

ROBOTICS (CYBERNETICS) IN MEDICAL SCIENCE: BLESSING OR BLIGHT*

“Necessity is the mother of invention” – so said the Greek philosopher Plato (427-347 BC) – the eminent pupil of Socrates (469-399 BC) and also the teacher of Aristotle (384-322 BC) in the Academy in Athens.

Robot is such a feather in the cap of our modern technological innovations. It is a necessity in our fast, rapid and dynamic modern life. Robot has given us speed; and speed is the spice of life. However, too fast life has its own demerits. Balance is what is most desirable.

The word-Robot-originates from the Czech- “robota” meaning ‘forced labour’ – “robotnik” – serf. The term was coined in the famous Czech satirist playwright Karel Capek’s (1890-1938) play, “R.U.R.: Rossum’s Universal Robots” (1920). In the play, Rossum and his son develop humanoid creation to be used as serfs (robot-niks)/servants for humanity; eventually, they become self-willed, revolt against, and then kill their masters. It was an indictment of industrialised society. Capek’s self-willed robot in satiric R.U.R. has been transformed in real life by modern technology into a strictly -guided, programmed and computerized tool of immense potentialities of positive nature. Satire has thus given place to sanity. Robot is one of the superb contributions of modern physics to modern medicine. The word- “Cybernetics” – originates from the Greek “Kubernetes” meaning ‘steersman’. Cybernetics is the science of communications and automatic control systems in both machines and living things.

Robots are automatic machines capable of carrying out tasks traditionally done by humans. Robots are widely used in industry to perform simple repetitive tasks accurately and without tiring, and to work in environments which are dangerous to human operators. They can also be used as sensors, equipped for artificial vision, touch and temperature sensing. Many are now capable of simple decision-making without the intervention of the operator. If the robots are in human form, they are called “Androids”. Computers are the most widespread example of automation, controlling systems which humans find too time-consuming.

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Cybernetics is the study of control systems that exhibit characteristics similar to those of animal and human behaviour. The term was coined by the U.S. mathematical logician Norbert Wiener (1894-1964) – author of “Cybernetics (1948)”, which deals with handling of information by electronic devices, based on feed back principles and encourages comparison between these and human mental processes. Cybernetics is essentially a broad-based discipline which includes information, message and noise theories, and can reconcile the work of neurophysiologists, psychologists and computer engineers.

Robots in Surgery

Simple industrial robots were first employed in 1961; now they are very sophisticated and complex – can perform extremely delicate precision manipulations, such as making a car or constructing complex electronic components.

Now, in the operating theatre, the surgeon can use his voice control to adjust the height and slope of the operating table, the theatre illumination and the lighting of the endoscopic apparatus. But there are limitations. Industrial robots perform their work mainly on unchanging items and are allowed trial runs in order to get the procedure right. In surgery and medicine every patient is different and trial runs are out of the question.

Robotic equipment in operative procedures, co-operative with, rather than replace, the surgeon. It is a symbiosis. Thus robot can be used to machine the cavity for placement of the prosthesis in hip replacement, for machining the bone ends in knee replacement, for accurate positioning of a biopsy probe or laser (Light Amplification by Stimulated Emission of Radiation) into a cerebral tumour, to carry out surface cutting of the cornea in refraction correction, where accuracy has to be measured in microns and in robotized transurethral resection of the prostate.

Technology has already developed to allow the surgeon to operate from a remote site, using a three dimensional monitor, to control endoscopic instruments for introabdominal and intra-thoracic surgery.

Fig. 1 gives an artist's impression of an endoscopic operating room in the future with virtual reality, telepresence and robotic manipulator technology. A large central processing unit integrates and controls these sophisticated systems.

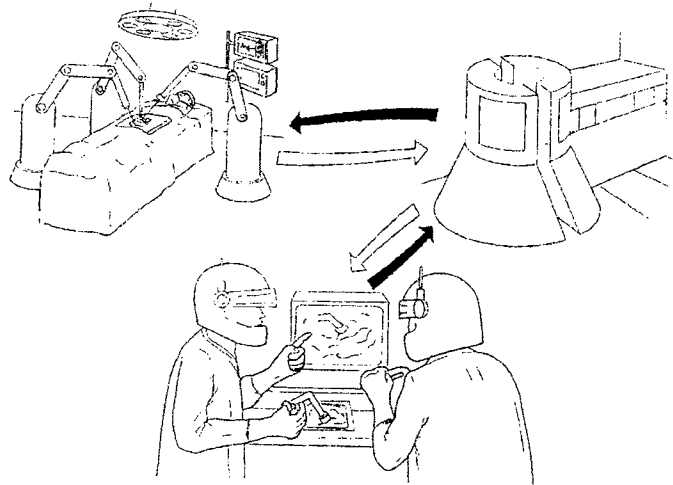


Fig. 1. Could this be the operating theatre of the future? The surgeons are outside the room with virtual reality, telepresence and robotic manipulator technology. A large central processing unit integrates and controls these sophisticated systems

Peter Goh and his colleagues at the National University of Singapore developed a robotic ‘mouse’ to be inserted into the colon and which is able to drive itself around the curves and corners of the bowel, transmitting pictures to he receiver, and is able to perform removal of small polyps or biopsy of larger tumours; the same device can be used in other body cavities, for example, the stomach (Goh, 1996).

The Epilogue

The surgeons, engineers, technologies and craftsman are working more closely with each other than ever before to exploit the possibilities of emerging technology. Advancement of fundamental sciences like physics, chemistry and mathematics and their application have made all these possible. The surgeons and physicians of tomorrow will certainly explore new frontiers of medical science, visit or observe inaccessible parts of the human body and operate where no man has gone before.

Though modern scientific technology has given speed and precision and thus has taken away human sentiments and decision to a great extent, it is still the human mind which has the final say. Robotics in medical science is just another

example. Direct doctor-patient interaction still rules the waves, and it is human and human alone and not machine that matters. Human life cannot, and should not, be put at the mercy of modern machine, be it assembly-line robots or any other present-day technical human counterparts or replacement. Man is unique, and will remain so for ever.

Modern science has given us the speed, but has taken away the spirit, emotion and sentiments, without which life becomes stale and stolid. The eminent Anglo-American poet, critic and dramatist, Thomas Stearns Eliot (1888-1965), Nobel Laureate in Literature, 1948, already put a big question mark on the subject in his “Choruses From ‘The Rock’, (1934)” with a fashionably slick despair:

“Where is the Life we have lost in living?
Where is the wisdom we have lost in knowledge ?
Where is the knowledge we have lost in information?
The Cycles of Heaven in twenty centuries
Bring us farther from God and nearer to the Dust.”

The pertinent question remains – whether Robotics in medicine is a boon or a bane, a blessing or a blight, a delight or a despair? The ultimate verdict lies in people’s court. Only time will tell. People are turning back to things indigenous. The direct human touch is what matters most in the art of healing.

Reference

Patel, Goh Robotics. In Savalgi R. Ellis H. eds. *Clinical Anatomy for Laparoscopic and Thoracoscopic Surgery*. Abingdon Radcliffe Medical Press, England, 1996.