Robotics and the Future of Laparoscopy

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Prof. Dr. Dr. h. c.mult. Kurt Semm

Let me begin by saying that it is a great pleasure for me as one of the first honorary members of the Society of Laparoendoscopic Surgeons to be the Keynote speaker of the 8th Annual Meeting. Perhaps you find it funny that one of the oldest of you should speak about the future. But remember, as Goethe said—to see the future one must examine the past.

I ask all of you to think back and look just how far we have come since the introduction of general anesthesia by the English gynecologist, Simpson, in 1846. Using chloroform, he anesthetized Queen Victoria at delivery and, therefore, his method became known as "L'Anaesthesie de la Reine."

The introduction of anesthesia marks the beginning of the era of modern surgery. Through this innovation, general surgery was born.

I urge you all never to forget the great work done by anatomists such as Leonardo da Vinci, Gabriele Falloppi and others. Please allow me to comment that Falloppi wrote in his own book, in 1564, his name with two "l"s and two "p"s. In *Encyclopedia Britannica*, his name is misprinted.

The early anatomists risked their lives to exhume fresh cadavers in order to do dissections and thereby discover anatomy based on reality and not on theory as was advocated at that time by the scholastics, who were supported by the church. For example, the scholastics believed that the number of teeth a cow had could be deduced theoretically, and they refused to go out to the pasture, open the cow's mouth, and count the teeth.

General anesthesia not only perfected limb amputation but brought with it the entire spectrum of general surgery, so that just 50 years after the beginning of this century general surgery has become a mainstay in medicine.

Following this, surgeons had now only one fear: the unknown, the enemies they could not see—Bacteria. In 1929, Alexander Fleming discovered penicillin and, in 1942, he was awarded the Nobel Prize for medicine. With antibiotics, the invisible enemy was conquered.

So now, 100 years after the beginning of the modern era of surgery progressed with the introduction of blood transfusions, and intensive care medicine made what was believed to be surgery's final hurdle, organ transplantation, a reality, surgery (whether general, orthopedic, neuro, or gynecologic) seemed to be perfected.

Since 1963, a new technique had begun to evolve that would eventually attack the fortress of surgery to its very foundation, particularly its credo "Big incision, big surgeon." This was largely due to the efforts of one man, a gynecologist from Kiel, Germany. He put a stop to the freestyle battle of the ten fingers within the broadly opened recesses of the human body. Declaring that "the palpation and grasping of organs is no longer necessary,"he invented a new style of surgery and all its regarded apparatuses and instruments.

He restricted the uncoordinated movements of our ten fingers to simple in, out and rotating restricted movements of the instruments. Access was given by the organ-oriented placement of small trocars through the abdominal wall in proximation to the organ or tissues to be surgically treated. At the beginning, his work was criticized as, "Small incision, small brain." He was openly called a charlatan, and his art of surgery was declared to be unethical. To convince his colleagues, the gynecologists, and the general surgeons that laparoscopic surgery is associated with a "better quality of life" required decades.

I performed the first laparoscopic appendectomy on May 30, 1980 in Kiel, Germany. The primary indication for the surgical pelviscopy was an ovarian cyst on the left side and not the endometriosis on the right side, which was causing the appendix to adhere painfully to the right Falloppian tube.

Then came the first laparoscopic cholecystectomy on September 12, 1985, by Erich Mühe, in Böblingen, Germany. But, unfortunately, his 94th patient died in March 1987, and he was forced by the high court to abandon his endoscopic work.

What was this new surgery? A method whereby the classic instruments for grasping, cutting and suturing are miniaturized and introduced to the human body through trocars oriented around the organ or tissues requiring

Address reprint request to: Prof. Dr. Kurt Semm, 5160 E. Oakmont Drive, Tuscon, AZ 85718, USA.

surgery. Movement was limited to in and out or rotation. Surgeons throughout the world started in the late 80's to switch more and more frequently to the new technique. They began to realize that feeling and grasping of the organs was, in principle, not so important. This new technique greatly simplified the movements of the classic surgeon, and some saw that the simple movements of the tissue graspers, scissors and needleholders could be done by robots.

We know from the automobile industry that manual production from the beginning was the base; nowadays, it is a thing of the past. Highly sophisticated cars can be produced using robots only. Robotics in the automotive industry are today standard; thirty years ago, robots were unknown. Progress in this area has been enormous and has now invaded the realm of surgery. By the end of the twentieth century, the first robotic operations on humans will have been performed—no more manual variable dexterity dependent on physical and psychological components. Shouldn't these irregular components also be improved upon with the precision that only a computer can achieve in surgery?

As an example, I would like to mention the bypass operation, which was performed a few weeks ago in the Saint Pierre University Hospital in Brussels, Belgium, described in detail with excellent photographs in the September special issue of *LIFE* Magazine, edited by Robert Friedmann.

At robotic operations, the surgeon will sit upright in front of a monitor, and his finger movements on virtual instruments will be translated into a computerized message to the robot, who will carry out the action. When I showed two slides in my scientific lecture in 1978, demonstrating how pelviscopic surgery is to be performed, the entire auditorium was laughing. At the end of the second millennium, surgery has indeed changed. Today, however, robotic surgery faces only two great problems to secure its future: funding and time.

Pelviscopic surgery was its pacemaker, and it has allowed us to progress to a point half-way to what I am sure will be the surgery for the third millennium: Robotic Surgery. Computerized surgery will replace the surgeon's ten-finger, freestyle battle in the broadly opened cavities of the human body! The surgeon will no longer have to be present in the operating room, and doctors will only be present for emergencies.

The surgeon's brain is in command and manipulates only virtual instruments. The computer has not only the surgeon's input, but also compares his actions with the very latest available information pertaining to the operation. Loaded with this collective knowledge, the computer drives the robot.

The work performed may be viewed throughout the world on multiple screens—even on the moon! An expert surgeon in Australia can operate on someone in New York!

My dear colleagues, please believe me – as a teacher of surgery for over 40 years – when I say that operations performed by robots will be done with greater manual skill than by the training surgeons of today!