ROBOTIC SURGERY

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What are robots?

– An electro-mechanical system.
– Composed from artificial substances.
– Can sense its environment.
– Ability to make choices.
– It is programmable.
– Axes of movement.
– Dexterous coordinated movements.
– Independent of human intervention.
– It appears to have intent or agency.
History of evolution

• Mechanical servants built by the Greek god Hephaestus.
• A mechanical steam-operated bird called "The Pigeon".
• Leonardo da Vinci had sketched plans for a humanoid robot.
• Complex mechanical toys and animals built in Japan as described in the *Karakuri zui*
Modern developments

• Televox, the first robot put to useful work.

• The first electronic robots created by William Grey Walter

• The first truly modern robot, invented by George Devol, the Unimate.
History of Robots in surgery

- 1985: PUMA 560
- 1988: PROBOT
- 1992: ROBODOC
- 1997: ZEUS
- 1998: DA VINCI SURGICAL ROBOT
- 2006: First unmanned robotic surgery
- 2009: First all-robotic kidney transplant
Types of robotic surgical systems

• Three kinds of robotic surgery systems:
  • Supervisory-controlled systems
  • Telesurgical systems
  • Shared-control system

Classified according to human involvement

• Supervisory-controlled system—most automated.
• Telesurgical system—under human direction
• Shared-control system—aid surgeons.
Supervisory-controlled systems

- Most automated.
- Extensive pre operative prep work.
- Commonly used in hip and knee replacement.
- Robodoc’s bone milling tool is an example
- Three-step process.
  - Planning: imaging of the patient's body
  - Pins may be used as markers.
  - Registration: match points on the body and its images
  - Navigation: involves the actual surgery
  - Robot is positioned accurately
  - Once activated, robot carries out the instructions
Tele-surgical systems

- Humans direct the system.
- Thus, it's an expensive set of tools.
- Gets the surgeon closer to the site.
- Minute incisions are made.
- Tools and a camera are inserted.
- Controlled by two foot and hand pedals.
- Copies and filters surgeons' hand movements.
- The da Vinci system is the most popular.
Shared control systems

- Humans do most of the work.
- System helps by active constraint.
- Four regions: safe, close, boundary, forbidden.
- Safe region is the focus of surgery.
- Provides haptic response or force feedback.
- Robot locks into place in forbidden region.
Applications

- General surgery
- Cardio thoracic surgery
- Gynecology
- Radio surgery
- Urology
- Pediatrics
- Orthopedics
Future developments

• Tele-surgery
• Receptionists, nurses, etc.
• Fusion of pre-operative and intra-operative imaging
• Touch sensation in robots
• Suture-less surgery
• Complete automation
Advantages

• Superior visualization
• Enhanced dexterity
• Greater precision
• Ergonomic comfort
• Decreased blood loss and pain
• Quicker healing time
• Reduced fatigue for surgeons
• No hand tremors
Disadvantages

• Cost
• Extreme pre operative prep work
• Cant make adjustments in real time
• Extensive training
• Joblessness for people
Conclusion

• 2006:
  – 3,540,000 service robots
  – 950,000 industrial robots

• 2008: more than one million robots

• 50% in Asia, 32% in Europe, 16% in North America, 1% in Australia and 1% in Africa
Thank you