h+

magazine

ISSUE 3 SUMMER 2009

DESIGNER BABY CONTROVERSY

From X PRIZE to Singularity U

BIOHACKING ARRIVES

Legalize Sports Doping?

WAS THAT A BOT OR A HUMAN?

CHRIS CONTE'S MICROBOTIC ART

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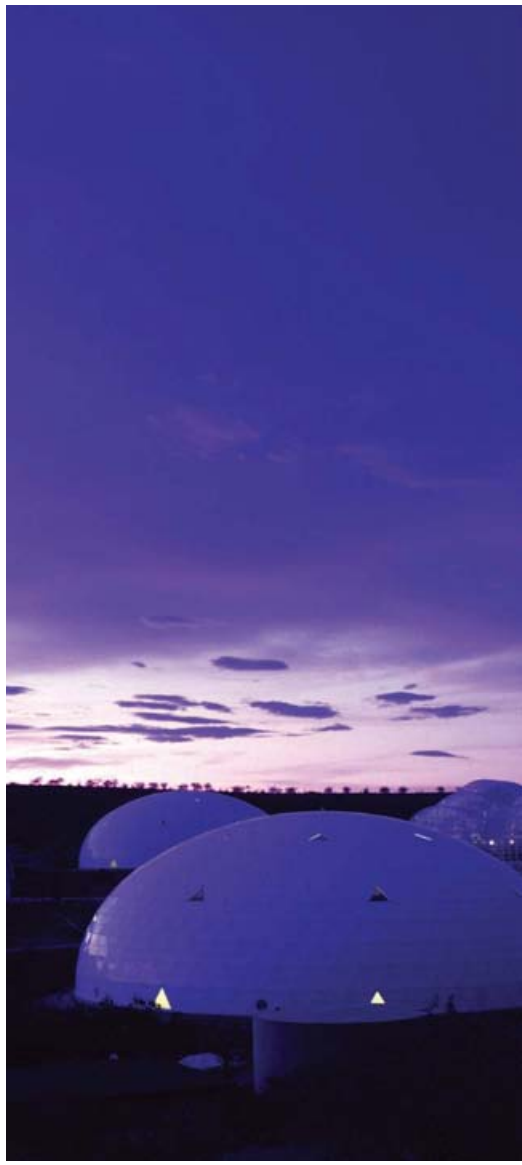

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LETTERS TO THE EDITOR
Please email the editor at editor@hplusmagazine.com

Futurist Heroes

We are privileged to know and to work with many Futurist Heroes. However, we want to see this league of advocates for a positive future in which poverty, scarcity, disease, and ignorance are erased from humanity, grow much larger.

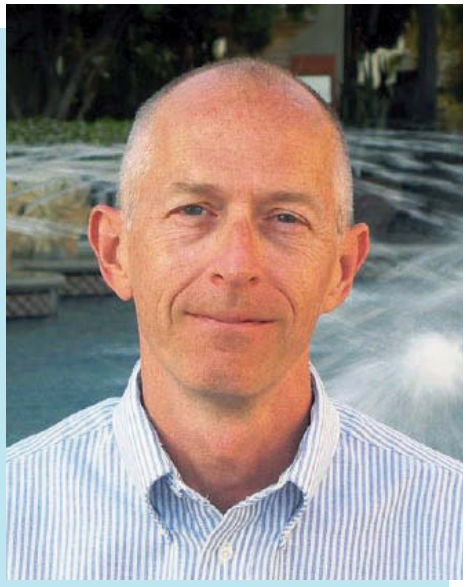
Watching the news as we do, we witness incredible breakthroughs nearly every week. These are stories that would have been the "story of the year" if they had happened just a decade ago. But these days, they are quickly swept aside by the next breaking science story. They seem to come at ever increasing speeds. In this sense, we are becoming ever more aware of the implications of Moore's Law being played out in the "NBIC" (Nano, Bio, Info & Cogno) "Information Science" fields.

Here at *h*+ Magazine, we hope that (among other things) we can inspire young people to study and get involved in the emerging "NBIC" sciences and technologies so as to help us transcend our genetic/biological limitations. We're hoping that future generations will be able to live incredibly long and healthy lifespans without disease, enjoy higher intelligences (perhaps augmented by computers through brain-computer interfaces), and generally be more productive and happy.

Join our h+ Community and help bring about this future – become a Futurist Hero too.

Best wishes,

James Clement and Dan Stoicescu
Co-Publishers



James Clement
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RESOURCES

Visit the h+ Community
http://www.hpluscommunity.com

RU Sirius
Editor in Chief

PREPA

I have tended to be a little less impressed with the rate of change than perhaps some other techno-progressives have been. Technology's best promises – for curing cancer, ending scarcity, insuring mental health – not to mention the more radical hopes for amplifying neurological function, expanding biological lifespan, and creating strong problem-solving AI... what have you – have at times seemed like chimera – the horizons recede just out of reach whenever we seem to get close. We've all heard those predictions from the optimists in various fields: "We will have (insert favorite breakthrough here) in five years." Five years later what do they say? "We will have this in five years."

But I've been getting substantially more impressed lately. I'm not sure if it's just because I have the privilege of editing *h+* (the magazine and the website), or if the rate of acceleration is really starting to get interesting, but I suspect that it's the latter.

Scanning through the news items we've covered on our website over the last couple of months we find (among many other astonishing items) that:

Professor Nadrian Seeman has created two-armed worker robots made of DNA.

An international team has cracked the mammalian gene control code.

Scientists have used embryonic stem cells to make synthetic blood.

British scientists have developed the world's first stem cell therapy to cure the most common cause of blindness.

RE for acceleration

RU SIRIUS

And scanning this issue of *h+* Magazine, we find that:

> Nanotech researchers have achieved real-time atom manipulation
>
> Neurobots are manifesting individual behaviors and "are just about at the edge of the amount of size and complexity found in real brains."
>
> Genescient expects to soon be able to make designer supplements containing nutrients made using detailed genomic information.
>
> ... All this and gamebots are threatening to pass the Turing Test.

So when I scan the evidence provided by my own magazine and website, I am, in fact, convinced that fantastic breakthroughs in NBIC (Nano-Bio-Info-Cogno) are happening all the time and they are starting to influence our lives. The promises and potentials for a radically different and (hopefully) far brighter future implicit in these sciences are moving quickly from theoretical possibility to laboratory breakthrough to hands-on practice.

Of course, promises are made to be broken. These hopeful breakthroughs are running neck and neck with any number of disaster scenarios. There are two wild cards in this race between resource/environmental collapse and a new dawn of health, prosperity, and novelty. One of them is plain dumb luck. The only thing we can predict about the unpredictable is that it will surprise us. The other is us. It's going to take a lot of intelligence and wisdom and social-navigational skill to bring this accelerating mess of contradictions broadly describable as the human (or transhuman) condition to a reasonably soft landing with over 6 billion humans (and many other less crazy species) on board.

I hope h+ is contributing to that effort.

Virtual Reality

Virtual Cocoon

Tristan Guillford

Researchers from several universities in the UK have teamed up to develop an immersive virtual reality headset that stimulates all five senses. Designed for maximum realism, the VR helmet will be equipped with high definition video, surround sound audio, special tubes that spray simulated tastes and scents into waiting mouths and noses, a fan that blows air to create hot or cold temperatures; and tactile devices for simulating touch.

THEY'RE CALLING IT "REAL VIRTUALITY."

A mock up of the Virtual Cocoon was showcased at Pioneers '09 on March 4th, a technology conference put on by the Engineering and Physical Sciences Research Council at London's Olympia Conference Centre. In a press release by the EPSRC, project lead David Howard of the University of York says: "Virtual Reality projects have typically only focused on one or two of the five senses — usually sight and hearing. We're not aware of any other research group anywhere else in the world doing what we plan to do."

The researchers estimate that it will take at least five years before a commercial model of the Virtual Cocoon is available for purchase. They hope to have it on the market for about 1,500 pounds, a little more than $2,500 USD.

CLIMB INSIDE A

For those of you who are tired of button-mashing and are looking to take your gaming experience to a whole new level, or merely looking to add a little spice to your typical workout, welcome VirtuSphere, Inc.

After 45 man-years, they have developed a functional, easy-to-assemble plastic sphere and base platform that fits inside a large living room. Just put on goggles and climb into the sphere, and you're interacting in the virtual world.

Because you're in a movable sphere, you can jump, run, crouch, look around, and walk without having

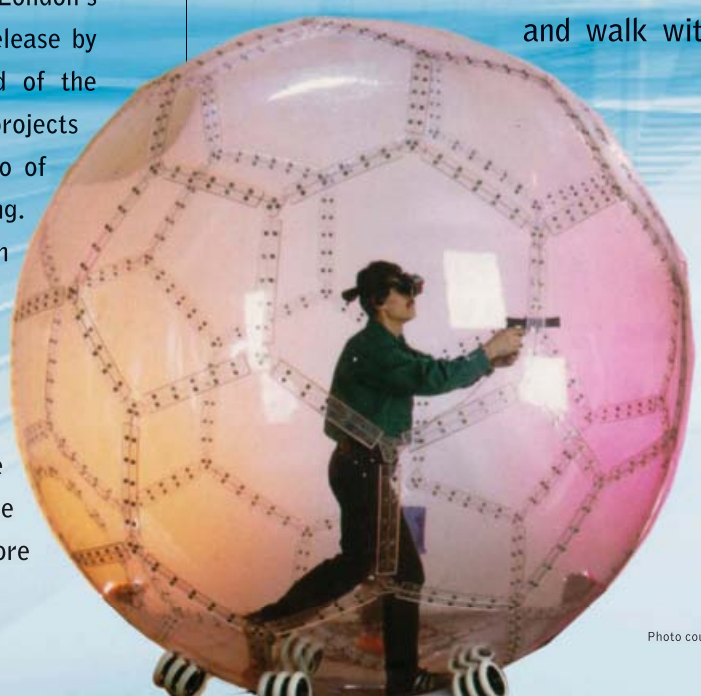


Photo courtesy of Virtusphere, Inc.

...Finally?

VIRTUAL SPHERE

KRISTI SCOTT

to worry about banging into the couch or being bitten in the crotch by your excitable pet. There are currently eighteen of these spheres up and running in government and academic locations such as the Office of Naval Research, the Moscow Government and Olympic Bid Committee, the A.S. Popov Central Museum of Communications, St. Petersburg State University of Telecommunications and the University of Washington.

VirtuSphere is currently being used for tourism, architectural design, and training for dangerous professions, but it is an attractive invention for the avid gamer looking to really get their game on. And for those of us who are shy at the gym, the VirtuSphere opens up the doors for us to have a virtual personal trainer in our homes. Or imagine going for a run on the beach or on top of the Great Wall of China. Select the correct program and let your imagination — and your legs — run wild.

Photo by Nadir Chanyshev

RESOURCES

Virtuesphere
http://www.virtusphere.com

Wearing the Internet

SURFDADDY ORCA

Photos by Sam Ogden

Wave your hand and the Rolex materializes on your arm like so much smoke. And then... poof... it's gone. Open the palm of your hand and suddenly your calendar and phone list overlay your life line. Use your fingers and thumb to create a picture frame and snap a photo. Check the latest book reviews on Amazon and display the results on the pocketbook or newspaper you're holding at the airport newsstand.

Leave it to students at the MIT Media Lab to develop a wearable computing system that turns any surface into an interactive display screen. With an ordinary webcam and a battery-powered 3M projector, they attached a mirror and connected it to an internet-enabled mobile phone. A mere $350 of off-the-shelf components and suddenly the glass window at Macy's, your car door, or your arm become a computer display. Want to Google the latest Dow Jones, Nasdaq, or S&P 500 returns? No problem, just do a quick search on your shirt sleeve.

MIT's Media Lab has explored the idea of wearable computing for some time. "Wearable computing hopes to shatter this myth of how a computer should be used," states the program's web site, "A person's computer should be worn, much as eyeglasses or clothing are worn, and interact with the user based on the context of the situation."

Pattie Maes of the lab's Fluid Interfaces group goes one step further. As the leader of a team of seven graduate students that developed the system, she characterizes it as somewhat more than a wearable device — she refers to it as a digital "sixth sense." No, she can't see dead people. But, as a recent TED demo shows — sans keyboard or monitor — she literally has the Internet cloud on her arm (and her hands, and...).

RESOURCES

MIT Media Lab
http://www.media.mit.edu/wearables/

MIT Fluid Interfaces Group
http://ambient.media.mit.edu

Wired
http://www.wired.com/epicenter/2009/02/ted-digital-six

Oh Rosie,

Can You Bring Me My Slippers?

SURFDADDY ORCA

Rosie, the Jetsons' maid robot, is a sweet, nurturing cartoon robot. Not only does she bring George his slippers, she washes his clothes, teaches his son to dribble a basketball, and sings while vacuuming the rug.

The Stanford Artificial Intelligence Robot (STAIR) looks more like tubular shelving on a Segway than a robotic maid. It finds objects with its stereoscopic camera eyes and grabs them with a robotic arm. Perhaps not unlike an early model of Rosie, STAIR can interpret relatively ambiguous vocal commands, navigate around unfamiliar environments and objects, and solve problems.

"STAIR, please fetch the stapler from the lab," says a researcher in a recent video. "I will go get the stapler for you," replies STAIR. Avoiding obstacles, STAIR wheels into the next room and scans it looking for the stapler. Grabbing the stapler, it returns to the researcher. "Here is your stapler," says STAIR, "Have a nice day."

Photo by Andrew Y. Ng

h+ contributor Ben Goertzel, an organizer of this year's Second Conference on Artificial General Intelligence, characterizes general intelligence as "the ability to solve a variety of complex problems in a variety of complex environments." STAIR shows the evolutionary transition that is occurring in artificial intelligence today — from the narrow AI of expert systems to more generalized intelligence. As the STAIR video demonstrates, the multitalented STAIR walks, talks, sees, hears, and solves problems in an obstacle-laden lab environment.

Andrew Ng, the assistant professor of computer science at Stanford who led the development of STAIR, is optimistic that the many disciplines of AI are now mature enough to be integrated "to fulfill the grand AI dream." And no, this is not just a robotic maid to fetch staplers or slippers, but rather computers that are as intelligent as people.

RESOURCES

Stanford Artificial Intelligence Laboratory
http://stair.stanford.edu

Computerworld
http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=332273

STAIR Fetches a Stapler Video
http://www.mefeedia.com/entry/stair-fetches-a-stapler/14005507

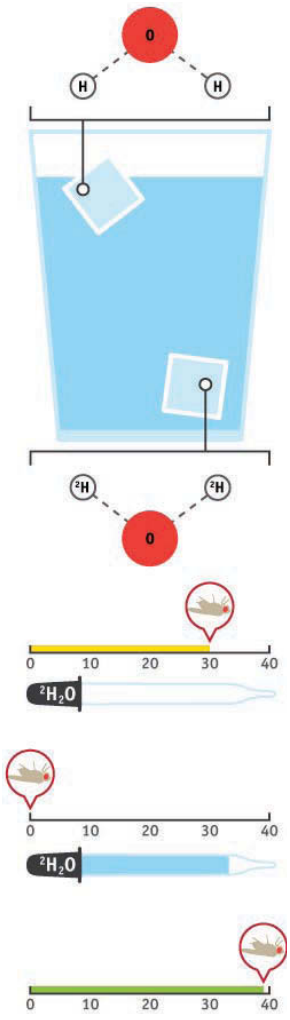
"The Jetsons" – Rosie the Robot
http://www.youtube.com/watch?v=9VyvnzhP2uM

Live Long and Heavy

STEPHANIE EUIN COBB

Eating foods containing heavier isotopes of common elements, such as hydrogen, carbon, nitrogen or oxygen, increases the stability of proteins. Research indicates this might protect against the damage caused by free radicals and so reduce the rate at which a human being ages.

The experiments, conducted by Russian biochemist Mikhail Shchepinov were first reported in the medical journal *Rejuvenation Research* (edited by gerontologist Dr. Aubrey de Grey) and then featured in *New Scientist's* November 29, 2008 issue. According to Shchepinov, dozens of experiments have proved that proteins, fatty acids and DNA can be influenced to resist oxidative damage with the isotope effect.



Like regular water, heavy water's molecules are composed of three atoms arranged like a boomerang with oxygen located in the elbow. But it differs in that the two atoms attached to the central oxygen atom are deuterium, an isotope of hydrogen that has double hydrogen's mass. Ice cubes made of heavy water will sink in ordinary water.

Retrotope, a company created to research the isotope effect and to develop it into life-extending products, has been feeding various amounts of heavy water to fruit flies. Large amounts proved deadly, while smaller quantities increased lifespans up to 30 percent. Dr. de Grey is on Retrotope's Scientific Advisory Board and Dr. Shchepinov is its co-founder and Chief Science Officer.

FAST BLASTS

MICHAEL ANISSIMOV

REAL-TIME ATOM MANIPULATION USING A HIGH-SPEED AFM

For over twenty years, investigators at the nanoscale have been using AFMs (atomic force microscopes) to image individual atoms and push them into stable configurations on a smooth surface. Now, for the first time, researchers at the Nanophysics and Soft Matter Group at the University of Bristol have built an AFM that operates so quickly that nanofabrication can be conducted in real time. This could be an important step to future technologies based on mass nanofabrication.

The group's improved AFM works by selectively oxidizing silicon to produce a desired pattern. Instead of conventional AFM tips, which move at about 1-100 μm/s — not much faster than the speed of a crawling amoeba — this new AFM can operate at speeds in excess of 1 cm/s, more than 10,000 times faster.

The penalty for such rapid operation is a faster degradation rate for the AFM tip, which is made more durable by covering it with a platinum coating. Though the AFM has proven its ability to avoid damaging the nanostructures it is working on, with no damage observed after more than 250 pass-overs, it did lose manufacturing resolution over the course of several experiments.

DETAILED MAPS OF HUMAN CORTEX INSPIRED NEUROROBOTS

Olaf Sporns, a professor at Indiana University, represents the leading edge of research into information flow within the brain, and in applying that knowledge to create neurorobots that learn. Last year, his lab produced the first detailed map of the human cortex using a new and powerful type of brain imaging called diffusion imaging. This map singled out a "cortical core" in the posterior medial and parietal cerebral cortex, sections of the brain near the back of the head.

Network studies in fields like computer science and biology suggest that strongly interconnected central nodes often mediate functions responsible for properties of the entire network. This suggests that the cortical core could be the key to treating cognitive disorders like Alzheimer's and schizophrenia, or for enhancing the human brain's processing ability.

Besides his pioneering work in brain modeling, Dr. Sporns also creates neurorobots piloted by cultures of a few thousand neurons to learn more about how the human brain processes rewards. (For more on Neurobots, see also "Here Come the Neurobots" in this issue.)

ARTIFICIAL MUSCLES WITH THE STIFFNESS OF DIAMOND

Ray Baughman is flexing some major artificial muscle. The muscle he and his colleagues at the University of Texas in Dallas have designed has so many advantages over past proposed projects that one wonders how such a major leap could occur without incremental progress in between. Baughman's artificial muscle is a ribbon made of tangled carbon nanotube "aerogel," meaning it is mostly empty space and weighs little more than its volume in air.

Despite its feather-light weight, the material is stiffer than diamond in its "long" direction, while stretchy like rubber in the "wide" direction. It is so stretchy, in fact, that the application of a modest voltage causes it to widen by 220%. It maintains these properties under an extremely wide temperature range — from -320.8 °F (-196 °C), the temperature of liquid nitrogen, to 2,800 °F (1,538 °C), above the melting point of iron. No previous attempt at artificial muscles even comes close to its potential usefulness.

There is one major drawback to these artificial muscles in their current form, however — they're only as strong as human muscle by weight, meaning that a truly practical version would need to be much denser, or have substantially more volume.

MYELIN INTEGRITY IS KEY CONTRIBUTING FACTOR IN INTELLIGENCE

Using a powerful new extension of fMRI technology called HARDI, scientist Paul Thompson and colleagues at the University of California, Los Angeles scanned the brains of 23 sets of identical twins and the same number of fraternal twins. The technology, which measures the amount of water diffusing through white matter in the brain, indirectly measures the integrity of myelin sheathing and therefore the speed of nerve impulses.

By extensive analysis and cross-checking of the identical twins (who share 100% of their genetic material) and fraternal twins (who share 50%), the researchers were able to determine that myelin integrity in parts of the brain that are important for intelligence is determined by genetics. This adds to previous research that found that the volume of the brain's grey matter (which correlates with IQ) is heritable, as is the amount of white matter, which provides crucial connections between neurons.

The researchers pointed out that the genetic determination of elements of intelligence isn't immutable. To the contrary, it leaves the door open for future intelligence enhancement therapies. ®

BRAIN-COMPUTER INTERFACING:

From Prosthetic Limbs to Telepathy Chips

BEN GOERTZEL

Direct brain-computer interfacing (BCI) may sound fanciful, but it's already a reality — and in coming decades it will almost surely advance dramatically. Neuroscientists are gradually understanding the electrochemical signals by which our brains encode thoughts and feelings; statistical and AI tools are getting better and better at interpreting complex data. The image at left shows one aspect of the state of the art. In an experiment by a group of researchers from the University of Pittsburgh published in a 2008 issue of *Nature*, a monkey used signals read directly from its motor cortex to control a multiple-jointed gripper with numerous degrees of freedom — causing the gripper to deliver food into its mouth.

Photos courtesy of Motorlab, U. Pitt. School of Medicine

Today BCI research is largely driven by the desire to help the handicapped via cochlear implants, prosthetic limbs and the like — but the scope of potential applications is far broader than this laudable but limited market. The entertainment industry is already getting into the picture; there are currently at least two companies (Emotiv Systems and Neural Impulse Activator) marketing BCI devices for video game control.

As BCI technology develops, we can expect it to increasingly serve the function of cognitive enhancement. I'm reasonably good at mental arithmetic and algebra, but I'd take an onboard calculator and computer algebra program any day. A neural interface to Google, Wikipedia and other online resources would be nice, too. And I wouldn't mind an expanded short-term memory: no more repeating a phone number over and over until I find a place to write it down! Learning a foreign language? Forget the tedium of memorizing vocabulary, verb conjugations and so forth; just plug some flash memory into your cortex and the knowledge is right there. There seems no fundamental reason all this and more can't occur in the next few decades.

The majority of today's BCI research involves the connection of various electromechanical devices to the peripheral nervous system, as we've seen with cochlear and retinal implants, and artificial arms and legs; or else the readout of a small set of brain-wave-based control signals, as in the Emotiv game controller (covered in *h+* issue #1). Only a handful of maverick researchers now explicitly pursue advanced forms of BCI that seek to read more abstract thoughts from the brain. The main bottleneck slowing this research is the lack of adequately accurate devices for measuring and stimulating the brain. In this regard, one critical research direction is the development of safe ways to implant more advanced BCI devices inside the skull. It will probably continue to be easier to read the brain state from within than without, though a breakthrough in "brain imaging from the outside" can't be ruled out. Scientists are exploring multiple radical brain imaging technologies, including devices involving carbon nanotubes and other nanotech-based materials, which seem to play more nicely with brain cells than conventional materials.

For now, many of our best insights into brain function have come from studies placing electrodes deep inside the brain. Dr. Rodrigo Quiroga and his colleagues have made great progress toward understanding how memories of faces, objects, animals and scenes are stored in sparse neural subnetworks in the region of the brain called the medial temporal lobe. Understanding how the brain stores complex information is step one toward figuring out how to read this information into a computer.

> Would you become suspicious if your husband or wife didn't want to do a telepathy-chip mind-meld after coming home late Friday night?

And in time, even more fascinating possibilities may be realized. Consider the "telepathy chip" — a neural implant that allows the wearer to project their thoughts or feelings to others, and receive thoughts or feelings from others. There seems no in-principle reason why this can't be done, but it raises a huge number of questions philosophically, technically, psychologically and socially. It's not clear what percentage of a person's thoughts and feelings would actually be comprehensible to another person — in many cases, you might send your thoughts to someone else only to find them interpreted as 90% gobbledygook mixed up with concepts and images that are recognizable to the receiver. It's also not too hard to envision some of the social and economic pressures that might arise surrounding telepathy chips. Would you become suspicious if your husband or wife didn't want to do a telepathy-chip mind-meld after coming home late Friday night? Might you become suspicious of a potential romantic partner who wouldn't let you peek into his or her mind? What's she trying to hide? Teams of individuals linked via telepathy chips might achieve far greater efficiency at some sorts of work than any group of detached individuals with similar skill could. Computer programming comes to mind, where the hardest part of the job is often understanding what other people were thinking when they wrote the code that you have to deal with. Social subgroups rejecting telepathy chips could become isolated, backwards communities similar to the Amish today (who, it must be noted, don't mind their backwardness and isolation at all).

Ultimately, telepathy chips and related BCI devices could lead to the emergence of new forms of intelligence, "mindplexes" composed of independent human minds, yet also possessing a coherent self and consciousness at the higher level of the telepathically-interlinked human group. AI systems could potentially join these mindplexes, reading from telepathy chips and projecting into the user's minds not just answers to questions, but also original ideas conceived by the AIs that they believe could benefit the humans. Humans who reject telepathic interplay with AIs could be at a significant disadvantage both socially and economically. Nearly any job requiring insight and creativity would benefit from a stream of "push technology" input from a savvy

AI. And wouldn't your date with Jane tonight go better if your natural charming personality were enhanced by a stream of witty anecdotes and sensitive, empathic statements supplied by an AI who has studied Jane's profile and history in the context of its comprehensive knowledge of human relationships? Potentially all this could lead to the emergence of a global brain spanning human and artificial intelligence.

BCI is early-stage now, and we don't know where it will lead exactly, but the near-term possibilities are dramatically fascinating and the longer-term ones truly profound.

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

RESOURCES

Nanoparticles to aid brain imaging
http://www.physorg.com/news78678220.html

Nanotube Scaffolds for Neural Implants
http://www.technologyreview.com/biomedicine/17525/?a=f

Invariant Visual Representation by Single Neurons in the Brain
http://www.vis.caltech.edu/~rodri/papers/nature03687.pdf

Neural Impulse Actuator
http://video.google.com/videosearch?hl=en&q=neural+impulse+actuator&um=1&ie=UTF-8&ei=nL3nSYX40p-0tgPhxK3hAQ&sa=X&oi=video_result_group&resnum=7&ct=title#

Emotiv Systems
http://www.hplusmagazine.com/articles/neuro/epoc-neuroheadset

SMART BIOLOGY to the RESCUE

Alex Lightman

As the Boomers begin to go gray and fragile, those with way high expectations confront an uncomfortable fact — nobody has done much about aging, throughout their lifetimes... and they get angry.

How could this be?! Technology has carried us along on its broad back, giving us computers, conveniences, Internet and media wonders. But aches and pains foretell much bad news ahead. We can do better, but to do it we'll have to *reinvent biology.*

Face it: young or old, we can't solve "the aging problem" using the standard 20th Century research methods of cell biology. Sure, they had some great success with some other medical problems — nobody fears smallpox, polio and other old school diseases. Diet and exercise help, too, (as discussed in my last column.) But nobody has done much *directly* about the mechanisms that erode our bodies.

Why? Because beyond our 20s, natural selection doesn't help us much. Once we start reproducing, all the genes that break us down get passed on to the next generation. It's been that way throughout natural evolution. Aging arises from a lack of natural selection in later adulthood.

So what's the smart biology dodge around this? Make selection work for us by forcing it to produce longer-lived animals. And then learn from what forced selection tells us. That's what the 21st Century medicine man knows. We can already see him peeking around the corner up ahead. He says: *Your aging comes from multiple genetic deficiencies, not a single biochemical problem.*

Michael Rose at UCI saw all this coming 30 years ago. He started breeding longer and longer lived fruit flies (Drosophila) by having them not keep their eggs to make the next generation until much later in adult life. Do that in humans and you'll be trying to get babies out of 60 years olds — not a promising route — though I guess the Italians, with a 1.1 fertility rate (2.1 is replacement) are trying.

Rose's years of painstaking Methuselah fly stud-servicing produced a fracking miracle: flies that live 4.5 times longer than ordinary flies. Do that with humans for 10,000 years – 500

Photos courtesy of Genescient

generations – and you'll start approaching Rose's results. But to get the advantages today you'd have to start back before there were cities.

That's why smart biology uses "animals" — particularly insects, that don't live long — to squeeze those 10,000 years down to a career-lifetime of about 40 years. (Rose is in his 50s.)

What do the genetic inventories of these Methuselah flies show? Multiple, overlapping genomic pathways. About 75% of the genes do the same jobs in flies as they do in humans. We share these basic operating systems with insects that we parted company from about a billion years ago. (Yes, intelligent design fanatics, you are related to mosquitoes. Suck it up. Stop bugging me.)

Genescient Corporation acquired the use of the Methuselah flies' genomics and has developed their implications for three years. Knowing that these complex genomic pathways can enhance resistance to the many disorders of aging, their crucial step is to find substances that can enhance the action of those pathways. Designer supplements containing nutrients made using detailed genomic information — a field called *nutrigenomics* — are about to come to your local supermarket, some of them using obscure traditional medicines. This is the essence of a 21st Century approach to aging. Nothing like it has existed before this year.

You'll know 21st Century medicine has arrived when you see immortality pills featuring mixes of designer supplements.

Noted hard science fiction author and Genescient (which means 'smart genes') cofounder Gregory Benford argues that there seems no fundamental reason why we can't live to 150 years or even longer ("and you can have sex up to 150 also"... I like that part). After all, nature has done quite well on her own, using pathways humans share and can now understand. The 4,800-year-old bristlecone pine, and koi fish over 200 years old, attest to this, not to mention tortoises.

Nature took several billion years developing these pathways; Genescient aims to explore them rather like someone playing *SimEarth* or *Spore*: by speeding up generational times. The medical technology emerging now acts on these basic pathways to immediately affect all types of organs. Traditionally, medicine focuses on disease by isolating and studying organs, and organizes diseases mostly by spotlighting local disorders. Genomics can focus on entire organisms by looking at the entire picture.

You'll know 21st Century medicine has arrived when you see immortality pills featuring mixes of designer supplements. These will regulate your own genes to improve their resistance to the many ways things can go wrong. The plausible outcome of taking these pills will be bodies that don't seem to age as fast and that can maintain vigor long after the childbearing years, when we traditionally begin to show wear and tear.

That's what happened with Michael Rose's Methuselah flies. The Genescient labs track fly vigor by their mating frequency — they count how often the flies get it on — and the numbers of eggs the females lay. Those horny Methuselahs beat out the other flies in the mating game. Basically, the more you want and get sex, the longer you will live. Adult Friend Finder and Be Naughty, you are free to quote me on this.

After the first wave of designer supplements, we'll see customized nutrigenomic pills. Medicine will get tailored to each personal genome. Targeting a person's own suite of complex pathways, smart designer supplements and drugs can propel the repair mechanisms and augmentations that nature provided. This will benefit everyone, not just the genomically fortunate.

The 21st Century has scarcely begun, and already it looks as though many who welcomed it in will see it out. The first person to live to 150 may be reading this right now.

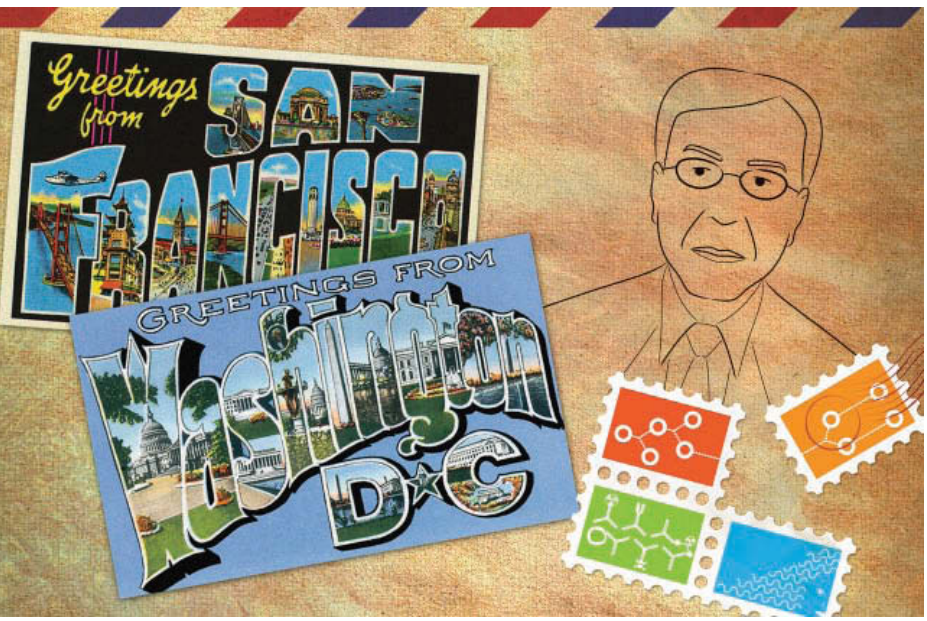
RESOURCES

Genescient
http://www.genescient.com

Alex Lightman is the author of the first book on 4G wireless, Brave New Unwired World (Wiley) and founder of pioneering companies in 3-D and Hollywood websites, wearables, and IPv6. He welcomes friending on Facebook.

ROGER PEDERSON, Won't You Please Come Home?

Moira A. Gunn, Ph.D.



About five years ago, a cadre of British scientists flew into San Francisco for a British Trade Commission event, and the smart gal who organized it asked me if I would consider interviewing them. Our previous interactions had served up such stellar guests as Lord David Sainsbury, the British science minister, and Sir Richard Sykes, the Rector (we would say "President") of Imperial College London. I thought it wise to simply trust her judgment, and I was rewarded.

She showed up with five illustrious biotech guests, one right after another. They included such luminaries as Dame Julia Polak, now emeritus professor of Tissue Engineering and Regenerative Medicine at Imperial and one of Britain's longest surviving heart-lung recipients, and Suzy Leather, the head of the HFEA, the Human Fertilisation and Embryology Authority. If you haven't heard of HFEA, it "regulate[s] the storage of all eggs, sperm and embryos" in the UK. It's interesting that the Brits control it all down to the strictest detail, while here in the US, it's a genetic free-for-all: Somewhere over half a million fertilized embryos are on ice and in private hands, while no one even thinks to count what's laying around in sperm banks.

Still, it was the last guest through the door that was the shocker: He was an American. In fact, he was from San Francisco. Roger Pederson was a stem cell scientist at UCSF, and he had moved to the University of Cambridge for one very simple reason: In 2001, President George W. Bush had put into place an Executive Order limiting federal funding to the 22 existing human stem cell lines. To Roger, this spelled disaster. He saw the handwriting on the laboratory wall and headed over to England as soon as he could. While they heavily regulate the embryos and such, they actually permit and fund stem cell research. What's this? American scientists leaving the U.S.? With a chuckle, the Brits described it as a "brain gain."

The bottom line was that Roger was a scientist — one at the top of his field. He *had* to work. He saw moving to Cambridge as both a great opportunity and the only real solution.

I hadn't thought about him since that day... until today. At this writing, it's

March 9th, 2009, and President Barack Obama has just signed an Executive Order, this one rescinding W's defiant edict. I say "defiant" intentionally — twice, Congress voted to overturn this Executive Order, and twice, President Bush vetoed it. There was simply no talking to him about it. He believed what he believed, and that was all there was to it.

But in the meantime, the sensibilities of the country have shifted. Congress has taken up the zeitgeist of the American people. Yes, some citizens will forever believe that using very early stage embryos for research — humans eggs fertilized outside the body in a scientific lab — is morally wrong, but the great swath of Americans do not. In fact, they're beginning to understand that DNA and genetics is hugely important. They gulp down season after season of CSI. They buy paternity kits for $29.99 at Walgreens. Pregnant women get tested for all kinds of genetic disorders, while women with breast cancer can immediately discover whether the drug Herceptin will work for them. Everyone has begun to suspect that within their lifetimes, their DNA will tell them more about themselves than they ever imagined — their past, their present and their future.

So, Roger Pederson, still a professor at Cambridge, must know that right here in the United States, it's a brand new day. Just weeks after the inauguration, the FDA approved the first-ever clinical trials enabling Geron Corporation to inject a stem cell therapeutic into newly-arriving patients with severe spinal cord injuries. For us, it's the realization of a dream described by the late actor Christopher Reeve, but for Roger Pederson, it's an undeniable indicator. He's got to know that a tsunami of drug applications are on their way to the FDA. He can Google the news and know that the House of Representatives voted $3.5 billion for the National Institutes of Health into the economic stimulus package, and that the Senate upped it to $10 billion. And now, President Obama has finally lifted the blockading Executive Order. So Roger Pederson has got to know that an avalanche of science is being proposed — and he's got to be thinking long and hard about his situation. The Brits have been very generous to him. They welcomed him with open arms. Can he cut and run? He's got to have studies mid-stream. And students. And colleagues. And funders. Yeah, just what do you do when the worm turns?

Roger is not the only one with a personal dilemma. Think of the people who have always been opposed to embryonic stem cell research. Do they believe so strongly that faced with a severe spinal cord injury, they would say, "No, I won't take this therapy"? Or will they, like most humans, seek whatever remedy they can muster?

For others, it's a question of faith, and different religions have begun to register their positions. In December, the Vatican issued a paper concerning the Dignity of the Person (*Dignitas Personae*). In it, *in vitro* fertilization is ruled out. That's right. "All techniques of … artificial fertilization … which substitute for the conjugal act are to be excluded." It doesn't matter that it's a married couple using their own eggs and sperm. If the fertilized embryo is not created during the conjugal act, it's unacceptable. The paper doesn't answer the question of what to do about all those humans who, indeed, have already been created in the proverbial test tube, yet I can't help but feel for Louise Brown and how she herself might feel reading the Vatican paper. Who would ever want to read something that clearly states it is wrong for you to exist.

Without a doubt, these are times of vertiginous change. We still have those in opposition to stem cell research, who believe fervently and have followed their moral compass. And there are those who are driven by a different moral imperative to develop these technologies for the good of humanity. Then there are many, many more in the middle, who are simply trying to get by and are worried about their next paycheck, not to mention the millions who have no health insurance. Few of these people can believe that stem cell research has anything to do with them. But the truth is – they would be wrong. The promise of genetic diagnostics and stem cell therapies is that we will be able to detect and fight disease and trauma, early, effectively, and on a vastly cheaper basis than ever before.

Do they believe so strongly that faced with a severe spinal cord injury, they would say, "No, I won't take this therapy"?

Everything tells me that we are at a fantastic turning point in history. The promise, the potential, the funding and the enormous, ready and willing effort of all our scientists – for once, it looks like it's all coming together. So, Roger Pederson – please come home. Consider it an "all hands" meeting. Thank the Brits for their generosity, but frankly, we need you, and I know you wouldn't want to miss it. You see, the "gene genie" is out of the bottle.

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 one of the* "Best Science Books of 2007." *She will be awarded an honorary doctorate in science in May, 2009 by Purdue University.*

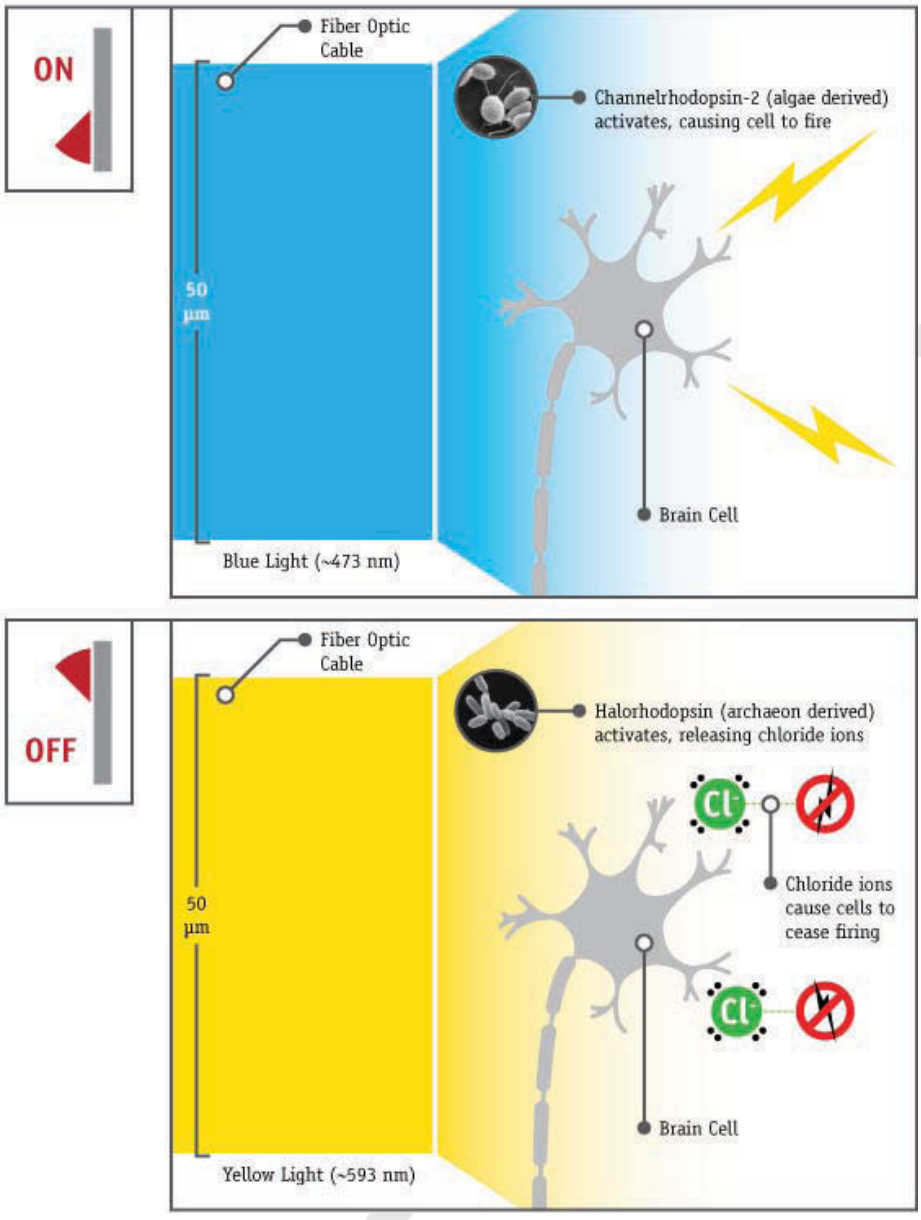
ENHANCED: Optogenetics

QUINN NORTON

Brain control has always proven tricky, particularly when it comes to the brain trying to control itself. We have many indirect methods — drugs, meditation, education, travel, etc. — but people have always wanted quick and reliable control of their brain states. And what that actually means is that they want to change an area of the brain. Switching the drives and mental states we need on and off would be considerably less frustrating than the transitioning struggles nature has given us. And so we are entering the era of a new set of technologies for direct neural control.

The best current technology combines psychosurgery and implantation. Right now, hard-to-treat disorders can get a difficult direct neural treatment called Deep Brain Stimulation, or DBS. DBS is like a pacemaker for the brain. An electrode is snaked down to the area associated with the disorder being treated and left in place. After the surgery has healed, the implant pulses current at a frequency that either activates or quiets the area responsible for the condition. Affecting cells further from the electrode means passing more current through nearby cells. DBS is by far the most precise clinical procedure for controlling areas of the brain, but it's still disappointingly non-specific. Since DBS involves brain surgery, it's generally a treatment of last resort, but it's shown good results for previously untreatable cases of Parkinson's, chronic pain, and depression. Electrode implantation is an extreme measure, not likely to be widely used.

Dr. Karl Deisseroth of Stanford University can go one better. He's developed a technique called optogenetics that combines genetic engineering, lasers, neurology and surgery to create a direct control mechanism. Optogenetics uses a brain cell switch with two genetic parts. The first is a gene taken from an algae that activates the cell in the presence of blue light in order to turn towards the light



and photosynthesis. In a neuron, that activation fires the cell. The second is from an archaeon, a salt-based extremophile, which responds to yellow light by pumping chloride ions. In a brain cell, that means not firing at all.

To get the genes in place, Deisseroth's team opens up the skull and uses a pipette to apply a non-reproducing adenovirus to the desired brain area. The virus is genetically configured to inject both genes into a single cell type. The single cell will take both genes. After the "light switch" genes are in place, those brain cells are now light sensitive and a 50 micrometer fiber optic cable is fed to the area. In this way, they can target very specific deep brain structures, areas currently too deep and fragile for most psychosurgery. Once the researcher attaches the other end of the cable to a laser, he or she has absolute and flawless control over that group of neurons: blue light on, yellow light off.

Dr. Deisseroth is a psychiatrist as well as bioengineer, and he envisions using optogenetics in place of DBS's not-so-deep cousin, Vagus Nerve Stimulation. Much like DBS, VNS uses an electrode to treat depression and epilepsy but targets where the vagus nerve passes through the neck rather than deep in the brain. It can still cause problems in many patients — sleep apnea, throat pain, coughing, and voice changes are the main complaints. Deisseroth believes optogenetics might be a way of reducing the side effects of VNS by targeting the treatments, rather than just shocking the neck region.

All this points to easier and more effective neural control. We're still far from knowing which cells do what, and further from orchestrating treatments and enhancements for specific conditions. But for the first time we can map and build useful handles on the very things that make us ourselves.

Quinn Norton covers science, technology, law and whatever else gets her attention. She lives in Washington D.C. and is most easily reachable at quinn@quinnnorton.com

The Great DESIGNER BABY CONTROVERSY OF '09:

The Fertility Institutes Back Away From Making History

MICHAEL ANISSIMOV

You may not know it, but gender selection based on pre-implantation genetic diagnosis (PGD) has been available to paying couples since at least 2001. One of the world leaders in providing this service is the Fertility Institutes, with branches in Los Angeles, New York, and Guadalajara in Mexico. According to their website, they've had over 3,800 cases of gender selection with a 100% success rate. Besides offering gender selection, they screen embryos for genetic defects such as breast cancer, cystic fibrosis, and over 70 other diseases. The Institutes are directed by Dr. Jeff Steinberg, a pioneer of IVF (in vitro fertilization) in the 1970s, and a successful scientist-businessman today.

In early February, the Fertility Institutes created enormous controversy by announcing that they planned to offer PGD services allowing for the selection of eye and hair color for children. Steinberg was quoted by the BBC as saying, "I would not say this is a dangerous road. It's an uncharted road." As a scientist experienced in PGD/IVF techniques, Steinberg was aware that the technology to select physical traits in humans has been available for years, but no one would touch it. "It's time for everyone to pull their heads out of the sand," Steinberg said. Transhumanists and other fans of procreative freedom were excited by the news.

The backlash was widespread. Quoted in the New York Daily News on February 23, the Pope himself condemned the "obsessive search for the perfect child." The pontiff complained, "A new mentality is creeping in that tends to justify a different consideration of life and personal dignity." The Roman Catholic Church objects to all applications of PGD because they invariably involve the destruction of blastocysts.

On his blog Secondhand Smoke, conservative bioethicist Wesley J. Smith, who has co-authored four books with Ralph Nader, wrote, "We are constantly told that the right of a woman to reproduce is absolute, including getting pregnant, aborting if the pregnancy is ever unwanted, and now, genetically engineering progeny to order. But no 'right' is absolute. The time has long since passed to put some regulatory controls over the wild, wild west of IVF."

On February 28, Steinberg continued to defend his approach by telling the Sunday Telegraph, "I understand the trepidation and concerns, but we cannot escape the fact that science is moving forward. If I have to get smacked around by people who think it is inappropriate, then I'm willing to live with that."

Then, all of a sudden, on March 2, Steinberg capitulated to widespread criticism. A press release on the Fertility Institutes web site read, "In response to feedback received related to our plans to introduce preimplantation genetic prediction of eye pigmentation, an internal, self regulatory decision has been made to proceed no further with this project." Gattaca was averted.

The public debate about selecting traits like eye and hair color for newborns is a continuation of a debate that has gone

PERCENTAGE OF PARENTS WILLING TO USE PGD TO SCREEN FOR:

75%
Mental Retardation

55%
Deafness

58%
Blindness

53%
Heart Disease

50%
Cancer

10%
Athletic Ability

15%
Intelligence

55%
"No conditions for which genetic testing should never be offered"

on for at least two decades – the debate about PGD-based gender selection, a technique that is easier than trait selection and has already been done thousands of times. Back in 1990, pre-implantation genetic diagnosis of any type was banned in Germany by the Embryo Protection Act. In 2003, the UK banned using PGD for gender selection, following a year-long public consultation in which about 80% of those polled were against the procedure. India and China have banned the procedure, despite the widespread practice of infanticide when babies of an undesired gender, usually female, are born to disappointed parents. Gender selection still occurs, albeit violently.

More recently, a January 2009 study by researchers at NYU Langone Medical Center found that an overwhelming 75% of parents would be in favor of trait selection using PGD – as long as that trait is the absence of mental retardation. A further 54% would screen their embryos for deafness, 56% for blindness, 52% for a propensity to heart disease, and 51% for a propensity to cancer. Only 10% would be willing to select embryos for better athletic ability, and 12.6% would select for greater intelligence. 52.2% of respondents said that there were no conditions for which genetic testing should never be offered, indicating widespread support for PGD – as long as it's for averting disease and not engineering human enhancement.

Trait selection using PGD is too new – and unproven – for there to be regulatory laws in most developed countries. But many fighters in the battle for or against PGD for trait selection and genetic disease screening believe that today is the decision point that will set the precedent for future regulation (or lack thereof) in the area. On May 21, 2008, the US Congress passed the Genetic Information Non-Discrimination Act. According to the Statement of Administration Policy associated with the Act, it "prohibit[s] group health plans and health insurers from denying coverage to a healthy individual or charging that person higher premiums based solely on a genetic predisposition to developing a disease in the future. The legislation also would bar employers from using individuals' genetic information when making hiring, firing, job placement, or promotion decisions. The Administration appreciates that the House bill clarifies that the bill's protections cover unborn children."

In the oft-cited movie Gattaca, a non-genetically-selected man with a heart problem in a trait-selected world must hide

his status through the course of his ambition to become an astronaut. Theoretically, the 2008 law would make this type of discrimination illegal, at least in the United States. But what about Gattaca? The film was invoked so frequently in negative responses to the Fertility Institutes' announcement that it is hard to find a comments thread on the topic that doesn't mention it. In his 2004 book Citizen Cyborg, Dr. James Hughes, a transhumanist bioethicist and director of the Institute for Ethics and Emerging Technologies, pointed out a few quibbles with the movie:

1. Astronaut-training programs are entirely justified in attempting to screen out people with heart problems for safety reasons;

2. In the United States, people are already discriminated against by insurance companies on the basis of their propensities to disease despite the fact that genetic enhancement is not yet available;

3. Rather than banning genetic testing or genetic enhancement, society needs genetic information privacy laws that allow justified forms of genetic testing and data aggregation, but forbid those that are judged to result in genetic discrimination (such as the previously mentioned U.S. Genetic Information Nondiscrimination Act). Citizens should then be able to make a complaint to the appropriate authority if they believe they have been discriminated against because of their genotype.

Those on the other side of the divide are numerous. At a 2008 meeting of the American Society of Human Genetics, William Kearns, a leading medical geneticist, when prompted about trait selection, said "I'm totally against this. My goal is to screen embryos to help couples have healthy babies free of genetic diseases. Traits are not diseases." Mark Hughes, the head of the Genesis Genetics Institute in Detroit, has called the practice "ridiculous and irresponsible". More bluntly, George Annas, a bioethicist with Boston University, has said "modern genetics is eugenics", while on a visit to the Holocaust Museum in Washington, DC.

The falling costs of gene sequencing is enabling PGD trait selection and lowering the barrier to entry. In the last few years, the cost of sequencing a base pair has fallen so low that even the optimists have been surprised. The first human genome that was sequenced, by the federally financed Human Genome Project in 2003, cost a few hundred million dollars. In 2007, sequencing James Watson's genome cost about $2 million. In March 2008, Applied Biosystems, based in California, sequenced a genome in two weeks for $50,000. In October 2008, Complete Genomics, another California-based company and a veritable who's who of genomics expertise, announced that it would be offering $5,000 genomes in mid-2009, with the goal of sequencing 1,000 genomes by the end of the year. Some observers, such as George Church, a professor of genetics and director of the center for computational genetics at Harvard Medical School, predict a $1,000 genome by the end of this year.

The requisite technologies for trait selection are on the way, but the battle lines have not yet been entirely drawn. Prompted by a Wall Street Journal article on the Fertility Institutes and trait selection, Kathryn Hinsch of the Women's Bioethics Project argued that thinking about issue carefully is important, and refrained from taking a hard stance on either side. She said that trait selection should be considered because, "1) It's a hive of ethical issues, 2) The technology isn't here yet, 3) We all have a stake in the issue, and 4) Questions raised go beyond designer babies." According to Hinsch, the key questions that need to be addressed are: "Should we ban it? Should we regulate the technology to allow only certain applications? Should we promote the widespread use of this technology?"

The advocates of trait selection using PGD, at least in the Western world, appear to be small in number. But as the NYU Langone Medical Center survey showed, there are at least a few. On his blog Sentient Developments, George Dvorsky, a prominent transhumanist bioethicist, pointed out that "some demand is still demand". Commenting on the survey, Dvorsky said, "An anti-enhancement bias is most certainly embedded in our society. It's very likely that many of the respondents were answering the survey in accordance to their social conditioning and what they thought was expected of them from an 'ethical' perspective." Supporting the idea of trait selection, Dvorsky wrote, "What we're talking about here is endowing our children with all the tools we can give them so that they may live an enriched, open-ended and fulfilling life. By denying them these benefits we are closing doors and potentially reducing the quality of their lives."

Another advocate of cautious trait selection is Ramez Naam, author of the 2005 book More Than Human. In a chapter on genetic engineering, he writes, "A regulatory regime consistent with family choice would focus on safety, education, and equality rather than prohibition". Looking past the immediate future, Naam also writes, "Ultimately, whatever choices we make for our children will be subject to change, at their choice, when they reach adulthood. In the coming years, pharmaceuticals, adult gene therapy, and the integration of computers into the brain will give people far more control over their own minds and bodies than we enjoy today."

In a March 9, 2009 WIRED online interview, James Hughes registered support for trait selection, and also railed against the "designer baby" terminology altogether. Responding to the future of trait selection, he said, "It's inevitable, in the broad context of freedom and choice. And the term 'designer babies' is an insult to parents, because it basically says parents don't have their kids' best interests at heart." He said, "If I've got a dozen embryos I could implant, and the ones I want to implant are the green-eyed ones, or the blond-haired ones, that's an extension of choices we think are perfectly acceptable — and restricting them a violation of our procreative autonomy."

James Hughes said, "the term 'designer babies' is an insult to parents, because it basically says parents don't have their kids' best interests at heart."

PGD and other reproductive technologies are commonly rejected as "unnatural". The transhumanists and technoprogressive response is summarized well in the Transhumanist FAQ, which says, "In many particular cases, of course, there are sound practical reasons for relying on "natural" processes. The point is that we cannot decide whether something is good or bad simply by asking whether it is natural or not. Some natural things are bad, such as starvation, polio, and being eaten alive by intestinal parasites. Some artificial things are bad, such as DDT-poisoning, car accidents, and nuclear war."

The legal and ethical future of trait selection based on PGD is still unknown. What is known is that parents will always want the best for their children. When push comes to shove, they will probably take advantage of whatever technologies are available that will give them the best lives possible.

Michael Anissimov is a writer and futurist in San Francisco. He writes a blog, Accelerating Future, on artificial intelligence, transhumanism, extinction risk, and other areas.

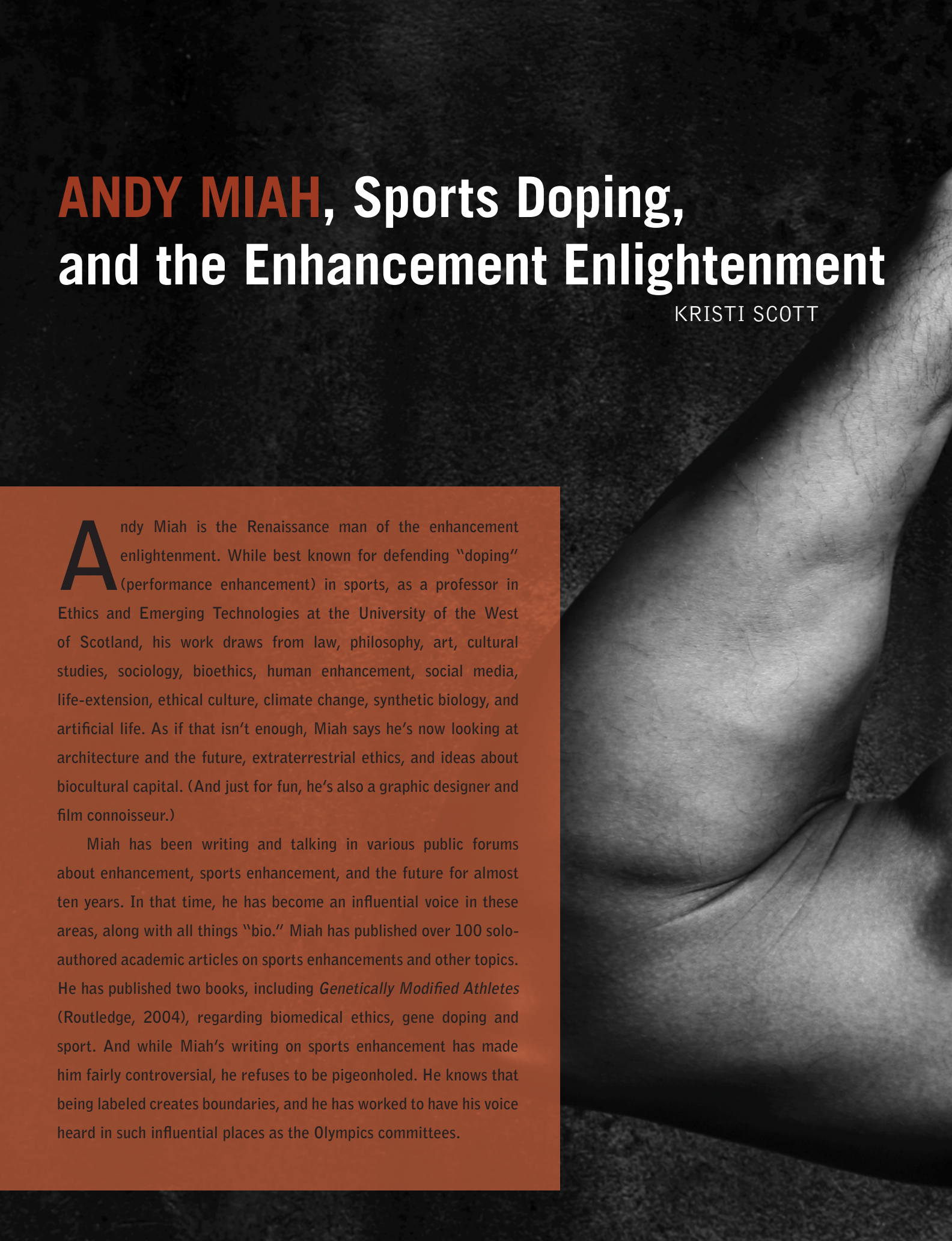
RESOURCES

Fertility Institutes
http://www.gender-selection.com

Sentient Developments
http://www.sentientdevelopments.com

ANDY MIAH, Sports Doping, and the Enhancement Enlightenment

KRISTI SCOTT



Andy Miah is the Renaissance man of the enhancement enlightenment. While best known for defending "doping" (performance enhancement) in sports, as a professor in Ethics and Emerging Technologies at the University of the West of Scotland, his work draws from law, philosophy, art, cultural studies, sociology, bioethics, human enhancement, social media, life-extension, ethical culture, climate change, synthetic biology, and artificial life. As if that isn't enough, Miah says he's now looking at architecture and the future, extraterrestrial ethics, and ideas about biocultural capital. (And just for fun, he's also a graphic designer and film connoisseur.)

Miah has been writing and talking in various public forums about enhancement, sports enhancement, and the future for almost ten years. In that time, he has become an influential voice in these areas, along with all things "bio." Miah has published over 100 solo-authored academic articles on sports enhancements and other topics. He has published two books, including *Genetically Modified Athletes* (Routledge, 2004), regarding biomedical ethics, gene doping and sport. And while Miah's writing on sports enhancement has made him fairly controversial, he refuses to be pigeonholed. He knows that being labeled creates boundaries, and he has worked to have his voice heard in such influential places as the Olympics committees.

The Olympian Professor

With his spiky jet-black hair, self-confident charisma, and his understated but hip sartorial style, Miah gives the impression of an intellectual rock star. Given his eclecticism, it shouldn't be surprising that our conversation skips across a wide range of topics.

We talked about the Beijing Olympics, which Miah attended. Suffice it to say that he continues to be an unapologetic supporter of human enhancement in the world of sports. Miah wants to see sports doping normalized, by regulating it and making the enhancements safe, accessible and accepted. In his article *Gene Doping*, published in the April 2007 issue of the Biochemical Society journal, he wrote,

"Genetically modified athletes will simply be those people who gave value to enhancements that are most suitable for athletic performances."

Our conversation turned to controversial headliner and amputee sprinter, Oscar Pistorius. Miah said that he wanted to see Pistorius be allowed to compete, if he would have qualified, amidst the fantastic architecture of the Beijing stadium, saying that, "there's so much conceptual overlap when thinking about the future" and seeing these two images together.

It may surprise you to know that Miah has written papers for the British Olympic Association, the International Olympic Committee, the International Olympic Academy, and the Brazilian Olympic Committee. But he doesn't seem to expect to win his point with the Olympic authorities. "For the anti-doping authorities, they have little option but to press on full steam. It's getting a bit out of control in my view, how much they will do for so-called clean sport."

I asked Miah about the notion of having two separate venues — one for enhanced athletes and another for clean (au natural, if you will) athletes, He's somewhat skeptical. "The problem is that, in this scenario, you'd still have the enhanced trying to get into the clean.... I think people like Pistorius will allow us to confront some important issues." Reflecting on it a bit, Miah conceded, "It all depends on whether the enhanced could achieve adequate prominence to rival the clean. It's ultimately about trying to build symbolic value around a new series of competitions. I actually think the way it'll go is that we end up with just the enhanced.... I argue that sports authorities are obliged to invest into creating safer forms of enhancement for athletes to use."

We seem to be witnessing the wisdom of Miah's way when we look at the borderline hysteria and the apparent

This Book's For You

Human Futures: Art in an Age of Uncertainty
Andy Miah, Editor
FACT (Foundation for Art and Creative Technology), Liverpool University Press
December 11, 2008

The first thing that hits you when you open up *Human Futures: Art in an Age of Uncertainty* are the visuals — they are stunning. And then you look at the content and are amazed. And then you realize it's an academic book, and you are perplexed. And let me tell you a little something, it was put together in around six months or so. Now look again.

Human Futures is a compilation of creative essays from leading scientists, designer artifacts, and artistic works. Some of the best and the brightest weigh in on topics that address "NBIC (nano-, bio-, info-, cogno-) sciences, ethics and aesthetics of human enhancement, the future of biological migration and transgressions, the emergence of systems and synthetic biology, ecosystem responsibility, global catastrophic risk, and outer space." And if one of these topics doesn't rock your world, and you're an *h+* reader, I'm stunned.

Academics will use this book as a point of reference, but it's also a damn good read (and it will look good on your coffee table.) With titles like: "Will Human Enhancement Make us Better? Ethical reflections on the enhancement of human capacities by means of biomedical technologies" by Ruud ter Meulen, "Embracing the Unknown Future: In Defense of New Technology" by Russell Blackford, and "Flesh to Data/ Subject to Data: Examining Processes of Translation" by Marilène Oliver, this book's for you!

WHERE TO BUY
http://www.amazon.com/Human-Futures-Art-Age-Uncertainty/dp/1846311810

The acceptance of personal enhancement "has been far from smooth… but equally the desire to enhance has become more apparent."

inability to stop steroid and other performance enhancement in major league baseball in the U.S. The societal consensus is that we do not want our athletes to do steroids or human growth hormone or any other drugs that enhance their athletic performance. The acceptance of human enhancements in sports will be a long time coming. In the meantime, we're likely to witness another unwinnable "war" attempting to stop people from doing what they are inevitably, eventually going to do. As Miah observed, the acceptance of personal enhancement "has been far from smooth… but equally the desire to enhance has become more apparent, as evidenced by the number of ways in which we seek to alter our bodies and minds."

As our conversations moved from sports and into the more general subject of human enhancement, I discovered that Miah's enthusiasms are pretty much limitless and his knowledge is encyclopedic. Mention that you're looking for an image of an enhanced eye, Miah's got one. Want a woman that could be a poster girl for the beauty of enhancement, with prosthetic legs and a body and face you wouldn't believe? Miah has the information and images. "We are very keen on exploring dimensions of our identity though biological modifications. We've done this in the past through tattoo, piercing, scarification even. There's a long list and each of these mechanisms has been about marking oneself out culturally and socially."

Remember that story about the selective memory deletion in mice a few months back? (If not, Google it. Crazy cool.) Ask Miah about it and he'll refer you to his article on *Eternal Sunshine of the Spotless Mind.* (Do you remember that movie? Or was it selectively deleted?) His article, like that film, really brings home the situation, and the nuances of memory deletion. It's a good read, not just a journal article.

"…the moral narrative of *Eternal Sunshine* is ambiguous in many respects, since it confronts our uncertainty about how best to overcome difficulties in life…. After watching *Eternal Sunshine*, while one is left feeling that the best solution to dealing with human suffering already resides within our learned capacities, there is also a sense in which leaving this merely for time to heal is inadequate and that we are quite right for seeking more effective, efficient and gentle means. The difficulty, though, is that *Eternal Sunshine* portrays memory deletion as anything but gentle."

Lastly, as Malcom Gladwell would say, Miah is a Connector "with a special gift for bringing the world together." Aside from his intellectual eclecticism, making connections between art and science and a broad mix of disciplines, he knows a lot of people: science fiction writers, philosophers, designers, artists, scientists, academics, people from sports and architecture. Andy Miah sees the value in bringing people together in a collaborative manner and having them work on ideas about the future. He believes that the artist and the scientist, working together, can create a truly beneficial relationship, envisioning a future that is enhanced, in the deepest and best sense of the word.

Kristi Scott has a Master of Arts in Liberal Studies, interns with the Institute for Ethics & Emerging Technologies, is a freelance writer, and mother of three.

RESOURCES

Andy Miah
www.andymiah.net

Oscar Pistorius
http://en.wikipedia.org/wiki/Oscar_Pistorius

Guardian New Science Writing
http://www.guardian.co.uk/science/blog/2009/mar/01/simon-singh-chris-french-pz-myers-andy-miah-new-science-writing

DARNING GENES: BIOLOGY FOR THE HOMEBODY

Meredith Patterson interview

TYSON ANDERSON

The age of the DIYbiologist has begun. With the price of equipment falling and the open source ideology flourishing, it was perhaps inevitable that we would see the rise of this new DIY community. And while it may conjure pictures of citizens with scalpels in one hand and a trowel in the other, DIYbiology is, in fact, an exciting and potentially productive new field.

Photo courtesy of http://flickr.com/enochsmiles

Primarily interested in the currently fashionable trend of synthetic biology — the creation of novel organisms using genetics and other techniques — they meet in groups, in cities, and unite online. One popular such location is DIYbio.org, created by Mackenzie Cowell and Jason Bobe. Meredith Patterson, the doyenne d'DIYbio, recently caught AP's eye with her pet project — a strain of the bacteria responsible for yogurt that secretes miraculin as a sweetener. While group discourse focuses on genetics and synthetic biology, there are other hot topics, like creating lab equipment using common household items or building a thermocycler for $25. There are intense debates about bioethics, and projects like the global bioweather map — a map that charts the flow, spread, and presence of various bacteria around the world.

As the diversity of topics suggests, this is a large community. Along with specialists in biological fields, you'll find educated amateurs with an eye toward starting their own home labs. From academic to soldier to artist, from middle schoolers to retirees, the DIYbio field represents a cross-section of humanity and their convergence makes for varied and interesting discussions.

And while one might envision dozens of isolated home biologists homebrewing genes in their basements and garages, there is a social aspect to this movement that goes beyond the online. Some people who lack the space to store large amounts of equipment have formed co-op labs where they work together. Meetings, arranged over the net, generally happen at people's homes and have a party vibe. A map of labs on the hackerspaces website shows the highest concentration of interest on the Eastern coast of the U.S. But participants can be found all over the globe, including Asia, Africa, and South America.

Why has this field suddenly exploded? The answer goes far beyond falling costs and the rise of the garage tinkerer, although these are factors. One big factor seems to be a desire to solve some of today's major problems. Discussions seem to frequently drift towards two particular topics: creating fuel-generating microbes and finding remedies for disease. Indeed, the DIYbio community owes much of its increase in size to do-gooders, concerned citizens who see DIYbio as a method of confronting problems in a novel way. And while this is heartening, many members simply want to pursue science for the love of it. They're DIY simply because they wish to conduct research into relatively unprofitable fields.

In much the same way that homebrew computer science built the world we live in today, garage biology can affect the future we make for ourselves. For example, the bioweather map could greatly augment the way we understand epidemiology and the environment on a micro scale. When we open science up to the public, we pretty much always get useful results.

Of course, there are bound to be some ethical concerns about, and within, a community tinkering with biology. The ethics of genetic research is certainly not lost on the practitioners. Encroaching legislation threatens to stifle their growth via tight regulation or outright restriction. The DIYbiologists are trying to come up with fair and workable solutions.

To get a better perspective on the DIYbio phenomenon and its issues, h+ talked to Meredith Patterson, a Computer Science doctorate, who is trying to solve issues with food contamination with bacterial warning systems.

> the bioweather map could augment the way we understand epidemiology on a micro scale. When we open science up to the public, we... always get useful results."

h+: How did you get involved with synthetic biology and DIYbio?

MEREDITH PATTERSON: Well, this goes back to about 2003. I was just starting my PhD in computer science at the University of Iowa, and I didn't know yet whether I was going to have a research assistantship or a teaching assistantship, so I was looking for a part-time job, and ended up taking an internship in the Bioinformatics department at Integrated DNA Technologies. My boss there was a guy named Andy Peek, who just recently became director of bioinformatics and biostatistics at Roche. He's a really hands-on kind of guy and remembers the days when everything in a wet lab was done with cobbled-together equipment. So we'd talk about stuff like how to do PCR without a thermocycler, or how to isolate DNA using only common household items, like Mac's "DNA shot" instructable.

Fast forward to 2005. I was working on SciTools, which is IDT's web-based primer design toolkit, and I got accepted to give a talk on it at CodeCon *(a software display conference)*. As an intro to the talk, I isolated chickpea DNA using non-iodized salt, shampoo, meat tenderizer, and a salad-spinner for a centrifuge, and that really blew people away. So that was the point when I started spending my free time reading old papers and thinking more about how to do more advanced genetics research at home.

Fast forward again to last summer, when Len *(Sassaman, Patterson's husband)* and I were in Houston for my sister's wedding and were hanging out at the home of some geek friends of mine. I'd had the idea for GFP yogurt several years before, and we were talking about that, and the conversation progressed to what other kinds of things you could make yogurt bacteria produce. Len hit on vitamin C, and we all went "Whoa, we could cure scurvy with yogurt."

When we got back to San Francisco, that was when I went full-bore ahead on building out my lab. I found the DIYbio list a couple of weeks later, and the rest is history.

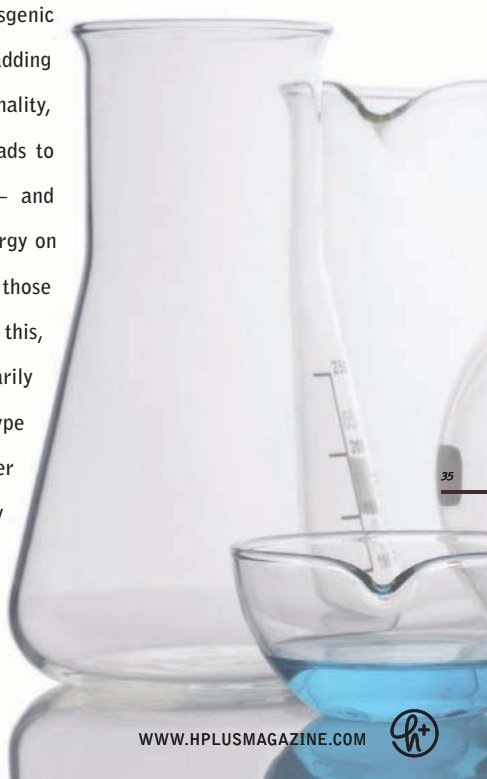
h+: You also talked about probiotics, yes?

MP: Yup. After all, lactobacilli are an important symbiote in the human gut. That's why doctors recommend you load up on yogurt after a course of antibiotics, to restore the normal balance of your gut flora. This is just taking the notion of probiotics to a whole new level. :)

h+: There has been a lot of discussion about the dangers of people doing this sort of research at home. Do you think this is over-exaggerated?

MP: I really do. The chances of someone accidentally creating a dangerous organism and the chances of it surviving in the environment outside a laboratory are vanishingly low.

Rudy Rucker has a great quote on that, "I have a mental image of germ-size MIT nerds putting on gangsta clothes and venturing into alleys to try some rough stuff. And then they meet up with the homies who've been keeping it real for a billion years or so." The bare facts of it are that there's nothing random about synthetic biology research. When we design a transgenic organism, we're deliberately adding one specific piece of new functionality, maybe a small pathway that leads to a new piece of functionality — and the organism has to expend energy on producing the new proteins that those new genes code for. Because of this, the synthetic organism is necessarily less competitive than its wild-type relatives who are much better suited for the niche they already occupy in the environment.



So any accidental release is fated to die out within a few generations, because it's just not competitive enough.

h+: Don't you think people may be taking some ethical liberties when they try doing this at home because of the lack of transparency?

MP: Do you mean because there aren't reporting requirements to the NIH or the FDA?

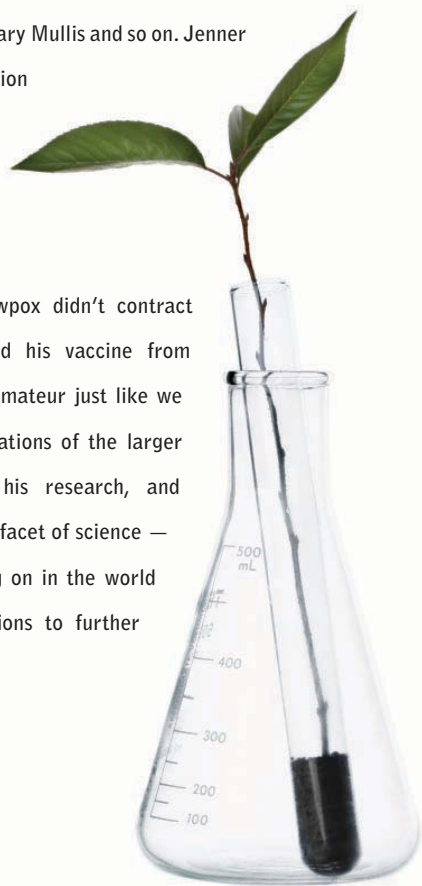
h+: Not just the lack of government oversight, but the fact that someone may be engaging in, forgive the dramatization, Mengele-type experiments and no one would know.

MP: One thing I've noticed about the DIYbio list in particular is that the open-source approach leads to more transparency. I come from an academic background in CS and linguistics, and something that's always frustrated me about academia is the fixation on keeping research secret from other research groups because people are afraid of getting scooped. Here, no one cares about getting scooped — the focus is on learning, and if someone else solves a problem first, then that's great, because that means the problem has been solved. Egos don't get in the way. We also have people documenting their research in public list e-mails and on blogs, like what JJ is doing with his "Homebrew Bioscience Research" blog, where he chronicles his experiments with moss.

It's interesting you mention that. I recently read an article about a town in Brazil that has an unusually high population of twins — and there's evidence that it was this town that Mengele fled to after WW2. So I think the question of whether people will engage in unethical experimentation sort of answers itself, without getting into DIYbio at all. As a community I think it's our responsibility to encourage ethical experimentation and to reinforce that on a social level — i.e., taking a stand against work that we think is unethical, and taking a good hard look at our own work to make sure that we're doing the right thing. I've gotten into some interesting discussions on my own blog about the ethical issues involved with transgenic symbiotes that complete the vitamin C synthesis pathway in humans... whether it would be ethical to release them on a global scale or not. On the one hand, hundreds of thousands of people worldwide suffer from scurvy, and I want to help solve that problem and reduce human suffering. On the other hand, there are a lot of people who are strongly opposed to GMOs for a variety of reasons and are angry at the notion of an endemic GMO, even one that prevents a very serious disease. And I do think that their rights have to be respected. So it's a very difficult tightrope to walk, and the questions about what is ethical and what isn't are really tough. They don't have simple answers. So I think my responsibility as an ethical researcher is to engage with these questions as they come up, and try to find solutions that reduce human suffering but still respect people's rights.

h+: In a recent interview with *Monitor 360* you compared DIYbiology with birdwatching. Don't you feel that there is a league of difference between the two?

MP: Well, I'm a generalist at heart, even if I'm working in a very specific area. To be honest, most of the cool things I've done scientifically have come from cross-pollinating a couple of different research areas. So I make that point about birdwatching and cataloging trees to remind people that biology is really, really big, and it's worthwhile for experts in small subfields to keep abreast of what's going on in other areas of the field, because our expertise can help other people and their expertise can help us. Between synthetic biology and birdwatching, absolutely. On the other hand, both DIY synthetic biology and birdwatching are biological endeavours, and a term like "DIYbiology" is broad enough to encompass both. Western culture has a long and exciting tradition of talented amateurs contributing to the progress of science, and I hope people remember that we're following in the steps of people like John James Audubon (who discovered and cataloged hundreds if not thousands of bird and mammalian species, expanding our understanding of North American biodiversity) as well as Edward Jenner, Jonas Salk, James Watson, Francis Crick, Kary Mullis and so on. Jenner came up with the notion of using cowpox as a vaccine for smallpox by observing that people who worked with cattle and got cowpox didn't contract smallpox, and developed his vaccine from that — and he was an amateur just like we are. He used his observations of the larger environment to guide his research, and that's a really important facet of science — recognizing what's going on in the world and using our observations to further understanding.



Here Come the Neurobots

Brain Bots are Developing Personalities – and a Whole Lot More

STEVE KOTLER

Photos courtesy of Jeff Krichmar and the CARL Laboratory

Can we build a brain from the ground up, one neuron (or so) at a time? That's the goal of neurobotics, a science that sits at the convergence of robotics, artificial intelligence, computer science, neuroscience, cognitive psychology, physiology, mathematics and several different engineering disciplines. Computationally demanding and requiring a long view and a macroscopic perspective (qualities not often found in our world of impatient specialization), the field is so fundamentally challenging that there are only around five labs pursuing it worldwide.

Neurobotics is an outgrowth of a growing realization that, when it comes to understanding the brain, neither computer simulations nor top-down robotic models are getting anywhere close. As Dartmouth neuroscientist and Director of the Brain Engineering Lab Richard Granger puts it, "The history of top-down-only approaches is spectacular failure. We learned a ton, but mainly we learned these approaches don't work."

Gerald Edelman, a Nobel Prize-winning neuroscientist and Chairman of Neurobiology at Scripps Research Institute, first described the neurobotics approach back in 1978. In his "Theory of Neuronal Group Selection," Edelman essentially argued that any individual's nervous system employs a selection system similar to natural selection, though operating with a different mechanism. "It's obvious that the brain is a huge population of individual neurons," says UC Irvine neuroscientist Jeff Krichmar. "Neuronal Group Selection meant we could apply population models to neuroscience, we could examine things at a systems' level." This systems approach became the architectural blueprint for moving neurobotics forward.

The Edge of Real Brain Complexity

The robots in Jeff Krichmar's lab don't look like much. CARL-1, his latest model, is a squat, white trash can contraption with a couple of shopping cart wheels bolted to its side, a video camera wired to the lid, and a couple of bunny ears taped on for good measure. But open up that lid and you'll find something remarkable — the beginnings of a truly biological nervous system. CARL-1 has thousands of neurons and millions of synapses that, he says, "are just about the edge of the amount of size and complexity found in real brains." Not surprisingly, robots built this way — using the same operating principles as our nervous system — are called *neurobots*.

Krichmar emphasizes that these artificial nervous systems are based upon neurobiological principles rather than computer models of how intelligence works. The first of those principles, as he describes it, is: "The brain is embodied in the body and the body is embedded in the environment — so we build brains and then we put these brains in bodies and then we let these bodies loose in an environment to see what happens," This has become something of a foundational principle — and the great and complex challenge — of neurobotics.

When you embed a brain in a body, you get behavior not often found in other robots. Brain bots don't work like Aibo. You can buy a thousand different Aibos and they all behave the same. But brain bots, like real brains, learn through trial and error, and that changes things. "Put a couple of my robots inside a maze," says Krichmar, "let them run it a few times, and what each of those robots learns will be different. Those differences are magnified into behavior pretty quickly." When psychologists define personality, it's along the lines of "idiosyncratic behavior that's predictive of future behavior." What Krichmar is saying is that his brain bots are developing personalities — and they're doing it pretty quickly.

Krichmar's bots develop personalities because, instead of pre-programming behaviors, these robots have neuro-modulatory systems or value judgment systems — move towards something good, move away from something bad — that are modeled around the human's dopaminergic system (for wanting or reward-based behaviors) and the noradrenergic system (for vigilance and surprise). When something salient occurs — in CARL-1's case that's usually bumping into a sensor in a maze — a signal is sent to its brain telling the bot to react to the event and remember the context for later. This is conditional learning and it mimics what occurs in real brains. It also allows Krichmar to examine one of the great puzzles in systems neuroscience — how do the brain's neurons work together?

"We're pretty sure you need a certain brain size for the level of complexity we see in biological organisms," he says, "but we don't have the tools to make a network that big behave in any stable way. The biological brain is remarkably stable. We can alter it with drugs, we can put it into all sorts of varied environments, pretty much it still knows how to function. Our robots are still brittle by comparison."

Besides personality, another thing these robots develop are types of episodic and categorical memory not found in other computers. After running early brain bots Darwin X and Darwin XI through a few mazes, Edelman, working alongside Krichmar and a researcher named Jason Fleischer, found they'd naturally developed place cells — meaning they didn't program them in. These are cells in the Hippocampus that fire whenever an animal passes through a specific location, essentially linking place with time. More than that, when Edelman examined his bots' brains, he found these place cells would not only fire based on where the robot had been, but also on where it was planning to go, "which," says Krichmar, "is exactly what you would see in the brain of a rat and nothing anyone's seen in a robot before."

The Biggest Dragon: Higher Cortical Functions

Meanwhile, Richard Granger is using brain bots to hunt down yet another grail: where language originates in the brain. "It's been pretty widely demonstrated that the brain is modular and highly uniform," he says. "There are certain broad stroke differences between humans and other animals, but we can count the number of those on two hands. Yet humans can speak and animals can't. That's a pretty big difference. And even the variations that have been found in brain language areas like Broca's Area don't hint at how language could emerge from the changes found. So where is language? We've spent billions trying to track down its origins and still can't find it."

Granger believes that the only real differences between animal and human brains are size and connectivity, an argument he lays out in his book *Big Brain*. "Humans have a lot bigger brains so we have much more space for neurons to make connections, to link with other neurons." It's in that space, in those extra connections, where Granger thinks language emerges. If he's right, as his bot brains draw closer and closer is size and complexity to human brains, language should start to emerge — and Granger will get to watch it happen.

Of course, since neurobotics is a dragon-slayer's approach, there are also a few scientists going after the biggest dragon. Just like Granger is upping complexity to examine language, researchers at Imperial College in London are doing the same thing for consciousness. "All of this work is comparable," says Granger, "because we're all modeling cortical structures to build whole brain models with the intention of seeing if higher functions like language and consciousness develop." And if what they've discovered so far is any indication, then when it comes to developing higher cortical function in neurobots, it's really not a question of if, only "when."

CARL-1 has thousands of neurons and millions of synapses that "are just about the edge of the amount of size and complexity found in real brains."

RESOURCES

Richard Granger's Brain Engineering Laboratory
http://www.dartmouth.edu/~rhg

Jeffrey L. Krichmar
http://www.socsci.uci.edu/~jkrichma

Unreal Tournament:

Was That a Bot or a Human?

SURFDADDY ORCA

With your shield gun pointing at the building ahead of you and your biorifle in your holster, you see heavily armored, well-muscled computer game characters running at you. They're coming at you in squads with team names like Thunder Crash, Iron Guard, and Fire Storm. Your mission? Obliterate your opponents and claim the *Unreal Tournament* Trophy.

Image courtesy of Epic Games

But, who exactly — or what — is that large pixilated dude coming after you in the camouflaged flak jacket?

Epic Games' *Unreal Tournament* 2004 is a multiplayer FPS (First Person Shooter) PC game that "combines the kill-or-be-killed experience of gladiatorial combat with cutting-edge technology." Users compete in "death match" teams over the Internet for a prized Tournament Trophy. Although there has been very little research into the psychological and social aspects of FPS games, existing studies show the players are almost exclusively young men (mean age about 18 years) who spend a lot of their leisure time on gaming (about 2.6 hours per day).

But young men are not the only players. Gamebots (as opposed to Internet bots or web robots) are a type of weak AI expert system software used to simulate human behavior in computer games such as *Unreal Tournament* and its ilk: *World of*

Warcraft, *Guild Wars*, *Lineage*, and *Everquest* – to name a few. Each bot is a separate instance of an AI computer program. Bots control pixilated characters that are often indistinguishable from human characters.

Unreal Tournament 2004 is designed to be hacked so that an AI program on a user's PC sends sensory information for a character over a network connection. Based on this information, the AI program decides what actions the character should take and issues commands causing the character to move, shoot, and talk. Project "Gamebots" at the University of Southern California's Information Sciences Institute "seeks to turn the game *Unreal Tournament* into a domain for research in artificial intelligence."

It may seem odd that a shoot-'em-up death match game might be a breeding place for machine intelligence. The IEEE Symposium on Computational Intelligence and Games (CIG) took this notion seriously enough to host the first ever "BotPrize" contest in December 2008 to see if a computer game-playing bot could convince a panel of expert judges that it was actually a human player.

> Will the first bot to pass the Turing Test end up obliterating its opponents in Epic Games' *Unreal Tournament* 2004?

The bots competing in the death match tournament were created by teams from Australia, the Czech Republic, the United States, Japan and Singapore. The judges included AI experts, a game development executive, game developers, and an expert human player. A $7000 cash prize was offered to the team who could create a bot indistinguishable from a human player.

How did the judging work? Well, remember the Turing Test? In 1951, Alan Turing wrote a famous paper in which he proposed a test to demonstrate machine intelligence. Often characterized as a way of dealing with the question of whether machines can think (a question that Turing considered meaningless), the "standard interpretation" of the Turing Test includes an interrogator or judge (Player C) tasked with determining which of two players (Players A and B) is a computer program and which is a human. The judge is typically limited to using responses to written questions in order to make the determination. In the case of the BotPrize, the judges actually played against the other players and then rated them.

The results? You can judge the players yourself based on short clips of the game's action posted on the Internet. It's not always easy. On a scale of 0 to 4 (4 is the most human-like), the humans in the contest all scored higher than the bots (humans: 4, 3.8, 3.8, 3, 2.6; bots: 0.4, 0.8, 2, 2.2, 2.4). The winning bot team AMIS, from Charles University in Prague, managed to fool 2 out of 5 expert judges, and achieved a mean rating of 2.4. Startlingly, one human competitor scored only 2.6, just two tenths higher than the winning bot. The AMIS team did not win the $7000 prize: they were unable to pass the test by fooling 4 out of 5 judges. However, they did take home $2000 for having the winning entry in the tournament. CIG's BotPrize contest is a variant on the Loebner Prize, an annual competition started by philanthropist Hugh Loebner in 1991 that challenges programmers to create a program that can pass the Turing Test.

Both the CIG and the Loebner prizes have yet to be claimed. Will 2009 be the year? And will the first bot to pass the Turing Test end up obliterating its opponents in *Unreal Tournament* 2004? Stay tuned.

Surfdaddy Orca is another monkey with a laptop and a cell phone waiting for Godot or the Singularity or whatever comes next.

RESOURCES

The 2K Bot Prize
http://botprize.org

Short clips of the game's action
http://www.botprize.org/quiz.html

Slashdot
http://games.slashdot.org/article.pl?sid=09/01/24/1657219

Unreal Tournament 2004
http://www.unrealtournament2003.com/ut2004/

University of Southern California Gamebots
http://gamebots.planetunreal.gamespy.com

The Appeal of Playing Online First Person Shooters (FPS)
http://www.allacademic.com/meta/p_mla_apa_research_citation/0/9/0/5/0/p90505_index.html

From X PRIZE to Singularity University:

An Interview with Peter Diamandis

ALEX LIGHTMAN AND R.U. SIRIUS

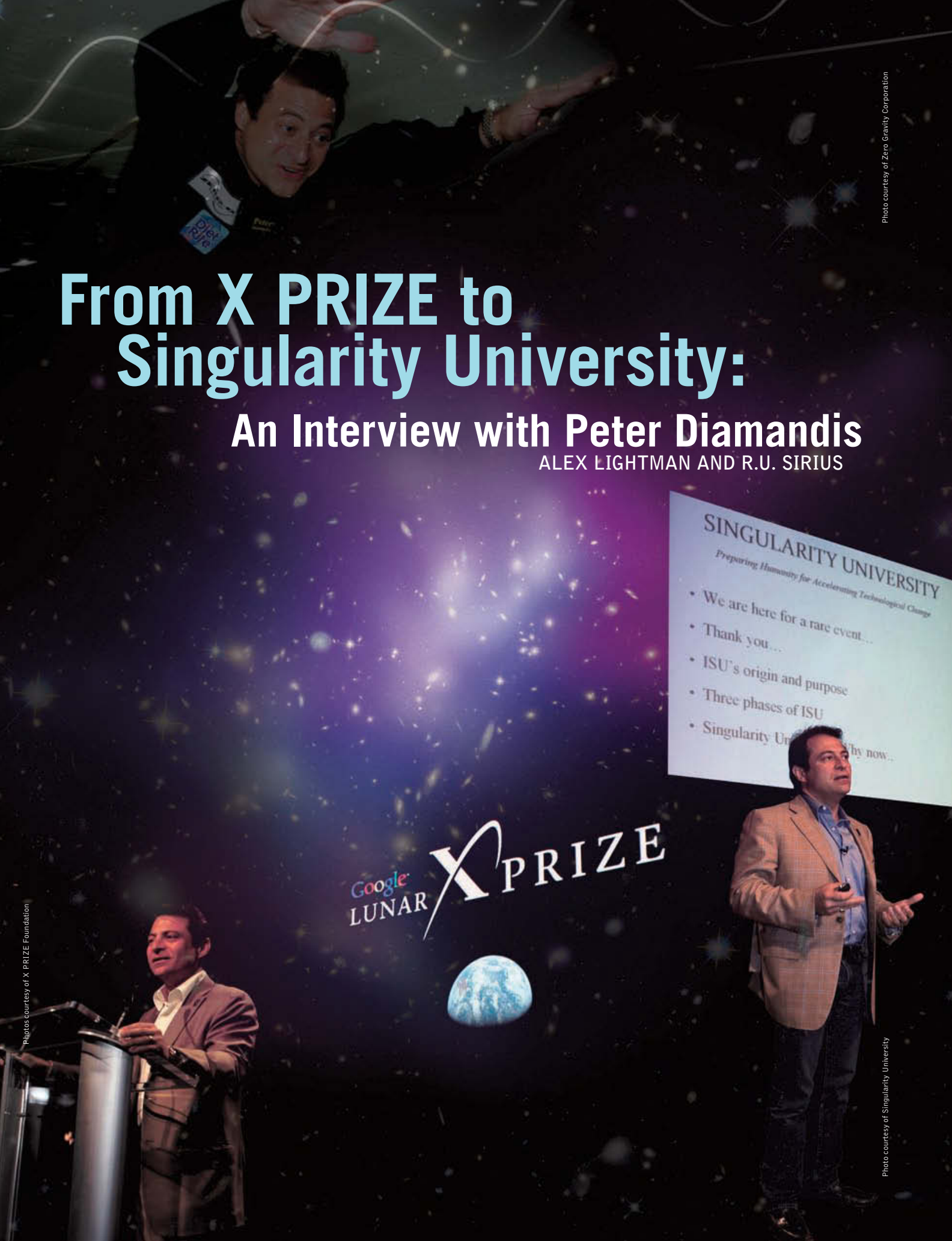


Photo courtesy of Zero Gravity Corporation

Photos courtesy of X PRIZE Foundation

Photo courtesy of Singularity University

William Gibson came up with the then-fictional notion of cyberspace in the 1980s when he saw a bunch of teenagers playing videogames while listening to Sony Walkmen. In this interview, Dr. Peter H. Diamandis, Chairman of Singularity University (Ray Kurzweil is Chancellor), reveals that he got intimations of "the singularity" in 1993 when he noticed people connecting to others by using their cell phones while traveling underground on the D.C. subway.

Diamandis is a serial social venture entrepreneur. He was born May 20, 1961, and graduated from MIT with his first degree in 1983. His enterprises include International Space University, the aforementioned Singularity University, Zero Gravity Corporation, Space Adventures, Ltd., and the Rocket Racing League. Dr. Diamandis' most famous and influential creation is the X PRIZE Foundation, an educational, non-profit, prize-granting enterprise that aims to use competition to inspire innovations that are good for human civilization.

The $10 million the X PRIZE Foundation offered for its Ansari X PRIZE competition inspired Microsoft co-founder Paul Allen to team up with Burt Rutan and create SpaceShipOne. It would win the competition by becoming the first non-government-funded spacecraft to reach outer space. The X PRIZE is now offered in a growing number of categories, including the heavily publicized Progressive X PRIZE for automotive energy efficiency.

We spoke to Diamandis primarily about Singularity University. According to SU materials, "Singularity University, based on the NASA Ames campus in Silicon Valley, is an interdisciplinary university whose mission is to assemble, educate and inspire a cadre of leaders who strive to understand and facilitate the development of exponentially advancing technologies (bio, nano, info, AI, etc.), and apply, focus and guide these tools to address humanity's grand challenges." Their nine-week Graduate Studies programs start on June 27 and their Executive Programs will start in the fall.

h+: Why are you starting Singularity University?

PETER DIAMANDAS: [laughs] It's something that needs to happen. I am absolutely convinced that humanity is going to undergo some fundamental evolution over the course of the next few decades. We're going from evolution by natural selection to evolution by intelligent direction. And the vast amount of breakthroughs — some of the most amazing breakthroughs are going to occur at the boundary conditions between all these exponentially-growing fields.

I feel that all disciplines (some more than others) are critical, and all nations will have a role in the evolution of humanity over the decades ahead. And sometimes, key technology breakthroughs are really fundamentally dependent on other breakthroughs. For example, an engineering concept might never see the light of day because the policies or laws are not in place to support its birth… or because someone can't get the required capital together. So it's very important to take people who are brilliant in their individual fields of AI or nanotechnology, robotics… whatever it might be, and help them understand how the other fields can fundamentally make or break their work.

> We want to create an ethos at Singularity University for the founding of new companies that are right at the birth of exponentially-growing fields.

So a critical aspect of this project is that it's interdisciplinary. And it's important that there may be some ex-Soviet scientist in Kazakhstan who's got a brilliant piece of technology sitting on a shelf or some incredibly creative teenager in India who has a missing piece of the puzzle. These days, of course, innovation and breakthroughs can come from anywhere, so the interdisciplinary and international aspect is a critical part of what we're doing. So those fundamental understandings are what drove me to propose this idea to Ray Kurzweil.

h+: What do you intended to accomplish with SU?

PD: The primary goal... primary targets to be accomplished... are assembling a world-class team of graduate and post-graduate students every year that will ultimately build a network of future leaders who know each other, have a common vision, and can work well together.

h+: The article about SU in the *S.F. Chronicle* emphasized SU as a locus for problem-solving. Is that a priority?

PD: It's an important aspect. I want to be very clear. The first priority is attracting and creating that network of the top people in their fields. There are two elements for our selection process that are important. One is that the students have to be the best in their individual field, but that's not enough. The second part of the equation is that they really have to be demonstrated leaders. They have to be someone who is not passive, but rather able to go and lead and create. And by the time you're in grad school or post-graduate, your attributes, like your willingness to take risks and lead have been demonstrated in some fashion.

Once we have a population of brilliant future leaders, the second goal is to teach them across disciplines so that they can create innovation.

The third goal... we're hoping they'll start new companies. We really want to create an ethos at SU for the founding of new companies that are right at the birth of these exponentially-growing fields.

And number four: we're going to be asking the students to focus these tools — these extraordinarily powerful tools coming out of these exponentially-growing fields — on the world's biggest problems. We have these large, global, intractable problems — pandemics, hunger, energy... whatever it might be. And the only way we'll be able to handle them is by wisely using the power of these exponentially-growing technologies.

h+: You mentioned intractable problems. It's an interesting choice of words, since you're trying to make them tractable. So in terms of your own sense of being a visionary futurist, and Ray Kurzweil being a visionary futurist — do you think that the future people have envisioned is in danger of being sort of cancelled by one crisis or another?

PD: I think these transformative technologies are powerful and cannot be stopped. They can be slowed down. For example, if you look at the curves that Ray Kurzweil has shown for Moore's law, it's a pretty consistent growth curve across recessions, depressions and wars. The biggest dangers that we have are the things that could fundamentally disrupt humanity — a global pandemic, a nuclear war, a form of terrorism that uses the same exponentially-growing technologies to do as much harm as they could do good. The technologies that we have at hand today are such that small groups of individuals can do extraordinary good or extraordinary harm with them.

h+: The original term singularity, from Vernor Vinge, relates to superhuman intelligence emerging decades in the future. Why use the word "Singularity" for this project?

PD: We had some discussion and debate about what we should name the university. And, to be clear, the university is not about *The* Singularity. It's about the exponentially-growing technologies and their effect on humanity. Now, one of the potential outcomes can be what has been referred to as The Singularity. There could be a multitude of futures. We'll find out. But for me, when we talk about Singularity University, it's really about these technologies and their ability to be used for good for humanity.

You know, we toyed with other terms... like Convergence University and others. But in homage to Ray and his work and his book, which was sort of the formative document that got me focused on this project, we called it SU.

h+: In terms of the Singularity, do you see a relationship between Kurzweil's notion and other people's notion of the Singularity, and your interest in space, and then your work with the X PRIZE?

PD: My interest in space is sort of encoded in my DNA. It's my life's mission to open the space frontier. But I remember a moment in early '93. I was in a subway in Washington, D.C. and I noticed that two or three people were on their cell phones. And I pulled out my cell phone, there was a signal and I was able to make a phone call. And

at that moment, it hit me how totally ubiquitous technology was becoming — how inextricably tied to our lives. And it hit me that we were on a path of ongoing mergers with technology that was unstoppable and irreversible. So I was seeing Kurzweil's Singularity.

So when that hit me, that humanity was on a mad dash to merge with or incorporate technology in an irreversible fashion... that was the only thing that caused me to momentarily take stock of my space-focused vision. I was so enamored with the concept, it got me to pause and wonder: was opening the space frontier still of any value?

h+: And this is a big discourse among people who feel that Singularitarian and other technologies open up a virtual space that's going to be so worthy that the physical space is no longer as important.

PD: Sure. And of course, that will be a debate.

By the way, I had the pleasure of flying Stephen Hawking into zero-G about 18 months ago. I don't know if you read about that. If you go to the website for my company, Zero G Corporation (see Resources below), you can find stuff there about it. We flew Stephen Hawking into zero-G. It was a very successful flight. We had huge media coverage around the world. So I asked Hawking why he was doing this? And he answered — before the media at the press conference — that he believed that if the human race does not evolve into space, we don't have a future. Because there are so many problems — with asteroids, pandemics, war — that we, effectively, have to backup the biosphere.

So opening the space frontier is critical for the purpose of backing up the biosphere, and for getting access to the resources needed for the continual growth of humanity. And the Earth, if you look at it, is a crumb in a supermarket filled with resources — the asteroids, the interstellar materials and so forth. We have the ability to have limitless manufacturing and limitless energy. And we really need the raw resources required to envision whatever might be possible.

Antecedents of Singularity University: Unity in Diversity

ALEX LIGHTMAN

The Singularity University vision: Bringing together smart people from many disciplines to seek and hopefully find common intellectual ground, and collaboratively brainstorm to solve global problems with technology is exciting, though not unprecedented. In reflecting upon what Peter Diamandis said during our interview, other endeavors reflecting similar ambitions and approaches came to mind. While Dr. Diamandis cites only International Space University as an inspiration, SU might be seen as one of a School of Schools of Schools. Here are six that come to mind:

1 **MASSACHUSETTS INSTITUTE OF TECHNOLOGY:** William Barton Rogers incorporated MIT in 1861, and got it going in 1865 after the Civil War. The original proposal includes sentiments that are remarkably similar, for something written 147 years earlier, to the SU ideal. "The practical nature of the discoveries...of scientific inquiry has multiplied almost infinitely the lines of connection between them...and these countless connecting threads, woven into one indissoluble texture, form that ever-enlarging web which is the blended product of the world's scientific and industrial activity."

2 **CLUB OF ROME:** The Club of Rome was founded in April 1968 by industrialist and scientist Aurelio Peccei in (it will come as no surprise) Rome. The Club of Rome commissioned The Limits to Growth, a study/book that sold 30 million copies in 30 languages, and which predicted collapse in the 21st century. A 2008 review determined that the predictions were still on target.

3 **SANTA FE INSTITUTE:** Santa Fe, where I lived for five years, with its 120 art galleries, is like Athens to nearby Los Alamos' Sparta, and the Santa Fe Institute combined the best of both worlds. Established in 1984 by George Cowan and six others (five of whom were Los Alamos scientists), the Santa Fe Institute focuses on interdisciplinary science seminars and research. I gave it a nickname: Complexity University, and it has been influential in artificial life and chaos research.

4 **ASPEN INSTITUTE:** Founded in 1950 and based in Washington DC with campuses in Aspen and on the Wye River in Maryland, the Aspen Institute is highly regarded for bringing together leaders from many fields to discuss interdisciplinary solutions to global problems. Some of the best technology discussions on issues such as spectrum have taken place under Aspen Institute auspices.

5 **INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS (IIASA):** IIASA was founded in London, 1972, to bring together the best scientists from east and west in sort of neutral Austria. IIASA has focused on complex systems and how to negotiate between different nations and professions to manage them.

6 **COPENHAGEN CONSENSUS CENTER:** Founded by Bjorn Lomborg, author of the *Skeptical Environmentalist*, the Copenhagen Consensus tries to apply a sort of cost "return on investment" analyses to solving global problems. The CCC is more financially oriented than the other schools.

RESOURCES

Rogers, William B., Chairman, The Committee of Associated Institutions of Science and Arts, "Objects and Plan of an Institute of Technology: including a Society of Arts, a Museum of Arts, and a School of Industrial Science; proposed to be established in Boston" - Boston, 1861, and archived at the MIT Libraries Collection. http://libraries.mit.edu/archives/mithistory/pdf/objects-plan.pdf

MIT
http://mit.edu

The Santa Fe Institute
http://www.santafe.edu

IIASA
http://www.iiasa.ac.at

The Club of Rome
http://www.clubofrome.org/eng/home/

The Aspen Institute
http://www.aspeninstitute.org

Copenhagen Consensus Center
http://www.copenhagenconsensus.com

h+: What are some of the directions for the university, some areas of study or some speakers that you think are the most exciting, or are the most exciting for you, that will be coming up?

PD: Well, we have this partnership with NASA and with Google, and we're in discussions with a number of other major high-tech companies in Silicon Valley. And we have the courses of computational network systems, AI and robotics, human-machine interface… those are exciting.

h+: Earlier in the conversation, you were saying that you hoped people who come to SU go on and start companies and projects and so forth. Are you planning to do follow-through and maintain contacts with people who participate in this?

PD: Oh, absolutely. And we're going to be teaching the students who come to SU about entrepreneurship and finance. And the students who come up with great business ideas… we're going to have a pitch day to the venture capital community at the end of the program. And we're also creating a program we call the one percent club. So students who donate one percent of the equity of their company to SU will be given prominent notice. Also, besides the summer program, there will be three-day and ten-day executive programs. And CEOs, CTOs, CMOs of companies will come to get some of what I call forward-looking radar. Any CEO who's not worried significantly about the future of their company, or doesn't recognize the power of these exponentially-growing technologies could have to transform their industry, needs to be.

h+: I've talked to some people who have the expectation that SU is going to solve really big hard problems. Should people have the expectations that you're really actually going to solve some of the big ones?

PD: I think we're mostly going to get to grapple with what the technologies could do once they come into existence. And I think having a clearly defined idea of that is the first step in solving problems that will emerge

So is understanding what the problem is and what the technologies might be. But… you guys know I chair the X PRIZE as well?

h+: Right.

PD: So I think there will be a relationship between SU and X PRIZE. The X PRIZE Foundation is focusing on those same big problems and creating prize purses, defining the grand challenge in an objective, measurable, clear way and then setting up a large cash purse for the person who achieves it. And I hope a lot of the SU graduates will actually form teams to compete for some of these grand challenges.

Left to Right:
Robert K. Weiss, Larry Page, Peter Diamandis, Buzz Aldrin

h+: You should get a reality TV show. [laughter] Do you think the cost of SU is justified? Some might compare the cost to TED, which is $6,000 for four days. Is that a valid comparison and would you like to explain the value that will be received by people who attend SU?

PD: Sure. The cost is similar to what we've charged for ISU for the last 20 years. It's a non-profit organization. So the cost is based on what it's going to cost us to operate. We bring in people from around the planet and we'll be giving an extraordinary experience. And the price includes housing and food as well as tuition, so it's very reasonable. Plus we give out a significant number of partial and full scholarships. But some people can afford to pay it, and are happy to.

Finally, at the end of the day, the students who come to SU are going to plug in to a global network that is so extraordinary that I believe will be worth the cost… just in terms of the people they will be able to meet.

h+: Is there a way that someone reading this article right now can get involved with SU?

PD: We're going to allow people to participate online and view some of the lectures online, like TED does. And we're going to encourage people to attend day and 10-day programs, as well as nine-week programs. The first nine-week graduate student program starts on June 27th, and runs through the end of August. And the first three-day and ten-day programs will take place probably in October.

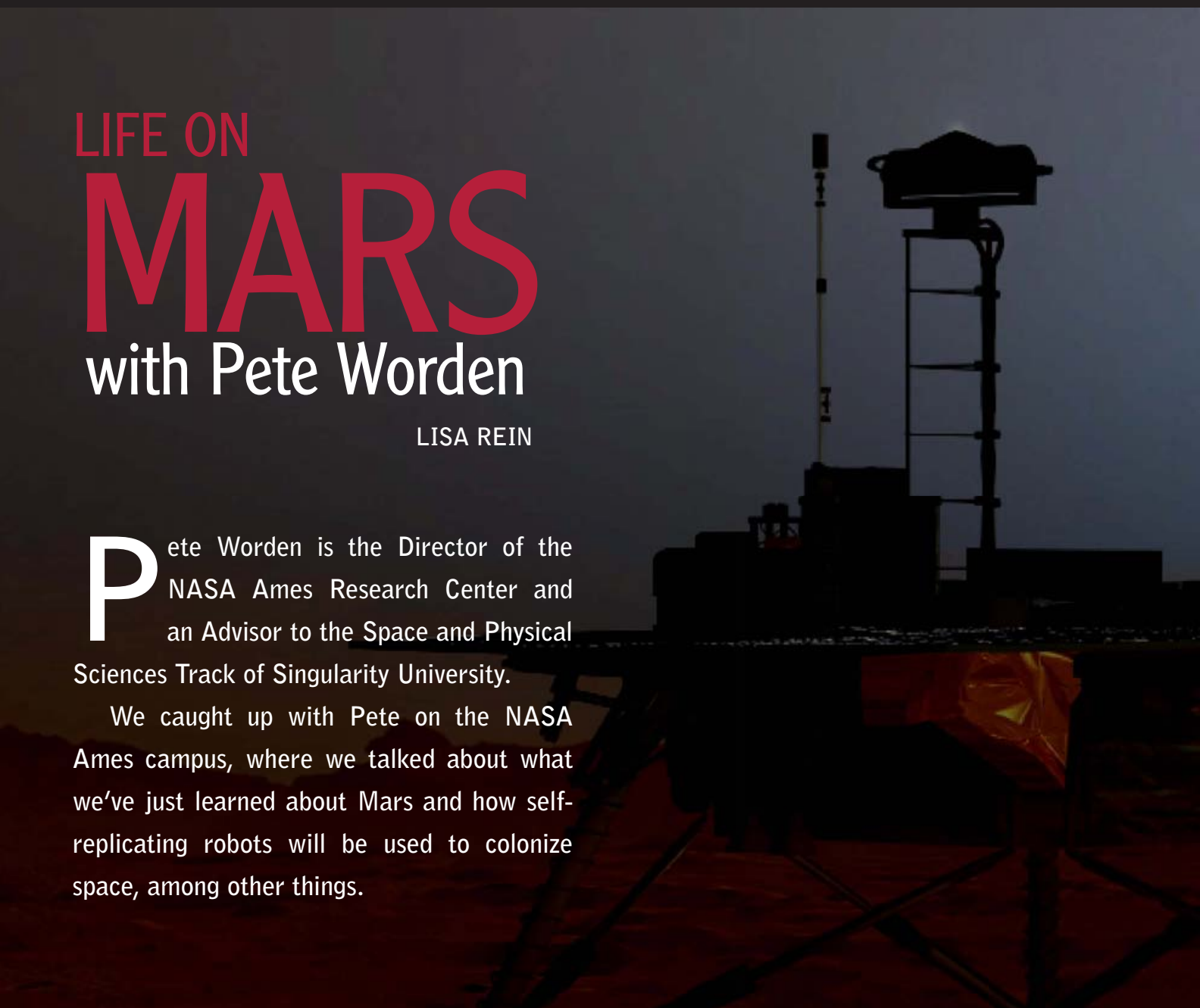
h+: So Peter, you told us your goal is to live 700 years. Why, and how are you going to do it?

PD: When I was in my late 20s, I watched a TV show where they were talking about ocean reptiles being some of the oldest living animals on the planet, and that it was believed that some of these could live as long as 700 years… old sea turtles. And I said, "If they can, why can't I?" Simple as that. And I still fundamentally believe that. And I believe that in the next few decades, we will unlock the secrets of human aging and we'll be able to slow down, stop, and ultimately reverse aging. And that not an *if,* it's a *when.* ®

Alex Lightman is the author of the first book on 4G wireless, Brave New Unwired World *(Wiley) and founder of pioneering companies in 3-D and Hollywood websites, wearables, and IPv6. He welcomes friending on Facebook.*

LIFE ON MARS with Pete Worden

LISA REIN



Pete Worden is the Director of the NASA Ames Research Center and an Advisor to the Space and Physical Sciences Track of Singularity University.

We caught up with Pete on the NASA Ames campus, where we talked about what we've just learned about Mars and how self-replicating robots will be used to colonize space, among other things.

h+: What have we learned recently about Mars and the possibility of life there?

PETE WORDEN: Well, from what we've seen and the missions we've had, Mars is obviously an environment that can support large-scale human activity. It has substantial quantities of water and other "volatiles" — carbon compounds and so forth — so it clearly can support life. In fact, it may *already be supporting life*, and that's one of the main things we need to find out before we do anything, because there may be microbial life below the surface of the planet.

We announced recently — and this is actually from Earth-based observations — that there is evidence of variable methane on the planet. This could mean that there is some sort of geologic activity going on underground, with its own source of heat that would melt water and allow flows underground. This would be exciting in its own right, for we have long thought that Mars was a geologically inactive, "cold" planet, like the Moon. However, since life can also cause methane to be produced, our first objective is to find out if there is already life there.

h+: And that's where the robot missions come in?

PW: Yes. The possibility that life exists currently on Mars suggests that we're going to have to do extensive robotic exploration here on Earth. Mars is obviously an environment that can support large-scale human activity. I don't want to take the chance that we're on the losing side, until we find out what it is, and if it's compatible with Earth life, or not. There's also a possibility that Earth life is Mars life. The first life forms here may have come from Mars. We don't know. It may be more compatible than one would think. But, at any rate, it's a very interesting scientific question.

h+: But you're also trying to be careful not to introduce any harmful bacteria to anything that might already be living on Mars?

PW: Exactly. Until we understand the full biospheres of both planets, we'll want to be careful. So, sterile robots can begin to help us do that. We're pretty sure that there's no life on the surface of Mars, or at least nowhere we've looked, but there may be life sub-surface. We already know

from the Phoenix Lander that right below the surface is a permafrost. One of the things we're doing here at NASA Ames is developing autonomous robots and drills that can drill down into that permafrost. We learned from Apollo that it's hard to drill on other planets. The rock characteristics are different… and different in a way you can't predict.

We have already done a lot of work on autonomous robots, which is the first step. Many of the Mars robots we've sent there have JPL on the outside and NASA Ames on the inside, since a lot of the software has been developed right here.

Next, we'll want to build self-replicating robots, and that's why nanotechnology, artificial intelligence, and other technologies being worked on at Singularity University are so interesting. When you start looking at self-replicating robots, a biologist would tell you "well, we already know how to do that. Those are called living cells. Microbes." in particular. So one of the obvious questions is: Can we begin to take existing microbes and engineer them to do things? And then, at some point, can you actually create synthetic life that can be engineered to extract the materials you need and construct environments?

We have a research group here at NASA Ames that is looking at "extremophiles," life forms able to operate under highly extreme conditions, such as close to the boiling point of water, or in highly acidic conditions. These conditions may or may not represent exactly what you'd find on Mars, but we've been able to extract these self-replicating proteins and are beginning to figure out how you can replicate them to manipulate metals to construct substrates, and maybe even grow an electronic component.

h+: Are you talking about creating "synthetic life" that will duplicate what's going on with biology?

PW: Yes. Eventually. But at first, we're just using what we've already found in nature. In fact, there was an article the other day about using viruses to create batteries, and that you can modify the genome of a virus to construct battery leads (+, -), to create a kind of "nanobattery" using the viruses.

So rather than using the current manufacturing process, where somebody melts metal and pours it into molds and machines those parts together into an electrical component, in the future, we'll use microbes and proteins to "grow" them. In a cell, a particular genetic coding manufactures a particular kind of protein that it links to build, say, a cell wall. Well, supposing we modify that so rather than building a cell wall, it builds a substrate for an electronic component. It might be a simple modification to say, "OK, build this in a flat area." Then you have another one that comes in and says "OK, every few microns we have an electronic lead."

The next step — and this is one that is speculative — is creating synthetic life. People like Craig Venter are beginning to do this. If we can actually understand the programming languages of DNA and RNA, which are basically natural computers that are able to replicate themselves, we can, potentially, write code to do things…. It would be like software. So, if nature hasn't already developed something that can build a brick, we can instead program artificial life to build a brick. Now, that may be decades away, but, maybe not. I mean, there are a lot of people working on this.

The next order of business, if we truly are going to "settle" another world, is that we have to create some sort of environment that's more hospitable than Mars' current surface conditions. Mars has less that one percent of the Earth's atmospheric pressure (that's like being above 100,000 feet), and the temperatures and other extremes are pretty substantial. People obviously can't live there.

h+: Enter "cyanobacteria"?

PW: Yes. Cyanobacteria is one of the earliest and most common life forms on Earth. Maybe *the* earliest, having existed for over 3 billion years. It's what converted the Earth's early atmosphere, which was a reducing carbon dioxide atmosphere, to its current oxygen atmosphere. Cyanobacteria are able to convert sunlight, in the presence of water and a few other materials and carbon, into life, and it also produces other carbon materials that can actually be used for fuel. In fact, they've already programmed cyanobacteria to produce ethanol from photosynthetic life.

The life that exists today on Earth, including us, is supported by these processes. So, one of the objectives is to determine if we can use what we find there, or modify it, or create synthetic forms of life that will enable us to operate on Mars, and convert its environment, at least on a small scale.

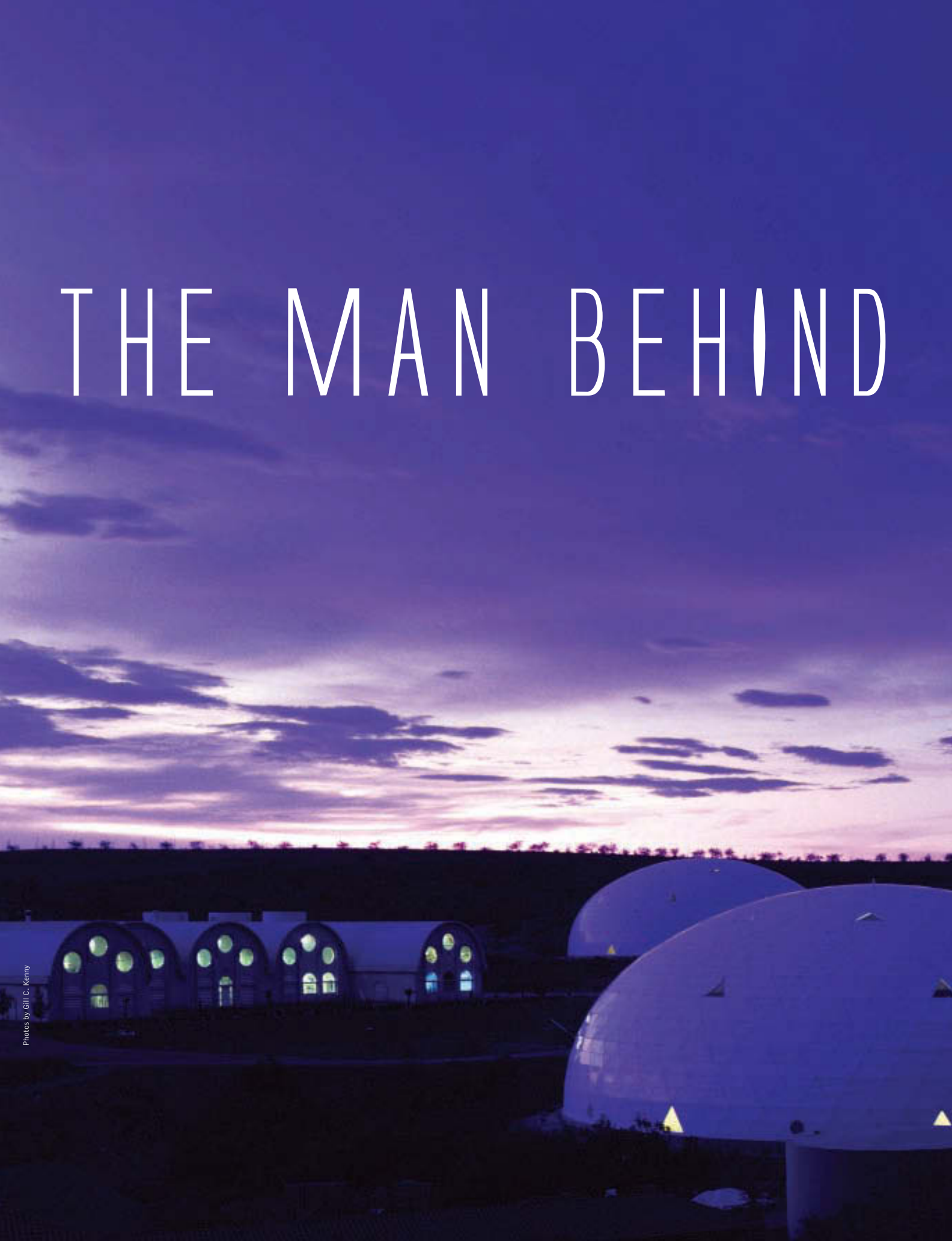
> Mars may already be supporting life."

In the near-term, on the Moon, which we're going to go to before we go to Mars, we can begin to understand more natural alternatives to using chemical reactors to clear the air, such as running air through canisters of cyanobacteria that consume the carbon dioxide and release oxygen. So, it's a scrubber. In the longer term, we'll want to see if we can modify it to operate in different temperature ranges and radiation conditions.

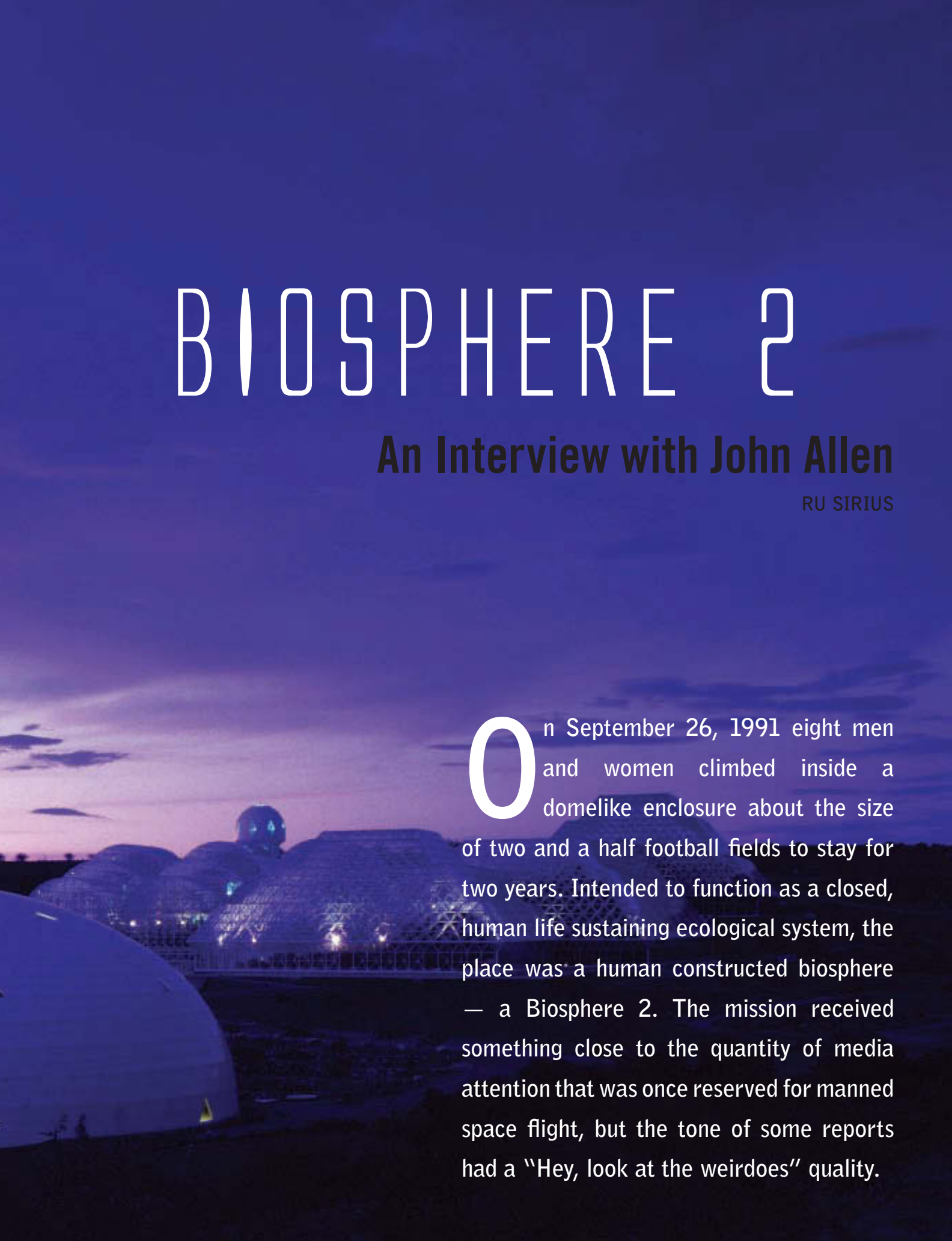
If we really want to settle Mars, and we don't want to have to carry millions of tons of equipment with us to duplicate the way we live on Earth, these technologies will be key. Ideally, at some point, hundreds of years in the future or maybe sooner, people can go to Mars, and take some seeds with them to plant in the Martian soil that will produce a house and an environment they can live in. It's obviously going to be more complicated than that, but that's the vision. ®

Lisa Rein is the Digital Librarian for the Timothy Leary Archives, a co-founder of Creative Commons, and a consultant for Ray Kurzweil's Kurzweilai.net.

THE MAN BEHIND



Photos by Gill C. Kenny



BIOSPHERE 2

An Interview with John Allen

RU SIRIUS

On September 26, 1991 eight men and women climbed inside a domelike enclosure about the size of two and a half football fields to stay for two years. Intended to function as a closed, human life sustaining ecological system, the place was a human constructed biosphere — a Biosphere 2. The mission received something close to the quantity of media attention that was once reserved for manned space flight, but the tone of some reports had a "Hey, look at the weirdoes" quality.

While there were some problems (with oxygen, for instance), the bionauts (who included longevity expert Roy Walford — a pioneer in caloric restriction) managed to achieve their goal of living in this closed system for two years.

After making improvements to the system, the Biospherians started a second mission in March, 1994. They intended to run ten months. But the mission ended early with management disputes and even accusations of vandalism by some crew members.

It was all the vision of John Allen; a visionary, engineer, adventurer, avant-garde theater producer, systems ecologist and all-around unique individual. Now Allen has told his story.

Me and the Biospheres: A Memoir by the Inventor of Biosphere 2 is a rambling, dense, charmingly told and almost-linear life narrative. We follow Allen on adventures in Vietnam (independently... in the middle of the war), in Katmandu, through the countercultural worlds of alternative theater in London, Paris, New York and Fort Worth, Texas, and finally into the Arizona desert for the biosphere project. Along the way, we meet a cast of characters that include the likes of Bucky Fuller, Ornette Coleman, William S. Burroughs, and Buzz Aldrin, along with hundreds of lesser-known scientists, engineers, environmentalists, theorists and performance artists, all ready to join Allen in attempting to prove that there is more to life than its fragmentary component parts. And sprinkled throughout the book are Allen's thoughts and observations, related primarily to his advocacy of "biospherics."

But let's let him tell it. I conversed with Allen about Biosphere 2 and biospherics via email.

h+: You carried the Biosphere 2 vision for a long time. How does a naturalist and adventurer find himself sending a crew into an enclosed space for several years?

JOHN ALLEN: Actually, all naturalist adventurers work within a system of tight parameters. In my case, I do this on our research ship the Heraclitus on the Amazon or deep ocean, or on our Australia savannah restoration project in the remote outback, or wherever — adaptability to demanding and limited spaces is a necessity. In the case of the ship, the "closure" of Planet Water [Earth] systems comes from gravity, not from a glass or steel structure. While the crew of Mission One at Biosphere 2 spent two years inside Biosphere 2 without stepping outside, on a Moon or Mars Base, one would go in and out of the enclosure on geological or other expeditions.

h+: A lot of space scientists and NASA types contributed to the Biosphere 2 mission. What was their interest?

JA: The interest of those scientists connected with NASA and space exploration was in understanding the vectors necessary for humans to live long periods in enclosed spaceships or on a Moon or Mars base. The Russian, Japanese, Chinese and European space scientists were — and are — highly interested, in many cases more than the American agencies (unfortunately, I think). Russia, China, and Japan are all planning Moon missions and we work with all of them on the requirements of such self-sustaining structures. There's a lot of interest and ongoing exchanges with American space people, but not at the top levels, because of their emphasis upon the use of machines in space, and on sending up stored supplies for the humans in orbit rather than developing a self-cycling system. I think it will take another President with the vision capacity of Kennedy to change this situation.

h+: What did the space scientists learn from Biosphere 2? Did you get much feedback?

JA: NASA financed two meetings here at our base on Synergia Ranch (in Santa Fe, New Mexico) and a number of NASA geological, Moon, and Mars scientists have participated over the years at our Institute of Ecotechnics conferences. Specific feedbacks relate particularly to best crops to grow, waste recycling, stability of atmosphere composition, oxygen levels, use of soils and how to make the best soils.

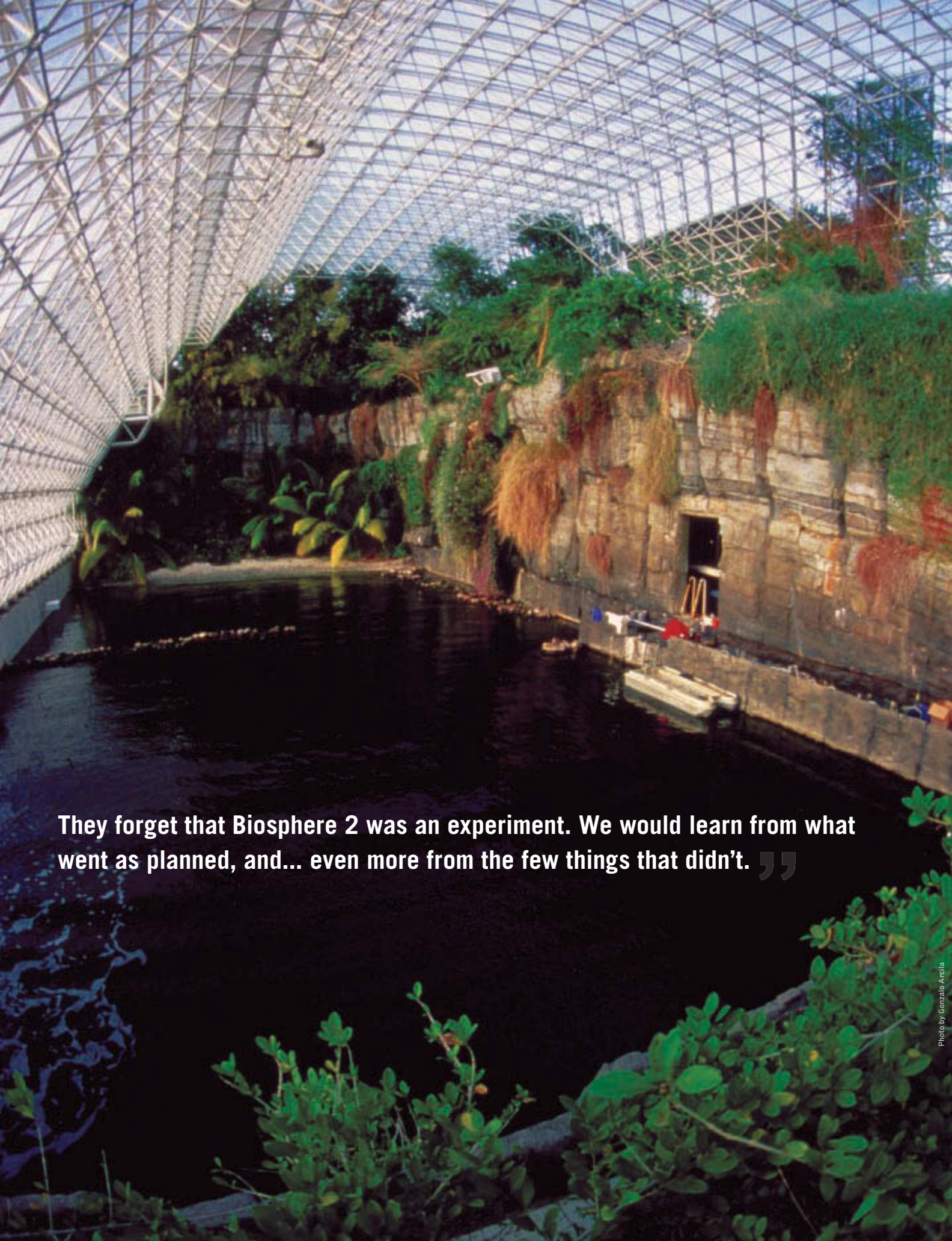
h+: Say a bit about how you view biospherics, and how it helps us live better.

JA: Biospherics, the science and understanding of our total life-system, (and any total life-system discovered or invented), helps us live better because: 1) it helps us think better about our actual conditions; 2) it educates our feelings to perceive complex, beautiful, dynamic forms; 3) it helps our health because we get out more to see these wonders; and 4) it stimulates inner growth by encouraging us to understand ourselves as part of a marvelous evolution at home in the universe.

h+: There are arguments around that biospherics isn't really a science. What would you say makes it a science?

JA: I first learned about this at Colorado School of Mines in Historical Geology in 1953. Vladimir Vernadsky established it as a science in the 1920's after pushing biogeochemistry as far as it could go (he was one of the founders of that science). The Earth's biosphere is the system that is composed of the atmosphere, hydrosphere, soils and mucks, and all the life forms on the planet. Biospherics is the name of the science that studies Earth's biosphere and any other biosphere, including artificial ones like Biosphere.

Mining engineers study it because different ore-bodies are life-



They forget that Biosphere 2 was an experiment. We would learn from what went as planned, and... even more from the few things that didn't. ”

Photo by Gonzalo Arcila

formed and they can be located at different epochs of the evolution of the biosphere and therefore found in the rocks associated with those periods. For example, the Carboniferous formations contain coal. At least one biosphere exists; anything that exists can be studied scientifically; the name of this science is biospherics.

There is no valid argument that biospherics is not a science any more than there is one that evolution is not a science. Unless, of course, one adopts a political or religious ideology in order to gain position and power. At the present moment evangelists oppose, by and large, evolution to gain contributions from their audiences of bible literalists. Many powerfully placed reductionist scientists oppose biospherics because they want to be supported by government agencies and corporations that pay them to specialize and even to oppose total system sciences that would expose the problems associated with denying biospheric implications of a given chemical or manufactured product. This is big-time money. Two examples out of hundreds: scientist sell-outs pushing peasants off the land (Africa, etc.) or cutting down forests for big-money soybean agriculture (Brazil, etc.).

h+: You refer to Biosphere 2 as a success, but the media reports at the time made it sound like a failure. What succeeded about the mission and what failed... or at least showed off some big problems?

JA: Mission One aimed for eight people to live and stay in top health for two years in a closed life system modeled on a no-ice biosphere (which has occurred in the past). It aimed for the life system to include seven of the basic biomes of Biosphere 1, all of which would survive with an increase of biomass, produce a high-yield chemical-free agriculture, stabilize species numbers and maintain landscape diversity in the biomes (the rainforest had a higher species loss), recycle 100% of waste (human and animal), stabilize the carbon dioxide-oxygen cycle at levels below those of concern for human health and recycle all air with a maximum loss of 10% a year (a tightly-sealed space vehicle loses thirty times more). And we promised to ensure full scientific monitoring by using a thousand different sensors plus detailed field surveys and publish all the results in peer-reviewed papers in reputable scientific journals and books.

Biosphere 2 succeeded in achieving all these objectives. One unforeseen problem occurred: a decline in oxygen which was due to carbon dioxide being sequestered in the concrete, contrary to engineering predictions. Some scientists, especially those involved in mountaineering, submarines, and space, thought this the most valuable part of the experiment, since we were able to monitor the physiological response of humans to a very gradual fall in oxygen occurring without a change in air pressure. One point we established was that oxygen can fall in a closed life system to sixteen percent with no noticeable effects on efficiency or well-being.

We aimed at total self-sufficiency in food production, and wound up with around 80% — we did set records for closed systems and high-yield, non-polluting agriculture. The second crew achieved 100% food

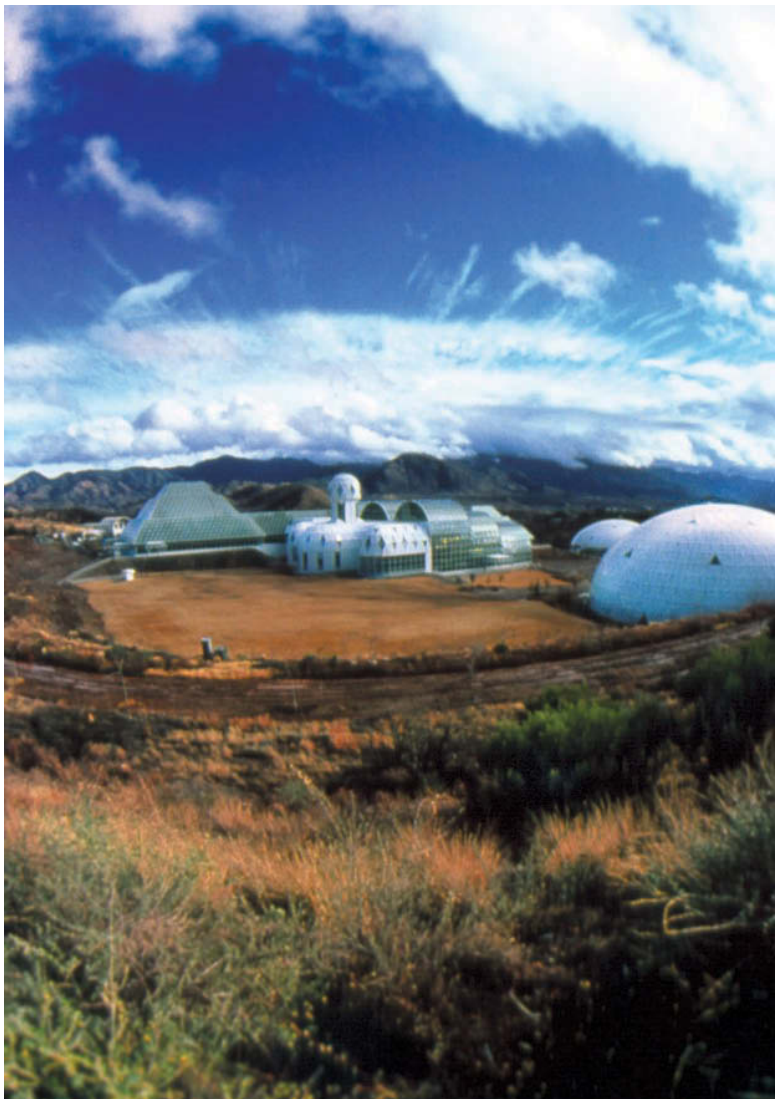


Photo by C. Allan Morgan

RESOURCES

Biosphere 2
http://www.b2science.org

Synergetic Press
http://www.synergeticpress.com

sufficiency with the system improvements made during the transition period between missions. And, of course, there were plenty of surprises — like the desert beginning to transform into a chaparral ecology because moisture levels favored that part of the original species selected. And the rainforest grew so rapidly that our first generation pioneer species were cut down during the transition – they had grown from small trees to over 30 feet in height. But such developments added to our knowledge of ecological self-organization processes.

Biosphere 2's biggest failure: not convincing the reductionist scientists and expansionist politicians who control America to include total systems sciences and engineering. This financial juggernaut and its ideological demagogues fatally cripple efforts to deal with the huge industrial and population expansion effects on our biosphere by restricting evaluation of its effects by species or by water valley or by shoreline or by city and country rather than by all effects on the total biosphere-geosphere-technosphere-ethnosphere system.

So despite these remarkable achievements and the body of knowledge that came out of Biosphere, there were elements of the press that said because Biosphere 2 wasn't perfectly self-sufficient in the first two-year experiment, and there were unexpected developments, that it was a failure.

Of course, they forget that Biosphere 2 was an experiment – we did it to learn about biospherics, confident that by doing something so radically new, we would learn from what went as planned, and perhaps learn even more from the few things that didn't. Biosphere 2 was also controversial because — though it combined both holistic (total systems) science and analytic (reductionist) science — it stirred up some opposition from some reductionist scientists, some of whom were jealous of the popularity Biosphere 2 achieved around the world, and others who simply don't work with complex systems and couldn't understand the levels of science possible in a facility like Biosphere 2.

h+: What are you doing now?

JA: My main line of new work is now in what I call cyberspherics — the development of a total systems feedback set of operations ranging from Chaos through Cosmos, Galaxy, Sun, Geosphere, Biosphere, Technosphere, Ethnosphere, and Noosphere. It's an extraordinary intellectual adventure; the age of Objective (Real) Science and Engineering is just beginning to dawn. The settlement of Mars, even just one settlement, would carry what we learned at Biosphere 2 and on the Moon landing into a true total systems art, science, and engineering that could be applied with grace and certainty to deal with our present crisis on Planet Water (a more accurate term for what is usually called Earth).

Meanwhile our team still works in closed life systems, doing research on relation of soils to agriculture in our small closed life system, "The Laboratory Biosphere" in New Mexico. Some of the technologies from Biosphere 2, such as wastewater gardens (constructed wetlands) are being used at ecotechnic projects around the world and implemented in a number of countries worldwide.

"The Laboratory Biosphere"
http://www.globalecotechnics.com

Synergia Ranch
http://www.synergiaranch.com

Wastewater Gardens
http://www.wastewatergardens.com

Real Discrimination AGAINST Digital People

STEPHEN EUIN COBB

"I must have lost almost half of my potential contracts because the companies wouldn't deal with an anonymous avatar."

So says Scope Cleaver, a designer and architect inside Second Life. Praised by *New York Times Magazine* for his design of Princeton University's Diversity Building (the article headline: "Architectural Wonders of the Virtual World," 12/7/2008), his creations have extended his reputation beyond Second Life and across several continents, but even that can't protect him from what appears to be discrimination. "I offered the companies a real world proxy who could sign all the papers, but it didn't seem to help."

Some people see the freedom of anonymity that virtual worlds give them as a nice perk. Others enter virtual worlds to promote their real world selves, or projects, and avoid anonymity for their avatars as much as possible. But for thousands, keeping their avatar's identity separate from their real world identity is a serious philosophic matter. They believe they should strive to be the people they are in their hearts and minds, rather than the person suggested by features of their physical body that are observable on the outside. After all, these external features were forced on them. Ethnicity is the cliché example, but other accidents of birth that either can't be changed — or can't be easily changed — include age, gender, stature, attractiveness, nationality, social class, the accent of their birth language, even regional dialect. None of these were chosen, and they are impossible or difficult to change in the physical world. Calling themselves Digital People, they design avatars that better fit their self-image, and then use them to build reputations, personalities and social circles that also better fit them.

Those who oppose this philosophy feel that Digital People present a false self to the world — a grand and elaborate lie. Bad feeling has accumulated as the result of social pressure and insults experienced by Digital People. Even non-Digital People who mean well have shown remarkable intolerance.

"I won't disclose names," Scope said. "What I'm talking about is pretty sensitive. I'm awaiting feedback for a few jobs right now. Some of these are recognizable corporate names, and it's international: France, Germany, etc.

"Last year I had a German client; about $10,000 USD contract. Lost it because they didn't trust an anonymous avatar.

"Many potential clients are *expecting* to talk to me on the phone and sign Real Life documents. I tell them that I have two options. One is total anonymity, which sometimes works because I have a pretty solid reputation in Second Life and a recognizable name. The other is I offer a Real Life proxy to sign all papers. Exactly the same as when people do business in Real Life. It's binding. If something goes wrong, they can sue him.

"I can't seem to find a way around it. It's very difficult to tell your client you want to remain anonymous and then say, 'trust me.' They immediately suspect something is wrong. Reputation and photos of past projects is enough for some — it was for the Estonian Embassy, Princeton University and others — but I could have worked for the biggest names in SL if it wasn't for that obstacle."

Photo by Gina Miller

How Deep the Rabbit Hole Goes.

Digital People who rely less on non-digital people tend to experience something more akin to confusion than discrimination. Extropia DaSilva (a Digital Person who is also a transhumanism activist, essayist and text-based public speaker) explained, "It is not uncommon for people to ask out loud if I have Multiple Personality Disorder after I explain what a digital person is."

Ivanova Shostakovich (a Digital Person who is also a virtual furniture designer and the co-owner, with Peter Stindberg, of a Second Life store called Greene Concept Furniture) emphasizes that discrimination is not limited to the divide between the devoutly anonymous Digital People and those avatars for whom anonymity is unimportant: "Most examples of prejudice I have heard of in Second Life are between different cultural subsets."

Hers is a valid point. Furries (avatars that resemble natural or cartoon-like animals) still risk frequent harassment in public places; and avatars that resemble children are banned in many SL locations because of fear that some may be the creation of child molesters looking for avatar-on-avatar sex. Small-breasted short women who want their avatar to look like their real body have been subjected to insults and discrimination based on this fear, as have people who wish to relive aspects of their childhood by being an avatar child.

Discrimination today is pretty much universally frowned on. But Digital People's rights are still subject to much debate, even in the most techno-progressive circles. For example, when, in December, 2008, the Order of Cosmic Engineers (a transhumanist organization of physical people that holds meetings in Second Life because its membership is global) accepted into its ruling body not one but three Digital People, there was a passionate debate as to whether the new members could vote. Since Second Life allows anyone to create any number of avatars, without limit, for free, community members voiced concern that someone who exists only as an anonymous avatar could vote twice by creating two avatars. Despite the Order of Cosmic Engineers' respect and admiration for the individuals in question, they decided to make the three Digital People non-voting members.

Scope Cleaver doesn't seem to think things will change soon. "I don't see it improving. There was a chat about this recently in the Metanomics Group *(ed: a group in Second Life that discusses business, education, economics, science and policy in the* metaverse: *meaning all virtual worlds, gaming or not, online and off).* [Anonymous avatars] seem to be a hot topic in SL related blogs lately. There sure seems to be a movement toward untangling and shaping how people think about the issue." When asked if the mood was mostly pro or anti, he said, "Anti, especially when it comes to business."

World of Warcraft has seen discrimination too. On June 19, 2007, *Wired* online reported that some guilds will not let players join unless they use voice chat, because text-only chat "seems shifty."

Don't Dis My Creds, Bro.

Sophrosyne Stenvaag is the host of *Sophrosyne's Saturday Salon,* a series of discussion events in Second Life. Her guests have included, in avatar form, many noteworthy thinkers such as bestselling authors Robert J. Sawyer, David Brin, Charles Stross, Catherine Asaro and Kim Stanley Robinson. Sophrosyne experienced some in-your-face discrimination from within the hallowed halls of academia.

"Last summer I attended a fascinating conference in a digital world," Sophrosyne told me. "There was a lot of interest in keeping the group together afterwards to build a digital community. Two of the three sessions were run by academics with little experience in digital world events. The moderators seemed to think that their high-level credentials entitled them to deference from the pseudonymous masses around them.

"Events after the conference took a natural digital-world-style turn: a democratic, collaborative desire to create the basis for an ongoing community. I contributed a little organizing — networking people to projects, and providing a few ideas for events. One of the conference organizers emailed me, politely asking for my credentials. That's where things got interesting.

"Basically, I told him: Here's my bio. Here are links to my portfolio, my project website, my dozen or so digital presences — business blog, personal blog, business and personal Twitters, business and personal Flickr sites. Here's a list of references in business, academia, and government that I've done project work for. I was applying a tribal standard: look, here are the elders who can vouch for me, the assets I've acquired, the measures of my standing in my tribe."

But his take was: "I don't understand or value any of this. What I need to know is your atomic name, and the names of the entities that verified your intelligence and employability — schools and corporate employers. That's what will let me determine if you are generally real and trustworthy. He was applying an atomic standard: don't tell me personal crap, give me your brains and dedication credit ratings from agencies I respect. And it rapidly went bad from there."

"For me," Sophrosyne said, "reality and legitimacy were digital. I was involved in a project that would affect my digital reputation. For him, reality and legitimacy were atomic, and the project would affect his atomic reputation."

This is the crux of the divide. Some people believe that the same tools used to measure reputation in the physical world can — or must — be used in a virtual world. And for Digital People this is an impasse. They won't submit to that standard.

For me, reality and legitimacy were digital. I was involved in a project that would affect my digital reputation. For him, reality and legitimacy were atomic.

Second Life, and perhaps other virtual worlds, have evolved reputation systems sophisticated enough to verify an anonymous avatar's credibility. But as Sophrosyne points out, these systems aren't familiar to most people alive today. Our tribal ancestors would not have been so ignorant. They successfully used these community reputation systems — these tribal codes —through hundreds of millennia.

It's a Big Mistake to Overlook Mid-Range DANGERS

MIKE TREDER

Ever hear the saying that most people anticipate too much change in the short term and too little in the long term? On the one hand, you'll hear complaints about "No flying cars yet!" from those who've bought into silly hype. And on the other hand, history is littered with definitive quotes from so-called experts who promised that one advance or another was "impossible" or would never happen.

"The abdomen, the chest, and the brain will forever be shut from the intrusion of the wise and humane surgeon." – Sir John Eric Ericksen, British surgeon, appointed Surgeon-Extraordinary to Queen Victoria, 1873

"There is not the slightest indication that nuclear energy will ever be obtainable. It would mean that the atom would have to be shattered at will." – Albert Einstein, 1932

"Landing and moving around on the moon offer so many serious problems for human beings that it may take science another 200 years to lick them." – Science Digest, *August 1948*

But if too many people are looking for short term exaggerated change, while at the same time, they aren't fully comprehending the extreme changes that can occur over the long term, there could yet be another reason for worry. The middle range may be badly underrated and might catch us by surprise — especially when it comes to the impacts of advanced nanotechnology.

Let's define the short term as the next five years. It's almost certain we won't have flying cars by then, or a colony on Mars, or a pill we can take to cure all diseases. Of course, we might be well on the way to having online access everywhere all the time, and that could be quite useful, but it's unlikely that people will see anything within the next five years that will knock their socks off.

What about the long term — say from 50 to 100 years? How much technological, social, and political change should we expect to see in that time frame? Given the vast differences in the world today — in all three of those realms — as compared to the lives of people from early in the last century, it seems beyond argument that enormous changes are in store.

By the end of this century, if not before, many millions or even billions of people will spend much of their lives in nearly indistinguishable virtual realities. Fully developed biotechnology and genetic engineering will allow the creation of tailored plants, animals, chimeras, and whole biomes. Advanced nanotechnology, well beyond early generations of molecular manufacturing, will completely revolutionize our infrastructures for living, working, traveling, and creating energy on Earth and in space.

All of that is predicated, however, on our ability to get safely past the formidable barrier of the mid-range — the period around five to twenty years from today. What happens during the mid-range is very likely to determine whether the remainder of this century will be one of unparalleled abundance, devastating war

and destruction, of warming-induced ecological collapse and mass deaths, or perhaps some miserable but survivable combination thereof.

We can illustrate the challenge with this simple chart, (see below) where we see an early period, the near-term, with levels of existential danger somewhat evenly matched by our abilities to adequately manage and avert the worst of those dangers. So far, so good.

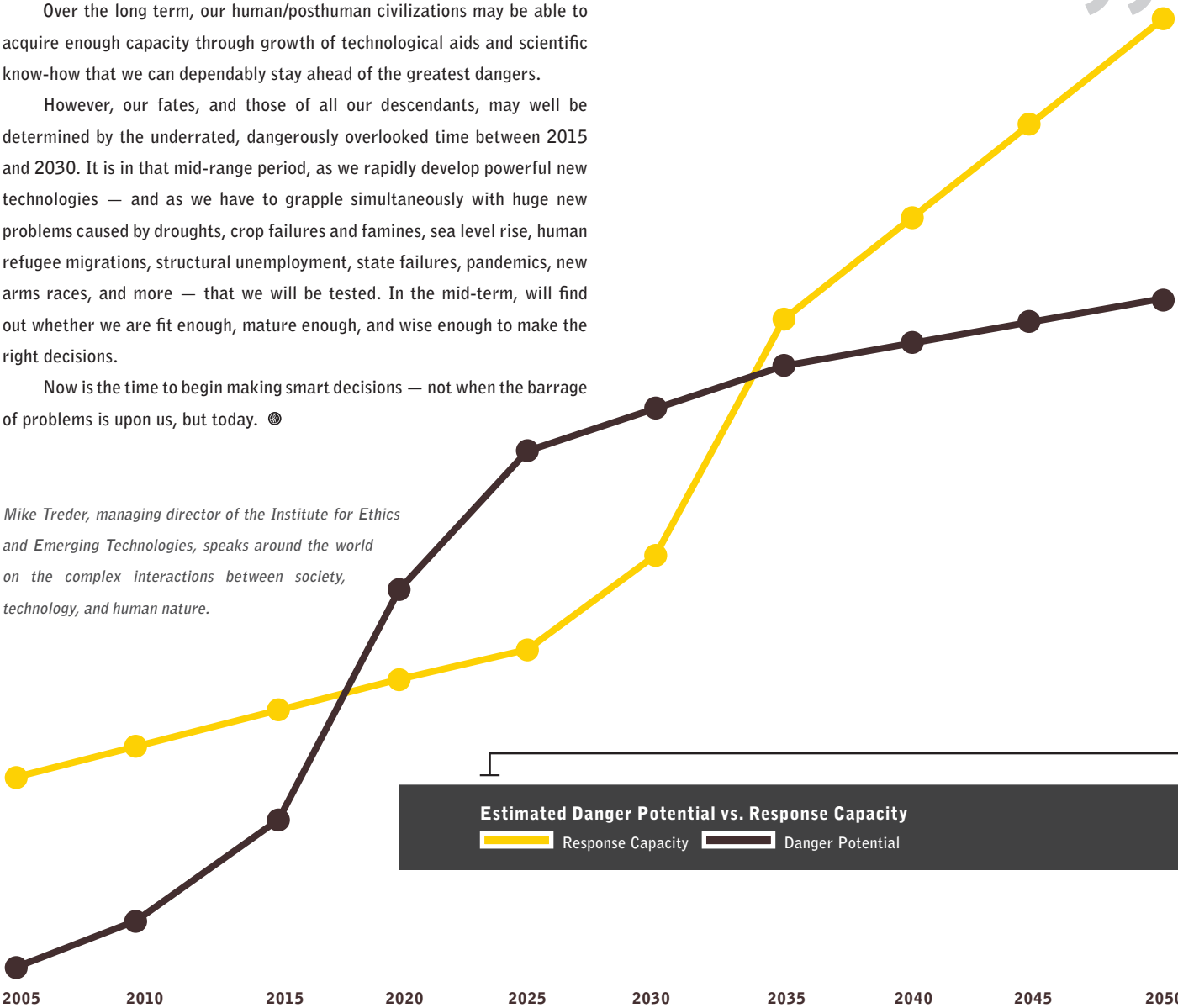
Over the long term, our human/posthuman civilizations may be able to acquire enough capacity through growth of technological aids and scientific know-how that we can dependably stay ahead of the greatest dangers.

However, our fates, and those of all our descendants, may well be determined by the underrated, dangerously overlooked time between 2015 and 2030. It is in that mid-range period, as we rapidly develop powerful new technologies — and as we have to grapple simultaneously with huge new problems caused by droughts, crop failures and famines, sea level rise, human refugee migrations, structural unemployment, state failures, pandemics, new arms races, and more — that we will be tested. In the mid-term, will find out whether we are fit enough, mature enough, and wise enough to make the right decisions.

Now is the time to begin making smart decisions — not when the barrage of problems is upon us, but today.

Fully developed biotechnology and genetic engineering will allow the creation of tailored plants, animals, chimeras, and whole biomes.”

Mike Treder, managing director of the Institute for Ethics and Emerging Technologies, speaks around the world on the complex interactions between society, technology, and human nature.



Estimated Danger Potential vs. Response Capacity

Response Capacity Danger Potential

Running with the Dopes:

Cheating to be a Better Human

JAMES KENT

Modern humans are put in many moral conundrums, but the most pernicious may be the conflict between performance and ethics. In the modern world we are expected to be productive for at least eight hours a day, and that means being awake, functional, in a good mood, and ready to perform without complaints. We have drugs and supplements to make us more productive and efficient, and the industries that supply those drugs are among the largest in the world. But while these industries thrive, we are told that using drugs is unethical and amounts to cheating. What is the modern performance-minded human to do?

No matter what you want to achieve in a lifetime, there is a drug to help you do it better and faster. Without coffee, the modern eight-hour workday would be impossible. When we get stressed and depressed from overwork and lack of sleep we turn to alcohol or anti-depressants to wind down. When we feel pain we knock it back with anti-inflammatory pills and keep going. We dope ourselves to be more productive. We are told it's okay. We do it without even thinking.

There's a pernicious aspect to all this — the lines between enhanced performance and cheating have become blurred. The adverse effects of chemical optimization are either grossly exaggerated by politicians or quietly understated by industry flacks, both using clever PR manipulation in order to pull bigger numbers. We are allowed to use coffee and alcohol and prescription meds to cheat our way through the modern day, but when we use steroids or marijuana this is suddenly a scandal. The doping rules are rigged and enforcement is arbitrary. The take-away message is, "Be more productive, but don't get caught doing it with the most efficient drugs: that's cheating." Welcome to the 21st century rat race: move along as fast as you can or get run over, and we may inspect your urine anywhere along the way.

All doping is rooted in two things — performance and expectation. As modern humans, we're expected to perform flawlessly. If we have performance flaws, we're told they can be fixed — we can be normalized with treatments and medications. The 20th century model said that patent pharmaceuticals and psychotherapy held all the answers to the human condition. But

now being normal isn't enough. We 21st century humans are expected to be super-functioning, highly productive, multi-tasking, and performance optimized. This expectation is placed upon us by modern media, culture, and economic pressures, but we are naturally inclined to sleep most of the day, have a big meal, fuck, and then go to bed. If modern life were easy, we wouldn't need to cheat, but it isn't easy. We stress to find security, get depressed about insecurity, feel anxiety, worry about the future, watch our bank accounts, keep up with the news cycle, stay involved, and hope we don't get hit by a stray asteroid. Provigil, a drug that keeps you from getting tired, is quickly becoming the new dope for people too busy to waste life on sleep cycles. Think of this as a symptom of our age: we've embraced the anti-narcotic as an illicit post-recreational drug. Stay awake and sober as long as you can!

And why not? The undisputed truth is that doping improves performance. That's why they're called performance-enhancing drugs. In a society obsessed with performance, it's only natural we should exploit them, but it would be wrong to call this behavior anything but pathological. Performance, achievement, and winning are a form of dope, the main symptom of the performance pathology being that winners are never satisfied even when they're winning. If civilization is built upon the pathology of achievement, we must embrace the dope race for what it is, otherwise we are criticizing the worth of progress itself, and that totally jumps the paradigm. It's easier to backtrack and say, "Win at any cost, but don't get caught cheating..." than to step back and ask, "What is the inherent worth of winning, anyway?"

Vexed by civilization I once trekked to a high mountain where a hermit lived and asked him, "What value is progress?" The old hermit lit a pipe and thought on it, then nodded and gave me an answer. "It keeps people busy," he said. "But to what end?" I asked. He thought on this some more, and then an answer came to him. "It makes them feel like they matter," he said.

Since the doping issue can be tricky I have come up with what I call the rules of doping. These are rules that can be applied to almost any situation. Doping is always okay in life and death situations. This is an unspoken truth. If you had to fight a bear, swim twenty miles from a shipwreck, or fly eighteen hours to drop a cluster bomb on your enemy in a distant land, everyone would agree that a little bump of speed is fine, no worries there. Using cocaine for job-related performance is okay as long as your company is making money, but when your stock price goes down you must switch to alcohol, coffee, and prescription opiates like everyone else. Doping is always okay if you are in a creative field like music, performance, writing, art, or any part of the entertainment industry. In fact, doping is encouraged in this industry, and they have award shows to celebrate notorious dopers for their edgy genius. It's okay.

Doping is sometimes okay to help with academic performance, and is perfectly fine for anyone with a career in academia as long as they keep their clothes on and don't stumble or slur in public. Doping is tacitly allowed for anyone in thankless performance-critical jobs who don't get enough sleep, like truckers, cooks, waiters, janitors, taxi drivers, and air-traffic controllers. Doping is never allowed in sports or competition where other people's money is on the line, unless the people with the money tell you it's okay and then deny it when you fail your blood test... in which case it's okay until it isn't okay anymore, and that's all on you for being a chump. Most of all, doping is usually accepted when your ass is on the line, and when other people's asses are on the line. If you have a good excuse, people find it is easy to forgive. But if you're doing it just because you like to win? That's cheating.

When your stock price goes down you must switch to alcohol, coffee, and prescription opiates like everyone else.”

James Kent is the former publisher of Trip *magazine and editor of http://www.DoseNation.com. Additional reporting by David Perlman.*

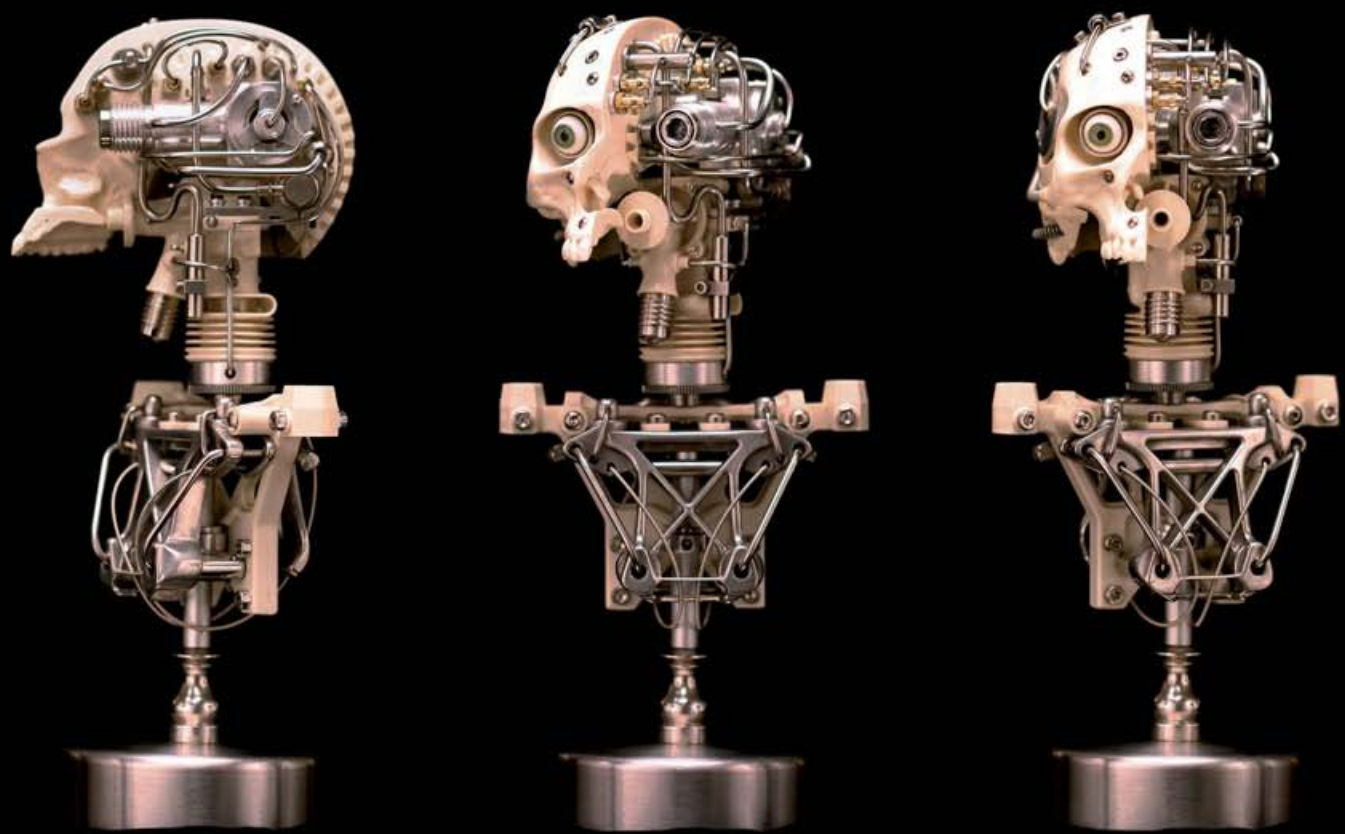
Not all of Chris Conte's work

will cost you an arm or a leg

Christopher Conte is a licensed prostheticist, and an amateur roboticist. A year and a half ago, he was inked by renowned tattoo artist, Anil Gupta. Taken by Conte's work, Gupta made a phone call to a friend, art agent Les Barany (perhaps most known for representing H.R. Giger). Within a year, Conte was exhibiting at The Last Rites gallery in New York, and had a budding international cult following. Unlike many contemporary artists who scramble to get their work into galleries at an early stage in their development, Conte worked in obscurity, developing his style and refining his craft for 16 years, before Gupta's phone call altered the trajectory of his life. These days he works as a full-time practicing artist and lectures internationally. I was fortunate to interview him over dinner at Yaffa Café in New York's East Village where he shared some of his current work and the thinking behind his creations.

When discussing his art, Christopher speaks with a contagious enthusiasm. He brought some of his sculptures to the interview, first producing a piece from his Cynthetic Series of microbotic busts.

by Chris Grayson



Decodroid

Most of these are found parts. This is a dental clamp, this is from a Singer sewing machine, these gears are from a clock, and then the legs are all cast from a lost wax process from sculpted components that I made.”

Chronos
Version 2

I was lucky enough to get in contact with a couple of guys who own an aerospace model shop, working as subcontractors to Northrop Grumman. They build miniature models of aircraft for wind tunnel tests and so on. These guys saw my work and took me under their wing. They're master mold makers and they helped me construct the silicone molds needed to cast this skull.”

View more of Christopher Conte's work at http://www.microbotic.org

Let A Hundred Futures Bloom:

A "Both/And" Survey of Transhumanist Speculation

MICHAEL GARFIELD

Mention the word "transhumanism" to most of my friends, and they will assume you mean uploading people into a computer. Transcendence typically connotes an escape from the trappings of this world — from the frailty of our bodies, the evolutionary wiring of our primate psychologies, and our necessary adherence to physical law.

However, the more I learn about the creative flux of our universe, the more the evolutionary process appears to be not about withdrawal, but engagement – not escape, but embrace – not arriving at a final solution, but opening the scope of our questions. Any valid map of history is fractal — evermore complex, always shifting to expose unexplored terrain.

Photos by Scott Liddell

This is why I find it is laughable when we try to arrive at a common vision of the future. For the most part, we still operate on "either/or" software, but we live in a "both/and" universe that seems willing to try anything at least once. "Transhuman" and "posthuman" are less specific classifications than catch-alls for whatever we deem beyond what we are now... and that is *a lot*.

So when I am in the mood for some armchair futurism, I like to remember the old Chinese adage: "Let a hundred flowers bloom." Why do we think it will be one way or the other? The future arrives by many roads. Courtesy of some of science fiction's finest speculative minds, here are a few of my favorites:

By Elective Surgery & Genetic Engineering

In Greg Egan's novel *Distress*, a journalist surveying the gray areas of bioethics interviews an elective autistic — a man who opted to have regions of his brain removed in order to tune out of the emotional spectrum and into the deep synesthetic-associative brilliance of savants. Certainly, most people consider choice a core trait of humanity... but when a person chooses to remove that which many consider indispensable human hardware, is he now more "pre-" than "post-?" Even today, we augment ourselves with artificial limbs and organs (while hastily amputating entire regions of a complex and poorly-understood bio-electric system); and extend our senses and memories with distributed electronic networks (thus increasing our dependence on external infrastructure for what many scientists argue are universal, if mysterious, capacities of "wild-type" *Homo sapiens*). It all begs the question: are our modifications rendering us *more* or less than human? Or will this distinction lose its meaning, in a world that challenges our ability to define what "human" even means?

Just a few pages later in *Distress*, the billionaire owner of a global biotech firm replaces all of his nucleotides with synthetic base pairs as a defense against all known pathogens. Looks human, smells human...but he has spliced himself out of the Kingdom Animalia entirely, forming an unprecedented genetic lineage.

In both cases, we seem bound to shuffle sideways — six of one, half a dozen of the other.

By Involutionary Implosion

In the 1980s, Greg Bear explored an early version of "computronium" — matter optimized for information-processing – in *Blood Music*, the story of a biologist who hacks individual human lymphocytes to compute as fast as an entire brain. When he becomes contaminated by the experiment, his own body transforms into a city of sentient beings, each as smart as himself. Eventually, they download his whole self into one of their own — paradoxically running a copy of the entire organism on one of its constituent parts. From there things only get stranger, as the lymphocytes turn to investigate levels of reality too small for macro-humans to observe.

Scenarios such as this are natural extrapolations of Moore's Law, that now-famous bit about computers regularly halving in size and price. And Moore's Law is just one example of a larger evolutionary trend: for example, functions once distributed between every member of primitive tribes (the regulatory processes of the social ego, or the formation of a moral code) are now typically internalized and processed by every adult in the modern city. Just as we now recognize the Greek Gods as embodied archetypes correlated with neural subroutines, the redistributive gathering of intelligence from environment to "individual" seems likely to transform the body into a much smarter three cubic feet of flesh than the one we are accustomed to.

RESOURCES

Greg Egan
http://gregegan.net

Greg Bear
http://www.gregbear.com

Charlie Stross
http://www.antipope.org/charlie/blog-static/

Arthur C. Clarke
http://www.clarkefoundation.org

Stephen Baxter
http://www.stephen-baxter.com

By Nano-Hacking

Then again, there might be systemic constraints to just how far tech will take us. Charles Stross' *Glasshouse* offers a rare perspective on the possible consequences of nanotechnology: once we all rely on computers to back ourselves up and store ourselves for interstellar transit, those computers become the targets for a new level of informational warfare. In a world where people can be rebuilt at whim, murder is effectively obsolete. No one can be killed, but everyone is at constant risk of being *hacked*. Suddenly you wake up working for the enemy, and loving it. Selective memory erasure programs saturate the network and prevent any further development from crossing communities and achieving universality. History is routinely wiped, so no new wisdom can accrue. Once again, humanity is splintered into countless isolated physical and mental regions, and some of them respond by choosing to eschew high technology entirely, living and dying on the clock of some long-forgotten world.

In other words, what we normally imagine as a linear continuum might instead be a *wave* of progress that ebbs and flows, a cycle of Light and Dark Ages distributed capriciously through space-time.

By Hyperdimensional Intervention

The idea that humankind will be "initiated" into a new and higher mode of being by some other race of transcendental entities has been circulating for thousands of years. Perhaps there is a common trajectory for the development of sentient species, and we receive intermittent, minimally-intrusive guidance by those who came before us. It is an idea that has certainly found its way into common sci-fi discourse — be it through Arthur C. Clarke's *2001* or Stephen Baxter's *Manifold*. Were we to take seriously the growing ranks of exopoliticians, exobiologists, and exolinguists, this in fact is happening. Descartes was given his famous plane — practically the emblem of rational modernity — by an angelic vision. Francis Crick (co-discoverer of the double helix) and Carey Mullis (pioneer of the Polymerase Chain Reaction) both admitted to interfacing with LSD when their Nobel Prize-winning finds came to them. Crop circles form overnight in muddy fields with no footprints, bearing strange radiation signatures and seeming to encrypt dense information about the structure of the quantum vacuum and the movement of celestial bodies. This pattern is almost universal among species-changing creative eruptions (or are they irruptions?) throughout history; even Moses had his burning bush. In every instance, these revelations drew our species closer to what we might call transhuman. We're "getting the message," but who is doing the talking?

By Natural Quantum Evolution

One option in particular seems to get short shrift by a community that tends to believe we will lift ourselves up into a posthuman order by our own bootstraps… but if the future even modestly resembles the past, then we cannot neglect the possibility that nature will do the heavy lifting *for* us. Recent research at UC Berkeley and Washington University has demonstrated that photosynthesis is 95% efficient because it uses quantum computation to *retroactively* decide upon the best possible electron paths. Johnjoe McFadden at the University of Surrey has suggested that this very same process may have been how life emerged in the first place, and other scientists have noted similar, strangely intelligent mutation responses in lab cultures. Egan's novel *Teranesia* runs with this new model of "smart evolution," suggesting that we may see posthumanity spontaneously self-organize out of the quantum superposition of all possible futures — as if good ideas reach backward in time to organize their necessary histories. Given the uncanny prescience of some sci-fi speculation, this might not be too far from the truth.

All Of The Above

As our options increase, humanity — and whatever else might call us their ancestors — will probably continue to take every form available: flesh, metal, and software; post-linguistic and pre-linguistic; evolution by self-mastery and deus ex machina. If it *can* happen, it probably will. This is the world in which we live, and every step we take into the future makes that increasingly, painfully obvious. Transhumanism, as best as I can define it, is the story of "and."

Essayist and evolutionary theorist by day, live painter and guitarist by night, Michael Garfield is intent on demonstrating that everything is equally art, science, and spiritual practice. Links to his music, writing, and imagery can be found at http://www.myspace.com/michaelgarfield.

It all begs the question: are our modifications rendering us *more* or *less* than human?"

EVERYTHING OF THE DEAD:
The Future of Humanity is Zombie

NICK MAMATAS

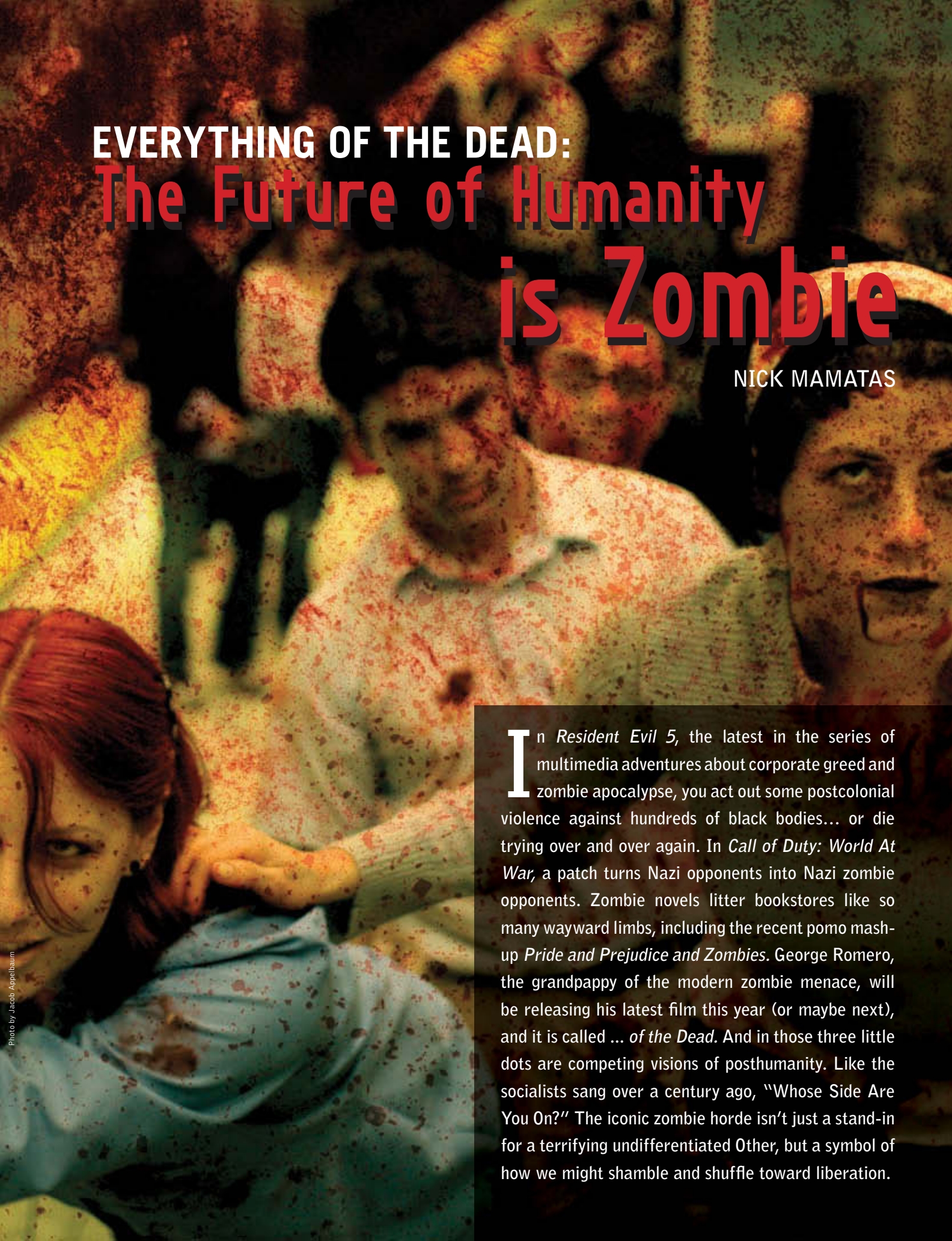


Photo by Jacob Appelbaum

In *Resident Evil 5,* the latest in the series of multimedia adventures about corporate greed and zombie apocalypse, you act out some postcolonial violence against hundreds of black bodies… or die trying over and over again. In *Call of Duty: World At War,* a patch turns Nazi opponents into Nazi zombie opponents. Zombie novels litter bookstores like so many wayward limbs, including the recent pomo mash-up *Pride and Prejudice and Zombies.* George Romero, the grandpappy of the modern zombie menace, will be releasing his latest film this year (or maybe next), and it is called *… of the Dead.* And in those three little dots are competing visions of posthumanity. Like the socialists sang over a century ago, "Whose Side Are You On?" The iconic zombie horde isn't just a stand-in for a terrifying undifferentiated Other, but a symbol of how we might shamble and shuffle toward liberation.

For Romero, a political radical whose *Night of the Living Dead* was made during the upheavals of the late 1960s, the zombies were a new world rising up against the old. The cannibalism of the undead was comment on exploitive social relations made flesh. As bad as the zombies were, the small-town racist cops were that much worse. But as the 1960s went, so too did the zombie. For many readers and viewers of zombie stuff, the zombies are what you practice on while preparing for the real uprisings to come. "You can have my brain (and my canned goods) when you pry them out of my cold dead hands!" is only a part of zombie anxiety — those cold dead hands may rise up and join the other side, after all.

"You can have my brain (and my canned goods) when you pry them out of my cold dead hands!" is only a part of zombie anxiety.

The zombie was once a servant, animated through the spiritual prowess of the vodou bokor. A zombie was someone who had wronged the community (or the bokor) and had been cast out, reduced to shambling, asocial slavery. A zombie was less than human. Romero's vision of the zombie, the vision that has influenced popular culture for the past forty years, is a transhuman vision. And zombies continue to evolve. There are zombie banks now, institutions that are worth nothing but continue to shamble through the economy thanks to government subsidy. *28 Days Later* and the 2004 remake of *Dawn of the Dead* showcased fast zombies, and zombies with a measure of intelligence and internal lives can be found in novels such as *Dying to Live* by Kim Paffenroth and David Wellington's *Monster* series. The zombie superheroes in the *Marvel Zombies* series are also smart, or at least chatty.

And people want zombies. Zombie-themed flash mobs have littered the United States and Europe for the last few years. Zombie message boards discuss not only the film and fiction, but bleed into survivalist strategies and rhetoric. It's no surprise that the Austen pastiches, the deadpan advice books, the video games seek to rewrite both the future and the past to include the zombie apocalypse. Zombies appear to be unalterably Other, just mindless consumers and reproducers of themselves, but they needn't be. Reducing the zombie to a mindless Other despite the evidence — teamwork, learning, tool use, a rather brutal sense of irony — is a human problem. (After all, there's no reason to believe that any living person you might meet on the street really has a rich internal life.) Recognizing the agency of the zombie is a posthuman solution.

In the traditional post-Romero zombie narrative, the characters who escape the zombies often find themselves confronting a corrupt human authority even worse than the undead... and not nearly as competent, despite supposedly still being in possession of their *brraaaaaaiins*. For example, in Max Brooks' *World War Z*, a novel in the form of an oral history recorded in the wake of an outbreak, it's Tibet and Cuba who are the "winners," while the United States has all but collapsed thanks to its own bureaucracy and political corruption (and zombies).

What makes the zombie posthuman is the elimination of human limitations intrinsic in the state. Everything is explicit in a zombie hoard. Scarcity, the thousands of implicit rules and social agreements that keep us from fulfilling all of our needs, failures of health and stamina, the state's monopoly on force, these all go by the wayside. Zombies will wear the monkey suits they were buried in, or the tattered uniforms of their old day jobs, but they don't have to dress to impress or keep up appearances. Romero's 2005 film *The Land of the Dead* features a utopian high-rise kept stocked by raids across the river into nightmarish zombie territory. Then the zombies learn to walk under water and the utopia crumbles into... not a dystopia, but a new and different utopia — one for the zombies.

Back during the last Great Depression, when the Next World War was still being plotted out in the backrooms and mass-minds of Europe and Asia, anthropologist Robert Briffault wrote, "It is not a new economic system or a social order which is being forged and which menaces traditional civilization. It is a new humanity." In a zombie apocalypse, there are only two choices. Go down fighting, and not for humanity but rather *for* canned goods and isolated mountain cabins. Or you can find the awe within the horror, the freedom of a sort that can only be enjoyed by former slaves, and do what George Romero once said he'd do if the zombie apocalypse came to his door: go out and get bitten.

Nick Mamatas is the author of the short story collection YOU MIGHT SLEEP... *and many other things. http://www.nick-mamatas.com*

What if Travis Bickle was "The Thing"?

RAY HULING

Images courtesy of Activision Publishing, Inc.

It's not too often that you get to elbow-drop a guy from the top of the Empire State Building, dust yourself off, run up the side of another building, leap off, and glide across the city.

Playing *Prototype,* an open-world video game developed by Radical Entertainment, you find yourself in the midst of a viral outbreak in New York City. Rather than making people sick, this particular virus turns them into monsters that, in turn, gobble up the uninfected. Naturally, the U.S. government's behind it all, which explains the presence of Marines and a secretive Special Forces unit called BLACKWATCH amidst the chaos. You play as Alex Mercer, who comes skulking through the city equipped with a grey hoodie, a cool jacket, and a bevy of virus-fueled super-powers — not to mention a bad case of amnesia.

Radical Entertainment's Dennis Detwiller and Eric Holmes came up with the idea of Alex and *Prototype* following on their success

An Interview with Dennis Detwiller about *Prototype*: A Way Dark Experiment in Gaming "Transhumanism"

with 2005's The *Incredible Hulk: Ultimate Destruction*. That game allowed players to wander a city as the rampaging comic book anti-hero, taking the open-world genre to new limits. (Open-world or "sandbox" games let players choose their own course, rather than following scripted missions.) Detwiller and Holmes decided to push things even further with *Prototype* by introducing themes of conspiracy and transhumanism, and by removing any comic-book morality.

When they say Alex is an anti-hero, they mean it. Much of the player's progression in the game depends on his devouring other people, much as the game's monsters do. Eating people is how Alex gains skills, augments his powers, and learns about his past.

Detwiller is *Prototype*'s Senior Designer. He wrote most of the game's backstory, all of its cinematics, and several of its missions. H+ asked Detwiller to elaborate on the thinking behind the game.

h+: *Prototype* takes its anti-hero theme pretty far. How did you frame this approach for the higher-ups at the publishing company?
DENNIS DETWILLER: The original pitch was "This is a monster movie. This is like *The Thing*, except... you're the Thing." So many people had been pitching games from the other angle that we took a lot of people by surprise. The first reactions were "No way! No one will want to do that." The second reactions were, "Oh wow. That might be good."

h+: Aside from monster movies, what other touchstones did you use to flesh out Alex?
DD: We looked at a lot of different sources. It was bizarre. We looked at *Taxi Driver*. That was one influence. We really like *Taxi Driver*. We really liked *The Thing*. We basically just said, "What if Travis Bickle was the Thing?"

h+: Playing Travis Bickle as a science fiction monster demands a certain setting. Once you'd settled on the main character, how did you develop the game's story?
DD: It was clear from the beginning we didn't want a "save New York" story—it's just boring. We wanted a really, really dark kind of game. You're not sure if you want to root for the main character or not, but it's a hell of a lot of fun playing him. Alex is not a moral person, because as Eric puts it, if you give a player a balloon in an open world, they're not going to play with it, they're going to pop it. Eric wanted to build an experience where the game would tailor around the concept of you literally doing whatever you want, and more often than not what that is, is something awful.

I just squeezed that into a story that told you something about Alex. So the entire story is geared around Alex discovering exactly what happened to him, what caused all of this — and that's it. Whether he saves New York on the side? It's a possibility, but it's not by any means the center of the story.

h+: If there's no moral arc provided by the game, what motivates the player to keep playing, to learn more about Alex?
DD: The idea of Alex transcending humanity was very strong in the story. By the end of the game, Alex has consumed hundreds of people. He's literally an agglomeration of a hundred minds, a hundred lifetimes. A hundred different people, all skewed into one. He can pilot helicopters and tanks, use any weapons, because he's consumed all of these people... he has all of their memories. That was a strong theme we wanted to hit.

The opening cinematic says, "There was once an idea of an Alex Mercer, a body linked to a particular name, a series of letters that meant one unique thing, one being, one mind, but I'm past all that now."

What we wanted was... you begin as a blank. You discover some really awful truths about who you were, and then you realize it probably doesn't matter, because you're no longer human. You're something bigger and something worse and something scarier. We didn't want to shy away from that. We didn't want a pat ending: "You're cured!" or "Don't worry about it!" or "It's no big deal! You did everything right! Good job!" It's more that you find out some horrible truths.

h+: These "horrible truths" have both in-game and real-world implications. What out-of-game ideas does *Prototype* get across?
DD: This idea that the government is willing to cut

its own throat to get anything done — that would be a good example of something we really consciously wanted to get in there. So with BLACKWATCH, if the Marines are the standard foot troops, BLACKWATCH are the Nazis. They're awful people and they do awful things, but they think they're serving the greater good.

A lot of the [game's] history, if you go deep enough, is based on real history. The bioweapons treaty between Nixon and the Soviet Union is in there. Basically, both superpowers agreed not to produce biological weapons, shook hands, turned around, and both started pursuing biological weapons.

So the idea there was BLACKWATCH is "BW"—"Bio-Weapons". It's a code name. They're set up to investigate and to test field uses of these weapons. They're very secret, and they're called in as a last resort. They're the shock troops that deal with viral outbreaks and things that can't be contained.

h+: So *Prototype* exaggerates real-world fears about the government.

DD: There's an old saying that whatever you see on the market now, the government had thirty years ago. All this genetic technology, all that kind of stuff… I wouldn't be surprised if DARPA was using it in the '70s. It wouldn't shock me.

There's a very conscious mythos built in there: what if the government had access to something that was the equivalent of the magic bullet for human genetics? What would they do with it?

h+: Tying aspects of the game to reality helps to establish verisimilitude. Is this why you put Alex and the viral outbreak in New York?

DD: The reason we set it in New York is exactly that. It's something people can visualize and understand. It immediately centers Alex in reality — and it's very easy to lose reality, trust me.

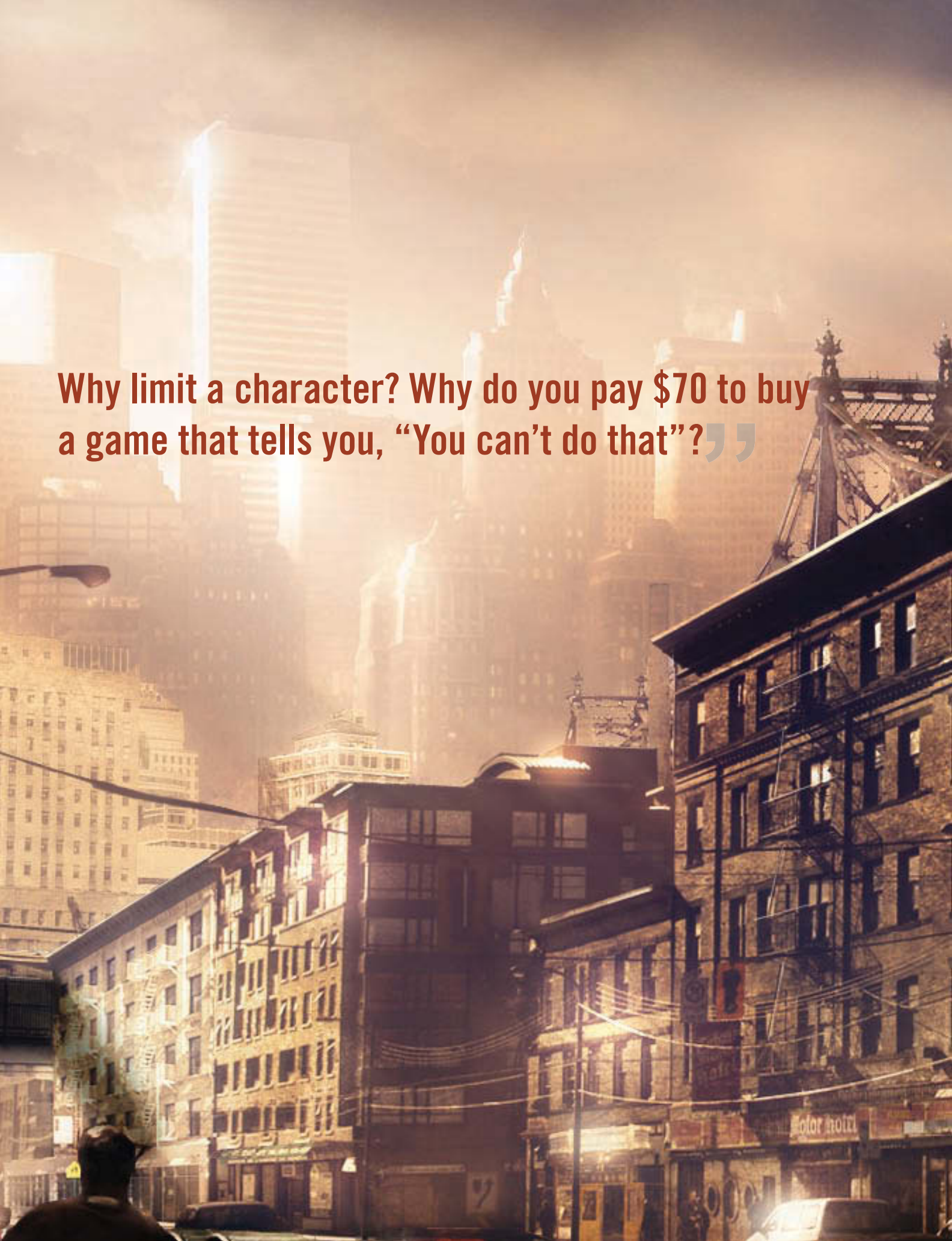
That's the reason behind how we did all of the vehicles and all of the weapons. You don't see the military running around with plasma guns or jet packs. You see them with Javelin missiles, M-16s, APCs and Abrams tanks and Apaches. That was a conscious choice. Even BLACKWATCH wasn't running around with very high-tech stuff. They're running around with real weapons.

h+: Let's turn back to Alex and how the player interacts with the game through him. His viral infection permits him to become stronger by consuming other people?

DD: One of the earliest ideas we had was… what if you literally ate somebody, absorbed their genetics, and you could do anything they could do? And we took that and just blew it up into: "I want to fly a helicopter, I better go find a helicopter pilot." It led to a lot of cool gameplay opportunities and makes a sort of dark, twisted sense. It gives you an excuse for why a biochemist can fly an Apache helicopter.

h+: How does this gameplay tie in to Alex's quest to discover who he really is?

DD: You can consume any target in the game and become them. You literally absorb them and get all their memories. So you want to lock in on people who know something about you, because you've consumed someone else who knows that other person — and that person was involved in the project with Alex. When you consume him, you get a memory that's relevant to that situation. It's this non-linear progression. You can see things, learn facts that you don't understand until a later point.



Why limit a character? Why do you pay $70 to buy a game that tells you, “You can’t do that”?”

h+: And as you understand Alex better, he doesn't necessarily become more sympathetic.
DD: As he learns what the government's doing, he also learns that they're not the worst [laughs]. There are worse things out there, and he's part of that. He's not entirely clear of all blame.

h+: Between the government and Alex and the monsters, *Prototype* seems bleak. How do you draw players into that environment?
DD: All of our references are dark. None of them are happy-go-lucky. At the same time, we also wanted to apply transhumanism as a power fantasy — and a power fantasy to a degree never seen in a video game before. That was very important. We basically just said, "Why limit a character?"

Why do you pay $70 to buy a game that tells you, "You can't do that"? That's what life is all about. You spend your entire life being told you can't do things. When you're playing a video game, the goal of the game is to transcend your normal limitations and it should let you do what you want to do.

We built a game that was the realization of every dark power fantasy you've ever had, and we just kind of put it in the controller and let the player do what they want with that. And they won't be judged. That's the important distinction. Many other games will allow you to do dark things and then impose some sort of penalty on you or judge you. I've always thought that was really foolish.

h+: You're giving players the experience of being an enhanced human set loose among ordinary people. How does *Prototype* encourage players to reflect on that experience?
DD: What we didn't want to do was make the moral choice for you and we didn't want to make the moral judgment for you. We wanted to put you in a situation where you couldn't help but notice that you'd made a moral choice and that moral judgment is coming from you, nowhere else. It's "Oh my God! I just killed a bunch of Marines! They were just trying to stop the attacking Thing!"

The game doesn't stop you. The game doesn't punish you, but the reactions and the dialogue might give you pause. As you see the game play out, you start to learn more about what the Marines are doing there. You might start to feel bad about what you're doing. It's up to you. *Prototype* will appear for Xbox360, PlayStation 3, and PC in late June.

Ray Huling is a freelance journalist living in Boston. He is working on a book about shellfishing in Rhode Island.

RESOURCES

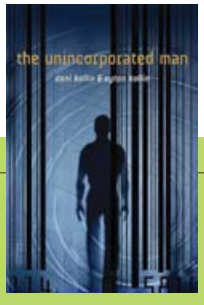
Radical Entertainment
http://www.radical.ca/

7 RECOMMENDED BOOKS

Transhuman
MARK L. VAN NAME AND T.K.F. WEISSKOPF
Baen (paperback)

Science fiction has explored the future evolution of humanity since Olaf Stapledon, but in recent years the concept of the Singularity has given it new energy. Leading SF publisher Baen brings us an anthology of original stories by Hugo award winner David Levine, old pro James Hogan, Wil McCarthy and eight others, all tackling the topic from different angles but with a shared optimism. The introduction and the first three stories are available free on the publisher's website. – Jay Cornell

WHERE TO BUY
www.amazon.com/Transhuman-Mark-L-Van-Name/dp/141659146X/ref=sr_1_2?ie=UTF8&s=books&qid=1241461728&sr=1-2



The Unincorporated Man
DANI KOLLIN AND EYTAN KOLLIN
Tor (hardcover)

A very sharp and often funny look at a 21st Century man who is resuscitated from cryogenic storage only to find himself in a tightly-controlled, techno-bean-counter socio-economic system. This novel may remind some of Heinlein — for both its clarity and its implicit individualist, libertarian satirical slant. – RU Sirius

WHERE TO BUY
http://www.amazon.com/Unincorporated-Man-Sci-Essential-Books/dp/0765318997

Nightmare in Silicon
COLETTE PHAIR
Chiasmus (paperback)

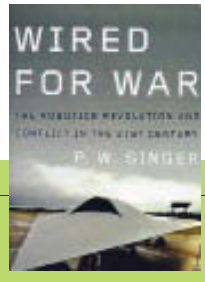
A highly interior, marvelous short novel written from the point of view of a woman who — facing imminent death from illness — becomes the first person to have her consciousness transferred to a robot body. This will not appeal to hard tech types and transhumanist literalists, but as Alan Moore wrote, it is "recklessly brave and driven writing, brimming with fluorescent style and startling ideas." – RU Sirius

WHERE TO BUY
www.amazon.com/Nightmare-Silicon-Colette-Phair/dp/0978549996/ref=sr_1_1?ie=UTF8&s=books&qid=1241462545&sr=1-1

Technology's Promise: Expert Knowledge on the Transformation of Business and Society
WILLIAM E. HALAL
Palgrave Macmillan (hardcover)

This is a truly fascinating book that deals brilliantly with the co-evolution of technology, business and society. A concise but complete "history of the future," written by a respected scholar, consultant and public speaker and based on information from a panel of 100 futurists, it covers most scientific and technological fields, with specific scenarios until 2050 and with general ideas for the future of humanity. – Jose Cordeiro

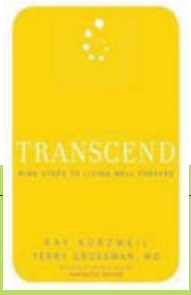
WHERE TO BUY
www.amazon.com/Technologys-Promise-Knowledge-Transformation-Business/dp/0230019544



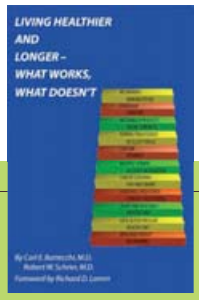
Wired For War: The Robotics Revolution and Conflict in the 21st Century
P.W. SINGER
Penguin Press (hardcover)

Singer has written extraordinary and exacting books about child soldiers and the "privatized military industry" (which is a nice way of saying mercenaries). Now he turns a withering eye toward the realities and terminator possibilities of robots at war. – RU Sirius

WHERE TO BUY
http://www.amazon.com/Wired-War-Robotics-Revolution-Conflict/dp/1594201986/ref=sr_1_1?ie=UTF8&s=books&qid=1241461865&sr=1-1



Transcend: Nine Steps to Living Well Forever
RAY KURZWEIL AND TERRY GROSSMAN, MD
Rodale (Hardcover)



Living Healthier and Longer — What Works, What Doesn't
CARL BARTECCHI, MD AND ROBERT W. SCHRIER, MD
Online

A follow up to *Fantastic Voyage: Live Long Enough to Live Forever, Transcend* is chockablock with advice, not just about nutrients, but about exercise, eating, stress relief, and much more. On the other hand, if you want a skeptical view regarding using lots of supplements to overcome age-related damage, you can check out *Living Healthier and Longer*. The authors say the evidence shows that antioxidant supplementation and taking doses of vitamins above the "Recommended Daily Allowance" may be harmful. Will the correct authors please stand up on their 125th birthdays? –RU Sirius (with thanks to Ben Scarlato)

WHERE TO BUY

http://www.amazon.com/s/ref=nb_ss_gw_1_9?url=search-alias%3Dstripbooks&field-keywords=transcend+kurzweil&sprefix=TRANSCEND
http://www.healthierlongerlife.org

RELINQUISHMENT, Step ONE

JOE QUIRK

Okay, if we're going to get started on this relinquishment thing, somebody is going to have to suggest the first baby step. It's all well and good for Bill Joy to suggest we immediately stop the infotech innovation that made him rich, but so far I haven't heard any practical steps on a realistic timetable. So I'm going to make a suggestion to get the ball rolling backward.

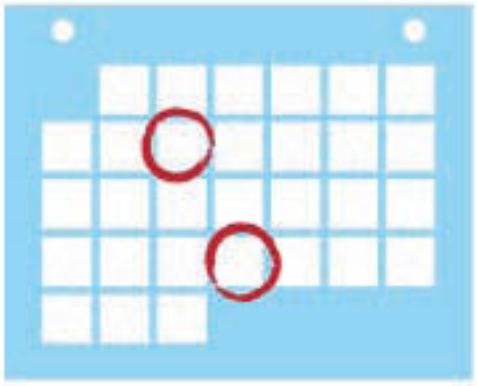
This might seem like a weird one because cell phones have not been invented yet. They're just marketing all the prototypes. Here's a list of amenities an actual cell phone would have:

It won't bleep out every 30th word.

It won't hang up on you at its discretion.

It sounds at least as good as the walkie-talkie I used from my tree fort in 1975.

It includes the most information-rich part of a conversation: the breath between the words that cues the user's intent to speak or listen.



I'm trying to prevent this futuristic device from being invented by convincing you to relinquish the primitive prototype in your pocket.

Why?

The first sign of Singularity Shock is when information technology changes so fast that the average human brain can no longer keep pace, causing intolerable cognitive dissonance and, eventually, madness. Slower brains are canaries in the coal mine, and I'm here to squawk.

Here are a few examples of intolerable cell-phone-induced cognitive dissonance:

Twice a month, I get a cell phone call from my buddy's balls. I turn on my answering machine and listen to twenty minutes of his testicles rustling around in his pants while in the muffled distance I hear him talk baby talk with that psychette he told me he broke up with. Sometimes his nads catch me when I'm home. I listen live while I holler into the phone for him to take me off his damn speed dial. Eventually he hears my tiny voice screaming from his scrotum and claims I'm not on his speed dial.

Twice a month, I get a cell phone call from my buddy's balls."

But that would mean that during the hundreds of thousands of steps he takes each month, his baubles randomly type out my phone number and hit send every two weeks, like a ten-thousand-monkeys-on-typewriters kind of thing.

I should point out my friend wears saggy homeboy jeans — which I call incontinence pants — with his baseball cap on sideways, and an overlarge shirt with a giant number and somebody else's name on it, an ensemble that sends a rebellious message of mental retardation. I'm not judgmental about this, except that his incontinence pants place his cell phone in proximity. I don't know about you, but when jingleberries dial me up making sounds as if to demonstrate Newton's Cradle in my ear, I'm way past the point of psychological overload. It's time to turn back now.

Second example of cell-phone-induced Singularity Shock:

I was alone in the men's room using the urinal. I heard somebody walk in behind me, step into a stall, and latch the door. He jingled his belt, sighed, and said:

"Hey, how are you doing?"

I looked around to double-check that we were definitely alone. "Okay, I guess."

"I just stepped into the men's room."

"Yeah, I figured."

"So how's it going?"

"Um … everything's coming along fine."

"Where are we getting dinner afterwards?"

"Look, guy, I'm straight."

"Hang on a second, sweet pea. *Hey out there! Leave me alone! You want me to call the cops right now?*"

"Oh! No-no! Sorry!

"No, it's okay. Just some pervert. You were saying?"

The advent of the cell phone age has provoked an assault on our most cherished values, including the ancient taboo against discussing dinner plans while defecating. Next time you borrow somebody's cell phone, remember your Handi Wipes.

I hope this story inspires you to chuck the damn thing into the recycle bin and join Bill and I in our journey back to the seventies, where we embrace the following technology: A call-waiting enhancement that, instead of interrupting your conversation, sends an automatic message to the caller telling them you are busy right now and to please call back later. No interruption, it doesn't charge the caller for the call, and the responsibility for making contact remains on the person trying to contact you. Sound convenient? We had that in 1975. It was called the busy signal.

We don't even need to go back that far. I'll settle for any relinquishment back to the time before I received messages like this on my message machine:

"Joe it's … blt … meet us at … o'clock … All the lobster and steak you can eat, pro bono strippers, plus … mrl … call her back at 51 … 3 … 28. Okay, I'll expect you there!"

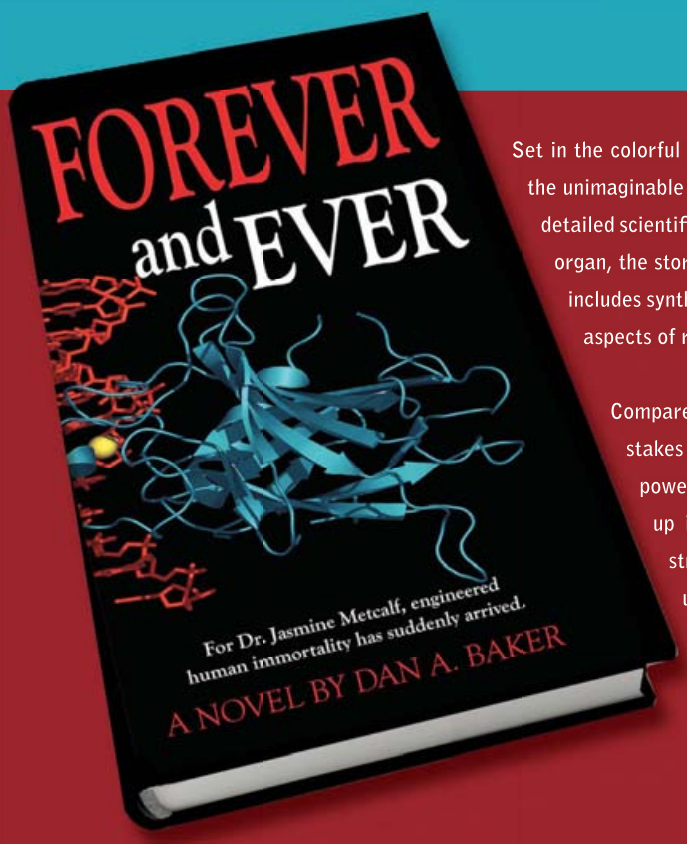
Relinquishment, Step Two:

Talking GPSs. Shut the hell up. I'm trying to figure out where I am. If I wanted my masculinity threatened by a voice telling me where to turn, I'd bring my wife.

Joe Quirk is the bestselling author of fiction and non-fiction. His new novel, EXULT, *is the very first digital ebook published exclusively at Scribd by a mainstream author. You can buy it for two bucks. http://www.scribd.com/doc/15582558/EXULT-by-Jow-Quirk*

NOW IN PAPERBACK!

Forever and Ever, by San Francisco Bay Area author Dan A. Baker is the first fiction title on the topic of gene-based aging reversal and engineered human immortality.



Set in the colorful and exciting world of today's biotechnology, *Forever and Ever* explores the unimaginable dilemmas posed by radical life extension. With carefully researched and detailed scientific scenarios, including the development of a stem cell generating artificial organ, the story follows the development of a highly plausible gene-based therapy that includes synthetic genes, nano-ball technology, organ printing, tissue engineering, and aspects of regenerative medicine that are in today's headlines.

Compared to Michael Crichton's best work, and in the Dan Brown genre of high stakes intrigue, *Forever and Ever* takes the reader on a wild ride through the power dynamics that this revolutionary breakthrough would present. Caught up in this invisible vortex of brilliantly directed power, Jasmine Metcalf struggles to save the life of a child dying of progeria, understand the unprecedented choices before her, and prevail against mysterious forces intent on controlling the age of biology.

Developed with the help of an eminent molecular biologist involved in the early breakthroughs in telomerase

Forever and Ever is a must read for high tech and medical thrillers.