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Brain Endorsement with Bio-Infotization *Future of Nenobot implants*



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Abstract - This paper will discuss the potentials and future of Bio-Infotization within the realm of medical research and development. This paper will focus on the implantation of nanobot's particles and different way of refuel the nano cell. We also discuss the radiation effect this technology. Prosthesis not only for victims of war or disease but also shall discuss its potential capability to enhance human senses and the immune system toward the betterment of the human experience and even be able to backup all the content of our brains, just as you backup your files on a computer. This paper will show the conceptualization of Bio-Infotization as it evolved into its form today, and will further speculate the future potentials of Bio-Infotization as an evolutionary leap in the world of prosthesis.

Keywords— *Nenobots ,Bio-Infotization*

I. INTRODUCTION

For as long as humankind has existed, there have been two major constants in its nature; one is its capacity to harm another one of its kind and the other, its susceptibility to disease. Next to fatalities, one of the highest costs of both constants is that of loss of organs, limbs and memory. An example of loss of limbs due to disease can be found amongst those afflicted with diabetics where if unchecked, one or more limbs need to be amputated due to the collection of toxins not filtered by the kidneys. War and disease, although major contributors, are not the only causes of loss of organs, limbs and memory. Natural and unnatural disasters are other contributors. Naturally as the age increases human start forgetting the things that is nothing but the simply a loss of memory behind that the natural contributors are responsible. In unnatural disaster like accident or even in some disease ill-treated person loss his/her memory. This disease is very well explained in the movie "Gajni". Whatever the reason, they are the means to the same end - loss of body parts. Prosthesis has been one of the most valuable set of tools to individuals who struggle with such losses. The technology used in prosthesis has evolved with each wave of technological evolution. The latest wave of technological evolution is that of Bio - Infotization, the conceptual child of both Bionics and Cybernetics. Not far in the future, losses of appendages and biological sensors such as eyes, ears, nose, brain and skin will be a thing of the past.

II. A BRIEF HISTORY

We see examples of prosthesis more frequently than we may realize. From fictional characters, to battle

stories, news events to celebrations of heroes, we see examples of physical disabilities compensated via some form of technological device. Might it be Captain Hook¹'s hook hand,

Commander Geordi La Forge²'s optical visor, or Terry Fox³'s Marathon of Hope with the use of one prosthetic leg, we can see that such obstacles due to loss of limbs can be overcome by the use of prosthetics. With the rapid evolution of technology, it is conceivable to anticipate a major evolutionary step in the field of prosthesis in the near future in one form or another.

Cybernetics has been an area of interest as the means to develop the next generation of prosthetics. The field of Cybernetics began in the 1940s as a blend of studies of control systems, mechanical engineering, biological evolution, logic modeling, neuroscience and electrical network theory. Since then, various fields of study have been associated with Cybernetics such as system and game theories, philosophy, psychology, architecture and control systems. Today, Cybernetics has influenced both control and systems theories all while evolving as an interdisciplinary study of complex systems structure, control and communications processes and mechanisms, and principles of feedback.

Another field of interest has been that of Bionics, a term coined by Jack Steele during his work at Dayton's Wright-Patterson Air Force Base in 1958, and deriving from the Greek term "bion-ic" meaning "lifelike". Bionics is the study of physical attributes and functionality of living organisms to design and simulate the same or similar application by the means of modern technology. Bionics has also advanced the fields of

artificial neurons and neural networks which are used to simulate the functionalities of a biological brain.

Back up for the human brain, including its entire memory, will be possible within the next two decades. Award-winning scientist, Mr Raymond Kurzweil, 62, told 500 guests at a sponsored Future talk event in Vienna, Austria, that the human brain backup was now already technically possible.

The marriage of Cybernetics and Bionics brings the best of both worlds together by simulating biological parts and systems, providing a form of communication between the technological and biological parts of the overall system in which a technology has been integrated. And so Bio-Infotization was born.

III. DISCUSSION

Bio-Infotization is the study of collaboration between mechanical machines and their biological counterparts. One aspect of this science has been explored heavily in science fiction mediums by the means of microscopic mechanical medics repairing damages to a human body. Others explored the potentials of some cybernetic organisms increasing the human potential by activating dormant genes and unused parts of human brain. Bio-Infotization has played the role of savior well; however, it has held an outstanding role as the villain in numerous fictional storylines.

A. NanoProbes

Science fiction has portrayed various forms of Bio-Infotization over the years with the most promising portrayal being the Borg⁴'s nanoprobes. Once injected into an individual, these nanoprobes travel through the bloodstream and latch themselves onto individual cells. The nanoprobes then rewrite the DNA⁵ of the cells altering their biochemistry, eventually forming larger, more complicated structures and networks such as electronic pathways, and data storage and processing nodes, ultimately forming external prosthetic devices.

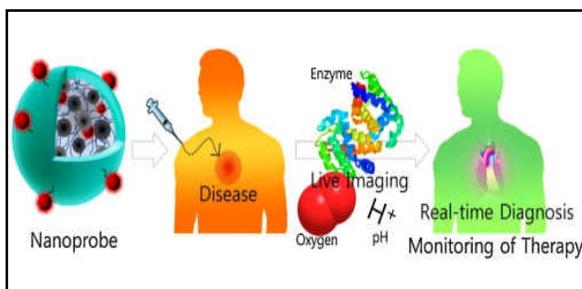


Figure 1: NanoProbes

Perceptions of pain relating to a limb or an organ no longer part of the body as a result of amputation. Although nanoprobes have been portrayed as tools of villains, they are no longer a thing of fiction as

they have intrigued minds of researchers to develop these very devices. Nanotechnology has made some great strides in the past decade as they have become common place in fields where cellular strength is of great importance, such as nano-fibres in law enforcement outfits, building blocks of the space station, and industrial machinery. Researchers continue to develop methods to conquer obstacles such technology presents when introduced into a human body.

B. Nano Chargers

A potential benefit of this technology is as microscopic medics who in collaboration with a physician or by following a set of pre-programmed procedures outlined by a specialist, attend to damaged parts of the body in which they reside. Short of some usage of biochemical processing of their surroundings, one obstacle these medics would face is a lack of a power source. One option would be to use radiation to recharge their fuel cells, but this would endanger the body they inhabit, as prolonged or repetitive exposure to radiation has proven to be harmful to biological organisms.

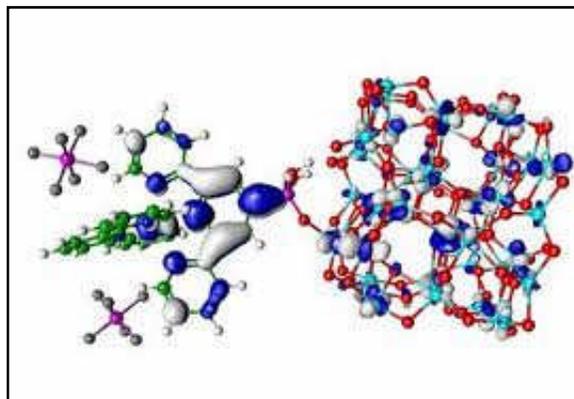


Figure 2: Nano Chargers

Short of re-injecting the organism with more nanobots, we could increase the lifespan of these mechanical medics by developing energy saving methods similar to those used on mobile devices. One such method is to activate them as needed by an external transmitter similar to that of Calypso Laboratories where a GPS⁶ the size of a grain of rice is implanted into the colon and is activated by their scanning system, but stays dormant until needed.

C. Nanobots

Another more radical method to better utilize such a system would be to strategically implant a transmitter at the pain centre of the brain or that of the cerebral cortex such that it would detect the sensation of physical pain

and activate the microscopic medics to attend to the area of damage.

Such a process is not without its challenges. Such interface integrated into the subject's nervous system, would have to be able to distinguish between perceived sensations of phantom pain⁷ or emotional pain and pain due to physical harm. It also would need to measure the degree of the damage as healable by body's own immune system, and the location of the damaged area by analyzing the path travelled through the pain receptacles throughout the body. Such a system would divide the body into multiple sections with a group of nanobots assigned to each area; as such when a part in one of these sections is damaged, only the nanobots in that area are activated to perform the necessary repairs.

Subsequently, this will further conserve overall nanobots' fuel reserves within the body. It is possible for such a system to demonstrate signs of swarm intelligence such that they may anticipate upcoming problems

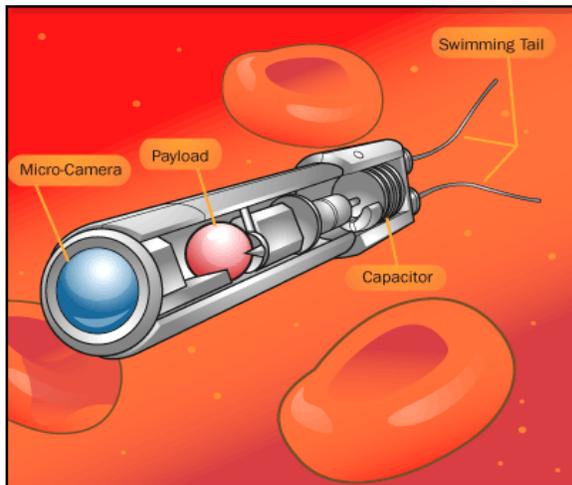


Figure 3 : Nano Bots

by analyzing incidents over time and cross-referencing them with other activities detected in the same section of the body.

D. Human Batteries(Nano – Generators)

Dr. Kazuo Eda⁸, heading the research on converting food to electricity within our bodies, believes bio-nano fuel cells were the next step for researchers after generators powered by hydrogen, natural gas and methanol. These nano-generators would be capable of producing electricity from blood, turning people into "human batteries" similar to that depicted in the revolutionary science fiction movie "Matrix"⁹.

Body divided into multiple section.nenobots assigned to each area.nanoprobes injected to individual travel

through the blood stream and latch them slaves on to individual cell and rewrite the DNA.

Japanese scientists are researching a method of drawing power from blood glucose, similar to how the body generates energy after food consumption. Such bio-nano generators could, theoretically, produce 100 watts provided all consumed food is utilized.

Clearly this is unpractical since the body requires the conversion of most of its consumption for cellular energy. Nevertheless, such bio-nano generators could power devices embedded in the body such as glucose fuelled nanobots.

Once nano-probes capable of rewriting the DNA of individual cells are realized, control and programming of injected nanoprobes are other obstacles to conquer. KUT¹⁰ BioRobotics Laboratory's research focuses on haptic interfaces between mechanical and biological systems. Such haptic interfaces enable human to feel and physically manipulate virtual or physical devices such as prosthesis or potentially nanobots within a human body. This type of interface could provide the capability of activating and deactivating these nano-medics as needed by a medical professional or even the individuals themselves.

E. Nano-terrorism

A network of such bio fuelled nano-medics controlled by a blend of haptic interface and swarm intelligence could potentially be the means to human immortality. Bio fuelled nano-medics could attend to and mend any and all external wounds, bond together to form internal braces to set broken bones in order to mend them, and reverse the aging process in individual cells by restoring their DNA similar to that of restoring a computer by resetting it to a stored backup state.

Potentially, they could even regrow body parts (similar to lizards), by rewriting the DNA of fat cells to build missing fingers, an arm, or a foot from the cellular level up. Although there are potential benefits, there are also drawbacks. An example of such a downfall could be if a Cyber Bionic individual were to receive repetitive physical damage and lack nourishment (such as prisoners of war), the integrated system could resort to utilizing stored fat cells throughout the body to fuel itself.

No matter how heavy set an individual is, even this form of fuel can be anticipated to deplete, even with energy saving methods in place. At this point, the system will either have to shutdown in part, fully, or begin using other forms of fuel by breaking down non-reserve cell blocks and consuming them as fuel. This could lead to productivity paradoxes where the system may resort to consuming dormant cells of an organ which then needs to be repaired as the cause of this insurgence. Yet another potential downfall could be damage or malicious

change to the system via the haptic interface by an external party which could introduce a whole new concept of nano-terrorism.

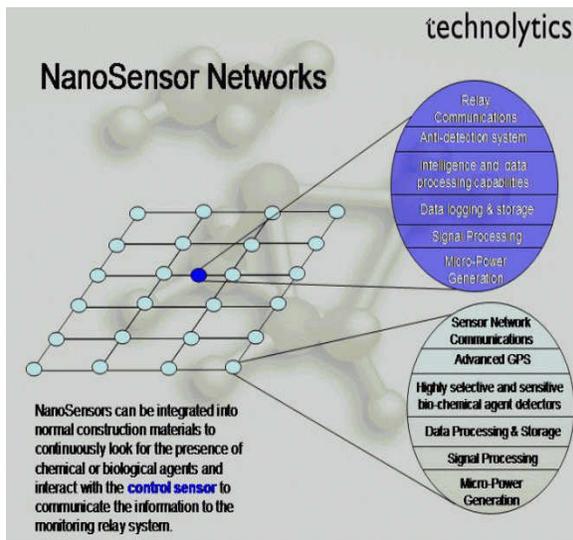


Figure 5: Nano-terrorism

The potential of system disturbance due to environment conditions such as those experienced by individuals working in high voltage power stations where high amounts of electromagnetic waves can raise the hair on your arms. Nano sensors can be integrated into normal construction materials to continuously look for the presence of chemical or biological agents and interact with the control sensor to communicate the information to the monitoring relay system includes: Relay communications, Anti-detection system, Intelligent and data processing Capabilities, Data logging and storage, Signal processing, Micro-power Generation, Sensor network communications, Advanced GPS, Highly selective and sensitive bio-chemical, Agent detectors, Data processing and storage, Micro-power generation.

IV. RELATED WORK

Applying Bio-Infotization is not entirely new. However, much of the related work outline below has emphasized Brain backup. Nevertheless, collectively they give a good indication of the range and richness of solutions that are possible.

A. Mouse Brain Simulated on Computer

Mouse brain simulated on computer. It takes a supercomputer to mimic a mouse brain US researchers have simulated half a virtual mouse brain on a supercomputer. The scientists ran a "cortical simulator" that was as big and as complex as half of a mouse brain on the BlueGene L supercomputer. In other smaller simulations the researchers say they have seen characteristics of thought patterns observed in real

mouse brains. Now the team is tuning the simulation to make it run faster and to make it more like a real mouse brain. Life signs Brain tissue presents a huge problem for simulation because of its complexity and the sheer number of potential interactions between the elements involved.

The three researchers, James Frye, Rajagopal Ananthanarayanan, and Dharmendra S Modha, laid out how they went about it in a very short research note entitled "Towards Real-Time, Mouse-Scale Cortical Simulations".

Half a real mouse brain is thought to have about eight million neurons each one of which can have up to 8,000 synapses, or connections, with other nerve fibres.

Modelling such a system, the trio wrote, puts "tremendous constraints on computation, communication and memory capacity of any computing platform".

The team, from the IBM Almaden Research Lab and the University of Nevada, ran the simulation on a BlueGene L supercomputer that had 4,096 processors, each one of which used 256MB of memory.

Using this machine refreshers created half a virtual mouse brain that had 8,000,000 neurons that had up to 6,300 synapses. The vast complexity of the simulation meant that it was only run for 10 seconds at a speed ten times slower than real life - the equivalent of one second in a real mouse brain.

On other smaller simulations the researchers said they had seen "biologically consistent dynamical properties"

Emerge as nerve impulses flowed through the virtual cortex.

In these other tests the team saw the groups of neurons form spontaneously into groups. They also saw nerves in the simulated synapses firing in a ways similar to the staggered, co-ordinated patterns seen in nature.

The researchers say that although the simulation shared some similarities with a mouse's mental make-up in terms of nerves and connections it lacked the structures seen in real mice brains. Imposing such structures and getting the simulation to do useful work might be a much more difficult task than simply setting up the plumbing. For future tests the team aims to speed up the simulation, make it more neurobiologically faithful, add structures seen in real mouse brains and make the responses of neurons and synapses more detailed.

B. Microsoft Work to Create Back-up Brain

Microsoft works to create back-up brain Researchers at Microsoft's laboratories in San Francisco are working on ways to create a 'back-up brain' that will

record and catalogue every picture you take, document you write and conversation you record.

Scientists within the MyLifeBits research group are convinced that the life database could hold a huge array of information and artifacts, which could eventually be as easily searchable as Yahoo! or Google. New Scientist magazine revealed that Gordon Bell, one of the scientists driving the MyLifeBits project, is already putting as much material as he can in a directory of his life, including each e-mail he sends and receives, and recordings or every meeting he attends. The Microsoft team estimates that within five years, a terabyte of data storage could cost as little as \$300, which in turn could hold 3.6m 300kb images or 290 hours of good-quality video.

The researchers recognise, however, that the biggest challenge will come with deciding on how best to organise the material. They are currently working on developing a taxonomy that will accommodate the huge range of associations and relationships the material will require.

The idea of a vast repository of personal information was first floated in 1945 by US academic Vannevar Bush, in an article entitled 'As we may think' that appeared in the Atlantic Monthly. In the article, Bush invented the term 'memex' for such a device, which would, he said, be "an enlarged intimate supplement to memory".

C. Nuclear Magnetic Resonance

Nuclear Magnetic Resonance (NMR) technology provides a non-invasive window to the anatomical, biochemical and physiological characteristics of the living organism. For the last thirty years, principal investigator A. Aria Tzika, PhD, has maintained research focus on the investigation of biologically important biomarkers using advanced imaging methodology, including multi-parametric, functional, and physiological and molecular MR imaging (MRI) and MR spectroscopy (MRS). This research aims to elucidate mechanisms underlying injury, neoplasia, and inflammation.

In more general terms, the P.I. is aiming to:

- Move research from in vitro and ex vivo biology to in vivo physiology and integrative biology
- Integrate research in experimental animal models with clinical research and medicine
- Develop therapies for neoplasia, injury, and inflammation

Specifically, Dr. Tzika's research activities are primarily occurring in imaging, but her research approach is strongly influenced by the fact that she was trained as a physiologist. In fact, she believes that the

underlying cause of neoplasia, injury, and inflammation in addition to stroke, myocardial infarction as well as aging is dysfunction at the mitochondrial level.

The P.I. has thus expanded my basic research program on the "Role of Mitochondria in Injury and Cancer Using Magnetic Resonance." This has been a topic of her interest since graduate school. She believes that the results from this research choosing a paradigm of burn injury are very promising and her publications on the subject testifies for this but, more importantly, they open the horizons of a more general role of mitochondria damage in a variety of traumatic situations and tissue injury in general.

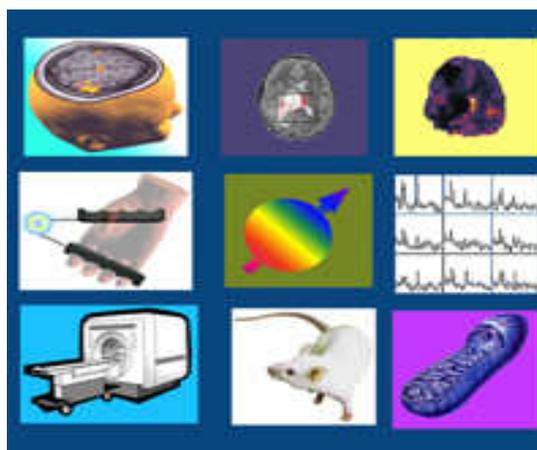


Figure 6 : Nuclear Magnetic Resonance

Meanwhile, she continues her research in cancer. One of her research projects focuses on developing and optimizing a novel computational approach that combines MRS and molecular genomics data to identify diagnostic biomarker profiles for tissue fingerprinting in clinical medicine. Currently, she is focused on applying these technologies to pediatric brain tumors, the leading cause of pediatric cancer mortality, since she has studied such tumors for over 15 years.

In addition, Dr. Tzika is working on the investigation of novel MR-derived biomarkers for stroke and traumatic brain injury patient rehabilitation using novel MR-compatible rehabilitation devices. Her working hypothesis is that rehabilitation results in functional and/or structural neuroplasticity and improved performance and that I can monitor this plasticity using on-line state-of-the art brain MRI mapping. Such rehabilitation can be also assisted by novel mitochondrial drugs that the P.I. is currently investigating in animal models of trauma.

Finally, as a co-investigator in other colleagues' projects, she is using molecular imaging to investigate inflammatory response, infection and bacterial virulence.

She applies NMR spectroscopy, high-resolution magic angle spinning NMR, multi-dimensional NMR, MR imaging, and functional MR imaging to answer specific questions. These techniques are complemented with a large group of collaborators (basic scientists and physicians), who provide support on data mining, molecular biology analysis, engineering design, genetic analysis, clinical evaluation, mathematical modeling and optical imaging.

D. Raymond kurzweil talk

Award-winning scientist Raymond Kurzweil, 62, told 500 guests at a sponsored 'Future talk' event in Vienna, Austria, that the human brain backup was now already technically possible. Kurzweil has notched up a string of pioneering computer inventions, including voice recognition technology, during his career, reports the Daily Mail.

"I believe that within the next 20 years we will have thousands of nanobot computer machines in our blood that will heal our bodies, improve our performance, and even be able to back up all the contents of our brains, just as you backup your files on a computer," he said. "That means they would back up every thought, every experience, everything that makes us an individual."

"It may sound far-fetched but in the early 1980s, people thought I was crazy for predicting the emergence of the world wide web by the middle of the 1990s; but it happened, and on the schedule I predicted."

Kurzweil has 19 honorary doctorates and now advises governments, scientists, military and business people across the world on a variety of technology-related issues.

V. UNPREDICATBLE ASPECT

But perhaps the most unpredictable aspect of such technology is the possibility of swarm intelligence developing its own methods of increasing efficiency to decrease repetitive repair of some body parts. Such improvement may include changing the format of reconstructing body parts which experience repetitive damage to be more durable.

At the age of 15, Kurzweil created a programme that could recreate music in the style of the great composers, which earned him a visit to the White House and an interview with President Lyndon B. Johnson.

He also built the first machine that could read written speech for the blind for his friend Stevie Wonder - for whom he also later made a revolutionary musical synthesizer capable of recreating sounds of real instruments. Kurzweil, has 19 honorary doctorates and now advises governments, scientists, military and business people across the world on a variety of technology-related issues.

Take as an example a factory worker working in a hazardous environment who has a network of nano-probes integrated into his/her body; it is then conceivable for him/her to experience physical harm on somewhat of regular basis due to the nature of his/her duties. Now let's look at this same scenario from the perspective of a system of nano-probes with a central or swarm intelligence embedded; one can then speculate that based on a repair audit the system may consider a different approach to repair the epidermis¹¹. Since these nanobots work at the molecular level, they may append their preset parameter to reconstruct the cell structure of the new replacements to be more complex than nature's design such that it could not be penetrated and as such would eliminate the need of resources to repair some reoccurring injuries. Although this is beneficial to the patient, it comes with its own complications.

VI. PROS AND CONS OF TECHNOLOGY

These are but a few examples of realms of unknown which at first may seem trivial but could have a great overall impact when implementing Bio-Infotization in the human body. This is not to say that Bio-Infotization would be void of non-technological or non-medical issues and concerns. It is conceivable that integration of Bio-Infotization in the human body would increase our life expectancy, but that too comes at the cost of economical, social, political and ethical levels. Short of an increased need of consumable goods to fuel the body and its nano counterparts, increased life expectancy would lead to an explosion in population growth and thereby even a higher demand of consumable goods as well as housing.

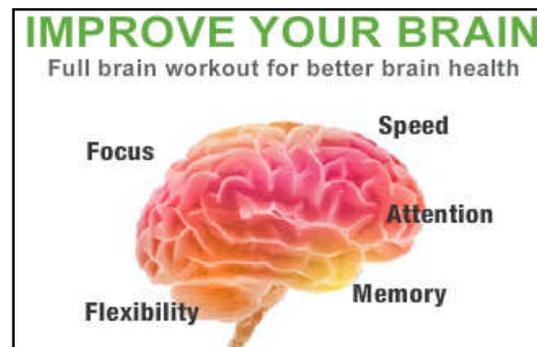


Figure 7: Advantages of brain – backup technology

At first explosion in population growth and thereby even a higher demand of consumable goods as well as housing. At first this may appear as lucrative for businesses focused on consumable goods and real estate, however since the size of our planet is constant there will be a limit on real estate expansion which will result in a higher cost of living and thereby increased poverty. Consumable goods will also increase in cost as they will

be used up faster than they can replenish leading to global hunger.

An example of this is best portrayed in the 1973's movie "Soylent Green" based on a novel by Harry Harrison where uncontrolled population growth had forced the government to resort to a questionable alternate food source. Problems raised by population growth can be addressed by an enforced social yet ethically questionable policy on reproduction. Such policies are currently in effect in parts of the world such as East Asia where couples interested in procreating must attain a license, where failure to do so is punishable by incarceration.

Using a novel, hand-operated robotic device along with functional MRI (fMRI), scientists have found that chronic stroke patients can be rehabilitated; this is the first study using fMRI to map the brain in order to track stroke rehabilitation technique.

VII. CONCLUSION

Although Bio - Infotization is at its infancy, it has great potential to improve our lives in both technological as well as biological levels. However, one must keep in mind the consequences of these technologies and their impact on humanity in the global scale. By utilizing this we can improve are brain speed, attention, memory, flexibility and focus. Thousands of nanobots computer machines in our blood to interchange the knowledge between human.

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