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Futuristic medicine: the way beyond and why we have to be cautious

Medicine progresses in an exponential manner. The drug that is found to be efficacious today becomes obsolete in five to ten years' time. Investigations become more and more technology dependent. It was Albert Einstein, the greatest scientist of the twentieth century who said, "Future medicine will be the medicine of frequencies."

The practice of medicine changes in the face of rapid advances in science, as well as new approaches by physicians.

Digital smart contact lenses, which earlier promised diabetes management by measurement of blood glucose levels from tears, has not been successful so far and has been limited to provide augmented reality function only. But the project is continuing, since a recent study from Japan has reported evidence of correlation between tear glucose concentrations and blood glucose concentrations. If this effort were successful, this avenue would be an efficient way for patients to monitor their health without having to extract blood themselves via the tips of their fingers.

The intelligent surgical knife uses a technology where an electrical current heats tissue to make incisions with minimal blood loss. With this technique, the vaporized smoke is analyzed by a mass spectrometer to detect the chemicals in the biological sample and to decide whether the tissue is malignant real-time.

Holographic computers being built into headsets is another innovative technique based on a technology called mixed reality, which is a form of augmented reality, because a person wearing this can interact with holographic objects—not just look at them in 3D due to depth sensors and tracking devices. This is presently used in some US universities as virtual anatomy classes. However these cannot replace traditional anatomy labs with human dissections, but rather supplements the learning of human structure. Another important use of this technique is in surgery. In surgery itself, the glasses give surgeons a roadmap to successfully navigate around organs. Using projections from their holographic headsets, surgeons can visualize precisely what they will encounter when they perform difficult surgeries.



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A multidisciplinary team of collaborators has adapted computer microchip manufacturing technology to produce microfluidic culture devices that recapitulate the microarchitecture and functions of living human organs. These microdevices called ‘Organs-on-Chips’ offer a potential alternative to traditional animal research and clinical trials. Each Organ Chip is composed of a clear flexible polymer about the size of a computer memory stick, that contains hollow microfluidic channels lined by living human organ-specific cells interfaced with a human endothelial cell-lined artificial vasculature, and mechanical forces can be applied to mimic the physical microenvironment of living organs, including breathing motions in the lung and peristalsis-like deformations in the intestine. They are essentially living, three-dimensional cross-sections of major functional units of whole living organs. Because they are translucent, they provide a window into the inner workings of human cells in living tissues within an organ-relevant context. These provide a very useful substrate for investigation of new therapeutic targets, drug delivery studies and exploring new clinical biomarkers.

Neuroscience advances at a tremendous pace, providing perspective into the inner workings of the brain hitherto not available. Optogenetics is a biological technique, which involves the use of light to control cells in living tissue, typically neurons that have been genetically modified to express light-sensitive ion channels. While the Human Genome Project maps all the genes of the human being, the Human Connectome Project aims to construct a complete map of the structural and functional connections in the brain providing an unparalleled compilation of neural data, which will be extremely useful for understanding the basis of some of the brain diseases which are still not clearly understood.

Medical tricorders are hand held portable scanning devices, which would self-diagnose medical conditions and alert the user. There are smart wrist watches available already in the market, providing limited information to the user. However, research in this direction is progressing so rapidly, in future, these devices will not only measure your body temperature, but also trace ECG, measure pulse rate and rhythm, oxygen saturation, systolic blood pressure, physical activity and sleep so that it will completely transform the notion of healthcare. There is a real danger of patients controlling their own health rather than waiting for the verdict of health professionals.

However we have to be cautious of the darker side of technological innovations too. Regarding technological development, there is always a risk for the emergence of so far unknown illnesses and conditions. New types of diseases will appear due to the excessive use of virtual reality solutions in gaming and other industries including healthcare.

Examples include virtual post-traumatic stress disorder (v-PTSD) which might be the diagnosis for gamers who participate in large virtual battles wearing virtual reality masks. Virtual reality as an extension of online activity and particularly that of gaming might also cause addiction. In future we may expect new ICD codes assigned to such new conditions.

With the technology taking over the place of health professional, we might envisage a breakdown in traditional doctor-patient relationship. What will be role of communication skills, empathy, social capital in a milieu of technologically advanced medical system. Unless we are cognizant of the fact that with the intrusion of technology, the humanistic touch will be replaced by relying heavily on mechanistic decisions we will not be able to face the challenges imposed by what is now referred to as “Technomedicine” and lose the human approach to the care of patients.

In this editorial I have only given a few of the unprecedented advances happening at present or may happen in the future in the field of medical research. These and many other marvels in science and technology are influencing future trends in medicine, and used prudently and wisely would lead to better health for the mankind.

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