Computer-Assisted Surgery

- Surgical planning: virtual reality; virtual environments help teach and plan surgeries
- Minimally invasive surgery (MIS)
  - Endoscope projects an image of the surgical site onto a monitor
  - MIS is performed through small incisions leading to less pain and shorter recovery time
  - Surgeon sees image on a monitor. It is image directed.
  - Endoluminal surgery—done through natural orifices
- Robots
  - Used to hold endoscopes
  - Used to “decide” if tissue is normal
  - Used in many surgeries
  - ROBODOC—in hip replacements
  - AESOP—first FDA-cleared surgical robot; holds endoscope—one arm
  - ZEUS—minimally invasive microsurgery
  - DaVinci—minimally invasive heart surgery—mimics surgeon’s hand motions; used to repair an inborn condition called atrial septic defect. In 2005, daVinci was approved for gynecological procedures; cleared for heart surgery in 2004; used in prostate surgery.
  - MINERVA—stereotactic neurosurgery
  - HERMES—FDA-cleared system software that connects operating room hardware into a voice-controlled network, from lighting to robots.
    - In March 2005, a six-day-old baby was successfully operated on by robots to repair a congenital hernia—the youngest patient to undergo robotic surgery!
- Currently attempts are being made to create smaller surgical robots.
- Augmented reality—provides surgeons with a look inside the body, projected onto the outside of the body
- CAVEman—new four-dimensional model of the human body
- Telepresence (distance) surgery: gall bladder surgery (2001), prostate surgery (2002), surgery to correct acid reflux (2003); first developed by NASA
- Lasers: different wavelengths do different things and are used to destroy cancer cells, used in LASIK (eye surgery) and in other surgeries, changes the shape of the cornea.
NASA Extreme Environment Mission Operation (NEEMO)
NEEMO 7 and 9 included doctors, but no surgeons. NEEMO 12 crew conducted advanced medical experiments using robotic telesurgery. The major purpose of these projects is to enable astronauts to be operated on in space from earth using wireless technology and robotics.

The Operating Room of the Future
- Images from all sources will be integrated and available to surgeons and other personnel.
- Information displayed includes a patient’s vital statistics, allergies, the whereabouts of operating room (OR) personnel.
- In some ORs of the future, all personnel including doctors are identified and their movements tracked by RFID tags.