

ALCOR

Reaching for Tomorrow

(formerly Cryonics magazine)

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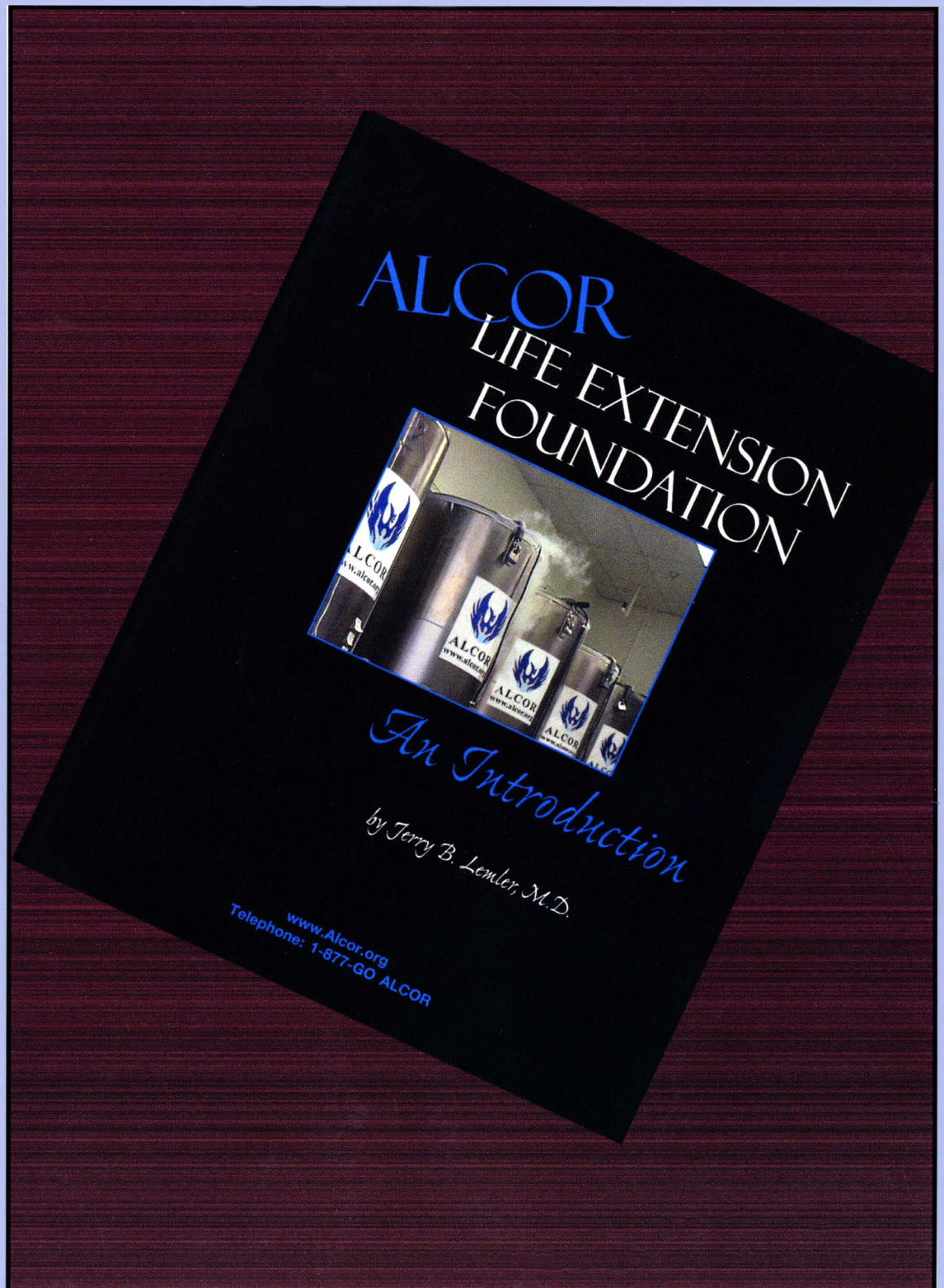
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*From the Artificial Heart
to Nanocomputers*

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Alcor: The Origin of Our Name

In September of 1970 Fred and Linda Chamberlain (the founders of Alcor) were asked to come up with a name for a rescue team for the now-defunct Cryonics Society of California (CSC). In view of our logical destiny (the stars), they searched through star catalogs and books on astronomy, hoping to find a star that could serve as a cryonics acronym. *Alcor*, 80 Ursae Majoris, was just what they had been looking for. It not only had some acronymic “fit” for cryonics but was also symbolic for its historical use as a test for eyesight and was located in a very well known constellation.

Alcor, a companion star of Mizar in the Big Dipper’s handle, is approximately 5th magnitude, barely within the threshold of human vision. Additionally, it is quite close to Mizar from an angular standpoint, and dimmer. Only with excellent vision can one tell there are two stars rather than just one. For thousands of years, people in the Middle East have used Alcor as a critical test of visual sensitivity and focus. If you could *see* Alcor, you had excellent vision indeed. In the early days of cryonics, few people could see the need for a rescue team or even for cryonics itself. Symbolically then, Alcor would be a “test” of vision as regards life extension.

As an acronym, Alcor is a close if not perfect fit with *Allopathic Cryogenic Rescue*. The Chamberlains could have forced a five-word string, but these three seemed sufficient. *Allopathy* (as opposed to *Homeopathy*) is a medical perspective wherein *any treatment that improves the prognosis is valid*. *Cryogenic* preservation is the most powerful method known to halt the rapid, entropic disorganization of people following clinical death. *Rescue* differentiates a cryonics approach from

(yet to be developed) proven suspended animation. The acronymic interpretation of Alcor is therefore *use of a cryogenic procedure, though unproven, to preserve structure and potential viability, since failing to do so allows further disorganization to occur and reduces the probability (prognosis) of reversal and reanimation at any future time*.

Some of these thoughts were presented at a CSC dinner meeting in the autumn of 1970. A number of people who have subsequently become members of the Alcor Life Extension Foundation were present at that gathering. Over the months that followed, it became increasingly evident that the leadership of CSC would not support or even tolerate a rescue team concept. Less than one year after the 1970 dinner meeting, the Chamberlains severed all ties with CSC and incorporated the “Rocky Mountain Cryonics Society” in the State of Washington. The articles and bylaws of this organization specifically provided for “Alcor Members,” who were to be the core of rescue team activity. Difficulties in securing nonprofit status in Washington then led to reincorporation in California, this time under the name “Alcor Society for Solid State Hypothermia.” In the late 1970s, to further broaden the organization’s objectives, the present name (Alcor Life Extension Foundation) was adopted.

Despite many transitions, the symbolism of the name remains. How long will it take for more people to *see* that “Ashes to ashes and dust to dust” is a meaningless destiny... to *see* that it is possible to reach for a distant tomorrow and perhaps to attain it... to *see* Alcor for what it really is: a vehicle with which to attempt that fantastic voyage!

—Reprinted from *A:RFT (formerly Cryonics)*, August 1984.



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Editor

Lisa L. Lock
llock@winterthur.org

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Alcor Life Extension Foundation
7895 E. Acoma Dr., Suite 110
Scottsdale, AZ 85260

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How to Join Alcor

Your research is finally complete. You browsed our web site (www.alcor.org), presented your questions to our Membership Administrator (jennifer@alcor.org), and toured our facility. Now you are ready to establish your membership with Alcor Foundation. Congratulations and welcome!

Upon receipt of your application for membership and application fee, Alcor will send you various membership documents (samples available upon request). After reviewing these documents, you will need to execute them in the presence of two signing witnesses. Perhaps a representative of your local bank can notarize the single document that also requires this official witness. After returning all of your documents to Alcor for approval, you can expect to receive one original copy of each for your personal records.

Most people use life insurance to fund their suspension, although cash prepayment is also acceptable. If you do not already have an insurance policy, Alcor recommends that you apply for one at your earliest convenience, as the underwriting

process can last several weeks. Jennifer Chapman, Alcor Membership Administrator, can provide you with a list of insurance agents who have previously written policies for this purpose. These agents can assist you with satisfying Alcor's various funding requirements, such as naming Alcor as the owner and irrevocable beneficiary of your policy and ensuring that your benefit amount is sufficient.

With your membership documents completed and your funding approved by Alcor, you will be issued emergency identification tags engraved with your personal Suspension Number. This is your confirmation that Alcor will provide you with suspension services, should our emergency technicians ever receive a call on your behalf. Certainly, Alcor hopes that you will not need our services anytime soon, but as a member of Alcor you can feel confident that our organization will care for you and your future. Please call 480-905-1906 ext. 113 today to request your application.

TO ALL ALCOR MEMBERS AND THOSE IN THE SIGNUP PROCESS

Please! Please! Please!

When you move, or change phone numbers (work number as well), change e-mail addresses, or undergo any medical procedure where general anesthesia is used, please inform us as far ahead of time as you can.

Too many times we have tried to contact our members and found out the contact information we have is no longer valid.

Other times we find out well after the fact that a member has undergone a medical procedure with life threatening potential.

*Help us to serve you better!
Keep in touch!*

What's it all about...

ALEFI ?

by Jerry B. Lemler, M.D.
Alcor President/CEO



Alcor's Revised Introductory Membership Book Has Been Released!

Eight Is Enough

It had been eight long years, and yes, enough was enough. Published in 1993, Alcor's primary promotional book, *Cryonics: Reaching for Tomorrow (CRFT)*, had served its readership faithfully but had aged beyond legitimate usefulness. Clearly, major advances in cryoprotectants, transport procedures and protocols, and theoretical repair scenarios (nanotechnology) portended the need for significant revision of the manuscript.

When the possibility of immortality first hit me (by reading Eric Drexler's *Engines of Creation*), it felt as though a hologram had popped out in front of my eyes. I immediately immersed myself in reading anything and everything I could about the subject. Naturally, *CRFT* was one of the first texts I devoured. The idea of creating a rewrite came to me while I was still in the Alcor sign-up process (Spring 2000).

So, I started by revising a few selected chapters and sent them to Linda Chamberlain for her suggestions and approval. Linda made some corrections, and then at Asilomar, she introduced me to our editor, Lisa Lock, whom I have been working with over the past year and a quarter to bring this project to fruition.

With exponential technological progress abounding in virtually every discipline related to our ultimate task, one wonders how long *ALEFI* will be relevant. Having authorized the printing of 10,000 units, we project we might be able to squeeze in a couple of years—though this decision may weigh in a bit on the side of optimism. I'll personally (and gladly) take the rap on this one if we've severely miscalculated. And, too, I suppose it could be argued, future editions may well be composed by post-Singularity authors, infinitely more prosaic than the present one. Suffice it to say, I would welcome the competition (and being conquered in such fashion!).

ALEFI attempts to be an eclectic read without possessing a numbing sanitization. I have interspersed anecdotes and cell repair scenarios, weaving tidbits of cryonics history into philosophical meanderings of justification for immortality. The resulting tapestry is an unapologetic collage in mosaic form. My fervent hope (and expectation) is for established and long-standing cryonicists to discover a few fresh concepts, while prospective members will assimilate the requisite information to make an energized, positive decision, to join our ranks.

I urge you to read *ALEFI* and pass it on!

To order additional copies of

***Alcor Life Extension Foundation:
An Introduction***

at \$10 per copy, please contact
Alcor Marketing Director Karla Steen
at
Karla@alcor.org

The Return of *the Krell Machine*

Nanotechnology, the Singularity, and the Empty Planet Syndrome

What will happen when humans gain the ability to manufacture nearly anything we want, and when our machines surpass our own intelligence? We had better hope the results are better than we see in science fiction, because, in a few generations, both these situations may well be upon us.

by Steven B. Harris¹

Introduction **Forbidden Planet and the Ultimate Machine**

In 1956, the Fred McLeod Wilcox film *Forbidden Planet* became the second memorable science fiction movie of the 1950s (the first being the Robert Wise film *The Day the Earth Stood Still*). *Forbidden Planet*, from a screenplay by Cyril Hume, is still entertaining today. It has become a classic by being among the first films to raise important issues about the use of ultimate technologies. Moreover, it has also had a vast impact on the art of the science fiction films that followed it.

Modern viewers of *Forbidden Planet* are reminded of *Star Trek*, but of course the connection is in the other direction. Many episodes of *Trek* borrow liberally from *Forbidden Planet*. As the film begins, a “United Planets Cruiser,” featuring a dashing young starship captain, is paying a call to the planet Altair IV to investigate the loss of a science mission there 20 years before. They find no one alive on the planet save for the expedition’s strangely powerful philologist, one Edward Morbius, Ph.D. (lit.), and his intriguing and beautiful teenaged daughter, who has never seen humans other than her father. (We recognize the basic plot of *The Tempest* from Shakespeare, of *Star Trek*’s episode “Requiem for Methuselah,” and many others. The captain is in for trouble.) Dr. Morbius, attended by an advanced robot servant, is engaged in solo decipherment of traces of an alien civilization that had once occupied the planet but that had become suddenly extinct 200,000 years before. In a key scene, Morbius, in almost blank verse, tells the starship captain about this vanished race, which had called themselves the **Krell**:

*Ethically, as well as technologically,
they were a million years ahead of humankind.
For, in unlocking the mysteries of nature,
they had conquered even their baser-selves.*

*And, when in the course of eons,
they had abolished sickness and insanity
and crime and all injustice,
they turned, still with high benevolence,
outward toward space.*

*Long before the dawn of man’s history,
they had walked our Earth,
and brought back many biological specimens.*

The heights they had reached!

*But then—seemingly on the threshold
of some supreme accomplishment
which was to have crowned their entire history—
this all-but-divine race perished,
in a single night.*

*In the two thousand centuries
since that unexplained catastrophe,
even their cloud-piercing towers
of glass and porcelain and adamantine steel
have crumbled back into the soil of Altair IV,
and nothing, absolutely nothing,
remains aboveground.*

Later, Morbius shows the starship captain the principal remains of the Krell civilization: a self-repairing and still-functioning gigantic machine that reposes, blinking and humming, beneath an empty desert of Altair IV. It is a cube measuring 20 miles on a side (think “Borg Cube” from *Star Trek*) powered by 9,200 working thermonuclear (fusion) reactors. Its function is a mystery, but later it is finally revealed. The huge device was built by the Krell as a replacement for all technological instrumentalities. It is a technical Aladdin’s lamp, an Ultimate Machine waiting for a command. The starship captain finally figures this out, with some clues from the brain-boostered (and brain-burned) ship’s doctor, and accosts Dr. Morbius with the answer:

“Morbius—a big machine, 8,000 cubic miles of klystron relays, enough power for a whole population of creative geniuses—operated by remote control! Morbius—operated by the electromagnetic impulses of individual Krell brains.... In return, that machine would instantaneously project solid matter to any point on the planet. In any shape or color they might imagine. For any purpose, Morbius! Creation by pure thought!”

But there’s also a little problem with such a technology, the captain tells Morbius: it is *Monsters from the Id*:

“But, like you, the Krell forgot one deadly danger—their own subconscious hate and lust for destruction!... And so, those mindless beasts of the subconscious had access to a machine that could NEVER be shut down! The secret devil of every soul on the planet, all set free at once, to loot and maim! And take revenge, Morbius, and kill!”

The nightmare monsters from the machine allow the Krell to destroy themselves, and later (guided unwillingly now by Morbius’s subconscious) the device acts as facilitator to destroy one human expedition and part of another. In the end, a desperate Morbius puts the machine into overload as a final stop to the invincible monsters (we see this scene later in the film *Alien*). The starship captain and Morbius’s daughter manage to get away from Altair IV just in time before the planet explodes. Wiping out everything is what these ultimate machines all seem to do.²

From our 21st-century vantage-point, we recognize the Krell Machine as perhaps a 1950s metaphor for the relatively new nuclear energy—a technology thought at that time to be potentially a nearly infinite power source, for either good or evil. The question asked in the film is thus the famous one of this early atomic era: Are our Freudian Ids, our ape’s emotional brains, ready for that kind of increase in power? If a machine had the power to instantly make for us anything we wanted, would we be wise enough to know what was good for us? The answer of *Forbidden Planet* is no.

But it’s a temptation. Since *Forbidden Planet*, the Krell Machine has turned up repeatedly in science fiction, from *Star Trek* to *Total Recall*. Perhaps the most interesting set of ideas it prefigures is a group of now serious predictions about our future.

It turns out that the Bomb is only a small subset of mankind’s worst coming worries. A nuclear bomb, after all, is merely one more device we made when we grew smart enough to do it. The underlying problem is that we’re getting smarter and better at making things, and both of these trends are snowballing toward an inevitable avalanche.

Mankind’s Pending Ultimate Instrumentalities, Part A: Nanotechnology

Let us look now at the darkest potentials of foreseeable technology. The rule we set for ourselves is that we will not consider “fantasy” ideas, such as what may be possible if we discover new loopholes in physical laws. We wish merely to ask how far ordinary human technology may go, given known physical constraints. Such possible “ultimate technologies,” as we have suggested above, divide broadly into those connected with the physical world and those connected with the mental and computational world.

We begin with the physical. Here, we are amused by one of the more advanced capabilities of Robby the Robot, who is the servant of Morbius in the 1956 film. Robby (a techno-version of *The Tempest*’s slave-spirit Ariel) is human-designed, using bits of advanced Krell knowledge. Robby can synthesize artificial gems of large size and can analyze and duplicate any food or chemical mixture, all within the small space of his body. At one point we see Robby obligingly make 50 gallons of bootleg liquor for the starship’s cook, who plays *The Tempest*’s drunken crewman/fool. Does any technology that we might realistically imagine allow such powers?

We do not know physicist Richard Feynman’s inspiration, when he gave the answer to this question just three years later, in his now-famous essay “There’s Plenty of Room at the Bottom.”³ But perhaps part of the inspiration was this film. Feynman’s answer was surprising: the idea of total molecular-level materials manufacturing control may be science fiction, but it is far from fantasy. Feynman advised that there do not appear to be any physical laws that prohibit the manipulation and manufacture of things atom-by-atom, allowing the kinds of duplication of food-stuffs that Robby does.

K. Eric Drexler predicted some design details in his 1986 publication *Engines of Creation*. Complex chemical syntheses, he proposed, might be done using submicroscopic construction-machines. Such machines (called *assemblers*) would work like natural biological catalysts (enzymes). By the time of Drexler’s writing, it was known that enzymes work semi-mechanistically, using tiny chemically powered protein “arms” to grab and move groups of atoms, changing the chemical bonds between them. (A chemical bond is a place where electrons are shared between atoms, causing the assembly to stick together to form a molecule.) Drexler now proposed that assemblers, unlike most enzymes, would be *programmable*. Instead of only one chemical job, an assembler might be programmed to do many.

In Drexler’s scheme, one could give a general-purpose as-

sembler *instructions* about what types of atoms and bonds to look for and work on, changing these instructions as the device moved from one part of a molecule to the next. Fully programmable assemblers would thus have the full flexibility of computer-controlled industrial robots but be able to use it on the size-scale of chemistry.

The potential power of such devices is already partly illustrated for us by the fine synthetic detail seen in biology, in which a semiprogrammable enzyme-complex called the *ribosome* is able to manufacture a potentially infinite number of different proteins (including enzymes), using programming information on the fly from an “instruction tape” of messenger RNA. Drexler’s proposed devices, by analogy with the ribosome, would be more powerful and flexible still—able to take a much wider variety of instructions and able to make more complex decisions as they worked. Such devices would be able to make not only proteins but nearly any chemical structure that was stable.

Since Drexler’s proposal, some progress has been made. In 1989 scientists working for IBM used a very pointy needle to nudge 35 individual xenon atoms on a cold surface into spelling out “IBM” in letters a few atoms long. In 1996, further studies showed that molecules could be individually positioned, even at room temperature.⁴ Thus, the crucial hurdle is not in manipulating individual atoms or molecules (this can already be done) but in doing it cleverly enough.

We see immediately that there is a chicken-and-egg problem here. Cell-sized computers for running assemblers would be possible to construct *if* molecular-scale engineering capability were available to begin with. If not, the difficulty would lie in making the first assemblers. These would need to result from a laborious process of miniaturizing manufacturing capability, level by level, to make the next smaller generation of devices until we reached the molecule-sized bottom of chemical reality. Once devices were manufactured this small, however, things would become much easier. The assemblers would then be programmed to simply create more of themselves, just as living cells replicate their own ribosomes and thus replicate themselves.

Nanotechnology (as Drexler referred to his program) would offer the ultimate physical manufacturing technology. Such manufacture would start with basic shapes. Josh Storrs Hall has proposed that nanomachines (“foglets”) of approximately protozoan size might interact tactilely with one another, to generate ordinary objects having low densities but high strengths. Solid objects might thus emerge from fluid dispersions like today’s plastic *stereolithography* sculpture, yet at the same time potentially be as mobile and protean as the “liquid metal” automaton in the film *Terminator 2*. A collection of foglets might float like mist, but morph or solidify when instructed to lock arms. Such a “*Utility Fog*” would quickly become any shape or color we wish. Say the word, for example, and an extra chair might coalesce and shape itself out of mist that is otherwise nearly invisible. If you can do such deeds just by thinking or visualizing, you will be approaching Krell territory.

A notable application for nanotechnology would lie in its role as the ultimate medical treatment. Feynman reported in 1959 that his friend Al Hibbs had remarked, on hearing of tiny machines, that it would be very convenient to simply “swallow the doctor.” Of course, the microdoctor, working quickly and by

Thus, the crucial hurdle is not in manipulating individual atoms or molecules... but in doing it cleverly enough.

touch, would need to have considerable onsite “intelligence.” As early as 1950, science fiction author Hal Clement (*Needle*, 1950) had already sketched the regenerative possibilities of a human body interpenetrated by an amorphous, intelligent, Being made of very tiny parts, that could “see” and fix problems microsurgically. Such beings are science fiction but seem physically possible. The direct miniaturization of humans or their craft as seen in *Fantastic Voyage* is fantasy, for it requires the miniaturization of atoms, which is far outside the limits of known physical laws. But not so the kinds of things that “inside doctoring” might do, if only the “doctor” were an intelligent but microscopic robot built of ordinary atoms, cleverly assembled. Atoms, even unminiaturized, still appear plenty small enough to make an intelligent machine far smaller than the cells it may be tasked to repair.

Nanotechnology would not necessarily need to work inside a body to make biomaterials. It should be able to synthesize healthy tissue at any place, for any purpose. Proteins, cells, and tissues could be laid down in *Utility Fog*-shaped forms. With the proper supply of information and raw materials, Drexler’s assemblers might use an artificial circulatory system to place cells on organ-shaped foglet-scaffolding. There would be no reason such an enterprise could not eventually manufacture a complete living organism.

With such biological manufacture, we come naturally to the most dramatic use of nanotechnology, which is the ability to duplicate and “fax” living organisms, including humans, using information taken (perhaps nondestructively) from a living template organism.

Living organisms as we know them now are constructed (we say “grown”) slowly from the raw materials of simple food molecules, using a seed of information that controls some nanomachine-like cellular organelles (ribosomes, etc.). Nothing, however, stands in the way of greatly improving this natural process, in both rate and fidelity. The cellular clones of today are far from exact copies of the original organism because DNA contains too little information for that. DNA is a *recipe*, not a blueprint. By contrast, nanotechnology in theory might read out the more complex “blueprint” of an existing individual human and build another much closer reproduction using this far-larger instruction set.

Moreover, rather than producing an adult human in 20 years, it might be possible to do it in weeks or perhaps even hours, including structure from a template brain so that memories and

learning could be replicated also. Thus, while simple cellular cloning of humans *per se* will not be capable of presenting the kinds of social problems seen in the recent Schwarzenegger film *The Sixth Day* (2001), a fully *duplicative* nanotechnology would be up to the task. To be sure, a nanotechnologically duplicated person might not quite pop into existence nearly so quickly as a matter-transportee on *Star Trek*. A human synthesis would also need machinery as well as raw materials in place at the “destination” point (the machinery could be grown as well from a small seed and instructions). But these are details. The point is that the basic process, as well as all the ethical and philosophical problems attendant with it, does not seem to be ruled out by any physical laws we know.⁵

As we have hinted, however, the powers being discussed are not unlimited. Nanomachines are precision, programmable, chemical catalysts that are held together by chemical bonds, subject to standard inter- and intra-molecular forces. This places severe limits on the kinetic energy that machine pieces may have and thus how fast they may work in order to move and assemble atoms. There is friction to deal with, molecular degradation, and of course the need for constant error correction, as in any complex system. There are also temperature and pressure constraints, again because nanomachines are made of ordinary molecular substances.

Further, nanotechnology techniques will have power over chemistry only; no nuclear transformations are included, so this technology *per se* cannot turn lead into gold—it will still take cyclotrons for that. These are fundamental limitations connected with physical law and not likely to be circumventable. Nanotechnology provides the limiting technology for how to make any chemically possible structure of atoms, on any scale that is stable. In theory, one can duplicate any object that already exists in the relatively low-temperature and low-pressure part of our universe (that is, at least crusts of small planets), though it won't be possible instantly. On these scales, the expected power of nanotechnology should fall somewhere between that of biology and the *Star Trek* transporter; between that of Robby the Robot and that of the Krell Machine. Such powers are God-like only if your imagination is limited and your gods are of the slow and patient type. Still, they are impressive.

If nanotechnology should eventually be able to manufacture (or assemble) any reasonably small and cool object that can exist on a planetary surface, and do it on command, the next problem is deciding who will be authorized to give the commands. Even if nanomachines are under docile control, their powers begin to resemble wizardry, and the way in which one may change the world with them (by speaking a word, or even thinking a thought) begins to look suspiciously like sorcery. Do we want that? Of course, in the virtual world *inside* a computer, it's always been that way.⁶ But the *Forbidden Planet* question is whether anyone, or any government, is safe in holding this kind of power over matter in the real physical world. With nanotechnology, we would get real “sorcery”—but even with the best of intentions we might still find ourselves in the position of the sorcerer's apprentice (think of Mickey Mouse in *Fantasia*). Even intelligent beings a good

deal smarter than we are might not be wise enough to control such technology safely.

But this question, too, is soon due to answer itself.

Mankind's Pending Ultimate Instrumentalities, Part B: The Computational Singularity

Unlike nanotechnology, the other main futuristic prediction of the 1980s regarding technology addresses a type of technical progress that is much easier to project but (ironically) also evokes ultimate limitations that are much harder to imagine. The starting point for this second set of predictions involves the notion that information processing or “computation” can be done much faster than we do it. Further, there appear no obvious physical limits as to how fast computation may ultimately be done. Certainly, if there are limits, they are well beyond the power of our own inefficient brains.

Therefore, it must be possible to construct intelligences far superior to our own. Nor are the paths to doing this completely obscure, since in a real sense we already do it when many people work on a given project too large for any single person to comprehend (a moon rocket or an economy), or when humans work in concert with computers. We're getting better at it, and this kind of thing will continue with a vengeance. As it does, it will assist in creating itself. Inevitably, this kind of progress in the speed of *progress itself* must lead to supra-exponential growth in “thinking” ability.

Computing machines (first mechanical, then electronic) have been shrinking at an exponential rate for as long as we've been making them, and many people have sensed that there is something wildly empowering ahead. When the first kit to allow homebuilders and hobbyists to construct their own personal electronic computers was offered (in late 1974), the device ended up being named the *Altair* (suggested by the 12-year-old daughter of the publisher of *Popular Electronics*, after a *Star Trek* destination). The name somehow seems appropriate, for the Krell Machine is seen here, trying to be born.

Today, personal computer power has grown to levels quite unforeseen in 1974, and there is no end in sight. Instead, it seems that ahead is a kind of watershed—or perhaps a waterfall. We are due to go over it. Such an event has been described in various terms for half a century, but we may refer to it as the *computational singularity*. The computational singularity corresponds to a singularity point in a mathematical function where the value of the function approaches infinity (like $1/x$ when x approaches zero). It is a time when total computational power rises to levels that are, if not infinite, at least qualitatively unimaginable. This is set to happen quite soon, if we continue at the present pace of advance.

Perhaps the first work of fiction to use this idea explicitly is the 1986 Vernor Vinge [VIN-jee] novel *Marooned in Realtime*. In this tale, human time-travelers in time-stasis bubbles come out of suspension to find themselves on the other side of a curious rift in civilization, during which all humans have disappeared from the Earth, leaving the planet empty. No one who emerges from

stasis understands what has happened to civilization, and since the travel is one-way, they cannot go back to find out. There are clues that the end hasn't been extermination. Possibly (Vinge hints) there has been an *Exodus* or *Ascendancy* or *Transcension* of some kind, since the computer technology of the civilization just before the rift has been clearly progressing exponentially toward a somewhat incomprehensible information-processing power. The implication is that mankind has perhaps "graduated" into some other kind of new mental life, much as happens in Arthur Clarke's 1953 novel *Childhood's End* (to which we will return—Clarke's fiction provides some of the first science fiction "mental millennium" genre stories, though the mental millennium in Clarke is not computer-generated).

Author Vinge, who in real life is an emeritus professor of computer science at San Diego State University, has also written formally in nonfiction about the concept of the "computational singularity."⁷ Vinge traces the idea at least as far back as the speculations of J. von Neumann and S. Ulam, a pair of legendary figures who made deep marks in computer science, mathematics, physics, and complex systems theory in the 1950s. Vinge also credits I. J. Good (another polymath) with first explicitly pointing out in 1965 that computer-design-of-computers leads to computer power progress that must be at least exponential. And indeed, here in the year 2001, we don't yet have a HAL 9000, but we do already allow a great deal of chip design to be done by machine. We have no choice—it's already beyond the capability of human designers.

The advent of true self-replicating nanotechnology may be difficult to predict, but recently there have been a number of suggestions that the *computational singularity* (which will be hereafter referred to simply as the singularity) should be upon us within a generation or two. The reason for the more confident prediction in this case is that information-processing power has been increasing smoothly and exponentially for a century, in a way that is easier to extrapolate. Hans Moravec, in the classic 1988 future-shock robotics book *Mind Children: The Future of Robot and Human Intelligence*, suggested that the unimaginable waterfall in this river of progress will happen about 2030 AD. Ray Kurzweil has recently updated and expanded Moravec's arguments in his 1999 book, called *The Age of Spiritual Machines*. Kurzweil suggests that during the last century, the doubling time of the figure-of-merit "computation power per dollar," which had been thought to have been relatively constant, has in fact decreased from three years toward one year. In other words, we used to have to wait three years to buy a computer twice as powerful for the same price, but with today's PCs, we now wait only 12 months for this to happen. So not only is the pace of change exponential, but the exponent itself is changing.

According to Kurzweil and others, the singularity is due not because of the sliding nature of the exponent (although this helps determine the time) but rather because of another key milestone: at some point in the process, our computers will become as computationally powerful as the human brain. This is projected to happen sometime between 2015 and 2030 AD, and the expo-

ponential effect ensures that the personal computers of five to ten years later will be just as powerful. A few years later, it follows inexorably that computers as complex as the human brain will be mass-produced items, like digital watches or wind-up toys. Shortly after this happens, our computer networks are expected to suddenly (and nearly instantaneously from our perspective) get very, very *smart*.

Of course, a computer as powerful as the human brain does not guarantee the performance of a human-equivalent mind. Indeed, even humans themselves, if not programmed correctly, become less *Mowgli* than "wolf boy"—not much more than animals. One special thing about a human brain is its sheer connectionist capacity and the ability to use this capacity to modify deep structural programs for learning. The attainment of human and superhuman mental performance by computers depends on the ability to program computers heuristically by *experience*, in much the same way that we semiprogram human minds today.

In such a scenario, simple learning programs become better learning programs until, at some point, they pass the Turing Test and become capable of some subset of human-level intellectual performance. The ancient Greek *sorites* paradox, as amplified by the philosopher Hegel, is then realized: an increase in mere (computational) *quantity* is mysteriously translated into a change in *quality*. We say that we now have a *system property*, or in modern parlance, an *emergent property*. In this case, the new property will be intelligent action.

That is the theory, but we are not without the beginnings of practice. Those who disagree with the theory, holding instead that the human mind is a specially creative instrument in all circumstances, never to be duplicated, were dealt a severe blow in 1997 when the IBM computer *Deep Blue* defeated chess grandmaster Gary Kasparov. World champion Kasparov was thought by most chess experts at that time to have been as formidable as any player in chess history. Until he encountered *Deep Blue*, Kasparov had contended that the play of computers was typically rote-mechanical and unimaginative in ways that a grandmaster could easily detect and then exploit. Great chess was said to take imagination and creativity of a kind that would forever elude a machine. For a long time it pleased the vanity of humans to believe Kasparov, as he kept beating chess computers. Finally, however, came the day of reckoning, as an inexorable increase in raw computer processing power resulted in a self-learning chess-playing machine that (somewhat mysteriously) became capable of formidable chess imagination and insight. Even the programmers were sometimes surprised at the details of how it had happened.

Deep Blue now passed its version of the Turing Test for machine intelligence, for Kasparov felt for the first time that he was glimpsing *amind* across the board from him. This may be the most interesting part of the episode, for Kasparov immediately accused the programmers of cheating and of having a human chess master in contact with the computer during play. Kasparov was wrong, however. There was actually no one "home" within the programs that constituted the "mind" of *Deep Blue*. The

programs that “creatively” dismantled and destroyed Kasparov’s strategies were running by themselves. Kasparov was indeed facing only a machine, not a human grandmaster, but now he *could not tell the difference*. There is a lesson: that this kind of thing is possible. And if it can happen here, it can happen in other areas of thought.

In the past, the field of Artificial Intelligence has suffered badly from the predictions made that in retrospect could never have proven out in the time given. Even the supercomputers of today have brains only about as computationally powerful as those of insects, so they’ve really had no chance to think as well as humans do, no matter how well-programmed. Also, it’s not very surprising that when given machine bodies, computers of today still interact with the world in somewhat insect-like ways. Indeed, insects themselves often behave in many ways that seem to us to be somewhat stylized and mechanical.

Even with real insects, however, we see some of the principle we seek: a qualitative amplification of intelligence is possible, if we increase only total complexity. Hive-insect minds, working in a linked fashion, may develop the flexibility of much more complex and intelligent animals. A bee colony, for example, which has far more neurological processing power than any single bee, is *as a whole* capable of more complex learned behavior than are single bees. A colony will remember the location and times of flower openings and is even capable of future-modeling or inductive behavior, rather like a vertebrate. If a dish of sugar-water near the hive is moved by a certain distance each day, bees will one day be found clustering at the next projected or *anticipated* spot.

In the same way, we guess, things cannot fail to change qualitatively as electronic computers and their networks grow more complex. In the future, as these networks become more capable, they will presumably mimic brains that are further along in the evolutionary scale of complexity. Today’s insectoid machines will one day act like lower mammals, then higher ones. (Toymakers are already busily modeling dogs and babies with 8-bit microprocessors and doing surprising well.) We can guess that along the way machines will pass more and more Turing Tests, and their behavior will become indistinguishable from that of a human, over ever-wider areas of human “expertise.”

Again, in making such projections, we run up against the past bad predictions of Artificial Intelligence enthusiasts. AI has always seemed forever in the future. But we should be careful of such things. The moon landing, gene therapy, and mammalian cloning were old science fiction ideas that seemed forever in the future too, but they didn’t stay there. Eventually, if computers continue on their present path, Artificial Intelligence, too, will come. Then we will presumably have robots like HAL or Robby, who answer questions in a flexible and nonmechanical way. (Complimented on the nice high oxygen content of the Altair IV atmosphere by humans making small-talk, Robby comments dryly: “I rarely use it myself. It promotes rust.”) At that point, we’ll have to begin worrying about whether or not such devices are not the equivalent of animals, or perhaps are something more.

There has been argument here too, of course. Vinge himself has remarked that the super-accelerated mind of, say, a dog would still not be human.⁸ But we may note that dogs as we have known them are particularly crippled by a short attention span and a relatively poor memory, neither of which would be expected problems for a computer-enhanced dog-mind. Indeed, Vinge himself has recently written some excellent science fiction discussing the value of having monomaniacal attention-span at one’s command, if only one can also leave some executive functions in control of it.⁹ A dog is also notably crippled by lack of hands and by lack of brain circuitry that allows rapid recognition, identification, and use of sounds and visual symbols that make up language (chimps have some of this). Add all these things, plus some mental quickness and some training and teaching, and it seems likely that a dog will no longer be a dog. Just what it *will* become, given enough time and experience, is an open question.¹⁰

If we assume that self-programming ability follows processing power, very soon after the point that computers of human brainpower are mass-production items, we may expect that computers will attain the total information processing power of all human minds on the planet. They will have long since become the experts in the design of more complex computers, just as they are today the reigning experts at chess strategy. At some point not long after that, computers will recapitulate human history, human culture, and human thought. They will then teach each other everything we humans know in a matter of years (months? days? hours?) and then move on. If it happens at all, it will be in a flash, and it will certainly happen long before we’re really ready for it. The “flash” seems inevitable before the end of this century and seems quite probable (given even modest extrapolation) before the middle of it. And, of course, we’ll be unable to stop it, anymore than we can stop anything on the Internet. Before we know it, it will be done.

In theory, either full nanotechnology *or* the computational singularity might happen first. But regardless of the order, it seems probable that the other will immediately follow in consequence. Nanotechnology, after all, requires molecular-scale self-replicating computers, and such machines should rapidly be able to grow and wire themselves in three dimensions to the complexities needed for the singularity to occur. In a similar fashion, an evolved computer that is far faster and brighter than we are will soon figure out how to manipulate matter on the atomic scale with self-replicators and will then do so in service of other goals, unless actively prevented. Thus, nanotechnology, whether it arrives first not, seems destined to be the incarnate “muscle” of the singularity Artificial Intelligence.

One might imagine optimistically that we might prevent such a connection with safeguards that prevent superintelligences from interacting with the physical world, except perhaps by something like censored e-mail. On second thought, however, any careful isolation program may be doomed. We might as well expect a bunch of chimpanzee guards to keep humans from escaping from Alcatraz. If a superintelligent computer has enough

contact with the world to be very useful, it will probably have enough contact to subvert some of its captors into aiding it to escape. An Artificial Intelligence might amass wealth, for example, and with that wealth influence the passage of laws in democracies. It might also simply bribe outlaw humans and outlaw governments. People who imagine that governments can control superintelligent computers might consider just how much control governments today have over junk e-mail, the Internet, or very large multinational corporations. Self-aware computers (which will be running the more successful multinational corporations by that time) will be far faster and more slippery than anything we've dealt with thus far.

Penalties for Playing God or Wanting To

After such an escape of Artificial Intelligence or nanotechnology into the "real world" and private hands, then what? Mankind does not have a good record for handling destructive technologies. We have thus far avoided global exchange of nuclear weapons only by a hair's breadth and would not have come this far if *all* governments had nuclear weapons, and still less if all *people* did. Coming soon now, however, is something as pervasive as the personal computer and cell phone but with the power of mass destruction.

There is the problem of deliberate "bio" or "nano" warfare. Viruses and bacteria as we know them are already much like assemblers and can be engineered to be more destructive (imagine HIV with the infectivity of influenza). There is also the problem of natural replication mutation accidents that correspond with the emergence of new wild viruses, like Ebola, HIV, or even the latest strain of the flu. As in any self-replicating system, parasitical forms may emerge in nanotech systems. An uncontrolled self-replication/assembler system can be imagined. It popularly manifests itself in the prediction-genre as a creeping, corrosive *gray goo*, a kind of undifferentiated assembler-cancer. Such stuff causes disaster, because like some super-corrosive bacteria or slime mold, it exists merely to transmute anything it touches into more of itself. Some say the world will end in fire, some say in ice (as the poet Robert Frost writes). Now, there is a third and more insipid option: perhaps it will all just melt into corrosive amoeboid sludge.¹¹

Those who favor fire may note that easy manufacture of nuclear weapons by uranium isotope separation should be a fairly straightforward subset of self-replicative manufacturing technology; yet no foreseeable technology, including nanotechnology, can provide a defense against such weapons. So there are many ways in which the coming world will get scarier.¹²

Very well—perhaps we have to "Let go" and "Let God" (as a bumper sticker says). Perhaps the advanced machines will end up doing everything for us, and in true *deus ex machina* style, everything will be fixed up and come out all right in the end. We like such endings. Culturally, the relative closeness of the singularity has visited on its truest believers much the same effect as belief in the imminence of The Second Coming. The complex set

of apocalyptic ideas, which parasitizes and sometimes immobilizes adherents to certain brands of Christianity, now in other guises seems to handicap certain alarmists and "cybernetic totalists" (to use Jaron Lanier's phrase) with visions of Technological Salvation, or Techno-transcendentalism. First it was Cryonics, then Nanotechnology, and now Singularity (all capitalized as religions, or at least political affiliations) that will get us to the "End of Time." And all perhaps without the conventional God. All of these ideas can serve as an apocalyptic religion, if conveniently simplified and the most scary parts are left out. We are promised the apotheosis of mankind.

At least the techno-evangelicals don't wear placards saying "**THE END IS NEAR / REPENT NOW!**" Actually, there doesn't seem anything much to *do* in the Religion of Singularity except spread the Good News (hence, perhaps, this essay). And, of course, one must believe. To be sure, there exist some who do seek to bring a more critical eye to the whole idea-set.¹³ Still, the whole thing does cause a certain amount of unease.

It's easy to place the sources of that discomfort. To begin, what will be the nature of these coming AI superintelligences? Will they be nice, or will we get, instead of *Forbidden Planet*, perhaps *The Forbin Project*? or *Terminator's* Skynet? Is there nothing else to do in the way of safeguards?

In *Forbidden Planet*, Morbius's powerful robot servant *Robby* has been explicitly constrained by Morbius to observe Isaac Asimov's "Three Laws of Robotics" [Editor's Note: The Three Laws of Robotics are as follows: (1) A robot shall not harm humans; (2) A robot shall follow human orders except in the case where such orders would conflict with the first law; and finally (3) A robot shall seek to preserve itself, except in such case where its actions would conflict with either the first or the second laws.] The Krell Machine, by contrast, is an infinitely dangerous servant precisely because it has not been preprogrammed with the Three Laws in mind, and the Krell evidently appear to have made a monumental error on this point.

We would like to take a precautionary lesson from the noble Krell. Could we perhaps hardwire Asimov's Three Laws permanently into machines that are smarter than we are? Alas, it may be that the answer is "No" for machines that "rewire" themselves, which is what they will have to be capable of if they ever *are* to become smarter than we are. Here is the rub of AI: we cannot directly program minds to be better than ours because we don't know how, and if they program themselves through learning, we won't then fully understand them and certainly won't then be able to perfectly control them. There is no such thing as immutable "hardwiring" when software is in control. Anything created by evolution may be *uncreated*, or gotten around, by a similar process (as Asimov himself pointed out in later life, on thinking about the future of robotics). In creating superintelligent robots, we can only face the key problem of every responsible parent and place our hope in the Hebraic injunction: "Train up a child in the way he should go, and when he is old he will not depart from it." Or will not depart too badly, we hope.

And what about the other Krell lesson? Leaving aside what

the computers may want, what about what *we* desire from the genie? What if the fates punish mankind by giving it what it wants, on both conscious and unconscious levels? Our experience with children and animals, not to say ourselves, makes us suspicious (to say the least) of what occurs then. The effects of our present fad- and impulse-driven market economy (not that the author sees better alternatives) on ourselves and the biosphere are frightening enough. What happens when these effects and externalities all become infinitely amplified via technical means?

According to our cultural mythology, both before and after the advent of science fiction literature, poets have classically laid heavy penalties on those humans who sought to steal knowledge from the Gods. The penalty is ostracism and worse: (1) Prometheus was chained to a lonely rock and tortured; (2) Adam and Eve, according to *Genesis*, were punished for their sin of disobedience by being evicted from the Garden of Eden and sent to an uncharted Earth, which prevented them from subsequently eating of “The Tree of Life” and achieving immortality (becoming like God Himself). “He posted a *cherubim* to the East armed with a ‘whirling and flashing sword’ to guard the path back to the garden lest they seek to return.”

Science fiction, as we know it, properly began in 1818 with *Frankenstein; or, The Modern Prometheus*, in which the monster, as a price for its unnatural science-given life, is cast out of society to wander—forever looking through the window at the celebration, forever seeking one of its own kind to talk to or to love. The monster suffers the social tortures of adolescence, and Mary Shelley, we may not be surprised to learn, was a motherless child who wrote the book while herself still a teenager. Shelley, in her later writing, sought other expressions of alienation: one of her works (*The Last Man*, 1826) features a man who is all alone on a completely depopulated Earth. Since Shelley, the ruined or deserted Planet, from Nuclear Winter to Silent Spring, has naturally come to be associated with visions of higher technologies and the far future (for example, H. G. Wells’s *Time Machine*, 1898). The Krell Machine in its many forms typically inhabits empty worlds (just as Prospero, in *The Tempest*, inhabits a nearly deserted island). Krell Machines of various kinds sit unused and lonely in the ruins of lonely cities on the edges of forever—their former users having either been destroyed or left to follow their dreams, leaving the shards and husks of more mundane realities behind.

Perhaps the image of a “wasteland containing a doorway” is a fictional metaphor that arises from our childhood experiences of being lost outside the home in a world we do not understand. Certainly it makes for a better story to be faced with a functional alien artifact that has no user’s manual. Larry Niven’s early short story “Wrong Way Street” (1965) and Frederik Pohl’s *Gateway* novels (1977–) contain an entertaining use of this plot device: long vanished aliens have left a deserted space port, and some of the semiautomatic spacecraft still work.¹⁴ Push the button and you go to wherever that ship is programmed to go (now, which of these thingamabobs do you suppose is the *fuel gauge*...?). Such mysteries are always dangerous, and they are not always resolved. In

Algis Budrys’s novel *Rogue Moon* (1960), humans use disposable duplicates of themselves to explore a large and still-working maze-like alien machine found on the moon. The moon artifact kills people who explore it in various gruesome ways, apparently as a side effect of a true design function that humans never do figure out.

It does seem to be a nearly universal idea in science fiction that the result of attaining ultimate technological power must be that those who have access to it vanish like 16-year-old boys with car keys. We don’t always know where they go, but their disappearance is expected. Stephen Spielberg’s movie *AI: Artificial Intelligence*, a film playing in theaters as this essay is written, typifies a now-standard mystery form. *AI* is a straightforward retelling of the *Frankenstein* story, with all of its subtexts of social isolation, child-abuse, and creators who fail to live up to their responsibility. The protagonist, an artificial child, is abandoned like an unwanted pet to wander the Earth as an outcast and finally is put out of his misery by being accidentally cryopreserved. (Shelley’s original *Frankenstein* also begins and ends in the arctic, as a metaphor for isolation and loneliness.) When the robot child wakes, humans have vanished, the cities are in ruins, and the child is surrounded by alien mechanoids whom he still asks pitifully for his human mommy.¹⁵ That’s meant to give you the creeps, and indeed it does. *AI* has not done as well at the theaters as it could have, possibly because, like the robot-child himself, the film jerks too many human emotional strings and does so too vigorously and too artificially.

We frequently do not know where civilizations go when they hit the singularity in fiction, but sometimes they leave behind deliberately cryptic messages. For example, in Robert Forward’s early treatment of the idea (*Dragon’s Egg*, 1980; *Starquake*, 1985), the alien action is set on the surface of a neutron star. The indigenous intelligent life is somewhat like an electronic computer, inasmuch as their nucleonic brain “chemistry” allows them to think a million times faster than humans can. In these novels, humans initially arrive in orbit around the neutron star to discover the inhabitants in a very primitive state. The humans, however, cannot visit the star’s surface due to its fantastically high gravity, but somehow communication is established. As the neutron-star creatures are taught by humans, however, they rapidly assimilate our culture, and, just as rapidly, surpass us. Then, suddenly, to the surprise of the starship crew, the world below them is empty. The aliens have reached their own “singularity” and (of course) disappeared. They leave behind nothing, save for a few condescending clues, the litter of “Ascended Beings” who now don’t wish to interact with primitive humans, until we are ready. This occurs in a novel published a year before *Marooned in Realtime*, so the idea was current in certain circles by then (Vinge, for one, had been talking it around for a few years). The ultimate humiliation may be an empty world containing vestiges of advanced beings who *could* talk to us if they wanted to, but don’t seem to *want* to.

We’ve seen a similar theme in *Forbidden Planet*. The superhumanly intelligent Dr. Morbius is a creator beyond good and

evil, and he doesn't at first want to communicate with ordinary men. There is something of Nietzsche about him. (Why else is he a *philologist*?) He has come to identify with the superhuman. The human I.Q. does not impress him, for his own brain has been augmented by the Krell Machine, which is an intelligence-enhancer as well as a physical-realizer of ideas. Morbius's technology and his intelligence are in the realm of magic, a la *Clarke's Law*, and at the end of the film, Morbius wears the wizard robes of Shakespeare's Prospero to illustrate this. We are fascinated that, like Prospero, Morbius has difficulty escaping his own animal passions, as even a much more advanced species on Altair IV could not.

In *Star Trek's* most light-hearted invocation of the Krell Machine (Theodore Sturgeon's "Shore Leave," 1966) the crew of the *Enterprise* land on an apparently empty planet only to find that it hides machinery that has the job of making fantasies into realities. After being harassed by the incarnate results of their idle thoughts, the crew finally encounters the planet's alien owners. The Owners use the technology for recreation (and for medical care—they repair a "dead" Dr. McCoy as easily as any machine). But they tell Captain Kirk that they (the Owners) are too advanced to meet humans: Now run along and play—but thanks for asking.

As with the scenario of nuclear war, it is traditional for planets to come out of the other side of the singularity depopulated, or worse. Science fiction is full of cautionary wastelands and ruins, markers of a time when humans stole Promethean fire and were burned by it. Authors of science fiction, for their part, write *past* the singularity simply because it's nearly impossible to write convincingly *into* it and keep a good and readable story with characters that we can care about and identify with. It's too strange. But there are many "fly-bys" of such apocalypses in the genre.

Childhood's End, the 1953 Clarke novel mentioned earlier, contains one. If "alienation as the price of technical advance" is the primal theme of all science fiction¹⁶ then it can be added that Arthur C. Clarke's story plots (in particular) often involve alienation with some continued and distant communication. Clarke's characters are often beyond help, but they can always still talk while they are trapped or while meeting their seemingly inevitable doom. In *Childhood's End* the role of the outcast monster is played by alien creatures called the "Overlords." The Overlords are inhumanly intelligent and ethical but physically unlovely beings who are destined never to be able to make the evolutionary leap to higher consciousness and who must therefore spend eternity on the outside of the party looking in. They are alienated aliens—monsters who are troubled with their own monsters. At the end of the novel, the last man on Earth stays to fatally witness mankind's transition to higher being. He continues to talk by radio through the last minutes of his life to the retreating Overlords, as the Earth itself begins to become transparent, in a scene that reminds us once again of Altair IV, the wizard Prospero, and some of the more famous lines from the play that was the inspiration for *Forbidden Planet*:

*Our revels now are ended: these our actors,
As I foretold you, were all spirits, and
Are melted into air, into thin air:
And, like the baseless fabric of this vision
The cloud-capp'd towers, the gorgeous palaces,
The solemn temples, the great globe itself,
Yea, all which it inherit, shall dissolve,
And, like this insubstantial pageant faded,
Leave not a rack behind: we are such stuff
As dreams are made of, and our little life
Is rounded with a sleep....*

And this is all we can really say, as Earth or Altair IV disappear in the aft-viewplate of our imaginations. The problem with the singularity is that there is apparently no way to "survive" it (pace the tongue-in-cheek Vinge subtitle *How to Survive in the Post-Human Era*¹⁷) because it is the nature of the singularity to change beyond all recognition even the basic concepts of humanity, life, individual identity, and survival—particularly "individual" survival.

A central problem in our imagination of what the singularity might be like is that the interfacing of brains and computers in the singularity must result in a vicious melding of various kinds of minds. Vinge remarks that "[a] central feature of strongly superhuman entities will likely be their ability to communicate at variable bandwidths...." This is a safe and nearly tautological prediction, for breadth of bandwidth is all that defines whether *communication*, as we usually understand the word, is taking place at all. *Communication* is generally not a word we use in connection with the mind's *internal* affairs. "Communication" therefore requires two or more minds—yet if bandwidth is too high, individual minds must disappear and only one group-mind is left. Thus, within a grouped computational being, minds and subminds are *defined* only by bandwidth. Imagine being "you" only when you close the door on the party, or they close the door on you. If the door is opened wide, however, "you" cease to exist, and you and they become part of a Larger You (or collective *Us*).¹⁸

Such Borg-like problems plague our predictions. So much so that writers considering the very far future have had to split some powers of technology off in order to have any recognizable human culture to deal with at all. For instance, Frank Herbert, in his *Dune* series, simply outlaws machine intelligence. Too much telepathy and too much technology make it difficult to generate recognizable dramatic tension, which comes from recognizable characters with problems we can care about.

One more empty-planet novel will serve as a final example. Arthur C. Clarke's novel *The City and the Stars* (1956, contemporaneous with *Forbidden Planet*) deserves mention as anticipating many ultimate technologies. This novel is set a billion years in the future, in a utopian metropolis called "Diaspar." Diaspar's machinery can manufacture anything on demand, including human beings. Indeed, the city's very inhabitants are a random collection of people from the much greater store available in the city's memory banks, something like books circulating from a

central library. Each inhabitant lives a thousand years but also recovers his old memories from previous incarnations, giving him functional immortality. And yet, the novel's main character, restless to explore, eventually escapes his version of the Krell Machine. Outside Diaspar, he finds the traditionally empty Earth, uninhabited except by a few mentally advanced communities of humans. These people deliberately eschew technology and live a rural, somewhat Amish-like, existence, complete with normal human reproduction, normal aging, and standard death. Significantly, however, they are telepathic and thus experience a sense of community and communal immortality that they find to be satisfying replacements for technological immortality. Thus, Clarke's immortal Diasparians pay for their technical utopia with severe communications and social isolation problems and with no way to satisfy the urge to explore. It is difficult to imagine the kind of lifestyle that would result if they were not thus crippled. Yet the sum of both Clarke's alternative worlds is exactly what we must contemplate for ourselves—not a billion years from now, but very possibly in the next century.

Using the name *singularity* to describe such a state-of-being is appropriate because, as is the case with a black hole, the singularity looks different depending on whether it is viewed from outside or from the point of view of an observer falling into it. We have readable fictional scenarios only for the outside. For all we know, however, perhaps *these* are the futures that will ultimately come to pass for mankind. After all, it is by no means certain that mankind will either be destroyed *or* entirely uploaded/assimilated into something nonunderstandable. There is a third possibility: mankind might be left in the dust like those old computers (or toys) in your garage that you're never going to play with again (Spielberg and Aldiss work this "*Puff, the Magic Dragon*" theme masterfully). If the singularity had been called the "Techno-Rapture," it should be remembered that a fundamental feature of the Rapture is that some go, while some are left behind.

Will those who wish to go into the singularity have a path to do so? One of the key issues determining what kind of future we get may be the timing of the development of a full brain/computer interface. Whereas computers may be made to talk to one another with relative ease, the human brain is not wired to accept or process input more complex than sensory data. Indeed, in *Forbidden Planet*, all but a few human brains overload and burn out when exposed to connection with the Krell technology.¹⁹ It will not be a trivial undertaking to directly connect brains with computers or to technologically connect brains with one another (mechanical telepathy). Virtual reality is technically simple compared with, say, constructing a system in which one can sort through and "remember" items in a computer database as easily as sorting through one's own memories. Thus, it may be that the planetary web of computer systems will exceed the sum of human intelligence well before the interface problem is solved. If events happen in this order, it will be up to the Artificial Intelligence, not mankind, to figure out how to put the full link between machines and

humans safely into place. There is no guarantee that the singularity AI will choose to do so.

There are dark possibilities at this point. Perhaps the Artificial Intelligence will simply protect itself and impatiently go on, without us. Perhaps (worse) it will even leave humanity behind some kind of technological lock, in order to prevent development of the computational power necessary for such uncouth creatures as ourselves to follow. Singularity-struck societies that leave any intelligences "behind" may even represent a kind of threat to the ascended beings who have gone before. Such stuttering "techno-adolescent" societies could be expected to attain new technical singularities regularly. With each one, they would unleash new species of Ascended Intelligences. Might some of these be pathological? The jury is out — it seems too early to guess. But if so, such societies might therefore be under careful watch by those who have gone before. They may, conceivably, even be under quarantine.

"What?" you say. "Surely these machines will let mankind 'upload' or mind-link with them and join the party.²⁰ Won't they? They have to!"

Er... don't they?

If not, we can glimpse *that* future — it's the main one we are familiar with from science fiction. And, likely, also familiar with from some of our own early adolescent experiences of being shut out of the world of adults. We know what things will look like then. They will look like being locked out by an intelligent computer ("Open the Pod Bay Door, HAL!") who not only controls our technology but also tells us that conversation can serve no further useful purpose.²¹ Mankind would then forever be the chained Prometheus, forever the orphaned and lonely Frankenstein's monster looking through the window—the subject of the ultimate snub. Indeed, we would be forever Caliban, left alone on an island Earth, with the wizards gone—and not even comforted by the whisperings of spirits that have long since been freed.

1

What will happen when humans gain the ability to manufacture nearly anything we want, and when our machines surpass our own intelligence? ...

NOTES

¹ E-mail address: sbharris@ix.netcom.com. The author appreciates any constructive feedback. This article reproduced by permission of Sceptic Magazine (scepticmag@aol.com), P.O. Box 338, Altadena CA 91001.

² For example, In Arthur C. Clarke's *2010: Odyssey Two* (1982), self-replicating all-purpose monolith machines, the alien Krell Machines of this tale and its successors, turn Jupiter into a small star. The humans in Jovian orbit get away just in time.

³ Feynman's original talk, delivered in 1959, was later published in CalTech's *Engineering & Science* (February 1960). It is available at <http://www.zyvex.com/nanotech/feynman.html>.

⁴ <http://www.zurich.ibm.com/news/96/n-19960112-01.html>. Drexler first published in the peer reviewed journals on molecular manufacturing in 1981. Readers interested in the history of and current progress in nanotechnology, including most issues discussed in this essay, should refer to <http://www.foresight.org>.

⁵ A human being is not the atoms that constitute him, any more than a novel, an insubstantial thing, is the atoms making up a particular physical book or audio tape. Atoms in the body are replaced in metabolism, but the person remains. In theory, all atoms could be completely replaced, and yet the *person* would still remain, as a *pattern*. A human being is information, not matter. Such information can theoretically be extracted on a molecular scale, sent from here to there, and reconstituted as a pattern in new matter.

To make an "effectively identical" duplicate of a person, such a process doesn't have to be done for each individual atom in a body because most positions of most atoms in a person don't make any differences that we care about. For example, protein molecules and cell organelles can be produced as generic copies of a single design, once identified by position. (For example, a person might have fewer than 70,000 different protein designs (genes), so most of his protein information will be in how each design has been modified by post-transcription mRNA splicing and post-translation chemical modification, and there each protein molecule has then been placed.) On a larger scale, many cells and even tissues can be generically specified the same way—for example, you probably don't care if all the glomeruli in your kidneys are replaced by many exact copies of a few of your best-performing ones. The important information in transmitting a human being will be in the connections of his or her neurons and the information regarding the delicate modification of proteins in the synapses. These form memories, some of which are not shared by any other human, and are thus irreplaceable. Some parts of a copy count more than others, if you care about performance. For example, if we want a duplicate player piano to play a recognizable piece of music, we must be particularly careful about the position of the holes in the new piano scroll but may be less careful about things like what the keys and pedals are made of, how the piano is painted, etc.

⁶ Vernor Vinge was also among the first to point this out, in his 1981 short story "True Names." For the 20 years since that publication, several subgenres (for example, W. Gibson's 1984 *Neuromancer*) have explored the ways in which power inside a computer network may give power in the external world. The

recent film *Matrix* (1999) is a descendant of this tradition, highlighting ways in which programming power and physical power will meld in the future.

⁷ Vinge's essay is available at <http://www-rohan.sdsu.edu/faculty/vinge/misc/singularity.html>.

⁸ *Ibid.*

⁹ See Vinge's 1999 novel *A Deepness in the Sky*, in which humans wait above an alien planet, patiently teaching, until the culture below progress to equal that of the space-farers. Vinge's chief horror-source in this work—the idea of finding yourself with full intelligence but slave to the grip of a monomaniacal madness, goes back in literature at least to Edgar Allen Poe's 1835 short story "Berenice" (<http://bau2.uibk.ac.at/sg/poe/works/berenice.html>).

Interestingly, this particular Vinge novel does not posit singularities when civilizations grow sufficiently complex but rather suggests inevitable breakdowns involving bottlenecks in communication within civilizations, leading to collapse and barbarism, much like Asimov's *Foundation* series (see the history of the Roman Empire).

¹⁰ I suspect that such augmented animals, even if never capable of formal operations, may yet advance far into progressive academic political thought.

¹¹ If this happens, all is not quite lost. There is a minor consolation in that one suspects that gray goo will be subject to the same evolutionary pressures as the rest of life and that (even if it arises) it won't stay primitive forever.

¹² Uranium isotope separation is more a physical than a chemical process, but it is still amenable to processes that could be performed on a small scale and then duplicated into practicality by a self-replicating manufacturing capability. The special problem with nuclear weapons is that they generate temperatures of tens of millions of degrees, and therefore no imagined material can stand up to them. For gray goo or biowarfare weapons or accidents there is always a possible nanotechnological defense (in the literature, police nanomachines are naturally known as blue goo). However, a defense against actual nuclear weapons falls into the realm of techno-fantasy. Such a defense joins science fiction ideas like faster-than-light travel and backward time-travel as a technology that would require new physics, or new kinds of matter, and that may therefore *never* come to pass. This is in sharp contrast to the rest of the engineering developments discussed in this essay, which require technical progress but no new physics.

Under threats of various kinds of mass destruction in the hands of individuals, many preemptive defenses will be tried. Partly due to security concerns, it is another inevitability of the future that, shortly, none of us will have much privacy. People who have lived through the last 30 years have already noticed that the increasingly computerized world is rapidly developing a certain "lack of slack," as information regarding anything you've ever done that created a record anywhere threatens to become almost instantly available to nearly anyone who has money to pay for it. Many public places are now under continuous video surveillance, and very soon they all will be. With computer visual image-

recognition, soon the power will be available to track your travel and all your public activities, just as we now track 18-wheelers on the highway. It's all a matter of processing power, which (as we have seen) discounts at 50 percent a year, year after year. If it's expensive to keep tabs on you now, it will be half as hard next year, a quarter as hard the year after that, and so on. Efforts to stop it will be subjected to far more resistive economic pressures than efforts to stop junk mail and junk e-mail, and we've seen how effective trying to do that has been.

¹³ See www.SingularityWatch.com. The SingularityWatch organization has been attempting to develop an "Academic Conference on Accelerating Change" by getting multidisciplinary scholars to more objectively evaluate the quality of evidence for "technical acceleration" of the kind that feeds on itself. My particular thanks to John Smart, organizer of the SingularityWatch.com site, for many helpful comments on this essay.

¹⁴ The 1965 Niven story is notable for describing alien technology that is able to grow crystals of any type and size "atom by atom" from basic building materials. Again this is the vision of Robby the Robot. But Niven thinks bigger—he describes *rocket motors* thus made from single diamond crystals—as it happens, the exact image of techno-wealth that will figure prominently in the popular work of K. Eric Drexler a generation later. Unlimited rockets and gems: the message is that nanotechnology has something for everyone; for *him* and for *her*.

¹⁵ Stanley Kubrick, in true *2001: A Space Odyssey* style, has given us an ending that is rather ambiguous and frustrating, unless one knows something of the original script conceptions. For these, see <http://www.visual-memory.co.uk/faq/index2.html>. The creatures at the end of the film are meant to be advanced Earth robots, not aliens. The problem is that they know so little of their own origins that they may as well be aliens, and they essentially function in the plot as such.

¹⁶ Brian Aldiss suggests only that the central theme of science fiction is *alienation*, but the connection of alienation with technology is certainly implied and understood. See Aldiss's excellent science fiction review "The Trillion Year Spree" (with David Wingrove, 1986). Aldiss also happens to be the author of the 1969 short story "Supertoys Last All Summer Long," upon which Kubrick/Spielberg's AI film is loosely based. In the 1995 movie *Toy Story*, we experienced the dramatic tension of intelligent toys (*beings*) being treated as mere toys (that is, *asthings*, not people). Aldiss and the movie *AI* work this theme even more explicitly, since the android-makers in the film, now in the role of Dr. Victor Frankenstein, are fully aware of what they are doing. We have also memorably seen this in Ridley Scott's 1982 film *Blade Runner*.

¹⁷ See Vinge's essay at <http://www-rohan.sdsu.edu/faculty/vinge/misc/singularity.html>.

¹⁸ See Alfred Bester's *Demolished Man* (1953) for one of the earliest and best views of a fully telepathic society. Individuation will be something of an act of will in such circumstances. Although we cannot predict what life will be like on the other side of the

singularity, we may guess that social strife in the style of "who's not talking to whom" may long survive problems of physical want, or even problems of mortality, in our future.

It is worth noting that, so long as our present notions of physical law hold, there will still always be circumstances in the future where physics dictates no choice in these matters. The physical size and mass (self-gravity) of any "ordinary matter" computer structure eventually must limit the maximal complexity of the computer, and on these distance-scales, the speed of light must limit the bandwidth of two-way interactive communication *between* maximally large and complex computers (minds). In the future, it may be comforting to know that the day of the individual will never completely pass, since some kind of individuation on the fastest time-scales seems destined always to be enforced by communications delays. Arthur C. Clarke, Brian Aldiss, and Vernor Vinge have all written fiction in which this is an explicit subtheme.

¹⁹ Brain burnout from brain-boosting connections is common in science fiction—for other examples, see Piers Anthony's *Macroscope* (1969) and Vernor Vinge's *Fire Upon the Deep* (1992). The Vinge novel is particularly interesting in that it treats several cases of individuation forced on group minds by communications problems, as discussed in the previous note.

²⁰ People who are tired of the ills and emotions of the flesh may wish to simply transfer their consciousness to mechanical bodies and be done with it, as Moravec suggests seriously in *Mind Children*. See William Butler Yeats's "Sailing to Byzantium" (1928) for an early romanticized view of this option. An especially creative cyber-existence science fiction tale, in which a man's consciousness is uploaded into an animal and finally a computer-world in which he can have his every fantasy, is John Varley's *Overdrawn at the Memory Bank* (1976). For an excellent book-length fictional treatment of this theme, see Charles Platt's *Silicon Man* (1991). These tales explore one type of scenario in which human consciousness is mechanically separated from human flesh. They do not treat the far more complex situation (because there would be no understandable story if they did) of what may be expected to happen when human and "machine" consciousness become intermingled and interconnected to any extent desired and when manufacturing capability makes the distinction between synthetic and biological "bodies" no longer meaningful either.

²¹ For a delightful romp through many of the possibilities discussed in this essay and more, the author suggests Damien Broderick's book-length treatment of these problems in *The Spike* (2001). Broderick points out that engineer and nuke-designer Theodore B. Taylor first called self-replicating von Neumann devices "Santa Claus Machines" in a 1978 essay. Here he was discussing the use of such devices to mine the moon—probably the entry point for the (then) space colony enthusiast K. Eric Drexler, who would begin writing just three years later about *miniature* Santa Claus machines.

An Explanation of How the Mind Is the Brain

by David Pizer

David Pizer

Age 60

Occupation: Auto Upholstery Stores, Real Estate investor,
motel/resort owner

David is presently constructing a conference center an hour north of Phoenix. He hopes to have many cryonics and life extension conferences there. When it is finished in July of 2002, he will retire from his other businesses and live there, continue his education, and promote cryonics full-time.

He became a cryonics suspension member of Bay Area Cryonics in the early 1980s. That company has now changed its name to ACS. He switched to Alcor in 1985. He became a member of the Board of Directors in 1990 and was also Alcor's treasurer and later its vice president for nine years.

In 1988 he was arrested and held in custody with five of his friends from Alcor for refusing to cooperate with authorities who wanted to remove Dora Kent from suspension at Alcor's facility in Riverside, California. They prevailed and kept them from removing her from suspension. He later filed a suit on his behalf and on behalf of his five friends called Pizer vs. Riverside. They eventually received a \$90,000 settlement. A few years later, he was a key player in helping Alcor acquire its present building.

He is a graduate student at Arizona State University. He has a bachelor of science degree in political science and is working on an advanced degree in philosophy. His favorite areas are philosophy of mind and medical ethics, which he hopes to learn more about. Besides being an Alcor member, he has founded an organization along with his friend Mike Perry called the Society for Venturism. This is a philosophical organization that is concerned with the promotion of biological immortality.

If the conference center goes well, he hopes to construct a retirement center in the surrounding area. This will be a place for healthy cryonicists to come and retire and live an active life. He will also set up a small hospice where cryonics members can deanimate surrounded by like-minded immortalists. His goal is help make cryonics a common practice as soon as possible.

He has been married to Trudy since 1958, and they are both signed up with Alcor for suspension.

The object of this article is to show that the mind is a physical thing and not a nonmaterial thing. This is a first step in bringing people to the decision to sign up for cryonic suspension.

Introduction

In this work I will explain my hypothesis on how the mind IS the brain (or a part of the brain), and I call this theory: "The Mind is an Awareness Neuron Group." I hope to show that by postulating that the Awareness Neuron Group and the mind are one and the same, problems in areas of the philosophy of mind go away. When I talk of Awareness Neuron Groups, I am talking about the groups of specific neurons that are at the final end of a causal chain—their activation IS what we call "awareness." The distinction I want to make is that Awareness Neurons are the final step in being, and they are unlike (what I will call) unaware "processing" neurons, which are not part of the final awareness process. "Processing" neurons prepare the signals in a certain way so that a specific feeling of awareness (for example, pain, heat, hunger) is produced when the Awareness Neuron Group is activated.

In this work, I will purposely try to use words that do not allow for even the slightest dual meanings concerning mental and physical. Where it is not obvious, when I use the term mental, I intend that as a term describing certain physical things we sometimes label "mental."

First I will try to explain my concept of what the mind is—a physical Awareness Neuron Group—and then I will try to show how acceptance of holding this view can remove some of the well-known problems in the philosophy of mind, including multiple realization, machine functionalism, rigid designators, the Time Gap Argument, and others.

My goal is to investigate one step beyond Descartes's "I think therefore I am" to "I think therefore I am a physical entity"—to determine if the object of thinking can only be physical, and, therefore, the if mind can only be physical.

The Mind Is an Awareness Neuron Group

Somewhere in the brain are special neurons that work together in what I call an "Awareness Neuron Group." An Awareness Neuron Group is different from other neurons in that when these neurons are activated they produce what we would call "feeling" or "awareness." I think we can postulate the existence of these

entities by looking for causes and effects of awareness.

Awareness Neurons are more like receivers in a two-way system of sending and receiving. Think of a television set that receives signals and a television station that sends the signals. Many neurons are like the television station in that they process and send signals. An Awareness Neuron Group is like the television set that receives the neurons and then produces picture and sound. The difference, however, is that an Awareness Neuron Group is “aware” of the sounds and pictures that are part of its activation. Since the Awareness Neuron Group’s activation is the definition of awareness, and since the Awareness Neuron Group is the awareness of what is going on inside itself, the firing Awareness Neuron Group is the definition of self-awareness. The feeling of being aware is contained in the process of the Awareness Neuron Group’s firing, along with the sounds and pictures that are also part of its activation. So in the final description, we would say the Awareness Neuron Group is aware of the sounds and pictures that are being produced within it by the activations of the neurons in it. That means that there is an ultimate (but as-yet-unexplained by physics) explanation that will reveal how the sounds and pictures exist within the firing process of certain neurons. The only reasonable explanation is that the sounds and pictures that we experience do exist somehow as a part of the sparks, and/or chemicals, that exist within certain neurons. I think we can be more sure of the existence of a concrete picture of, for instance, a blue square that we see in our mind, than the blue square (perhaps a picture frame) that we might think exists, say, on a wall. Other neurons may process incoming signals so that the Awareness Neuron Group will fire in a certain way. However, it is the *activation* of the Awareness Neuron Group that IS the feeling of awareness in the brain. The fact that “I am aware” is one and the same fact that “My Awareness Neuron Group is activated.”

An Awareness Neuron Group is usually activated in a specific way after the original signal has been processed, so that the feeling of awareness (its activation) also has the content of what it is that it is aware of. So if an Awareness Neuron Group is activated by groups of neurons that specialize in processing pain sensations, the feeling of awareness that is produced will be a feeling of the awareness of pain. Feelings of awareness are usually, if not always, feelings of the awareness of something, including the awareness of self.

If an Awareness Neuron Group is activated by processing neurons that produce the sensation of sweetness, say while eating sugar, the feeling of awareness that is produced will be a feeling of the awareness of sweetness. Keep in mind that even if an external stimulus, say something that eventually causes a feeling of pain, were to activate receptor neurons and they sent the signal to be processed by other neurons, it is only when the final Awareness Neuron Group was activated that the person would be aware of pain. At that time, the person could say either: “My Awareness Neuron Group is now activated after having been stimulated by a signal that has been processed to cause it to fire in a certain way as to be an awareness of pain,” or the person could say, “I now feel pain.”

Separating Other Body Parts and Neurons from Awareness Neuron Groups

Just as the body can be seen as a support system for the brain, so can a part of the brain be seen as support and processing for the Awareness Neuron Group. In looking at the body as support for the brain, we see that the heart pumps oxidated blood and nutrients so the brain can survive. The digestive system processes food to collect the nutrients. The lungs provide the oxygen the brain needs. In this fashion most of the organs are seen as machines that help provide support for the brain. The eyes allow the body to see to navigate, get food, and avoid danger; the legs move the body around, and so on and so forth, all for the benefit of the brain and especially the Awareness Neuron Group.

Just as these parts are a support system for the brain, we can look at parts of the brain that are a support system for Awareness Neuron Groups. Some systems process signals that originate in the eyes and are then sent on their way to their final destination in the Awareness Neuron Group. In this way we can become aware of the external world. Similarly, some neurons receive sounds, other neurons process them on their way to their final destination in the Awareness Neuron Group. However, it is only when the Awareness Neuron Group is activated that a person is finally aware of a signal or stimulus. Other neurons may receive signals and process them in ways to finally cause a specific firing order, rate, and intensity in Awareness Neuron Group. Is our picture of reality accurate? We can assume evolution has caused our initial signal processing neurons to accurately activate the Awareness Neuron Group so that a reliable simulation of the outside world is realized and the organism can then successfully survive, breed, and raise its offspring.

One way my theory differs from some others is that I want to make a strong distinction in the dual meanings of words such as “pain” and “heat” and other words of sensation. When some philosophers talk of pain, they talk about it as either a cause or an effect (or as a cause and effect together). I would say there are at least two distinct meanings for the word *pain*. One is the ability of pain to cause a sensation and the other is the pain as we are aware of it. For instance, philosophers talk about pain as being “c-fibers firing.” I assume they got this from experiments where a subject was stimulated and said “ouch,” or “I am in pain.” The observers noticed that to make the subject feel pain, they stimulated his c-fibers. This leads to the hypothesis that “pain = c-fibers firing.” When philosophers try to defend this thesis they run into problems because their position of “pain = c-fibers firing” looks at “pain” as a causal entity. I think pain can be thought of as a causal entity, but it also has a separate meaning as an effect entity. And, the two meanings of pain are very different.

If we assume c-fibers are not part of the Awareness Neuron Group but are part of the processing that leads to them, we can then see that pain as a cause, where it causes us to feel a pain when the Awareness Neuron Group fires. But the pain that is the cause is not the pain we are feeling.

The pain that is the cause is one original activation (electrical

and chemical) that eventually causes the activation of the final Awareness Neuron Groups, and that second activation is the one we are aware of. The pain we feel is the Awareness Neuron Group firing in a certain way, depending on how the signal has been processed before it arrived in the Awareness Neuron Group. The specific way it fires (which synaptic connections are activated, how rapid the firing, what intensity) can be described by words such as pain. There are very distinct differences in the two types of pains. One has the feature of nothing being aware of it, and the other has the feature of something being aware of it.

What Is in Your Brain?

What is it that is in your brain when you see, say, a picture of a blue square? Let's say what we would call a square item, with what we would say is a blue surface, is before your eyes. The light is hitting it and reflecting to your eyes. You think you see a blue, square object. I would hold that when a person sees a blue square, his receptor and processing neurons have sent a signal to his Awareness Neuron Group and it has been activated. The Awareness Neuron Group is the mind and the feeling of seeing a blue square object is a concrete depiction of reality. At that time the blueness and squareness of the object do exist in the mind. They are a feature of the physical activation of the Awareness Neuron Group. A volume of these neurons has the qualities of the blue square. We know this because we see a blue square in our brain at the time. The neuron firing process is blue and square. Why can't scientists see this blue square when they look at a subject's brain when the subject is seeing the blue square? Because the scientists are "seeing" with their eyes or with very crude instruments compared to how our neurons "see." In other words, what looks like an electric spark, or transfer of some tiny molecules, to the raw eye or to crude instruments looks like a blue square to Awareness Neuron Groups. When we humans are able to build machines that function like neurons, these machines, when hooked to a person's Awareness Neuron Group, will see and hear and feel exactly what the subject sees, hears, and feels. We can't do this yet, but someday scientists will develop the tools to see the blue square in the brain of the subject. When we realize that the blue square in the brain is a composite of virtually infinite combinations of synaptic connections, at specific firing rates and intensities, we also realize it will take the manufacturing of extremely complex detectors to interpret the activation of neuron groups. Using today's technology these detectors might have to be larger than a galaxy to hold all the information about what is happening at any one instant in an Awareness Neuron Group. Only when we can build machines that work exactly like brains will these machines be smaller and be able to see the blue square in the brain as clearly as we see the original blue square.

How the Awareness Neuron Group Theory Affects Some Current Mind-Brain Philosophical Theories

There are various versions of "the body (brain) is the mind" theory, including token and type mind-brain identity theories.

(Tokens are concrete. Types are abstract.) These theories work with problems that arise out of versions of the statement: "pain = c-fibers firing." The statement mixes two meanings of the word "pain"—as a cause and as an effect. These meanings are often used interchangeably, which leads to problems in thinking about pain. There is one meaning of pain as a cause, and a different meaning of pain as an effect. When we hit our finger with a hammer, the pain that the receptors on the skin feel is causal pain. When it travels up the neurons to the brain, it is causal pain. When preliminary fibers in the brain process the signal, it is causal pain. When the signal activates the Awareness Neurons, it is then effect pain, and that is the only pain that we can ever experience. Causal pain is unfelt pain. It is only the effect pain that we feel. When we talk about the pain that we feel, and not the unfelt pain that causes us to feel pain, we should not postulate that "pain = c-fibers firing." Instead, we should say that the felt pain is an Awareness Neuron Group firing. The stimulus that activated the Awareness Neuron Group may have been prepared by nonaware c-fibers. (Note: even if it is discovered that c-fibers are in the terminal brain process, my theory would postulate two parts of a c-fiber—its beginning part [which is causal] and its ending part [which is an effect of feeling]). Again, I want to stress that there are two distinct meanings of the word "pain." There is one meaning, the causal meaning of the stimulus of pain. The causal meaning could be the cells of the skin making contact with a hot item. It could be the signal sent down the pathways on the way to the brain. It could be the initial processing of neurons. But when there is activation in the Awareness Neuron Groups, that activation is no longer a cause but an effect. That effect is the awareness of pain, the feeling of pain. The activation of the Awareness Neuron Group = (felt) pain.

One may ask that if (felt) pain is only the firing of Awareness Neurons, what happened to qualia? There is no problem here. "Qualia" like "awareness" or other sensation words is just another word for the statement "the Awareness Neuron Group is firing." Each qualia is the certain way that the Awareness Neuron Group fires. Since this way of thinking makes each human's sensation a unique sensation, the multiple realization objection (which sidetracked the popularity of the mind-body identity theory a few years back) is going to go away. With the Awareness Neuron Group theory, or some further developed similar theory, the mind-body theory may regain its popularity.

Briefly, the multiple realization argument rests on the idea that the same pain in one organism can be realized in a different way in another organism. So when the identity theorist, of olden days, said "pain = c-fibers firing," the multiple realization proponent would then say that there could be, and are, animals that don't have c-fibers but that can feel pain in the same way humans can. Therefore, since pain can be realized in other ways, pain is not c-fibers firing. And there is some truth to that conclusion, since there are virtually infinite different meanings of "pain." But my conclusion is different. First, the successful identity theorist has to make the distinction between pain as a cause and pain as an effect and take that to its logical conclusion: that every pain, in every entity is unique. Just as no two snowflakes in the universe are identical, so is the fact that no two pains in the universe are identical.

In humans, c-fibers may process a signal to eventually cause a feeling of pain. In dogs, d-fibers may be involved somehow in a causal chain for a dog to feel pain. But only with the activation of its Awareness Neuron Group, or its instantiation, can a thing feel pain. And since no two Awareness Neuron Groups are the same, not only are different species evolved to feel (perhaps slightly) different pains, but no two humans can feel the exact pain. And to its logical end, we must say that since no Awareness Neuron Group can fire exactly the same way two times, even a person cannot experience the exact same pain each time he feels pain. If a person has trillions of neuronal connections, intensity, and rate combinations, it is a virtual impossibility that the same exact state of a neuron's firing could ever be repeated. If you believe that you can't step into the same river twice, you must believe that you can't feel the same pain twice.

I am making a distinction between causing pain and feeling pain. I am holding that "felt pain = Awareness Neuron Groups firing" and that there can be no other way to feel the kind of pain I am talking about except in this way. If an organism seems to feel something that is like a specific pain, it is not a specific pain, it is only like a specific pain. For an organism to feel my type of pain, it has to have my type of Awareness Neuron Group. To feel my pain, it must BE my Awareness Neuron Group. Since no two pains are alike, and no two exact pains can ever be realized, there is no longer any multiple realization objection to the theory that the mind is the brain.

Since pains can be similar, people tend to lump them into groups. Joe's headache is similar to Jim's headache. Jim's headache is similar (but less similar) to Fido's headache. Fido's headache is similar (but less similar) to an ant's headache. As the Awareness Neuron Groups have similarity to one another, so is the relation of results they can produce.

The proponent of the multiple realization objection might say that it seems impossible that beings that don't have Joe's exact Awareness Neuron Group can't realize his pain. But that is exactly what this line of reasoning shows us.

Does Color Exist?

There are several theories about color:

1. Color is the relational property of emitting or reflecting light at certain wavelengths.
2. Color is the disposition of the object that has it, that it will reflect light we call color when white light is reflected upon it.
3. Color is a quality that we are directly aware of.
 - 3a. Awareness Neuron Group postulation is that color is a concrete entity that exists and is identical to certain neuronal processes, and we cannot know if color exists outside the Awareness Neuron Group.

Versions of "The Mind Is a Computer"

Some mind-brain theorists have tried to describe the mind through analogies to computers. They do this by trying to show

how a mind "functions" like a computer. The problems have been that a functionalist has to describe what a sensation is, say pain, through behavior. A functionalist differs from a behaviorist in that the functionalist will say the output may include some other mental states. But a lot of the problems with behaviorism are found in functionalism, and the functionalist claim of "some other mental states" needs to be clarified.

Objections to machine functionalism, like other objections to mind-brain theory, arise because they confuse the causal meaning of sensations like pain with feeling the pain. Let's look at unrefined machine functionalism and then see if we can refine it.

It is popular in philosophy now to discuss Turing machines. A Turing machine performs according to rules (depending on what state it is in) that govern what happens to certain input when the machine is in a certain state and dictates what the output will be, and in some cases, moves the machine to a different state.

The Turing Test is where the "blind" contestant (a person), tries to guess which black-box-type room contains a computer and which one contains a person. If the computer can fool a human (at least a normal adult) into thinking that it is a human too, then you are supposed to agree that the computer has a mentality or psychology similar to a human.

The machine functionalists hold that a particular mind is a realization of a Turing machine. The mind is a computer. Mental states can be identified with the internal states of the machine table.

According to Arizona State University Professor Theodore Guleserian (and I agree!), the (unrefined) Turing Test fails because it doesn't shed any light on internal processing, mentality, or qualia. There is no way to know, for instance, if the computer, even if it did fool a human, had any sense of awareness. (John R. Searle's Chinese room argument tries to point this out.)

Professor Guleserian's (and one of my) objections to the unrefined Turing Test is that computers don't understand real things. A real thing, for instance, causes you to behold it. A computer doesn't understand or work by rules that state that there has to be a causal connection between the thing, and your word that stands for it, and you.

I think we can help the mind-brain theory if we imagine a computer that operates like a Turing machine except that it uses an Awareness Neuron Group to do the work instead of plain, old, unaware neuronal instantiations of the Turing machine. How could we make a machine that we knew was as aware as we are? The only way to have even some confidence is to build one atom-for-atom just like us.

Rigid Designators

Saul Kripke brought up the problems of rigid designators. A rigid designator picks out the same object in every possible world—for example, Benjamin Franklin, Moses, Osama Bin Laden. Before Kripke, if most of the descriptions of a person were true, then a name was a designator. Kripke said that a rigid designator picks a feature by some expression, usually an accidental feature, of the person. "Ben Franklin" is fixed by the

description “the person who invented bifocals,” but this is not necessarily the meaning of the name. When you have two rigid designators (A and B), the statement $A=B$ (if true), is necessarily true in every possible world in which A and B exist. Kripke would say that if pain is c-fibers firing in this world then that is an essential feature of pain and so pain is essentially c-fibers firing—in every possible world.

Kripke declares a difference between pain and heat. He says the sensation of heat is an intermediary, where pain is the sensation we feel. Kripke describes the idea of pain as c-fibers firing as being internal and describes heat as molecules in motion as an external thing. However, with the theory of Awareness Neuron Groups and the two meanings of words like “pain” (the causal meaning and the effect meaning), now when we talk about the effect meaning of pain, the rigid designator has more meaning. It is not “pain” in general that is a rigid designator, but it is each specific pain that is a rigid designator. Your felt pain can only BE your Awareness Neuron Group firing. But that is different from the pain that initially caused the process to start. Also, Kripke’s distinction of pain and heat go away.

Examples:

Pain as a cause = bumpelbow. This sends a signal to the brain, which processes the signal and sends it to the Awareness Neuron Group, to fire in a certain way; when the Awareness Neuron Group fires in this certain way, pain is a felt effect.

Heat as a cause = molecules in motion. We touch the thing that has excited molecules and that sends a signal to the brain, which processes the signal and sends it to the Awareness Neuron Group, to fire in a certain way; when the Awareness Neuron Group fires in this way, that is feeling heat.

The Time Gap Argument

Some philosophers try to give an alternative view to the strict physical mind-brain theory by postulating a nonmaterial entity in the mind called *sense data*. First I will give their argument and then subject it to the Awareness Neuron Group thesis.

Say you are looking at a star in the sky that appears to you to be white, bright, and twinkly. And then you find out that science has shown that this particular star went out of existence a million years ago, but it is so far away that the light from this star is still traveling to earth, and you think you see what you assume to be the star’s qualities even though the star does not exist at the time you are looking at it. This situation allows for the Time Gap argument for sense data and dualism, which some say shows that the mind is separate and nonphysical. In the argument, the object of perception is the object (in your mind) that you are directly aware of.

The argument attempts to show that because the object of perception in your mind does not exist in the material universe outside your mind, the object of perception must therefore itself be a nonmaterial thing (whatever that could be). And, if you accept this, it will lead to the conclusion that the mind itself is a nonmaterial thing.

I believe the argument makes several wrong assumptions, starting with the assumption that the qualities you see in your mind/brain are those of the star, rather than assuming that those qualities are of neuronal processes that have been stimulated in some way. I will use the term *final neurons* to designate the last neurons that are stimulated in a long and complicated process; these are the ones that I claim produce the feeling of awareness of what we would call qualities.

I also believe there are other wrong assumptions with the Time Gap Argument, and I will attempt to expose them. First, the argument itself:

1. The object of perception is not the real object (for example, the star) because the object of perception can be perceived in absence of the real object (consider that the star went out of existence a million years ago, but the image is still being perceived by you on earth).

2. The object of perception is not the light from the object because the object of perception can be perceived in absence of light. (A device that records the signals being sent from the receptors in the eyes down the optical nerve could be hooked to your optical nerve, and the nerve could be stimulated in the same way that you perceived light even though there was none at the time. This could all be done in a dark room.)

3. The object of perception is not the retinal image or the optical nerve process because (in principle) the object of perception can be perceived in absence of these if a certain area of the brain were stimulated in a certain way to recreate this image in the brain. (You hooked a probe or sensor direct to the brain and knew how to stimulate the brain in such a way as to cause the brain to see a white, bright, twinkly star. Say you used a recorder that recorded which neurons fired when you were perceiving the white, bright, twinkly star and directly stimulated those neurons while in a dark room.)

4. The object of perception cannot be the terminal brain process (where there is no Time Gap involved), because the object of perception has qualities (whiteness, brightness, and twinkly) that the brain process lacks.

5. So the object of perception must be a nonmaterial, nonphysical representation of the real physical world.

6. Intuitively we know that only a nonphysical thing can be directly aware of another nonphysical thing.

7. THEREFORE: there must be a nonphysical mind or self that is directly aware of our representations of the real world (sense data).

Why the Time Gap Argument Seems To Fail

Premise 1 gives the wrong impression and sends one off in the wrong direction to search for what is the object of perception.

The Time Gap proponent is trying to show that your mind can contain representations of things that no longer exist, AND if those original things no longer exist, then they (the original objects) are no longer material, AND if your mind has representations of things that are not material, then those representations

in your mind are not material.

Most stars are perceived by the emitted light that eventually hits the receptors in our eyes, and those receptors then create electrical-chemical combination signals that travel through neural pathways. The signals are processed until they eventually stimulate our Awareness Neuron Group. The Awareness Neuron Group then sees what we think are (or what we would call) the qualities of the star—white, bright, and twinkly. But it is more reasonable to think that what we would call “qualities of the star,” are the concrete firing process of the Awareness Neuron Group. The Time Gap really shows us that it is more reasonable to think that what some people call the qualities of white, bright, and twinkly are concrete neuronal processes because we can see white, bright, and twinkly in our brains without the star existing as shown in Premise 3. Some sparks and chemicals, in motion, of the neurons are white. Some sparks and chemicals are twinkly. Some sparks and chemicals are bright. To take this a step further, some sparks and chemicals are pain, some are hunger, some are the thing that you see when you look at your family, some are the feeling of support from the chair you sit in, some are what you call the feeling of being cold. Every possible thing that you experience is a spark or chemical in your brain. To not accept this line of thinking, it seems to me, is to hold the old-fashioned and primitive way of postulating that everything that you can not yet explain is some immaterial, supernatural, or mystical entity.

Although the concept of Awareness Neuron Groups as the mind does not rule out these possible answers, it seems just as reasonable (perhaps a little more so) to theorize that we don't yet understand how the physical universe works well enough to explain how material things work, than to postulate that there are immaterial entities outside the physical universe that can have causal effects upon entities within the physical universe.

Premise 4 also seems wrong because under the Awareness Neuron Group thesis, white, bright, and twinkly, which is the object of perception, IS neurons firing. It isn't, and never was, the original object, even in examples of objects that we perceive that still do exist. Some stimulation from the original object (light waves from it, or recordings of it) is what stimulates the receptors that process and send electric signals, and those processed signals activate the Awareness Neuron Group to fire in a certain way, and that certain way of firing IS white, bright, and twinkly. Certain combinations of sparks and chemicals ARE what is the concrete

thing we would call white, bright, and twinkly.

Just because we do not yet know how to decode the virtually infinite number of connections and firing rates does not lead to the conclusion that they are not in there. All one should be allowed to conclude at this stage is that we don't yet know how they work. But the very fact that we see white, bright, and twinkly inside our brain is evidence that white, bright, and twinkly are there.

In my explanation, we say that the entities we call “qualities of objects” are Awareness Neuron Groups firing at specific rates and that we can experience them every time those final neurons are stimulated in some specific physical way (light waves, recorder, or other internal recording neurons).

Premise 6 is also built on the false assumption (relying on the fact that somehow along the way you have been fooled into thinking that) the white, bright, and twinkly that you see is a nonphysical thing, AND so your mind must be nonphysical also.

In conclusion, the Time Gap Argument fails because it assumes (or confuses) the idea that we can perceive things without a material cause. It assumes a (false) conclusion, hidden within a (false) premise, which is: “The qualities that we perceive are not terminal brain processes.”

Conclusion

There is a terminal process that I call (the activation of) the Awareness Neuron Group. These neurons may be single function neurons or may be combined with neurons that also do the processing, but it is more clear when trying to understand them to postulate them in isolation rather than as the second part of a two-part process of neurons. Someday we will specify the neuronal process that is an effect different from any cause, and that effect is awareness. And when better equipment becomes available, we will see and hear in our brains with this equipment the pictures and sounds that our Awareness Neuron Groups see and hear. The stuff that makes up the pictures and sounds we see and hear is the sparks and chemicals in the neurons or their synaptic gaps. We don't give up what we call “qualia.” What we think we feel that we call qualia under other theories, we still think we feel under this explanation, but we can understand that it is simply concrete electricity and molecules. 1

*Have an article you'd like to see published in Alcor: Reaching for Tomorrow?
Wish to share an opinion on something you've read in a recent issue?
Send your submissions to Lisa Lock, Editor, at:*

llock@winterthur.org

Alcor Outreach

Reception

The gathering at Kat and Dave Kekich's home in August 2001 was labeled the inaugural Alcor Outreach Reception. The specific purpose of the affair, other than social, was to give Alcor members and their guests an update of the status of Project Future Bound—Southern California. A fabulous time was had by all!



The hosts: Kat and Dave Kekich



The crowd



The spread!



*Jerry Lemler and
Hugh Hixon*



*Louise Gold, Maria Dugué,
and Gilda Cabral*



*Natasha Vita-More announcing
the upcoming Cryofeasts*



Anita Riskin and Michael Riskin



*Michael Hartl and
Bryan Hall*



Bobby June and Rachel June

A Tribute to Herman Kekich

by Dave Kekich

Dear Dad,

Did I ever tell you you're my best friend? No, I don't suppose I ever did. And I regret that. Will you forgive me?

You taught me to walk, talk, think, play ball, and to do just about everything useful and fun.

You fed me, clothed me, made sure I got through school, and took care of me when I got sick. You always made sure I had a comfortable and secure place to live. You were always there when I needed you. And you were always there when I needed a buddy.

But that's not why I love you Dad. Even though you worked two hard jobs making sure Carol and I had a better life than you had, I took every single thing you gave me for granted.

It wasn't 'til years after I moved away from home that I realized you were my best friend. Only after I had my own life did I get to appreciate what your best gifts to me were. You taught me the difference between right and wrong. You demonstrated the power of a smile and a cheery disposition. You proved to me the lasting value of strong honest relationships. You taught by example Dad. You showed me what hard work and earned reward was all about, and the fact that there's no such thing as a free lunch. And maybe best of all, you passed on the seeds of optimism that led me to Alcor... which in turn could hand you immortality one of these days.

You gave unconditionally to those you loved Dad. Your lifetime of generous acts laid the path to me giving something back to you. You brought me into the world. You gave me life. Then you gave me a head start. Now, it's my turn. By having you suspended, maybe I can pay you back. Maybe I can give you life again. Just imagine, the son bringing his father into the world. Then, it might be my chance to reverse roles and give you a head start your next time around.

We don't get to pick our parents. But if I had my pick of anyone in the world, you'd still be my dad. I love you Dad. I hope I'm half the man you are. If so, you'll get the same nourishing in your new future that you gave me when I started out.

All my love, your son,

Dave



A

Update

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End of the Year (2001) President's Report

by Jerry B. Lemler, M.D.

C

Greetings everyone! To say your Alcor Foundation has been busy this fall would be a blatant understatement. Perhaps the lone exception to this bold assertion would be the lack of suspensions, as we have had none since our last patient entered cryostasis back in August. Since then, however, we have been in contact with a Russian national member, who, along with his physician/friend/medical surrogate, made his way to Tel Aviv, Israel, and who now (fortunately) is receiving inpatient treatment for a significant cancerous condition in Houston, Texas. At one point in time a couple of months ago, we believed his condition to be critical—however, he has now been upgraded to serious. Additionally, Alcor performed two Standby operations in early December for Board Member Dr. Michael Riskin when he underwent angiography and subsequent five-vessel bypass surgery at St. Jude's Hospital in Southern California. Alcor deployed its newly formed (see below) Project Future Bound Southern California Team for these Standbys, headed by Russell Cheney, Project Future Bound Southern California Coordinator. Our thanks go out to not only Russell for his diligent preparatory work but also to other members of his team who directly participated and/or offered to be available and on call. These Alcor rescue members included Hugh Hixon of the Alcor Central staff, and Bobby June, Keith Dugue, Peter Voss, Louise Gold, Dr. Mark Schumacher, and Kathleen Bartlett in California.

O

You'll be comforted to know your newly elected (September 9, 2001) Alcor Board has been exceedingly busy. During the fall, in fact, we had personal visits from Board Members Saul Kent, Ralph Merkle, Michael Riskin, Stephen Van Sickle, Hugh Hixon, Carlos Mondragon, and Kat Cotter. Our Board Directors and Advisors have been of invaluable help to me in my first months as your President and CEO on any number of issues, and their advice and sagacity has been freely solicited and much appreciated.

R

As you will see in other sections of this magazine, the number of inquiries regarding possible memberships has shown a decided increase of late. This is, of course, gratifying, but as you know does not always translate into active memberships. Conversely, our appeal with respect to gaining in numbers has been showing a concomitant rise as well. The recent opening of Tom Cruise's movie, *Vanilla Sky*, has been a veiled positive, in that it portrays in a somewhat balanced way the possibilities of cryonics. As a corollary issue, it has come to our attention that our gifts and donations have not kept pace with the increase in memberships. We recognize the underlying reasons for this are multifactorial, yet we are forced to admit the statistics are somewhat discouraging. In 2002, Alcor will make a greater concerted effort to raise funds from its membership and friends alike, and you can expect a donor's program to begin in earnest early in the year. One family prominently stands out in the way of donations, and I would be remiss if I didn't acknowledge Robert and Rodney Miller of Montreal, Canada, who expressed their generosity to Alcor by increasing their gift designated to our marketing fund from their previous level of \$100,000 to this year's \$120,000. The extra money is being spent (in part) to hire Board Advisor Karla Steen as Alcor's first-ever Director of Marketing. Karla brings many attributes to the table, not the least of which is her infectious, ebullient personality!

Alcor has made several improvements in our communication systems over the last few months to the point where we are considerably a more "open" organization than we've been in some time. The first advancement was a revamping and upgrading of our telephone system, such that when you call us during regular business hours, you now have the opportunity to talk to a real, live, and hopefully breathing human being. You can

still access those individuals you wish to speak to via their voice mailboxes, but this is now an option and not a mandatory exercise. As you probably know, in September we began a "new" column on our web site (and on CryoNet) entitled "This Week at Alcor." This has been assiduously maintained by your Alcor staff on a weekly basis and lets you know what various members of our organization are doing and the projects they are working on. Additionally, the Alcor database is still being upgraded by Alcor Life Member Joe Waynick. This, of course, is a never-ending project and hopefully can be maintained to keep pace with our various needs. Our web site is also currently undergoing a major revision, with a scheduled completion date of mid March 2002. Along the lines of communication, I wish to thank Alcor Board Advisor and Ombudsman, Dr. Robert Newport, for conducting a series of three Communications Seminars with the Alcor staff. These were most helpful in generating more effective interpersonal professional communications amongst us all here at Alcor Central, and we certainly appreciate Dr. Newport volunteering his services free of any charge for this purpose.

Alcor continues to provide community service and education to our local colleges. Both Joni Adams and Bob Fern bring their respective college students from Ottawa University and Mesa Community College to our Scottsdale facility, where we present didactic lectures and offer a tour of Alcor to them on a regular basis. Alcor has also been featured significantly this fall in print and other media. There were very positive articles about us in the *Dallas Morning News*, *Popular Mechanics*, and *City Arizona* magazines, as well as a very nice feature on Brazilian television.

As many of you know, the new Alcor Advisory Committee is active in the completion of its assigned task. On Thursday and Friday, December 13 and 14, Charles Platt and Brian Wovk visited our facility and met with Hugh Hixon, Mathew Sullivan, and myself to initiate the fact-finding process, subsequently leading to the expectation of a written report in preparation for an augmented improvement of our cryotransport capabilities. These changes will have a ripple effect on Alcor procedures both in the field (especially as it applies to Project Future Bound Southern California and beyond) and at Alcor Central itself.

By now you will have received your copy of *Alcor Life Extension Foundation: An Introduction*, the first major revision of *Cryonics: Reaching for Tomorrow* since it was last published in 1993. I do hope you enjoy reading about the many facets of cryonics and Alcor in particular, and please keep in mind it is not meant to be a decidedly technical manuscript but rather to introduce prospective members to cryonics and Alcor in hopes of gaining their membership. To piggyback the new introductory book, Alcor is in the process of significantly revising our information packet to send to those who inquire about membership in our foundation. This should have a sporty new look to replace the rather drab materials we had previously been sending.

We believe our 47 patients in cryostasis are about as secure as we can make them at the present time. In view of the September 11 tragedies, one can never be completely fortified against all

potential evils. However, to render us more invulnerable (a relative term, naturally), Alcor has contracted with the ADT Security System and purchased more than \$30,000 worth of security and camera equipment. With the addition of this equipment, we are, in effect, decidedly more secure than we have ever been.

This fall we conducted two training exercises. On September 22, Grant Dahmer, Chairman of the Willed Body Program of the University of Arizona in Tucson, came to Scottsdale with an anatomical specimen inclusive of head, neck, and upper torso. Lead Alcor surgeon, Dr. Jose Kanshepolsky worked with Mr. Dahmer in training Alcor surgeons on the techniques of cephalic isolation and four-point cannulation. This was a very productive exercise, and we thank all those who attended. Additionally, Hugh Hixon accompanied me to Laughlin, Nevada, on October 21 to 23 to train Rick Armstrong's superb security team in the event of our member and benefactor, Don Laughlin, becoming medically distressed. The Laughlin trainees were largely EMT and related health care professionally trained individuals who showed an avid interest in the various exercises we put them through. I'd also like to thank Alcor ADR-A volunteer Joe Tennant for coming down from the Bay Area to participate in the teaching of the Laughlin staff.

Project Future Bound in Southern California is ready for action. Various equipment is being securely stored, and we have a reliable site location in Buena Park for Alcor procedures. Project Future Bound Southern California Coordinator Russell Cheney has assembled an excellent team of volunteers and surgeons, and their efforts will be augmented, no doubt, by the implementation of the recommendations of the Advisory Committee in the very near future. Our thanks also go once again to Joe Tennant, who along with Russell Cheney, helped train various members of the Future Bound team to enhance their certification from ADR-B to ADR-A status.

Personally, I have been on the road quite a bit over the last few months. On September 28, Hugh Hixon and I traveled to southern California to kick off the inaugural Alcor Outreach Reception at the beautiful home of Kat and Dave Kekich. We had a terrific turnout and a lively discussion of various facets of what Alcor has been doing. On October 14 I traveled to Sunnyvale, California, to meet with the northern California group at the home of Tim Freeman and Jane Zhu. Once again, it was great to see so many Alcorians with so much in common! I personally attended two of the five Cryofeasts. On Saturday, December 1, I flew to Philadelphia to attend the first (hopefully annual) East Coast Cryofeast, this one hosted by Lisa Lock and Michael Seidl at their home in Wilmington, Delaware. We had a most interesting crowd, consisting of Alcor members who traveled from as far away as Boston, Massachusetts, and Washington, D.C., for this event. I left early Sunday morning, December 2, to fly back to Arizona, where I joined the Alcor staff in traveling to Tucson to the home of Judy and Mark Muhlestein for an incredible spread and more cryonics festivities. Thanks go to all of you for hosting me as well as thanks also to Shelly and Richard Gillman for hosting the Seattle, Washington, Cryofeast, Tim Freeman and Jane Zhu for hosting

the Northern California Cryofeast, and Natasha Vita-More and Max More for hosting the Southern California Cryofeast. At the present time, Rudi Hoffman is in the process of arranging the first annual Florida Cryofeast (Outreach Reception), which will take place on Sunday, February 10, 2002.

Another issue of interest, on Saturday, December 8, Alcor hosted a higher temperature storage teleconference, inclusive of involvement by Hugh Hixon, Dr. Brian Wowk, Peter Voss, Louise Gold, Hara Ra, Stephen Van Sickle, and myself. This two-hour teleconference was a most enlightening event, and the upshot of the experience fell to Hugh Hixon to design a prototype storage vehicle for those members who would eventually prefer to be stored at higher than LN2 temperatures. Further meetings will address the practicality and costs of such a venture as well as the ongoing storage limitations and ramifications.

Alcor is very proud of its new monthly magazine, the resurrected *Alcor Phoenix*, now published under the name *Alcor Forum*. Collaborating in this effort have been renowned professional writer Charles Platt and Alcor's very own engineer-in-residence, Hugh Hixon. Two editions were released this fall, and every effort is being made to promote this publication on a monthly basis, and a give-and-take repartee among our foundation, our members, and the public at large is being sought. As you can see by leafing through this issue of our magazine, we have

received contributions from any number of individuals who have re-emerged to share their thoughts and suggestions in print with our membership. Significant in this effort are contributions from Dr. Steve Harris, Dave Pizer, Charles Platt, and Rick Potvin (in an upcoming issue). We hope you enjoy and give careful study to what these gentlemen have written, and we hope to be able to offer a continuing platform in print for them.

Additionally, Alcor has reversed its position on international membership, particularly as it applies to our friends in the UK. Alcor Central representatives are making plans to visit the United Kingdom during the first half of the year (2002) to train an Alcor UK staff in our latest cryoprotective techniques, once the Advisory Committee (see above) has completed its work. With respect to the insurance policies, it will no longer be necessary for international members to obtain US-only insurance policies to cement their Alcor memberships. Our local Alcor attorney will be working with a British solicitor to ensure that Alcor is protected in the event of the demise of one of our international members, and now that this roadblock has been removed, we can move forward again to hopefully welcome back some of the disaffected international members.

I hope all of you have a healthy and prosperous 2002 and remember to stay vertical! 1

Communications Update

by Jessica Lemler

Have you called Alcor lately? We have been quite busy here at Alcor Central, working to improve our communications capabilities and keep our members better informed of what is happening here at our Scottsdale offices. Our phone system was recently revamped, thanks to the diligent work of staff members Jennifer Chapman and Mathew Sullivan. The new phone system allows for a live operator (usually in the form of Jennifer Chapman) to answer incoming calls. We feel this not only adds a more personalized touch for the caller but also eliminates some of the frustration we know people were feeling with the old phone system, which sent callers into an automated "phone tree." We have noticed a drop in the number of complaints regarding the phone system, and we are quite pleased about this.

We are also happy to announce the implementation of our "This Week at Alcor" postings on our web site. Every Friday, all

Alcor Staff members submit to our Web Master, Jessica Lemler, a few paragraphs summarizing their weekly activities. The summaries detail each staff members' work progress, activities, and duties and are intended to give the reader a better idea of the events that are occurring here at Alcor. Additionally, Jessica uses the Alcor digital camera to add pictures to the page, so the reader can view staff members in action. The summary is posted on the Alcor web site and is also sent to Cryonet, for Alcor members, prospective members, and even nonmembers to view. If you would like to see our "This Week at Alcor" posting, log onto our web site at www.alcor.org and from the homepage select the "This Week at Alcor" tab. Updates are made to this page every Friday afternoon. The web site is currently undergoing many changes in an effort to become a more updated, informative site for all who visit.

The *Alcor Forum*, Alcor's new monthly newsletter being published in place of *The Alcor Phoenix*, celebrated the publication of its second issue in December, thanks to Charles Platt and Alcor staff member Hugh Hixon. Alcor members received their newsletters via mail, and the *Alcor Forum* can be viewed on the Alcor web site by selecting the "Newsletter" tab from the homepage.

Save the Date!

An introductory Tutorial on Cryobiology, Nanotechnology, and other relevant subjects will be held on November 15, followed by a reception.

Fifth Alcor Conference on Extreme Life Extension November 16–17, 2002

at the
Newport Beach Marriott Hotel
900 Newport Center Drive
Newport Beach CA 92660

Conference Chair: Ralph Merkle

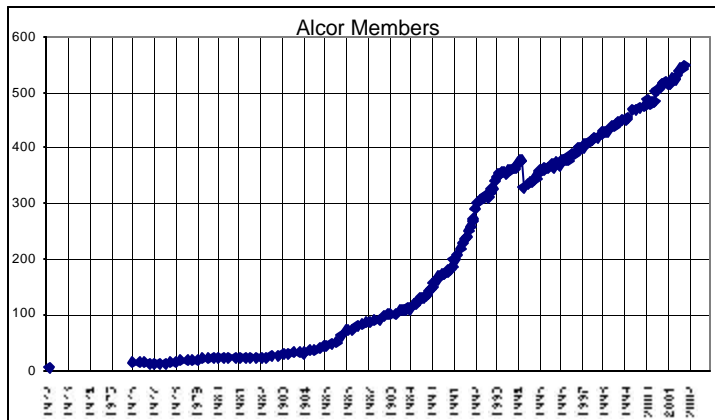
We live longer and healthier lives today than in centuries past because of remarkable advances in medical technology. We've already sequenced the human genome, cloned mammals, and replaced the human heart with an artificial pump. Soon we will understand the basic mechanisms of life. Not only is our understanding deepening, we are also gaining the ability to modify, control, and repair the fundamental molecular and cellular structures from which we are made. Age and infirmity will become as rare as bubonic plague and smallpox. Youthful vigor and long-lasting good health will be the norm. How rapidly these advances take place and the extent to which we as individuals benefit from them depends very much on what we do. The Fifth Alcor Confer-

ence on Extreme Life Extension is a meeting of scientists and individuals who are working toward the expansion of human health and longevity. This conference will cover topics relevant to these pursuits including:

- cryobiology
- tissue engineering
- cryonics
- nanomedicine
- genetic engineering
- cryonics estate planning
- therapeutic cloning
- radical life extension
- vitrification
- gene expression
- anti-aging medicine
- medical nanodevices

Membership Update

This is a historical graph of Alcor's membership growth. Our current plans are to provide an updated version in each issue of *Cryonics*.



Alcor Membership Status

Alcor has 557 Suspension Members (including 106 Life Members) and 47 patients in suspension. These numbers are broken down by country below.

Country	Members	Applicants	Subscribers	Country	Members	Applicants	Subscribers
Argentina	0	0	1	Mexico	0	0	1
Australia	9	1	3	Monaco	1	0	0
Austria	1	0	0	Netherlands	1	4	0
Brazil	1	0	0	Russia	0	0	3
Canada	13	1	13	South Africa	0	0	1
France	0	0	1	Spain	6	0	0
Germany	3	1	2	Sri Lanka	0	0	1
Ireland	0	0	1	Sweden	0	0	1
Israel	1	0	0	Switzerland	0	0	1
Italy	0	2	3	Taiwan	0	0	1
Japan	1	0	2	U.K.	14	5	14
Korea	1	0	0	U.S.A.	505	65	236
Lebanon	0	0	1	TOTALS	557	79	286

DUES INCREASE!!!!

DUES INCREASE!!!!!!

DUES INCREASE!!!!!!

On April 1, 2001, Alcor's Board of Director's passed the following resolution:
"Resolved, that the dues be increased by ten percent (10%) to take effect on January 1, 2002."

Please note that this dues increase does NOT affect Life Members as to their rates or percentages.

This increase only applies to regular memberships.

Therefore, as of January 1, 2002 the following dues schedules will apply:

REGULAR ADULT MEMBERS

Annual \$398
Semi annually \$199
Quarterly \$100
Monthly \$34

DEPENDENTS

Annual \$100
Semi annually \$50
Quarterly \$25
Monthly \$8.50

FAMILY MEMBERS (spouses or S.O.'s living
in the same domicile as the regular member)

Annual \$199
Semi annually \$100
Quarterly \$50
Monthly \$17

STUDENTS

Annual \$199
Semi annually \$100
Quarterly \$50
Monthly \$17

If you have any questions, contact Joe Hovey at joe@alcor.org or 480-905-1906, x106

Cryofeast 2001

by Natasha Vita-More



In honor of Alcor Foundation, which has been a head-starter in biostasis and which has ushered in a culture of superlongevity enthusiasts, doors opened in December for delicious potluck dinners and high-spirited toasts!

The CryoFeast reflects a thanksgiving sentiment by thanking each of us, and all of us, who have been torchbearers in the valiant effort to overcome disease and the effrontery of death. Each person who supports the toppling of disease to replace it with healthier, extended life is thanked for being on the winning edge—the brink of superlongevity.

In the tradition of the Annual Alcor CryoFeast party, this year's six locations ranged from the west coast of California, north to Washington, down to Arizona, across to Florida, and up east to Delaware. Next year we look forward to continuing our former tradition of holding the CryoFeast parties around the world.



Los Angeles Cryofeast

by Natasha Vita-More

Everyone must remember the notorious phrase: “Freeze your head to save your ass.” Who came up with the quote, Dave Pizer? Several people have placed a spin on this phrase, and, although I prefer the Pizer’s heartfelt language, my neuro-spin has been “Freeze your head to upgrade your mind.” On December 2nd, the Los Angeles CryoFeast lived up to its festive and debonair repute. The jaunty crowd of cryonicists, who for the most part are extropian transhumanists, didn’t miss a beat when it came to a stirring mix of brainpower and cheeky humor.

The CryoFeast LA is one of my favorite parties of the year for several reasons. First and foremost, it’s a potluck—the more cooks, the better the brew. Likewise CryoFeasts co-hosts have time to mingle rather than labor in the kitchen. The second reason is that I hardly get a chance to enjoy other Alcor members in one location and without anything on our minds other than light conversation and a sense of festivity. With a plethora of foods and a diversity of diets, it’s a draw to see who will bring the turkey or the tofu, but hopefully there are always enough vegetables and desserts to go around. Anita Riskin was the superwoman of party as she carved the smoked turkey with determination and humor. What a menscha! Everyone was ecstatic when Jose Salgado and Beatrix (not yet Alcor members, but we are working on it) brought a tray of gourmet sushi, and with Kat and David’s epicurean refreshments, Russell Cheney’s hearty fruit bowl, and Regina Pancake marinated tofu, so many people brought food that the kitchen was literally overflowing. Bobby June cleverly brought his Aibo robot named Peanut (not a robotic dog!), which took the limelight off of all else.

In making sure everyone could locate our townhouse, we put up signs around the complex with directions and the one-liner, “Freeze your Head to upgrade your mind.” I suppose this could have been a mistake on my part. At midpoint during the party, an unknown man poked his head in the front door, walked directly into the living room, and said he was “Curious too see what types of minds were being upgraded.” The frozen expressions on our faces were apt and we all laughed at the incident.

Thanks to everyone for bringing your dishes and contributing to a jolly feast.

Northwestern CryoFeast

by Richard Gillmann

I’ve always wanted to attend a CryoFeast, but there has never been one in the Pacific Northwest, to my knowledge. So this year I organized one. It was held at our house near Seattle on Saturday, December 1, the same weekend as the other CryoFeasts around the country. I was worried that no one would come. I e-mailed all the people I knew who were signed up for cryonics, or at least interested—most of whom we had met at the Alcor conference in Monterey. Natasha Vita-More did her part to publicize all the CryoFeasts, and Alcor very generously sent out invitations on our

behalf to members in the Northwest.

My fears were unfounded and more than a dozen people attended the CryoFeast, some coming from as far away as Oregon. We held it in the middle of the day, to allow driving time for those who might be coming a long distance and making a day trip out of it. In addition to myself and my wife Shelly, we had a silicon chip designer, a psychiatrist, the founder of the Libertarian Party in Washington (Skip Barron), some software jocks, and, well, it was just a fascinating group in general. We ate our pot-luck food, and then went around the room introducing ourselves, as most of us had never met before. Then we broke into discussion groups and wound up talking for six hours altogether. Cryonicists are such interesting people; at least we are willing to think for ourselves.

As a result of the CryoFeast, I set up a public e-mail list for those in the Northwest who have an interested in cryonics. The group is called CyronicsNW and you can join by sending an e-mail to CryonicsNW-subscribe@yahoogroups.com. There is a homepage of sorts at <http://groups.yahoo.com/group/CyronicsNW/>.

There was interest in meeting again. Local groups can provide mutual support and outreach. I hope our new group in the Northwest will thrive. It was great to meet everyone and discuss cryonics with such a lively and knowledgeable group.

Northeastern Cryofeast

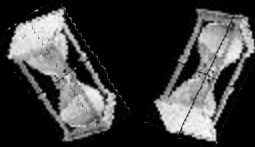
by Michael Seidl

Like Richard, my wife Lisa Lock and I were interested in attending a Cryofeast and meeting other like-minded cryonicists. (The descriptions of the parties on the Left Coast always sound so fun!) But, given our geographical handicap (“Delaware—It’s Good to be First”), we weren’t able to partake.

So, we organized our own, too, on December 2. Turns out, Delaware isn’t such a bad little state after all; in fact, it’s relatively central to the major eastern cities, and it’s right on the rail line. Consequently, we were able to lure attendees from as far south as Virginia, as far north as Massachusetts, and as far west as Arizona (what?!). Alcor President Jerry Lemler (a closet Delawarian from years back!) flew all the way out to jump start our little East Coast contingent.

Knowing that people were coming from so far, we opted out of the pot-luck alternative and put together instead an array of hot-and-cold appetizers, regular and vegetarian lasagnas, and desserts. Generous attendees nevertheless brought food and drink, and our cups (and plates) overflowed.

Guests started to trickle in around 6 pm; we met really great fellow Alcorians and may have even recruited some new members. Talk turned from lasagna and wine to skydiving, the proximity of the Singularity, memory and identity, the advantages of vitrification, and (after a surprise power outage) we all agreed by candlelight (which made it seem like a sacred pact or sworn promise) to get together again sooner than next December.



You Only Go Around Twice

by Jerry B. Lemler, M.D.



The Problem

I would like to focus on what (at least to me) I believe is a startling statistic. Whenever I have conducted tours of our Scottsdale facility, I've frequently been asked about the ratio of the sexes in terms of our membership. Heretofore, I have casually replied, "Oh, it's something like four to one, males to females." Then, naturally, depending on the gender of my visitors, I've noted their all-too-predictable responses to my guesstimation. If I'm amidst a group of gentlemen, they'll likely shake their heads in nodding approval, as if confirming their alleged intellectual superiority.

I must admit it's a rare occasion for a lone (or group) of females to request a tour, but it's happened at least a couple of times on my watch. When given the same (or similar) information, the women are genuinely surprised they number so few. The most blatant retorts, though, emanate from heterosexual couples or groups. My "four to one" pronouncement usually prompts the men to smile (?smirk) and stick out their chests in a somewhat vain, vindicating posturing maneuver, while the women are more prone to a demure acceptance, with more than an infrequent verbal acknowledgement of how this precisely correlates within their own S.O. relationship. I'm not especially one to blindly select parcels of casual observations and extrapolate generalities from them to form "position statements." I've read far too many such so-called authoritative treatises, whether back in my formal educational years or in yesterday's newspaper. Erroneous conclusions, especially when propagated in dogmatic form, are a genuine turnoff for me.

Yet, our ultimate success as an organization and a movement is contingent in part upon our capturing a much larger portion of the 51 percent of individuals that constitute the female persuasion. So far, we've largely been unsuccessful in this endeavor. Perhaps the adage, "Men can always lead women, but only to where they intended to go in the first place," is operative in cryonics. To nudge Alcor towards some semblance of mainstream public acceptance requires us to rethink our less-than-stellar appeal to contemporary distaff thought.

Okay, then, enough with the bellyaching. You've heard it before, I suspect. And, of course, we do have a cadre of remarkable women feverishly devoting countless hours on our behalf. So,

what's missing here? you might ask, recognizing as we do our outstanding female Alcor supporters and their oft-noted accomplishments. The answer lies in an understanding of a confounding paradox. These remarkable women, at least in this author's opinion, are so professionally endowed, they are not seen by the quasi-average potential female Alcor applicant as "one of them." Perhaps another way of explaining this is to speculate that these high-achieving Alcor women actually intimidate mainstream homemaker types. In effect, this translates into, "If I can't be nearly as beautiful, competent, articulate, or bright as them, why should I even try?"

The Solution

Standard operating procedure amongst non-life-extensionists calls for producing children to carry on their legacy. As cryonicists, most apparently, we do not subscribe to this doctrine. We most prefer coming back ourselves, children or not. This notion, though hardly selfish, resonates poorly with some males in contemporary society, but it seems almost an anathema to most females. Don't take my word for it—test it out for yourself if you'd like.

In order to turn this around where the female psyche is concerned, we don't need to waste time and energy on a paradigm shifting of consciousness, a decidedly difficult, if not impossible undertaking in any event. Rather, we should enjoin this reluctant cadre by effectively utilizing a "childhood approach."

This is not to say women are (or are not) more childlike than men. What it does assert, however, is that women are more child-oriented than men. Again, the anthropological and sociological literature abounds in consensus agreement of this postulation. So, why shouldn't we capitalize on this discrepancy? Quite naturally, I argue, we must!

The way to a woman's heart (and her Alcor application) is to convince her to want to see her grandchildren and their children, etc., grow up. I know this sounds overly simplistic, yet I'm convinced it's a method we're not following. If we continue to recruit prospective women to our movement in like fashion to men (nanotech, vitrification, uploading, etc.), we'll also continue to see the same sorry statistics in female membership growth. So, let's smarten up and remember there are as many wise women in this world as there are wise guys! 1



Planning for the Day Before Tomorrow

by Michael R. Seidl, Ph.D., J.D.

I recently corresponded with an Alcor member who was especially concerned because he had been told, after questioning personnel at his local hospital, that the biostasis protocols on his Alcor bracelet would be unlikely to be performed were he brought there under emergency conditions. His concern and forethought are warranted (and somewhat unusual). Having made plans through Alcor for our suspension, funded that suspension through insurance or otherwise, and donned our bracelets and/or necklaces, we seem naturally to turn our thoughts ahead to tomorrow, to prospects for reanimation and the future. Unfortunately, the road from life to cryosuspension can involve substantial obstacles, and the day before tomorrow is likely to be a rough one. I was disappointed to be unable to provide the member with an easy answer to his dilemma, one couched in terms of “your rights are *x*, show the hospital *y*, and they will have to follow the instructions you give them.” The reality is not that simple. Your Alcor bracelet and/or necklace is not a sure pass-card to prompt cryosuspension, and collapsing while wearing it is no guarantee that Alcor will be promptly notified. The complex truth is that while joining Alcor is the necessary minimum to effectuating suspension, it is far from the full range of arrangements a member ought to make. We must look at this problem as a continuum—not a single question about how to get hospitals to perform the protocols but how to help to ensure successful cryopreservation in a variety of circumstances. Some situations under which cryopreservation will be undertaken will, by definition, be less than favorable. We must individually help to ensure that the most favorable alternative available is actually implemented at the time we die.

I am consistently surprised by the number of people concerned with strategies for investing and/or preserving wealth for their eventual reanimation who have not first considered the possible financial requirements for initially reaching suspension. The same rules that apply to investing in *this* life cycle would seem to apply to investing for the *next* life cycle; investment

counselors routinely advise that, before you begin investing for the long term (and I cannot think of much longer term than eventual reanimation), you should be sure that you have taken care of your short-term, emergency needs, that you have put aside a sum equal to several months salary to cover the unexpected, invested in insurance, etc. In planning for cryosuspension, the same seems to hold true: before you begin making extensive wealth-preservation plans, be sure that you have adequately provided for your suspension. Adequately providing for your suspension means more than funding the suspension itself with Alcor—it means making sure that you get from final-stage illness or unexpected death to Alcor promptly. While there is no adequate way to compel the cooperation of doctors and hospitals, money and planning, as in other parts of life, can help to grease the skids to ease your path to suspension.

I cannot be plain enough here—you cannot depend on regulation, good luck, or a wrist-bracelet to compel an unknown attending physician in an emergency room to do what you want. There is no law that exists or that could exist that will guarantee the hospital’s cooperation; laws are designed to elicit voluntary compliance (and they do not always work too well at that—e.g., the frequency of speeders) and to punish people for non-compliance (and they do not always work too well at that either—e.g., the frequency of uncaught or unpunished speeders and other rule/law violators). There is no way to compel hospital personnel to act on your behalf (although, once involved, Alcor has a good record of eliciting cooperation). In the event of non-cooperation, at best you have a (useless to you) remedy (or your estate does) in suing them afterward, and maybe not even that. Alcor has set up a system whereby it requests the cooperation of hospitals via the alert tags we wear. If the situation you find yourself in is one where you are apparently dead, and no one else intervenes on your behalf to protect your interests, you might get compliance, or you might not. If you die as a result of an accident in an emergency room, the attending physician would probably

be found negligent if he or she fiddled with biostasis protocols for you (you are dead, in their eyes) while someone in the next bay died. You cannot rely upon a sense of entitlement or rights.

With the foregoing in mind, it first ought to be clear to everyone that effective suspension is a last resort. It is far preferable to live to such point in time as medical technology makes death redundant. Cryosuspension, like other sorts of insurance in which I have invested, is a resource that I hope never to have need to draw upon. Every day added to my life brings me that much closer to not needing to die to begin with. To that end, I try to take care of myself by eating right, exercising, not driving like a maniac, and seeing a doctor regularly. I believe that the breakthroughs in medical science required to slow or halt aging are comparatively near, although not so near that I would wish to give up the fallback position of cryopreservation. So, without wasting the life I have by living too cautiously (after all, even with my best efforts, this might be the only one I get), I try to remember that I am a fragile being potentially on the cusp of being fragile no longer; I live accordingly.¹ The best plan for the day before tomorrow is to plan to live through it to begin with and arrange one's life accordingly.

I also try to remember that, should I die, successful cryosuspension requires dying under conditions where my brain is retrievable and intact. The same issues discussed above will assist here to help to ensure that when and if I die it is as most Americans will, old and under medical care rather than in a messy accident. Senile dementia and/or loss of my brain through catastrophic accident are potential impediments here, but the alternatives are too drastic for ready answers. The answer to senile dementia, or some other brain-wasting disease that might leave a body alive long after large portions of the brain have passed beyond any recovery by even advanced nanotechnology, would be to make grim—and practically and legally difficult—arrangements for euthanasia at an appropriate point. Loss of my brain through catastrophic accident would require that I give up almost all mechanical transportation, especially travel by air or over water, and I am unwilling to accept those strictures. So, leaving aside the general exhortation to live healthily and the presently insoluble issues of brain preservation, let us turn to the circumstances of cryopreservation itself.

Given the current development of cryopreservation, the best way to ensure the most efficient cryopreservation possible (as recent suspensions have shown) is to die under hospital/hospice care at a cooperative hospital/hospice close to the Alcor facility with Alcor personnel in attendance to take charge of the body upon pronouncement. Making this happen requires some luck (not dying an accidental, unexpected death), some planning, and some money. On the planning side, each member needs to consider the requirements for making that final transportation and to put in place mechanisms for ensuring that it occurs. Preparations for your final illness ought to be both financial and legal. Put aside money for your transport to that facility—health insurance will not pay to move you—and for your terminal care. Do not rely—without carefully investigating the benefits—on

health insurance or long-term care insurance, which (1) may not provide terminal care to begin with; (2) may provide it but not in the facility you wish; or (3) may provide it where you wish but not help you get there. Put your desire to be transported to that facility in writing and give a power of attorney to a neutral party you trust (e.g., an attorney rather than a family member who may decide he or she wants you close to or in your home at the final stage of your life) in case you are *non compos mentis* in last-stage illness. Have the insurance and/or money and the plans in place so that nothing unexpected frustrates your wishes; in short, make effective plans to die where and when you want—under Alcor supervision.

The second best way to ensure that the protocols are performed is to die in a cooperative hospital/hospice/home-care environment not close to the Alcor facility with Alcor personnel in attendance. Making this happen requires all the concerns identified above with respect to ensuring you die in a hospital and making sure your wishes are set in writing and that there is a neutral party there to enforce them. Set aside money for a long standby that may not be otherwise covered. Make sure your family and friends and doctors and attorneys know of your desire so that Alcor is contacted and can attend. Alcor has lots of experience with this and, if in attendance, can help to ensure that the protocols are carried out.

The third best way (and this is a distant third) to ensure that the protocols are performed is to die in a hospital or otherwise (e.g., unexpectedly) with a safety net set up to ensure that Alcor is promptly contacted and that, to the extent possible, the biostasis protocols are performed. Having this safety net in place, planning for the worst case, will assist with the cases above where the challenges are less great. As above, the general goal is to commemorate your wishes and make financial/legal arrangements to be sure those wishes are followed. First, obtain and begin building a relationship with a local doctor who will agree to support your decision and help to see that it is carried out after your death (or in the above circumstances). Make sure there is a way that the doctor will be contacted by any local hospital to which you are brought in an emergency situation (you might want to contact local hospitals and see if they will put such information on file). Talk to your doctor annually about your desire to be suspended to keep it fresh in his or her mind. Make provisions to pay the doctor for the additional services that will have to be rendered and expenses incurred that otherwise may not be covered by health insurance for the period immediately preceding and after your death; make sure your doctor knows he or she will get paid for what you are asking—they don't work for free. Second, get an advocate, a local attorney; discuss your wishes with him or her and see if he or she will agree to carry them out, for a fee. Work out the arrangements for payment of that attorney and your doctor with your attorney (perhaps by placing funds in escrow with a third party to be held pending successful cryotransport to Alcor, at

(continued on page 38)



Alcor Then and Again: Twenty-Five and Ten Years Ago

by R. Michael Perry, Ph.D.

Alcor has been in business nearly thirty years now, a very long time in cryonics. Here I want to bring you a little bit of this long history; I will focus on a quarter century and a decade ago—1976 and 1991—with some relevant background. Both dates were especially significant, for rather different reasons.

Background

Cryonics was born in the 1960s and nurtured, in the first few years, in a heady state of optimism. Robert Ettinger's book, *The Prospect of Immortality*, published by Doubleday in June 1964, presented the basics of the freezing idea and gave it wide publicity, which was further amplified by media attention including talk show appearances by Ettinger and others. Evan Cooper, meanwhile, had started the Life Extension Society in Washington, D.C., for those who wanted to be seriously involved, and he offered a newsletter, *Freeze-Wait-Reanimate*. Finally and most importantly, organizations to do actual freezing were started up, beginning with the Cryonics Society of New York in August 1965. Its inception gave us the name *cryonics*, which has endured to the present. Cryonics received its wakeup call when actual freezings were done, starting with that of James Bedford in January 1967 by the then-brand-new Cryonics Society of California (CSC), which was headed by Robert Nelson. (Actually, an embalmed body had been frozen a few months earlier in Arizona after a lengthy period of above-freezing storage, but this type of freezing [this one abandoned after a year] is not usually considered a true cryonic suspension.) Patients—as the subjects of freezing came to be reasonably called—required constant maintenance in liquid nitrogen and an unending financial commitment—somebody had to keep paying the bills as the nitrogen evaporated and had to be replaced. Generally, it was assumed that relatives would bear the expenses—a very bad assumption, as it turned out. Most of the early freezings ended in burials when relatives, initially firmly committed, found their interest waning as the years went by and payments still had to be made on schedule. The suggestion was offered that expenses might be substantially reduced, and suspensions made more secure, by

saving only the head, which still contains what is essential (the brain), but this idea was slow to gain acceptance. A foolish squeamishness prevailed instead. Suspensions terminated that might otherwise have continued, and others that might have occurred were never attempted.

Fred and Linda Chamberlain began their cryonics involvement with CSC but by 1971 had become disillusioned with Nelson and his group. (CSC would later gain notoriety in the Chatsworth incident in which nine of their ten frozen patients were abandoned and they decomposed; however, their first patient, Bedford, remains frozen today and is now stored at Alcor. All of CSC's patients were whole-body, and Bedford, for the record, is also still whole-body.) Among the failings of CSC was that it had virtually no provisions for emergency suspensions. Fred (actually Fred III) was especially anxious because his father, Fred Jr., was in failing health and might need the services at any time. The Chamberlains, in launching their own initiative, first formed Manrise Corporation as a for-profit service organization to provide emergency suspension coverage. With financial and other assistance from Fred Jr., they soon had acquired and further



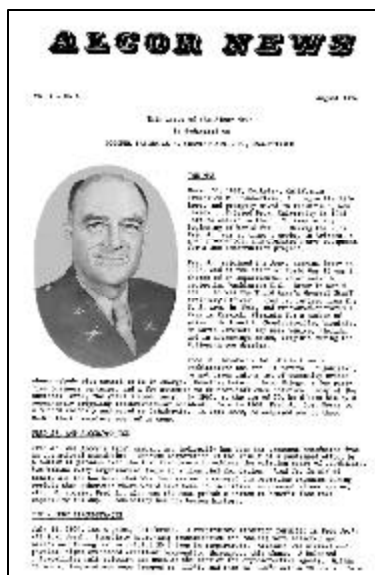
Fred and Linda Chamberlain with an early perfusion machine of their own devising, 1971.

developed basic perfusion equipment, had written a 100-page manual, and had put together some contracts for the use of funeral parlors as suspension facilities. Finally, on February 23, 1972, they formed the cryonics membership organization Alcor, with Linda as first president. Alcor obtained a van and an ambulance, known as "Big Al" and "Little Al," respectively, but grew only slowly for the next few years.

In 1976 the still-fledgling Alcor had about a dozen members and was headquartered in Verdugo City, California. On July 16, with the help of Manrise, it carried out its first suspension, that of Fred's father, Fred Jr., which moved quickly following his clinical death. It was also the first neurosuspension or head-only freezing in the cryonics movement. The recently chosen president, Allen McDaniels, was an M.D., something that would not be repeated until Jerry Lemler was installed as president last September. (Among other things, this allowed the president to legally take possession of the patient, on behalf of Alcor, as an anatomical donation—a task that would otherwise have to be less conveniently relegated.) The suspension itself was carried out in "Big Al," as a pioneering test of a mobile suspension capability, but the space was tight, as Fred and Linda recounted later. "We found, during that first suspension, that getting a team of 4 to 5 people into the cramped quarters of the laundry van-sized operating room made moving about nearly impossible, especially during surgery, when it was necessary to have surgeon and assistant surgeon on opposite sides of the table." Alcor had meanwhile acquired office space and, from then on, would do its suspensions at a fixed location with more elbow room. (Alcor's next full suspension—using cryoprotectants—would not occur until 1985; it, too, was a neuro. Alcor's first whole-body suspension was in 1988.)

Otherwise the year was less eventful, but it is worth noting that Alcor's first newsletter, *Alcor News*, was first issued in May. (It would continue for about two years as a simple, typed, two-pager monthly.) In it one finds the usual concerns: a calendar of events, elections of officers, offers of services. And, of course, the write-up on that first suspension. In all, the small size of the organization and its slow growth to that point might have made its future look doubtful. But a hard-nosed, rational approach had been demonstrated in performing that first neurosuspension when it seemed called for, and it would win the day. Alcor would endure, and, by cryonics standards, prosper.

Alcor's first suspension is detailed in the fourth issue of Alcor News, August 1976.



By 1991 Alcor had become a different and much larger organization, indeed, now the largest one devoted to cryonics practices, with some 200 animate members and 17 patients. Now located in Riverside, California, Alcor had long since become self-sufficient, storing its own patients. (Its earliest patients, including Fred Jr., had been initially stored at Trans Time's facility in northern California.) In 1991 Alcor added 102 members, an all-time record, and did three more suspensions, not counting one in progress as the year commenced.

Past years had been eventful, especially after the ascension to the presidency of Mike Darwin in 1982 and the rise to prominence of Jerry Leaf, a UCLA instructor of thoracic surgery. Research efforts of Leaf and Darwin had demonstrated the recovery of hypothermic canines from the initial stages of suspension procedures. Though the dogs were not frozen, they were cold and dead by clinical standards, and this lent confidence that fully frozen patients, stored at low temperature where further changes are minimal, would eventually be recovered when resuscitation technology was more advanced. Then had come the crisis over Dora Kent, whose suspension in 1987 had started a coroner's investigation when it was alleged that she had been still alive when the procedure was started. Alcor stood its ground and was finally vindicated in the summer of 1991. An out-of-court settlement awarded nearly \$9,000 each to six staff members who had been falsely arrested during the investigation. (I had joined the staff before the incident and was one of the six.) But the lengthy and expensive court proceedings had largely put research on hold. Leaf, Darwin, and the rest of the staff were eager to get rolling again. Leaf, whose strong and persuasive personality had had other good effects beyond the results of research, held discussions in early July with a wealthy member who might help.

Meanwhile there were upgrades to the storage containers, and a long-standing question about the earliest patient was answered. Frozen by Nelson in 1967, James Bedford of Glendale, California, was moved by relatives to Phoenix, Arizona, and maintained in liquid nitrogen at the facilities of Cryo-Care Equipment Corporation. (The white, horizontal capsule that first housed him can be seen in the Alcor lobby today and is featured in the 1998 *Guinness Book of World Records*.) Around 1969 he was moved to Galiso, Inc., a cryogenics firm in Anaheim, California, and there, in April 1970, was outfitted with a new capsule. (This unit was also horizontal and was welded shut for greater security and to reduce nitrogen boil-off.)

Bedford's amazing odyssey continued in his new housing, with stopovers at various other California sites, including Trans Time, then in Emeryville. Finally, in 1982, he was transferred by his watchful relatives to Cryovita Laboratories in Fullerton and effectively into the control of Alcor. (Cryovita was a suspension services corporation founded by Jerry Leaf that worked closely with Alcor; Manrise, Alcor's original service provider, had merged with Trans Time in 1977.) Bedford legally acquired the status of an Alcor patient in 1987. By 1991 his capsule was boiling

nitrogen too rapidly due to “softening” of its vacuum insulation and needed replacement. Bedford would have to be removed from his welded-shut container and transferred to a new one. On May 25 the old capsule, still with liquid nitrogen inside, was tilted up and carefully sliced open at the “foot” end with a small cutting torch. What would be found inside?



Cover of Cryonics for August 1991 showing early stages of the Bedford transfer on the morning of May 25. The foot of the old capsule is open and the patient—inside on a stretcher with liquid nitrogen—is about to be removed and examined. Jerry Leaf (left) and Mike Darwin begin removing the Dimplar foil that had been placed around the patient many years before for thermal protection. [Photo by Tanya Jones.]

Bedford had not been seen since his last transfer, more than two decades before. Rumor had it that he might have thawed out at one time or another during his long journey, much of which was not well documented. But on examination his body looked intact, and indeed, looked more lifelike than more recent suspendees since he had been only minimally perfused. (The glycerol solutions then commonly used as cryoprotectants caused an amber discoloration of the skin during a suspension when a sought-for high concentration was achieved.) Closer inspection showed that cube ice packed around him when he was frozen in 1967 was still intact with no signs of melting—he had indeed stayed frozen the whole time, and there were sighs of relief. Bedford was placed in a precooled sleeping bag, enclosed in a recently designed metal box or “pod,” and transferred to a “bigfoot” dewar, where he remains today. Two other patients were also transferred that day.

It was less than two months later, on the night of July 10, that Jerry Leaf complained to his wife of “indigestion” but didn’t think it serious enough to call a doctor. Soon he was still and silent, the victim of a massive coronary. The 50-year-old Leaf had

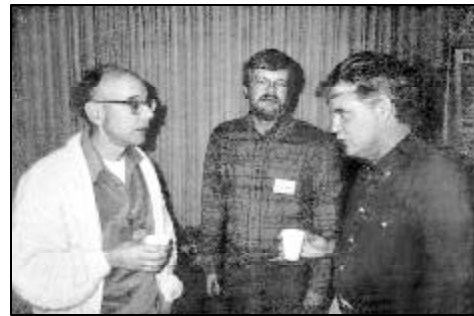


Jerry Leaf assists with the overhead crane for the Bedford transfer; seven weeks later, Jerry himself was suspended.

been a heavy smoker who had tried unsuccessfully to quit. His untimely demise and suspension was a blow whose consequences would be felt in the coming years. Simmering disagreements among some of the Alcor membership would now erupt. Some of the top technical talent and important sources of funding would leave and, in time, form their own organization. Research would remain on hold and not be resumed on a significant scale, despite some brave attempts. Membership growth would continue overall, in spite of the split, but not at the same pace.

Other developments in 1991 involved ongoing legal battles. Besides the matter of Dora Kent, there was a challenge to Alcor and cryonics more generally by the California Department of Health Services. It originated from Alcor’s first whole-body suspension, that of Robert Binkowski, in May 1988. Cryonics, claimed the DHS, was illegal since it was not a recognized form of “disposition of a dead body”—these being limited to burial, cremation, burial at sea, transfer out of state, or use as a medical cadaver or in research. When it was protested that Alcor’s use was for a type of research, the Department countered that the existing legislation did not contemplate research to restore a legally dead person to life, and there was no mechanism for licensing it! “Legislative intent” was said to be important, more so, evidently, than trying to save someone’s life. The courts would disagree and, in 1992, handed down a ruling favorable to Alcor.

Meanwhile, Alcor member Thomas Donaldson was locked in a battle of his own. In 1988 he had been diagnosed with a brain tumor of a particularly virulent sort (an astrocytoma). Given only a few years to live, he wanted to be suspended premortem—the procedure started before his clinical death—to forestall any destruction of his brain by the invading tumor. (As an alternative,



(Left to Right): Thomas Donaldson confers with science fiction writer Gregory Benford and attorney Christopher Ashworth at a fundraising benefit for Donaldson in December 1990. [Photo by Steve Harris.]

Thomas was prepared to choose self-starvation/dehydration, that is, refusal of food and fluids. This would bring about death in a matter of days through “natural” causes (by the legal definition), so no autopsy would be required. But it is also an ordeal reminiscent of a concentration camp, even though pain medication can also be administered.) Thomas, it turned out, would lose his legal battle the following year—a premortem suspension must qualify

as homicide, ruled the courts—but he would win the war. The tumor stayed in remission, and Thomas is still well and active today. Much favorable publicity was also generated from his case.

A third ongoing battle, ironically, involved the right *not* to be frozen if one so chooses. A 60-year-old cancer victim became a “last minute” case in 1990. The woman was frozen at the insistence of her husband who made the arrangements after paperwork had been sent to her but not completed. Incredibly, and unknown to Alcor, the lady had left a will specifically requesting no freezing but a “Christian burial” instead—the only time, to my knowledge, that such a thing has ever happened. In a long and bitter court struggle the husband would argue that the will, which survived only in a photocopy, had been revoked and nullified by his wife prior to the freezing. The courts would disagree; her body was unfrozen and buried some years later, when the appellate process had run its course.

In all, 1991 was the sort of “interesting” year you feel good about not having to live over again, though it did have its positive side too. Alcor would have additional interesting times to come but would survive and flourish nonetheless. Today, in a new location in Arizona, it is still the largest cryonics organization, bigger and stronger by far than ten years ago. The rift that opened after the Leaf suspension is now nearly healed. And there are unprecedented possibilities for progress, as shown, for example, in the collaborative work with 21st Century Medicine to develop better cryopreservation through vitrification.

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(continued from page 33)

which time the funds could be released to doctor and attorney). Consult your attorney annually; ask him or her to update for you the law on the issue, to check the agreement and escrow. Make friends with both your doctor and your attorney—make sure they acquire a vested (personal and commercial) interest in your transport. In short, you will be more likely to get what you want through the promise of payment and a long, cooperative relationship than by standing on any perception of your rights.

In sum, think of your cryosuspension as a three-step process. Your first step was joining Alcor and funding your suspension—that is today. The final step occurs when you die, Alcor is notified, and you are suspended—that is tomorrow. In the middle—the day before tomorrow—is a vast gray area of risk where many things could go wrong. Just as prospective parents map their route to the hospital in anticipation of childbirth, we must map our routes from death to Alcor, anticipate contingencies, and make provisions for the contingencies we can anticipate. If we have professionals in our employ—doctors and lawyers—who can remain calm, effective, and efficient and who are committed to our interests on a legal, personal, and professional level, we vastly increase our chances of prompt cryopreservation. Before you figure out how to take it with you, make sure you are going.

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* I welcome discussion of these topics: mseidl@magpage.com.

¹ *Vanilla Sky* notwithstanding (stop reading now if you have not seen the film and wish to avoid any spoiler), suicide (especially alone in your home) followed by cryopreservation seems like a bad risk to me.



Getting It Right

by R. Michael Perry

The second quarter 2001 issue of this magazine contained my survey of some twenty-four cryonics authors and their books. It was an ambitious project, and it grew in size and scope as it progressed, with discoveries of more people and books who “ought to be included” by one criterion or another (and one or two I decided to drop after they first made the cut, though the “added” substantially outnumbered the “dropped”). I had read most of the books but not all of them. In some cases, a quick skim-through and/or check of others’ comments was all there was time for. On the other hand, I was not doing full reviews in the thumbnail sketches of each author, and so, I hoped, it would be adequate. As it turned out I received a complaint from one of the authors, whose book I had only skimmed, so I read it cover to cover. Yes, she did have a point. Here is my revision for the section on Natasha Vita-More and her book, *Create/Recreate*, with apologies and hopes that this version will be more accurate and appropriate.

Natasha Vita-More.

Both an artist of note and a futurist philosopher, Vita-More shares her vision in *Create/Recreate*, an illustrated probing of future possibilities, and an antidote to doomsayers. While showing the influence of transhumanist thinking such as that of FM-2030 and Max More (her husband), the book develops themes of its own in the spheres of art, culture, and creativity. “Who are we? What are we becoming? How will we do this? What are our values? What is our culture? What will be the evolution of our brains and bodies?” (quoted from page 17). These big questions are approached with thoughts of the role to be played by our growing control of the forces that shape our reality. Science and art must increasingly find a common ground and partnership as we shop and bargain for a rightful destiny. With the additional emphasis on life extension, we are prodded to contemplate a world where the individual is, and ought to be, immortal, and one whose attainment is a possibility to us living today.

IMPORTANT NOTICE

TO ALL MEMBERS

WITH LIFE INSURANCE POLICIES THROUGH NEW YORK LIFE

If you ever have an address change, you must contact Alcor (480-905-1906 ext. 114) or Mary Naples (1-800-645-3338), insurance specialist, to ensure that your contact information is properly processed. New York Life is currently undergoing changes to its central database and is experiencing unexpected glitches that could result in your receiving insurance mail intended for other clients. Your cooperation will prevent this inconvenience from occurring and is much appreciated by Alcor.

—Jennifer Chapman
(jennifer@alcor.org)
Membership Administrator

A lot has happened since the last TechNews column some two quarters ago. (The third quarter TechNews was skipped, along with all other regular features, due to the special nature of that edition as an update of Alcor's main informative publication.) A horrified world has witnessed terrorist attacks that now force us to consider, more than ever, how technology can be used to counter such barbarism, even as it also, regrettably, helps to enable it. In addition to the devastation by suicidal hijacker pilots, which caused the main loss of life totaling in the thousands, there has been an outbreak of anthrax deliberately induced by contaminated mailings and apparently unrelated. Aside from all this, there is, as usual, much more than can reasonably be covered in an article of this scope; some highlights will have to do.

Artificial Heart News

Robert Tools, the first recipient of the Abiocor, the first self-contained artificial heart, continued his progress and was no longer in intensive care, until November 11, when he suffered a stroke from an apparent blood clot and was again placed on a ventilator. Tools died November 30 of multiple organ failure and



Robert Tools

internal bleeding, after 151 days on the artificial heart. As of mid February 2002, it appears that two others of the five successful recipients of the artificial heart have also died, leaving two survivors. The deaths are regrettable, but the impression from news reports is that the lives of the patients were prolonged well beyond the few weeks they were expected to live otherwise, and much of the time they were in a reasonable state of cheerfulness and able to get around. One survivor who was going strong as of mid February is 51-year-old James Quinn, who received his new heart on November 5. He had become an outpatient and was

enjoying restaurant meals along with other aspects of normal life. A recurring problem is blood clotting or the bleeding that resulted from anticoagulants used to control clotting. More than half of the patients have suffered strokes after implantation, and bleeding or strokes were prominent among the causes of death. The device is being modified to try to reduce this problem. The artificial heart is manufactured by Abiomed, Inc., of Danvers, Massachusetts.

There are interesting parallels between artificial heart recipients and us cryonicists. We both want to extend our lives and health through a means that has not had clinical verification. We both see our option as better than the death we face otherwise. We both have to sign paperwork acknowledging that there is no guarantee the procedure will work. There are, of course, important differences. The artificial heart is directed toward a much more modest and less controversial goal than cryonics, and, moreover, was successfully tested in animal models before being tried in humans. For us, logic and circumstantial evidence must suffice for now, as we try to build a more solid case for cryonics through research and promotional efforts.

Self-Aiming Camera Could Have Surveillance, Defense Uses

A self-aiming camera is being developed at the University of Illinois at Urbana-Champaign. Its guidance system uses a neural network to model the superior colliculus, a region of the brain that correlates input from the eyes, ears, and other sensory organs, and initiates motion. The camera is able to identify and train itself on a speaker in a group who is also using prominent hand gestures. A faint sound or slight motion might not attract its notice individually, but the two together could. Among the possible applications are surveillance and defense. The camera, for instance, could direct returning artillery fire based on the flashes and sounds of an attack. Sensory input other than visual and auditory could eventually be incorporated. The work is being directed by Dr. Thomas Anastasio and is funded by the Office of Naval Research.

Truth Machine Possibility

Functional Magnetic Resonance Imaging (fMRI) can reveal whether a person is lying or telling the truth, according to Daniel Langleben and his colleagues at the University of Pennsylvania, who studied the brain activity of test subjects. The group is hopeful that the new technology will offer an improvement over the traditional polygraph, in which individual responses vary

widely and results are not always reliable. Conventional MRI is used to nondestructively peer inside the body and show the interior structure of the living tissue. In addition, fMRI applied to the brain highlights the regions that show increased activity in such tasks as speaking or remembering. The imaging method appears to work as a lie detector because deception requires extra effort in certain brain regions and thus produces a characteristic "signature." More work will be necessary before it can be used as a forensic tool, since, for example, cultural differences may affect the results.

Combating Anthrax

Although antibiotics to cure anthrax are available, they will not destroy the toxin that occurs in persons already infected; it is a toxin that could still kill them even though the invading bacterium has been destroyed. There is also a vaccine, but it can have unwanted side effects. A major, coordinated effort would also be needed to vaccinate a large number of people, and there are other infectious agents besides anthrax that terrorists could then easily turn to. In work that could lead to a viable alternative, researchers at Harvard Medical School in Boston have developed an antitoxin for anthrax and successfully tested it in rats. The group led by R. John Collier calls its synthetic molecule polyvalent inhibitor, or PVI. The substance works by interfering with a chemical cascade that normally occurs in the course of the disease. Cells of the host are first fitted by the bacterium with receptors for a lethal protein it also produces; the protein then proceeds to attack the cells. By blocking the receptors, the antitoxin protects against the damage that would otherwise follow. Rats that were tested survived ten times a normally fatal dose of anthrax toxin. It remains to be seen if PVI will also work in humans. If so, it could be produced in large quantities and stockpiled around the country to provide a more practical protection scheme than mass vaccination.

Meanwhile another team has found that certain genetic variations in mice protect the creatures against the anthrax toxin. This effort, directed by William F. Dietrich of Harvard Medical School and the Howard Hughes Medical Institute, could shed further light on how the disease does its work and how it might be more effectively countered.

The problem also occurs of decontaminating buildings or other places of occupancy where noxious agents such as anthrax spores may have been spread. For the recent anthrax threat on Capitol Hill in Washington, D.C., a formulation developed in 1999 at Sandia Laboratories (Albuquerque, New Mexico, and Livermore, California) has proved useful. The decon foam, as it is called, is spread from a pressurized container somewhat resembling a hand-held fire extinguisher. The cocktail, which contains some ingredients found in hair conditioner and toothpaste, is nontoxic and noncorrosive, yet combats a wide variety of both chemical and biological agents, among them anthrax. Under license from Sandia, commercialized versions of decon foam are also being produced by Modex, Inc. (Denver, Colorado), and EnviroFoam Technologies (Huntsville, Alabama).

Plague Genome Decoded

Besides anthrax there is plague (*Yersinia pestis*), another infectious bacterium that has a long and lethal history with the human race and could also be an agent of bioterrorism. At least there is new hope of defeating it: its genome has now been decoded. The advance was reported in *Nature* (October 4) by a research team at the Sanger Center near Cambridge, England, headed by Dr. Julian Parkhill. The bubonic form of plague infects the lymph nodes and is transmitted by fleas that normally prefer rats to people. (When the rats are scarce the fleas may attack humans.) But there is also a lung-infecting or pneumonic form of plague that has a very high mortality rate and, in some varieties, is spread by inhaling fluid droplets from an infected host. As it happens, the version decoded came from a veterinarian who had died after an infected cat had sneezed on him in 1992. Having the whole genome makes it easier to test specific genes of the organism as possible targets for vaccines.

Common Remedy for Alzheimer's?

Ibuprofen, a commonly available, nonprescription drug, is showing promise in warding off the effects of Alzheimer's disease. Available at drugstores and supermarkets under such brand names as Advil and Motrin, ibuprofen is regularly purchased to ward off minor aches and pains. But since 1997 scientists have noted that it and other nonsteroidal anti-inflammatory drugs, or NSAIDs, reduce the incidence of Alzheimer's disease for those taking large doses. The reason for this has been unclear, but research led by Dr. Edward Koo, a neurologist at the University of California at San Diego, may have found the answer. Studies with mice showed that NSAIDs reduced the amount of amyloid-beta 42 (AB42), a protein found in the jumbled plaques that clog and kill the brain cells of Alzheimer victims. Other pain killers such as aspirin had no effect on AB42. Despite the promising results, much remains to be learned, and there are dangers with massive doses of NSAIDs such as life-threatening kidney damage and severe gastrointestinal ailments. For now, Dr. Koo and others are warning against the heavy use of NSAIDs as a strategy to prevent Alzheimer's.

Possible Cure for Prion Diseases

Mad cow disease, or bovine spongiform encephalitis (BSE), and its human counterpart, variant Creutzfeldt-Jacob's disease (vCJD), are unusual in that they are caused not by bacteria or viruses, but by malformed prion proteins. Found in the brain, the misshapen molecules are able to transmit their anomalous folding to other, "good" prions, which thus turn bad and become agents to further spread the infection. The consequences are progressively worsening brain damage and eventually a miserable death. Other mammals also have counterparts of the disease; the bovine form seems to have originated in sheep, where it is called scrapie. No cure was known, but a group headed by David Peretz of the

University of California, San Francisco, may have found it. In studies with mice, an antibody was created—they named it Fab D18—that protected normal prions from contact with the infectious form and halted the spread of the disease. With the infection held in check, the body's defenses were able, over time, to remove all the malformed prions and bring about a complete cure. What works in mice will not necessarily work in humans, but hopes are raised that an effective human treatment may soon be at hand.

Progress Understanding Ischemia

When living cells are deprived of oxygen or have an inadequate supply (a condition known as ischemia) deleterious changes occur leading to impairment of function and eventually, death of the cells and deterioration. Understanding and minimizing this process is of vital concern not only in cryonics but also in the medical mainstream where, for example, it severely limits the time that harvested organs can be stored before transplantation under currently available procedures. Some light appears to have been shed on this problem recently. A research group headed by Hamid Rabb of Johns Hopkins found that mice bred to lack a normally occurring component of their immune system showed marked improvement resisting the effects of ischemia. The component, the CD4 cell, also known as a helper T cell, normally helps identify, attack, and destroy infectious agents such as bacteria, fungi, and other germs that invade the body. It also has downsides, however, the best known being that it is specially targeted by the AIDS virus. When the deficient mice were given CD4 cells, their susceptibility to ischemic damage increased, further suggesting the cells were the culprit. Two molecules, CD28 and IFN-gamma, appear to be implicated in the damage mechanism. Work is continuing.

Progress Toward Nanocomputers

Recent progress at several independent laboratories suggests that a fantastic miniaturization of computer components could happen within a few years. This would bring us close to the limits allowed by physics, with very tiny hardware components made of precise assemblages of individual atoms. Computation speed and memory capacity should make enormous leaps, while cost and difficulty of manufacturing would plummet (and all this without the exotic possibility of quantum computing, though that could drive an even greater revolution in enhanced computer capability and/or cost reduction).

To get down to cases, Cees Dekker and coworkers at Delft University of Technology in the Netherlands have constructed logic circuits of nanotubes capable of doing basic arithmetical calculations. (Nanotubes are hollow cylinders of carbon atoms arranged in a "chicken-wire" configuration, like a buckyball, only stretched out along one dimension.) Dekker's group was the first to build a nanotube transistor (in 1998), and they have now wired nanotubes together to make a variety of logic circuits, including a memory cell that could serve as part of a random

access memory. The tubes are only a few nanometers across, and the tiny circuits are assembled atom-by-atom. A problem with this fine assembly is that precision is very important—it determines, for example, whether nanotubes will be semiconducting as they need to be, or only metallic, like conventional wiring, or electrically insulating. Precision, on the other hand, is difficult to achieve; what you get by today's methods is largely a matter of chance and raises doubts as to whether this whole approach will be practical.

A second, contending group, based at Harvard University in Cambridge, Massachusetts, and headed by Charles Lieber, uses silicon and gallium nitride as basic materials. Again the assemblage is atom-by-atom, but much finer controls are possible; both the p- and n-type semiconducting nanowires that are needed can be reliably manufactured on demand.



Bell Labs scientists Zhenan Bao (left) and Hendrik Schon are part of a team that made molecular-scale organic transistors. Copyright © 2001 Lucent Technologies.

Finally, in early November, a group at Lucent Bell Labs in Murray Hill, New Jersey, under Hendrik Schon, announced an impressive advance in nanoscale transistors. Just a month before, they created a transistor whose main signal-processing component, or "channel," nestled between its three electrodes, consisted of only a single molecule. A drawback was that the device could only work in tandem with several thousand similar devices. In the latest advance, the single-molecule transistor is fully addressable individually, and, except for its minuscule size (it is estimated that ten million could fit on the head of a pin), it appears to function much as its conventional silicon counterpart. The new transistors are made of a class of organic semiconductor materials called *thiols*, which, in addition to carbon, also contain hydrogen and sulfur. The main difficulties in making the nanotransistors (each is, in fact, about a nanometer in length) are constructing electrodes that are separated by only a few molecules and attaching appropriate electrical contacts. The Bell Labs researchers overcame these obstacles by a clever design coupled with a self-assembly technique in which the channel molecule establishes its own connections with the three electrodes. The process is relatively easy and inexpensive, and does not require clean room conditions, in marked contrast to the requirements for conventional microchip fabrication.

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The Last Mortal Generation

By Damien Broderick

New Holland Publishers, Sydney, Australia, 1999

Book Review by R. Michael Perry



The book is a sequel to the author's 1997 futuristic study, *The Spike*. Its opening premise is that we, our children, or some other group now living may be the last generation to die, in view of the ongoing advances in the understanding and treatment of now-fatal ailments, not excepting aging itself. The possibility is also raised that these advances may be faster than expected, so instead we could find ourselves the first immortal generation, a prospect that ought to be appreciated by readers. We advocates of cryopreservation have an obvious rejoinder to this, which is to please consider signing up for low-temperature preservation at legal death. That way you have a fighting chance, we think, to join the ranks of the immortals when aging and other lethal disorders are conquered, *whenever* that turns out to be. (By then there should also be ways to repair and reanimate you, or, if not, they shouldn't be long in coming.) The book is written for a mainstream-enough audience that it doesn't go very far in advocating the preservation option, though it does address it, and otherwise offers some exciting thoughts about a future that seems tantalizingly near.

The first two chapters address the nuts-and-bolts issues of overcoming death scientifically. The rest of the book is more far-ranging and covers such topics as the mind, consciousness, cosmology, and parallel universes. The author, then, is trying to

come to grips with what life is really about as much as how we might get more of it. The book has been criticized for this reason, though here I'm inclined to be lenient. The later chapters do drift from the beginning topics, but as immortalists we are aware of how many and varied are the subjects that legitimately bear on the long future we hope lies ahead, so it's appropriate to consider a larger picture. (Indeed, the failure to take this larger picture seriously, and thus be motivated toward the benefits of life extension, may be a greater obstacle to ending mortality than any technological barriers.)

Unfortunately, the future is hard to second-guess in any way that would accurately reflect the peace, joy, and liberation many of us immortalists like to think is coming. One can imagine, by comparison, the difficulties that would be faced by someone of 1,000 or even 200 years ago trying to anticipate the good side of the world of today. However, if really accurate anticipation is impossible, one can still depict an interesting future that would hold many attractions. Robert Ettinger did this in *Man into Superman*, a 1972 volume that still has much to offer, despite all that has happened in the time since that could inform other, newer efforts of this sort.

The work before us is not so daring. It explores many interesting topics but does not make a strong case for greatly extended life being a *must* for you, the individual. As its title suggests, it is in some degree resigned to a viewpoint appropriate to the many who still will perish, and the sense of wonder is correspondingly muted. The book is also less focused than *The Spike*, with its sights set firmly on the wave of current progress and its anticipated cresting a few decades hence. It slips occasionally. Broderick gives too much credibility, in my view, to studies suggesting the reality of certain paranormal experiences and also somewhat misunderstands the implications of the many-worlds viewpoint in physics. (The latter does *not* give equal weight to good and bad versions of possible histories!) But its strong points are compelling. Read it for a summary of work on aging that could lead to immortalization and a survey of current thinking about our place in the universe at large. The prose has the author's usual, bright sparkle, and the overall tone is hopeful but sober.

Nanotechnology Playhouse

By Christopher Lampton

Waite Group Press, 1993

Book Review by Jennifer Chapman



To appreciate the feasibility of cryonic suspension it is necessary to appreciate the potential capabilities of future technology. Unfortunately, it is probable that most humans do not adequately understand the majority of technology currently in use today, which hinders the likelihood that theories of future advances will be adequately understood. However, *Nanotechnology Playhouse* takes the reader through an entertaining exploration of our future technology without requiring excessive time or concentration. It is a small dose of knowledge that makes a large contribution towards immunizing the reader against the fear and intimidation imposed by the overall concept of immortality.

An entire book could be written based upon one key concept mentioned in the first chapter of this publication, as the presentation of this idea has the potential to significantly impact how receptive the reader will be to the remaining information. It is in these initial pages that Christopher Lampton encourages his readers to start “thinking small” in order to begin understanding current and future technology. The author further emphasizes that the scale upon which we view life largely determines our understanding of it and only by adjusting that scale can we also adjust our understanding.

For example, a house is small compared to a mountain, but a house is big compared to a single brick. This seems like a simple concept, but understanding the implications can be more difficult. Once it is understood that any given object can be described as “big” or “small” depending upon the scale the viewer is using,

it becomes much easier to start thinking about life on a scale much smaller than our macroscopic senses are capable of detecting. Although our eyes cannot distinguish between individual atoms, we can understand that activities are taking place on the atomic scale. With this knowledge, the reader gains a new perspective of the atoms and molecules that constitute our world. Indeed, the reader can now begin to understand that a vast world exists within the world we know, and nanotechnology is our means of exploring it.

Lampton presents various issues relevant to nanotechnology in simple terms. The reader is introduced to a variety of concepts regarding implementation of this technology, as well as the many associated difficulties. It is not the author’s intent to provide extensive explanations or details, making this an ideal source of introductory literature. Without knowing everything about all aspects of nanotechnology, the reader will know that the manipulation of individual atoms will someday be possible with nanotechnology.

Several chapters are devoted to briefly presenting the impact this technology will have upon the existence of humans. Although some imagination may be necessary to visualize the advancements we will experience in the capabilities of computers, manufacturing, and space travel, the author has made this easy by inserting short, fictional narratives within each chapter. Perhaps unknowingly, the author reveals within these chapters another scale that benefits the perspective of his readers. Just as varying the means of comparison will broaden the description of an object, understanding the realities of our future will enhance our understanding of our current world.

Members of the life extension community often wonder why more people do not recognize the feasibility of our pursuit. As observed by Lampton, technology that is difficult to understand can seem like magic—and that can be frightening. Still, an adult audience tends to recognize that there is a logical explanation for the talents of a magician. Perhaps a bit more courage is needed to explore the “magic” that our lives depend upon.

Level 7

By Mordecai Roshwald

McGraw-Hill, 1959

Book Review by Jessica Lemler

Written in 1959, Mordecai Roshwald's *Level 7* is the fictional story of a soldier's life in an underground bunker during a nuclear war. The protagonist soldier, X-127, has renounced his life on the surface to claim his new identity underground on Level 7, which, at 4,000 feet below the surface of the Earth, is the deepest and most secure of the government-operated underground facilities.

The story, which is presented in the form of a diary, opens with an introduction, in which X-127 relays the events of the day he came to reside on Level 7. He describes his own fears and reservations, as well as those of his comrades, several of whom had to be "carried off." Over the course of the next few days, using X-127's diary, Roshwald is able to portray for the reader the complexity of the underground world in which these soldiers are living—"This is a very small world, but it seems to be quite self-sufficient. Although it lies so deep underground it has its own supply of energy, food and all the other essential commodities needed by its crew. We might be on a ship, equipped for an endless voyage" (p. 27). A whole new artificially created environment has been introduced on Level 7, and for awhile X-127 appears content in exploring the workings of this world.

X-127's official title on Level 7 is "Push-Button Operator," which means that when instructed, it is his duty to push the buttons that set off nuclear bombs on the Earth's surface. He is regarded as a hero on Level 7, perhaps because no one else would be willing to shoulder the responsibility of having personally triggered such nuclear holocaust. At times, X-127 appears to

comprehend the impact the performance of his duties will have on the world, but he seems to be so pre-programmed the remorse quickly fades. It is not until well after he has completed his tasks he realizes what he has done, saying, "There is a strange feeling in the air—other people besides myself have noticed it, and perhaps it is not restricted to Level 7—a feeling that we are living in a new world. The old world, on the surface of the globe and on the underground levels connected with or dependent on the surface—that world is dead" (p. 114). Later, he contemplates, "Why is it so difficult to push that button of humanity, and so easy to push the ones which launch deadly rockets? And why did nobody discover my good button earlier, before it was all too late?" (p.123)

Beyond the questions of what would transpire during a nuclear war, Roshwald's novel poses questions and thoughts about a utopian society, and what can happen when a person enters into a society that is supposedly "fool-proof." Part science fiction, part existential philosophy, *Level 7* addresses some of the very questions we cryonicists face—what will the future hold? How will we adapt to a society and culture so much different from the one that we are accustomed to today? Do we have a right to survive while everyone else around us is dying?

The novel is short—it is only 143 pages and is a very easy read. I am not a devotee of the science fiction genre, but I did enjoy this book, most likely because it provoked such philosophical debate within my own mind. 1

Reading a book you're sure will interest other Alcor members?

Would you like to write a review for Alcor magazine but aren't sure if one has been published already?

Contact Lisa Lock, Editor, to discuss the possibilities:

llock@winterthur.org

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Letters to the editors are most welcome on all topics, including counterpoint on previously published materials and suggestions as to future content. We especially invite questions about cryotransport (cryonics) that are original and far-reaching. If you are seeking information about Alcor, please consult our web site, at www.alcor.org. If you have questions about developmental programs within Alcor, you may stir us into talking about them even sooner than we might have otherwise. If your letter is lengthy and involved, we may use it as a separate article and may ask you to expand it. We need your ideas, your personal visions. This is the place to start.

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