

# 화학공학의 역사 (인공신장과 의공학)

충남대학교

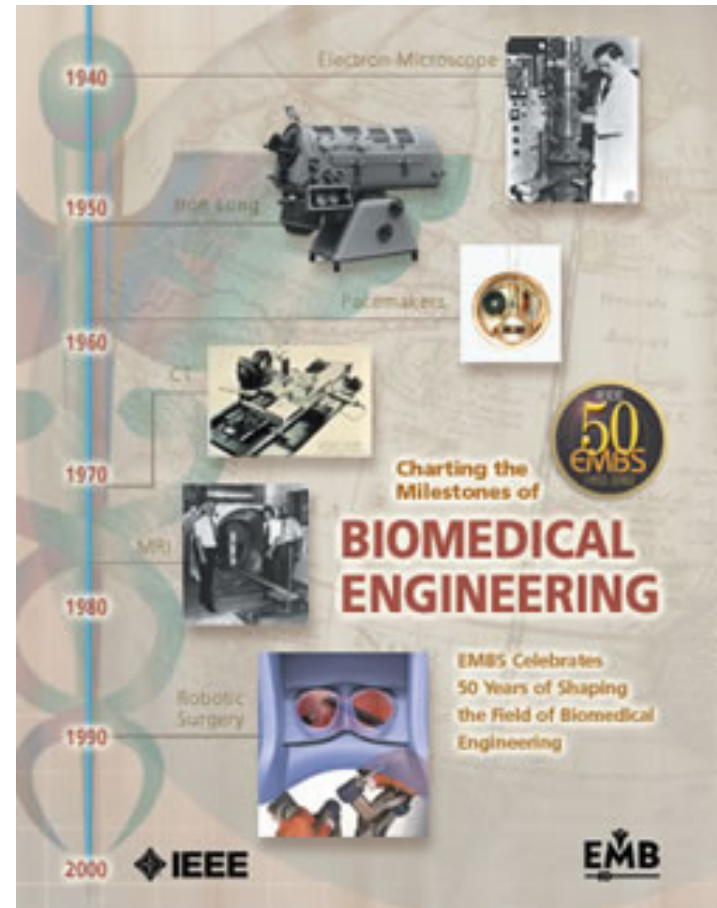
김인호

# 목차

- Biomedical engineering (BME)
- Biomedical Engineers
- Short history of BME
- NIH programs
- Kidney transplant
- Hemodialysis
- Artificial kidney

# Biomedical engineering

- IEEE history of biomedical engineering
- Biomedical Engineering originated during World War II. Biologists were needed to do work involving advances on radar technology. This work prepared them for the electronic developments in medicine in the post-war years.



# Biomedical Engineers

- A bridge between the gap of technical knowledge and biology was needed.
- Doctors and biologists with an interest and understanding of engineering, along with electrical engineers with an interest in biology, became the first bioengineers.
- Those primarily concerned with medicine became the first Biomedical Engineers.

# Short history of BME

- 1895: Roentgen (German) discovered the X-Ray
- 1896: Henry Becquerel (French) discovered X-rays were emitted from uranium ore.
- 1901: Roentgen received the Nobel prize for discovery of X-rays.
- 1903: Eindhoven discovered the [electrocardiogram](#) (ECG).
- 1929: Berger discovers the electroencephalogram (EEG).
- 1930: X-rays were being used to visualize most organ systems using radio-opaque materials.
- mid 1930–early 1940: sulfanilamide and penicillin, reduced cross-infection in hospitals.

# Short history

- 1927: Drinker respirator.
- 1930: refrigeration, permitted blood banks.
- 1940: cardiac catheterization.
- 1950: electron microscope.
- 1950–1960: nuclear medicine.
- 1953: Cardiopulmonary bypass (heart–lung machine).
- 1970: CT, MRI imaging systems.

# NIH programs

- In the early 1960s the NIH took three significant steps to support biomedical engineering.
- First, it created a program–project committee under the General Medical Sciences Institute to evaluate program–project applications, many of which served biophysics and biomedical engineering.
- It set up a biomedical engineering training study section to evaluate training–grant applications, and it established two biophysics study sections.
- A special “floating” study section processed applications in bioacoustics and biomedical engineering.

# Biomedical Engineering Society

- The diversity of work in biomedical engineering and the diversity of background of the people contributing to this field made it difficult for a single organization to represent everyone.
- In 1968, the Biomedical Engineering Society was formed to give “equal status to representatives of both biomedical and engineering interests and promote the increase of biomedical engineering knowledge and its utilization.”



# Kidney transplant

- **1902** – The first successful experimental kidney transplants were performed at the Vienna Medical School in Austria with animals.
- **1909** – The first kidney transplant experiments were performed in humans in France using animal kidneys.
- Scientists of the time believed kidney transplants were possible, but their success was limited by unknown biochemical barriers which prevented long-term kidney survival.
- **1933** – The first human-to-human kidney transplant was performed
- Unknown to doctors at the time, there were mismatches in donor and recipient blood groups and the donor kidney never functioned
- **1940** – Sir Peter Medawar at the University of London experimented with the immunologic basis of organ rejection.
- **Early 1950** – Cortisone-like medications were used to suppress the human body self-defense system (immune system), resulting in some kidney transplant success.

# Kidney transplant

- **1954** – Joseph E. Murray and his colleagues at Peter Bent Brigham Hospital in Boston performed the first truly successful kidney transplant from one twin to another. This was done without any immunosuppressive medication.
- **Late 1950** – New approaches were needed to prevent the body from fighting off a foreign donor kidney when an identical twin donor was not available.
- **1960** – Better techniques for matching donor and recipient blood and tissue types, as well as improvements in preserving cadaveric (from recently deceased donors) kidneys, were developed.
- **1961** – Powerful immunosuppressives became available and helped decrease the chance for kidney rejection
- **1980s and 1990s** – New techniques, new medications and new patient information have helped make kidney transplants a safer, more effective and more routine procedure

# Hemodialysis

- Since the 1940s that hemodialysis can sustain life and relieve the symptoms of uremia, the widespread access to dialysis in the 1970s has been lifesaving for patients with kidney failure.
- Like many other therapeutic advances, the advent of dialysis was slow. Thomas Graham is credited for the term ``dialysis'' in his 1854 description of the diffusion and the movement of water across semipermeable membranes.
- The term ``artificial kidney'' was coined in 1914 by John Abel, who used the principle of diffusion for the removal of substances from the blood of rabbits and dogs by perfusing it in colloidin tubes in a dialysate bath.,

# Artificial kidney

- Around 1945, hemodialysis became a reality through the pioneering work of Willem J. Kolff.
- The introduction of a permanent vascular-access device allowed long-term dialysis in 1960.
- Dialysis membrane was used in the first artificial kidney, which replaced by high performance ultrafiltration membranes developed in the 1960s.
- Chemical engineers play an important role in developing novel membranes such as hollow fibers for artificial kidneys.