

What will doctors be doing by 2050?

The following points summarise the core elements of the essay:

- How doctors will be using genetics and genetic engineering to predict conditions and cure illnesses.
- A movement away from traditional pharmaceutical methods of treatment, for instance physicians using viruses to treat cancer.
- The usage of advanced technologies such as nanotechnology and tissue regeneration, allowing doctors to treat disease more effectively.
- A movement of primary care away from clinics and surgeries, and into the home with monitoring of the patient.
- Doctors will face more of a dilemma in declaring new techniques as useable and there will be continued debate over the use of certain materials such as embryonic stem cells.

Doctors' lives will change by 2050 mainly due to the advances in technology which will alter the practice of medicine, and the progression of medical ethics and regulation which will follow.

The 1950s discovery of DNA by Maurice Wilkins, led to Watson and Crick claiming it to be 'the secret of life'¹. During the last 5 years the final pieces of the jigsaw puzzle have been put into place in the human genome project. This vast undertaking has mapped the human genome linking each gene to a sequence of bases in a section of DNA. Understanding the genome may lead to a fundamental insight into the pathogenesis and treatment of disease. This, for example, allows the identification of proto-oncogenes, genes which if mutated cause cancer.

The film "GATTACA" shows a baby's blood being sampled and the child's future illnesses and age of death being predicted from this initial analysis. In 50 years this may become reality and doctors might be testing for particular genes which indicate a vulnerability to a disease. This method of 'genetic typing' will be used to diagnose conditions many years before the occurrence of complications, therefore allowing the doctor to give advice on how to alter lifestyle factors to pre-empt or minimise the effects of the disease. This is certainly possible for ailments such as coronary heart disease where the damage to coronary arteries develops silently many years before any symptoms emerge. Genetic typing will therefore lead to the advancement of the science of preventative medicine which will occupy an increasing amount of doctors' time. Associated with the development of benefits from this field, there will be ethical dilemma's which will occupy and affect doctors lives. These will include the invasion into an individual's privacy of whom the genetic makeup is known, and who would want to know their time of death? In 2050, greater choice for the patient will mean that doctors will have to exercise careful genetic counselling.

In conjunction with this there will be development of genetic engineering, the process of manipulating genes, which will be used more commonly in the treatment of disease. Currently human genes are added to bacterial plasmids to form recombinant DNA which is then inserted into a bacterium. The bacteria can then multiply and secrete the desired human protein. This ingenious method is used to synthesise injectable human insulin for diabetic patients. By 2050 gene therapy may allow

¹ www.time.com/time/time100/scientist/profile/watsoncrick.html

doctors to insert genes into the pancreatic cells of diabetic patients to create insulin within the body, avoiding the need for daily injections of insulin. In cystic fibrosis sufferers, the problematic gene means that a channel protein for chloride ions does not function. The solution may involve replacing the faulty sequence of bases with the correctly-coded gene, therefore creating the correct protein and curing the problem. This would be a major breakthrough to a disease which affects 1 in 1600 of the UK population and would drastically increase their life expectancy. The rare few who are immune to HIV could be used to create artificial immunity to the disease amongst the general population. By isolating and cloning the resistance gene then inserting it into an individual, immunity could be created. This branch of therapeutic science will create a new group of specialist doctors whose major interest will be to alter the damaged or malfunctioning genetic material in individuals.

In 2050, aside from traditional pharmaceutical treatments, other weapons in a physicians' arsenal may include viruses. Paradoxically these pathogens may experience role reversal, and be used for beneficial purposes namely overcoming diseases where pharmaceutical remedies have difficulties. For instance an adenovirus has been found which will selectively attack cancerous cells leaving somatic body cells unaffected. Furthermore the use of viral vectors² combined with gene technology, means that conditions which involve the incorrect expression of protein could be cured by using the virus to insert the correct gene into the patients DNA. Furthermore in the same way that biological control was used to kill rabbits by myxomatosis, viruses may be genetically engineered to attack particular bacteria or parasites.

Time dilation may mean that in 2050 doctors will have the ability to slow time so that treatment can be administered to a patient. In a hypothetical case, a patient in need of a liver may die in 2 weeks, however it may take 4 weeks to culture the liver. The patient might be sent into orbit at a very high velocity, allowing time dilation to occur. During the patient's time away, the liver could be synthesised allowing the patient to survive.

Nanotechnology³ may progress sufficiently to allow doctors to place remote controlled nano-robots (nanobots) into humans, for example to locate and remove cancerous tumors. Perhaps by 2050, nanobots will be introduced into blood stream of healthy people supplementing the role of the leukocytes in the immune system. In essence nanobots could be used as an artificial immune system to prevent and help stop outbreaks of a disease. These may be useful in a disease such as HIV, where the virus attacks the immune system. Minuscule robots capable of performing the job of the immune system by removing infected cells and destroying the virus itself, could save hundreds of thousands of lives.

In addition robots may be used to aid surgeons in operations which require precision, for instance in brain surgery where small errors can lead to large degrees of damage. By 2050, robots are unlikely to have the dexterity, sensibility and initiative of a human surgeon and therefore will not carry out operations single-handedly, but will be used for precision movements such as making a hole in the femur to accept an artificial hip joint. Surgeons currently see the advantages of robots being tele-surgery, or doctors using video-feeds to conduct an operation at a remote site using robots to mimic their movements. This would allow a surgeon suited to specific cases to be

² **Applications of Genetics** (Cambridge, 2000) J.Gregory *Human Genetics* pp.64-65

³ **Future** (Dorling Kindersley, 1998) M.Tambini pp. 28-37, 40-41

able to carry out those procedures from a different city or country. In addition using surgical robots will reduce the cost of procedures since fewer medical staff such as nurses would be required to aid the surgeon.⁴ The robots may also be used in prolonged operations to help relieve the surgeons when their hands begin to tremble. The daVinci robot already performs some of these techniques but in future robots will play more of a pivotal role in surgery. By 2050, doctors will have a close working relationship with the programmers who develop the software for the robots. Computer programming may even become as integral as anatomy in a medical student's course!

Surgery is becoming rapidly more advanced. Previously a blocked coronary artery was frequently fatal, or caused substantial damage to the heart muscle. The advent of clot-busting drugs led to a major advance in the management of heart attacks. Now semi-invasive methods such as angioplasty (inflating a small balloon to clear the blockage) are rapidly being advocated as the preferable technique. Studies in the 1980's demonstrated that patient survival could be improved by cardiac bypass surgery. Cardiac surgery is, however, a large invasive operation. A move towards less invasive keyhole surgery is likely to take place, and traditional methods will be used as last-ditch procedures.

The techniques for tissue regeneration will drastically improve; human tissue can already be grown in nutrient-rich fibrin gel and even bone can be developed using mother-of-pearl and human blood or bone cells. Doctors will be able to rebuild the limbs and bodies of those who have been disfigured by horrendous accidents. In addition, prosthetics will improve significantly, perhaps people who have lost limbs in accidents will receive artificial limbs which equal or even supersede their original limb. Another technique being investigated is surgery using fetal tissue to generate organs. Fetal tissue has the special ability of being pluripotent and can differentiate into a plethora of different cell types. These cells could, for example, be used to treat Parkinson's patients⁵ where the nervous system cells degenerate, leading to the features of the disease. The fetal tissue would grow into the neurones required, thus relieving the problem. This approach may in 2050 be used by doctors to cure degenerative disease.

By 2050 the traditional methods of notes on paper will be discarded in favour of an electronic system. Gone will be the days where medical notes are kept in bulky folders containing barely legible hand written notes, half of which are missing. The NHS is already moving towards a paper-free system and patient data is stored in databases. By 2050 all medical data could be stored on the identity cards, so individuals will always carry a record of their medical history so that emergency treatment can be administered much more rapidly and efficiently. The danger of this is that doctors could be the instruments of a 'Big Brother' state. Moreover, the issue of patient confidentiality and the Data Protection Act may mean that stricter levels of access will be employed to prevent exploitation of the data.

Implantable devices such as pacemakers are already being fitted with the technology to remotely transmit information to the doctor about the performance of the pacemaker. In 2050, doctors will be giving patients implantable devices which also contain numerous other sensors such as temperature and heart rate which can alert doctors to changes in the status of the patient. Therefore, in the case of a patient with angina, a 24-hour record of ischaemic episodes would be available to the doctor

⁴ <http://www.howstuffworks.com>

⁵ **Cambridge Illustrated History of Medicine** (Cambridge, 1996), *Looking to the Future* Geoff Watts pp.342-372

in advance of a consultation. By 2050 doctors will be able to follow their patients from home via special sites on the internet on which patient data could be transmitted. This leads to very close follow-up of patients but the danger that doctors may not be free of the responsibility of the patient at any moment of their lives.

Over the recent years there has been a huge rise in medical litigation faced by doctors. Episodes such as the Harold Shipman case and the Bristol enquiry have unsettled public confidence in medicine as a profession. These public insecurities have led to doctors experiencing increasing amounts of scrutiny. In the future, mounting levels of bureaucracy will play a part in the practice of medicine. This will lead to high stress levels and any medical innovation, such as new techniques and therapies, will be highly regulated. Changes in the health service may result in its function as a high-profit company will further undermine the humanitarian nature of doctors' work.

Medical ethics will become increasingly complex. When the University of Harvard patented their genetically modified mouse for cancer research there was an intense debate over whether this was acceptable. Ethical debate over the use of embryonic stem cells and the production of clones is likely to continue. This will lead to the setting up of national and international bodies which will regulate and intervene with this kind of work. With greater choice and complexity of treatment doctors will have to put more effort into ensuring patients have informed consent.

In conclusion, in 2050, doctors will have the knowledge and technology to be treating a plethora illnesses, more effectively than now.

Since Hippocrates' times doctors have tried to alter the course of disease to improve and save patient's lives. In the year 2050, this will continue to be their primary goal.

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