Cognitive Nanotechnology and Life Extension

Editor's Note

This article was submitted for publication to the Journal of Geoethical Nanotechnology by Thomas F. Carney, futurist and Mensa member.

Mr. Carney postulates on the future technologies thwarting neurological and biological cell death, thereby serving to extend human life and consciousness.

The foreseeable impacts of nanotechnology[1] are already enormous: medicines, computer processing, potential energy - the list of applications for technology on the nano scale are endless. If correct, they promise to be of such great influence that the world as it is today would be unrecognizable to someone fifty years from now. The implications of nanotechnology will change virtually every aspect of modern day civilization, revolutionizing the entire way technology affects the world around us.

As new developments open the doorways to new possibilities, the very definition of possibility will change - the very scope of new ideas will progress forward to entirely

[1] Nanotechnology - shortened to "nanotech", is the study of the controlling of matter on an atomic and molecular scale. Generally nanotechnology deals with structures of the size 100 nanometers or smaller in at least one dimension, and involves developing materials or devices within that size. http://en.wikipedia.org/wiki/Nanotechnology January 12, 2010 4:22PM EST

new, previously unimagined concepts; what may have been considered science fiction may in fact become scientific reality. The movement for life extension is one such new idea, and although people have been searching for the fountain of youth since the very incunabula of human philosophical thinking, never before have the possibilities been so within reach. It isn't really too hard to imagine that soon, Nanobots[2] may 'swim' inside the bloodstream and repair (or even replace) degenerating tissues and cells, an idea already under research and possibly close to development[3]. Such physical regenerative techniques have great promise to extend human health and lifespan.

Slightly more intriguing than the potential nanotechnology has for the body is the potential nanotechnology has for the mind. The brain is where the conscious identity of the person resides; replace the heart, and the person lives, replace the brain, and that same person will no longer exist. The human mind or consciousness is a result of chemical and electrical processes ongoing within the brain- these processes create all conscious experience. The human brain is composed of 100 billion neuron[4] cells, all

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[2] Nanorobotics - the technology of creating machines or robots at or close to the microscopic scale of a nanometre (10-9 metres). Nanorobots (nanobots, nanoids or nanites) would be typically devices ranging in size from 0.1-10 micrometers and constructed of nanoscale or molecular components. As no artificial non-biological nanorobots have so far been created, they remain a hypothetical concept at this time. http://www.nanobots.com/ January 12, 2010 2:57PM EST

[3] Tissue Regeneration - The **Tissue Engineering and Regenerative Medicine Centre** (TERM) based at Chelsea and Westminster Hospital was Imperial's first example of a collaborative enterprise between translational biological research and Material science to stimulate new paradigms in tissue engineering. This was the pioneering enterprise of Dame Julia Polak who, although officially retired, is still active as an Emeritus Professor and has recently been elected to the Steering Committee of the UK Stem Cell Collaboration. http://www1.imperial.ac.uk/medicine/research/institutes/tissue/ January 12, 2010 3:00PM EST

[4] Neuron – or neurone *n.* Any of the impulse-conducting cells that constitute the brain, spinal column, and nerves, consisting of a nucleated cell body with one or more dendrites and single axon. Also called nerve cell or neurocyte. The American Heritage STEDMAN'S Medical Dictionary. Boston, New York: Houghton Mifflin Company, 2004: 550.

interconnected by millions of axons[5] and dendrites[6]. Brain signals occur when chemicals known as neurotransmitters[7] are released; in short, conscious thought is the result of electromagnetic[8] signals within the brain. This concept is of extreme importance to the transhumanist[9] and/or life extensionist, and opens the possibility for cognitive technological life extension. As long as the brain remains intact, a person can "survive", so long as the brain's chemical and electrical processes are maintained. The purpose of all biological function is to support of the brain… the heart gives it blood; the lungs take in the necessary air; and so on. The brain is a mere transmitter and receptor of electromagnetic impulses, and these impulses come together to create "identity". This has profound impact on the sciences of life extension. Between nanotechnology, stem cell research, and gene therapy, it's not hard to imagine that within the next few decades lifespans may be radically increased. It is only a matter of time before gene therapy

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[5] Axon – or axone *n.* The usually long process of a nerve fiber that generally conducts impulses away from the body of the nerve cell. The American Heritage STEDMAN'S Medical Dictionary. Boston, New York: Houghton Mifflin Company, 2004: 80.

[6] Dendrite – *n.* Any of the various branched protoplasmic extensions of a nerve cell that conducts impulses from adjacent cells inward toward the cell body. Also called *dendritic process, neurodendrite, neurodendron.* The American Heritage STEDMAN'S Medical Dictionary. Boston, New York: Houghton Mifflin Company, 2004: 214.

[7] Neurotransmitter – *n.* (1961): a substance (as norepinephrine or acetylcholine) that transmits nerve impulses across a synapse. Merriam-Webster's Collegiate Dictionary. Massachusetts: Merriam-Webster Incorporated, 2005: 834.

[8] Electromagnatism – *n.* (1828): **2a**. A fundamental physical force that is responsible for interaction between charged particles which occur because of their charge and for the emission and absorption of photons, that is about 200 times weaker than the strong force, and that extends over infinite distances but is dominant over atomic and molecular distances – called also electromagnetic force. Merriam-Webster's Collegiate Dictionary. Massachusetts: Merriam-Webster Incorporated, 2005: 401.

[9] Transhumanism - a loosely defined movement that has developed gradually over the past two decades. It promotes an interdisciplinary approach to understanding and evaluating the opportunities for enhancing the human condition and the human organism opened up by the advancement of technology. http://humanityplus.org/learn January 12, 2010 3:43PM EST

cracks the secret to programmed cell death and senescence (the process of aging). Nanotechnological medicines will repair damage at the cellular level. Even if all fails, stem cell therapy will by then, more-than-likely be able to grow entirely new tissues and organs. The natural functions of the brain though, remain a problem. After a certain age, the brain, like the rest of the body, begins a process of programmed cell death - at depressing rates: every year, over ten million neurons are expected to die. Even the body can be kept in shape; the brain without intervention will eventually fail.

Even if technological remyelization[10] of the brain cells were made possible, the question arises as to whether the consciousness and personal identity or ego would survive. Employing nanotechnology, the cells of the brain may possibly be repaired as would the rest of the body. A thorough understanding of exactly where in the brain's consciousness resides remains a mystery, although there are several candidates (including the hippocampus). If nanotechnology can successfully replenish, replace, or protect brain cells, and those cells retain the synaptic connections (such as memory, personality, etc) of the original cells, the problem of theoretical information death would then be been solved. If it does not, and the brain's consciousness continues to decay and eventually die out, nanotechnology may still have the potential to prevent a termination of consciousness.

The primary contenders toward achieving a neurological life extension are nanotechnology or picotechnology, technologies already under research and

[10] Remyelinating – adj. (1939): causing or characterized by reparation of myelin. Merriam-Webster's Collegiate Dictionary. Massachusetts: Merriam-Webster Incorporated, 2005: 332.

development. Consider the principles of the brain's electrical signals; if the brain is merely a receptor and transmitter of electromagnetic impulses which make up consciousness, then the signals of consciousness could very well be reproduced through technology. If artificial intelligence at the nano scale is one day successfully integrated with the biological brain, then any programmable signal feed into the brain employing this technology would be read and processed the exact same way biological signals are. The technology feeds the brain its signals, and the brain, as it typically does, receives those signals and "creates" the experience of the signal is. So, the technology could deliver the same signals ad pulses the sights and sounds a warm tropical beach requires in real life, and the brain (or more importantly, person), receiving those signals would actually experience a day in the sun. A virtual reality could thereby be created inside the brain itself. Technology within the brain would be responsible for consciousness and would not be subject to biological cell death. This signal feeding cognitive technology requires an understanding of how the brain reads a certain signal, and then how to create that signal. It's obviously very complicated and requires a solid understanding of how conscious works, and then how to recreate the consciousness with technology, and feed it to a person's brain. However, if the conscious experience is the result of chemical/electrical processes, than cognitive technology should, in theory, have the ability to create a perfect simulation.

Still, theories on how technology may preserve consciousness go even farther. At this point, the theories and concepts become rather speculative and highly futuristic. Technology would need to advance to a much higher level than it has to date, and at a

very fast pace. In one scenario, not only would a more advanced technology need to be developed, but also technology itself would have to 'evolve'. This idea was first put forth by M.I.T.[11] graduate, Ray Kurzweil[12], who envisaged a technological singularity. The singularity describes a point in the future where the artificial intelligence reaches the level of intellect, reasoning, and computing power equal to that of a the human brain. If the brain is indeed nothing more than a receptor and transmitter of electromagnetic impulses, and if consciousness is nothing more than a chemical reaction, then it is reasonable to predict technology will one day be capable of an 'existence'. Conscious thought is electricity produced by a biological computer; a mechanical computer should one day have no problem doing exactly that. Along this thought process is the theory of mind uploading, a controversial idea for the preservation of consciousness through

http://www2.werkstuknetwerk.nl/knaw/cognitie/thema.html
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technological means. If the brain's electrical signals are really just electromagnetic waves similar to a computer signal, then according to the mind uploading theory, it would be

[11] MIT - Massachusetts Institute of Technology, whose mission is to advance knowledge and educate students in science, technology, and other areas of scholarship that will best serve the nation and the world in the 21st century. http://mit.edu/aboutmit/ January 12, 2010 4:08PM EST

[12] Ray Kurzweil - described as "the restless genius" by the Wall Street Journal, and "the ultimate thinking machine" by Forbes. Inc. magazine ranked him #8 among entrepreneurs in the United States, calling him the "rightful heir to Thomas Edison," and PBS included Ray as one of 16 "revolutionaries who made America," along with other inventors of the past two centuries.
http://www.kurzweiltech.com/aboutray.html January 12, 2010 4:09PM EST

entirely possible to “download” these electrical brain patterns into whatever future technological repository may exist. Analogous to the telephone….information is electrically transmitted at the atomic level rearranging itself when it reaches its intended destination. Mind uploading faces a few serious hurdles before it can be successfully applied. Certain technological demands are immense, and may seem currently out of reach for centuries, if not more. One must be consider whether or not consciousness is copied or moved…..if the information from the brain is electronically transferred to a futuristic storage device, would the conscience of that person move with it, or would the electrical patterns of the brain simply move or shift to another location? As always, the better technology gets, the better we will understand and the closer we will get.

Approved by Tom Carney, via email, on Monday, July 12, 2010 at 4:04PM EST

Bio

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