Blood Measurements

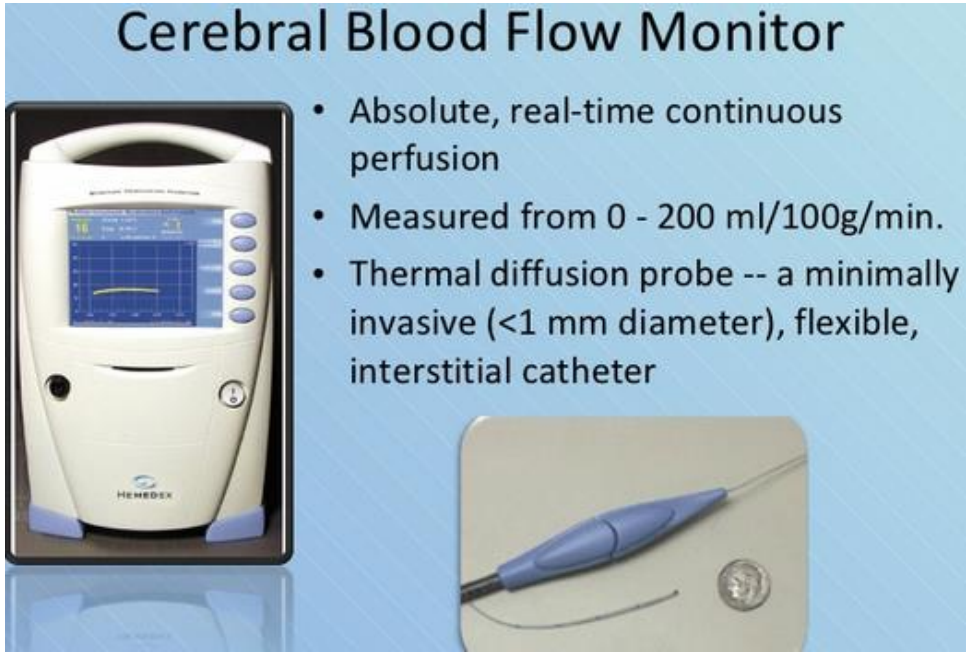
- Blood flow
- Blood pressure

Blood Flow Measurement

- Invasive blood flow measurement
  - ➢ flow sensor
- Non-invasive blood flow measurement
  - ➢ Ultrasonic
    - Transit time flow meter
    - Doppler type
  - ➢ Magnetic
  - ➢ Laser doppler flow meter

Invasive Blood Flow Measurement

- Used in special cases, normally non invasive methods are prefeerd



Non Invasive Blood Flow Measurement

Ultrasonic Transit Flow

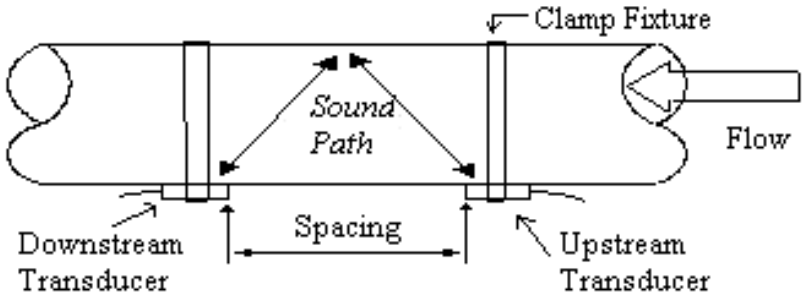
Transit-Time Ultrasonic Flow Meters

$$t = \frac{distance}{conduction\ velocity}$$

$$t = \frac{D}{c \pm u\cos\theta}$$

Where

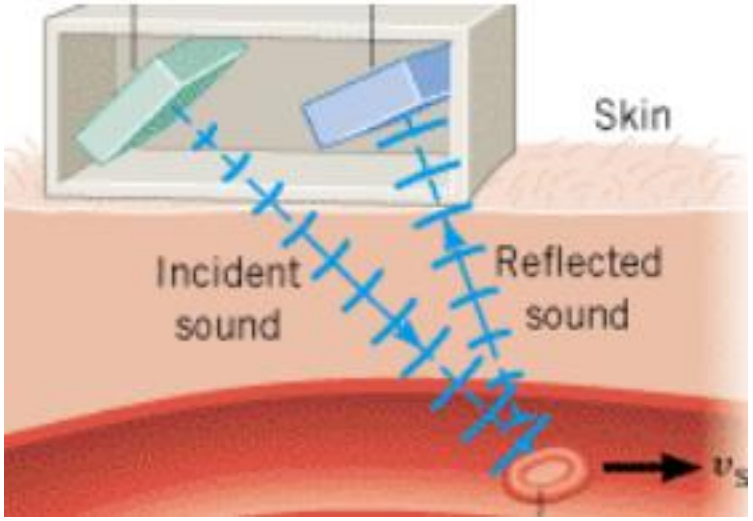
- t - transit time
- D - Distance between the transducers
- c - Sound velocity
- u - blood flow velocity



Non Invasive Blood Flow Measurement

Ultrasonic Doppler

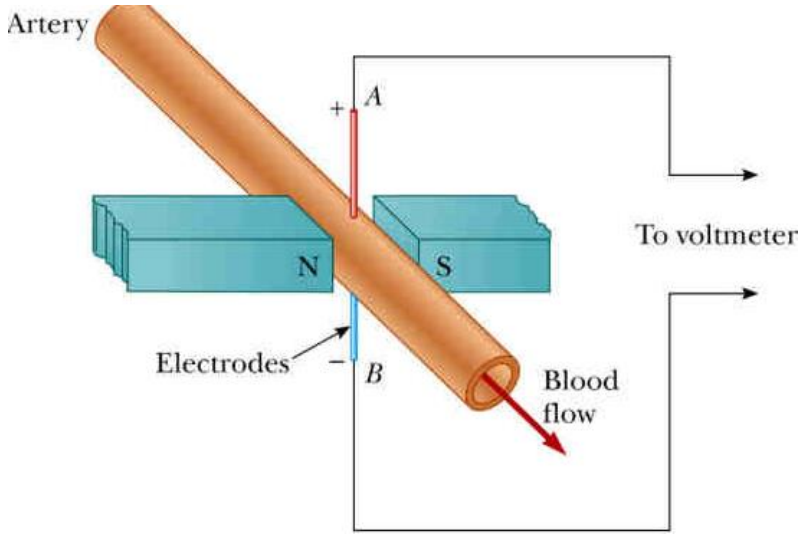
- Reflected ultra sound is proportional to blood flow



Non Invasive Blood Flow Measurement

Magnetic sensor

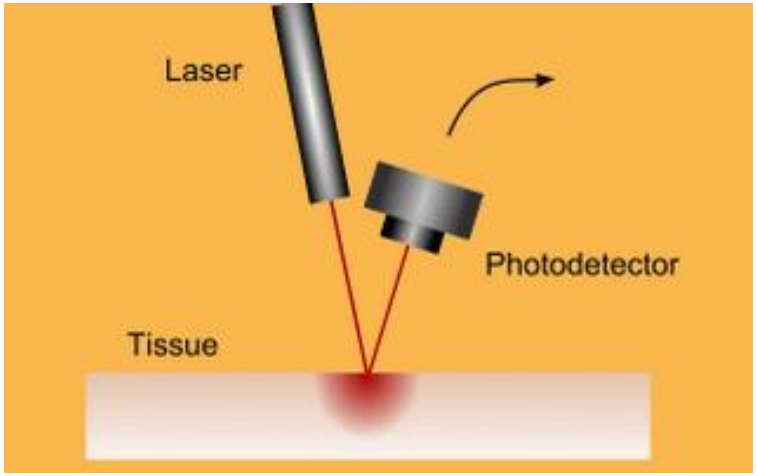
- Blood flow in the magnetic field generates a voltage proportional to blood flow



Non Invasive Blood Flow Measurement

Laser Doppler

- Reflected laser beam is proportional to blood flow



Blood Pressure Measurement

- Blood pressure sensors operate similar way than any kind of pressure sensors
- E.g. piezoelectric sensors