Special Feature:

A physician's training: new challenges

M.S. Valiathan

National Research Professor, School of Life Sciences, Manipal University, Manipal

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It is a privilege for me to be the Chief Guest at the 5th Convocation of the Sri Venkateswara Institute of Medical Sciences, Tirupati which became a University by an Act of Andhra Pradesh State Legislature in 1995. Though young, the University has already made a name at the national level as a reputed Centre for medical education and excellence in patient services. The progress it made in a short span of five years in becoming a State University, upgradation to the level of All India Institute of Medical Sciences (AIIMS), New Delhi, starting Medical Council of India (MCI) - approved training programs in specialities and super-specialities, and attracting extramural funding for research are highly commendable. I would like to begin by saluting the Sri Venkateswara Institute of Medical Sciences, Tirupati for all its achievements. Equally importantly, I would like to extend my sincere congratulations and warmest good wishes to all the students who have received their degrees today and crossed a major milestone in their life's journey.

Medicine; an evolving saga

The Hippocratic Oath you took today is an inspiriting reminder of the antiquity of our profession. The central objective and important mission of our profession in the time of Hippocrates 2500 years ago and today remain the same – compassion and efficiency in the care of patients. Everything else in our profession has changed. Leave aside Corpus Hipocraticum, if you glance through Osler's "Text book of Medicine" which was the standard book in medicine in the early 20th century – only 100 years ago – you would find that most of what you find there is of historical – not scientific or professional-interest. How did our profession evolve over centuries? Unceasing change is the characteristic of evolution, biological and cultural. The evolution of culture – medicine is part of our culture - is not stoppable any more than Darwinian evolution. It follows that medicine in evolving even in our own times. If so, in what direction does it evolve? This question is of importance to those who graduate today because they will be practising medicine of the future.

Medicine long ago

If natural selection is the force that drives Darwinian evolution what is it that drives the evolution in medicine? In the practice of medicine many centuries ago dating back to Hippocrates and Galen, elements of anatomy, physiology, hygiene and therapeutics did indeed exist but the practice was rooted in faith. *Aesculapius* was the God of medicine – a European *Dhanvantari* – and his daughters were *Hygeia* and *Panakia*. You may remember that Socrates requested Crito on his deathbed not to forget his vow to sacrifice a rooster on his behalf. In that age of faith, progress was slow but certainly not nil.

Corresponding author: M.S. Valiathan, National Research Professor, School of Life Sciences, Manipal University, Manipal, Tirupati, India.
e-mail: msvaliathan@gmail.com

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But a revolutionary change in the evolution of medicine occurred during Renaissance in Europe. No one knows why the liberation of the human spirit – which is what happened during Renaissance-occurred only in Europe and not in India or China. It was a whirlwind which affected art, science, medicine and every aspect of human endeavour. What distinguished post-Renaissance medicine from the earlier model were accurate observation and experimentation. The outstanding exemplars of these two achievements were Vesalius and Harvey. By painstaking dissection of cadavers over many years and careful observation, Vesalius produced an accurate description of human anatomy "The Fabric of the Human Body", which laid the foundation for medical science. While Vesalius pioneered structure, Harvey turned to function and discovered the circulation of blood by performing experiments in animals. These two events had a profound effect on medicine which was never the same again. The contributions of Vesalius and Harvey sowed the seeds of science in medicine which became a fertile ground for the growth of medical science. The practice of medicine changed as science entered its soul. This new direction and pace of medicine in Europe set it apart from the medicine of other ancient civilisations of India, Egypt and China.

A new wind in 19th century

Despite the entry of observation and experiment, the progress in the practice of medicine was not dramatic. Then and now, basic scientific discoveries such as the circulation of blood do not immediately translate into diagnostic tests or therapeutics. However a new wind blew in the nineteenth century, which radically changed the practice of medicine in Europe. The wind was driven by four events from chemical, biological, and also surprisingly, from social sciences. I will discuss the event from social sciences first.

Public Health

Industrial revolution shook England in the 19th century. Manchester and Liverpool witnessed manufacturing on an unprecedented scale in new factories, ruthless pursuit of wealth, overcrowding, exploitation, and the collapse of municipal services. Epidemics of cholera, infectious diseases like tuberculosis, and heavy mortality of women and children claimed hundreds of thousands. Doctors insisted on treating illnesses even though the treatment was thoroughly useless as the germ theory had not even been heard of. In this crisis, a few citizens moved by common sense and compassion braved criticism and ridicule and came forward with the slogan. "Clean water, clean air, clean housing, two good meals a day". Everyone took them lightly as they were neither doctors nor scientists nor priests. But their disarmingly simple call and sincerity gradually caught the attention of people who responded. In a couple of years, the mortality dropped dramatically and the Public Health movement was born. It was the first demonstration that mortality from major diseases could be controlled if not eliminated by non-medical measures. This led to the Chadwick report and the spread of public health as the engine of social medicine over the entire world. The impact of this event on the practice of medicine was far-reaching.

Antisepsis

When Joseph Lister began his surgical career in Glasgow, the commonest operation was amputation of legs for severe infection and gangrene. The operation also carried high mortality, which was the distressing experience everywhere. He had heard that carbolic acid was being used successfully to treat stinking municipal waste in Carlisle and wondered whether he could try the method to manage or prevent the stinking suppuration of post-operative wounds. He devised a simple, carbolic engine which would emit a carbolic cloud over the operative field during surgery. Conservative surgeons ridiculed the experiment but it turned out to be a great success in sharply reducing wound infection. That was the first use of antisepsis which revolutionised surgery and hospital care of patients.

Anaesthesia

Until the 19th century, surgery was done without anaesthesia. Patients were given plenty of wine

and subjected to physical restraint when surgeons operated with unbelievable speed. There was no time for careful dissection, the study of diseased structures, the choice of techniques, control of bleeding and so on. It is difficult for us to imagine the pain, anxiety and fortitude of patients and the agonising experience of surgeons in the pre-anaesthetic age. This was the context when Sir Humphrey Davy – a chemist – discovered nitrous oxide during his study of the chemistry of gases. He noticed a pleasurable sensation on inhaling the gas which soon got the nick name "laughing gas". Soon it was found that the gas, if inhaled longer and in greater concentration, would make one unconscious in a reversible manner. Dentists lost no time in using it followed by surgeons. This was the greatest act of altruism by science for pain relief in history. The magnificent achievements of surgery in saving millions of patients all over the world would never have been possible without anaesthesia and anti-sepsis.

Germs and infectious diseases

The fourth event was slow to unfold. In the seventeenth century, a lens maker in Holland, Antonie Van Leeuwenhoek, had observed "animalcules" under the microscope but they were merely objects of curiosity initially. It took the genius of Pasteur, Koch and other "microbe hunters" to understand the pathogenicity of many bacteria which had been seen as animalcules earlier. Their work on "germ theory" which identified the causative organisms of typhoid, cholera, plague, tuberculosis, and many other dreaded diseases was revolutionary and opened the doors to the development of vaccines without which we could not have prevented cholera or plague even in India. Without this fundamental understanding of bacteria as pathogenic organisms, Fleming could not have discovered penicillin many decades later. These four events in the nineteenth century altered the practice of medicine in so radical a manner that it had no precedent in the history of medicine since Hippocrates. Secondly, they ensured that the driving force of medicine became science and its companion technology in the place of faith which had driven medicine for many centuries.

Twentieth century and the dominance of science and technology

There is little doubt that the defining characteristic of medicine in the twentieth century was the pervasive influence of science and technology in theory and practice. For the first time disease process was understood. For example, it was known that sore throat in some children would be followed by disease of the heart valve – but microbiology showed how certain streptococci would cause the initial sore throat and induce an immunological response. In the course of weeks or months, antigen – antibody reaction of the immune response would target the heart valves and cause serious damage. This understanding paved the way for the prophylaxis of rheumatic heart disease. Similarly, it was known from "ancient wisdom" in Britain that digitalis leaves would relieve the generalised swelling and shortness of breath in patients with heart failure, when Withering employed it in treating patients. Only a century later did we understand the contractile function of the heart muscle, the response of the heart muscle to stretch, the mechanism of heart muscle failure and the pharmacological action of digitalis. These are merely two examples among hundreds of others which can be found in the treatment of virtually all diseases affecting the body. When we turn from science to technology, the dominance is even more striking. Technology was always a part of the physician's armamentarium but its use exploded after the Second World War. It is impossible to practice medicine today without instruments for the analysis of body fluids; for electrophysiological studies; for scanning by ultrasound, X-ray, computed tomography (CT), magnetic resonance imaging (MRI); for a variety of surgical interventions by laser; and for visualising the interior of the body and doing procedures through endoscopes. Similarly, medical practice is hardly possible without

devices – implants such as joint prosthesis, heart valve, and pacemakers – and thousands of disposables ranging from syringes to dialysers for treating end-stage kidney disease. In the twenty first century we already see biotechnology products making their entry – DNA-based diagnostics for HIV, therapeutics such as human insulin, and vaccines such as Hepatitis B. There are even predictions that biotech products will grow and eclipse other technologies in the present century. Science and Technology in medicine have brought immense benefit to patients and made the practice of medicine exciting and profoundly satisfying for a physician today.

New winds; twenty first century challenges for the young physicians

Hardly a day goes by in our time without one hearing of new advances such as "intervention procedures" done by "interventionists", which replace surgery; no less often do we hear of minimal access surgery, day care surgery and so on which reduce hospitalisation and the cost of treatment. Administrators and media discuss social health insurance and various forms of health care financing endlessly; the pressure on the Government of India to raise the allocation for health to 2% to 3% of gross domestic product (GDP) is mounting. Behind all these moves, one cannot miss the irresistible pressure of economics. It drives research and development (R&D), hospital projects, and health care itself. A doctor wishing to set up a practice or a nursing home will be confronted immediately by the challenges of economics. The young generation of doctors will be obliged to learn the elements of hospital economics to run their practice or even continue their successful affiliation to corporate hospitals. This is a reality which cannot be wished away any more.

The other wind is really the ancient breeze of ethics, which has gathered unprecedented strength in recent years. The Hippocratic Oath you took today or the oath administered by Charaka in India at the initiation of a physician's training are reminders of the eternal validity of the professional code for physicians. But its scope has expanded far beyond what Hippocrates or Charaka would have imagined. This is unhappily a consequence of the medical profession committing grave ethical errors if not horrors in the last 100 years. The terrible experiments on human beings done in Nazi Germany which led to the Nuremberg Code and the series of 50 human experiments conducted in the US and reported by Beecher in 1966 are examples of the eclipse of medical ethics. There must be many more unreported errors and crimes going on all over the world including India even today. The errors often arise as an indirect consequence of the entry of technology into medical practice. If an intensive care unit (ICU) has only 10 beds and there are 15 patients needing admission, how does one prioritize admission? If a hospital charges two hundred rupees a day for a bed and five hundred for an ICU bed and you have a patient who needs observation but no intensive care, would you admit him to the ICU if the management so demands? If the patient has signed a living will "Not to Resuscitate" and the relatives insist that you should resuscitate and put him on life support, would you do it? It a woman gets her genotypic profile done and finds that she has BrCA1 and BrCA2 genes for breast cancer and demands that you do bilateral mastectomy, would you do it? A colleague sets up a Scan Centre and asks you to invest and tells you that patients would be referred by doctors in the city on paying a commission, would you go along? Would you accept the lavish hospitality and first class airfare from a company who is a seller of equipment to your hospital? There are hundreds of such moral dilemmas facing doctors today – they would not have arisen in the absence of technological advances. There is no doubt that India will have the best of times in the years ahead when the young generation of doctors arrayed here will be practising medicine. The challenge for them will be to practice medicine rooted in science and technology but, at the same time, remain mindful of economics and above all, ethical conduct.