

# The Future of Medicine

This is the second in a series of articles for *Connections* by Baystate Health staff looking at the future of their disciplines.

## Surgery: Get Ready for a “Fantastic Voyage”

New technologies and techniques have resulted in enormous changes in surgical care over the past 20 years. In this space of time we have seen the introduction of minimally invasive surgery, robotic surgery, minimal access techniques for heart surgery, innovative surgical anticancer tools, and even surgery performed on babies prior to birth, just to name a few developments. In addition, much more advanced diagnostic studies, including computerized imagery of various types, have completely changed the surgical approaches to certain diseases. As impressive as these developments have been, the next 20 years may produce even more dramatic changes.

### Decreased Invasiveness

Minimally invasive surgery has progressed from a technique applicable in only a few specific situations to a mainstream method that is employed for most major types of surgery. This evolution will continue, and it is likely that the degree of invasiveness will decrease even further. Single incision laparoscopic surgery has now been used successfully to reduce the number of incisions made for access to the abdomen and chest. This has prompted the development of entirely new instruments to take advantage of this new method. As this continues, the range of procedures that will be performed through a single miniscule opening will dramatically increase. In addition, the use of new types of energy instruments to divide tissue or to destroy abnormal tissue such as tumor cells will greatly improve the ability to perform major operations without creating large openings to enter body cavities. This will affect the way general, vascular, cardiac, urologic, and gynecologic surgery is performed.

### No Evident Incisions

Natural orifice transluminal endoscopic surgery (NOTES) is a very recent evolution of minimally invasive surgery that envisions the performance of major operations without any incision evident on the patient. This is performed by entering a natural body opening such as

the mouth, and opening the intestinal tract so that a flexible telescope can be used to visualize the internal organs and other structures. Using this opening, various surgical manipulations can be done up to and including the removal of diseased tissues. When the patient awakens, there is no external evidence that surgery has been performed, and none of the pain



**Neal Seymour, MD**, Chief, General Surgery, Baystate Medical Center

associated with conventional incisions. This surgical method is in its infancy, and requires refinement and further development before its full promise is realized. The first procedures have been performed, however, and Baystate Medical Center has been recognized for its pioneering work in this area.

### Advances in Telerobotics

The use of robots or telemanipulation devices to perform surgery that requires great precision or maneuvers that cannot be performed easily with conventional surgical tools is now commonplace. There are few areas where greater advances will be made than in telerobotics in surgery. Among the imminent possibilities are more flexible and more maneuverable robotic tools, as well as the possibility of totally autonomous robotic “vehicles” that could gain access to surgical sites that cannot be reached without major incisions using conventional surgical

techniques. Miniaturization of robotic devices to cellular size raises the specter of a “Fantastic Voyage”-like future, where the surgeon navigates a patient’s anatomy from a remote workstation, in much the same way that a pilot flies a remotely piloted aircraft. These developments have already occurred in areas other than medicine, but it is not unreasonable to expect that they will become clinical realities in the next 10 years.

### Future Tends to Exceed Expectations

Although it is exceedingly difficult to envision all possibilities, the future has a tendency to exceed our expectations in unexpected ways. Some advances are evolutionary, while others are truly revolutionary, and surgeons may suddenly gain access

to dramatic new tools that rewrite an entire approach to human diseases. In addition to the evolutionary changes listed above, even more radical developments, such as the replacement of diseased body parts with tissues or organs raised from stem cells (or a patient’s own cells), may completely change the concept of a surgeon’s function. Whether it is the surgeon, or a new type of medical specialist, who performs surgical-like manipulations of the cellular core of diseased tissues (perhaps to turn off cancer growth by precisely altering a gene) remains to be seen. Ultimately, though, the tools will change to reflect the state-of-the-art of human technical knowledge, even if the concept of surgery becomes unrecognizable to our predecessors. There is no one more eager than the surgeon to see surgical work become completely pain-free, and conducted with the smallest conceivable amount of trauma to the patient.

—NEAL SEYMOUR, MD