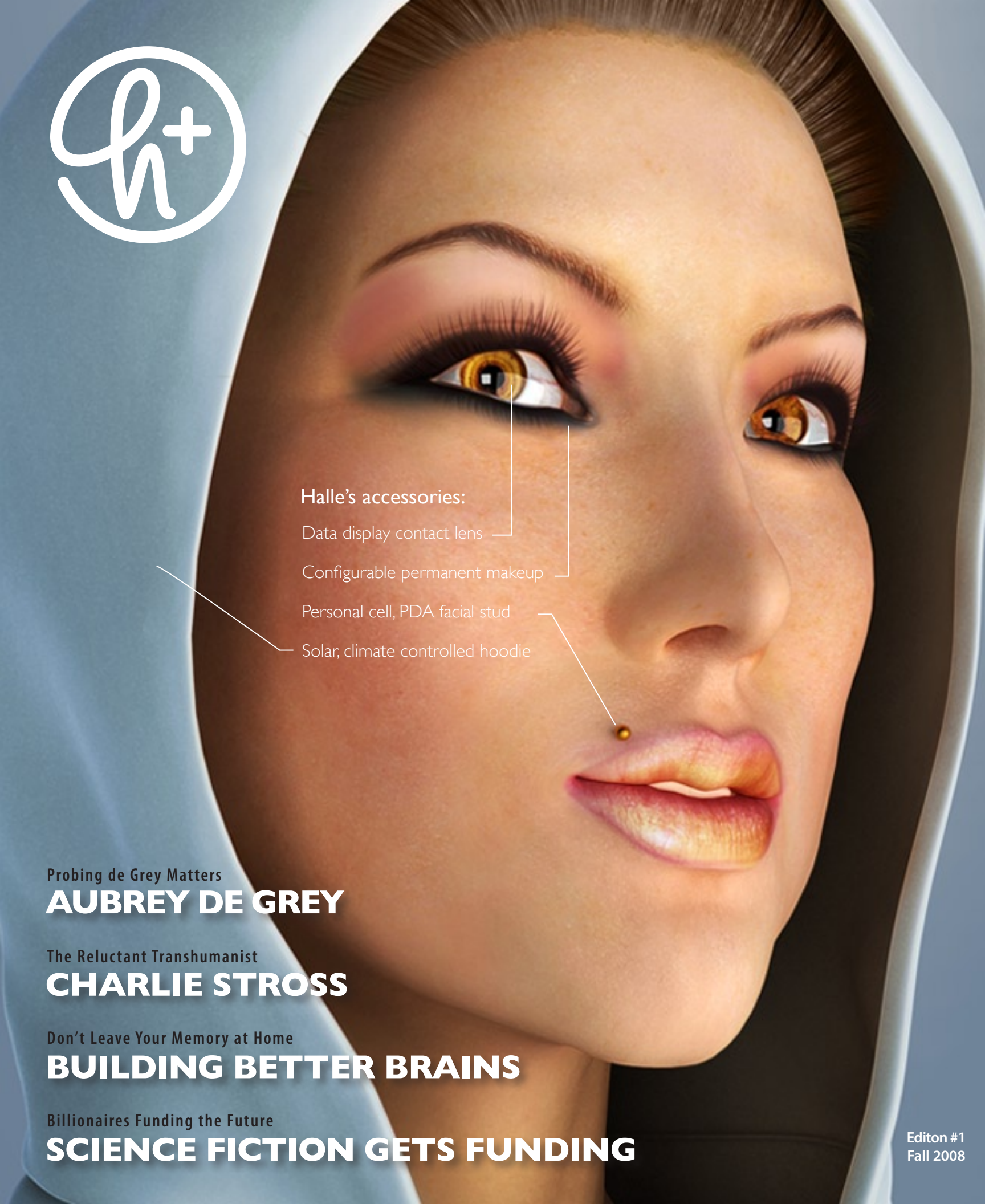

Probing de Grey Matters
AUBREY DE GREY

The Reluctant Transhumanist
CHARLIE STROSS

Don't Leave Your Memory at Home
BUILDING BETTER BRAINS

Billionaires Funding the Future
SCIENCE FICTION GETS FUNDING

Editon #1
Fall 2008

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H+ *Magazine* Advertising Specifications

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File Formats Accepted

Most bitmap file formats are accepted. Photoshop native (PSD, no layers) or Photoshop PDF files are preferred, but JPEG, TIFF, PNG, and BMP formats are acceptable. Formats not accepted at this time are: GIF, SWF, PPT, Word, Targa, EPS, and AI. No vector or page layout formats are recommended and any files sent that require fonts, file conversion, or other intervention will result in production charges or may not be used.

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Ad layouts should be designed to the ad size specified in the illustration on the right. Full bleed ads are available in Full Page and Full Spread only. All ad sizes given to the right include .25 inches margin so please plan on a **live** area .25 inches from any edge. Specific placement or other information should be noted in the submission email. Ads created with a document size different from the sizes suggested in the illustration to the right may incur production charges.

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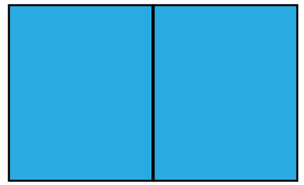
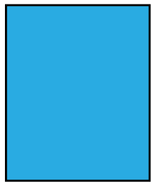
Full Spread



36.5 in x 22.5 in
92.71cm x 57.15 cm"

Full Page



18.5 in x 22.5 in
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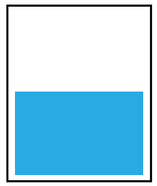
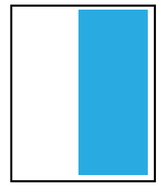
1/2 Page Horizonal



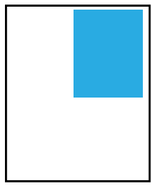
15.5 in x 9.5 in
39.37 cm x 24.13 cm

1/2 Page Vertical



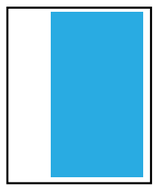
8 in x 19 in
20.32 cm x 49.26 cm

1/4 Page



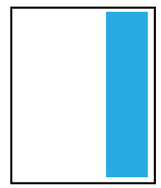
8 in x 9.75 in
20.32 cm x 24.765 cm

2/3 Page Vertical



10.5 in x 19 in
26.67 cm x 46.26 cm

1/3 Page Vertical



5.5 in x 19 in
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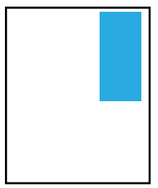
1/6 Page Vertical



5.5 in x 10 in
13.97 cm x 25.4 cm

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H+ *Magazine*

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Contents

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Humanity Plus: The New Synthesis

RU Sirius

Lately, I love it when people out there in the general population ask me what I do. I tell them that I'm working on a transhumanist webzine and then pause -- offering no further explanation -- as if a transhumanist magazine were as comprehensible as a magazine about real estate or pet monkeys.

It's a sort of test. Will anybody ever have a clue as to what I'm talking about? So far, the answer is no. Not one stranger -- or person outside certain in-the-know social circles -- has had even a nano-hint of a clue.

By the way, I'm not talking here only about people who barely know how to turn on a computer. The conversations I'm referencing have included those with people who work at Google and Microsoft, people who make digital art, and even one guy who owns a multi-million dollar technology startup.

After enjoying a few moments of puzzlement in my conversational partner, I am likely to mention the idea that we might be able to stop aging -- or I might mention "The Singularity." Aha! On a rare occasion, there may be a glimmer of recognition. Someplace, sometime, my conversational partner had read or heard something: a vague memory, something noted while sucking at the firehose of endless infotainment.

Clearly transhumanists have some work to do, if the idea that humans may be on the verge of self-directed evolution is to become common currency. But why does this matter? Why is it important to get more people to start thinking about humanity plus?

There are probably dozens of answers to that question, but I want to emphasize just one of them -- the importance of multidisciplinary, synthetic reasoning and perception in preparing for the near future.

Our species faces a virtual agora of life-altering, paradigm-changing developments in science, technology, and culture. Whether it's germ-line engineering or molecular computing; advanced AI or cyborg bodies (replaceable parts); engineered hyper-longevity or high-quality performance -enhancing drugs, the body politic is likely to experience the near future as a series of isolated shocks to prior assumptions unless we suffuse the public discourse with a different view.

The glory of transhumanism is that it's not just a movement of immortalists, or singularitarians, or advocates of digital democratization, or experimenters in self-enhancing technologies. Transhumanism reminds us that all -- or at least many -- of these developments are coming online at about the same time, that they impact each other, and that they will be remaking our societies and our personal experiences of the world in tandem. It represents nothing less than an attempt to have a realistic discourse about the human future while most of our leading intellectuals and politicians are still looking at that future through the rear-view mirror.

Our responsibility, then, is to cover the events and ideas -- the discoveries and the cultural expressions -- that are taking place on the borderline between the human and the post-human world. It is for us to give expression to an emergent cultural/technological sensibility -- and to do it within an intentionally compressed space through the deliberate creation of an online "artifact" -- a digital magazine organized within the traditional magazine format.

So welcome to the first edition of H+. We hope you find value in this publication. But please -- don't just be a consumer. As with any initiatory effort, there is plenty of room for improvement via feedback and participation. So we ask you to increase the value by spreading the word and by adding your own ideas and content to the mix.

The Chinese epigram "May you live in interesting times" was considered a curse. But that's old thinking. More recently, Americans have been reasurring themselves with the straightforward saying "Life is good." Indeed. But it could be a whole lot better.

Make it so.

Addendum: H+ *Magazine* is published by Humanity+. However, not all the views and ideas expressed in this publication are the views of that organization. While the general mission of this online periodical is to spread transhumanist news and ideas, this periodical will also enclose dissenting views, darker visions, irreverent humor, and quirky observations. Anything less than that would be stiff, boring, and dishonest.

Resources

www.transhumanism.org

I Am Ironman!

HAL (Hybrid Assistive Limb)
Cybernetic Suit

Tristan Guillford

Cyberdyne Corporation of Japan, in conjunction with Daiwa House, has begun mass production of a cybernetic bodysuit that augments body movement and increases user strength by up to tenfold.

The HAL (Hybrid Assistive Limb) suit works by detecting faint bioelectrical signals using pads placed on specific areas of the body. The pads move the HAL suit accordingly. The Cyberdyne website explains: "When a person attempts to move, nerve signals are sent from the brain to the muscles via motoneuron, moving the musculoskeletal system as a consequence. At this moment, very weak biosignals can be detected on the surface of the skin. HAL catches these signals through a sensor attached on the skin of the wearer. Based on the signals obtained, the power unit is controlled to wearer's daily activities."

Among the potential applications, Cyberdyne is emphasizing helping people with movement disabilities, augmenting strength for difficult industrial tasks, disaster rescue, and entertainment.

The HAL suit is not currently available. But according to Nikkei News, Daiwa and Cyberdyne are planning an annual production of 400 units and they should be marketed at approximately $4,200 US dollars.

Image by Prof. Sankai, Univ. of Tsukuba / CYBERDYNE Inc.

Resources

HAL
www.cyberdyne.jp/english/robotsuithal/index.html

Video of HAL
www.youtube.com/watch?v=ynL8BCXih8U

Image by Jim Mielke

Skin Phone

Kristi Scott

Welcome to the conceptual solution that combines the beauty of a tattoo with the convenience of your cell phone and Bluetooth technology, the "Digital Tattoo Interface." DTI, developed by Jim Mielke, debuted at this year's Greener Gadgets Design Competition 2008, receiving Notable Entry award. This is one tattoo with a lot of potential: a phone that would be implanted under the skin, with microscopic spheres that would act as the touch-screen buttons. Don't want to show off your phone? The concept has a button that, when pushed, can render the phone invisible. If you get a call, just push the same button to answer the display and have the phone reappear, with video capability. Where's the battery? There isn't one. You just eat something (preferably food), and the phone works off your own blood supply. With luck this phone quickly moves on from concept to actuality for a fashionable future enhancement.

Resources

Digital Tattoo Interface
www.core77.com/competitions/GreenerGadgets/projects/4673

PETA Wants Meat!

RU Sirius

The notion that tissue cultures could be developed into veritable animal flesh without the necessity of raising and slaughtering living creatures has been in circulation among tech enthusiasts for several years. With current off-the-shelf biotechnology, it should be possible to grow edible meat in laboratory vats, starting from a single cell.

Recently, this idea got a boost from PETA (People for the Ethical Treatment of Animals). The animal rights group is offering a $1 million prize for "the first person to come up with a method to produce commercially viable quantities of in vitro meat at competitive prices by 2012." The challenge has been controversial among PETA supporters because… well… like, I mean… yuck!

Image by DC Spensley

More-reasonable commentators may note that any person or organization that can make commercially viable fake meat in sufficient quantity to have an effect on animal suffering won't need PETA's money. Still, you never know. The competition could supply motive simply by calling more attention to the possibilities. Guilt-free meat eating -- a yummy idea.

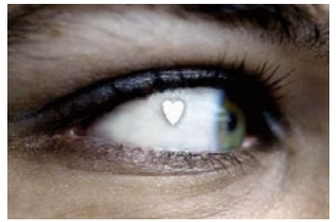
Resources

When Meat Is Not Murder
www.guardian.co.uk/science/2005/aug/13/genetics.internationalnews

New Harvest
www.new-harvest.org/default.php

Here's Jewels in Your Eye

Kristi Scott



If you've ever wanted to have that extra-special something that puts a sparkle in your eye, and really attract attention, you should take a trip over to the Netherlands. The Netherlands Institute for Innovative Ocular Surgery has developed a procedure for Cosmetic Extraocular Implants -- nicknamed "JewelEye." For the starting price of about $750 (not including getting there) and approximately 15 minutes of your time, you can have your very own. Brave souls and surgery freaks can check out the Institute's website (see "Resources"), to learn about the surgical procedure via text or video. The adornment doesn't interfere with sight, since it is not implanted in the field of vision, and the surgery is allegedly not very painful, because the implant is under the thin layer on the outside of the eye. Shapes offered include heart, star, eurosign, four-leaf clover, and music note. But for those who really want to make a personal statement and stand out, the material used is capable of being molded into a variety of shapes and sizes upon request. Currently there are only two labs that are performing the procedure, and they are both located in the Netherlands.

Resources

Netherlands Institute for Innovative Ocular Surgery
www.niioc.nl/cei-eng.htm#klinieken

EPOC Neuroheadset

Tristan Guillford

A San Francisco–based neuroengineering company called Emotiv is developing a brain–computer interface that they say will be available on the commercial market later this year. The EPOC neuroheadset uses EEG technology to read electrical patterns in the brain and then sends this information through wireless signals to a computer. According to Emotiv, the headset will be used with new biofeedback games or can be incorporated into popular PC games like *Harry Potter*, where characters could pick up and move objects with the power of their minds. In addition, the EPOC could eventually be used in multi-player online games like *World of Warcraft* or *Second Life* to control facial expressions of virtual game characters in real time. Emotiv claims the headset can detect and replicate thirty different emotional and facial expressions, including excitement, anger, laughter, and calmness.

Unlike earlier EEG devices, the EPOC is the first commercially available EEG neuroheadset that does not require gel on the scalp or an elaborate net of electrodes, and will be sold for the consumer -friendly price of $299. The EPOC will be bundled with Emortal software, which enables you to use the headset to browse your computer files and applications, and also to connect to other Emotiv users in live chatrooms.

Resources

www.emotiv.com/INDS_3/inds_3.html

We're All Edge Cases

with Cory Doctorow
by RU Sirius

DOCTOROW: Building a search engine that only contains the information that we're mostly looking for is easy. But at that point, there's no value. It's pursuing the deviance, what Bruce Sterling called "Wooing the muse of the odd," that actually creates a system that has a lot of perceived value. And that's because we are all weird in some way.

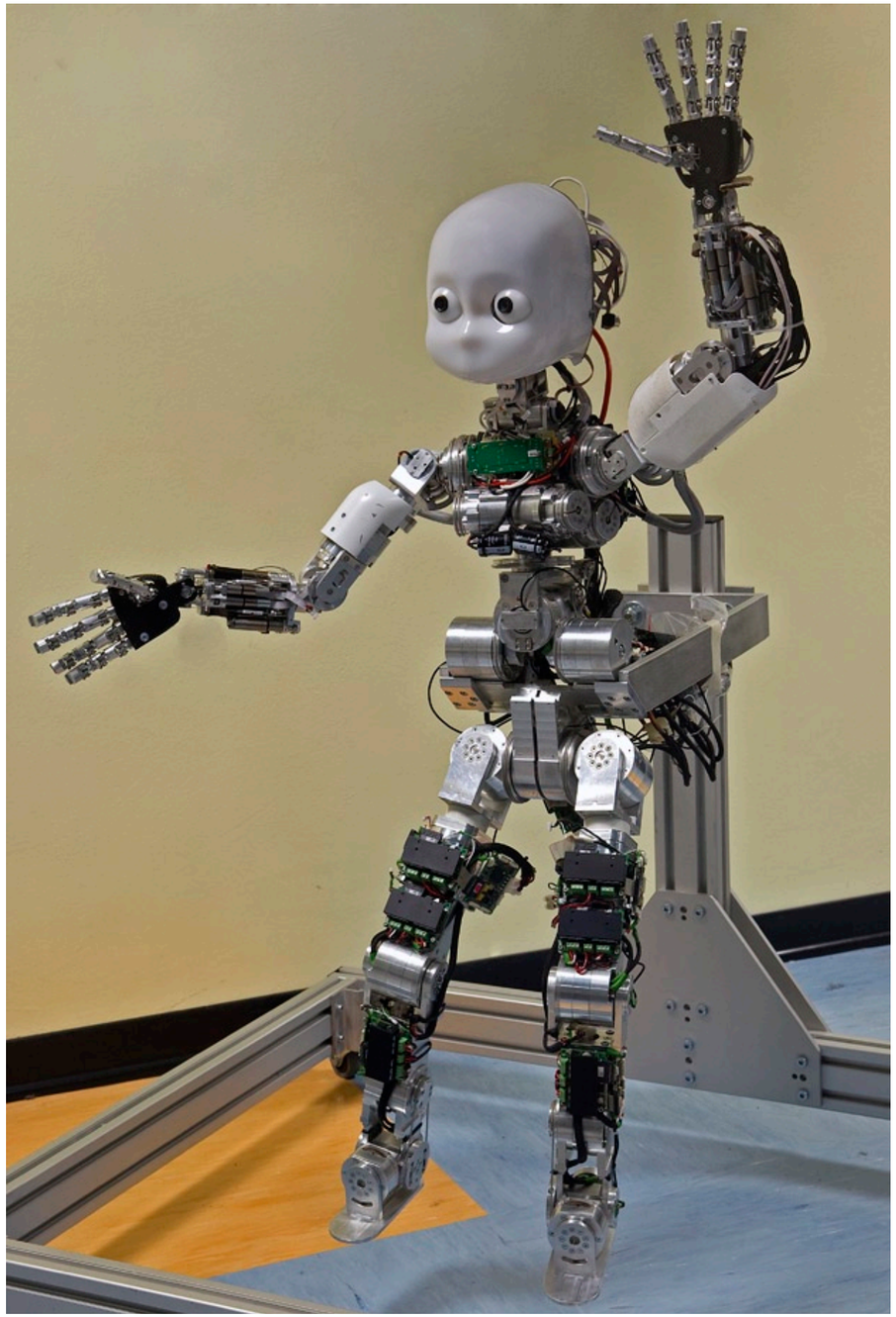
This is the most corrosive thing that happens to people who self-identify as science fiction fans… the idea that everyone else is mundane in science fiction argot… you're either a mutant or you're a "norm," right? But norms are every bit as weird as any of us. It's a matter of presentation and identity. We are all of us every bit as weird as any one of us.

AI

Open Source Robotics Looks Better Than Ever

Ben Goertzel
April 2008

iCub, the New Open Source Humanoid Robot



Where's C3PO when we need him? Compared to many other aspects of advanced technology -- even compared to AI software technology, which isn't exactly zooming along -- humanoid robotics seems to be advancing at a snail's pace. As in many other areas, the cause of the relatively slow progress is a combination of technical and economic/cultural factors. One possible work-around to the latter, being explored by an increasing number of roboticists worldwide, is the open source development methodology. Perhaps the most exciting example of this trend is the iCub, recently developed by a European Union–funded consortium of researchers.

The power of the open source methodology to get complex, important things done has been well established by now in the software domain. The Linux operating system and the Firefox browser are probably the best-known examples, but there are countless others, ranging from everyday consumer software (such as, say, BitTorrent clients) to technical software helping scientists do their research (nearly all serious bioinformatics work these days is done using open source software). Open source hardware, on the other hand, has been slower to take off. Consumer hardware benefits so much from economies of scale in manufacturing that it's proved hard for upstart open source hardware alternatives to really take off. But humanoid robotics is one area where the open source hardware approach has tremendous potential. This R&D domain is of tremendous importance to the future of humanity – and beyond – yet it's something neither industry, government nor academia is doing an adequate job of funding. Japanese companies have been the pioneers here but their enthusiasm has flagged in recent years, with Sony dropping its Qrio project and Honda's Asimo robot remaining, basically, a skunkworks project. The robotics industry as a whole is arguably flourishing better than ever, but there is a huge gap between Roombas, industrial robot arms, and their ilk, and mobile humanoid robots with the capability for complex interactions in the physical and social world.

Open source humanoid robots have been proposed before, e.g. PINO created by Japanese scientists and launched in 2001. These earlier projects were technically solid but didn't really take off in the community. However, I'm guardedly optimistic that the iCub may meet a better fate. Early results look promising – for instance, a nifty video of iCub drumming (see resource link). (OK, it's no Max Roach yet, but what we do have here is coordination of hands, feet, and hearing – sensorimotor integration – which is a powerful first step toward real embodied intelligence.)

Making a demo of a robot playing the drums is no big trick, given modern engineering technology.

Of course, demos are demos, not robust technologies, and making a demo of a robot playing the drums is no big trick, given modern engineering technology. But if you dig a little deeper, you find that the technical ideas underlying the iCub seem extremely solid, and it's clear that the architecture is capable of a lot more than just the handful of tricks demonstrated to date. Its fingers and arms have an impressive number of degrees of freedom: a choice made because the designers favor cognitive theories, implying that advanced human cognition largely arises out of the interaction between perception and action in the manipulation of objects.

iCub itself is just a platform and it doesn't solve all the problems of robotics, by any means. The iCub team has so far focused on low-level perception, action, and coordination, without plunging much into the depths of communication, learning, abstract reasoning, and so forth. But they are collaborating with others that have expertise in areas such as language learning. And the beauty of the open source approach is that it's relatively straightforward for others with AI ideas and technical chops to extend their work. Building an iCub of one's own is not free, nor trivial, but it's a damn sight easier than designing your own humanoid from scratch... and more possible than getting your hands on Qrio or Asimo, which have not been publicly released. And unlike Sony's Aibo, the robotic dog who has become a staple of academic AI research -- if one finds aspects of the hardware platform inadequate, one can always modify it, since the specs are completely open. Different researchers are bound to take the iCub in radically different directions. For instance, while I'm an AI guy rather than a robotics researcher, reading about iCub has inspired me to think a bit about how it might be integrated with various open source AI software platforms, robot simulators. and virtual worlds.

Will open source do for humanoid robotics what it's done for Web browsers and bioinformatics? It's too soon to say for sure, but there's reason to hope.

Ben Goertzel is the CEO of AI companies Novamente and Biomind, a math Ph.D., writer, philosopher, musician, and all-around futurist maniac.

Resources

iCub
www.robotcub.org

PINO
www.symbio.jst.go.jp/PINO

iCub Drumming
www.robotcub.org/index.php/robotcub/content/download/1135/3982/file/icubFullDrumming3.wmv

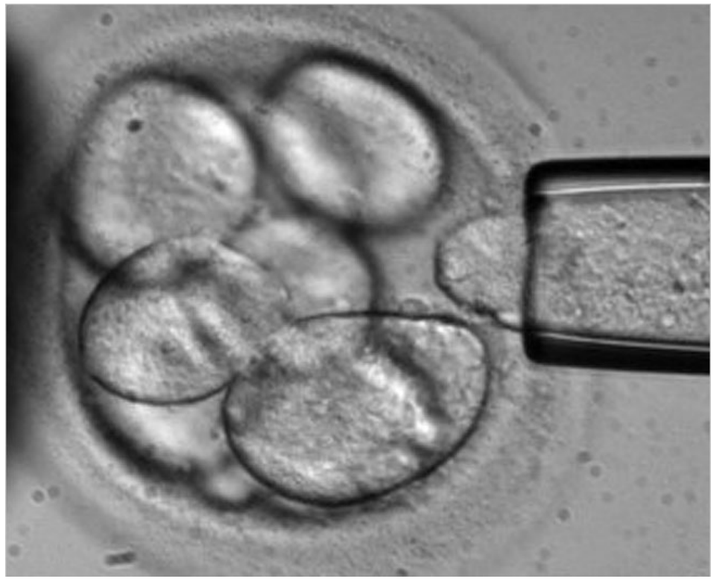
Open source AI software platforms

Robot simulators
www.goertzel.org/blog/2008/05/open-source-robots-robot-simulators.html

Strong AI
en.wikipedia.org/wiki/Strong_AI

Ray Kurzweil
www.kurzweilai.net

The Singularity Institute for Artificial Intelligence
www.singinst.org



Simple Questions/ Challenging Answers

Moira A. Gunn, Ph.D.

Is the product of a cloned cow, cloned milk? Or real milk? Is the offspring of a cloned cow and a "natural" bull, a half-clone? And then when they mix again, as cows and bulls of all persuasions are apt to do, do we get quarter-clones? Three-quarter clones? The parlor game must obviously stop in a very few generations, but the melody lingers on. Like genetically modified seeds that have jumped the fence and are mixing and matching in the wild, once the progression begins, it's a little hard to follow.

So now let's look at some interesting challenges that emerge on the human scale. In the United States, women are free to pursue in vitro fertilization, and American clinics have really gotten good at it.

When they treat young women – who might be motivated because they are about to undergo chemotherapy or other medical procedures that might compromise fertility – it is not unusual for a woman to emerge with a dozen or more viable eggs. Today we know better than to implant more than two at any one attempt, and so we find ourselves with hundreds of thousands of fertilized eggs on ice. No one knows exactly how many, because while the federal government will only permit federal research funds to be expended on the stem cell lines derived as of August 9, 2001, when President George W. Bush issued his Executive Order, the government does not regulate this particular end of the techno-human reproductive supply chain.

Not so with the Brits. I have just returned from the international BIO conference, where I had the great good fortune to moderate a panel of fellows including the illustrious Dr. Lyle Armstrong, who heads the Institute for Human Genetics at Newcastle University. With the recent passage of an update to the UK Human Fertilisation and Embryology Act of 1990, his group has now proceeded on to something rather controversial. Under the original act, the government had regulatory control over private citizens' frozen embryos, which required that they be tracked and that each private citizen make a decision about these "frozen potentials" within a reasonable time frame. No frozen potential went unnoticed. But that's not the story.

Despite the absolute tracking of each and every embryo, the UK permits stem cell research on any viable line. This is where Dr. Armstrong and the latest revision of the act enter the picture. And wouldn't you know it? So do the cows.

It turns out that the UK researchers can get only a few human eggs each week, while he – or rather his lab – can get perhaps 200 per day from local cows. To quote: "We have a lot of cows." And here… it gets interesting.

Under the new approvals, researchers may now take an animal cell, remove its nucleus, and inject it with a nucleus extracted from a human cell. This suits Dr. Armstrong just fine. He and his fellow scientists can then proceed to study how early cells develop. The law determines that these cells may not be permitted to live beyond fourteen days, although Dr. Armstrong tells us that they seldom live half that long in any event. Still, in that short time, these

Researchers may now take an animal (cow) cell, remove its nucleus, and inject it with a nucleus extracted from a human cell.

cow-cell -- human-nucleus hybrids give scientists a direct way to study cell differentiation at its earliest stages.

To date, Dr. Armstrong's group has created 271 human–animal hybrid embryos. By his estimation, they are 99.9% human, 0.1% cow.

So where does that leave us? I asked Armstrong directly if we could FedEx him our extras to save him the involvement of the cow, and he very specifically indicated that after eighteen-vplus hours, the human eggs were no longer of use. And yes, if we found another way for him to do the research, he would.

Expediency. Cows. Humans. The inexorable call of science. And there are a whole number of people who find this entire conversation simultaneously wonderful and questionable. It's appropriate to quote the name of this BIO panel, the brain child of Dr. Mike Fisher, the life sciences adviser for UK Trade and Investment in the United States: "It's life, Jim, But Not As We Know It …"

Moira A. Gunn, Ph.D., hosts "BioTech Nation" on NPR Talk and NPR Live. She's the author of **Welcome to BioTech Nation… My Unexpected Odyssey into the Land of Small Molecules, Lean Genes, and Big Ideas** *cited by the Library Journal as being among the "Best Science Books of 2007."*

Resources

Tech Nation/Biotech Nation
www.technation.com/

Reuters article about human-cow embryos
www.reuters.com/article/latestCrisis/idUSN02399515

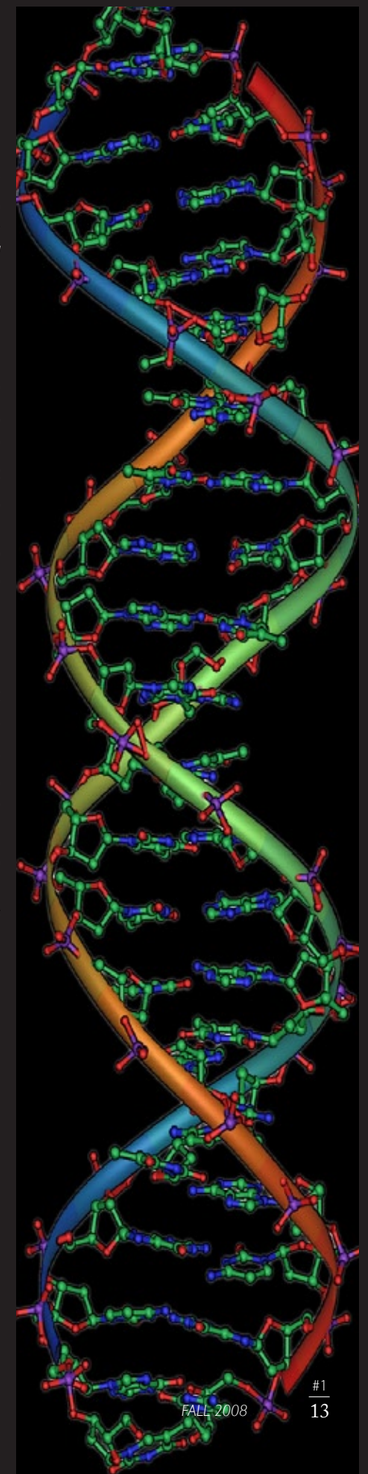
Manipulating Evolution

with David Ewing Duncan, co-host of BioTech Nation and author of ***The Geneticist Who Played Hoops with my DNA: and Other Masterminds from the Frontiers of Biotech.***

by RU Sirius

H+: I might spend the whole day thinking about politics, economics — thinking about solutions to knotty human problems — and then I start thinking that a lot of this is hardwired. Maybe nothing really good is going to happen unless we change our wiring. Unless we actually technically evolve. Is that part of the intrigue with biotechnology?

DUNCAN: Yeah, it is. I actually agree with Gregory Stock on a lot of this. He just thinks this stuff is inevitable. We have the technology now to alter the germ line. Somebody's going to do it somewhere. It's more a matter of figuring out how to do it safely and manage it. So I would agree with the notion that we're going to be manipulating evolution. It's not even a question of *if* anymore; it's a question of *when* and *how*.



Resources

Germline Engineering
en.wikipedia.org/wiki/Germline_engineering

David Ewing Duncan
www.davidewingduncan.net

Post-Darwinian Hedonic Engineering

*with David Pearce, founder of **BLTC** (Better Living Through Chemistry) Research and original cofounder of the World Transhumanist Association.*

RU Sirius

PEARCE: In maybe three or four decades or so, we'll be choosing such traits as the average hedonic set point of our children. Over time, I think allelic combinations [suites of variant copies of mission-critical genes] that leave their bearers predisposed to unpleasant states of consciousness — unpleasant states that were genetically adaptive in our ancestral environment — will be weeded out of the gene pool. For a very different kind of selection pressure is at work when evolution is no longer "blind" and "random," i.e. when rational agents design the genetic makeup of their future offspring in anticipation of its likely effects. In that sense, we're heading for a post-Darwinian transition – ultimately I believe to some form of paradise-engineering.

Image by DC Spensley

Resources

BLTC Research
www.bltc.com

The Hedonistic Imperative
www.hedonistic-imperative.com/

The Eye

Kristi Scott

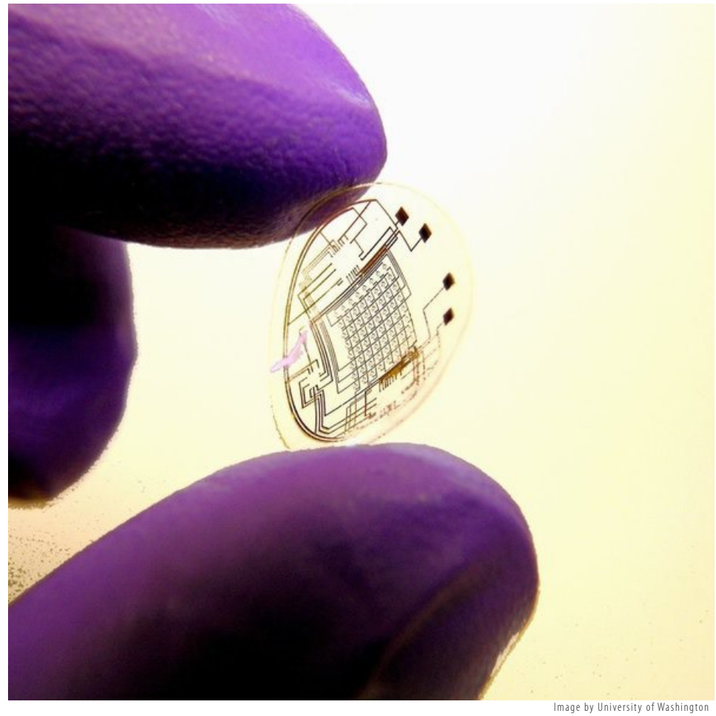


Image by University of Washington

Some of us can't help but look to the future, and pretty soon, we may be looking at it through contact lenses with a virtual reality overlay.

Engineers at the University of Washington have developed a contact lens that creates a virtual display superimposed over the normal field of vision. By using a transparent part of the eye to place instrumentation, the contact will be safe for human wear. The lenses will be imprinted with an assortment of electronic circuits and lights to make superimposition possible. A future version of the product might include the addition of wireless communication via the lens. The team has already demonstrated that rabbits can wear the lens for 20 minutes safely without any adverse effects, and are looking into a feasible production method for the contacts. There are still some major wrinkles to be ironed out in the manufacturing process, given that the materials need to be both safe for the body and incredibly small.

The enhancement creates the potential for a merger between our virtual and real worlds, overlaying them into one frame of vision. It would allow people to use online services such as Google Earth in real time over the real landscape in front of us. All those giant pushpins will become a reality, making it much easier to navigate, since the desired location will have a great big arrow or identifier for you. Less practical but more exciting is the potential gaming experience these lenses will provide.

But don't throw away the digital glasses just yet. A very basic version with a few pixels may be available soon, but a fuller realization of this concept may take years. Even with obstacles still to be overcome, these engineers have achieved something taken straight from a science fiction movie or novel. Eye enhancements… check.

Which sense is next?

Resources

Superhuman Vision
uwnews.org/article.asp?articleID=39094

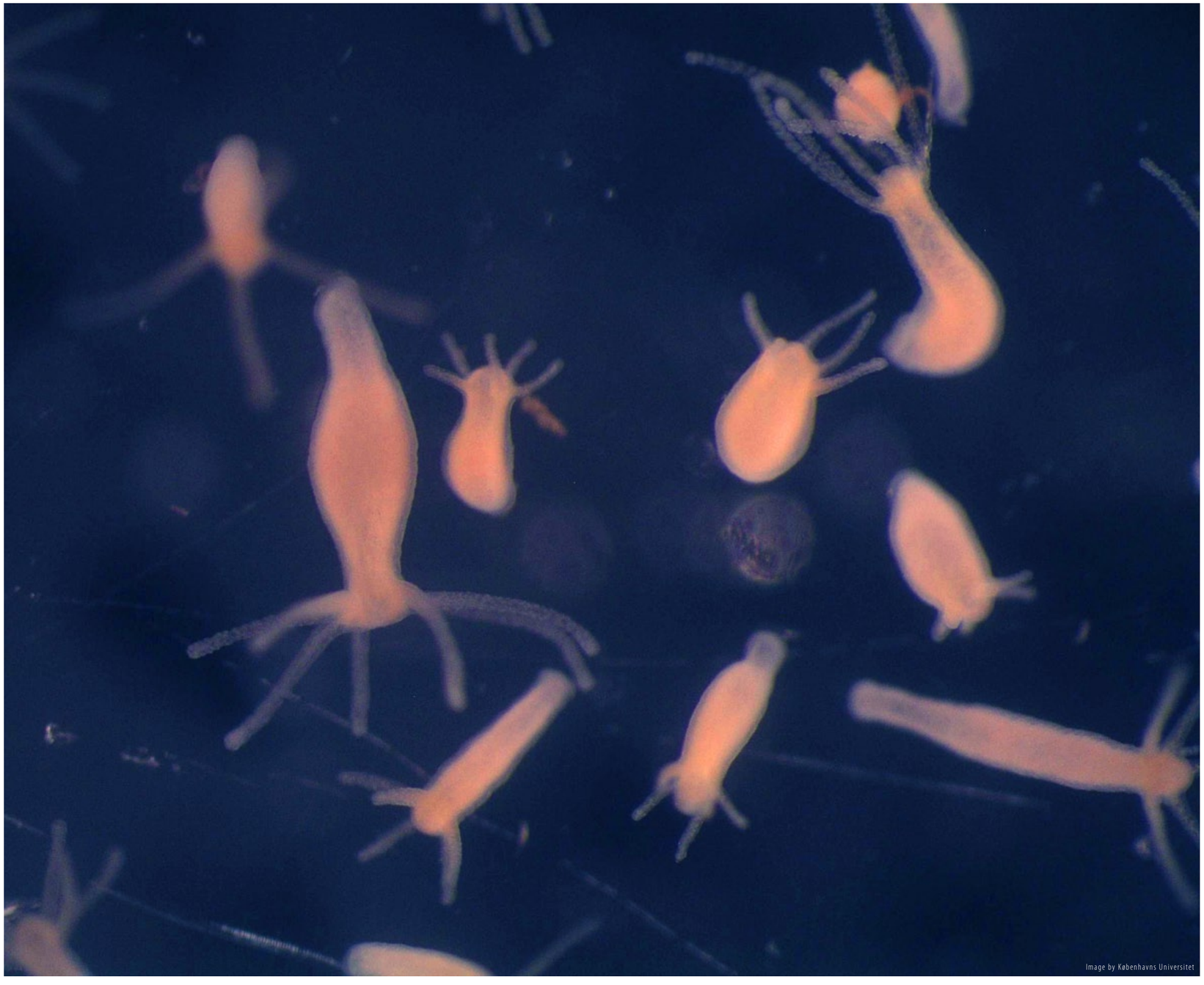


Image by Københavns Universitet

Engineering an End to Aging

Michael Anissimov

Age-defying creams and lotions, esoteric herbs and elixirs, Botox and plastic surgery -- what do they all have in common?

None of them will actually increase your life span. Usually, they're snake oil. At best, they improve external appearance without actually extending life. We deserve better, and we'll need it if we want to live longer than the typical three score and ten years.

The first thing to realize is that nature doesn't specifically want us to die. There is no "death gene." For any species in any environmental context, there is an ideal life span from an adaptive point of view -- an evolutionary optima. One evolutionary strategy includes species that reproduce quickly and die off fast. Another includes species that reproduce slowly and live for a long time. Call it quality versus quantity. Thankfully for humans, we're squarely in the quality column, but many would agree that 80 to 90 years is not enough.

We perish not because of some internal clock that says, "Time to die now!," but because of a lack of attention and self-healing -- mere neglect. Once we've reproduced a few times, in the eyes of nature, our usefulness has run its course. We are cast aside, onto a pile of skeletons 600 million years deep. This is unacceptable, and we need to find a new way, but since nature isn't actively working against us -- just neglecting us -- the challenge is surmountable.

LONGEVITY IN NATURE

First, let's look to nature for inspiration. Are there any animals with extraordinarily long life or regenerative capacities? Absolutely.

There is one animal that scientists believe is immortal -- the lowly hydra, a simple, microscopic freshwater animal, shaped something like a tiny squid. Apparently, the challenges of indefinite tissue regeneration are simple enough for such a small organism that nature has solved them. American biologist Daniel M. Marinez did a study of mortality in three colonies of hydra for four years straight, and barely any of them died. Death rates were random, uncorrelated with age. This means they weren't displaying senescence (aging), and died from other causes. In almost all other known species, death rates increase with age. Not in hydra. They die from getting eaten, or infected by a virus, or squished, but not from aging. There could be a thousand-year-old hydra out there, maybe in a small lake right in your neighborhood. We don't know, because there is no way of telling their age by looking at them!

Planarians -- those odd animals that look like a slug squished in a microscope slide -- are another organism that scientists suspect may be immortal. No detailed studies have been conducted yet. In many cases, if you cut a planarian in half, it becomes two planarians. These live as long as one born by conventional means. If you kept cutting a planarian in half, it might never die, because each piece would go on living.

What about more-complex animals? There are our friends in the order Testudines: turtles, tortoises, and terrapins. Scientists have examined the internal organs of young and old turtles and found that they look exactly the same. Something in a turtle's physiology prevents these organs from breaking down. An article in Discover magazine asked, "*Can Turtles Live Forever*," and came to the conclusion that it's entirely possible. Like hydra, turtles experience no increase in mortality rates and no decrease in reproductive rates as they grow older. There are turtles 150 years old that exhibit no signs of aging. Harriet the Turtle, a pet of Charles Darwin's, was born in 1830 and died only in 2006. It seems turtles can die from disease, injury, or predation, but not aging. This quality is called "negligible senescence." Sign me up.

From these animal examples, we see it would be premature to state that negligible senescence is biologically impossible, as is frequently assumed. Nature seems to be uninterested in our quaint notion that all organisms must age. The question is -- how can we make this work for humans? The oldest person who ever lived, Jeanne Louise Calment, kicked the bucket at the age of 122 1/2. Can we push that boundary?

(continued next page)

ENGINEERING NEGLIGIBLE SENESCENCE

Enter Dr. Aubrey de Grey, a biogerontologist from the UK, and his "strategies for engineered negligible senescence" (SENS) plan. Instead of exclusively studying the complex biochemical processes of aging in detail, as in gerontology, or ameliorating the worst symptoms of age-related decline, as in geriatrics, de Grey and his supporters advocate an "engineering approach" to aging that asks, what are the main categories of age-related biochemical damage, and how can we fix them? The idea is not to eliminate the sources of age-related damage, but to fix the damage fast enough so it doesn't accumulate and cause health problems. This is far easier than deciphering all the intricacies of the biochemistry of aging.

Although some tentative engineering approaches to aging had been proposed before, it was de Grey who really fleshed it out, popularized it, and made it respectable. It's no wonder that he has already raised $10 million in funding for his organization, the Methuselah Foundation.

As de Grey points out, gerontologists have discovered seven biochemical causes of aging. The last cause was discovered in 1981, and considering how immensely far our knowledge of biology has come since that time, it seems quite likely that these seven causes are all of them. De Grey calls these causes of aging the "Seven Deadly Things." They are: (1) cell loss, (2) death-resistant cells, (3) nuclear DNA mutations, (4) mitochondrial DNA mutations, (5) intracellular junk, (6) extracellular junk, and (7) extracellular crosslinks. That's it. If we find medicines or therapies that can clean up this damage, we could extend our lifespans to great lengths and achieve negligible senescence in humans.

A word on a philosophical point of view: many world philosophies and religions teach, or strongly imply, that the body depends on some immaterial animating force, a soul or chi, to give it life. Scientists disagree: the functioning of the body seems entirely rooted in atoms, molecules, and forces between them. As recently as 1907, French philosopher Henri Bergeson wrote about an élan vital, or vital force, that animated all living things and drove their evolution and development. This was closely connected to the idea, common at the time, that organic molecules could not be synthesized by inorganic precursors. Unfortunately for Bergeson and other vitalists, Friedrich Wöhler, the father of biochemistry, had already synthesized urea from inorganic precursors as early as 1828, and scientists were becoming more and more convinced that the same laws of biochemistry that govern inorganic molecules govern organic molecules as well.

Because the laws of chemistry apply to both life and non-life, aging is an entirely chemical, non-mystical process of degradation with specific physical causes. Although it is a matter of preference whether you consider aging a "disease" or not, from the perspective of the body, aging is like a disease -- a life-destroying biochemical phenomenon occurring in the body. And like diseases, aging is treatable. It is due to the complexity and the aura of inevitability around aging that people have only recently begun to look at it this way. Some say that aging is something mandated by God, and we have no right to mess with it, but these very same people have used this same argument throughout history to protest against vaccinations, the dissection of cadavers, organ transplants, and numerous other therapies or techniques of extreme medical value. Is it so radical to say that being healthy is a good thing, and that we should use whatever ethical strategies are available to pursue that end?

We perish not because of some internal clock that says, "Time to die now!," but because of a lack of attention and self-healing mere neglect.

Aubrey de Grey's SENS plan is complex and quite thorough. To examine it in full, I suggest looking at the website of the Methuselah Foundation, or getting his recent book, *Ending Aging*. But I will summarize the basics here.

The first cause of aging is cell loss, or cell atrophy. For most of our lives, our bodies are programmed to replace cells when they die. Our individual cells live much shorter life spans than the body itself: some cells last a few years, others, like skin cells, a few weeks. All of them are constantly regenerated using the body's supply of stem cells. Over time, the processes of cell replenishment begin to break down. This is what causes muscle atrophy among the old, and the phenomenon especially afflicts the heart and brain, our two most important organs. To fix this problem, two strategies have been proposed: stimulating the division of existing cells, or introducing new cells, possibly including stem cells. Both are under investigation.

The second cause of aging is death-resistant cells, cells that overstay their welcome. There are three main types of cells guilty of this offense. The first are visceral fat cells, fat cells that build up around our internal organs. These cause a progressive loss in our body's ability to respond to nutrients from the stomach. Eventually, it leads to Type 2 Diabetes. The second type of cells is called senescent cells, cells that have lost the ability to reproduce. These stick around, releasing proteins that are dangerous to their neighbors. Thankfully, they primarily aggregate in just one type of tissue, the cartilage between our joints. A third type is a category of immune cells called "memory cytotoxic T cells." These build up faster than other immune cells and refuse to go away, crowding out the other immune cells and eventually causing disease. There are two approaches to solving these problems: inject something that makes the unwanted cells commit suicide but doesn't touch other cells, or stimulate the immune system to kill the target cells.

The third cause of aging is mutations in the DNA of the nucleus, the center of every cell. Most of these mutations are entirely harmless, as they only affect a few cells at a time. These cells eventually die and are replaced with unmutated cells. Mutations get dangerous when they lead to malignant cells that self-replicate -- otherwise known as cancer. So, finding a cure for a cancer is a subtask of finding a cure for aging. According to de Grey, this is the most difficult part of the strategy, because cancer is constantly evolving to exploit us.

There are several proposed approaches to finding a cure for cancer, but de Grey's favored strategy is one called "Whole-body Interdiction of Lengthening of Telomeres" (WILT). The Methuselah Foundation's website calls WILT "a very ambitious but potentially far more comprehensive and long-term approach to combating cancer than anything currently available or in development." It is based on a vulnerability shared among all cancer cells: their need to renew their telomeres, junk DNA that serves as the ends of chromosomes. Telomeres of a certain length are necessary for a cell to self-replicate. If the telomeres are too short, the cell self-destructs. When cancer hijacks the body's cells, the cancer cells replicate so rapidly that their telomeres shorten quickly. The cancer cells avoid destruction by using the cell's protein synthesis machinery to build enzymes -- telomerase and ALT -- that extend telomeres, and allow endless self-replication. Previous attempts at cancer cures target these enzymes, but WILT proposes removing the very genes that contain the information necessary to synthesize them.

Removing the genes underlying the synthesis of telomerase will mean that all cancers will self-destruct before becoming a serious problem to their host, effectively curing cancer. This is one of the most ambitious strands of the SENS plan. The challenge of this approach is that removing these genes in all the tissues of the body will mean that the body's natural cells will have a limited life span, as they will not be capable of lengthening their telomeres. To counteract this will require introducing stem cells with renewed telomeres into the body every decade or so. This has already been demonstrated in mice with cells of the blood and gut. Skin and lungs will be next. When this therapy is used to cure cancer in mice, tremendous resources will be pumped into efforts to develop a therapy that works for humans.

The fourth cause of aging is mutations in the mitochondria, the "power stations" of the cell. Mitochondria have their own DNA, much less than that in the nucleus of the cell, but some of it is essential to synthesizing the proteins that make it up. When the DNA is damaged, the mitochondria break down. Mitochondrial DNA is especially susceptible to damage because of two reasons. The first is that mitochondria, being the site of cellular respiration, are heavily exposed to its by-products -- dangerous free radicals. These react with the DNA, causing it to mutate. The second is that mitochondria lack the complex DNA-repair machinery found in the nucleus.

Luckily, although mitochondria are made of thousands of proteins, only 13 of them are synthesized using the genes of the mitochondria itself. The rest are synthesized in the nucleus and imported in. The solution to this problem is to move the thirteen critical genes from the mitochondria to the nucleus of the cell. Evolution has already been doing this without our help for millions of years, and we need to finish the job. This will require using gene therapy to add supplementary genes. Gene therapy is in its early stages, but has been used effectively to replace defective genes with functional ones, helping cure genetic diseases. Research is under way to improve the process and test it with mice.

The fifth cause of aging is intracellular junk. Cells synthesize, reconstruct, and deconstruct many thousands of different molecules during the course of their operation. Every once in a while a cell ends up with a molecule so large or unusual that it has trouble breaking it up. If a molecule cannot be broken down by the "incinerator" of the cell, the lysosome, it stays there forever. In cells that don't divide, this can build up to critical levels. This includes some cells in the heart, the back of the eye, some nerve cells, and white blood cells trapped in the walls of arteries. This can cause diseases, such as Alzheimer's, Parkinson's, macular degeneration (the leading cause of acquired blindness), and atherosclerosis. To clean up intracellular junk, the SENS project proposes equipping the lysosome with new enzymes, thereby expanding the range of molecules it can break down, allowing it to digest even very large or unusual molecules.

...aging – besides killing more than 100,000 people per day; it makes us suffer for years or decades before it kills us.

The sixth cause of aging is extracellular crosslinks, molecular garbage that accumulates outside cells, linking together proteins that otherwise slide smoothly over each other. These can lead to some of the most outwardly visible effects of aging: wrinkles in tissue and the like. Fortunately, these crosslink molecules have chemical structures different than the healthy tissue of the body, so it shouldn't be too hard to find an enzyme that breaks them down while leaving the rest alone. In fact, just one type of crosslinks, called glucosepane crosslinks, may count for up to 98% of all long-lived extracellular crosslinks in the human body, meaning if we figure out a way to get rid of these, we'll have almost solved this cause of age-related damage.

The seventh and last known cause of aging is general extracellular junk, the type that just floats around instead of linking together proteins. Most of these junk molecules are called amyloids, and they build up in everyone, but are especially found in the brains of Alzheimer's patients. The main approach to dealing with this, already being pursued by at least one company, is to stimulate the body's immune cells to clear out these molecules. There is a strong overlap between treatments for Alzheimer's and atherosclerosis and anti-aging treatments that address this cause, so there seems to be significant momentum in the right direction.

There may be other causes of aging that emerge after we have solved most of these seven. We'll just have to wait and see. But if all these seven causes of aging were eliminated, people could live a lot longer -- maybe even hundreds of years. That would buy us more time to develop new therapies to address the remaining sources of aging.

It's hard to imagine why we wouldn't want to fight the scourge of aging -- besides killing more than 100,000 people per day; it makes us suffer for years or decades before it kills us. Everyone is susceptible. Instead of seeing aging as inevitable, why don't we view it as a disease and search for a cure?

Michael Anissimov is a science writer. He blogs at accelerating future.

Resources

Can Turtles Live Forever
discovermagazine.com/2002/jun/featturtle

Methusalah Foundation
www.methusalahfoundation.com

Anissimov Blog
www.acceleratingfuture.com/michael/blog

Probing de Grey Matters

A conversation with **Ending Aging** *author and Methuselah Foundation Chairman Aubrey de Grey*

RU Sirius

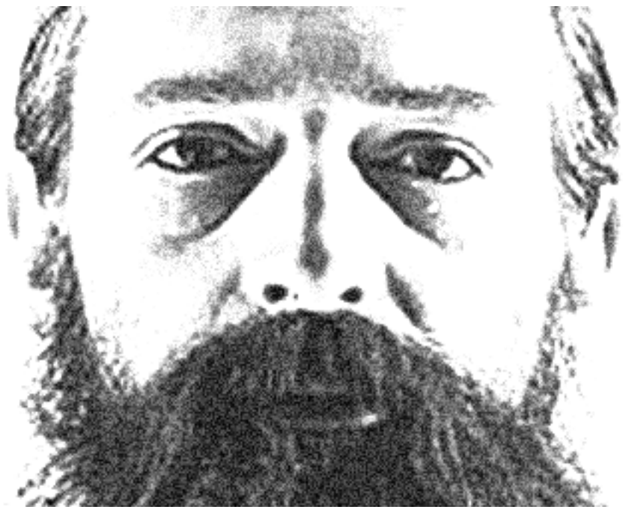
Throughout history, human beings have quested after rejuvenation – in myth and in fact. Here in the US, legend has it that Spanish conquistador Ponce de Leon came to Florida looking for the Fountain of Youth. It is perhaps a great irony, then, that Florida -- famous for its retirees -- is a place where the fact that aging still rules is most evident.

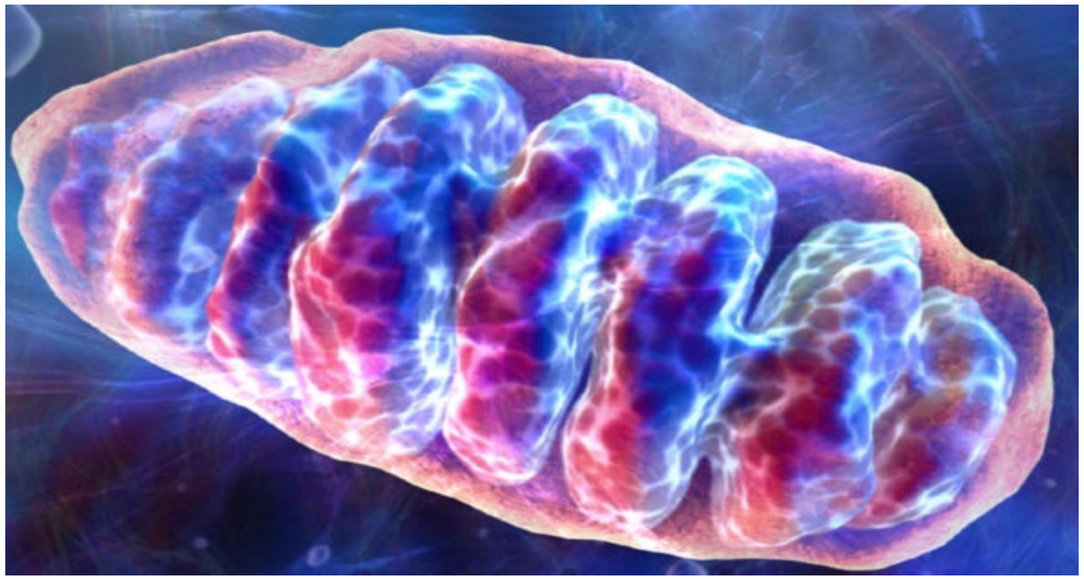
During the 1960s, some individuals began to suggest that radical increases in longevity – even immortality – was within our grasp, not by dint of the discovery of some magic waters, alchemical elixirs, or Taoist methodologies, but through the use of science and technology. In 1964, Robert C. W. Ettinger published *The Prospect of Immortality*, which encouraged the notion of cryogenic preservation in the expectation that our understanding of biology and other advances in science and technology would allow us to defeat death.

By 1993, Mike West had formed Geron corporation, hoping – among other things – to someday market cures for aging. And, in 1999, Cynthia Kenyon formed Elixer Pharmaceuticals, a company that was even more explicitly dedicated to finding a pharmaceutical solution to the aging problem. During that same decade, a very lively community of transhumanists and extropians were exploring and extrapolating about the possibilities of resolving this aging thing – and what the world would look like if we did.

Sometime around the turn of the millennium, Aubrey de Grey, an English biogerontologist who is now as famous for his long beard that makes him look like Father Time as he is for his outspoken vision of radical life extension -- looked at aging as an engineering problem and decided… Eureka!... we can do this.

I think it's vital to get all of them (categories of damage) fixed as soon as possible, because any one of them could kill us on its own.





Since then de Grey has appeared on *60 Minutes, The Colbert Report*, and a Barbara Walters special report: "Live to be 150." He is chairman and chief science officer of the Methuselah Foundation, a nonprofit organization that has raised $10,000,000. Among its activities, Methuselah offers prizes for major experimental breakthroughs in aging using mice.

De Grey's recent book, Ending Aging: *The Rejuvenation Breakthroughs That Could Reverse Human Aging in Our Lifetime*, is coauthored by Michael Rae, and published by St. Martin's Press.

Michael Anissimov covered many of the basics about de Grey's theories in the previous article ("Engineering an End to Aging" – it really functions as an introductory piece to this interview, so please take the time to read it). So rather than asking de Grey to regurgitate the basics of his theory one more time, I decided to probe his thinking on a few peripheral issues.

H+: Are there still people who study aging that cling to the notion of a biological clock, and do you think there's any possibility that new evidence might turn up for a more centralized mechanism leading to aging?

AUBREY DE GREY: A small minority of gerontologists do still propound the idea that aging is "programmed" in most or all species, yes. (Everyone accepts that it's programmed in a minority of species, those that age extremely fast after reproduction, such as salmon.) The widespread rejection of programmed aging is actually over fifty years old, dating back to a paper by Peter Medawar from 1952. Basically the mainstream view is that slow aging (of the sort we see in most species) can't be controlled by genes because the presence of those genes would give the species just the same life span and health span as it would have if it lacked those genes and had slightly less powerful inbuilt anti-aging machinery. This lack of a function of pro-aging machinery means that there would be no selection to maintain such machinery, so it would have mutated into oblivion even if it had ever existed. There's really no chance that new evidence could overturn this. The only reason there's still any controversy is that there are a few rather artificial circumstances that at first sight seem to look like programmed aging – but closer inspection shows that they aren't really.

Initially… journalists "knew" I must be crazy. More recently most journalists have begun to realize that what I'm saying is actually quite plausible…

H+: Does the fact that there are -- your account -- seven different causes of aging ever worry you, in the sense that there might be some frustration when one or two of those causes won't budge?

ADG: There are actually many more than seven – my seven strands are just categories of damage, within each of which there are many examples. But still, sure, I think it's vital to get all of them fixed as soon as possible, because any one of them could kill us on its own. That's why my own work has historically focused on the hardest strands.

H+: What are these foci and what is happening with them?

ADG: The three hardest aspects of SENS (at present – this could of course change!) are: the relocation of the mitochondrial DNA to the nucleus to make mutations in the original mitochondrial

DNA harmless; the introduction of microbial (or other foreign) enzymes into our cells to destroy molecules that accumulate in them; and the elimination of our cells' ability to prevent the ends of their chromosomes from shortening with each cell division, combined with stem cell therapies to address the side effects that this will cause. Research is proceeding healthily in all these areas, largely funded by the Methuselah Foundation.

H+: In your book, you write that to be truly immortal or nonaging we will need to lose the meat. Some people don't think that's too far away. What do you think?

ADG: I'm not sure. Actually I think it's risky to think in terms of "truly immortal" even in a non-meat scenario – after all, nearby supernovae can fry most things. But as to the time frame of technologies such as uploading, I'm not equipped to speculate.

H+: Longevity advocates have finely thought-out, statistically oriented arguments as to why longevity will not strain resources or the environment. But does the longevity movement, nevertheless, have a responsibility to do everything it can to prevent or end scarcity and ensure a survivable environment for however many long-living people?

ADG: I have a number of arguments as to why the defeat of aging may not strain the environment, but I never say that those arguments are certain. I don't think prolongevists have a duty to solve that problem themselves, but I do think we have a duty to bring the parameters of the problem to the attention of society, so that society neither overestimates nor underestimates it and so that those best placed to shape public policy act accordingly. The same goes for all aspects of the sociological consequences of the defeat of aging.

H+: In talking about the culture of long-lived people, you say that people will be less inclined to take risks. I can see this being a big problem, in a lot of different ways. Don't we gain benefit and novelty from people who are inclined to take risks? (I see you as a big risk taker, reputation being the currency of the current age.) And aren't people who will preserve their lives at any cost easily controlled by an authoritarian state or some other type of oppressive imposition?

ADG: Benefit and novelty come from the taking of risks, yes, but not the type of risks that will be inhibited by the defeat of aging; that will cause aversion to risks of death, but risks to one's career (for example) will be more acceptable, because there'll be so much more opportunity to make amends for misjudgment. As for being controlled, heh, my reaction is that only someone from a country that still cherishes the right to bear arms could ask such a question... the rest of the civilized world has amply demonstrated that there is no such danger.

H+: Really? So no one will ever have to risk their lives again to stop oppression?

ADG: Since you press me... my closing words "no such danger" were perhaps a misstatement, but not a material one. I should have said "insufficient such danger to affect our choices today" -- but that's the same thing in practice, because your question was about risks, and therefore about quantifying risks rather than about what will or will not "ever" happen. It's hard to dispute that the need to risk one's life to stop oppression is generally lower in democracies than elsewhere and is lower in longer-standing democracies than in younger ones, and further that long-lived democracies very rarely cease to be democracies whereas non democracies embrace democracy at a steady rate. Those claims are all that are needed to justify my previous answer.

I'm... not mainly driven by a desire to live a long time. I accept that when I'm... 100 years old... I may have less enthusiasm for life...

H+: You've been in the media a fair bit introducing this very unfamiliar concept of a radically expanded life span. On the whole, how would you review the response that you've received?

ADG: Very positive, especially recently. Initially a lot of the coverage was quizzical – journalists "knew" I must be crazy but were impressed by my ability to run rings around their attempts to demonstrate it. More recently most journalists have begun to realize that what I'm saying is actually quite plausible and that the more derisory comments made about SENS by some of my colleagues should not be taken at face value.

H+: One hundred years of life can wear you down physically, but it can also wear you down emotionally... perhaps even existentially. For you, is a desire to live long accompanied by a desire to live long in a much-improved human civilization, or is this one satisfactory?

ADG: I'm actually not mainly driven by a desire to live a long time. I accept that when I'm even a hundred years old, let alone older, I may have less enthusiasm for life than I have today. Therefore, what drives me is to put myself (with luck) and others (lots and lots of others) in a position to make that choice, rather than having the choice progressively ripped away from me or them by declining health. Whether the choice to live longer is actually made is not the point for me.

Resources

Methuselah Foundation
www.mfoundation.org

The Longevity Meme
www.longevitymeme.org

The Distribution of Post-Humanity

with Ramez Naam, author of ***More Than Human, Embracing the Promise of Biological Enhancement***

RU Sirius

H+: Can you give our readers a brief synopsis of your view of why post-humanity will be more distributed and less likely to create population problems than many people suspect?

NAAM: Sure. There are really two specific questions that come up frequently: "Who will be able to afford these technologies?" and "Won't the population explode if we lengthen human life?"

On the population question, it turns out that the major driver of population growth is really fertility rather than the death rate. If you look around the world, the countries with the longest life expectancies — Japan, Sweden — are actually shrinking in population. As these countries have gotten rich, people — particularly women — have decided that they want fewer children. On the other hand, the countries where population is rapidly growing — Indonesia, Nigeria, Pakistan — have relatively low life expectancies. People die early there, but those who survive have big families. On the other hand, over the next 50 years, the UN projects that 3.7 billion people are going to die on this planet, while another 6.6 billion will be born. That'll take global population to about 9 billion people. Of the 3.7 billion who are projected to die in the next 50 years, less than 2 billion of them will die of age-related causes. So even if we cured aging completely tomorrow, and magically delivered the cure to the entire world, the largest possible impact would be about 2 billion lives over 50 years. That would increase global population in 2050 from about 9 billion to about 11 billion — a big change, but not as radical as the more than doubling that happened between 1950 and 2000.

In any case, aging isn't going to be cured tomorrow. I walk through some calculations that if you could raise global life expectancy to 120 years by 2050 — almost twice what it is today — you would raise the 2050 population from the current projection of 8.9 billion people to 9.4 billion people. That's a good-sized increase, but as a percentage of population, it's actually smaller than the change that occurred between 1970 and 1973.

...even if we cured aging... tomorrow, and... delivered the cure to the entire world, the largest possible impact would be about 2 billion lives over 50 years.

The takeaway, for me, is that life extension isn't going to have any radical effect on population for some time.

The question of economic access is a little more complex. People do worry that when these enhancement technologies come out, only the rich will have access to them. And they're right — at the very beginning, only the rich will be able to afford some of these techniques. It helps to realize, though, that most of these enhancement techniques are really information goods. They cost a huge amount to develop, but almost nothing to manufacture. The same thing is generally true of pharmaceuticals today. Viagra costs about $15 per pill, but only a few cents of that is production cost. Mostly it's Pfizer bringing in profit or paying off the $1 billion price tag of developing a new drug. Pfizer can charge that much because the drug is patented. By law, no one else can manufacture it without Pfizer's consent. But in 2012, the patent expires. At that point, any generic manufacturer can make the drug. The more suppliers you have, the more price competition sets in. The more consumers you have, the more incentive there is for suppliers to enter the market. The net effect is that, the more desired any information good is, the cheaper it will be to acquire.

You can see this when you look at drugs that are commonly used today. Penicillin was absolutely priceless when first introduced to the market. But now it costs less than one cent per dose to manufacture, and twenty cents a dose to buy online. The same inverted supply and demand even applies to non-drug techniques. LASIK cost $5,000 per eye when it first came out — now you can get it for $299. As more and more people wanted LASIK, more doctors started offering it. And the more doctors there are offering it, the more they have to compete with each other on price.

The absolute worst thing you can do -- if you want these technologies equally available to poor and rich -- is to ban them. Prohibition would create a black market with worse safety, higher prices, and no scientific tracking of what's going on. Viagra and cocaine cost roughly the same per gram at the moment. In a decade, Viagra will be much cheaper but cocaine will be around the same price it is now. I think we'd rather have our enhancements follow prescription drug economics rather than illegal drug economics.

And even if governments could implement perfect bans, that wouldn't stop people from using these technologies. Asia is much more receptive to biotech than the US and Europe. If a rich couple can't get the genetic treatments they want here, they can absolutely fly to Singapore or Thailand and have it done there. The poor or middle class couple doesn't have the same options.

Don't Leave Your Memory At Home

A conversation with Pete Estep of InnerSpace Foundation

Your brain. It may be your second favorite body part or – if you're a true geek – it may be your first. Either way, your brain is the one and only implement at your disposal that allows you to have any experience of the world. A recently organized nonprofit, The InnerSpace Foundation (IF), seeks to open up new ground in the operation and use of the human brain. Declaring themselves "dedicated to accelerating the development of technologies for improving learning, memory, and other frailties of the human mind," IF has created a neuroengineering competition it calls The IF Prize.

IF is offering two awards. "The Learning Prize" will be "awarded for a device that augments or bypasses the need for traditional learning of information." And "The Memory Prize" will go to "a device that allows storage and later retrieval of memory information."

So fire up your neurotech engines, ladies and gentlemen. And as for the rest of us, presumably the contest winner will remember it for us wholesale.

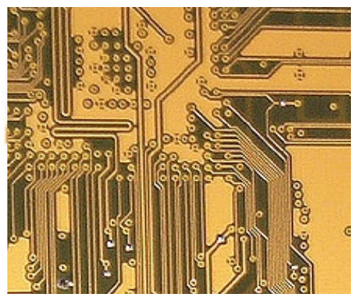
I interviewed Preston W. (Pete) Estep III, Ph.D., chairman and chief scientific officer of IF, via email.

H+: Let me start off with a broad general question. I interviewed Zack Lynch a few years ago – the executive director of the Neurosociety. He believes that neurological improvement and self-control will be the defining characteristic of human society in a decade or so, acing out even biotech. I wonder if you share this view. Will we see a neurological age?

PETE W. ESTEP: I absolutely share this view and Zack is a trustee of the InnerSpace Foundation to help make this vision a reality. But maximum benefit will only materialize on that timeline if we push hard on the accelerator. I started out in neuroscience research as an undergraduate (at Cornell) because I saw the importance and centrality of the field to both understanding and improving biology and behavior. I also sensed huge future potential for the integration of neuro with computer technology. When I moved on to get my Ph.D. [at Harvard] I was still excited about the prospects for a neurotech revolution a few years down the road, but I wanted to do more in silico biology and I sensed an impending revolution in genomics after I met and began to work with my doctoral adviser, George Church. So, I got into genome science because it was so hot and exciting and so many smart people from computer science, engineering, and various hard sciences were joining in, and George's lab seemed like the place to be. I am still very excited about what is going on in genomics but I've segued back into neuro because I think the potential is even greater — probably far greater, especially for people already alive. The Internet and electronic devices have become pervasive and indispensable, and interfaces between us and these outboard intelligences will become increasingly powerful and direct. I think these changes will come steadily and will profoundly transform our lives, but maximum impact will only come if we alter the current research and development dynamic to produce those technologies with the greatest potential.

H+: Your project, as I understand it, is offering awards for uploading information to the brain, and downloading information from the brain. And the idea is a device, whether external or implanted, that allows one to retrieve information by thinking about it. It sounds like a first step to the sort of mind uploading envisioned by people like Hans Moravec and much copied in various science fiction scenarios. I'm trying to envision what a prize-winning project would do. Would this be a first baby step toward these visionary ideas or a "great leap forward?"

PWE: The InnerSpace Foundation is concerned primarily with challenges that lie within the visible technology horizon, which is getting shorter in some ways. The challenges of improving natural mental



functions are very daunting, so we have focused on establishing basic two-way communication between the brain and prototype devices. Interfacing with non-biological electronic devices is important because they have many advantages over brains and neurons in terms of speed, accuracy, and durability. Input of information into the brain by electronic means rather than just through our normal sensory channels can be called learning, even though it is a non-traditional form of learning, and outputting existing memory information to a device for later access is potentially an extremely powerful way of augmenting memory because it has essentially unlimited capacity and high fidelity.

Since it is difficult for us to imagine exactly how these things might be done best in several years' time, we have decided to set up a prize-based competition for rewarding one or more teams who produce the most compelling breakthroughs that most clearly satisfy the prize guidelines.

We already know we don't have to destroy or dismantle the brain to get enormous quantities of information out of it; I think we simply need to push forward technologies that allow for maximum information flow to and from the brain in a non-destructive manner. Therefore, procedures like those suggested by Moravec that require the brain to be destroyed or dismantled and reconstructed don't appeal to me. The IF is committed to technologies that will move essential information to and from the brain, and allow it to be stored and backed up, but I don't want to speculate much on "mind uploading," which implies dynamic reanimation of downloaded and stored information. Nevertheless, there are many very serious and respectable people who contemplate and seek the development of such technologies. The IF is trying to get the world's leading neuroengineering talent to give us baby-step technologies toward what we currently regard as the future great leap of exceeding or transcending our unwanted evolved limitations — whatever they might be — and I am a very strong advocate of this bioprogressive view.

H+: Do you see this program of neural achievement as running in parallel to ideas of developing smart AIs, potentially of greater-than-human intelligence, and could this – in some sense – be a step toward fostering hybridization between humans and advanced AI?

PWE: A long-term goal of the IF is to allow the maximum possible degree of direct human control over powerful outboard intelligences. Many extremely bright people have argued that self-improving AI could have catastrophic consequences for humanity unless we are an indispensable part of the overall equation. My view on the AI developmental timeline is pretty conventional. I think AI of this level is some way off, and might even be dependent upon improved human intelligence, but I see the logic of their argument.

It is interesting to contemplate the interdependent hybrid human–AI intelligence scenario I just mentioned. It is entirely possible that naturally evolved human intelligence is incapable of producing catastrophically (for us) self-improving outboard intelligences, and that both natural human intelligence and AI are largely incapable of producing dramatic increases in human intelligence through purely biological manipulations because of the constraints of neurons and neuron-based storage and "computation." However, when we consider that both abiotic and biotic storage and computational devices have their own strengths and weaknesses, it is easy to envision hybrids that tap the advantages of each and have characteristics superior to either alone. As one simple example of the comparative advantage of abiotic storage, my (inexpensive and old) 1 gigabyte keychain flash drive can store about a thousand 400-page books. And in less than a decade, a 1 terabyte (TB) keychain storage should be inexpensive and common. People will

be able to store the equivalent of about a million books of text on their 1 TB keychain, and using standard and simple protocols retrieval is essentially error-free and extremely fast. 1 TB is also equivalent to about a million minutes of CD-quality music, a million photos from a typical 3 megapixel camera, or 140 days of continuous video (5 MB/minute bitrate, which is about YouTube or better).

Each of us should probably ask ourselves if we could store all information that is essential and important to us on a single such device how we might make real use of that potential. I think when we seriously reflect on such questions we begin to really see some of our inherent biological limitations. The harsh reality is this: the human brain is a magnificent and mysterious collection of abilities, but for fast and accurate storage and retrieval of important information, even a humble keychain flash drive has overtaken us. But I am extremely excited that -- for the first time in history -- we can envision using such technologies to augment the brain's natural limitations.

H+: You're focusing on memory

rather than. say. perceptual intelligence or happiness, mainly because it's measurable. My immediate impulse is that eliminating psychological misery would create the greatest benefit of all -- both for its own sake and because troubled people cause our biggest problems socially and economically. But are there other reasons why memory has the greatest advantage, if it does?

PWE: We're focused on memory because it is the currency of our very existence. Our memories give us a sense of continuity and connection to our friends, relatives, and associates and to our own histories. We're also focused on memory because moving memory information from the brain to a device accomplishes one of the two most basic directional transfers of information (into the brain and out of the brain), which is a first step toward establishing meaningful and increasingly complex two-way communication. There are many types of information that might flow from the brain to a device but when we consider establishing connectivity at the most basic prototype stage, we probably think of "sending" requests to a device for information input, and transferring to a device somewhat more meaningful, preexisting information about ourselves. This first type of "query" information is important for accessing or learning information and we are addressing this with our "The IF Prize for Learning."

This information can be stored and retrieved as "memory" but this challenge is somewhat different from dealing with other types of information, particularly complex and preexisting memories of, for example, friends and events. Capturing this more-meaningful "memory" information on a device is beyond our current understanding and technical abilities, but this is information you'd like to recall accurately over time, and even back up in the same way you back up important documents stored on your computer hard drive. But the complexity of this type of information exists on a continuum that can be as trivial as a grocery list or as meaningful as the details of your wedding day or your first date. We won't be able to store and subsequently access all the complexities of an important memory with initial prototype devices; we'll probably begin much closer to the grocery list stage but with time they'll improve; and it is hard to say what the upper limit will be. So, we have established "The IF Prize for Memory" to accelerate the development and demonstration of a prototype memory augmentation device. and a particularly powerful prototype device might satisfy the criteria for both prizes.

The reason we're not trying to accelerate development of other research or technologies is multilayered. First, mainstream research into the brain and behavior is very well funded. Mental diseases and disorders are researched by thousands of people around the world. The kind of research we would like to accelerate is woefully underfunded and is difficult to fund through traditional channels. Second, we think that the pace of scientific research and technology development are limited primarily by the natural limitations of the human mind. It seems self-evident that a more-powerful intelligence can solve difficult problems -- including providing lasting cures for any disease or disability -- much more quickly and efficiently. So we're putting all our efforts where we think they'll do the most long-term good, rather than wishfully employing underpowered brains to continue devising superficial solutions to these extremely serious problems.

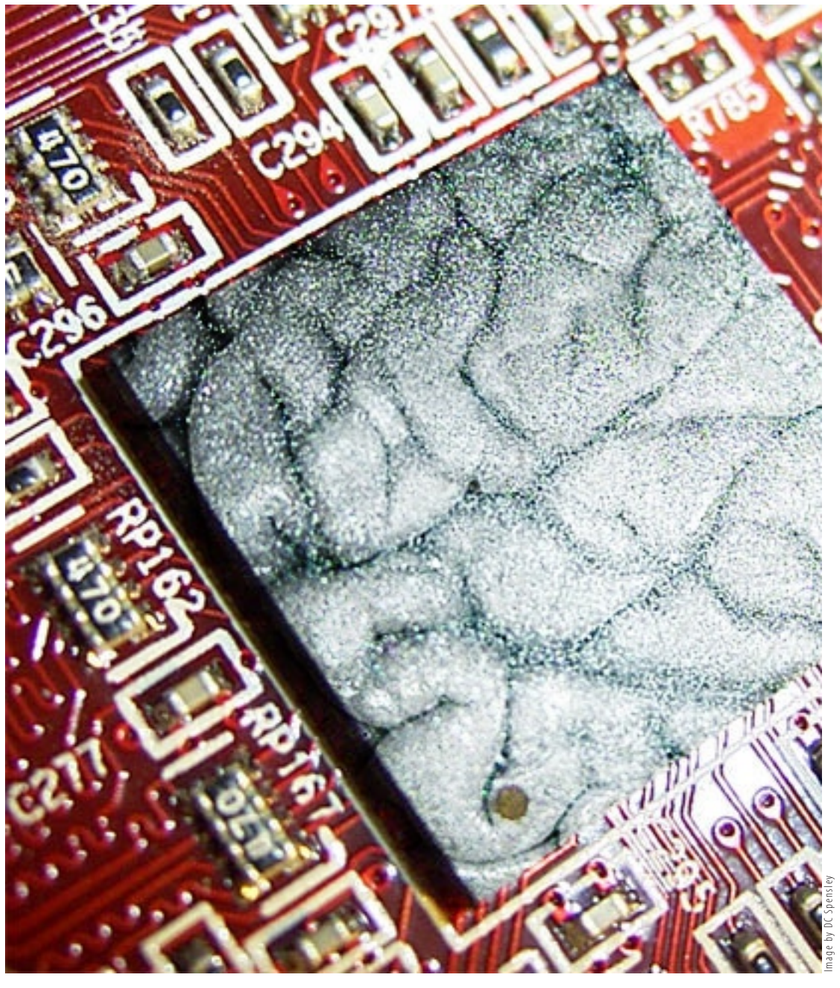


Image by DC Spensley

H+: I realize that it's not part of this project, but do you worry at all about the quality of the information that human brains will be linking to? In other words, if my brain is directly hooked up to the Internet, or more specifically to Wikipedia, I'm still going to experience the same frustrating quantity of crap — errors, irrelevancies, and the tendency of Internet informational materials to exclude important bits of data.

PWE: I am very concerned with the data quality issue but when we consider the downside of what we might get with new technologies, we should carefully reflect on the quality of what we already have and ask why and how it got that way. The reason our public discussions and databases give us some garbage out is because people put garbage in. Wikipedia has gotten much better over time and in many cases is surprisingly good, which shows that mature technologies eventually establish an acceptable signal-to-noise ratio. One of the problems of the naturally evolved mind trying to sift through large amounts of data in a complex modern world is that we don't have efficient filters. We do have filters, lots of them, but they are not very good at rapidly sorting through complex data. This is another area that should benefit greatly from increasingly direct interfaces with computers. But your question raises some very vexing downstream questions that will take a long time to sort out. Nevertheless, we're already painfully aware of excessive noise in at least parts of our essential communications systems like the Internet, and we feel the impact from time to time. This is a really serious problem, and like any other really serious problem, faster and more accurate learning and memory, and increased overall cognition and intelligence, should contribute to more rapid and satisfactory solutions.

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H+: Do you see a relationship between this project and neural performance enhancement oriented projects like brain exercises, nutrients, and "smart drugs?"

PWE: I'd say there's only a weak relationship. I'm certainly an advocate of those approaches since they're all we've got right now; but their potential is very limited relative to what we would like to accomplish — although, right now I'd be happy with anything to remind me to return emails or phone calls on time! It might sound a little futuristic at this point but I think for what we'd like to achieve there is a much greater upside to investments in brain imaging, biocompatible materials science, microelectronics, and information technology, than in inherently weaker approaches for tweaking our existing biology. I support the continuation of basic research on brain function using brain exercises, drugs, and other approaches but I'd like to see each person thinking "outside the box" that sits on his or her shoulders.

We have expanded our intelligence and reach in unexpected ways in the past and I'd like people to contemplate possible future expansions. Richard Dawkins' seminal book *The Extended Phenotype* is an exploration of the selection for genotypes that result in organisms creating various extensions of themselves, including physical extensions of their biological selves (a more succinct treatment can also be found in the second and later editions of *The Selfish Gene*, in the chapter "The Long Reach of the Gene"). This process can be very abstract; it can extend to the establishment of various novel relationships and can be extremely rewarding. Consider our relationship with dogs.

Dogs are not just a human's best friend, they are one of our greatest creations ... well, we didn't exactly create dogs as much as cultivate them from a preexisting species, the wolf. But everyone knows a dog is not equivalent to a wolf. We used a crude but effective understanding of trait-based selective breeding to enrich our proto-dog companions for behavioral tendencies to herd, protect, hunt, and probably to show obvious appreciation and affection for us. They have intelligences and abilities that are complementary to ours and we turned a marginal initial relationship. into an extremely mutually rewarding relationship that we valued then and probably value even more now because they have become increasingly what we wanted them to be.

I think we should go forward with an extremely optimistic belief that we can establish even more rewarding and complementary relationships with other intelligences — including one another — by all becoming more like we'd like ourselves and others to be.

Resources

InnerSpace Foundation
www.InnerSpacefoundation.org

Brain Stimulant
brainstimulant.blogspot.com

Brain Waves
brainwaves.corante.com

The Artificial Hippocampus

with David Pescovitz, director of research at the Institute for the Future and ***Boing Boing*** *Editor.*

RU Sirius

PESCOVITZ: Biomedical engineer Theodore Berger at the University of Southern California in Los Angeles has developed an artificial hippocampus: a silicon substitute for the part of the brain that scientists believe encodes experiences as long-term memories. To do this, Berger built mathematical models of neuronal activity in a rat's hippocampus and then designed circuits that mimic those activities. The next step is to implant the devices in rats to see if they can process the electrical impulses associated with memory and then communicate them back to the brain for long-term storage. Joel Davis at the Office of Naval Research, a sponsor of Berger's work, said, "Using implantables to enhance competency is down the road. It's just a matter of time." While Berger's work is a far cry from a hard drive for the brain, I'm intrigued by the notion of being able to "back up" my memory just in case.

The Reluctant Transhumanist

SF Writer Charlie Stross keeps his options open

Interview by RU Sirius & Paul McEnery

Singularity, 2012: God springs out of a computer to rapture the human race. An enchanted locket transforms a struggling business journalist into a medieval princess. The math-magicians of British Intelligence calculate demons back into the dark. And solar-scale computation just uploads us all into the happy ever after.

Stripped to the high concept, these visions from Charlie Stross are prime geek comfort food. But don't be fooled. Stross' stories turn on you, changing up into a vicious scrutiny of raw power and the information economy.

The "God" of Singularity Sky is really just an Artificial Intelligence, manipulating us all merely to beat the alien competition. The Merchant Princes (from a series of novels by Stross) are just as rapacious as anything on Wall Street, and a downstream parallel universe is just another market to exploit. The Atrocity Archives gives us a gut-punch full of paranoia -- on the far side of hacking and counterhacking lurks an unspeakable chaos. And for all our engineering genius, *Accelerando*'s paradise is won at the cost of planetary destruction, with humanity cul-de-sac'd as our future heads off into the stars without us.

For his latest novel, *Halting State* (released in June 2008), Stross savages the fantasy worlds we escape into for fun and profit and invites us to peek underneath the surfaces as our chattering gadgets dress up reality with virtual sword-and-sorcery games, all underwritten by oh-so-creative financial instruments.

All of Stross's highly connective pipe-dream superstructures are wide open to the one geopolitical prick that will pop them all like the balloon animals they are. Be warned. Take care of the bottom line, or your second life will cost you the life that counts.

It's no surprise that Stross is a highly controversial figure within Transhumanist circles – loved by some for his dense-with-high-concepts takes on themes dear to the movement, loathed by others for what they see as a facile treatment of both ideas and characters. But one thing is certain -- Mr. Stross is one SF writer who pays close attention to the entire plethora of post-humanizing changes that are coming on fast. As a satirist, he might be characterized as our Vonnegut, lampooning memetic subcultures that most people don't even know exist.

H+: With biotech, infotech, cognitive science, AI, and so many other sciences and technologies impacting the human situation, it seems that most social and political discourse remains back in the 20th century at best. You talk sometimes about being a post-cyberpunk person. How do you deal with the continued presence of so many pre-cyberpunk people?

CHARLIE STROSS: As William Gibson noted, "the future is already here: it's just unevenly distributed." Most people run on the normative assumption that life tomorrow will be similar to life today, and don't think about the future much. And I'm not going to criticize them for doing so; for 99.9% of the life of our species this has been the case, barring disasters such as plague, war, and famine. It's a good strategy, and periods when it is ignored (such as the millennial ferment that swept Europe around 990 A.D. and didn't die down until 1020 A.D.) tend to be bad times to live.

Unfortunately, for about the past 200 years -- that's about 0.1% of H. sapiens' life span as a species – that strategy has been fundamentally broken. We've been going through a period of massive technological, scientific, and ideological change, and it has invalidated the old rule set. But even so, at a day-to-day level, or month-to-month, things don't change so much. So most people tend to ignore the overall shape of change until it's impossible to ignore. Then they try to apply the old rules to new media or technologies, make a hopeless mess of things, and start on a slow and painful learning process. It's been quite interesting to watch the slow progress toward an international consensus on certain aspects of Internet culture, for example. In that context, I suspect the mainstream is only a decade or so behind the cutting edge: the debates over spam and intellectual property that the geeks were having in the early 1990s are now mainstream. (Of course, a decade feels like an eternity when you're up close and personal with it.)

H+: Remaining on the cyberpunk tip for a moment, Gibson's *Neuromancer* (the whole trilogy, really) popularized a trendy subculture that impacted on both entertainment and actual technology. Do you think that *Accelerando* could have that effect? Do you see yourself as a popularizer of memes that are just taking root?

CS: Naah.

A chunk of *Accelerando* was extracted in raw juicy nuggets from my time on the extropians mailing list in the early to mid-nineties; another chunk came out of my time in the belly of a dot-com's programming team in the late nineties. I wanted to get my head around the sense of temporal compression that was prevalent in the dot-com era, of the equivalent of years flickering past in months. But it's too dense for the mainstream. As we've already noticed, a lot -- probably the majority -- of people aren't interested in change; in fact, they find it frightening. And *Accelerando* compressed so many ideas into such a small space (I think there's about 0.5 to 1 novel's worth of ideas per chapter in each of its nine chapters) that it's actively hostile to most readers. Some people love it, those who're already into that particular type of dense fiction-of-ideas, but many, even seasoned SF readers, just turn away.

I would like to hope that I've gone some way toward changing the terrain within the SF genre itself, though. Robert Bradbury's concept of the Matrioshka Brain (or Jupiter Brain, in earlier iterations) is one of the most marvelous SF concepts I've run across in a long time, and not trivially easy to refute. I wanted to get past the then-prevalent idea that you couldn't write about a Vingean singularity -- it's difficult, but we've got tools for thinking about these things. And I got the idea of computronium into common enough parlance that Rudy Rucker recently took a potshot at it, implying that it's part of the universe of discourse in my field.

H+: I'm curious about the Economics 2.0 idea that is featured in *Accelerando*. What do you think about economic systems in a presumably post-human world? Do any of the theories – free market, Marxist, and so forth – that have guided those who ideologize these things continue to make sense after replicators and the like?

CS: In a nutshell, about Economics 2.0: economics is the study of the allocation of resources between human beings under conditions of scarcity (that is, where resources are not sufficient to meet maximal demand by all people simultaneously). Resource allocation relies on information distribution -- for example, price signals are used to indicate demand (in a capitalist economic system). In turn, economic inter-

actions within, for example, a market environment hinge on how the actors within the economic system use their information about each other's desires and needs.

To get a little less nose-bleedingly abstract: say I am crawling through a desert and dying of thirst, and you happen to have the only bottled water concession within a hundred miles. How much is your water worth? In the middle of a crowded city with drinking fountains every five yards and competing suppliers, it's worth a buck a bottle. But in the middle of a desert, to someone who's dying of thirst, its value is nearly infinite. You can model my circumstances and my likely (dying-of-thirst) reaction to a change in your asking price and decide to hike your price to reflect demand. You can do this because you have a theory of mind, and can model my internal state, and determine that when dying of thirst, my demand for water will be much higher than normal. And this is where information processing comes into economic interactions.

What kind of information processing can vastly smarter-than-human entities do when engaging in economic interactions? In *Accelerando* I hypothesized that if you can come up with entities with a much stronger theory of mind than regular humans possess, then their ability to model consumer/supplier interactions will be much deeper and more efficient than anything humans can do. And so, humans will be at a profound disadvantage in trying to engage in economic interactions with such entities. They'll be participating in economic exchanges that we simply can't compete effectively with because we lack the information processing power to correctly evaluate their price signals (or other information disclosures). Hence Economics 2.0 -- a system that you needed to be brighter-than-human to participate in, but that results in better resource allocation than conventional economic systems are capable of.

H+: What do you think about transhumanism and singularitarianism as movements? Are these goals to be attained or just a likely projection of technologies into the future that we should be aware of?

CS: My friend Ken MacLeod has a rather disparaging term for the singularity; he calls it "The Rapture of the Nerds."

This isn't a comment on the probability of such an event occurring, per se, so much as it's a social observation on the type of personality that's attracted to the idea of leaving the decay-prone meatbody behind and uploading itself into AI heaven. There's a visible correlation between this sort of personality and the more socially dysfunctional libertarians (who are also convinced that if the brakes on capitalism were off, they'd somehow be teleported to the apex of the food chain in place of the current top predators).

Both ideologies are symptomatic of a desire for simple but revolutionary solutions to the perceived problems of the present, without any clear understanding of what those problems are or where they arise from. (In the case of the libertarians, they mostly don't understand how the current system came about, or that the reason we don't live in a minarchist night-watchman state is because it was tried in the 18th

and 19th centuries, and it didn't work very well. In the case of the AI-rapture folks, I suspect there's a big dose of Christian millennialism (of the sort that struck around 990–1010 A.D., and again in the past decade) that, because they're predisposed to a less superstitious, more technophillic world-view, they displace onto a quasiscientific rationale.

Mind uploading would be a fine thing, but I'm not convinced what you'd get at the end of it would be even remotely human. (Me, I'd rather deal with the defects of the meat machine by fixing them -- I'd be very happy with cures for senescence, cardiovascular disease, cancer, and the other nasty failure modes to which we are prone, with limb regeneration and tissue engineering and unlimited life prolongation.) But then, I'm growing old and cynical. Back in the eighties I wanted to be the first guy on my block to get a direct-interface jack in his skull. These days, I'd rather have a firewall.

H+: You said "I'd be very happy with cures for senescence, cardiovascular disease, cancer, and the other nasty failure modes to which we are prone, with limb regeneration, and tissue engineering and unlimited life prolongation." It seems to me that this still puts you in the Transhumanist camp. Would you agree?

CS: To the extent that I don't believe the human condition is immutable and constant then yes, I'm a Transhumanist. If the human condition was immutable, we'd still be living in caves. (And I have a very dim view of those ideologies and religions that insist that we shouldn't seek to improve our lot.)

H+: Earlier on, you referred to the Matrioshka brain. Can you say a bit more about that and why you find it an appealing or, perhaps, realistic concept?

CS: As I said, the credit for the concept belongs to Robert Bradbury, who refined it further from discussions by Eliezer Yudkowsky and others in the mid-nineties, in turn based on speculation by Freeman Dyson going back as far as the 1960s.

Dyson first opened the can of worms by suggesting that we could make better use of the matter of the solar system by structuring it as free-flying solar collectors and habitats in variously inclined but non-intersecting orbits, which would trap the entire solar radiation output and give us access to mind-numbingly vast amounts of energy and inhabitable space.

The extropians took the idea one step further, with the idea of computronium — the densest conceivable form of matter structured to maximize computation. What amount of thinking can you get done by building a Dyson sphere, optimized to support computation rather than biological life? Bradbury suggested building multiple concentric spheres of free-flying compute nodes, each shell feeding off the waste heat of the next layer in. Some estimates of the computing power of such a Matrioshka Brain (named after the nested Russian dolls) suggest that it would be roughly as far beyond us -- the entire human species -- as we are beyond a single nematode worm.

If the idea of procedural artificial intelligence holds water, it's possible that a

Back in the eighties I wanted to be the first guy on my block to get a direct-interface jack in his skull. These days, I'd rather have a firewall.

Matrioshka Brain (or something like it) is going to turn out to be the end state of any tool-using civilization: after all, the bulk of the mass of which our planet is composed is of no use to us whatsoever (other than insofar as it makes a dent in spacetime for us to stick to), never mind the rest of the solar system...

H+: Moving on, your latest novel, *Halting State* is all about different levels of reality. LARPs and Second Life, office politics, the "mammalian overlay" of sexual seduction, financial instruments: they're all artificial realities, one layer on top of each other, and all interacting. It's sort of like what we used to think of as a spiritual realm, but it's right here running on TCP/IP. It used to be only shamans and schizophrenics who had these sorts of visions, but now, if you're wearing the special specs, we all get to share this world that's haunted by imaginary beings. I think of Arthur C. Clarke's notion that a sufficiently advanced technology is indistinguishable from magic. Do you think the areas and powers that we're opening up will change us?

CS: What makes you think it's about us?

We're human 1.0. We're not going there. Or we may go down that road, but the things that arrive at the other end won't be us. (They might remember having started out as us, but I'm not betting on it.)

H+: There's a nasty little idea buried in *Halting State*, I think. Like: if you think things are bad when people get their ideas about reality from TV, wait until our imaginations are completely colonized, surveilled and programmed. Our hero bleakly opines, that this is the reason for the Fermi Paradox. There are no signs of alien life because you get so far and then vanish up your own artificial reality. Have I got that right? And is that a prediction?

CS: I try not to make predictions -- but I see that one as a distinct possibility (and indeed, as yet another solution to the Fermi Paradox).

The Sheep Shit Grass (or The End of Scarcity)

*with Cory Doctorow, SF writer and **Boing Boing** editor.*

RU Sirius

DOCTOROW: It's not hard to think about a kind of nanotech future where virtually all objects are available on demand. In that kind of world, both the traditional Marxist and the traditional Keynesian analyses don't make a lot of sense. These are predicated first and foremost on the regulation of scarce and valuable objects. In a "Kazaa World" where every time someone expresses a market signal about the value of a song by downloading a copy of it, instead of there being one fewer copies of that song, there's now one more copy of that song, this is a really different economic proposition. And I talk about this as an alternative to the tragedy of the commons. This is a commons where the sheep shit grass. The more you graze the more you get.

Botox Parties, Michael Jackson, and the Disillusioned Transhumanist

*with Christopher Dewdney, culture theorist and author of **Last Flesh: Life in the Transhuman Era***

RU Sirius

H+: Michael Jackson seems to reflect various trans-mutant themes.

DEWDNEY: For me, Michael Jackson represents a sort of pioneer of self-transformation. Aside from whatever questionable personal motives are impelling him, he is using cosmetic surgery to achieve a look that is definitely transhuman. He has taken us by proxy to the frontier of what is currently possible with cosmetic surgery and he has even escaped the constraints of race by lightening his skin color. This last aspect is perhaps the most controversial and disconcerting, but the freedom to choose all your "inherited" features, both familial and racial, will probably become an intrinsic part of the transhuman era.

H+: He reflects, although perhaps not fully consciously, a pursuit of otherness, alienation, and mutation that runs through many contrasting subcultures from psychedelicists to goths to UFO nuts, to early transhumanists, SF fanatics, ad infinitum. And now middle-aged, middle-class ladies have parties to shoot up Botox. Does the mainstream culture show signs of understanding itself as evolving into a mutant breed and do those who need to be different or avant garde have any new avenues opening up to keep them ahead of the hoi polloi?

DEWDNEY: The corollary to the Botox craze is the predicament of disillusionment, nay, misanthropism, that I have found myself immersed in the last couple of years. Perhaps the real ground of my disillusionment is my hard-lost benevolence. I'm an optimist; I like people. Yet when I asked a lot of "average" people — people who weren't part of my circle — what they would do with the kind of self-transformative power that may perhaps be ours to wield, I was increasingly appalled. The jocks I talked to wanted to be bigger and stronger so they could beat the shit out of everybody else; the women wanted to morph into their ideal role models. I began to realize that what most people wanted was conformity; their "ideals" would turn us into a world of underachieving Nicole Kidmans and eight-foot Brad Pitts, identical cut-outs with no individualism.

My previous rather naive notion that biotechnology would free us from the tyranny of "normalcy," that we could become anything we wanted, morph ourselves into elongated, blue-skinned, orange-haired, sixteen-fingered geniuses or perhaps flying ribbons of sensual bliss that performed acrobatic choreographies above the sunset, was a very utopian and, as it turns out, unpopular dream. Individuality or creative improvisation is the last thing most people want. So Botox is really a dreadful symptom of a new, radical mundanity enabled by biotechnology. And that's disillusioning.

Science Fiction Gets Funding

Sonia Arrison

Billionaires who care about escape velocity, radical life extension, or the Turing Test don't come along very often, but when they do, their actions have the potential to dramatically change the world. Space travel, biotechnology, and artificial intelligence are three areas where some super-smart, super-wealthy people are directing their money – and it's starting to pay off.

For instance, Richard Branson of Virgin Group has already signed up 200 people to take his commercial space flights starting in 2009. And, as if that wasn't enough, he also announced that he'll be performing the first-ever space marriage on board one of his ships. When the new couple considers a location for their honeymoon, hotel chain billionaire Bob Bigelow can help. His company, Bigelow Aerospace, is planning on launching experimental inflatable hotel modules sometime in 2010. But it doesn't end there.

Google co-founders Larry Page and Sergey Brin take things a step further with the $30 million Google Lunar X Prize for any team of scientists who land a robot on the surface of the moon, travel 500 meters over the lunar surface, and send images and data back to the earth.

When it comes to biotechnology, Microsoft co-founder Paul Allen's Institute for Brain Science has already mapped an entire mouse brain, detailing more than 21,000 genes at the cellular level. Now his researchers are focused on the human brain, and perhaps soon they can start thinking about reverse engineering it.

Then there's Peter Thiel, the PayPal co-founder turned hedge fund manager who is looking to speed up research in all three areas (space, life extension, and AI). On the non-profit side, Thiel has given to the Singularity Institute for Artificial Intelligence as well as the Methuselah Foundation that seeks to cure aging. On the for-profit side, he's working to create a unique kind of investment strategy with his associates at the Founder's Fund.

"I'm trying to construct a science fiction fund," Thiel says, "but I'm nervous to describe it as that because it might attract crazy people and not real entrepreneurs."

It's true that wherever there are new ideas, there are a few crazies, which may explain why Larry Ellison seems to go out of his way to downplay the "anti-aging" tone of his $42 million per year bioscience donations. Yet Ellison's foundation was responsible for funding David Sinclair of Sirtris Pharmaceuticals, which is developing a drug based on resveratrol, a chemical found in the skin of red grapes that fights the effects of aging. Sinclair's company was recently sold to GlaxoSmithKline for $720 million, proving that Ellison's anti-aging bet is not only edgy, but also valued by the marketplace.

Paul Allen's Institute for Brain Science has... mapped an entire mouse brain, detailing more than 21,000 genes at the cellular level...

Of course, some billionaires funding cool technology prefer to avoid the limelight and questions of money. For instance, Amazon's Jeff Bezos refuses to say how much he is spending on his space project Blue Origin. It was also difficult to find details concerning the investments of Apollo Group's John Sperling and investor Jeffrey Epstein. Nevertheless, all these billionaires are funding edgy and important work, and one hopes their ranks will grow.

Name	*Net worth*	*Edgy projects*	*Amounts*	*Web*
Paul Allen	16 billion	Seti, Allen Telescope Array (ATA)	25 million	http://www.seti.org/seti/projects/ata
		Sponsored SpaceShipOne, which won the Ansari X-Prize in 2004	30 million	http://www.paulallen.com/Template.aspx?contentId=26
		Fred Hutchinson Cancer Research Center for early detection	5 million	http://www.fhcrc.org
		Allen Institute for Brain Science	100 million	http://www.alleninstitute.org
Jeff Bezos	8.2 billion	Blue Origin	Refuses to disclose	http://public.blueorigin.com
Robert Bigelow	Reportedly around 1 billion (he won't comment)	Bigelow Aerospace	500 million	http://www.bigelowaerospace.com
Richard Branson	4.4 billion	Virgin Galactic in collaboration with the SpaceShipOne team	25 million investment	http://www.virgingalactic.com
Larry Ellison	25 billion	Ellison Medical Foundation	42 million a year for basic biomedical research anti-aging research	http://www.ellisonfoundation.org/index.jsp
Jeffrey Epstein	Unclear	Harvard, Program for Evolutionary Dynamics	6.5 million	http://www.ped.fas.harvard.edu
		Funds R&D on AI	Unclear	One example: http://intelligenesiscorp.com/agiriorg/path/acknowledgements.htm
Larry Page, Sergey Brin	18.6, 18.7 billion	Google Lunar X Prize	30 million	http://www.googlelunarxprize.org
John Sperling	1.7 billion	Kronos	50 million for all anti-aging initiatives claimed in an '04 *Wired* article.	http://www.kronoshealth.com http://www.wired.com/wired/archive/12.02/immortal_pr.html
		Kronos Longevity Research Institute (founded 1999)	6.3 million in '06 from Sperling's Aurora Foundation, usually 1.5 million per year according to Kronos spokesperson, but the extra funding is for the Keepstudy	http://www.kronosinstitute.org/ http://www.guidestar.orgFinDocuments/2006/860/873/2006-860873239-03778e30-F.pdf
		Genetic Savings and Clone	Created first cloned cat	Went out of business in 2006
		Via Gen	Livestock cloning and gene banking	http://www.viagen.com/
Peter Thiel	1.2 billion	Methuselah Foundation	3.5 million	http://www.methuselahfoundation.org/
		Singularity Institute	500,000	http://www.singinst.org/
		Cynthia Kenyon at UCSF	$150,000	http://kenyonlab.ucsf.edu/

Sonia Arrison is a senior fellow at the Pacific Research Institute and is currently working on a new book examining the social and political impacts of extreme longevity.

Resources

Paul Allen's SpaceShipOne
www.paulallen.com/Template.aspx?contentId=26

Allen Institute for Brain Science
www.alleninstitute.org

Jeff Beznos' Blue Origin
public.blueorigin.com

Bigelow Aerospace
www.bigelowaerospace.com

Virgin Galactic
www.virgingalactic.com

The Ellison Medical Foundation
www.ellisonfoundation.org/index.jsp

Google Lunar XPrize
www.googlelunarxprize.org

Kronos Longevity Research Institute
www.kronosinstitute.org/about/whoweare/index.cfm

Singularity Institute
www.singinst.org

Cynthia Kenyon
kenyonlab.ucsf.edu

Overclocking the Human CPU

A primer for the future of human intelligence

James Kent

Although the human imagination is capable of many things, it is very difficult to imagine being smarter than we are now. We may be able to envision a life where the average human can hold hundreds of facts in working memory and manipulate them all with perfect accuracy and efficiency, but it is hard to imagine what that would feel like. How much more would we "know" due to the heightened capacity of our super-genius intellect? Would the feeling be cold and computer-like; would it be eerily prescient and clairvoyant? Would it be god-like?

These are more than just rhetorical questions. While we 21st century humans are currently locked within the framework of our genetic neural architecture, our species has gotten to the point where we can routinely tweak and build on the physical traits we're born into with some training, chemical or surgical tinkering, and/or targeted genetic alteration. Messing with the fabric of human intelligence may be an ethical black area in today's climate, but superintelligence research is well under way in many forms right now. We're heading into a future we can hardly begin to imagine with our primitive brains.

Human intelligence is already progressing in ways we cannot accurately measure. The sheer force of evolution, culture, and centuries of written language has imprinted our neural DNA with the networks needed to process abstract symbols and draw complex hypothetical conclusions based on available data sets. This is the core of human intelligence: the ability to compare, contrast, and juxtapose sets of data against each other in order to draw accurate conclusions and predict likely outcomes.

Unfortunately, our mental toolkit is comically weak, allowing us to only hold five to seven variables for comparing and contrasting at any one time, and constantly needing to "dump" whatever is in working memory when distracted by new tasks. Lame! Not only is our working bandwidth low, our long-term memory is lossy, leaving us to rely on external storage methods (ideas encoded in symbols or bits) to communicate rational output to other people and keep track of all the new "information" we create over time. For creatures that have short unpredictable lives, this limited setup might be okay, but for modern humans it leaves us wanting more, better, faster.

Since we have external memory storage down (thanks, Internet!), this leaves personal working-memory bandwidth the most lacking of human traits in our time. In biophysical terms the bandwidth of our intelligence is limited to a tiny conduit of neural cables running from our working memory in the brain's frontal lobes, back to the abstract symbol processing networks in the parietal lobes, and back to the working memory again. This intelligence circuit is where all the heavy-duty puzzle solving goes down when you're reading a map or working a Sudoku grid. Human problem-solving requires that data moving along this circuit be fast for focus and precision (good conductivity) and robust for complexity of thought (dense wiring). Increased speed and connectivity along this circuit is where the future of human intelligence lies, and there are only a few ways to get it moving in the right direction.

Since we have external memory storage down (thanks, Internet!), this leaves personal working-memory bandwidth the most lacking of human traits in our time.

At one point in time it seemed that drugs were the answer to this question: Dexedrine and piracetam, cognitive enhancers, ginko, ephedra, nootropics, and the like. While these supplements are indeed nifty for achieving short-term focus and mental clarity, they seem to only milk the limited capacity of our current wetware without providing the instantaneous multi-point IQ boost we would expect from our "smart drugs." Drugs can increase human intelligence temporarily by increasing the speed and conductivity along the intelligence circuit. However, most of the evidence to date suggests that the brain will eventually begin to power-down or tip into psychotic states if this method is used or abused for too long. To build long-term conductivity you need to train your mental reflexes just as you would train your hand-eye reflexes, and like any training this takes long periods of discipline to see even limited results. Books, video games, and websites that focus on multistage puzzle solving in strict time limits (yes, I'm talking about Tetris) are probably the best way to get the logic circuit wires crackling and ready for more complex problem-solving, but what about improving the robust capacity we crave?

Data capacity, bandwidth, or robustness along the intelligence circuit is the main shortcoming of human intelligence, and what divides the geniuses from the morons. In real terms, this metric defines how many abstract symbols we can hold in working memory at any one time while still performing rational analysis on those objects. For instance, how many words from the last paragraph could you recall if you closed your eyes right now? Could you remember enough words to complete a simple seventeen-syllable haiku in thirty seconds or less without any errors? No? Why not?

If you can do it you're probably a genius, because that means you have the capacity to hold at least ten or more random words in your working memory while performing rule-based contextual algorithms to rearrange logical syntactical output under strict time limits. A computer could do it in a snap, but the limitations of our working memory make this all but impossible. This capacity is a trait we cannot easily improve in a lifetime, not without radical mental training, dodgy neural steroid hormones, or even dodgier drug-induced neural plasticity. What we do know is that this capacity for robust intelligence is genetically inherited, which naturally gives some people the upper hand. According to Richard Haier of the University of California, Irvine, one of the initial founders of the Parieto-Frontal Integration Theory (P-FIT, referred to here as the intelligence circuit), "Genetic research has demonstrated that intelligence levels can be inherited, and since genes work through biology, there must be a biological basis for intelligence."

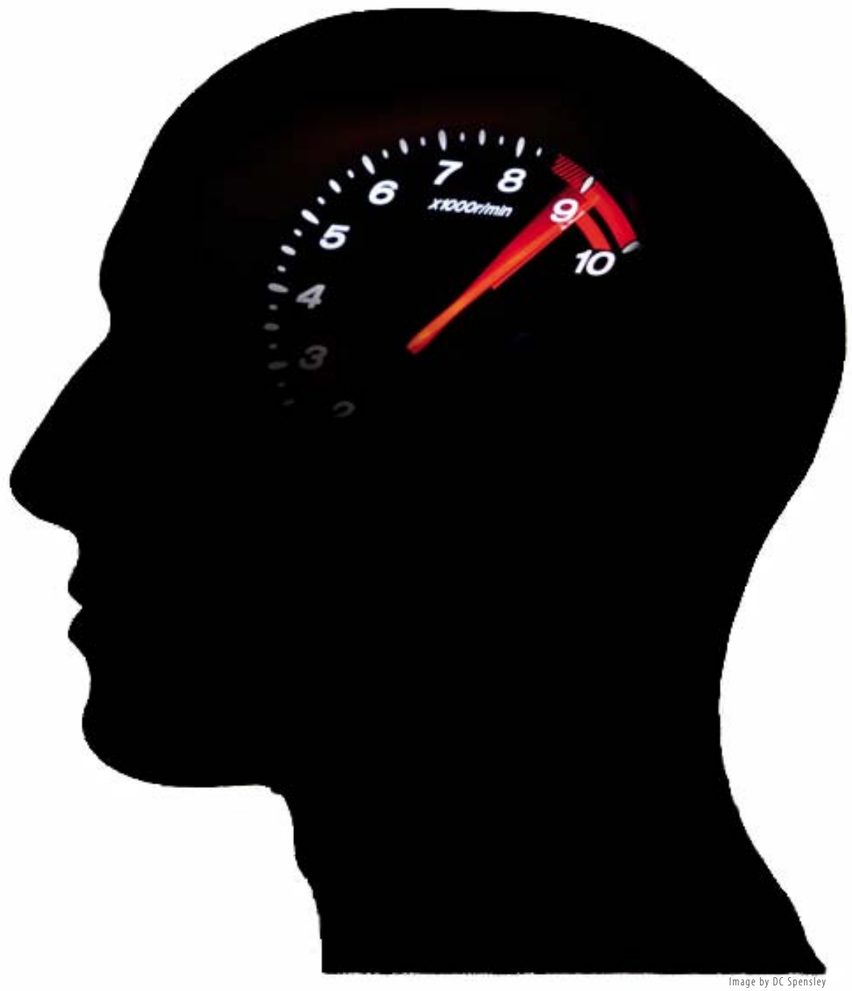


Image by DC Spensley

Since there is most likely a biological basis for intelligence, and intelligence is considered to be a positive survival trait, it is reasonable to assume that humans will get smarter over time just by having sex and making babies, which is a fun (but slow) way to go about solving this problem. The imposed pressures of modern society – such as requisite cultural literacy and basic math skills – also drive the trend toward smarter humans, but simple education and evolution aren't enough for some people. How do we get people to become more intelligent within a single generation?

...scientists find a common splice for increasing the efficiency of learning and... neurotrophin supply at specific neural targets, leading to targeted neural growth and plasticity in mammalian neural networks

There are a few popular answers to this question. The first is that humans take advantage of brain-computer-interfaces (BCI) to create more robust "offsite" memory and logic processing in a small microchip we keep implanted in our chest or shoulder. The technological foundation for making this work exists today, and is currently used to effectively treat Parkinson's disease via targeted computer stimulation of dopamine neurons. While the BCI option seems optimal at first pass, the fact that it requires surgery to embed electronics and pass dozens of thin electrodes into our brains at various areas presents ethical roadblocks to research. Perhaps if someone

could finagle a sweet big-money grant to cure stupidity via microchip-aided neural synchronization we would see some major progress in this area, but that's not likely in the U.S.A. anytime soon. Maybe China? Maybe India? Hello, developing world, I hear opportunity calling…

However, the most likely (and potentially darkest) scenario for rapid intelligence increase within a single generation is the genetic one. With all the trendy biotech being thrown down these days it is only a matter of time until scientists find a common splice or knockout method for increasing the efficiency of learning and memory genes and/or neurotrophin supply at specific neural targets, leading to targeted neural growth and plasticity in mammalian neural networks, a technique that will then be applied to neurogenesis and plasticity along the intelligence and motor-skills circuits of animals in vitro in order to create super-functioning organisms. Over a period of decades these methods will of course be secretly tested in humans, resulting in a jump in IQ on the order of two - threefold in a single generation, no doubt spawning a race of Kahn-like supermen who will beat us at chess all the time, grow to loathe us, and ultimately plot to destroy us all. But that's still a few years out, so go play some *Halo* 3 to get those hair-trigger reflexes up to snuff. When the black-market neural steroid hormones hit the milk supply we'll have to hope we don't all go insane, but at least SAT scores will be through the roof, for once.

James Kent is the former publisher of ***Psychedelic Illuminations*** *and* ***Trip Magazine****. He currently edits* ***DoseNation****.com, a multi-user blog featuring drug news, humor, and commentary.*

Resources

Working Memory Capacity
en.wikipedia.org/wiki/Working_memory#Working_memory_capacity

PFIT - Intelligence Circuit
www.physorg.com/news108722746.html

Diversity of Steroid Hormone Actions on the Brain
www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=bnchm.section.3529

Drug-induced Neural Plasticity
www.acnp.org/g4/GN401000067/CH067.html

Nootopics
en.wikipedia.org/wiki/Nootropics

Book: Mind Performance Hacks: Tips & Tools for Overclocking Your Brain
www.amazon.com/Mind-Performance-Hacks-Tools-Overclocking/dp/0596101538

VideoGame: Nintendo Brain Age
www.cnn.com/2007/TECH/11/26/brain.training/

Ways to overclock your brain
ririanproject.com/2006/11/03/22-ways-to-overclok-your-brain/

ririanproject.com/2007/05/22/33-new-ways-to-overclock-your-brain

Wired on Neurostim implants
www.wired.com/medtech/health/news/2001/08/46278

Neurotrophins
en.wikipedia.org/wiki/Neurotrophins

Learning and Memory Plasticity Genes
www.sciencedaily.com/releases/2007/04/070418104300.htm

MindFit Brain Training Software Achieves Highest Score in Wall Street Journal Brain Aging Experts Review
www.pr.com/press-release/81533

H+ Lab

Natasha Vita-More

I am writing a paper on radical life extension for a developmental field in the media arts and sciences. Even though I have tried to avoid it, the technological singularity keeps appearing, not because it was propitious for the paper but because it touches on the very technologies that are crucial for investigation of radical life extension. The nano-bio-info-cogno (NBIC) convergence and its offspring generate inspiring and devastating narratives. (For those who may be unfamiliar with NBIC, the acronym refers to a nascent field that employs the interdisciplinary possibilities of nanotechnology, biotechnology, information technology, and cognitive science and technology.)

Passing through this nano-bio-info-cogno intersection might require some finessing -- much like the smooth moves of synthetic nanometer-scale material passing through cell membranes without ruptures. But MIT scientists has done this.

Stelacci Nano Research
www.medindia.net/news/Synthetic-Nanoparticles-can-Penetrate-Cells-Without-Adverse-Effects-on-Membrane-37853-1.htm

So why is it so difficult to locate enough cognitive surplus to engage in meaningful conversations about radical life extension? Maybe it's because many people simply want to be in the now and experience as much comfort and joy as possible, and then pass the knowledge on. I suppose it is easier to accommodate our physiological wet-ware by experiencing a sense of accomplishment now, rather than in anticipating an arduous reach toward H+ mental plasticity.

Anyway, since we are, in fact, experiencing the now — we can look to the field of Experience Media Design as a medium for building narratives that can perhaps mimic the experience of radical life extension.

For example, immersive environments, wearable technology, alternate-reality games and, adjacently, bioart practices touch on futuristic scenarios. These works can be found in two distinct fields: the field of industrial design and the field of artistic design. The fields are distinct because of their intention. The intention of industrial design is to serve a client's or potential client's needs; the field of artistic design is to realize a concept conjured up in one's mind — a creative process. These fields overlap and are allied, to be sure, but they are nonetheless distinct. Here are some examples:

Immersivity

You can find a great example of an industrial-type interface at Tronic Studio -- a company I am fond of. Working in the context of commercial design, they provide a collection of experience designs for their clients.

Tronic Studio
www.tronicstudio.com

Digital Water Pavillion is an example of an artistic experience design that is exhibited for audience viewing and participation. It premieres at the World Expo in Spain, and offers a sensorial experience — architecture as experience.

Digital Water Pavilion
www.core77.com/blog/object_culture/mit_digital_water_pavilion_makes_a_splash_in_spain_10171.asp

Another architectural experience – one that spins – is planned for Dubai.

Spinning Architecture
www.latimes.com/news/nationworld/world/la-fg-buildingmotion26-2008jun26,0,312971.story?track=rss

Wearables

"FrogConcept" is a wearable industrial design that allows for a full-sensory experience by reshaping the world into a soothing spa-like escape. While it gives a robot appearance around the eyes, nose, and mouth, its streamline mask is, in itself, a pleasant design that can't help but make for an aesthetic experience.

FrogConcept
www.frogdesign.com/news/frogconcept-a-digital-escape-05162008.html

Image by Natasha Vita-More

"Seven Mile Boots" is a clever artistic design — a stunning contemporary piece of red footwear that enables the person wearing the boots to be a flaneur in the real and virtual worlds simultaneously.

Seven Mile Boots
randomseed.org/sevenmileboots

Alternative Reality Gaming

This genre is both industrially and artistically based and might be appropriate for engaging with other people in a narrative, real-world experience. Alternative reality gaming could provide a potential inducement for imagining together the actual experience of living longer. Unfortunately, at the Cannes Lions Award, the winner game was Trent Reznor's devastating narrative of the year zero. Instead, it might be worth looking into the designers at 42 Entertainment, providers of immersive experiences.

www.42entertainment.com/see.html

Bioart

What can I say about bioart? It is a fabulously new genre that has a particular set of ideological viewpoints that are not terribly H+, but are in close proximity to NBIC works that some of us designers have been engaging in. Bioart doesn't include experience design yet, but there is potential, particularly as the nano-bio-info-cogno revolution begins to explores new media. Upcoming exhibitions that are a precursor to a nano-bio-info-cogno rad-life-ex will be appearing at the Moscow International Film Festival and also at the "Evolution Haute Couture: Art and Science in the Post-Biological Age."

www.artifacial.org/evolution_haute_couture

My video, "Bone Density," will be exhibiting. Returning to my paper, I stumble across a famous 1954 quote from Norbert Weiner, the founder of cybernetics: "The human species is strong only insofar as it takes advantage of the innate, adaptive, learning faculties that its physiological structure makes possible." In H+ Lab, I will be encouraging all of us to do just that through media and art.

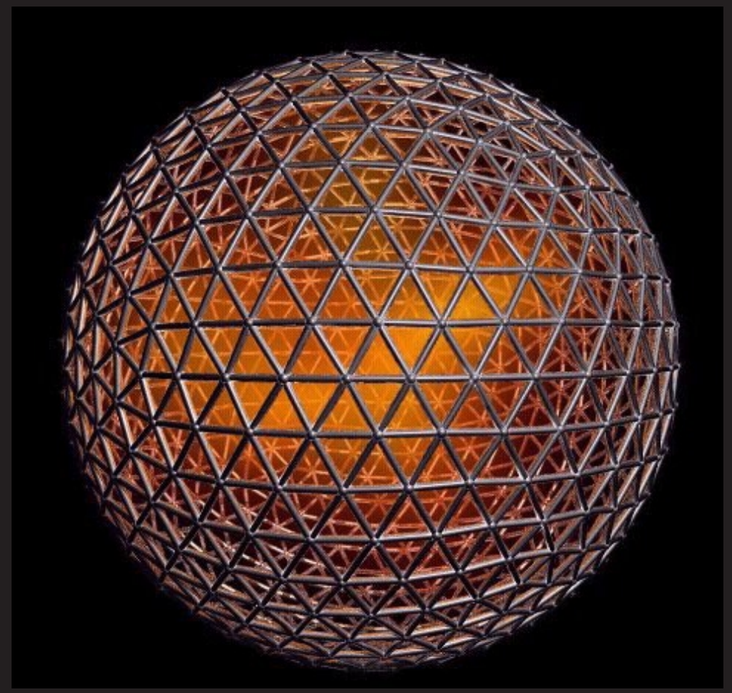
Additional Resources

Year Zero
www.alternaterealitybranding.com/cannes2008yearzero/

42 Entertainment
www.42entertainment.com/see.html

Moscow International Film Festival
mediaforum.mediaartlab.ru

Evolution Haute Couture: Art and Science in the Post-Biological Age
www.artifacial.org/evolution_haute_couture



TheProgressive Ingression of Intelligence into Matter

with Mark Pesce, senior lecturer in Emerging Media and Interactive Design at the Australian Film, Television, and Radio School and designer of VRML

RU Sirius

PESCE: Ray Kurzweil has this nifty little chart that shows the cost of computing per bit, dropping precipitously – exponentially – as time goes by. Like so much of his work, he manages to miss the big point by focusing on a particularly meaningless one. If I were to draw a chart, I'd map out the minimum number of atoms a human being can manipulate at one time through time. We'd start out with stone and flint and obsidian tools – that's maybe a billion billion billion atoms at a pop. And we'd move through metallurgy, and chemistry, and come down to the manipulation of billions to millions of atoms. Then we could get down to current state-of-the-art microprocessors, where the surface features are about a thousand atoms thick. And we can see how the subsequent generations of chips will have features that are a hundred atoms across, then ten atoms, and then – perhaps around 2012 or so – a single atom across. That'll end the chart.

What this chart actually shows is the relationship between human activity and human artifact. Artifacts have consistently moved away from the crude – in terms of the raw number of atoms being manipulated – to the refined. Fewer and fewer atoms are employed in each manipulation. The end state of this process is nanotechnology, which, for those of your readers who don't believe atomic scale assembly will ever be possible, I insist is the natural and inexorable vector of human activity, as demonstrated by the chart I have just described.

Why is this process taking place? It is my belief – and I think anthropology can back me up here – that language isn't just an internal process. Rather, linguistic components overflow their boundaries in the mind and become concretized as artifacts. Writing is the most obvious of these boundary overflows, but every technology represents some sort of material fixation of a linguistic concept. In that sense, the materiality of human history is a story of how homo sapiens learned to speak with their hands, translate their language into artifact, and then engage in a conversation with these artifacts. This sets up a very interesting feedback loop, because the exteriorized linguistic object – the technology – produces ramifications of language, which in turn produce new technologies, etc., until the whole thing spirals completely out of control. And we're already well past that point.

A succinct way of phrasing this process, using two-dollar words, is the "progressive ingression of intelligence into matter."

Warren Ellis Takes It Past The Limit

Ultimate Human 1-6 (Marvel Comics), Warren Ellis and Cary Nord.
Freakangels, Warren Ellis and Paul Duffield.

review by Paul McEnery

Warren Ellis will, if pushed, write about ordinary people. Take "Crecy." It's a novella that details every horrible technique ordinary British people used to give two fingers to the French nobility -- especially the longbow. But mostly he writes about extraordinary people, modified people, people with a little extra jammed into their eye socket or pumping through their veins. People you'd patent to make a fortune from, except they're the kind to use every horrible technique they can think of to give you the finger somewhere you wouldn't want it, with something novel and filthy and lethal and active flickering under the nail.

And speaking of extraordinary and lethal people, there were two big superhero movies let loose early this summer, with Robert Downey Jr. boozing his way through *Iron Man*, and Ed Norton brooding it up as *The Incredible Hulk*. Marvel Comics, in its wisdom, gave Ellis the tie-in book, *Hulk vs. Iron Man* in *Ultimate Human*. That might sound like a Mixed Martial Arts pay-per-view special – the flying shiny metal of death against the biological freak who eats monster trucks, as Ellis puts it – but what we've got here is sharper, more cerebral, something that drives both properties hard into the 21st century. What we've got here is two mad scientists arguing engineering tips for the future of the species.

In the green corner, Bruce Banner, pumped full of a biochemical "Supersoldier stack" that physically reimagines his body on the fly to fit any hostile terrain (like, say, the planet Venus). In the red and yellow corner, Tony Stark, bloodstream flush with nanotech that talks directly to the metal hand with the repulsor ray. Round one: smash each other's head in. Round two: team up against the real villain, who blends both flavors of post-humanity, the internalized biotech and the externalized mech-tech, to form a self-modifying brain grown out of pure mechorganic computronium. And why? Why to take down America's best, and brightest for Britain, of course. That the villain is a hard-drinking, hard-smoking, antagonistic, self-promoting, over-thinking cynic doesn't make him a stand-in for the author, but only because they haven't quite invented it yet.

In parallel to this mainstream big event book, Ellis has invented a property of his own, on a turf of his own, in a medium of his own devising. Freakangels is a weekly six page webcomic - net community that merges *Midnight's Children* with *Children of Men* in an Anglified anime style. "23 years ago, twelve strange children were born at exactly the same moment. 6 years ago, the world ended. This is the story of what happened next." What happens next is a post-apocalyptic London under permanent flood, stripped down to subsistence living and watched over by eleven gothic oddities with peculiar powers and nasty habits.

"What is the way the world ends?" "Of course, everyone has a different name for it. The Violent Unknown event. The Eschaton. The Singularity. The Collapse. Lol/Dies. And yet, whatever caused it saved us from a world where all future time was predetermined and free will meant nothing. Imagine: It took the end of the world to create the conditions for the human race to move forward into time on their own terms."

They live in Jack the Ripper's territory, but it's Lucifer's agenda. Time and Space ripped apart to create total freedom from necessity, and with the added benefit of giving you precognition, telepathy, and flying steampunk bikes that run on water, which may not be enough to compensate for what Number Twelve means to do with his filthy, lethal fingertip technique.

Freakangels unfolds slowly, in episodic time, and two-by-two windowpane space, with a guarantee of one unexpected idea a week, completely mad but still as of yet available for commercial exploitation. And unlike the commercial films that provide the impetus for this project, there's no chance at all of a sappy ending with a baby.

Paul McEnery is a former editor with Mondo 2000. He is writing a mosaic novel about an ill-tempered God trapped in his own creation. He is beginning to sympathize.

Resources

Freakangels
www.freakangels.com

Warren Ellis Live Journal
warren-ellis.livejournal.com

Akhentek's Music For Mind States

Michael Garfield

A moment of speculation, rooted in a study of universal trends: human history can be defined as development along any of numerous axes, but my preferred story-for-our-species is of an advance in mind control technologies. For good and ill, the development of our consciousness flies in tandem with our expanding capacity to access and explore various states of mind at will. Our command of navigating the mind with sensory and electrochemical stimulation has matured to include everything from reviving early entheogenic experiments with drumming and chanting, to contemporary techniques of magnetic temporal lobe stimulation and virtual reality immersion. And with impending advances in biotech and nanotech that will profoundly deepen the intimate relationship between brain and machine (and erase those primitive distinctions), we can be sure that individual control of the mind will be one of the best markers we have for measuring our humanity (and our transhumanity).

With this in mind, I spend much of my time looking at contemporary art and music as touchstones, clues to our place as a self-transcending species. Every time I see intention meet technology in a deliberate manipulation of mindstates, I rejoice that we are on the right track. And nowhere is this confluence more apparent than in the careful structuring of electronic musicians like Akhentek, a self-described "crystalline array technician" from Elphinstone, British Columbia, whose psy-trance productions are "precision engineered sonic textures intentionally designed to induce higher frequency mindstates."

Akhentek's nuanced tracks, like the burbling glitch of "Spectrality" or the free-floating guitar and synthesizers on his "White Girls in Saris" remix, definitely induce a strange, buzzing feeling – and unlike many other buzz-inducing artists, I know that he's doing it on purpose. Binaural beats coast inaudibly across each other underneath warm and deep mastering, giving this music the strange quality of feeling at once transparent and mysterious.

Deep within the art of this music coils the esoteric theory of neuroentrainment: the science of getting the brain to vibrate at specific frequencies. It seems to be an easy enough trick. Our brains expect to hear more or less the same thing in each ear, so they split the difference between tones that don't quite line up, creating the auditory illusion of a single note. This activity requires special collaboration between the right and left hemispheres, which syncs brain activity at that agreed-upon mean. If the left ear hears 104 Hz and the right ear hears 108 Hz, the entire brain will pulse at 4 Hz, the corresponding state of mind. It may be one of the cheapest ways to engineer consciousness. No drugs, no surgery, no nanobots – in theory, all you need is a pair of headphones and a "crystalline array technician" to prepare the sounds for you.

These so-called binaural beats coast inaudibly across each other in Akhentek's music underneath warm and deep mastering, giving his compositions an odd quality – it feels at once transparent and mysterious.

It's little wonder that he has a background in biology and "Brazilian Genetics" (which I assume is a euphemism for ayahuasca initiation) – this guy's eye and ear are definitely trained on human evolution and accelerating its numerous permutations. Cascades of twittering clicks and swells of buzzing oscillations sweep through my head as I listen, seemingly reformatting my consciousness on some deep unconscious level. I start feeling the effects of his "rare sensitivity to frequencies" as the physical environment around me begins to ripple with gauzy transparency.

It may be a long while before we have total agency over individual awareness, but until we do, I'm thrilled to know that we have innovators like Akhentek. Fighting the good fight, sculpting sound to elevate consciousness directly and for the greater good–secret agent techno-shamans like Akhentek are about the business of enlightening unwitting ravers and inspiring the next generation of state-engineers to plunge even deeper into our limitless potential to explore – and create – novel states of mind.

Michael Garfield is a live painter, songwriter, and essayist in Boulder, Colorado.

Resources

Akhentek
www.myspace.com/akhentekmusic

en.wikipedia.org/wiki/Binaural_beats

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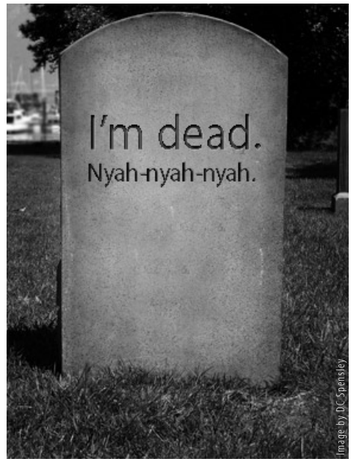

The Meaning of Life Lies in Its Suckiness

Joe Quirk

I've been converted. Frances Fukuyama, Leon Kass, and Bill McKibben have shown me the folly of all you silly transhumanists. Life has meaning in direct proportion to how royally it sucks.

I saw Bill McKibben read a speech to the Singularity Summit. He was on a giant Teleportec screen. His face was three feet wide, towering over the transhumanist panel, explaining why every nerd in the room should suffer and die. The guy never smiled. Not once. McKibben is a perfect spokesman for death, because he looked like a giant talking skull.

If you pause the streaming video at 13:18, you see a shot of me, slack-jawed, with an expression on my face that says: "This giant skull wants to kill me to give my life meaning."

McKibben's dedication to the nobility of age and death doesn't prevent him from posting a photo on his website that shows him looking twenty years younger than he actually is. Nor does his stance against technological enhancement prevent him from wearing eyeglasses. But pay attention, because this argument is so profound it only seems stupid to the untrained brain: If you never die, your life never had any meaning. Only if you die will your life have had meaning. Of course, there's no way to tell, since you're dead. That's where I get a little confused. Maybe it's knowing you will eventually die that gives life meaning. Wait, this is deeper than you think. Here's an example: wake up with a feeling of existential anomie. Life is so meaningless. Then stub your toe. See any meaning? Maybe not yet How about you find a lump in your breast? Aha! Now your life is suffused with meaning! Why? Because it just started sucking.

McKibben will put on his tombstone: "I'm dead. Nyah-nyah-nyah. Have a nice eternal enhanced life, transhumanist suckers." Ray Kurzweil will be sitting there with his nanotechnologically enhanced penis and Wikipedia brain feeling like a chump. Whose life has meaning *now*, bitches? That's right, the dead guy's.

Won't it be funny if Bill McKibben outlives Ray Kurzweil? Can you imagine anything pissing off Bill McKibben more than if he reaches 110? That would be poetic justice.

But no matter how much older he gets than his photos, Bill can always hope he will die. So what's his concern?

McKibben is concerned that the rest of us might not suffer and die. If we all live long healthy happy lives, Bill's favorite poetry will become obsolete. Bill is worried that an enhanced Ray Kurzweil won't appreciate Ecclesiastes. In case you don't know, Ecclesiastes is the most depressing poem in the gloomiest book ever written, on the subject of all things sucky, and Bill thinks we should appreciate it.

Here's another moral imperative you transhumanist fools haven't considered: we owe something to people who don't exist yet. People who don't exist yet are waiting in line to take our places. They can't do that unless we die. Don't nonexistent people have rights? Damn right they do. The right to demand our deaths. Luckily, nonexistent people have Bill McKibben and Frances Fukayama speaking up for their right to kill you. Which they can't do, since they don't exist. So Kass and Fukayama will kill you for them, by legislating against doctors interfering with your long slow death. Which takes me back to my initial terror of Bill McKibben, the human death's head.

Their argument isn't actually that death is good. Their argument is that heaven is good. All prominent anti-transhumanists -- Fukuyama, Kass, McKibben -- are religious. Their sense of meaning springs from a faith that through suffering they will enter paradise after they are dead. If a bunch of nonbelievers creates a real deathless paradise here in reality, it will ruin that fantasy. It will be like when all the bad kids on your block get better presents from Santa. To work so gleefully for immortality and cessation of pain is to thumb your nose at ancient sources of meaning. Success will demonstrate that such deep sources of meaning are not eternal, but technical solvable problems. That's a real faith-shaker.

I've tried to convert to what I call the Wendell Berry style of argumentation, which is to replace clear thinking with literary eloquence, but I just don't get their core syllogism:

I'm alive. Then I'm dead. Where's the meaning?

How about this? I'm alive. I keep living longer. Not sure if that's more meaningful, but it sure sucks less.

Joe Quirk is a TV talk show darling for his hilarious nonfiction ***It's Not You, It's Biology: The Science of Love, Sex and Relationships****.*

Resources

Joe Quirk
www.joequirk.com

Bill McKibben
www.billmckibben.com

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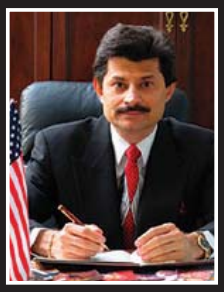
Dear Readers,

The board of directors of Humanity+ welcomes you to this first edition of H+ Magazine, with its inspiring stories of how emerging technologies can help elevate humanity in increasingly powerful and positive ways. We will cover diverse fields such as nanotech, biotech, artificial intelligence and robotics, longevity medicine, space exploration and colonization, and, of course, their legal and ethical issues.

2008 has been a watershed year for us. We launched our first ever matching grant fund drive, raising over $75,000; we began rebranding our organization as "Humanity+"; we launched this magazine; we began redesigning our site under www.humanityplus.org; and we created Convergence08: ***Bringing Life to Big Ideas, an Unconference*** in partnership with other future-focused organizations.

We especially want to thank the generous financial contributions from our members, who helped make these achievements possible, and give our deepest thanks to Bill Faloon, Brian Cartmell and Dan Stoicescu for their unprecedented support. Their matching grants accounted for over two-thirds the money we raised this year. **Thanks, guys. We couldn't have done this without you.**


Bill Faloon


Brian Cartmell


Dan Stoicescu

We would also like to thank our Editor RU Sirius and Art Director, DC Spensley for making our dream of producing a quarterly magazine a reality!

In the coming year, we hope to build on our successes, growing our membership and guiding our ideas out into the mainstream through as many forms of communication as the future allows.

For a brighter, healthier and happier future,

Ben Goertzel

Bruce Klein

Giulio Prisco

James Clement

PJ Manney

Michael LaTorra

Michael Treder

Nick Bostrom

Tyler Emerson

James Hughes

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