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RESPECTING OUR MEDICAL HISTORY, DREAMING OUR FUTURE

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ABSTRACT

From the nineteenth-century basics science microbiologists Louis Pasteur and Robert Koch to the sequencing of the human genome, gene therapy, robotics, sensors, gene editing and bionics, the past 200 years have seen medicine advance at an extraordinary pace. There are about 30,000 diseases known to human beings and of those most of them have no treatment. Hundreds of thousands of people are alive today because of life saving, life altering and life sustaining treatments that have emerged from the continuous research. Advanced research in (bio) medicine and technological innovations make it possible to combine high-dimensional, heterogeneous health data to better understand causes of diseases and make them usable for predictive, preventive, and precision medicine. Healthcare changes dramatically because of technological developments, from anaesthetics and antibiotics to magnetic resonance imaging scanners and radiotherapy. By 2050, expert surgeons will use robots to operate on patients. Infants will have their DNA sequenced before they are born. Patients will be able to generate new blood inside their own bodies without the need for a blood donor. The human factor of the doctor at the patient's bedside equals modern computerized medical equipment. Breakthroughs in gene, advances genomics and genetics, new research of DNA and RNA, the frontier research of life sciences, new biotherapy discovery, emerging areas for medicine applications, robust technology development, and cutting-edge Biotechnology, etc. will come in use in future.

INTRODUCTION

The Mutiny of 1857 led to the dissolution of the East India Company and the British government was established in India.[1] In 1869, the medical departments in the three presidencies were amalgamated into the Indian Medical Service.(2) The European officers of the Indian Medical Service headed the military and civil medical operations in the three presidencies. However, they needed trained assistants and supporting staff such as apothecaries, compounders, and dressers in their work.[3] In 1822, the Native Medical Institution was established in Calcutta to provide medical training to Indians. European texts in anatomy, medicine, and surgery were translated into the local languages for the benefit of students.[4]

In 1826, an Indian medical school was started in Southern Bombay with surgeon John McLennan as the superintendent.[5] In this vision of the future, systems medicine promises to provide new impetus for participative, proactive, and preventive healthcare (6,7) Due to the complexity and the necessary integration of heterogeneous concepts there is no consensual understanding of systems medicine so far (8) Recent technological developments have allowed healthcare to increasingly be tailored towards specific patients and sub groups-a medical model referred to as precision

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medicine [9]. The 'precision' is informed by tools that incorporate genetic, environmental and lifestyle information, and ranges from risk equations to genetic testing [10,11]. Technological progress in precision medicine is expected to continue, spearheaded by programmes such as the Precision Medicine Initiative and the 100,000 Genomes Project [12,13].

The development of 'learning' health information systems that analyse molecular and health record data to inform future prevention, detection or treatment strategies are two cited possibilities [14]. In this vision of the future, systems medicine promises to provide new impetus for participative, proactive, and preventive healthcare [15]. It is not yet clear how and in what period the systems medicine approach will find its way into the healthcare system. [16,17]

Complicates a shared vision and the development of strategies for the implementa-tion of systems medicine in healthcare [18] Systems medicine is not a medical discipline in the traditional sense, but terms a rel-atively young interdisciplinary approach that brings together (bio) medical knowledge and digital technologies for systems-oriented thinking and action [19,20]

History

Ancient medicine

India has one of the world's oldest Ayurveda medical systems. It is focused on understanding the use of medicinal plants, healing practices, illnesses.(21).

Florence Nightingale, widely known as the lady with the lamp, was noted that in the Crimean War, more soldiers died from Typhoid, Typhus, Cholera, and wound infections than injuries on the battlefield. She employed small steps such as hand washing, improving sanitation and ventilation, providing safe drinking water, and caring for wounds to make a significant impact.

Hippocrates was considered an outstanding figure in the history of medicine. He is popularly called as the "Father of Medicine"(22) William Harvey discovered blood circulation. Robert Boyle explained that air is essential to life. In 18 th century chief remedies were alcohol and opium. Highly significant medical advance is vaccination. Edward Jenner began inoculations with material from cowpox.

The development of scientific medicine

Hippocrates described medicine in scientific manner. Scientific medicine has developed with particular emphasis in the fields of anatomy, physiology, as well as of specific medical branches. First medical college in India started at Calcutta in the year 1835.Simultaneously, in the year 1856,two medical colleges opened in Bombay and Madras.

It is a challenging time in medicine

Since the beginning of the 20th century, a number of doctors and academic historians have advocated in favour of incorporating medical history into clinical practice and medical education. Medical school administrators have repeatedly questioned medical historians about the justification for teaching "outdated science" in medical training programmes outside of antiquarianism and learning for learning's sake after the germ theory of disease replaced the humeral model of medicine in the late nineteenth century.

Many aspects of the current practice of medicine and the illness experience cannot be fully understood without a longitudinal examination of prior history. For instance, the structure of the profession and its culture, healthcare economics, and health delivery systems cannot be fully understood without a longitudinal examination of prior history.

Human factor of the doctor at the patient's bedside equals modern computerized medical equipment

As predicted by Antoine de Saint-Exupéry and what we wrote about in our scientific papers, for example Forty Years Success of No Maternal Mortality in Critical Obstetrics on the Operating Table. A Decrease in The Increased Marker of Tissue Hypoxia PCO2 > (Av-Gap) in Microcirculatory-Mitochondrial Distress Syndrome in Critical Obstetrics is Achieved by Complex Methods of Recruiting Microcirculatory-Mitochondrial Distress Syndrome.

Considering maternal mortality in state-of-the-art clinics and sophisticated methods of treatment and diagnosis, the human factor of the doctor and the available methods of treatment and diagnosis remained a priority in reducing and even eliminating obstetric mortality.

The of success since the last century as in many other previously published works, and represented at international congresses in the Republic of Moldova, Romania, Spain, the Netherlands, Russia and others, where decrease in the increased marker of tissue hypoxia pCO2> (AV-gap) in microcirculatory-mitochondrial distress syndrome in critical obstetrics is achieved by complex methods of recruiting microcirculatory-mitochondrial distress syndrome, contributed to the absence of maternal mortality over 40 years of work in critical obstetrics is presented as a brilliant proof of an affordable model in any medical institution that finds itself next to a dying woman in labour.

Future medicine and how to impart it to normal population

Specific prediction about future developments.

Within ten years every drug in the supply chain will be a digital object, every patient will know what they take and how it will affect their body.

The mobile internet is a transformative technological step change. It is remaking all aspects of our lives and that will increasingly include medicine. So the number one mega trend that will transform medicine is digital technology.

New pandemics and deadly bugs

The second global mega trend is demographic: aging, urbanization and affluence. These three together are leading to global pandemics of dementia, depression and diabetes.

While it is safe to say that more people will be able to live longer, healthier lives in the future, it's also likely that future generations will face health threats that are less common and illnesses that are less heard of especially fungal and viral and parasitic illness. The life span of all end stage diseases would rise up more transplant patients and new opportunistic infections in the pipeline.

Healthy aging

Unfortunately, the healthy lifespan has not, and the period of life when a person lives with disability and illness at the end of life is growing, especially in women.

The big hope is that 25 years from now, medical sciences will have progressed enough to enable people to have healthier and more active lives almost up until their eventual death.

Future viral threats

A catastrophic global pandemic is one of the greatest risks to humanity. Over the last 25 years, we have seen SARS, Ebola, Zika and other viruses spread undetected for months, leading to international emergencies and often devastating consequences. Even in the best US hospitals, most infectious diseases are not properly diagnosed or tracked.

But advances in two fields, genomics and information science, can transform our fight against viral threats. Ultrasensitive genome sequencing technologies are enabling the detection and characterization of viruses circulating under the radar. The advent of novel CRISPR, synthetic biology and microfluidic tools have allowed the development of rapid, ultrasensitive point-of-care diagnostics that can be deployed anywhere in the world. The resulting diagnostic and surveillance data can be integrated across healthcare nodes, from rural clinics to city hospitals, thanks to powerful new information systems. Over the next 25 years, the development and integration of these tools into an early-warning system embedded into healthcare systems around the world could revolutionize infectious disease detection and response.

Drug availability and financial burden

Of the many biomedical advances made by the scientific community, only those that can generate large financial profits are taken up for development by for-profit companies. This leaves many gaps-but also opportunities-in regard to developing new treatments to meet public health needs.

We need a paradigm shift such that medicines are no longer lucrative market commodities but are global public health goods-available to all those who need them. This will require members of the scientific community to go beyond their role as researchers and actively engage in R&D policy reform mandating health research in the public interest and ensuring that the results of their work benefit many more people. The global research community can lead the way toward public-interest-driven health innovation, by undertaking collaborative open science and piloting not-for-profit R&D strategies that positively impact people's lives globally.

Availability of drugs to each and every section of population irrespective of their affordability is of paramount importance.

A Novel Tool for Research Discovery

Less publicized in recent years, yet still, the central driver of progress is the steadily proceeding biological insights gained through the tried and true hypothesis-driven investigation into the complex worlds of metabolism, growth, development, and regulation.(23)

Biomarkers Discovery in research

Hope for the next 50 years is that someday a single blood test could inform individuals of the diseases they are at risk of (diabetes, cancer, heart disease, etc.) and that safe interventions will be available at an early stage.

Biomarkers can be used for many purposes, including diagnosis, prognosis, and selecting appropriate patient therapy, and can provide information on disease mechanism or progression. (24). Biomarkers may be apparent measures such as blood pressure or heart rate in humans or less visible means such as hair color or cell cycle stages, gene polymorph, life or death, and ability to fertilize and produce offspring. (25). Hypertension is one of the most common cardiovascular disorders over the age of 60 years; around 60%-70% of the population is affected. Antihypertensive drugs are still among the most prescribed medications by clinicians. (26). In experimental hypertension research, several animal models exist, and rats are the most commonly used animals (27).

Recent advances in diagnostic technology

Improving therapeutic strategies involving existing treatments is a prime concern for now. Patient variation, concerning treatment response is a well-documented phenomenon (28)

Through the capturing of clinical data and pertinent samples across a large patient population that exhibits variable treatment response, retrospective statistical analysis of the integrated clinical, experimental and molecular data could reveal the underlying causes of this variation (29).

Through the integration of molecular-based technologies, systematic tissue procurement, and medical informatics, can identify clinically applicable "genotype"-"phenotype" associations across cohorts of patients that can rapidly be translated into useful diagnostic and treatment strategies (30).

Medical Research--Future Directions and challenges

Artificial intelligence

Artificial intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and animals. Recently AI techniques have sent vast waves across healthcare, even fueling an active discussion of whether AI doctors will eventually replace human physicians in the future.

Diagnosis of disease using AI is the most crucial part of innovative technology. It uses machine learning algorithms to understand the onset of disease. Deep Learning algorithms – have recently made huge advances in automatically diagnosing diseases, making diagnostics cheaper and more accessible (31)**.**

Machine Learning is particularly helpful in areas where the diagnostic information a doctor examines is already digitized (32). The advantage of machine learning algorithm in diagnosis of various disease includes detecting lung cancer or strokes based on CT scans, assessing the risk of sudden cardiac death or other heart diseases based on electrocardiograms and cardiac MRI images**, c**lassifying skin lesions in skin images and finding indicators of diabetic retinopathy in eye images. (33). Since there is plenty of good data available in these cases, algorithms are becoming just as good at diagnostics as the experts.(34)

Digital therapeutics

Digital therapeutics, a subset of digital health, are evidence-based therapeutic interventions driven by high quality software programs to prevent, manage, or treat a medical disorder or disease (35) Digital therapeutic companies should publish trial results inclusive of clinically meaningful outcomes in peer-reviewed journals. (36) The treatment relies on behavioral and lifestyle changes usually spurred by a collection of digital impetuses (37) Because of the digital nature of the methodology, data can be collected and analyzed as both a progress report and a preventative measure (38)

Treatments are being developed for the prevention and management of a wide variety of diseases and conditions, including type 1 & type II diabetes, congestive heart failure, obesity, Alzheimer's disease, dementia, asthma, substance abuse, ADHD, hypertension, anxiety, depression, and several others (39,40)

Lab-on-a-chip

A lab-on-a-chip is a class of device that integrates and automates multiple laboratory techniques into a system that fits on a chip up to a maximum of a few square centimetres in size. We apply our method to the rapid detection of SARS-CoV-2 RNA in clinical samples.(41,42)

Light at the End of the Tunnel

Epigenetics

The study related to changes in gene expression, resulting in different phenotypes without changing the genomic DNA sequence is known as Epigenetics. Epigenetics facilitates heritable changes (Meiotical and/or mitotic) at the level of gene translation by the utilizing exogenous sources like nutrition, both post and prenatal stress, psychological factors, etc; Epigenetic modifications related to maternal and paternal nutritional related programming of germ cells ensure to receive valid adaptive information by the offspring (43)

SARS-CoV-2 had learned to cause epigenetic network disruption, forming an antagonist of host immune system. 44)
Epigenetics can be an ideal therapeutic target for various diseases by reversing the expression of abnormal genes as studies have evidenced that epigenetic factors are reversible. (45)

The first epi-drug for Alzheimer's disease is ORY-2001 developed in 2010. This drug aims to target the genes related to memory and learning (cognition) by altering the abnormal gene expression. (46,47)

Gene-Editing

Evolution is a continuous process exhibited mainly through genomes of the organisms by introducing genetic changes enabling the loss or gain of certain specific features.

Gene editing allows for extremely precise genetic alterations to be made to living things, thereby altering their genetic composition. CRISPR-Cas9 is a powerful gene-editing molecular tool and this technology was discovered in 2012. This is an efficient technique with high precision, which helps in removing and inserting the DNA at desired location. These "genetic scissors" are simpler to design, more methodically effective, and better able to target specific genomic sequences.

Gene editing tool is used in genetic engineering for the larger production of pharmaceuticals like vaccines, enzymes, antibodies and hormones. Entire genes can also be replaced, deleted, or added. Chromosomes can even be rearranged.
Gene editing tool is used to understand certain disease conditions, mechanism, also helping in creating / production of proper medication for many animal and human diseases.
CRISPR-Cas system is potential to treat diseases like allergies, cancer, Duchene muscular dystrophy (DMD), metabolic disorders, cardiovascular and neurological diseases (48) The gene editing is helpful in blocking cell proliferation of the bladder cancers, in myeloid cell leukaemia there is a possibility to delete complete gene responsible for the said cancer.(49) CRISPR-Cas has also shown its role to knock-down the expression of multidrug resistance (MDR) gene leading to chemotherapeutic drug resistance. (50)

Translational Medicine

The main aim of translational research is to achieve improved patient care and quality of life by incorporation of scientific discoveries in life sciences. Translational research includes all the fields of research contributing to human health applications like nutritional research, pharmaceutical research, Nano medicine, clinical trials on preclinical animal models of medical genetics, diseases, tissue engineering, regenerative medicine and many more.

The phases of translational research are T1, T2, T3. T1- deals with identification of health problems and disease mechanisms. T2-discovery of application to clinical setting and human health. It covers controlled observational studies, human clinical studies, and efficacy studies (51)

Probiotics and Synbiotics: beneficial gut microbiota comes from probiotics fermented diary products (yogurt, cheese) pickles are common probiotics used since ancient times research states that probiotics exhibit pro regenerative and anti-inflammatory effects (52) It can be substituted as a reference product by the pharmacist without the intervention of the healthcare provider (53)

Stem cells and tissue engineering

Stem cells are capable of treating degenerative diseases by replacing the damaged cells and tissues. Embryonic stem cell (ESC) is pluripotent natured and capable of giving rise to any type of the cells and tissues and somatic stem cell is capable of producing one or many types of specific cells and tissues but has restriction in plasticity.(54)

Great achievements in degenerative medicine is product of 3D organoids and multi-layered microstructures of cells along with scaffolds, helps in learning about the pathology of diseases/ injuries.(55)

Nanomedicine: This uses molecular knowledge and is the combination of medicine, biology and nanotechnology. (56)
Nano medicine the most intensive area of research in the present scenario but still it could achieve only 247 products and applications.(57)

Antibody engineering

Antibody technology has made a significant progress as it is deleting with human therapeutic use. It has greater application in antibody-based assay, passive immunization, cancer therapy, imaging/ diagnostic purpose, neurodegenerative diseases, immunosuppression, etc;. antibody therapy is still a better option of treatment in many diseases. (58,59,60)

Theranostics

Theranostics is the term used to describe the combination of using one radioactive drug to identify (diagnose) and a second radioactive drug to deliver therapy to treat the main tumour and any metastatic tumours.

Oncogenomics

Oncogenomics is a sub-field of genomics that characterizes cancer-associated genes. It focuses on genomic, epigenomic and transcript alterations in cancer.(61)

Prognosticate the future medicine--
In the future, with the help of 3D print technology, anything can be easily made by shaping it. As a result result of technological development, it is possible to eradicate cancer scrupulously. All types of diseases are treated with only one vaccine. All most all laboratory tests were tested with machine computer technology. All the medical reports will be sending to the doctor by email, it will be possible to get the treatment of the disease sitting at home.

Manipulate the devices that detect input from the physical environment called "Smart bodies" which can connect to the internet and reside inside the body, Flying vehicles, which travel, are used for relief operations during earthquakes, floods, accidents, and famines. Robots will be able to perform surgeries. Lab grown organs render human organ donation. The use of DNA computers for certain specialized problems. These computers are faster and smaller than any other computers. The neuromorphic hardware uses in processing the behavior of neurons directly in hardware, and a web of physical interconnections facilitate the rapid exchange of information.

The future of care in 2023 and beyond

Successful demonstration of a 5G Connected Ambulance equipped with the latest medical equipment, on-board cameras, AR/VR-based Headgear and Body Cams for paramedic staff, and patient monitoring applications that can transmit patient health data to the hospital in real-time. Time is critical in the management of trauma and combining 5G with healthcare technology can transform trauma care. This will be invaluable in early disease prediction, patient care, and focused healthcare services for the community.(62)

CONCLUSION

The twentieth century saw amazing advances aimed at preventing the onset of disease-including vaccines and risk-factor interventions-nearly doubling life expectancy worldwide. Only two decades into the twenty-first century, healthcare has already entered its next phase of rapid advancements. By using precision medicine technologies, genetic vulnerabilities to chronic and deadly diseases at the individual level can now be identified, potentially pre-empting disease decades later.

There might be a possibility of developing cancer vaccines. Vaccines targeting the causative agents of cervical and hepatocellular cancers have already proven to be effective A successful trial is the 5G-driven, Artificial Intelligence-guided Colonoscopy that helps doctors detect colon cancer much faster and with greater accuracy. Robotic surgery with forefront technology, representing the generation of healthcare innovation to treat cancers.

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