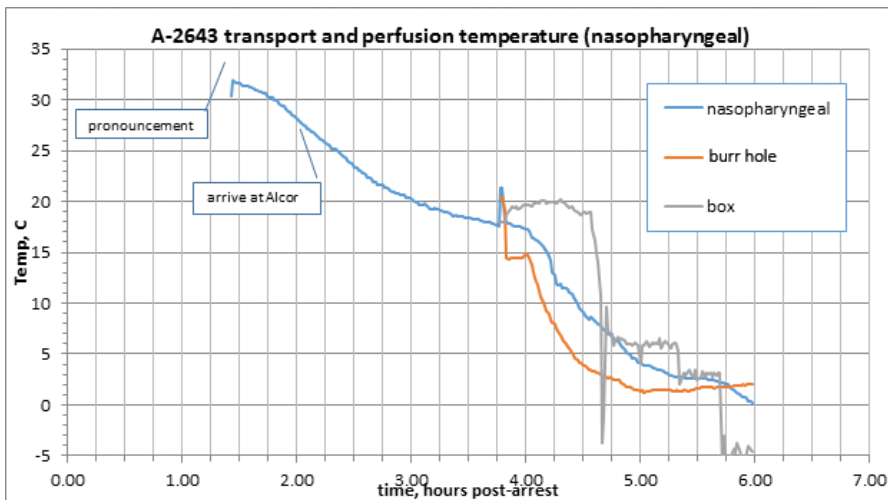
Appendix B: Transport temperature (nasopharyngeal)

SURGERY

Surgery commenced with Kim still in the PIB. As cardiopulmonary support continued, Kim's hair was clipped and the remaining hair shaved while ensuring that ice remained around the head. Upon completion of hair removal at 08:15, incisions were made for creating the left and right burr holes and skin was separated using a retractor to prepare the tissue for drilling of burr holes using a craniotome. Burr holes were completed at 08:22 and crack phone probes were inserted into each

burr hole and placed in contact with the surface of the brain at 08:36.

Further surgical procedures were initiated once Kim's temperature had dropped below 20°C. The right and left carotid arteries were isolated at 09:17 and 09:20, respectively, with Kim still in the PIB and receiving mechanical chest compressions. After consulting with a medical advisor regarding the appropriate temperature for cephalic isolation, Kim was removed from the PIB, placed on the OR table at 09:33 (nasopharyngeal temperature = 18.0°C),



Appendix C: Transport and perfusion temperature (nasopharyngeal)

and cephalic isolation was completed at 09:43.

At 09:45 the cephalon was placed in the holding ring of the neuroperfusion box and nasopharyngeal temperature data collection was switched from the handheld data logger to the main computer. The carotids were then cannulated with 18 Fr catheters. The perfusion circuit had already been primed at this time. The temperature of the washout perfusate (B1) was 3.0°C.

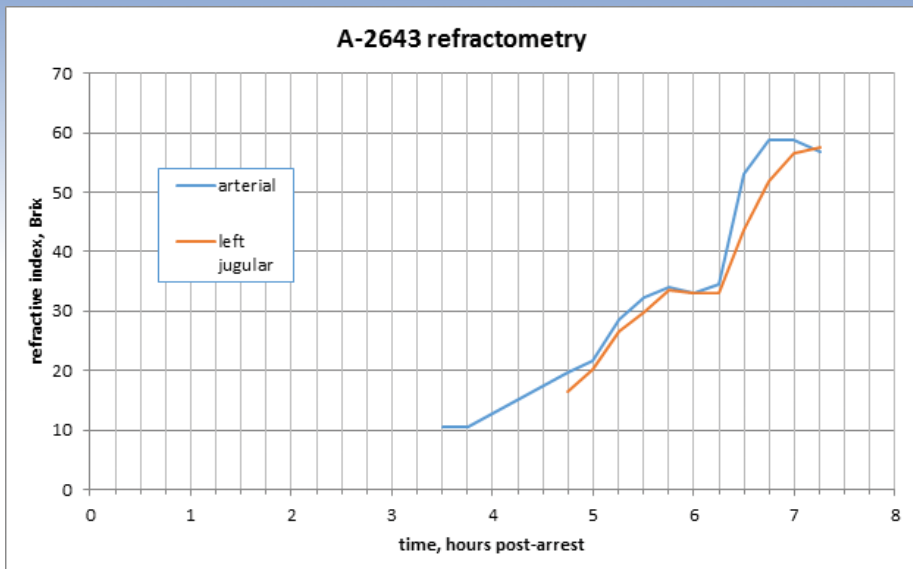
Flow was established at 09:59. The nasopharyngeal thermocouple read 17.2°C, while the burr hole thermocouple read 14.6°C.

CRYOPROTECTIVE PERFUSION

Washout of Kim's blood was started at 09:59. A total of 6 liters of B1 were perfused during washout. After washout the cryoprotectant ramp was started at 10:19 in order to gradually increase the concentration of M22 cryoprotectant into Kim. The washout intake line was closed, changing the system from "open circuit" perfusion to "closed circuit" perfusion (i.e., recirculation of cryoprotectant). The left jugular vein was then isolated but the right jugular vein could not be located. A thermocouple / sampling line was placed in the left jugular and connected to the thermocouple and process refractometers at 10:30.

Cooling in the cephalon enclosure started at 10:32. At this time, arterial temperature read 3.2°C, right venous temperature read 4.2°C, left venous temperature read 15.9°C, and nasopharyngeal temperature read 8.6°C. Eyeball shrinkage due to dehydration was noted at 10:57. Observation of the brain indicated greater retraction of the left hemisphere than the right.

Pump speed was gradually reduced to maintain pressure within an acceptable range (100-200 mmHg) as perfusate viscosity increased due to decreasing temperature and increasing cryoprotectant concentration. At 11:41 the cryoprotectant ramp was paused and the temperatures of the cephalon enclosure and the chiller were set to -3°C. The ramp was restarted at 12:15 and stopped again at 12:45 when jugular effluent measured over 100% of concentration necessary to vitrify (CNV).



Appendix D: Refractometry data

Perfusion continued at this concentration for 30 minutes, terminating at 13:15.

Visual observation of the brain showed the left hemisphere had retracted a few millimeters while the right hemisphere was still pressing against the skull (i.e., no dehydration). The face was evenly tanned except for a streak on the right cheek. Scalp coloration was irregular.

After removing the carotid cannulae, Kim's cephalon was removed from the enclosure and transferred to a modified LR40 dewar for cooldown to cryogenic temperature.

COOLDOWN

After placing Kim's cephalon in the modified LR40 dewar, installing the top, and connecting the temperature probes, cryogenic cooldown was started at 13:40 on January 17, 2013. When a temperature of -110°C was reached the cooling rate was reduced to minimize fracturing due to thermal stress. Once temperatures neared -196°C (approximately 96 hours after initiation of cooldown), the level of liquid nitrogen in the dewar was increased over a period of several hours until the cephalon was immersed. After reaching liquid nitrogen temperature, the cephalon was transferred to a Bigfoot dewar for long term care.

CT SCAN

Recently, Alcor has obtained CT scans of the heads and brains of neuro patients after cryoprotective perfusion. Originally performed as a means of determining the location and placement of acoustic "crackphone" sensors, it quickly became clear that much more than the crackphone sensors could be visualized. Using open source software to view CT scans, Alcor then developed color lookup tables (CLUTs) for various materials within the images in order to differentiate among things like bone, blood, ice, and cryoprotectant. The resulting images provide a long sought-after detailed view inside Kim's skull to help determine the efficacy of cryoprotective perfusion.

In general, patients who receive good care (i.e., immediate pronouncement of death, prompt stabilization, and short transport time) are well cryoprotected, while patients who experience problems suffer from some degree of perfusion impairment. The primary means of assessing the success or failure of brain cryoprotection until now has been to measure the retraction of the brain from the skull—a sign indicating dehydration of the brain as a result of successful uniform cryoprotective perfusion. With CT images, Alcor is now able to distinctly visualize such brains in three dimensions and to

assess the degree of perfusion impairment by inspecting the brain at various levels for evidence of areas of residual blood vs. areas of cryoprotectant.

Although a well-cryoprotected, dehydrated patient's brain is quite easy to distinguish, patients with varying degrees of perfusion impairment are more difficult to assess. A limited number of patient scans across various case conditions as well as a lack of experience in analyzing scans results in making a variety of assumptions regarding those cases. This is inevitable until more data can be gathered by performing more CT scans and then making comparisons across conditions.

In this case, Kim's medical power of attorney desired Alcor to use this new CT scanning technology in an effort to gauge the success of cryoprotective perfusion of the brain. Again, due to the limited number of scans performed so far, it is difficult to state observations with absolute certainty. However, several items are worth noting.

First, and in complete agreement with measurements of brain retraction during perfusion, there appears to have been very little dehydration of the brain overall. The left hemisphere is minimally dehydrated, while the right hemisphere shows no evidence of dehydration. This supports the view that cryoprotective perfusion was not generally successful.

Further evidence of poor perfusion can be observed when viewing images of Kim's brain serially using various CLUTs to differentiate areas of presumed impairment vs. cryoprotected areas. When viewed serially ~~there appear to be some areas of cortical cryoprotection, though minimal.*~~ The entire subcortex appears impaired.

Additionally, some anatomical abnormalities are distinguishable, such as the surgical site and entire areas of disturbance that are difficult to interpret but may, presumably, be caused by compression due to the presence of a space-occupying lesion (i.e., tumor).

Two factors have been hypothesized to have played a role in the poor cryoprotective perfusion of this patient's brain: (1) delay of pronouncement resulting in one hour of warm ischemia prior to commencement of stabilization procedures, and (2) high

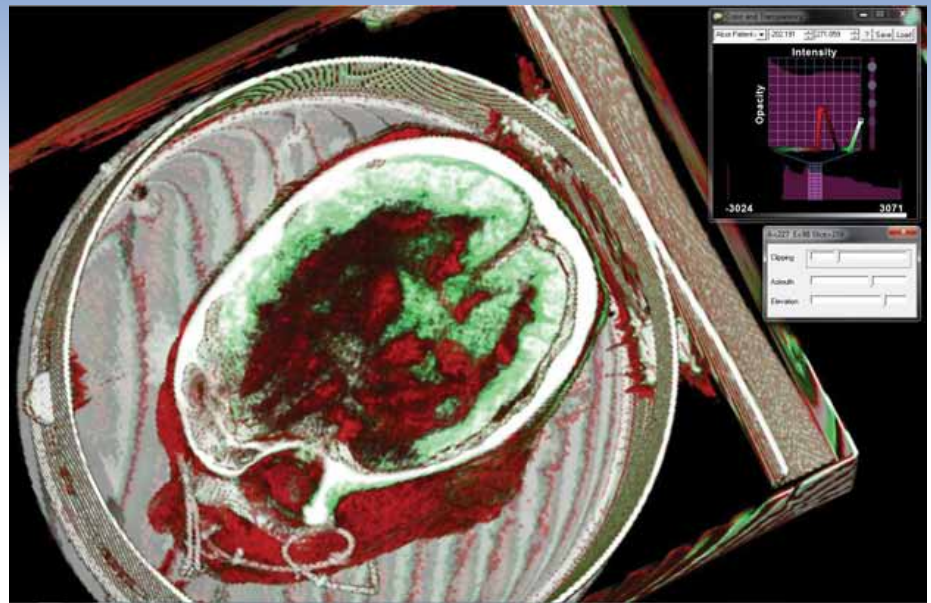
intracranial pressure caused by the tumor itself. While Kim certainly exhibited pre-mortem symptoms of increased intracranial pressure, such as headache and progressive loss of function (e.g., walking, speech, and ability to swallow), it is worth noting that the pattern of perfusion impairment observed in CT scans is entirely consistent with results from laboratory experiments in (non-pathological) rat brains undergoing similar periods of warm ischemia. It should also be noted that high intracranial pressure can also be a consequence of prolonged periods of warm and cold ischemia and resulting brain edema.

It would be quite useful and instructive to perform CT scans of several patients with space occupying lesions who were perfused under different conditions (e.g., immediate stabilization vs. delayed stabilization, short vs. long transport) to further elucidate the role of intracranial pressure in cryoprotective perfusion of the brain.

DISCUSSION

The primary reason for writing case reports and evaluating case performance is to determine whether, and how well, the objectives of stabilization and cryopreservation were achieved in a particular case (and, comparing cases over time, whether or not continuous improvements are made in meeting those objectives). Evaluations should be carried out while always keeping in mind the limitations under which a cryonics organization must operate in any given scenario. Such constraints will necessarily vary according to the particular details surrounding a given case. For example, all other conditions being the same, a patient who is pronounced close to a cryonics facility will benefit from a shorter (cold) ischemic period, which in turn may facilitate better cryoprotectant perfusion. For a fair appraisal, the most important question to ask is what could have *reasonably* been expected from a cryonics organization taking into consideration the constraints of the case.

In this case Alcor was informed well in advance of this member's condition and she was admitted to hospice quickly upon



Appendix E: Representative CT images

Figure A. A horizontal "slice" of a CT image at the level of the eyeballs. Using the CLUT for this image, we presume that red indicates unperfused tissue (i.e., electron densities similar to blood), while lighter colors (greens and whites) indicate cryoprotected tissue (i.e., electron densities similar to cryoprotectants). Under these assumptions, it appears that cortical tissue suffered the least impairment while subcortex was more severely impaired.

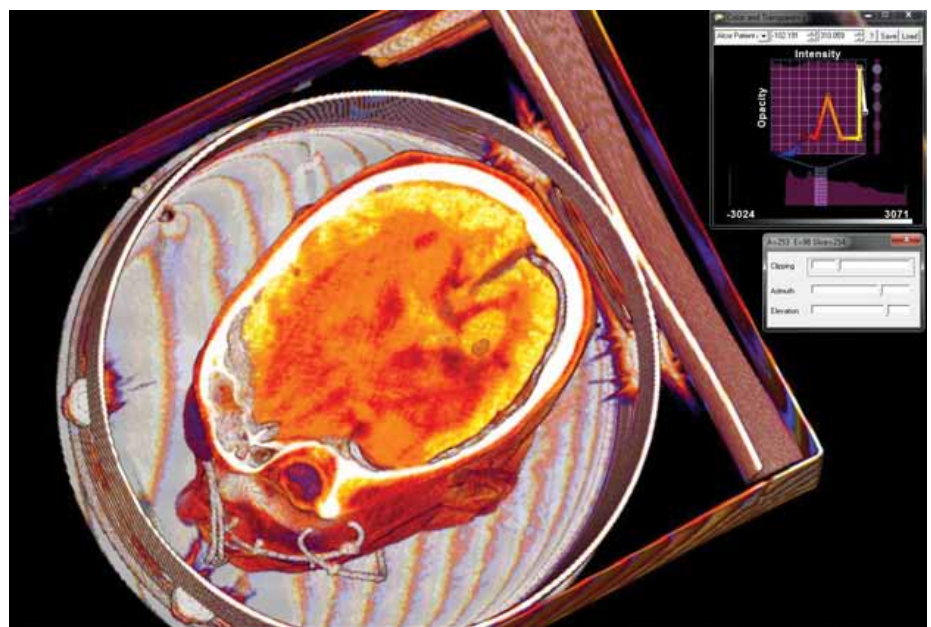


Figure B. A horizontal "slice" of a CT image at the level of the eyeballs (at the same level as Figure A). Using the CLUT for this image, we presume that darker colors (orange and red) indicate unperfused tissue (i.e., electron densities similar to blood), while lighter colors (yellows and whites) indicate cryoprotected tissue (i.e., electron densities similar to cryoprotectants). Again, we see the same pattern of perfusion impairment of the subcortex with uneven cryoprotection of the cortex.

More CT scans at: <http://www.alcor.org/Library/html/CTscan2643.html>

her arrival in Scottsdale. It is unfortunate, then, that she was discharged only one day prior to her pronouncement. This is, by far, the event having the most negative impact on this case.

Though she was relocated to a condominium near Alcor and the hospice advised that a staff member could be onsite within 10 minutes of being called, Kim's death apparently occurred at shift change and this situation ultimately resulted in a one hour delay between death and legal pronouncement of death, which is required before Alcor can take possession of the body. At least three other nearby long-term care facilities had been considered by the family prior to their decision to move her to a nearby condo because it gave them greater control over the administration of Kim's pain medication. There had been a number of disagreements between the patient's family and the hospice prior to Kim's discharge that make the delay in pronouncement that much more unsavory an occurrence. Whether another hospice would have provided better service is a question whose answer cannot be known. Ultimately, this is an issue between the cryonics organization and the member or her representatives.

Once pronouncement was made, stabilization moved smoothly except for a few problems primarily concerning batteries. Specifically, the DuaLogR batteries were dead prior to the start of stabilization, requiring team members to search for and obtain replacement batteries during stabilization activities. Contrary to protocol, only one temperature logger was used during stabilization, which further aggravated the problems with the DuaLogR. Additionally, the Lucas stopped working during CPS, resulting in a five minute period of (less efficient) manual chest compressions while the batteries were replaced. Another item, not described in the case report but found in the preparation notes, was that the battery of the rescue vehicle (RV) was also found to be drained upon inspection the day prior to the case. This situation is easily remedied by adopting a protocol for regularly testing power in all battery-operated equipment and replacing batteries when necessary.

The use of longer-lasting batteries is recommended as well, but testing and maintenance of equipment according to an established schedule is paramount if situations like those experienced in this case are to be avoided.

Given the condition of Kim the day prior to cardiac arrest, it may also be asked whether medications should have been drawn earlier. In the end, due to the late arrival of a nurse for pronouncement, it did not make a difference. However, if there had been a prompt pronouncement of death, medications would not have been drawn and ready at that time. Medications can be drawn when a patient's decline becomes apparent and may be kept stable by refrigeration (if necessary) until they are required.

Absence of the SCCD ("squid") from the PIB during initial stabilization procedures was another oversight and was not corrected until Kim had arrived at Alcor's facility (see Appendix A: Case Timeline), and even then not until a team member had asked about it several times. The use of a checklist for RV preparation would have easily identified any missing equipment and/or supplies, and is quick and easy to implement.

While there was an adequate number of team members to perform the most fundamental interventions (cardiopulmonary support, induction of hypothermia, and medications administration) for this case, and intervention was rapid once pronouncement was made, the only stabilization data collected was patient nasopharyngeal temperature. Additional data, including additional temperature collection, capnography and pulse oximetry (using the CO2SMO), and blood-gas analysis (using the i-STAT) could have been carried out given the number of team members available. This would have provided valuable information about how Kim responded to interventions.

Lack of data collection in this case was further aggravated by the absence of formal stabilization data collection sheets. Good data collection sheets not only improve the quantity and quality of data collected during a case, but also serve as a checklist to assist deployment of equipment prior to

legal pronouncement and to alert the scribe to errors and omissions during a case. Notes in this case were a conglomeration of time-stamped, free-form observations. Thankfully, due to the experience of the scribe during stabilization, they were comprehensive. But this became a bigger problem during surgery and cryoprotective perfusion, resulting in an incomplete description of OR events within the case report.

On the positive side, the fundamental interventions were carried out in parallel rather than in sequence, resulting in a very quick transport to the Alcor facility. Multiple IV access points were established, allowing medications administration to progress quickly. Additionally, an experienced team member served as scribe during stabilization, providing the team with a global view of the case as it progressed as well as a detailed set of notes for later case debriefing and reporting.

In the OR, surgery to isolate the carotid arteries was initiated with Kim still in the PIB and receiving chest compressions. This reduced the risk of patient warming during surgery and allowed for quick cannulation after cephalic isolation and transfer of the cephalon to the cephalon enclosure. Unfortunately, there was some confusion and disagreement regarding the ideal temperature at which to perform surgery. This has since been clarified, the fixed target temperature replaced by a target cooling rate. The new guidelines have been printed and placed in the procedures manual in the OR.

While surgery and perfusion were accomplished without incident, ~~the actual success of perfusion in this case appears negligible.*~~ A lack of brain dehydration, as seen in all patients under non-ideal circumstances of death and/or stabilization and transport, suggests that perfusion was significantly impaired. Further evidence from CT scans corroborates this assumption, revealing what is assumed to be significant perfusion impairment, minimal dehydration, and areas of significant pathology.

Two other basic procedures and observations that could provide more insight about the degree of ischemia /

edema, quality of cryoprotectant perfusion, and ice formation include the weighing of the cephalon prior and after cryoprotectant perfusion and inspection of the surface of Kim's brain between completion of cryogenic cool down and transfer to the Bigfoot dewar.

In general, a substantial gap remains between the amount of data that can be collected during a case and what is actually collected, reported, and analyzed. ■

* See Corrigendum for important updates to this article at:
<http://www.alcor.org/Library/html/CorrigendumA2643.html>

DETAILED TIMELINE

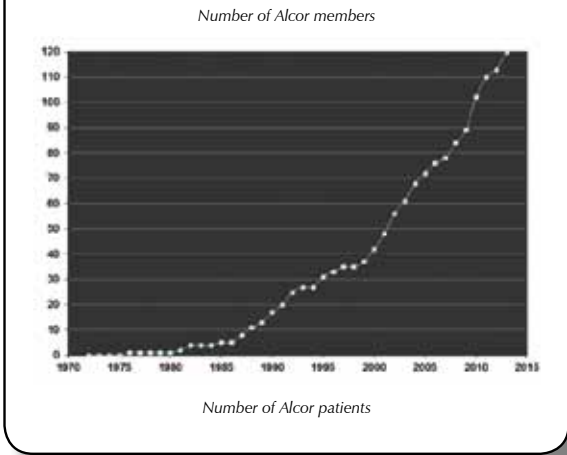
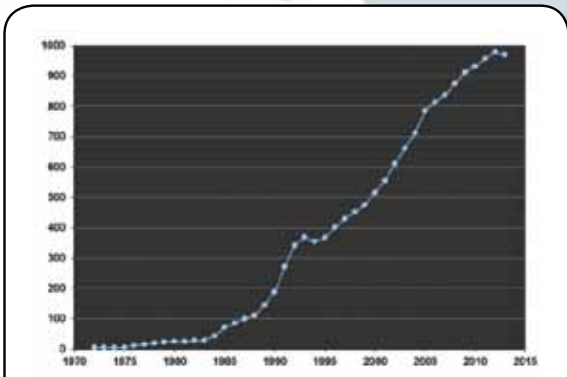
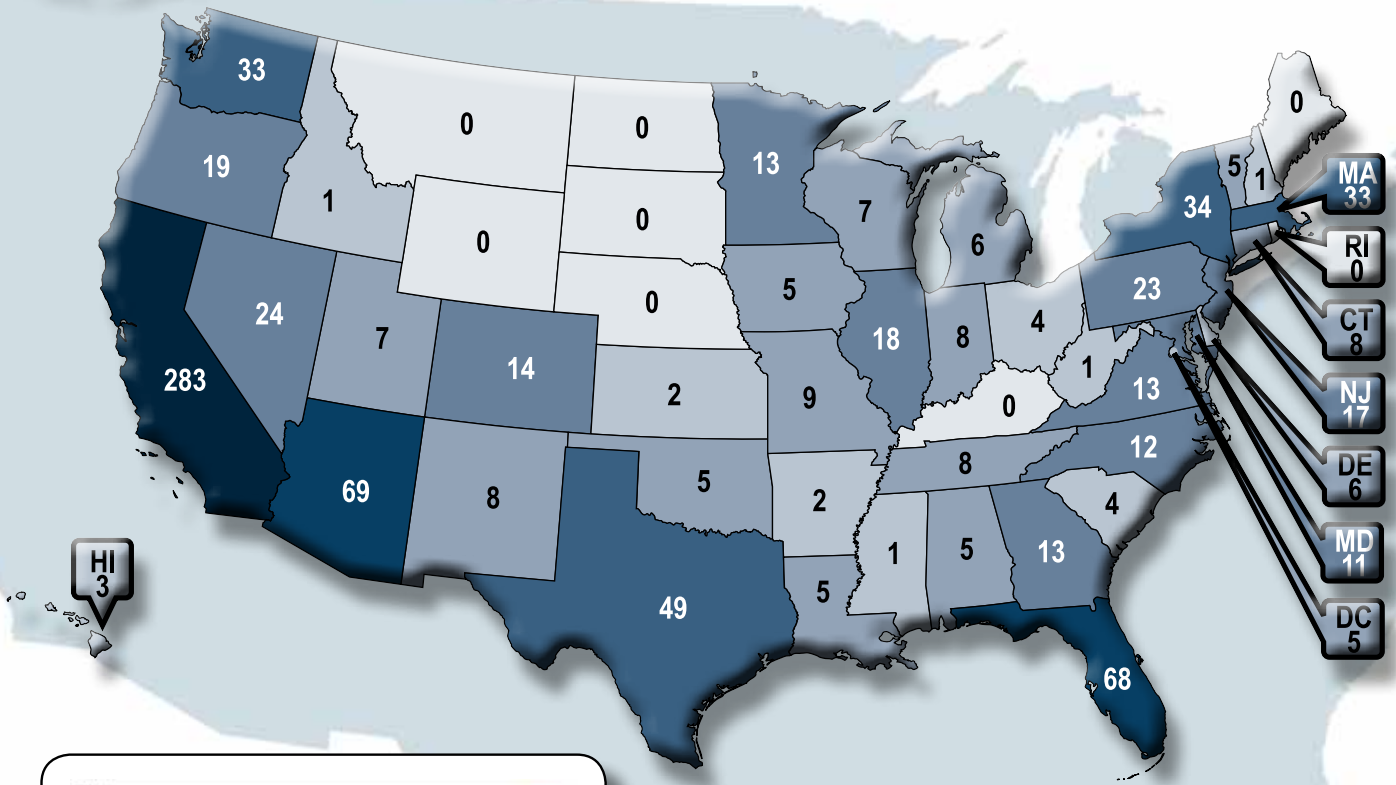
January 17, 2013

05:55	Respiratory arrest	07:20	Lucas stopped working, manual chest compressions begun	09:28	Nasopharyngeal temperature 18.4°C
06:10	Arrival of first stabilization team member	07:25	Lucas restarted (battery replaced)	09:33	Patient moved to OR table
06:25	Arrival of second stabilization team member	07:25	Temperature data logger started (batteries replaced)	09:43	Cephalic isolation
06:45	Arrival of third and fourth stabilization team members	07:28	Move PIB out of condo	09:45	Cephalon placed in holding ring of cephalic enclosure
06:46	Medications drawn while waiting for hospice nurse	07:30	Load PIB onto transport vehicle	09:51	Cephalon fell out of holding ring
06:59	Arrival of hospice nurse	07:45	Patient arrives at Alcor	09:52	Cephalon repositioned
07:00	Patient pronounced	07:49	Nasopharyngeal temperature 30.0°C	09:55	Carotids cannulated
07:02	Patient placed in portable ice bath (PIB)	07:51	Medications administration complete	09:58	Right carotid flushed
07:03	Start of mechanical chest compressions (Lucas)	07:54	Patient brought into operating room	10:00	Left carotid flushed
07:04	Left tibial IV line placed	08:00	Nasopharyngeal temperature 28.1°C	10:00	Nasopharyngeal temperature 17.2°C. Arterial temperature 5.3°C. Left venous temperature 23.7°C.
07:05	Additional ice added to PIB	08:02	Hair removal begun	10:01	Start washout (open circuit)
07:06	Administration of propofol	08:10	SCCD applied	10:19	Start cryoprotectant ramp
07:06	Administration of streptokinase	08:15	Hair removal completed	10:20	Start of closed circuit perfusion
07:07	Right tibial IV line placed	08:17	Incisions made for burr holes	10:38	Could not find right jugular vein
07:09	Bolus epinephrine administered, followed by slow infusion	08:22	Burr holes completed	10:38	Vascular resistance dropping
07:09	Administration of VitalOxy	08:31	Nasopharyngeal temperature 23.2°C	10:57	Observe eyeball shrinkage
07:10	Temperature data logger not working	08:36	Crack phone probes inserted in burr holes	11:16	Observe evenly tanned face, eyeball shrinkage, but little brain retraction
07:11	Nasopharyngeal thermocouple secured in left nostril	08:58	Ambu bag removed from King airway and more ice added to the PIB	11:20	Repositioned enclosure thermocouple, which was touching side of enclosure
07:13	Placement of King airway	09:00	Nasopharyngeal temperature 20.1°C	11:41	Ramp paused; enclosure and chiller temperatures set at -3°C
07:14	Administration of mannitol	09:05	Carotid isolation surgery started	12:15	Ramp restarted
07:15	Start of ventilation (Ambu bag valve mask, room air)	09:17	Left carotid isolated	13:15	End of cryoprotective perfusion
07:17	Nasopharyngeal temperature 31.4°C	09:20	Right carotid isolated	13:40	Start of cooldown

Membership Statistics



2013	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Members	981	983	985	974	980	982	980	967	968	971	968	971
Patients	114	115	117	117	117	117	117	117	117	118	120	120
Associate	37	40	42	44	45	49	51	52	68	80	86	89
Total	1132	1138	1144	1135	1142	1148	1148	1136	1153	1169	1174	1180



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

Country	International	
	Members	Patients
Aruba	1	0
Australia	13	3
Canada	41	2
Denmark	1	0
Germany	4	0
Israel	1	1
Italy	2	0
Japan	1	0
Lebanon	1	0
Mexico	4	0
Monaco	2	0
Netherlands	2	0
New Zealand	2	0
Norway	1	0
Portugal	4	0
Spain	3	1
Thailand	3	0
United Arab Emirates	1	0
United Kingdom	21	2
TOTAL	108	9

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VASCULAR BENEFITS OF A Mediterranean Diet

VALIDATED IN HUGE NEW STUDY

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

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

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

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Olive Fruit Extract (std. to 6.5% polyphenols (39 mg), 1.73% hydroxytyrosol/tyrosol (10.4 mg), 0.5% verbascoside/oleuropein (3 mg))	600 mg
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Nanomotors Are Controlled, for the First Time, inside Living Cells

For the first time anywhere, a team of chemists and engineers at Penn State has placed tiny synthetic motors inside live human cells, propelled them with ultrasonic waves and steered them magnetically. It's not exactly "Fantastic Voyage," but it's close. The nanomotors, which are rocket-shaped metal particles, move around inside the cells, spinning and battering against the cell membrane. "As these nanomotors move around and bump into structures inside the cells, the live cells show internal mechanical responses that no one has seen before," said Tom Mallouk, Evan Pugh Professor of Materials Chemistry and Physics. "This research is a vivid demonstration that it may be possible to use synthetic nanomotors to study cell biology in new ways. We might be able to use nanomotors to treat cancer and other diseases by mechanically manipulating cells from the inside. Nanomotors could perform intracellular surgery and deliver drugs noninvasively to living tissues."

Krista Weidner / Penn State News
10 Feb 2014

<http://news.psu.edu/story/303296/2014/02/10/research/nanomotors-are-controlled-first-time-inside-living-cells>

New Advance in 3D Printing and Tissue Engineering Technology

Researchers at Brigham and Women's Hospital (BWH) and Carnegie Mellon University (CMU) have introduced a unique micro-robotic technique to assemble the components of complex materials, the foundation of tissue engineering and 3D printing. Described in the Jan. 28, 2014, issue of *Nature Communications*, the research was conducted by Savas Tasoglu and Utkan

Demirci, both of BWH, in collaboration with Eric Diller and Metin Sitti, both of CMU. Tissue engineering and 3D printing have become vitally important to the future of medicine for many reasons. The shortage of available organs for transplantation, for example, leaves many patients on lengthy waiting lists for life-saving treatment. Being able to engineer organs using a patient's own cells can not only alleviate this shortage, but also address issues related to rejection of donated organs. "Our work will revolutionize three-dimensional precise assembly of complex and heterogeneous tissue engineering building blocks and serve to improve complexity and understanding of tissue engineering systems," said Sitti.

Brigham and Women's Hospital
10 Feb 2014

http://www.brighamandwomens.org/about_bwh/publicaffairs/news/pressreleases/PressRelease.aspx?sub=0&PageID=1670

New Live-Cell Printing Technology Works Like Ancient Chinese Woodblock Printing

With a nod to 3rd century Chinese woodblock printing and children's rubber stamp toys, researchers in Houston have developed a way to print living cells onto any surface, in virtually any shape. Unlike recent, similar work using inkjet printing approaches, almost all cells survive the process, scientists report in this week's *Proceedings of the National Academy of Sciences*. The researchers, led by Houston Methodist Research Institute biomedical scientist Lidong Qin, Ph.D., say their approach produces 2-D cell arrays in as little as half an hour, prints the cells as close together as 5 micrometers (most animal cells are 10 to 30 micrometers wide), and allows the use of many different cell types. They've named the technology Block-Cell-Printing, or BloC-Printing. "We feel the current technologies are inadequate," Qin said.

"Inkjet-based cell printing leaves many of the cells damaged or dead. We wanted to see if we could invent a tool that helps researchers obtain arrays of cells that are alive and still have full activity."

Houston Methodist
10 Feb. 2014

<http://www.houstonmethodist.org/methodist.cfm?xyzpdqabc=0&id=495&action=detail&ref=1183>

Research Reveals White Matter 'Scaffold' of Human Brain

For the first time, neuroscientists have systematically identified the white matter "scaffold" of the human brain, the critical communications network that supports brain function. Their work, published Feb. 11 in the open-source journal *Frontiers in Human Neuroscience*, has major implications for understanding brain injury and disease. By detailing the connections that have the greatest influence over all other connections, the researchers offer not only a landmark first map of core white matter pathways, but also show which connections may be most vulnerable to damage. "We coined the term white matter 'scaffold' because this network defines the information architecture which supports brain function," said senior author John Darrell Van Horn of the USC Institute for Neuroimaging and Informatics and the Laboratory of Neuro Imaging at USC. "While all connections in the brain have their importance, there are particular links which are the major players," Van Horn said.

USC Institute for Neuroimaging and Informatics
11 Feb. 2014

http://www.eurekalert.org/pub_releases/2014-02/uosc-hob020614.php

An Essential Step toward Printing Living Tissues

A new bioprinting method developed at the Wyss Institute for Biologically Inspired Engineering at Harvard University and the Harvard School of Engineering and Applied Sciences (SEAS) creates intricately patterned 3D tissue constructs with multiple types of cells and tiny blood vessels. The work is a major step toward a longstanding goal of tissue engineers: creating human tissue constructs realistic enough to test drug safety and effectiveness. It is also an early but important step toward building fully functional replacements for injured or diseased tissue that can be designed from CAT scan data using computer-aided design (CAD), printed in 3D at the push of a button, and used by surgeons to repair or replace damaged tissue. “This is the foundational step toward creating 3D living tissue,” said Jennifer Lewis, Ph.D., senior author of the study. Tissue engineers have tried for years to produce lab-grown vascularized human tissues robust enough to serve as replacements for damaged human tissue. Others have printed human tissue before, but only in thin slices about a third as thick as a dime.

Wyss Institute, Harvard University
19 Feb. 2014

<http://wyss.harvard.edu/viewpressrelease/141/an-essential-step-toward-printing-living-tissues>

Nanopatterned Natural Scaffold May Allow for Softer Engineered Tissues

Feng Zhao of Michigan Technological University (MTU) has persuaded fibroblasts—cells that make up the extracellular matrix in the body—to make a well-organized nanopatterned scaffold (support structure). This discovery could have major implications for growing engineered tissue to repair or replace virtually any part of our bodies. In all multicellular organisms, including people, cells make their own extracellular matrix,

a complex, nurturing structure that is essential for many biological functions, including growth and healing. But in the lab, scientists attempting to grow tissue must provide an artificial scaffold. Typically, researchers construct scaffolds from synthetic materials or natural animal or human substances grown in a Petri dish. (KurzweilAI has reported a variety of such synthetic approaches to creating scaffolds for extracellular matrices.) But such scaffolds have not been able to mimic the highly organized structure of the matrix made by living things—at least until now. Zhao’s fibers are a mere 80 nanometers across, similar to fibers in a natural biological matrix.

Kurzweil AI
26 Feb 2014

<http://www.kurzweilai.net/nanopatterned-natural-biological-scaffold-for-stem-cells-may-allow-for-softer-engineered-tissues>

New Cortical Connectome Online

Although US and EU leadership have recently pledged millions of dollars to support the development of a comprehensive understanding of the neuronal connections throughout the brain, researchers have been toiling away at this goal for years. Most recently, a group from the University of Southern California (USC) has published a carefully constructed “connectome,” built from the analysis of hundreds of neuronal pathways in the mouse cortex. The work appeared today (February 27) in *Cell*. “The one thing I really appreciate about this work is that it combines the large data scale with careful, manual annotation and analysis of the data,” said Pavel Osten, a neuroscientist at Cold Spring Harbor Laboratory (CSHL) in New York, who was not involved in the project. A number of groups, including one at CSHL, are developing roadmaps of the rodent brain—descriptions of how brain regions connect with one another. The goal is to better inform studies of both normal brain function and of diseases that involve malfunctioning networks.

Kerry Grens / The Scientist
27 Feb. 2014

<http://www.the-scientist.com/?articles.view/articleNo/39298/title/New-Cortical-Connectome-Online/>

A Molecular Ballet under the X-ray Laser

An international team of researchers has used the world’s most powerful X-ray laser to take snapshots of free molecules. The research team headed by Prof. Jochen Küpper of the Hamburg Center for Free-Electron Laser Science (CFEL) choreographed a kind of molecular ballet in the X-ray beam. With this work, the researchers have cleared important hurdles on the way to X-ray images of individual molecules, as they explain in the scientific journal *Physical Review Letters*. CFEL is a cooperation of DESY, the University of Hamburg, and the Max Planck Society. “We have captured the first images of an ensemble of isolated molecules with an X-ray laser,” said DESY scientist Küpper, who is also a professor at the University of Hamburg and a member of the Hamburg Centre for Ultrafast Imaging (CUI) cluster of excellence. “The molecules all posed for the picture in synch.” According to Küpper, this approach opens the way for studies of the ultra-fast dynamics of isolated molecules. There are existing techniques to image single molecules, but none is fast enough to catch the ultra-fast motion of molecules.

Deutsches Elektronen-Synchrotron DESY
28 Feb. 2014

http://www.desy.de/information_services/press/pressreleases/@@news-view?id=7361

Leech Has a Remarkably High Tolerance to Freezing and Thawing

Imagine you’re a leech, happily making a living on a turtle in some quiet, freshwater pond. What do you do when winter comes

and temperatures in your warm little habitat begin to dip below freezing? In a recent study, a team of researchers discovered that the leech, *Ozobranchius jantseanus*, has a remarkably high tolerance to freezing and thawing. Scientists once thought that it would be difficult for organisms to survive at temperatures below freezing because the water inside cells and tissues forms ice crystals, and this can ultimately damage the cells beyond repair. In the new study, *O. jantseanus* survived after being stored for 24 hours in liquid nitrogen at temperatures of -196°C . The leech also recovered after being stored for 32 months at -90°C , and repeated freeze-thaw cycles at temperatures that fluctuated between from 20°C to -100°C . According to the paper by D. Suzuki et al., “All of the individuals had been active before initiating the experiments, indicating that this cryoresistance ability is always present in *O. jantseanus*.”

Aaron L. Gronstal / PhysOrg
3 Mar 2014

<http://phys.org/news/2014-03-leech-remarkably-high-tolerance.html>

New Technique Visualizes Live Cells

A new optical imaging platform offers a significant step toward visualizing small biomolecules inside living biological systems with minimum disturbance. A team at Columbia University has developed a general method to image a broad spectrum of small biomolecules, such as molecular drugs and nucleic acids, amino acids and lipids, for where they are localized and how they function inside cells. “Our new technique will open up numerous otherwise-difficult studies on small biomolecules in live cells and animals,” said researcher Wei Min, an assistant professor of chemistry at Columbia. “In addition to basic research, our technique could also contribute greatly to translational applications.” The researchers coupled the laser-based technique stimulated Raman scattering (SRS) microscopy with a small but highly vibrant alkyne tag to produce a strong Raman scattering signal at a

frequency different from natural molecules inside cells. A broad spectrum of small molecules in live cells and animals can be visualized, including DNA, RNA, amino acids, lipids and triglycerides.

Photonics
3 Mar 2014

<http://www.photonics.com/Article.aspx?AID=55903>

Optical Nano-Tweezers Control Nano-Objects

Invented in Bell Labs in the 1980s, optical tweezers have changed forever the fields of both biology and quantum optics. The technique has considerable limitations, however, one of which is its inability to directly trap objects smaller than a few hundreds of nanometers. This drawback prompted the pursuit of new approaches of nano-tweezers based on plasmonics, capable of trapping nano-scale objects such as proteins or nanoparticles without overheating and damaging the specimen. A few years ago, ICFO researchers demonstrated that, by focusing light on a very small gold nano-structure lying on a glass surface which acts as a nano-lens, one can trap a specimen at the vicinity of the metal where the light is concentrated. This however did not enable any 3D manipulation needed for practical applications. Now researchers at ICFO have taken this a crucial step further by trapping and 3D displacement of specimens as small as a few tens of nanometers using an extremely small, non-invasive laser intensity.

ICFO / ScienceDaily
2 Mar 2014

<http://www.sciencedaily.com/releases/2014/03/140302143626.htm>

3D Printing of Tissue with Blood Vessels

Using a custom-built four-head 3-D printer and a “disappearing” ink, materials scientist Jennifer Lewis and her team created a

patch of tissue containing skin cells and biological structural material interwoven with blood-vessel-like structures. All prior regenerative tissue projects have run up against the same wall when trying to build thicker and more complex tissues: a lack of blood vessels. Lewis’s group solved the problem by creating hollow, tube-like structures within a mesh of printed cells using an “ink” that liquefies as it cools. The tissue is built by the 3-D printer in layers. A gelatin-based ink acts as extracellular matrix—the structural mix of proteins and other biological molecules that surrounds cells in the body. Two other inks contained the gelatin material and either mouse or human skin cells. All these inks are viscous enough to maintain their structure after being laid down by the printer. A third ink with counterintuitive behavior helped the team create the hollow tubes. This ink has a Jell-O-like consistency at room temperature, but when cooled it liquefies.

Next Big Future
6 Mar 2014

<http://nextbigfuture.com/2014/03/3d-printing-of-tissue-with-blood.html>

The Power of Light: Super-Resolution Laser Machining Possible

A newly discovered natural phenomenon shows that light could be used to pick apart a substance atom by atom, with new avenues for nano-scale diamond devices, as identified this week by Australian researchers in *Nature Communications*. “Lasers are known to be very precise at cutting and drilling materials on a small scale—less than the width of a human hair, in fact—but on the atomic scale they have notoriously poor resolution,” says lead researcher Associate Professor Richard Mildren. Through their research, Mildren and Macquarie University colleagues Andrew Lehmann and Carlo Bradac have now discovered that it is possible to remove atoms from a surface, using ultraviolet lasers, and confining the interaction to the atomic scale. “So far we have used

the technique to demonstrate structures in diamond of size about 20 nanometers, which is the size of large molecules,” says Mildren. “However, the technique looks highly promising for doing much better, enabling manipulation of surfaces with the ultimate single atom precision....”

Macquarie University Newsroom
5 March 2014
<http://mq.edu.au/newsroom/2014/03/05/the-power-of-light-super-resolution-laser-machining-possible/>

Engineers Design ‘Living Materials’

Inspired by natural materials such as bone—a matrix of minerals and other substances, including living cells—MIT engineers have coaxed bacterial cells to produce biofilms that can incorporate nonliving materials, such as gold nanoparticles and quantum dots. These “living materials” combine the advantages of live cells, which respond to their environment, produce complex biological molecules, and span multiple length scales, with the benefits of nonliving materials, which add functions such as conducting electricity or emitting light. The new

materials represent a simple demonstration of the power of this approach, which could one day be used to design more complex devices such as solar cells, self-healing materials, or diagnostic sensors, says Timothy Lu, an assistant professor of electrical engineering and biological engineering. Lu is the senior author of a paper describing the living functional materials in the March 23 issue of *Nature Materials*.

MIT News
23 Mar. 2014
<http://web.mit.edu/newsoffice/2014/engineers-design-living-materials.html>

A Roadmap to Resuscitation

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

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

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

Corey Noble, “**A ‘Realistic’ Scenario for Nanotechnological Repair of the Frozen Human**

Brain,” in Brian Wowk, Michael Darwin, eds., *Cryonics: Reaching for Tomorrow*, Alcor Life Extension Foundation, 1991.

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

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

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

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

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

How Much Curcumin Are You Absorbing?



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

Life Extension[®] took the lead in resolving this issue several years ago by introducing **Super Bio-Curcumin**[®] containing **BCM-95**[®], a patented, *bioenhanced* preparation of curcumin that has been shown to reach up to **7 times higher concentration** in the blood than standard curcumin.⁹

Now, an exciting *next generation* curcumin formula has become available! The *new* **Advanced Bio-Curcumin**[®] with **Ginger & Turmerones** provides additional compounds that *further* boost absorption of curcumin's highly beneficial phytonutrients!^{10,11}

UNRIVALED POTENCY AND ABSORBABILITY

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

1. Turmerones: After curcumin is extracted from turmeric, what remains is **turmeric oil** rich in compounds called **turmerones**.^{11,12} Combining **BCM-95**[®] with a high content of **turmerones** provides health consumers with more beneficial **turmeric** compounds that further multiply absorption.⁹ Scientists have shown that these potent **turmerones** not only support curcumin absorption, but significantly increase the amount of curcumin **inside** the cell as well!¹³

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

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

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

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

Turmeric Phospholipid Blend	630 mg
BCM-95 [®] Bio-Curcumin Turmeric 25:1 extract (rhizome) [total curcuminoids complex with essential oils (380 mg)], Turmeric oil (rhizome) [providing 60 mg total turmerones], Phospholipids	
Ginger CO₂ extract (root)	200 mg
[providing 60 mg gingerols]	

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

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

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



Item# 01808

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

MEETINGS

ABOUT THE ALCOR FOUNDATION

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

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

ARIZONA

FLAGSTAFF:

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

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.

AT ALCOR:

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

CALIFORNIA

LOS ANGELES:

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

SAN FRANCISCO BAY:

Alcor Northern California Meetings are held quarterly in January, April, July, and October. A CryoFeast is held once a year. For information on Northern California meetings, call Mark Galeck at (650) 969-1671, (650) 534-6409 or email Mark_galeck@pacbell.net.

FLORIDA

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

NEW ENGLAND

CAMBRIDGE:

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

PACIFIC NORTHWEST

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

BRITISH COLUMBIA (CANADA):

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

OREGON:

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

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

ALCOR PORTUGAL

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

TEXAS

DALLAS:

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

AUSTIN/CENTRAL TEXAS:

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

UNITED KINGDOM

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

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

WHAT IS CRYONICS?

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

HOW DO I FIND OUT MORE?

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

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

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

HOW DO I ENROLL?

Signing up for a cryopreservation is easy!

Step 1: Fill out an application and submit it with your \$90 application fee.

Step 2: You will then be sent a set of contracts to review and sign.

Step 3: Fund your cryopreservation. While most people use life insurance to fund their cryopreservation, other forms of prepayment are also accepted. Alcor's Membership Coordinator can provide you with a list of insurance agents familiar with satisfying Alcor's current funding requirements.

Finally: After enrolling, you will wear emergency alert tags or carry a special card in your wallet. This is your confirmation that Alcor will respond immediately to an emergency call on your behalf.

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

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

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



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- **Discounts on prescription drugs, blood tests, and pharmaceutical quality supplements** that will greatly exceed your membership dues. You'll receive a directory listing

the latest vitamins and supplements, backed by scientific research and available through a unique buyers club.

FREE BONUS!

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

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