

A Publication of the Immortalist Society

LONG LIFE

Longevity Through Technology

Volume 46 - Number 02

MICRO MACHINE pg. 10

Scientists at BYU create an incredible microscopic nanoinjector for gene therapy.

Image: © Brigham Young University

- ▶ Nanotechnology Breakthroughs
- ▶ Transhumanism for Cryonicists
- ▶ The Past, The Present, The Future and Everything: Part 2
- ▶ 1986 Retrospective on Nanotech



Why should You Join the Cryonics Institute?

The Cryonics Institute is the world's leading non-profit cryonics organization bringing state of the art cryonic suspensions to the public at the most affordable price. CI was founded by the "father of cryonics," Robert C.W. Ettinger in 1976 as a means to preserve life at liquid nitrogen temperatures. It is hoped that as the future unveils newer and more sophisticated medical nanotechnology, people preserved by CI may be restored to youth and health.

1) Cryonic Preservation

Membership qualifies you to arrange and fund a vitrification (anti-crystallization) perfusion and cooling upon legal death, followed by long-term storage in liquid nitrogen. Instead of certain death, you and your loved ones could have a chance at rejuvenated, healthy physical revival.

2) Affordable Cryopreservation

The Cryonics Institute (CI) offers full-body cryopreservation for as little as \$28,000.

3) Affordable Membership

Become a Lifetime Member for a one-time payment of only \$1,250, with no dues to pay. Or join as a Yearly Member with a \$75 initiation fee and dues of just \$120 per year, payable by check, credit card or PayPal.

4) Lower Prices for Spouses and Children

The cost of a Lifetime Membership for a spouse of a Lifetime Member is half-price and minor children of a Lifetime Member receive membership free of charge.

5) Quality of Treatment

CI employed a Ph.D level cryobiologist to develop CI-VM-1, CI's vitrification mixture which can help prevent crystalline formation at cryogenic temperatures.

6) Locally-Trained Funeral Directors

CI's use of Locally-Trained Funeral Directors means that our members can get knowledgeable, licensed care. Or members can arrange for professional cryonics standby and transport by subcontracting with Suspended Animation, Inc.

7) Funding Programs

Cryopreservation with CI can be funded through life insurance policies issued in the USA or other countries. Prepayment and other options for funding are also available to CI members.

8) Cutting-Edge Cryonics Information

Members currently receive a free subscription to Long Life Magazine, as well as access to our exclusive members-only email discussion forum.

9) Additional Preservation Services

CI offers a sampling kit, shipping and long-term liquid nitrogen storage of tissues and DNA from members, their families or pets for just \$98.

10) Support Education and Research

Membership fees help CI to fund important cryonics research and public outreach, education and information programs to advance the science of cryonics.

11) Member Ownership and Control

CI Members are the ultimate authority in the organization and own all CI assets. They elect the Board of Directors, from whom are chosen our officers. CI members also can change the Bylaws of the organization (except for corporate purposes).

The choice is clear: Irreversible physical death, dissolution and decay, or the possibility of a vibrant and joyful renewed life. Don't you want that chance for yourself, your spouse, parents and children?

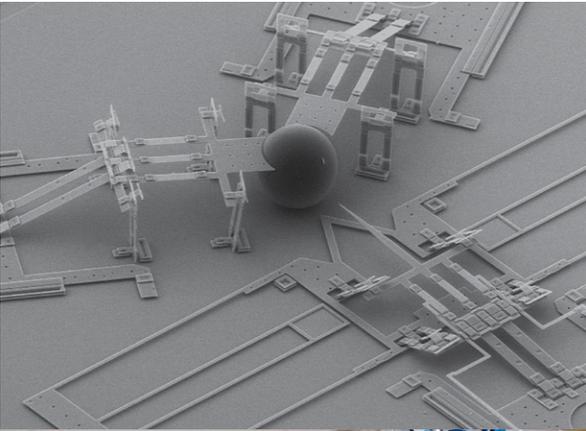
To get started, contact us at:

(586) 791-5961 • email: cihq@aol.com

Visit us online at www.cryonics.org



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LONG LIFE

A quarterly publication of the
Immortalist Society

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President: York W. Porter

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Volume 46 Number 1

First Quarter, 2014

Recently, I ran across a company online offering cloning services for breeders. Like any commercial website, they touted their services and, most interesting to me, the quality of their product, including a testimonial from the owner of a new cloned foal. Maybe I'm out of the loop, but I was a little surprised to learn animal cloning was already out of the lab and in commercial production.

I think a lot of people have a similar experience with cryonics, where they only vaguely understand the concept from TV or movies, but are quite surprised to discover there are real facilities that offer human cryostasis services. I'm sure you've probably heard at least one person remark when you mention the Cryonics Institute, "Really? I didn't know people were doing that in real life."

Well, yes, we are "doing that in real life," and letting people know the service is real, viable and available is half the battle. How many prospective cryonicists are out there who have never entertained the idea of signing up for a literal "chance of a lifetime" simply because they believe cryonic preservation is still only something that happens in science fiction, not in real life?

My guess would be a large part of the population. Longer life, or even immortality has fascinated mankind since we first recognized the concept of mortality, and yet, somehow, cryonics remains one of the world's "best kept secrets." At the same time, breakthrough medical technologies, nanotech applications and computerized gadgets of every kind regularly capture headlines around the world.

However, as newer, cooler and faster gadgets continue to proliferate, people are waking up to the potential world-changing benefits of today's emerging technologies. This thinking brings them closer to the vision of the exciting future that many cryonicists believe in, a world without disease, aging and death.

This issue provides a compelling argument in support of that vision by looking at the present through the lense of the past. Revolutionary ideas always draw skeptics, so to me, it's exciting to see the predictions of the past (Tiny Tech p 19) being realized, and vindicated, in the present by new breakthroughs like BYU's Nanoinjector (p 10) and Penn State's promising work with nanomotors in living cells (p 13).

This points out the amazing "someday" we all look forward to is getting closer to being "today," and that's a message we need to let the public know about!

— *Douglas Golner - Managing Editor, Long Life*

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Single subscriptions in USA: \$25 Canada/Mexico: \$30, Australia/ Asia: \$62 Gift subscriptions: \$20 (Note: Gift Subscriptions can only be bought by members)

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CI is continuing its efforts to upgrade and improve our facilities and web presence. We have seen continued positive growth both in the way of our social media outreach and, more importantly, our actual CI membership. News outlets and other media sources have been clamoring to speak with us about the subject of cryonics and I think continued advances in related technologies are having a slow “see I told you so” effect. I believe that while much of what drives the public to cryonics is out of our hands, being ready and on our “A” game when they come looking is making a huge difference.

Operationally, we are still looking at ways to improve what we do while keeping prices as low as possible. Every dollar counts and the money we save the membership is money that can go to preserve another family member, a close friend, or a beloved pet. We are about saving lives and being the best at what we do. In cryonics we do not get the immediate gratification of seeing someone awaken who we just saved, but we know that we have provided these people with hope during their lives and given them a real chance at life should the future smile upon us all. We work hard and we put up with a lot in our quest to make a difference. I think that in the end we will be vindicated. We are fighting the good fight and we have to stay true to our mission. Doing so has been paying off as well since CI’s already solid but humble financial position is improving dramatically.

One important mission is a common theme for me but it is so important that I will keep sounding the alarm. If you haven’t considered working out your standby then please start now. Make a list

of goals or use the ones we provide. It could be a small goal such as speaking with a family member or setting up a will. Perhaps it’s taking the time to talk with a funeral director and considering very carefully what you will say and how you will say it. Will you be selling them on the sometimes complex and deep subject of cryonics or on simply asking them to honor your wishes no matter how different than from their own? Sometimes the latter is all you need. Will you be buying just one piece of standby equipment on your check off list or a whole kit? These are important questions designed to motivate you to get up and start. It’s hard to convey just how important local standby is. We are still collecting useful data and working on presenting members with a basic and simple to follow outline for cryonicists but don’t wait for CI or others - just keep chipping away at your own missions.

For a few examples, you may want to look at what other members have put together with their own ingenuity and hard work. There is Cryonics UK which, with a grant from the Sinclair family, have put together a significant standby response for CI members in England. There is Cryonics Canada, which is very active in providing standby for its members there. Australia has both SSA and the Cryonics Association of Australasia to provide members with much-needed standby. There are so many. See our Cryonics Groups pages to see what organizations already exist in your area or start your own. We encourage all members to share standby information as conventional emergency medicine shares its information in order to improve patient care. Not every method and technique will suit everyone’s needs. Some people have greater financial resources but less in the way of people to assist. Others groups have the opposite challenges. Standby is not necessarily a “one size fits all” solution to our needs. We encourage customization when it helps, and standardization when methods have already been found to provide the best quality preservations. By no mistake, standard medicine has evolved similar methods to cope with scarce resources and logistical challenges such as population density and distance to treatment. While you may see standardization in CPR protocols from the AHA, you will, in contrast, see different levels of emergency response in urban vs rural settings depending on what trends emerge. CI also continues to work closely with Suspended Animation which provides standby services as a very useful option to CI members using advance cool down and, when feasible, air ambulance.

In yet another powerful example, two of CI’s newest members,



Stephan and Magali Beaugard, have negotiated their own personal standby with local funeral directors in Quebec to provide advance cool down and perfusion techniques with transport for under \$4000. The Beaugards are working to expand such cooperation with funeral directors in many other parts of the world. They want to provide information on what they have already found for others to follow suit. Funeral directors are a great resource and their network exists everywhere in the world. Having them on board ahead of time and willing to carry out our wishes urgently, at affordable prices, is a tremendous asset.

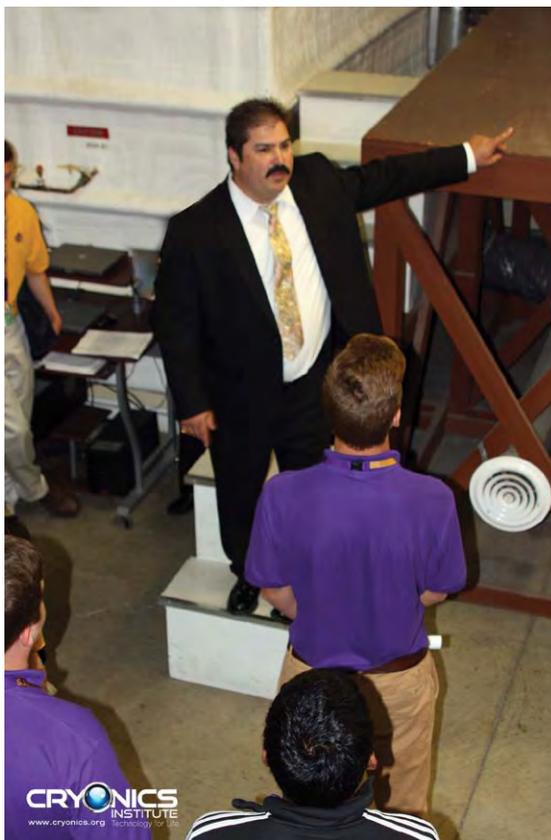
CI continues to explore different types of community outreach. This May, we hosted a high school biology field trip in which students had the opportunity to learn more about cryonics and how technology is impacting our perceptions about life and death. This was a unique and rewarding opportunity to help educate young people about what we do, not just to advance cryonics, but to broaden the scope of critical thinking in these young people before they venture out into the land of opportunity. If we can inspire just one new per-

son both about cryonics and the infectious optimism we hold dear then I am sure this trip will have been well worth it.

Remember this year's AGM is coming up and will be Saturday Sept 6th starting 3PM at the Cryonics Institute. Please mark your calendars and make your flight and motel arrangements ahead of time. We as always will provide interesting speakers, with food and refreshments to go around. The election of 4 of our director positions will be held just prior to this. There will be a total of 4 positions available to the candidates that they will be running for. I will be seeking reelection to one such position. Additional incumbents running include CI's Operations Manager, Andy Zawacki, and CI's Chief Business Officer, Steve Luyckx. Former president and director Ben Best will not be seeking reelection this year. I certainly wish him the best of luck and hope that his long service in cryonics and with CI brings him both happiness and the success that he deserves. Thank you all and I look forward to seeing you at the AGM this year!

Dennis Kowalski — CI President

High School Students Visit CI



CI President Dennis Kowalski answers students' questions during their CI facility tour.

This May, CI hosted a tour for about 50 high school students at their Michigan facility hosted by Dennis Kowalski, Andy Zawacki and Joseph Kowalski. The program featured a PowerPoint presentation outlining cyonics and the theories behind it, a tour of the building and a lively question-and-answer session. As a final bit of showmanship, the hosts made ice cream using liquid nitrogen. Kowalski said "It was a great tour - I was happily surprised as how quickly the kids grasped the basic concepts and at the questions they asked. Without any coaching from us, they asked a number of really deep questions about cryonics, life and death, revival and cryonics' implications for future."



Show-Stopper! Andy Zawacki pours liquid nitrogen, the magic ingredient to "Cryo-Ice Cream", into the mix.





You've signed up for Cryonics Now what should you do?

Welcome Aboard! You have taken the first critical step in preparing for the future and possibly ensuring your own survival. Now what should you do? People often ask "What can I do to make sure I have an optimal suspension?" Here's a checklist of important steps to consider.

- Become a fully funded member through life insurance or easy pre-payments

Some members use term life and invest or pay off the difference at regular intervals. Some use whole life or just prepay the costs outright. You have to decide what is best for you, but it is best to act sooner rather than later as insurance prices tend to rise as you get older and some people become uninsurable because of unforeseen health issues. You may even consider making CI the owner of your life insurance policy.

- Keep CI informed on a regular basis about your health status or address changes. Make sure your CI paperwork and funding are always up to date. CI cannot help you if we do not know you need help.
- Keep your family and friends up to date on your wishes to be cryopreserved. Being reclusive about cryonics can be costly and cause catastrophic results.
- Keep your doctor, lawyer, and funeral director up to date on your wishes to be cryopreserved. The right approach to the right professionals can be an asset.
- Prepare and execute a Living Will and Power of Attorney for Health Care that reflects your cryonics-related wishes. Make sure that CI is updated at regular intervals as well.
- Consider joining or forming a local standby group to support your cryonics wishes. This may be one of the most important decisions you can make after you are fully funded. As they say-"Failing to plan is planning to fail".
- Always wear your cryonics bracelet or necklace identifying your wishes should you become incapacitated. Keep a wallet card as well. If aren't around people who support your wishes and you can't speak for yourself a medical bracelet can help save you.
- Get involved! If you can, donate time and money. Cryonics is not a turnkey operation. Pay attention and look for further tips and advice to make both your personal arrangements and cryonics as a whole a success.



Worldwide Cryonics Groups

If you know of, or are considering starting a support, standby or other cryonics-related group in your area, please send details to immsoc@aol.com. We'll be using Long Life to list existing groups of interest as well as help spread the word and encourage new organizations. (New additions to the list are denoted with an asterisk).

AUSTRALIA: The Cryonics Association of Australasia offers support for Australians, or residents of other nearby countries seeking information about cryonics. caalist@prix.pricom.com.au. Their Public Relations Officer is Philip Rhoades. phil@pricom.com.au GPO Box 3411, Sydney, NSW 2001 Australia. Phone: +6128001 6204 (office) or +61 2 99226979 (home).

BELGIUM: Cryonics Belgium is an organization that exists to inform interested parties and, if desired, can assist with handling the paperwork for a cryonic suspension. The website can be found at www.cryonicsbelgium.com. To get in touch, please send an email to info@cryonicsbelgium.com.

BHUTAN: Can help Cryonics Institute Members who need help for the transport & hospital explanation about the cryonics procedure to the Dr and authorities in Thimphu & Paro. Contacts: Jamyang Palden & Tenzin Rabgay / Emails: palde002@umn.edu or jamgarnett@hotmail.com Phones: Jamyang / 975-2-32-66-50 & Tenzin / 975-2-77-21-01-87

CANADA: This is a very active group that participated in Toronto's first cryopreservation. President, Christine Gaspar; Vice President, Gary Tripp. Visit them at: <http://www.cryocdn.org/>. There is a subgroup called the Toronto Local Group. Meeting dates and other conversations are held via the Yahoo group. This is a closed group. To join write: csc4@cryocdn.org

QUEBEC: Contact: Stephan Beauregard, C.I. Volunteer & Official Administrator of the Cryonics Institute Facebook Page.

For more information about Cryonics in French & English: stephanbeauregard@yahoo.ca

DENMARK: A Danish support group is online. Contact them at: david.stodolsky@socialinformatics.org

FINLAND: The Finnish Cryonics Society, (KRYOFIN) is a new organization that will be working closely with KrioRus. They would like to hear from fellow cryonicists. Contact them at: kryoniikka.fi Their President is Antti Peltonen.

FRANCE:

- SOCIETE CRYONICS de FRANCE
Roland Missionnier would like to hear from

cryonicists in Switzerland, Luxembourg and Monte Carlo, CELL: (0033) 6 64 90 98 41, FAX: (0033) 477 46 9612 or rolandmissionnier@yahoo.fr

- Can help Cryonics Institute Members who need help for the transport & hospital explanation about the cryonics procedure to the Dr and authority in Toulouse Area. Contact: Gregory Gosselin de Bénicourt / Email: cryonics@benicourt.com Phone: 09.52.05.40.15

GERMANY: There are a number of cryonicists in Germany. Their homepage is: www.bio-stase.de (English version in preparation.) if there are further questions, contact Prof. Klaus Sames: sames@uke.uni-hamburg.de.

GREECE: Greek Cryonics Support Group. Sotiris Dedeloudis is the Administrator. Find them at: <http://www.cryonics.gr/>

INDIA: Can help Cryonics Institute Members who need help for the transport & hospital explanation about the cryonics procedure to the Dr and authority in Bangalore & Vellore Area. Contacts: Br Sankeerth & Bioster Vignesh / Email: vicky23101994@gmail.com Phones: Bioster / 918148049058 & Br Sankeerth / 917795115939

ITALY: The Italian Cryonics Group (inside the Life Extension Research Group (LIFEXT Research Group)) www.lifext.org and relative forum: forum.lifext.org. The founder is Bruno Lenzi, contact him at brunolenzi88@gmail.com or Giovanni Ranzo at giovanni1410@gmail.com

JAPAN: Hikaru Midorikawa is President Japan Cryonics Association. Formed in 1998, our goals are to disseminate cryonics information in Japan, to provide cryonics services in Japan, and eventually, to allow cryonics to take root in the Japanese society. Contact mid_hikaru@yahoo.co.jp or <http://www.cryonics.jp/index.html>

NEPAL: Can help Cryonics Institute Members who need help for the transport & hospital explanation about the cryonics procedure to the Dr and authorities in Kathmandu. Contact: Suresh K. Shrestha / Email: toursuresh@gmail.com Phone: 977-985-1071364 / PO Box 14480 Kathmandu.

* **NETHERLANDS:** The Dutch Cryonics Organization (<http://www.cryonisme.nl>) is the local standby group and welcomes new enthu-

siasts. Contact Secretary Japie Hoekstra at +31(0)653213893 or email: jb@hoekstramedia.nl

* Can help Cryonics Institute Members who need help, funeral home, transport & hospital explanation about the cryonics procedure to the Dr and authority at Amsterdam with branches in other cities. Contact: Koos Van Daalen / Phone (24 Hours) +31-20-646-0606 or +31-70-345-4810

* **NORWAY:** Can help Cryonics Institute Members who need help for the transport & hospital explanation about the cryonics procedure to the Dr, funeral home and authority at Sandvika. Contacts: Gunnar Hammersmark Sandvika Begegravelsesbyraa / Phones: 011-47-2279-7736

PORTUGAL: Nuno & Diogo Martins with Rui Freitas have formed a group to aid Alcor members in Portugal. Contact: nmartins@nmartins.com or visit www.cryonics.com.pt/

RUSSIA: KrioRus is a Russian cryonics organization operating in Russia, CIS and Eastern Europe that exists to help arrange cryopreservation and longterm suspension locally, or with CI or Alcor. Please contact kriorus@mail.ru or daoila.medvedev@mail.ru for additional information or visit <http://www.kriorus.ru>. Phone: 79057680457

SPAIN: Giulio Prisco is Secretary of the Spanish Cryonics Society. Website is <http://www.cronicacion.org>. He lives in Madrid and he's a life member of CI and is willing to serve as a contact point for Europeans. He can be contacted at: cell phone (34)610 536144 or giulio@gmail.com

* **UNITED KINGDOM:** Cryonics UK is a nonprofit UK based standby group whose website is: www.cryonics-uk.com and who can be contacted via David Styles (Organizer) at: +44 7706 149771 or ds@cryonicsuk.com or via Alan Sinclair (President) at +44 1273 587 660 cryoservices@yahoo.co.uk

* Can help Cryonics Institute Members who need help, funeral home, transport at London. Contact: F.A. Albin & Sons / Arthur Stanley House Phone: 020-7237-3637

INTERNATIONAL: The Cryonics Society is a global cryonics advocacy organization. Website is www.CryonicsSociety.org. They publish an e-newsletter FutureNews. Phone: 1-585-643-1167.

Please note, this list is provided as an information resource only. Inclusion on the list does not constitute an endorsement by Long Life magazine or our affiliated organizations. We urge our readers to use this list as a starting point to research groups that may meet their own

individual needs. We further note that readers should always use their own informed judgment and a reasonable amount of caution in dealing with any organization and/or individual listed.



Cryonics Institute Membership Statistics:

As of June 2014, the Cryonics Institute has 1,150 members, up 23 from our last report. Of the 1,150 Members, 563 have funding and contracts in place for human cryopreservation, an increase of 14. Of these 563, 165 have arrangements for Suspended Animation Standby and Transport.

There are 122 human patients and 103 pet patients in cryopreservation at CI's Michigan facility.

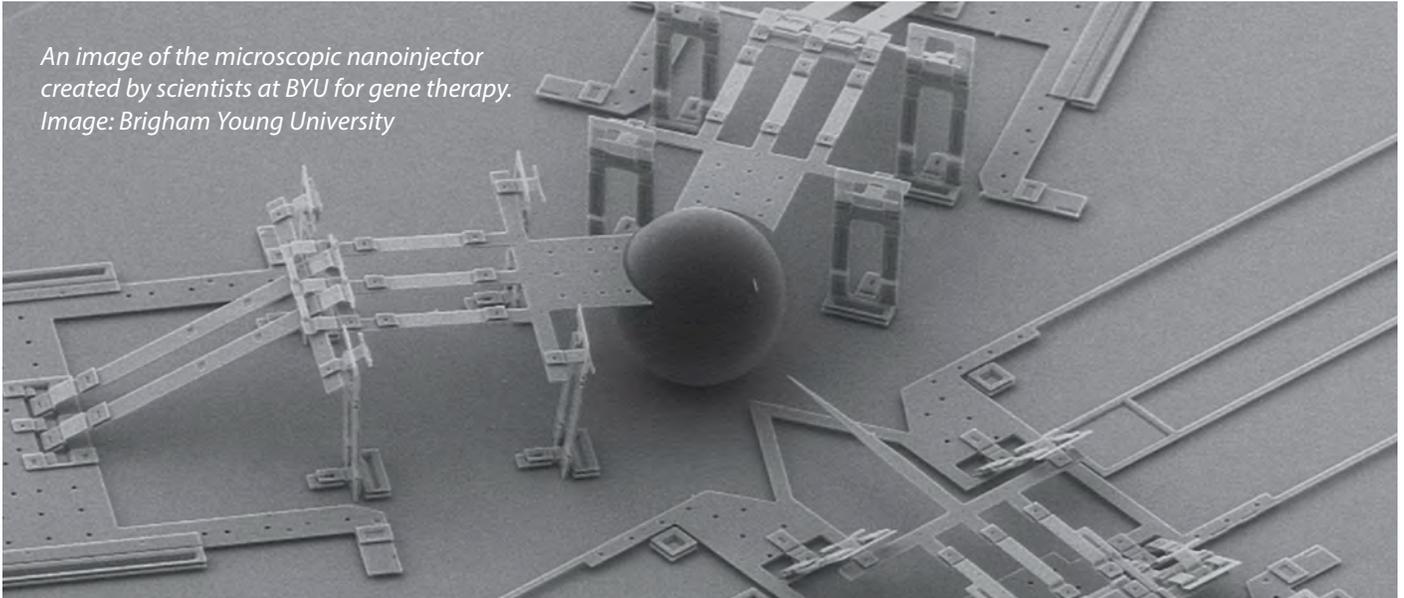
CI continues to be an industry leader in terms of both membership and practical affordability for all.



Cryonics Institute Membership by Country:



An image of the microscopic nanoinjector created by scientists at BYU for gene therapy.
Image: Brigham Young University



BYU researchers create tiny nano-device in newest gene therapy advance

Nanoinjector is used to transfer genes and DNA to new cells

Brigham Young University News Release | <http://news.byu.edu/archive14-may-nanoinjector.aspx>

The ability to transfer a gene or DNA sequence from one animal into the genome of another plays a critical role in the medical research of diseases such as cancer, Alzheimer's and diabetes.

But the traditional method of transferring genetic material into a new cell, microinjection, has a serious downside. This method uses a hollow needle to pump a DNA-filled liquid into an egg cell nucleus, but that extra fluid causes the cell to swell and die 40 percent of the time.

Now a multidisciplinary team of Brigham Young University scientists has developed a way to significantly reduce cell death when introducing DNA into egg cells. The researchers have created a microscopic lance that delivers DNA to the cells through electrical forces.

"Because DNA is naturally negatively charged, it is attracted to the outside of the lance using positive voltage," said Brian Jensen, BYU professor of mechanical engineering. "Once we insert the lance into a cell, we simply reverse the polarity of the electrical force and the lance releases the DNA."

Because the lance is 10 times smaller and no extra fluid is used, the cells undergo significantly less stress compared to microinjection, and thus, have a higher survival rate. The researchers describe their "metamorphic nanoinjection" process in an article published today

by Review of Scientific Instruments.

Currently the BYU researchers, which include microbiology professor Sandra Burnett and mechanical engineering professor Larry Howell, are using the technique to inject DNA into mouse zygotes (single-cell embryos consisting of a fertilized egg).

"The microinjection technology hasn't really changed over the last 40-50 years since it was invented," Burnett said. "Not having to force liquid into the nuclei by shifting to a lance is a huge advantage. It not only increases the survival rate, but it also causes less damage for future development."

In research published in *Transgenic Research*, the team found that 77.6% of nanoinjected mouse zygotes proceeded to the two-cell stage of development as compared to 54.7% for microinjected zygotes.

A major reason for creating transgenic animals is to research genetic or infectious diseases. By modifying the genes of a mouse to carry a human disease, researchers can generate data with insights into future treatments and therapies for those illnesses.

One of the BYU team's most significant findings is that it's possible to use the electrical forces to get DNA into the nucleus of a cell without aiming the lance into the pronucleus (the cellular structure



containing the cell's DNA). This may mean that injections can be performed in animals with cloudy or opaque embryos.

"Such animals, including many interesting larger ones like pigs, would be attractive for a variety of transgenic technologies," Jensen said. "We believe nanoinjection may open new fields of discovery in these animals."

Jensen said more efficient injections should also reduce the cost

to create transgenic animals. Jensen's research is funded in part by the \$400,000 awarded to him in 2011 through a National Science Foundation CAREER Award.

Quentin Aten, a former PhD student at BYU now with Nexus Spine, LLC, served as the lead author on the research published in *Review of Scientific Instruments*.

The North Wind Doth Blow: The Past, Present and Future State of Cryonics in Canada

by *Christine Gaspar*

The Cryonics Society of Canada was created by Douglas Quinn in 1987. Two years prior, he became the first contracted Canadian cryonicist, and went on to be the president of the CSC (Cryonics Society of Canada), and editor of the *Canadian Cryonics News* [1]. One of the early ideas in cryonics circles which he advocated for was the concept of permafrost burial [2] as a low cost alternative to standard cryopreservation by using areas of northern Canada where the ground never thaws at a certain depth. This has become a largely forgotten concept. Doug federally incorporated the CSC and wrote its bylaws. Formal application for incorporation was made in 1989 by Doug Quinn, Scott Maynard, a biochemistry student and the secretary for the CSC, and Benjamin Best. The CSC was finally incorporated in August of 1990 after long administrative delays.

In 1990, British Columbia, our westernmost province passed a law prohibiting the marketing of cryonics, and the early 1990's were spent by the CSC unsuccessfully attempting to overturn it. Similar legislation was considered in Alberta, but it was not passed into law [3]. Even though it is fortunate that no other state or province has passed such a law, it still remains in force to this date. Technically, a resident of British Columbia

can have cryonics arrangements made, but as one can imagine, a law written in such a manner makes it difficult to find funeral directors and medical professionals that are comfortable assisting these efforts.

The annual tradition of summer parties and winter dinners started in Toronto during this time, and Ben Best took over the role of president of the CSC and editor of the *CCN* from 1991 to 1999. He was the first cryonicist I met, in 1997 while I was still in college for nursing, and was very influential in my decision to become a cryonics activist and advocate. I consider him to be one of my oldest and dearest friends in this community.

The *Canadian Cryonics News* ceased publication in 2000, replaced by the Yahoo email and members forum. Guy Desrosiers, of Alberta was elected CSC president in May of 2001 and held that position until contact with him was lost in early 2003 in the CSC's first online election. I, Christine Gaspar, was appointed interim president in his absence, and it was decided by vote that I would remain in that position. I bring to the group a background in emergency nursing. I have held that position ever since, with the exception of a period in 2004-2008 when I moved out of country. Patrice Levine was elected as president in my absence but due to personal obligations, stepped down

when I returned to Canada.

In the fall of 2002, the Toronto Local group—a subset of the CSC participated in our first cryopreservation of a lady that was to become a patient of the Cryonics Institute [4]. For most of the life of the CSC, it has been focused on education and advocacy of cryonics in the Canadian community, often answering press requests and assisting new members with their enrollment in either CI (the Cryonics Institute) or the Alcor Life Extension Foundation. One of the most important aspects of assisting with this case was that it planted the seeds for how the CSC would evolve, and which direction it should be aiming for. Through generous donations, we were able to acquire an ice bath and a Brunswick thumper that would deliver CPR hydraulically. We did also have some rudimentary medications but in hindsight, it would seem that our preparations barely scratched the surface of what would be needed if we were to evolve into an organization that supported its members more than just theoretically.

As can be said for any group whose members are volunteers, with only a single case to base ourselves on, change came slowly. It is really only in the last 2-3 years that significant effort has been taken to truly change our capability to a group that can offer standby support and a cohesive, orga-



nized team of volunteers with the capability to truly offer a valued service to a cryonicist in need.

Another element that has served us well is that the political climate and public attitude towards cryonics and transhuman ideas has begun to shift in a positive direction. The fantastic advances in science, and strong transhuman advocacy, have helped make cryonics a concept that is gaining mainstream acceptance and legitimacy. This is truly the time to act if we have any hope of improving our chances for a good cryopreservation. Our most basic message is that one can take as many precautions and attempt as many procedures as possible to extend one's life radically, but life is unpredictable, death can be as random as a car accident, and any serious attempt at transhuman radical life extension must seriously consider a "Plan B".

One area of focus that I have been diligently trying to develop, with the assistance of our solid group members, is a formalized, clearly defined protocol. Canada is a huge country, with pockets of cryonicists who are thousands of kilometers apart. The same can be said for the rest of the world. My vision here, in collaboration with CI and Alcor, is to write a standardized field manual that can be given to any group who wants it, that will outline the equipment, preparation, and steps needed to initiate a good cryonics response. It needs to be simple enough that a person without a medical background can work with, and yet comprehensive enough to be worth the group's effort. We do not have the benefit of contracting with Suspended Animation, as they are still restricted to working within the borders of the continental USA, and clearly, it would take hours, at the earliest, to mobilize a team from Arizona, or coordinate with a funeral director for CI. My goal is to create training videos, and "kits" that can be purchased or obtained by any start-up group, and then operate as a mobile support professional that can come to their aid to initiate the more complex aspects of

a stabilization. My ultimate goal would be to have the capability of doing field vitrification, so that a patient can then be shipped to the provider of their choice, in the best possible condition at dry ice temperature.

One of the most significant barriers that we have recently overcome is taking custody of an Alcor meds kit, in the greater Toronto area. A long time concern we have had is that if there is a last minute case, that any delay at Customs would severely impact the quality of a perfusion. Now, Alcor representatives have a kit pre-positioned here, and all they have to be concerned about is moving personnel. On the weekend of August 15-17, Aaron Drake and Dr. Max More will be coming to Toronto to provide us with orientation and training on their equipment and protocols. It is our goal to not only hold their kit, but to be able to offer immediate assistance, when possible, to their patients, in the hours before their team can arrive. Every minute can make the difference between an optimal and a sub-optimal perfusion.

Over the next few months, we will also acquire vitrification solution and supplies from CI, in order to offer the same advantage to its Canadian members. Once we have a plan in place for the Toronto region, it is my goal to duplicate these efforts in other parts of the country that have the most pressing need, such as British Columbia for example.

This takes us to our next challenge, which is the anti-cryonics law in BC. Cryonicists in BC have been trying to have that prejudicial law overturned for many years now. This is a very important issue, not only for the people of BC, but also for cryonicists in other regions. Having an anti-cryonics law on the books creates the potential for others to be influenced by that established precedent. It is in everyone's best interest to overturn it, lest another zealous lawmaker sees that as an opportunity to create similar rules. In consultation with a civil rights attorney, BC cryonicists have proposed that the best way

to challenge the law is to create a business that would be directly affected by it and appeal on the grounds that it is discriminatory. This creates an opportunity to formally start an organization with a similar purpose that Suspended Animation, Inc. has in the USA, and it falls beautifully in line with the above mentioned goals of the CSC. What this venture lacks at this time is the funding to realize these goals.

If I was to be completely direct about what the CSC needs to further its mission, it would have to boil down to two elements. The first would be active participants. I want to inspire momentum, and help encourage other cryonicists to take a more active role in this service. The future is as of yet unwritten. Every effort that we make now, contributes to our future success.

The second inevitable need we have is financial support. The ideal situation, as I see it, is twofold. One aspect is the ability to earn a living in cryonics, so that my efforts and time aren't divided between what I must do in a career which takes up valuable time, and what I could do if I could devote my fullest efforts on this mission. The second area where financial support would be hugely beneficial is to support the start-up of the BC organization, currently named Biostasis Canada, that would be born as a mobile, professional standby organization that would operate to deliver high quality cryonics field work, and have the teeth to take on the anti-cryonics law in court.

I have always been raised to believe that being honest and transparent are worthy attributes, and I believe that these ventures would be a wonderful addition to building a cryonics infrastructure that we would all benefit from.

1. cryocdn.org/cdnhist.html
2. cryocdn.org/perma.html
3. cryocdn.org/law57.html
4. benbest.com/cryonics/toronto.html



Nanomotors are controlled, for the first time, inside living cells

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



Very active gold nanorods internalized inside HeLa cells in an acoustic field. A demonstration of very active gold nanorods internalized inside HeLa cells in an acoustic field. This video was taken under 1000X magnification in the bright field, with most of the incoming light blocked at the aperture. — Mallouk Lab, Penn State

Krista Weidner — February 10, 2014

UNIVERSITY PARK, Pa. -- 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."

Up until now, Mallouk said, nanomotors have been studied only "in vitro" in a laboratory apparatus, not in living human cells. Chemically powered nanomotors were first developed 10 years ago at Penn State by a team that included chemist Ayusman Sen and physicist Vincent Crespi, in addition to Mallouk.

"Our first-generation motors required toxic fuels and they would not move in biological fluid, so we couldn't study them in human cells," Mallouk said. "That limitation was a serious problem." When Mallouk

and French physicist Mauricio Hoyos discovered that nanomotors could be powered by ultrasonic waves, the door was open to studying the motors in living systems.

For their experiments, the researchers use HeLa cells, an immortal line of human cervical cancer cells that typically is used in research studies. These cells ingest the nanomotors, which then move around within the cell tissue, powered by ultrasonic waves. At low ultrasonic power, Mallouk explained, the nanomotors have little effect on the cells. But when the power is increased, the nanomotors spring into action, moving around and bumping into organelles -- structures within a cell that perform specific functions. The nanomotors can act as egg beaters to homogenize the cell's contents, or they can act as battering rams to puncture the cell membrane.

While ultrasound pulses control whether the nanomotors spin around or whether they move forward, the researchers can control the motors even further by steering them, using magnetic forces. Mallouk and his colleagues also found that the nanomotors can move autonomously -- independently of one another -- an ability that is important for future applications.

"Autonomous motion might help nanomotors selectively destroy the cells that engulf them," Mallouk said. "If you want these motors to seek out and destroy cancer cells, for example, it's better to have them move independently. You don't want a whole mass of them going in one direction."

The ability of nanomotors to affect living cells holds promise for medicine, Mallouk noted.

"One dream application of ours is Fantastic Voyage-style medicine, where nanomotors would cruise around inside the body, communicating with each other and performing various kinds of diagnoses and therapy. There are lots of applications for controlling particles on this small scale, and understanding how it works is what's driving us."

Video clips related to this research are available at:

<http://www.youtube.com/user/scienceresearchclips>.

The researchers' findings were published in Angewandte Chemie International Edition on Feb. 10. In addition to Mallouk, co-authors include Penn State researchers Wei Wang, Sixing Li, Suzanne Ahmed, and Tony Jun Huang, as well as Lamar Mair of Weinberg Medical Physics in Maryland. The research was funded by the National Science Foundation (MRSEC grant DMR-0820404), the National Institutes of Health, the Huck Innovative and Transformative Seed Fund (HITS) and Penn State.





Meeting Yourself Coming Out of the Freezer

by Jim Yount



The first person you see when you are reanimated may be yourself! Could the *you* on the outside of the cryostat really resist? If *that you* is notified that reanimation day has come for the *you* on the inside, wouldn't the outside *you* want to be around to greet the frozen *you* as he or she is brought back?

The question of personal identity - - what can correctly be called the "*real you*" - - has been much discussed by cryonicists. Robert Ettinger wrote a chapter on that very subject in *The Prospect of Immortality*. Much of Professor Ettinger's final book *Youniverse* dealt with this question. Still, I am surprised and concerned by the lack of discussion or even awareness of the topic by a lot of people in the cryonics community including, it seems to me, some of the Directors of CI, IS, and ACS.

Even among those of us who are interested in the subject, little is said about the *practical implications* of this Gordian knot. For example, if there can be more than one version of yourself, which version gets the money you have put aside in your cryonics trust? Another example: Will CI or whoever is responsible for making the reanimation decision(s) for your frozen material self follow such a *strict definition of self* that you are never reanimated?

Star Trek. A Starship Enterprise transporter analogy can be used as a way of introducing the Identity Problem to people who have not read, or have skipped lightly over, Chapter VIII of *The Prospect of Immortality*. Other analogies or "mind experiments" in line with what Ettinger has used in *Prospect* or *Youniverse* follow our introduction of the subject.

Captain Kirk, away on Earth on some adventure, speaking into his communicator says, "Beam me up, Scotty." Mr. Scott, aboard the Starship Enterprise, then focuses a beam on the captain that scans his body and clothing down to (it is supposed) the molecular level. The identity of each molecule, each atom in relationship to the other atoms that make up the captain is noted by a smart computer program. That information is then used by the smart computer to construct a Captain Kirk in another location, that location being the transporter room aboard the Starship that is circling Earth. The earthside captain's body is converted to electricity. Or perhaps the earthside body of Kirk is reduced to its component parts: so much water, so much salt, so much iron, etc. All that is needed is the information about how Captain Kirk was put together and that information is then used to make a shipboard Kirk. Since every atom in the shipboard Kirk is in the exact same location relative to all the other

atoms in Kirk's body, the shipboard Kirk is identical to the earthside Kirk.

In the future reanimation laboratory: "Beam me up, Scotty," may be more than just science fiction. The body of a person who has died by the 2014 definition of death, then cryopreserved, will be much damaged. It may be that replacement of damaged parts that are functionally identical to a healthy 2014 version of this person will be easier than repairing the damaged parts. To most of us that is OK for arms, legs, liver, and kidneys. But what about replacing the brain? Replacing a part of the brain? Replacing part of the brain where the information in the damaged parts of the old brain is used to reprogram the brain replacement parts?

Back to the Enterprise: So the information that describes the Captain, down to his dandruff and fallen arches, is collected through scanning. Once the scan is complete, that information could be used to construct a Captain Kirk on board the Enterprise, in Philadelphia, in San Francisco or all three locations at about the same time. The information can be stored in computer files and used to construct a Kirk in one year or in ten years. Each of the new Captain Kirks would have all memories of the earthside Kirk and each one would (presumably) feel that he is



the *real* Captain.

What about the earthside Kirk? Does the fact that he has been scanned and duplicated made of him in (perhaps) dozens of locations affect his existence in any way? It certainly would if, after the scan, the earthside Kirk is destroyed. If the earthside Kirk is not destroyed after the process, he might not even be aware that he has been scanned, or it might be that he just feels slight warmth during the scanning. He would go on with his earthside existence completely unaware that he had just been duplicated.

Back to cryonics: the self as information.

In Chapter VIII of *Prospect*, Ettinger presents a number of mind-experiments where various physical removal and replacements are done (mostly to the brain). The question is posed, explicitly or implicitly, as to whether or not the new person (after the replacements) is the same as the original person?

It is commonly held by modern physics that an atom is an atom the world-round. If an atom of iron at a particular location in a subject's brain could be replaced by another atom of iron in that exact location of our brain it would make no difference to the subject. If that is true, then could not all atoms of the brain be replaced with identical atoms and it still make no difference to the subject? If so, then could it not be said that we are information beings? If the information is preserved, then the original body could be destroyed as long as the information is of perfect fidelity; that is the information is not degraded in any way? Thus the *information theory of self*.

Back to The Enterprise. The writers of Star Trek got around any possible objections to Captain Kirk, having gone through the transporter, NOT being the same person as Captain Kirk post-transport. They did this with "the atom stream." After Kirk has been scanned and the information on his atomic positioning beamed back to the Enterprise,

the atoms of his body are dislodged and those very same atoms are fed up to the Enterprise in an atom stream! So the Kirk that emerges from the transporter aboard the Enterprise has the *very same* atoms replaced in the *same relationship to each other* as they were in the Kirk on earth.

Most 2014 physicists would say that an atom stream is not necessary since it would make no difference if the atoms used to reconstruct Kirk on the enterprise were the same as those that composed his body on earth. Remember: "an atom is an atom the world-round."

Back to Cryonics: tiny tugboats. One possible reanimation scenario is where techniques now associated with nanotechnology are used, not as *Engines of Creation*, but as assemblers of a giant jig-saw puzzle. In this scenario nanites are formed as tiny tugboats that are directed by a super-scanner and sophisticated computer program to move displaced molecules (or atoms when necessary) back into place so that the neural pathways and chemical make-up of the brain are complete to what they were prior to deanimation.

This method of reanimation would satisfy many people, be they subscribers to a theory of self as information, or if they believe that the original material, or most of it, must be used to make up the reanimated self. This is somewhat akin to the "atom stream" of Star Trek that also uses the exact same (original) atoms of Captain Kirk to reassemble him at the transporter room aboard the Enterprise.

Whole brain emulation (mind copying):

Cryonicists will remember long discussions of this subject on CryoNet, especially in the 1990s. The topic was then more commonly called "mind uploading." This study can be traced as far back as the 1940s when McCulloch and Pitts observed that a neuron can be in only one of two possible states. It can be active (firing) or at rest. Thus neural

activity might be treated with binary math and programmed into a computer.

Paraphrasing and simplifying the definition of *Whole Brain Emulation* from that offered under that topic title in Wikipedia: *It is the hypothetical process of copying mental content (including long-term memory and "self") from the brain to any other form (substrate) such as a computer or artificial neural network. The computer can then simulate the neural firings of the brain from which it was copied.* Advocates believe that in the most sophisticated form, the new "self" thus emulated will experience having a conscious mind. Once the information that describes (makes up) your mind is in the computer it may be used to program (download) a mind in a biological body, perhaps based on cloning or regrowing a second, third or more biological brain in a new, maybe improved, biological body. Advocates are quick to point out that the application need not be limited to biological bodies. For example, a download into a mechanical body and brain might allow such a being to inhabit Jupiter; or to experience virtual life in a computer in a "have it your way" created virtual world.

But wait! Isn't this a copy and not the "real thing?" Isn't this like the Star Trek example of scanning Captain Kirk and sending that information to the Enterprise or Philadelphia, or San Francisco to there be used to recreate the captain? "The new Captain Kirks are not just copies!" say the information theorists. Each of the captains would have as much claim to being the "original" captain Kirk as the one whose scanning produced the information: *Information of Captain Kirk = Captain Kirk.*

Regardless of how we may personally feel about the apparent anomalies created by equating information with self, it may well be necessary to use such techniques, to some extent at least, to deal with the loss of information that comes about because of



damage to the body. So . . . in for a penny, in for a pound?

There is, of course, the very real problem of how one is to retrieve the information that constitutes the self. Some of the proposed means of extracting such information would result in much damage, or downright destruction, to the brain: more on that problem later.

In the laboratory -- mapping the brain.

Funding for two ambitious brain research projects, one European and one US, is eye-popping. Such projects have great interest for cryonicists since any meaningful reanimation of our frozen patients will necessitate understanding of the brain. Such research will also enable the creation of virtual brains, a goal flatly stated by the Europeans and alluded to by the US's organizers.

\$1.66 Billion is planned to be spent on *The Human Brain Project* by the Swiss Federal Institute of Technology to create the first complete computer simulation of the human brain. The project, recently begun, will employ 250 researchers who will work over a ten year period to model all that we now know about the human brain to create virtual neural networks. (www.human-brainproject.eu)

\$300 million a year each year for ten years is the price-tag for the equally ambitious US effort, organized under the National Institute of Health. Dubbed *The BRAIN Initiative* (Brain Research through Advanced Innovative Neurotechnologies), the study promises to "revolutionize our understanding of the human brain" and "provide unprecedented opportunities for exploring exactly how the brain enables the human body to record, process, utilize, store, and retrieve vast quantities of information, all at the speed of thought." See www.nih.gov/science/brain/ and *New York Times*, February 18, 2013.

In the Laboratory: getting inside the virtual brain.

Well worth reading, for those interested in the subject, is: **Whole Brain Emulation, a Roadmap**, a 130 page paper by Anders Sandberg and Nick Bostrom that is based upon a 2007 Oxford Future of Humanity workshop. <http://www.fhi.ox.ac.uk/brain-emulation-roadmap-report.pdf>

"The basic idea is to take a particular brain, scan its structure in detail, and construct a software model of it that is so faithful to the original that when run on appropriate hardware, it will behave in essentially the same way as the original brain." (page 7 of the above cited study)

The concept may be summarized as:

- 1) Scan brain;
- 2) Duplicate brain

Perhaps more in line with the thinking of some cryonicists is the following plan:

- 1) Make virtual brain;
- 2) Insert self.

Concerted efforts and throwing a lot of money at the task, will likely let us apply the vastly increased computer power now available to produce virtual brains. The results would not simply model human brains, but be thinking entities. Viewing such a virtual brain as a "blank slate," Aristotle's *Tabula rasa*, how may we write the contents of either a live or frozen person's memory and/or consciousness on that blank slate? Do we have any ideas on how that may be accomplished?

Link Between living body and "blank slate" artificial brain. In Ettinger's *The Prospect of Immortality*, Chapter VIII, (thought) Experiment 20, a living person's brain is connected to a computer such that the process of thought through firing the of neurons is transmitted to a computer and

recorded, thus programming in memories. Over time the person finds that he is "living" in the computer memory as much as in his natural brain. When his body and natural brain dies, he notes the fact and (my speculation) may even shed a few tears, but he goes on using only the computer brain.

So far we have considered techniques that might be applied with a living person, or that would be non-destructive if applied to a frozen cryonics patient. There are other techniques for reanimation/identity restoration that are much more vigorous in changing the physical make-up of the patient. It may be that such techniques must inevitably be used; if not we just go on adding liquid nitrogen to our cryostats forever.

Slicing the brain and scanning the slices.

At the Center for Brain Science at Harvard University, neurobiologist Jeff Lichtman and colleagues strive to create a comprehensive map of the brain's structure at the level where memory is stored. A rat's brain is sliced into very thin sequences slices, placing the slices on a reel of tape. An electron microscope is used to scan the slices where they can be enlarged and viewed, or recorded on a computer, somewhat reminiscent of the frames of an old 16 MM movie.

Since so much information is stored in the brain, this process is slow. Lichtman points out that his laboratory's ability to slice and record has speeded up dramatically since inception of the project about five years ago. He can now slice and scan a cubic millimeter of brain material every two years and anticipates that a new microscope to be installed this summer will enable him to slice and scan that quantity in two weeks. For cryonicists, the time scale is not so very important, but the fact of the slicing may be, even though the slices may be frozen again after scanning. Putting Humpty Dumpty together again is another matter,

Continues on page 26





TRANSHUMANISM

for Cryonicists

by Christine Gaspar
for Long Life Magazine

Most of us become interested in cryonics for a simple reason. We like to be alive, and nature isn't going to give us enough time to satisfy all of our ambitions, or contain all of our dreams. If I may be so presumptuous as to make assumptions of some of our characteristics as a group, I will try here.

We tend to be intelligent, logical and adventurous people who have decided that there is no limit to what humanity can accomplish with the right motivation and resources. Death is a process that can be observed, quantified and controlled. There is nothing mystical about it, and it is an unfortunate legacy of our biology. We come to learn about cryonics from many different stages in our lives and from many different directions. If we are to be honest, we can admit that it gives us some hope that the precious, unique spark that is our consciousness, stands some chance, finally, of surviving our greatest threat and thwarting the eternity of nothing that would otherwise await.

Transhumanism is a philosophy and intellectual movement that espouses the use of scientific discovery and technology to improve the human condition. Transhumanism, also called Humanity Plus or H+, advocates for the modification and the enhancement of a human, in an effort to evolve into a more perfect being. It isn't about reaching perfection, but rather about continuous evolution. The purpose of such improvement is not only to eliminate the causes of suffering of the human condition, but to guide evolution in a positive and novel way. Its goals include radical life extension, elimination of disease, merging with artificial intelligence, genetic

engineering and human enhancement. Cryonics is a natural tool that fits well within the transhuman arsenal for overcoming death and helping to create a bridge between now and a time when biotechnology and nanotechnology reach the maturity necessary to realize those dreams.

One of the first thinkers in the field of modern transhumanism was FM-2030 (15/10/1930 – 08/07/2000). His birth name was Fereidoun M. Esfandiary. He was a well known philosopher, futurist, writer and teacher who made prescient predictions about future social trends and promoted transhuman ideas. He spoke of 3D printing, telemedicine, and post-biological humans. He was cryopreserved and resides at Alcor, where he has been since 2000 and was their first vitrified patient.

Dr Max More took up the gauntlet, writing his PhD dissertation on an examination of transhumanism in 1995. He was the founder of the Extropy Institute, which brought together scholars in areas such as nanotechnology, genetic engineering, radical life extension and other futurist ideas for the purpose of refining the philosophy of transhumanism. He helped found the first European cryonics group, currently called Alcor UK, and is the CEO of the Alcor Life Extension Foundation, where he has done tremendous work both in supporting cryonics, and further refining and disseminating transhuman ideas.

Ray Kurzweil is currently one of the world's foremost transhumanists. He is a futurist, author and inventor. His accomplishments are tremendous, and he currently serves as Director of Engineering at



Google. He popularized the concept of “Singularity” which represents a point in our future where AI (artificial intelligence) will exceed human intelligence, where we will be able to fully merge with that intelligence, and where all points thereafter become impossible to predict. He predicts that such an event will arrive in the next 20-30 years, most often predicted at around 2045.

With Kurzweil at its helm, Google has recently made some very large purchases of AI and robotics companies. They recently also announced the formation of the company *Calico* whose goal is to overcome aging. It seems that Ray Kurzweil is not only interested in predicting the future, but in creating it.

One cannot talk about transhumanism without discussing the concept of the singularity. According to Kurzweil, there exists a law of accelerating returns. This means that growth in areas such as genetics, nanotechnology, AI and robotics will be exponential rather than linear. He envisions that once this growth reaches 2045, it will be so large and rapid, that we will no longer fully comprehend it. Humans will seek to merge with that technology rather than be left behind. They will augment their minds and bodies accordingly

and perhaps even move their consciousness to a newer and more durable substrate. We will reach out into the universe in a manner that truly is “post-human”, rather than human, and then all bets will be off.

Transhumanism is very compatible with the values that cryonicists tend to have. We have an optimistic view of the future and what mankind can accomplish. We have an appreciation for the technology that will be required to resuscitate a suspended member, and realize that the future is infinite, both in time and in opportunities. This essay has barely scratched the surface of the ideas, thinkers and technologies that exist within the transhuman sphere. There is a huge amount of information available to the trans-curious, and I encourage cryonicists to explore these ideas further. Some of it is amazing, some is paradigm-shifting, and some can be very unsettling. It really is up to us, the transhuman and cryonicist world builders to write the story of the future we wish to see. In my opinion, learning about transhumanism has enriched my life and I have discovered that I was one from the beginning and didn't even know it.

Exploring Transhumanism

It is difficult to distill and condense everything there is to know about transhumanism into one essay. Here are some excellent starting points to delve deeper into the subject.

Websites:

<http://www.ieet.org>

<http://www.humanityplus.org>

<http://www.hplusemagazine.com>

<http://www.foresight.org>

<http://www.immortallife.info>

<http://www.singularityweblog.com>

References:

<http://en.wikipedia.org/wiki/FM-2030>

http://en.wikipedia.org/wiki/Max_More

http://en.wikipedia.org/wiki/Ray_Kurzweil

Books:

The Transhumanist Reader: Classical and Contemporary Essays on the Science, Technology, and Philosophy of the Human Future;

Dr Max More, Dr Natasha Vita-More, 2013

The Transhumanist Wager;

Zoltan Istvan, 2013

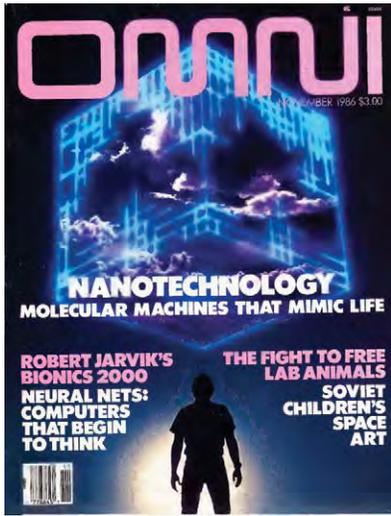
Ending Aging: The Rejuvenation Breakthroughs That Could Reverse Human Aging in our Lifetime;

Dr Aubrey De Grey, Michael Rae, 2007

Transcend: Nine Steps to Living Well Forever

Ray Kurzweil, Dr. Terry Grossman, 2009





PREDICTING THE PRESENT Flashback to 1986

We never know where inspiration will come from, or where it will take us. Almost 30 years ago, a young man was intrigued by an article in Omni magazine talking about the amazing possibilities of an infant science called "Nanotechnology." Fast forward to the present, and Dennis Kowalski is now a leading member of the Cryonics Institute, and just as excited about the applications of nanotechnology as he was the very first time he heard the term.

It's always interesting, particularly for future-minded cryonicists, to look back at what the past has to say about where we'll be today.

Long Life is pleased to present the original 1986 Omni article here. We invite you to take a step back into the past and consider just how far we've come today.

TINY TECH - Meet the ultimate machine. It's one cell large *By Fred Hapgood - Omni Magazine, November 1986*

God, it was depressing. He'd driven hundreds of miles — from the bookstores and coffee shops of Cambridge, Massachusetts, to a cabin retreat in the wilderness of New Hampshire's great north woods. The reason for this pilgrimage three days of brainstorming and the hope that he and his colleagues could explore man's final technological frontier. Fry had barely gotten out of his car, though, when the conversation turned not to the nuts and bolts of this scientific revolution but to its effects: the importance of accidents when life span exceeds 500 years, the ability to monitor thoughts — everyone's thoughts — with molecular brain probes, flesh-eating robot hordes, the collapse of the economy we know today.

By the end of the workshop, Fry now says, a few things were clear "There were a lot of problems coming up fast over the horizon, and nobody was paying attention to them. We decided it was up to us to save the world."

Fry—not Dr. Fry, George Fry or even Aloysius Fry, just Fry—is a computer programmer at one of the several software houses around MIT's Tech Square, where the intense, highly intellectual atmosphere is virtually indistin-

guishable from that of the university itself. When Fry speaks or listens a patina of sly humor glimmers over his face, giving him the air of a goblin. But behind his expression lies a fierce, eclectic curiosity. It was this that drew him, in the winter of 1985, to a series of MIT lectures on nanotechnology—designing and building incredibly precise, infinitely varied machines one atom or molecule at a time.

The talks were given by K. Eric Drexler, then a research affiliate at MIT's Space Systems Lab. Drexler has a nervous affect, a shock of auburn hair, and conspicuously expressive eyebrows he has been told to keep under tighter control. His revolutionary ideas have caused some critics to say his bent for science fiction is extreme. But when Fry heard him speak in the somber MIT auditorium that frigid January evening, he glimpsed a visionary whose ideas would catapult us, remarkably changed, into the twenty-first century.

Speaking before dozens of MIT students and professors, Drexler explained that the term nanotechnology is derived from the word nanometer — a billionth of a meter, or about ten times the diameter of a hydrogen

atom. Nanotechnology is simply technology built on the atomic scale.

These days, Drexler said, machines and products are constructed with quadrillions of atoms at a whack. The clothing we wear, the jet planes we fly, even the minuscule integrated circuits that drive our computers are all thrown together in crude approximations of the absolute perfection achieved in the molecular realm. Indeed, at first glance the notion of building machines as fine-tuned as, say, a water molecule or a strip of DNA seems implausible. But this, Drexler declared, is exactly how most things on Earth are made. Almost every ounce of the huge weight of biomass that covers our plane! is made of cells, and cells work by building structures one atom or molecule at a time. We fight off disease, for instance, when our immune system generates hundreds of different and wondrously complex molecules known as antibodies. If nature can do it, why can't we? "The first assumption of nanotechnology," Drexler insisted, "is that we can. Humans will soon be able to manipulate molecules as deftly as the living cell does."

Indeed, according to Drexler, an obvious



application of nanotechnology is “the cell-repair machine,” which would drastically extend our life spans and improve our general health. The remarkable devices “would enter tissues, identifying and destroying bacteria, viruses, cancer cells, parasites, blood clots, and deposits on bacterial walls.” Once injected into the cells, the devices would subject DNA to error-checking tests far more exhaustive than those now imposed by the body itself. They could then repair whatever errors or anomalies they might find. If we wanted to replace a scar (laid down before cell-repair machines had been invented) with fresh tissue, Drexler added, it might be possible to do that, too. “Cell-repair machines,” Drexler told his audience, “can be viewed as an upgrade of the biological processes already at work today.”

But nanotechnology would not only improve upon the immune chemicals and DNA-repair enzymes laid down by nature. It would go beyond biology.

Consider, Drexler said, what a tiny fraction of the range of engineering ideas natural selection has chosen to adopt. The wheel, to pick a really basic example, hardly appears anywhere; neither do toothed gears, the block and tackle, or the screw and cam. Natural selection based the structure of life on just four elements — hydrogen, oxygen, nitrogen, and carbon—instead of the 100-plus elements known to man. And living creatures make little use of the direct current associated with wires and electronics. Whatever electrical systems they do use seem easy to improve on. (Copper wire, for example, is 40 million times more conductive than neural tissue.)

In light of all this, Drexler said, combining engineering concepts with the precision, durability, and blinding speed of molecules would revolutionize civilization. Suppose, for instance, that nanoengineers built rotary hammers just a few molecules long. We might use them to hit carbon atoms at just

the right angle with just the right force—like a pool player putting a ball in the pocket— so that they formed diamond rods. Both man and nature now make diamonds in the imperfect form of lumps and grains. But perfectly regular, tight-knit diamond fibers would be ten times stronger than steel for each unit of weight, and their importance for the construction and aerospace industries would be incalculable. “To mention just one application,” Drexler said, “space shuttles woven from these fibers would be so lightweight that the price of space travel would sink to that of air travel in general.”

A whole range of molecularly perfect materials from plastics to metals would render structures lighter, stronger, and more durable than ever thought possible. But nanotechnology wouldn’t just lead to better structures; it would also change our notion of just what a structure is.

“The members of many species of social insects — the army ants, for instance—sometimes group by the thousands to form artifacts like bridges and chambers and insulating blankets,” Drexler explained. “These artifacts then serve the purposes of the colony as a whole. It is possible to imagine, given this model, a material composed of very large numbers of mobile units that could form any shape with any given color or texture: a raincoat, a bookcase, a bathtub, a bicycle. These mobile units would hold a particular shape until you told them what to turn into next.”

Drexler even came up with the mechanism through which such chameleon structures would work. “One would begin by designing the desired object on a computer,” he said. The computer terminal would be connected to one of several trillion nanomachines, each perhaps as large as a bacterium. That first tiny machine would take on the shape dictated by the computer and then communicate the design to the machines sur-

rounding it. “Each nanomachine might be connected to adjacent units through twitch cables just an atom thick,” Drexler proposed. “These cables could twitch a billion times a second, propagating the design through millions of nanounits in no time at all.”

Finally, Drexler proposed the controlling force behind all of nanotechnology: the nanocomputer itself. The nanocomputer, Drexler said, would work by clamping and unclamping one-atom-wide rods. Memory would be stored in long molecules. The presence or absence of certain chemical “side groups” along these atoms would represent the elements of a binary code. Such a machine, he thought, would have the power of the largest contemporary mainframe but would run about 100 times faster and occupy a thousandth the volume of a body cell. It would provide the intelligence for the nanomachines.

Sitting in the audience, Fry was drawn to Drexler’s sweeping vision. He was captivated less by the Twilight Zone aspects of the talk than by the engineering challenge itself. “The point,” he now says, “was to see just how large a fraction of contemporary engineering techniques might work in the molecular domain. All I had been thinking about was computers, and this seemed like an excuse to go beyond. So when I heard about Drexler’s workshop in the north woods, I decided to go.”

But despite Fry’s desire to immerse himself in the nitty-gritty of the technology, Drexler had an agenda of his own. The difference was, Drexler had been thinking about nanotechnology for years.

Drexler dates his interest in molecular engineering back to 1976, when, as a graduate student in engineering (What sort of engineering? “Oh, generic engineering,” he says), he decided to see what might be involved in building a biochemical computer. A biochemical computer would have to be built molecule by molecule, so Drexler took a few



textbooks on molecular biology out of the MIT library.

Such texts are written by research scientists — organic chemists, molecular biologists, geneticists — whose goal is to understand how the cell works. Drexler, as an engineer, and a generic engineer at that, was impressed instead by the engineering versatility of the molecular realm. Atoms always perform to specifications. One atom can rotate around another for the lifetime of the universe without showing wear. They don't rust, rot, get dirty or wet, or indeed ever require any sort of maintenance. You can use them over a very wide range of combinations, circumstances, and time spans without altering their properties in the least. The atomic constituents of a molecule will clasp each other with the exact same degree of force forever, assuming they are not blasted apart by a cosmic ray.

Further, atoms seem to want to make things; they snap together like Tinkertoys in highly defined, very stable structures. For a lot of molecular structures, once tab A and slot B get anywhere in each other's neighborhood, they will pounce and couple automatically. And the smaller things get, the faster they move, both because the accelerating impulse takes less time to travel from one edge to the other and because as parts shrink, they're better at resisting stress. A lever a few thousand atoms long, for instance, should be able to wave back and forth 50 million times a second without snapping. And the energy required would be minute.

Finally, when you build something atom by atom, you can build it right. Practically everything in our world, the macroworld, is shot through with impurities, dislocations, gaps, and cracks. When you get to specify the location of every atom, everything you build is just as good — just as strong, just as flexible — as theory allows. And the potential applications are limitless. If you work on

that level you can build anything, because all anything is, ultimately, is just a particular arrangement of atoms.

"Atoms and molecules are the ultimate building components," Drexler now says. "In 1976 this struck me as an awesome revelation. I'd found engineer's heaven."

Drexler's visionary gift, his ability to fathom the unimaginable in a leap of psyche and faith, blew him right out of his doctoral program and into his current career. Today, while supporting himself as a communications consultant in Palo Alto, California, he spends his free time publicizing nanotechnology's benefits and warning of its risks. He is essentially a combination Johnny Appleseed and Paul Revere, The MIT lecture that had intrigued Fry was delivered by the Appleseed side of Drexler — the fervent optimist spreading news of technical fruits to come. The recent New Hampshire retreat, convened to warn of nanotechnology's dangers, was led by a Cassandra, by Drexler/Revere.

"He took a large sheet of paper," Dave Forrest, an MIT graduate student in materials science, remembers, "and asked us to list fields of endeavor. Which we did: fashion, food, sculpture, architecture, war, communications, transportation, mining, religion, music, art, poetry, friendship, education, property rights, and on and on. Then he asked us which of the things on this list would not be affected by nanotechnology. Virtually everything we had named was going to get changed, usually a lot."

For instance, what are the likely social and economic consequences of construction material that can take on any shape or form? In theory a consumer could buy a few hundred pounds of the stuff, and that would be it; all he'd need to buy thereafter would be designs (probably encoded in nanocomputer software) for his material to make. How would our economy deal with that? Our status hierarchy? How many of

our ideas about interior space have to do with the need to maintain objects, like chairs, so that even while unused they are conveniently at hand? With a universal material, existence is defined by use: Something not being used, like a room with no one in it, will not need to be there at all.

And that's just the beginning. There is, for example, the horrifying instance in which damaged nanomachines go awry. Drexler calls these flawed machines "the gray goo." In the worst-case scenario of the gray-goo problem, lethal nanomachines will reproduce to infinity, and life on Earth will end.

To truly understand the gray-goo problem, Drexler adds, we must comprehend one of nanotechnology's greatest challenges: gearing up for mass production in the first place. Whatever nanotechnology's other advantages, it's obvious that just a single cycle of a molecular process does an incredibly small amount of work. Filling a glass of water at the rate of one water molecule a second, for instance, would take more than a billion years. This might seem like a strong argument against nanotechnology, but the problem can be dealt with:

Each day the biosphere, the aggregate of biological processes on the planet, makes hundreds of thousands of tons of biomass. Every gram is tooled out by molecular manufacturing.

Two strategies allow mass production to occur. The first strategy is hierarchical mass production: the mass production of factories, which then mass-produce products. An example of this is the body's ability to produce millions of cellular-energy factories known as mitochondria, which, over the course of a lifetime, generate molecular fuels that help the body work.

The second strategy — the hydrogen bomb of production technologies — is known as replication. In the process of replication, molecules (such as DNA) are programmed



to assemble themselves and, ultimately, to reproduce. If a nanofaucet that released only one molecule of water a second could also replicate every 30 minutes, Drexler calculates, it and its progeny would fill a cup in less than two days and all the earth's oceans in less than three.

According to Drexler, most nanotechnology manufacturing facilities will come with replicability bundled in. This has several consequences. And over the three days of the retreat— walking under the great pine forest, talking over eggs at breakfast, murmuring at night from one mattress to the next— the young engineers and programmers worked them out.

Replicative cell-repair machines could generate enough units in a month to assess the health of every cell of every human alive. Replicative space probes, nibbling on asteroids and sunlight, would allow us to explore systematically every star system in the galaxy, Replicative waste processors, diffusing through the earth's crust and oceans, could search out every toxic-waste site and garbage dump in the world and detoxify anything remotely poisonous to any living thing, Replicative "miners" could inspect every cubic centimeter of the planet. And replicative nano-vacuum cleaners, programmed to gobble molecules of carbon dioxide, could — in just a few weeks— reverse the global warming trend that CO2 will cause,

Replication would also lower the cost of manufacturing to almost nothing. A civilization that decided to buy one nanofarm a device that could assemble any specific food [Beluga caviar, pumpnickel bread, potatoes Anna] out of sunlight, water, air, and dirt— would find thrown in at no extra cost enough food to feed everyone on or off the planet. That is fine as far as eliminating hunger goes. "But how on earth," Drexler the worrier asked, "could our economic system adjust to a manufacturing technology

that destroyed the cost structure of whatever it made?"

He had concerns about the political ramifications, too. "Nanotechnology," he said, "would lead to surveillance technology par excellence." Tiny snoopers could follow us everywhere, even perch in our brains and look for suspicious neuron activity. Crime could be eliminated entirely — and you don't have to be an anarchist to see what a mixed blessing that would be.

The nature of war, Drexler asserted, would change as well. Nations might try to steal one another's rare atoms, the only valuable resource left to fight over, by deploying huge fleets of concentrators through the soil. The targeted nations would presumably resist by building nanotech defense systems extending hundreds of miles down into the earth, leading to great battles deep in the lithosphere. "We came up with a huge list of things," says Kevin Nelson, a Boston-area science educator who participated in the New Hampshire retreat. "The villains included insidious saboteur bacteria that would infect the industries of competing nations, making them slightly less efficient or more prone to breakdown; billions of replicating flesh-eating locusts spreading over a battlefield; and behavior-modification units that would spread through the air, pass through the skin, and migrate to the brain."

But perhaps the most frightening aspect of nanotechnology was the gray goo. Suppose a little imperfection — perhaps a bug— were introduced by a terrorist at the time of manufacture. Such tampering could cause nanomachines to multiply until they had destroyed everything on Earth. "Nanoplants with leaves as efficient as solar cells, could outcompete real plants, crowding the biosphere with an inedible foliage," Drexler said. "Tough, omnivorous nanobacteria could outcompete real bacteria, reducing the biosphere to dust in a matter of days."

"The people on this retreat were sober, sensible, and competent," Nelson says. "To see them all agree that this stuff was going to happen, that these problems had to be dealt with, was a powerful experience. It made it seem real."

At the end of the three days Fry put it best. "Eric," he said, "this is a terrible thing you've done, bringing us up here, telling us about all this. Now we have to do something about it."

What they did, of course, was form the Nanotechnology Study Group at MIT, The dozen or so members of the society sponsor lectures, maintain an archive of research materials, and meet twice a month to prepare for the nanorevolution to come.

And if Drexler's timetable is correct, that revolution will be here soon. "We should make the transition to the nanotechnological era in just twenty years," he says, "plus or minus ten,"

We are, as an industrial society, just beginning to see benefits from such molecular technologies as genetic engineering and protein design, he says. Each new advance takes us closer to nanotechnology's goals: miniaturization and the ability to build things in the molecular realm. Drexler is confident that progress will accelerate as each successful step down allows the construction of tools, especially research tools, to facilitate the next. "Faster computers will solve the engineering and design problems required to build even smaller, and therefore faster, machines. They'll also be able to simulate more complex molecular configurations, aiding advances in biotechnology. And advances in biotechnology will generate tools and enzyme probes that help researchers to understand and build ever more elaborate molecular systems," he says.

Much of the replication technology, he adds, is already in place. The molecular mechanisms installed in plants and animals

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The Legacy Continues

Long Life magazine continues to feature thoughts from the prolific pen of Robert Ettinger, the Father of Cryonics. Ettinger's thought-provoking writings from years past continue to be relevant to today's cryonics movement, giving a glimpse into how far we've come today and where we can go tomorrow. This particular submission is from the September 1986 issue of The Immortalist (which was the former name of Long Life magazine).

In 1994 Robert Ettinger was invited to give a talk about the origins of his book The Prospect of Immortality. He talked about that, as well as other topics such as the early cryonics movement, the present situation as it existed at that time, and other matters. This talk was first published in the Alcor magazine Cryonics (3rd Quarter, 1994). It was transcribed at the time by Dr. R. Michael Perry. It was then republished, slightly edited, in the April 1995 issue of The Immortalist, which was then the name of Long Life magazine.

In this talk Mr. Ettinger gives an excellent review of how cryonics came to be, both in his mind, and in general, and spoke about some problems that faced the field back then, some of which are still present, to some degree, today. The clear headed thinking that dominated Mr. Ettinger's approach to the field he basically founded is also quite noticeable in this speech.

The Past, the Present, the Future, and Everything: Robert Ettinger's Presentation to the 1994 Sixth Annual Venturist Festival

PART TWO

(Continued from last issue)

Despite the slow start, the movement did continue to grow, and in recent years, largely because of the energy shown and publicity obtained by Alcor, it began to grow faster. Another factor is that the scientific climate is gradually becoming better. Every year, almost every day, you hear of breakthroughs in science, or advances at least in technology, that make our position more credible. More and more marvelous things are happening, more disease are being

cured, et cetera. I thought it was obvious; in fact I've written a booklet, based on probability theory, that our chances of resuscitation by future technology are good (although unfortunately this kind of argument doesn't cut much ice with most people). A few years ago, too, however, starting around 1987, we got the scanning tunneling microscope and a lot of parallel technologies. We now can image on a molecular and atomic basis, and in some cases even manipulate individual atoms. All of this gradually builds up and people begin to think our aims and chances of success are more reasonable.

So, at present what do we have? We have several organizations, or groups of organizations. There's Alcor, of course, the largest. There's Cryonics Institute, the second largest. (Incidentally, a lot of people don't seem to realize that, and in one way CI is actually the largest--it has more full body patients than anyone else.) Then there's American Cryonics Society, which does not have its own facility but is a signup and overseeing organization. You also have Trans Time. Then of course there's the new group of organizations that Saul Kent, Brenda Peters, Charles Platt, Mike Darwin and others have formed. These are centered around CryoCare, which subcontracts with other organizations, particularly the new ones they've formed, BioPreservation and Paul Wakfer's CryoSpan (the new CryoSpan, not the old, new York, 1960s organization).

There have been some fairly nasty mistakes in the past, of one kind or another, but those appear to be mostly over now, at least the worst. And it's probably also true that, for the most part, the organizations offer options sufficiently different that it doesn't make sense to put great effort into direct competition. (This is so even though ACS and CryoCare are both subcontracting and overseeing organizations.) If we merely let the public know we are available, the differences are sufficient that most of the prospective members or customers can simply see what options are available, and choose the ones that suit them best. I think that's probably what's going to happen.

Cryonics Institute is going to take a higher profile pretty soon, I think. A major reason few people know about us is that in the past we've kept a fairly low profile, mainly because our facility doesn't make a good impression. It's a small building, and neither the building nor the location are the kind to brag about. We haven't had any problems there; we've never had a break-in or attempted break-in, but nevertheless it's not impressive.

We have a verbal agreement, which we'll be able to formalize this week, to buy a building in one of the exurbs. It'll be much larger and nicer, and at that point we should be able to raise our profile and get a little publicity--which I think will help everybody.



Now--what about the future? First of all let me emphasize that, in my opinion, we are irreversibly on a growth trend. We have survived. We are gaining momentum, although not a tremendous amount so far, but the tide is with us. The tide is coming in, and as I suggested before, every day our position becomes more credible. The public and the media are becoming more friendly, and I don't think it's possible for this trend to be reversed. The organizations are going to be making it a thing to consider. Whether some of us as individuals are going to make it, is another story.

That's where we have to refigure. There are several aspects to this, and of course I can't in one short evening offer even any complete suggestions let alone complete plans of action. But I do have a few thoughts. One is that Hugh Hart recently sent me a clipping about a number of psychologists who have been looking at the way people make important changes in their lives--the way, for example, they give up smoking or something else that is bad for them, or do something that is good for them.

They found that people rarely do it on an instantaneous decision basis. Now it does sometimes happen. Saul Kent, for example, tells me that he sacked out on a beach and read my book in one afternoon, and that was it. He was instantly converted, became an activist, and still is. It's happened to a few other people. On the other hand, for some of our best people, it took much longer. Walt Runkel, who was our Vice President for many years, one of our mainstays, now one of our patients, attended several Immortalist Society meetings over a period of a year or more before joining. And so on. It's not a matter of intelligence. You can't pin it down, you don't know what the psychology is. But in any event, some people are swift, some are slow.

The psychologists quoted in this newspaper article found that for most people it was

very, very slow. It consists of several stages' they gave them names (like Kubler-Ross gave names to the stages of dying!). They called them: precontemplative, contemplative, preparation, action, and maintenance. They said the first two stages took the longest, sometimes several years each, and furthermore, many people, perhaps most, had to go through the whole cycle several times. So what I'm saying is that it's not unusual for it to take a long time for people to make this change, and in light of the revolutionary character of the change we're talking about, it's even less surprising.

We can look at this in a couple of ways. We can be negative and say, "In thirty years, look how little we've accomplished: only fifty people frozen worldwide, fewer than a thousand active members--how could we have done so poorly?" Or we could be more positive and say, "We're looking at the most profound revolution in human history. We're looking at the overturning of thousands of years of evolution and acculturation and tradition, and nobody's been lynched. A miracle! We did better than the Bolsheviks and Mensheviks!"

Incidentally there was something on the Cryonet the other day. Somebody said that the real enemy was "the People's Front of Judea." This was a reference to an old Monty Python movie where the Jews were in revolt against the Romans, but there were two separate revolutionary groups. One was called the People's Front of Judea, and the other the Judean People's Front. They both hated the Romans, but they hated each other more. Draw a parallel if you wish. [Laughter]. Anyhow, I think we're past the point of the Judean People's Front.

What I'm getting at is, among other things, don't make the mistake of assuming that because there's so little showing on the surface, nothing is happening. People who are in the precontemplative, contemplative and preparation stages--there are lots of them. We don't know about them, but they're

there. We've had lots of publicity in the past. Millions and millions of people know a little bit about cryonics. Millions and millions have it in the back of their minds that someday they're going to do something about it.

Always all this stuff is growing and fermenting below the surface, and someday it's going to break through, it's going to show. There's going to be some psychological trigger at some point. We're going to grow, at a moderate rate, hopefully at an increased rate, and at some point there's going to be some trigger we can't identify in advance and won't even be able to discern in retrospect, but nevertheless it will take effect. And there'll be an explosion of activity.

What can we do to help it? I think we have to think of at least two main problems--There are many of them, but let me point out two. One is that we have to look at the people who are not involved at all, how to get them involved, and the second is how to work with the people who are involved, and escalate their degree of involvement. With respect to the first, going back to this phrases of change business, I think we may have focused too much, too exclusively on the rational side of it. People don't make decisions, for the most part, on the basis of logic or rationality. People make decisions on the basis of emotions, of feelings--they believe what they want to believe.

Our problem is to persuade them that they should want to be revived--that's all. After all, that's all the churches do. That's all that most ideologies, movements or parties do. They persuade people that they ought to want, and do want, what the sellers ostensibly have to offer. And you do that not by logical arguments, you do it by offering camaraderie, companionship, social contacts, interesting people to talk to, supportive people to be with, friends, laughter, jokes, music, dancing--all that kind of thing. I mean, why do people go to political parties and help with mailings? Because they think one politi-



cal policy is better than another? Not very often!--or very much.

They do it because they have friends there, and they enjoy it. It makes them feel good. They salute the flag, get prizes, get pats on the back and other bonuses. People believe what they want to believe, as I said, so our job is to make them want what we offer.

That's one side of it. We've done some of that but not enough. Most of the people already in cryonics are motivated mostly by logic. And a lot of our people are really not social animals. I'm not a social animal. I don't have any charm, any small talk--I can't tell people I encounter that I'm fun to be with--I'm not except with my wife maybe. [Laughter] But there are people who are more sociable: Steve Bridge, Davie Pizer, and among our own people, Rich Davis, one of our directors--there are lots of people like that. So that's what we need more of, to get more outsiders involved, and more of our personable people.

Now, how about the people who are already involved, but haven't done much? I guess for them you've got to use reason a little, but mainly you've got to get their attention. Because what they've got to understand is that even though they have a chance now, it isn't the best possible chance. To have the best chance we need more numbers, better technology--a lot of things. If they can help improve that, according to their means and abilities, they should. Some people, of course, are fanatics and work 26 hours a day, and are self-starters--but most are not. Most tend to let somebody else do the work who wants to, and do not contribute any more than they feel obliged to. What they must be made to understand somehow, is that their personal chances depend to some extent--the exact amount is unknown but is certainly non-zero--on how rapidly we grow and our capabilities improve.

For example, let's consider research projects. What projects are we doing? In terms of

actually improving the biology of suspension procedures, most of you know, for example, that the Cryonics Institute did sheep head research a couple of years ago, and we did it by methods that according to Greg Fahy have not been done before. One principal difference was that we used an immediate, high concentration of glycerol rather than starting out with a low concentration and going up. We sent our specimens through one pass of the circuit, then cooled them down very slowly, much more so than others have done. We typically take a week to cool down to dry ice temperature, and another week to cool to liquid nitrogen temperature. The result? We found that at the naked eye level there was no cracking in the brains, and we got good reperfusion after rewarming from liquid nitrogen temperature, and no apparent leakage in the vasculature. This contrasts with results that others have reported, of cracking at all levels, from the naked eye down to the electron microscope. Many people think this cracking is the most serious problem we have.

What could account for our apparent results? There are three possibilities. One, of course, is that there is cracking, but it's at the microscopic level, not the level we've seen. Another possibility is that there is no cracking but there's some other kind of damage with our method that more than offsets the lack of cracking. And a third possibility is that it really is a better method, we do avoid cracking, and it's easier than we thought--that would be a kicker, wouldn't it? Anyhow, we're working on it; we have a team of Ukrainian scientists working now.

There is Dr. Yuri Pichugin, a cryobiologist; and Prof. Gennadi Zhegunov, who was recently appointed Chairman of the Department of Biology at Kharkov Medical University, a prestigious position. They have completed the first phase of their work; by September they expect to have either confirmed our results or not, and to have extended them, and studied the results in much more detail

than we were able to do. So that's somewhat hopeful.

There's also a Russian team that may do the same thing. Alcor is going to try to repeat those experiments also, but they haven't done so yet because they had a problem obtaining fresh sheep heads in the Phoenix area. I would like to see all three groups, the two European ones and Alcor, repeat our experiments, and of course if they all agree on the results, that'll settle it one way or the other. If they disagree, there'll have to be more work done.

So there's a big field there. Regardless of what happens, even if it turns out that our procedure is better than the others and does avoid cracking, it still isn't perfect. We'll have to try to revive the sheep brains after that, but my guess is that they would not be capable of being revived, even if the procedure did avoid all cracking. There'll be lots of further work to be done, and of course there's need for a lot more money to support it. I'm told that at the present time in Russia a scientist or researcher gets about \$300 a month and in the Ukraine about \$100 a month. We can get the work done there a lot cheaper than here. Another possible advantage, by the way, is if these Europeans start turning out reports that are published in scientific periodicals. The American cryobiologists who have been so negative all along may be given a little edensitz--a jab in the rear.

So the biological research does need a lot of initial support. There will need to be a lot more of it. It has been going on at Alcor and it will be again. It's going on at BioPreservation. We'll be doing some more of it ourselves, in our own new building. (We've had to call it off temporarily because we didn't have the space for it anymore.) And then the Europeans are going to be doing it, and all of this is going to need money.

The other very obvious and very important area that needs to be funded is the panic button. Some of you probably know that for



about \$400 you can buy a navigation system that uses satellites and will inform any sportsman, explorer or whomever exactly where he is at any particular moment. It'll give the longitude and latitude within a few yards, anywhere on earth. I read recently about a college in New England that uses a system like this, but they also had it hooked up to a computer, and had the campus mapped out in coordinates. Any student, for only \$300, could have a panic button. If pressed it would inform the computer and headquarters personnel would instantly know exactly where he or she was, generally what room, what floor. They could get the police there within minutes or sometimes seconds.

Some of you know that one of our own people, Jack Erfurt, our Secretary for many years, died a year or two ago, and we didn't know it until several hours later. He died at home of a heart attack in bed, and wasn't

found for several hours, a very bad deal. I'm not saying he has no chance—he does have a chance—but several hours of warm ischemia isn't good.

So, for our purposes we really need something better than the simple panic button. It would be a good thing for people who are homebound or bedbound: If they had the consciousness and strength to press the button then help could be sent wherever they were. But most of us, who move around a lot, need something better than that, and we also need something like a dead man's switch that won't have to be pressed but will activate itself. What we need is something that uses existing technology, and is adapted to a wrist monitor, that will activate itself when the pulse stops, and will locate us by map coordinates and by street number in the country. An off-hand guess is that it would cost a few million dollars, considering both hardware and software. (and the hard-

ware would be almost trivial; all of it already exists in one form or another.) The software part of it, mapping the whole country so that from the pulse you send out, the appropriate local agency will know exactly which address to go to, will cost money and take time. But it's very important.

These, then, are some thoughts on the cryonics movement: how it started, my own involvement, where we are now, where we ought to be heading, what to expect in the future. In closing, I'll consider a line from the Epic of Gilgamesh, of several thousand years ago. Gilgamesh wanted to be immortal, and make everybody immortal. he flung down his challenge and said, "I will break the door of Hell, and smash the bolts; I will bring up the dead to eat food with the living, and the living shall be outnumbered by the host of them." And I say, "Go for it, Gilgy."

Meet yourself - continued from page 16

perhaps impossible even with the help of all the King's horses and men.

Further information on Lichtman's technique:

<http://ic.epfl.ch/page-95508-en.html>; <http://www.npr.org/2011/11/04/142024614/peer-ing-into-the-brain-but-at-what>; Popular Science, The Master Code, May 2014 page 59

I recall an interesting conversation when an ACS (then BACS) member suggested a similar technique to Art Quaife and this author quite some time back, perhaps in the late 1970s. He identified the fact that heat would be produced during slicing and thought the heat would seriously damage the material thus sliced. From reading information on Lichtman it is not clear how he is getting around that problem.

Splitting the Brain. Ettinger's Thought Experiment Number 6 in Chapter VIII of

The Prospect of Immortality discusses the split brain experiments that neurologists and psychologist have engaged in for many years. Professor Ettinger points out that in a living person the brain cannot currently be split "all the way down" (through the brain stem, for example). Since the two cerebral hemispheres of the brain are thought to be the agents of memory and personality, for the purposes of this discussion, that fact may not matter much. In discussing split-brain monkey experiments Ettinger cites a study by Dr. C.M. Trevathen and quotes ". . . the surgically separated brain halves may learn side by side at the normal rate, as if they were quite independent." (full references to this study are in "Prospect")

Since some methods of retrieval of information from the brain may be destructive of some or part of the organ itself, perhaps only half of the brain could be used in such destructive retrieval processes, leaving the

other half to be treated by alternate retrieval process that are less destructive but where only limited information can be retrieved? For example, using the brain slicing techniques of Dr. Lichtman the right brain might be sliced and the thin slices scanned but the left brain retained in a frozen state in the hopes of better techniques being available in the future.

On the Island: In 1719 Daniel Defoe published his famous book *Robinson Crusoe*. It has been widely published and distributed since that time. If the edition of *Robinson Crusoe* at your public library were to be destroyed in a fire, the book *Robinson Crusoe* would continue on because there are so many other copies of the book world-wide. It would be a simple task for the librarian to order another copy.

Such examples have been cited by advocates of whole brain emulation as illustrations of their concept that information can



be equated to self. Let's push the example to another logical step.

Suppose there actually was a shipwrecked (castaway) sailor on a desert island along with his faithful dog spot and a man he named Friday who he rescued from cannibals. He has no companions and few possessions. Among those few possessions is a copy of Defoe's book *Robinson Crusoe* which the sailor treasures and reads again and again. One day while our castaway is off digging clams the dog Spot eats the copy of *Robinson Crusoe*. It is gone forever, no longer available to the sailor.

Unlike the copy of the book at your public library that is destroyed in a fire the copy of the book on the island cannot be replaced. Even though there are many copies of *Robinson Crusoe* in many parts of the world, and the fact of the destruction of the copy on the island would make little difference to you (the outside observer) there are no other copies on the island and the sailor cannot leave the island. To the inside observer, the sailor, the book *Robinson Crusoe* is gone forever. He may endeavor to reproduce portions or even all the book from memory but unless the sailor has a photograph memory, any such attempted reproductions, when compared to Defoe's work, will be quite incomplete.

Considering the book *Robinson Crusoe*, as a rendering of information in a media or substrate we see that whether or not one can say the book was destroyed depends upon the various individuals' ability to access the information in the substrate, or for that matter any information that contains the contents of the book in any substrate. To the outside world, it matters little if a single copy of the book is destroyed. To the sailor on the island the destruction of his copy IS the destruction of the book. The question of whether or not the book is destroyed depends upon the position of the observer. Is the observer an inside observer or is he

or she or it ("it" in the case of an intelligent machine) an outside observer?

Having a "self" without the help of a frozen brain. As you read this article and the rest of the content of this issue of Long Life magazine, your brain creates and stores memories of the experience. Later you will likely be able to recall the article to a greater or lesser extent. However, the information from the article, besides being stored in your brain is also stored in the article itself. So if your memories of the article were somehow destroyed or could not be accessed, the knowledge that you had read the article would allow you to go back and read it again and create new memories. It might not matter much to you that you had once had such memories and had lost them and then had them restored through reading the article again.

An advanced computer with a sophisticated computer program could, perhaps, aid your recovery of the memory of your original reading of the article by putting it in context of what you were doing in life when you first read the article to produce a second memory more like the first than you would do without such help.

Given a new brain, created sometime in the future, as a tabula rasa could we possibly use information from the world outside your present brain to program that new brain so that any reasonable claim could be made that the person who possessed that new brain was "the same person" (an identity) of you?

There is certainly plenty of information around that tells of you and your times. You can also make a concerted effort to record memories, feelings, attitudes, your thoughts about various subjects. The sophisticated computer and program that in previous writings I have referred to as a "Sherlock Holmes Computer" could use deductive reasoning to fill in the many blanks so that, to your friends and family, the you with the former

tabula rasa brain would be your same old dumb self!

This idea is one of those concepts that lots of people, especially cryonicists, have advanced and discussed many times going back to the penning of *The Prospect of Immortality*. For example, this author wrote of the Sherlock Holmes Computer in the book *Being Human* (Agincourt/Marsilio, 1999).

Presently this media-unspecific compilation and organization of extensive personal information is championed by the well-financed Terasem Movement which has made it possible for anyone to record memories and memorabilia in what the Terasem advocates call "mindfiles" with the express purpose of using that information to create (or recreate?) a self, by use of future technology "mindware". Terasem as expressed by TMF, Inc. (see link below) promises to keep the mindfiles safe into the indefinite future, until you or your agents call for them even if that time is 500 years from now! It is difficult to overstate the importance to cryonicists of such a commitment, and I urge all to consider the advantage of this opportunity for personal information storage. <http://www.terasemmovementfoundation.com/>

The clash of differing ideas of what the "self" really is.

It may be that no matter what cryopreservation techniques we use in the near future there will be such a separation in time and space between the old and new "self" that we cannot reasonably claim that the person reanimated is the same person who was frozen. We pursue the prospect of immortality, with no guarantee we will attain that prospect.

It is clear that individual cryonicists have very different ideas on what techniques should be allowed to reanimate or reconstitute the self.

Perhaps we should not trouble our feeble little minds over such questions. Leave it to



future cryonicists to figure out, or perhaps more likely, future intelligent machines (AIs).

The quest for immortality, or at least a good long life of perhaps thousands of years, involves many individual choices. In cryonics we seek to anticipate the future and make present choices or take present action based upon that anticipation.

Examples of disagreements concerning reanimation and identity.

1. The XYZ Artificial Intelligence Society ("XYZAI"), of which Jack Jones was a member, asks CI for access to Jack's frozen person for the purpose of identity reconstruction. XYZ assures CI that the scanning techniques to be used will do no physical harm to Jack.
2. XYZAI wishes CI to provide it with half of Jack's brain for slicing and scanning but will return the half brain to then be frozen for future versions of Jack.
3. XYZAI brings CI to court and argues that reanimating Jack with the techniques CI is willing to use are not possible but the information in Jack's brain can be accurately read out and used to program a machine version of Jack.
4. Jack's relatives take CI to court and demand that his body be handed over to them based upon their contention that when Jack was frozen CI was basically a cemetery and under cemetery law the relatives have the legal right to the remains. The relatives promise to reanimate Jack using techniques that characterize as "memory transfer."
5. A machine entity that claims to be an analog of Jack brings suit against CI to gain access to Jack's remains in order to improve the analog's fidelity (become a closer version of Jack).
6. The association of Jack Jones Identities made up of fifty Jack Jones' created

from information about Jack bring suit against CI to force CI to reanimate Jack in accordance with generally accepted practices based upon information theory.

7. There is spirited disagreement among CI members concerning which methods of reanimation may be used. One group accused the other of plans to "murder" frozen members by applying unacceptable reanimation techniques. The other group claims that the first group does not understand what identity means at all and that if it had its way no one would ever be reanimated.
8. A trust set up by a frozen member defines reanimation or "self" in a way that the Directors of CI find unacceptable. The trustees bring suit to enforce the trust and to force CI to reanimate the subject or to hand him over to another entity that will.
9. 9) An anti-cryonics association asks the court to prevent the reanimation of Jack Jones based upon documents that Jack signed when he enrolled in the CI program. Lawyers for the anti-cryonics group argue that the definition of cryonics and reanimation stated or employed in Jack's paperwork requires that only what they call a medical repair be utilized.

Making Your Wishes Known. What the future CI Directors will do, or a court, or a future AI (perhaps post-singularity!) making decisions concerning your reanimation may depend upon what instructions or lack of instructions you have provided. Whether you wish to put absolute restrictions or conditions on the techniques that may be used for reanimation, simply state preferences. or specifically allow some of the techniques that information theorists suggest, it is best to make a statement on the subject. This can be in the form of writing or by just setting down in front of a video camera. Any

instructions should be clear and consistent and when left in more than one document such as both a will and a trust, be consistent between documents. If you simply wish to empower future CI or ACS Directors, or to make such decisions that fact should be unambiguously stated.

The Politics of definitions of Self. Perhaps this kind of discussion will be purely academic to the wise old men and women (or AIs) of the future. It is far from that now. In cryonics societies where the Governors or Directors are elected, it behooves the electorate to know that the people who are elected to run the society know enough about cryonics to realize ideas about and the definition of self will determine what reanimation or identify reconstruction methods are used. Such considerations are NOT simply to be shrugged off for future consideration. Remember: in cryonics we seek to anticipate the future and make present decisions based upon those anticipations. Decisions such as how we spend research money depend upon just what we regard as the self.

I began this discussion with the specter of you meeting yourself coming out of the cryostat. I don't think that is necessarily a bad thing for me at least, unless I find that the version of me on the outside has spent all my money! But just in case, I (as the person coming out of the cryostate) intend on sticking my tongue out at the me who is there to meet and greet the me on the inside, unless of course my tongue is still frozen to the roof of my mouth!



Tiny Tech - continued from page 22

might at first be used as major machine components. Genetically engineered bacteria could be used to make even more sophisticated components. In another approach high-precision fabrication tools can make the parts required to build smaller high-precision fabrication tools; and that cycle could be repeated again and again. It's even possible that minuscule needle-tip sensors, already used to "feel" surfaces at atomic resolution, can be adapted to assemble or cleave molecular machines directly.

"There's an important difference between the line of advance and the line of sight," Drexler says. "The line of sight is the most direct way of seeing that a destination exists. The line of advance is the path we will actually follow in crossing what may be a rugged, uncharted stretch. When we arrive and how we get there will depend on the underbrush and the lay of the land."

His line of sight remarkably clear, Drexler has begun to map the outback of nanotechnology. While supporting himself with various consultancies and research affiliations, he has been lecturing at forums as diverse as Mensa conferences, Naval Research Lab workshops, and meetings of the L-5 Society. He has written a few articles, and Doubleday has recently published his book *Engines of Creation*.

"I feel it's important for people to think about what will happen when nanotechnology exists," he says, "to rethink their worldview in that light."

How have things been going? "Pretty well," he says. "A lot of people have been coming around saying this makes sense."

Distinguished people, too. Freeman Dyson of the Institute for Advanced Study in Princeton, New Jersey, says that "if nature does this, we should be able to do it, too." And roboticist

Marvin Minsky, Donner Professor of Science at MIT, says, "Nanotechnology could have more effect on our material existence than the replacement of sticks and stones by metals and cements, and the harnessing of electricity."

Others have responded — appropriately, perhaps-with caution. When Drexler laid out his design for a nanocomputer at Xerox's Palo Alto Research Center just recently, computer scientist Dan Russell said, "I found the theory plausible, but it seems far off. Physics just starts to get weird at those scales."

A recent review of Drexler's book in *The New York Times* states that "it is one thing to refit a single protein and quite another to get millions of different types working together. If biology is indeed any measure, it will be a long time before scientists get nanotechnology humming. Consider that, while the earliest living cells probably had proteins much like some of our own, only after about two billion years of evolutionary trial and error did such nanomachines gather themselves into anything as complex as a nerve."

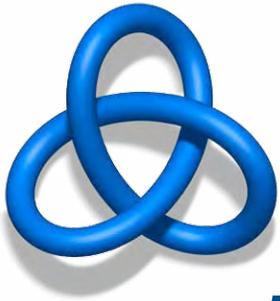
While many establishment scientists are low-key about Drexler's work, a group of younger devotees has taken his message and hit the ground running. Conrad Schneiker, a futurist and programmer at the University of Arizona, for instance, dreams of the day we combine nanotechnology with artificial intelligence. "Computers are already much faster than the human brain," he says, "and nanocomputers will be faster still. If you were to take a million such high-speed machines, which is a small population as far as nanotechnology goes, their thinking capacity would exceed in one hour that of all the scientists who have ever lived."

The members of the Nanotechnology Study Group at MIT have voyaged out even farther. After a speaker has been heard, new busi-

ness disposed of, and the pizzas devoured, Fry, Kevin Nelson, Dave Forrest, and the others sit back and take the long view. Imagine, they say, what our bodies might be like if they'd been built right. Protein is fine as far as it goes, but it goes no distance at all. Everything — temperature, tensile stress, moisture, atmospheric pressure, ambient radiation intensity — has to be just so or the stuff will start to unravel, and even-then its useful life is short. A creature built out of protein can live (without artificial aids) in only a fraction of natural environments, and not for long even in those. We cannot live unaided in volcanoes, on the bottom of the oceans, or in deep space.

Our brains are limited as well. One nerve cell communicates with a second through a surge of chemicals. Whatever the advantages of this system, it is necessarily slow, dependent on the diffusion of molecules through the gap between the cells. Suppose natural selection could have drawn on a more modern signal-propagation technology, like optical fibers; maybe today we would all think hundreds of times faster than we do. And suppose our muscles were made of diamond fibers; and our bones, of steel. Sooner or later, they say, we are going to transcend the flesh. Dave Lindburgh of the study group has likened that step to crawling out of the ocean all over again. That analogy, other members say, is the best we have; but it is, if anything, conservative.





Final Thoughts

York W. Porter - Executive Editor

Technology Progresses... Sometimes Quite Slowly...



Like many twenty first century citizens, I'm enamored with technology. The now relatively easy ability to communicate with millions of people in other countries from across the world just fascinates me and fills me full of hope for a full fledged spreading of democracy and other good ideas (like cryonics) throughout the globe. Advances in transportation came forward as well, even during the decades before I was born in 1952, and in the decades that followed my birth. We are now able to move people and goods through the air at hundreds of miles an hour. We are, exceedingly expensive though it is at the moment, able to move man made objects to other planets and, in the case of people, to the lunar surface and back. Sadly, we haven't done the latter for several decades.

It's a case, I'm afraid, of technology still moving forward but sometimes quite slowly. In a more "down to earth" (no pun intended) example, one of my favorite modes of transportation, which is moving things by railroad, gives a good example of how technology can progress and then seem, for various reasons, to slow down, sometimes with fatal consequences.

Modern railroading first got its substantial start way back in the 1800's. In 1804, a small but sturdy locomotive hauled ten tons of cargo plus 70 men over a nine-mile course. Just roughly a decade later, one former colonel in the Continental Army said, "I can see nothing to hinder a steam-carriage from moving on these ways with a velocity of 100 miles an hour". Nowadays, the high speed TGV train in France, as well as others, routinely runs at speeds well above that.

No matter what the speed, however, the whole thing has to be done safely. Due to the sometimes limited availability and the always great expense of track, railroads normally proceed by the "block method" of control. That is, you can view each section of single track as being a "block" of track. Just like a tunnel or a bridge that only has one lane, as long as traffic is moving in the same direction and at roughly the same speed at any one time in the "block", there really isn't any problem. It's only when two-way traffic occurs at the same time and/or when one vehicle moves at a different speed through the "block" that trouble occurs. In the early days, and to the same degree even today, timing is everything. The Ball Watch Co. first made a watch with the precision needed to run trains in the late 1800's. Being on time with the train meant being "on the Ball", which is where the expression we all use today first came from.



With the extra addition of telegraphs, trains became much safer as orders could be wired to stations along the route giving orders for trains to speed up or slow down or stop altogether. Later developments in automatic signaling and switching were instrumental as well. Still, the fundamental principle of making sure that a “block” of track was being used correctly was at the bottom of everything that was done.

One would think that, when it became available, two-way voice radio would be the way to go. That wasn't the case with one railroad, many of whose engineers refused to use the technology unless they were paid extra for being “radio operators”. One of them would pay for his obstinacy with his life.

On a very foggy morning decades ago, human error occurred and two trains were sent speeding towards one another in the same block of track. Realizing the error, but having no way to contact the locomotives directly, the railroad had a state trooper dispatched to head off disaster. It turned out he was too late as the trains collided before he could warn them. One of the survivors of the collision said that in the fog ahead, they spotted the headlight of the oncoming train but initially thought it was an automobile near the tracks. When the awful truth dawned on them, they locked the brakes and blew the whistle, but it was too late.

The accident investigation revealed the obvious, that human error had placed two trains in the same block going in opposite directions. It was mentioned also that if there had been two-way radio communications in the cab of each locomotive, the whole thing would have been avoided. One of the engineers killed was one who refused to use a two-way radio without extra pay for doing so, paying the ultimate price for his viewpoint.

The lesson is that useful technology needs to always be looked for and adapted as quickly as it safely can be. With cryonics, the goal is to use existing technology, with any improvements that come along, to extend human life. But you have to take advantage of it. If you haven't joined, join! If you have, make sure your funding, your contracts and documents and your standby arrangements are in place! Don't wait until the “headlight of disaster” is straight in front of you. Like the obstinate engineer, the price you pay may be way too high.



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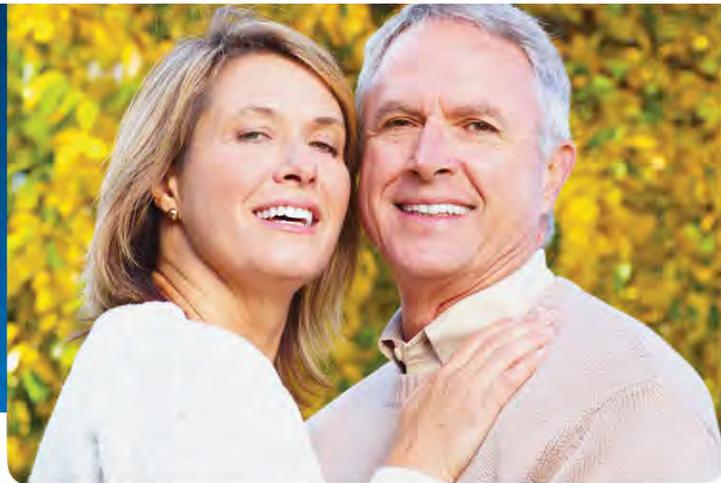
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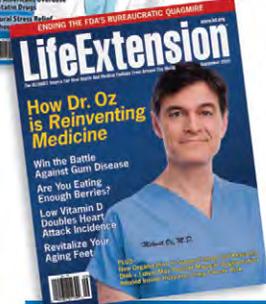
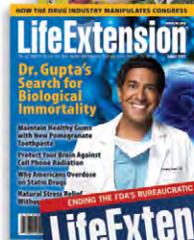
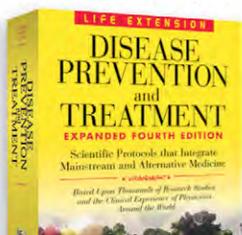
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