**Biomedical Engineering: Improving and Protecting the Quality of Life**

I believe biomedical engineers will meet future critical human needs in health care and quality of life. Engineering fields are civil, electrical and computer, mechanical, industrial, and biomedical engineering. Biomedical engineering applies science and math techniques to solve problems in medicine and biology. For instance, biomedical engineers will assist with diagnosing and treating cancer, improving the lives of war veterans, and detecting environmental toxins.

Engineers need to design machines that more accurately read Magnetic Resonance Imaging (MRI), Computed Tomography (CT), and Positron Emission Tomography (PET) to eliminate human error. Doctors often do not read medical images correctly and may give patients the wrong diagnosis. They either falsely state the person has cancer and over treat it, or they incorrectly tell the patients they do not have cancer and don't treat it at all! According to the National Program of Cancer Registries (NPCR), many forms of cancer like lung, prostate, and colorectal cancer are causing many people to die. Engineers need to create machines that will correctly read MRIs, CTs, and PETs to assist doctors in correctly diagnosing cancer.

Biomedical engineers will also help doctors treat cancer, the second-leading cause of death in the U.S. Cancer kills one out of every four adults each year. Sometimes, doctors try treating cancer with radiation but much guesswork goes into delivering radiation. They cannot always trace a tumor's precise location and know the amount of radiation the tumor has received. This is why electrical and computer engineer Babak Ziaie at Purdue University has developed a small wireless device that will allow doctors to locate the exact position of the tumor and calculate how much radiation the tumor has received to effectively treat it with radiation. Current imaging methods are not easy to use, costly, and sometimes require damaging X-rays. Ziaie's technology could solve these difficulties.

The ingenuity of biomedical engineers will be needed to improve the lives of casualties of war because of recent military conflicts and those probable in the future. U.S. soldiers desperately need prosthetic devices made by engineers. Jonathan Kuniholm, a student in biomechanical engineering at Duke University is developing improved artificial arms for amputees. Arm devices have not improved for twenty years, as opposed to improved man-made legs. Stéphane Bédard, an electrical and mechanical engineer is inventing synthetic legs. Because current devices are entirely controlled by the owner, amputees must expend a lot of energy to walk which can be extremely painful. Bédard has made an active prosthesis, the first one on the market. Sensors on the good leg send information to an artificial intelligence unit on the artificial leg which recognizes the amputee's walking pattern. If the person starts to sit down, the AI recognizes his intention and mobilizes the prosthesis. Engineers will help injured soldiers walk and use their arms more easily with new devices.

Engineers will help an increasing number of U.S. veterans of war suffering with Traumatic Brain Injury (TBI) from bomb detonations. Applying electronics, a team of engineers from Princeton University, Columbia University and the University of Cambridge have developed flexible electronic membranes. These membranes feature microelectrodes that are able to withstand the sudden stretching that is used to stimulate brain trauma. This system will allow more precise studies of brain injury and lead to greatly improved treatment of TBI.

A significant need exists for engineers to develop accurate detection devices to sense chemical and biological agents and environmental pollutants with the increasing threat of bioterrorism to the US. For instance, engineers need to design Escherichia coli (E. coli) detecting sensors because E. coli cells can contaminate food and poison people. At Drexel University, Professor Raj Mutharasan, a professor of chemical engineering has designed a simple, quick, and cheap device for detecting E. coli. Whereas current detection processes take

twenty-four hours, his miniature glass beam detects E. coli within ten minutes! In the future, engineers will develop devices that will detect E. coli within seconds. The Hebrew University of Jerusalem, Israel has developed BioLP™ technology to extend bacterial assay shelf lives without refrigeration. The University of Maine is developing an algae based sensor system to detect toxins in drinking water. Engineers are working in a myriad of ways to detect harmful contamination caused naturally and through bioterrorism.

In conclusion, biomedical engineers are going to improve and protect the quality of life for people by detecting and treating cancer, assisting injured war veterans, and detecting environmental toxins.  Reading about the research conducted by top engineering departments, makes me believe the work of engineers is truly incredible!

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