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Innovations in science and medical technology in the 21st century: excerpts from a recent commencement address

Volume 11 Issue 1 - 2022

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Received: April 12, 2022 | **Published:** April 26, 2022

Commentary

Introduction

First and foremost, I would like to welcome and congratulate the graduates of the class and recognize the many challenges and achievements you have made while students at the university. You must be proud of your accomplishments, as they convey distinction, and they have set you above your peers, and are the first step in the next phase of your new career in Science, Medicine and the healing arts.

Second, I wish to especially welcome the parents, spouses, and family of the graduates – as few individuals could mark these academic successes without a support system in place, without a family, without the ongoing encouragement, the emotional support, and in some cases, the financial support to build your future in your selected area of medicine.

And finally, I wish to thank the academic and professional support teams of NUHS, without which none of this could be possible. In today's world, to borrow a phrase, I think it is safe to say that it takes a village consisting of motivation and individual determination, emotional and financial support, and the unending professional resources of your faculty, staff, and your academic institution, and your family support system to create the environment needed for you to achieve your academic success culminating in today's activities. I am reminded that none of us accomplish these plateaus without help and support from somewhere, so to you parents and family, I say thank you for all you have given for the sake of your son, daughter, or other family member.

Thus, the purpose of this address is to summarize the importance of the science and technology you have mastered that is the underpinning of the academic career you are now completing, and to set the stage for the lifelong learning that is an essential element for the professional career you are about to undertake.

It has been said that a good speech must be short enough to evoke excitement but long enough to convey a striking insight. I will keep this one short. A great speech, however, must not only be spoken. It must be heard. This reminds me of a story that I heard several years ago.

An old man went to the Doctor complaining that his wife's hearing was failing, and she could barely hear him. The Doctor suggested an easy way to find out the extent of the problem. He suggested, "Stand far behind her and ask her a question, and then slowly move up and see how far away you are when she first responds." The old man excited to finally be working on a solution to what he perceived to be the problem, ran home and saw his wife preparing supper. "Honey," the man asked standing 20 feet away "what's for dinner ?" After receiving no response, he tried it again 15 feet away, and again no response. Then again at 10 feet away and again no response. Finally, he was 5 feet away, he asked one more last time -"*honey what's for dinner*?" Finally, his wife replied, "For the fourth time it's lasagna!" I guess we now know whose hearing was at fault. And thankfully, through advances in science and technology, we have better ways of examining hearing nowadays, although I have used the old man's approach in the bush of South America when no other resources were available.

As president of USAT, I am a staunch advocate of the benefits and importance of medical sciences and emerging technologies although I am also fully aware of their potential limitations. When we seek faculty for our medical programs, we look for faculty who can connect the dots so to speak, faculty who can connect the intricacies of basic sciences of their discipline to clinical outcome. Overall, we at USAT place emphasis on how to use scientific innovation and emerging technologies for better health results, and to improve and potentially revolutionize patient care. Whether using telemedicine for viewing images or diagnosing heart rate or using medical apps and patients' portals to access medical results, aspects of nanotechnology to engage in diabetes monitoring or Electronic Medical Records [EMR] to facilitate patients prescription renewals and monitoring breakthroughs in medical technologies can improve health, wellness, and the quality of life and longevity for all they can help reduce waste, and hopefully to control the burgeoning cost of medical care today thus making healthcare more available, more deliverable, and more effective to more people throughout the globe and more sustainable than ever before.

At this juncture, I am reminded of my own graduation from the University of Vermont back in the last century. As the youngest of 5 brothers – we had no sisters - as I looked out from the stage when it was my turn to walk, I saw the proudest parents and family I have ever seen – my parents and some family members who had driven over 400 miles in a 1968 Volkswagen to see me graduate from UVM – *Even though I was the baby of the family, I was the first graduate from College, and the first in my family to earn a doctorate*. My mom was a schoolteacher, and I guess as evidenced here today, she never

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told me I was allowed to leave school after I graduated, so here I am today, as a university founder and President, I guess it is safe to say, *I am still at school*, and I am sure she is still watching from somewhere.

In commenting about the importance of Science and Technology in Medicine, I am reminded that the advances that have occurred in my lifetime and in my career have been nothing short of incredible and *the more we learn, the more we realize we are still at the tip of the iceberg*. In my dad's generation [born in 1899], he witnessed the discovery and emergence of many technologies that we take for granted today: the electric light, the automobile, the cell phone, modern air travel, [he was born before Wilbur & Orville Wright], the X-ray[Dad had his first one in 1927], the radio, the TV, radar, modern refrigeration, *[I have may parent's original ice box ca 1927, which now serves as a beverage cabinet]* and a host of modern technologies that were far greater by the 1950s than that which had occurred in any century that had gone before. I just returned from the International Research Conference Experimental Biology 2016, in San Diego, where USAT students and grads had 12 papers, and saw many of the results of the most recent developments in technological innovation and development.

Since Watson & Crick's original sketches of DNA at a corner table at the Eagle Pub in Cambridge England, we have seen the discovery of PCR, the mapping of the genome, and the characterization of dozens of chromosomes that can predict health, disease, longevity, and of course, predict genetic abnormalities, and which now have clinical application from the time of conception forward. We now have DNA synthesizers that can sequence and construct virtually any gene sequence one wishes to make and program into the instrumentation, with an eye toward the insertion of those new genes into a genome to modify the genetic make-up of a cell, and ultimately to address some potentially genetically based disorders. With the evolution of newer stem cell technologies and nanodelivery techniques, we can treat diseases heretofore thought impossible. In the UK, they cloned Dolly the sheep whom I am sure you all recall, the first example of successful cloning of a mammalian species. Who knows what the next frontier will be! We can not only wait and see, but as emerging scientists and practitioners, we can all become a part of it, limited only by the depth and breadth of our imagination and creativity.

Today, I would like to further explore the topic of Integrating science and technology into medicine. Modern Technology is based on science and has added considerable value and often lifesaving benefits to the diagnosis and treatment of illness in Western Society and throughout the world. The integration of science and technology into medicine has been occurring for the past century and is truly wonderful! *However great, technology can never replace a keen mind, a discerning and compatible spirit (necessary for investigation and analysis) or the personal touch required to meet the needs of the patient.* I am still fascinated by complex technologies such as artificial organs, robotic prosthetic limbs and the brilliant wide applications of Biophotonics on patients affected by previously incurable infections and disorders such as Hepatitis, HIV, and other maladies that the USATs Einstein Medical Institute is now pioneering, assisted by faculty, and medical grads and PhD graduate students from USAT. Graduates, there are several new science-based technologies that I want to share with you:

Cancer remains a leading cause of death in Western Society, despite the war on cancer announced by the Whitehouse and the discovery of HeLa cancer cells decades ago. Until recently radiation and chemotherapy have been the gold standard, but we believe new, less invasive treatments may soon be available. It has taken extensive study of cancer biology, to identify potential cracks in their basic biologic processes that can be targeted, in addition to improvements in therapeutic delivery measures that are less intrusive and thus more compatible with the patient's own biology. This represents applications of science to the advancement of medicine at its best. The recent issue of journal, The Scientist focused on breakthroughs in tumor biology, clarifying the difficulties in getting chemotherapeutic agents into the tumor, and getting the cancer out by utilizing basic biochemical mechanisms and the biochemical alterations of the tumor cell. The role of immunotherapy and cancer treatment has been in progress for over 40 years, and it too is still in its infancy. In the early 1970s a physician form UVM College of Medicine experimented with tumor adjuvants to trigger the patient's own immune system to attack the tumor, with an apparent 80% success rate. That science is now highly refined. Recently we saw the dramatic effectiveness of cancer immunotherapy work its wonders with former US President Jimmy Carter, who at age 91 was declared free of metastatic cancer [including brain lesions] late last year. Professor Einstein, from USATs Einstein Institute, has applied biophotonics which we now know can also trigger a patient's immune system, with a result to shrink the tumors. While the war on cancer is far from over, evolving new technologies may one day make radiotherapy and chemotherapy obsolete.

In an article on Biology and Medicine (April 16, 2016 www.futuretimeline .net/blog/biology-medicine-blog-htm#) at the Berkeley [CA] Lab a group of international researchers was able to produce the first high-resolution 3-D images of flexible DNA structures to appear as nanoscale "jump ropes." The technology they employed is called IPET—Individual Particle Electron Tomography, an electron microscope technique which could help them produce images of disease-relevant proteins. This function is to store and deliver drugs to specific areas of the body via advances in nanoscience and technology.

Another incredible breakthrough on the radar is brain-to-tech interface which uses the Electroencephalogram (EEG) to decode and transform brain signals into electrical pattern through a high-tech computer algorithm. Scientists at the University of California, Irvine CA are is using this sophisticated technology to convey brain signals to wires attached to the legs, essentially replacing some of the job of the spinal cord. Although this technology is still being fine-tuned, it has allowed a man with a spinal cord injury to walk for the first time in seven years. The technology is now being channeled to recreate the sensation of touch through prosthetics (Jan 1, 2016—Article—A cure for blindness –six medical breakthroughs for 2016 www.howitworksdaily.com/six-scientific-miracles-for-2016).

In another article entitled—Top 10 Medical Technologies of 2016, Novitas and Microsoft are making a remarkable impact on medical practices. Using a Google patented lens, blood sugar levels can now be measured from tears and transdermal sensors, which can radicalize diabetes treatment and management.

In the public sector, advances in science and technology particularly with respect to DNA technology, have helped many people to find long lost relatives and discover their ancestry and when applied to forensic sciences, have proved instrumental in helping to solve long forgotten crimes and capture criminals, some termed 'cold cases that are often decades old.

In addition, we can now help medical students do unlimited dissections from any angles without the stench of formaldehyde, a practice endorsed by USAT, where we utilize ONLY fresh, formaldehyde-free cadavers in our state-of-the-art anatomy labs, and supported with the virtual computer programs Anatomage and Body Viz systems. (www.medicalfuturist.com/2016/01/08/top-10-medical technologies-of-21st Century).

Citation: Tulp OL. Innovations in science and medical technology in the 21st century: excerpts from a recent commencement address. *MOJ Public Health.* 2022;11(1):54–56. DOI: 10.15406/mojph.2022.11.00375

Nowadays, technological breakthroughs are advancing some of the most exciting learning and problem-solving issues in medicine. However, it is important to keep in mind that *no amount of technology can replace the noble attitude or skills that you bring to the medical profession*. Technology cannot and should never replace the human touch (a feel for the sacredness of life), or substitute human interaction between doctors and patients, or the need for an ethical sense of caring. Yet, each of you must become conversant with the innovative trends, thinking and applying technologies that bring hands-on insights to the bedside.

Graduates of the class of 2016, promise yourself and all who have supported you on this journey that you will never, never, never, allow anyone's postal code or socioeconomic status to determine their health status. Instead, you will want to spend your energy zeroing in on the patients' greatest needs. Remember that each of you stand on the frontier of a new era, and each of you can become the Doctor that revolutionizes medicine. Therefore, I want to give you the following charge:

I charge you to bring an infectious attitude flushed with enthusiasm, compassion and a positive demeanor to your medical practice, even when you are given the most undesirable task. Do not forget that your attitude can make a distinct difference in the lives of your patients.

I charge you to get involved with best practices, research, and professional development that can expose you to the underlying knowledge that can help break down the barriers between health and disease entities.

I charge you to create and use technological devices that reduce human pain and suffering while advancing improvement in human health and wellness.

I further charge each of you of the 2016 graduating class to help redefine and reshape the world's health through developing greater technical efficiencies in the delivery of care. I charge you to master the most effective usage of advance tools for patient education and self-improvement, and to apply innovations in research and development to foster the best outcomes for your patients and their families.

But above all, I charge you to focus on better understanding patients' experiences, health conditions and the lifestyle struggles that surround us all so that you can better understand how to best treat illnesses and diseases and how to care for patients by integrating science, technology and medicine, for the greater good! And always remember, they all began with a firm understanding and thoughtful application of medical basic sciences to medical care. Actually, this is not too different from where those who came before us started in their careers.

Are you ready? Yes, you are!!!! And constantly remember the advice of Lord Byron: "Always laugh when you can. It is cheap medicine". Today I want to leave two quotes with you. George Bernard Shaw once said, "A doctor's reputation is made by the number of eminent men who died under his care." On the lighter side, Dick Wilson reported: "My doctor gave me six months to live, but when I couldn't pay the bill in time, he gave me six more months." If the possibilities for being a remarkable, technologically competent and caring doctor are wide open to you, then cultivate an appetite for new knowledge, as you have now reached the tip of an iceberg of unknown proportions. But always keep your eyes fixed on the unchanging desire to change the world for the better. May all that you learn, think and did while you were students at this great University become the building blocks of a successful career.

This is just the beginning. I would like to leave you here with one final quote from the famous Chinese proverb—"To shine is better than to reflect "-- Yet I believe that to both shine in your medical practice or other endeavor and to reflect on the power of applied science and technology is the fortune that is yours to tap into, as you leave the hallowed halls of the University. This is the beginning of your days in the sun and may the fortune cookie reflected in that ancient Chinese proverb be yours to keep also.

Acknowledgments

None.

Conflicts of interest

The author declares there is no conflict of interest.

Citation: Tulp OL. Innovations in science and medical technology in the 21st century: excerpts from a recent commencement address. *MOJ Public Health.* 2022;11(1):54–56. DOI: 10.15406/mojph.2022.11.00375