

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 preferred

Cerebral Blood Flow Monitor



- Absolute, real-time continuous perfusion
- Measured from 0 - 200 ml/100g/min.
- Thermal diffusion probe -- a minimally invasive (<1 mm diameter), flexible, interstitial catheter



Non Invasive Blood Flow Measurement

Ultrasonic Transit Flow

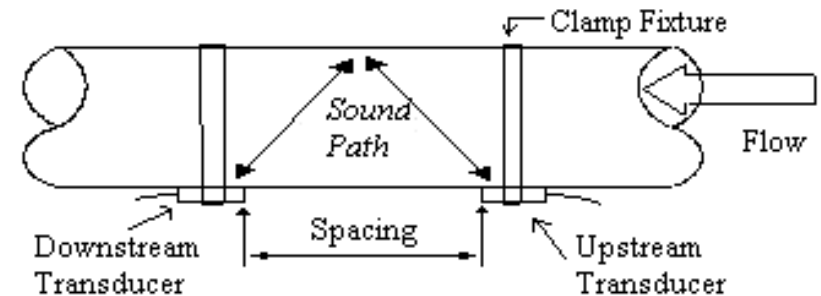
Transit-Time Ultrasonic Flow Meters

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

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

Where

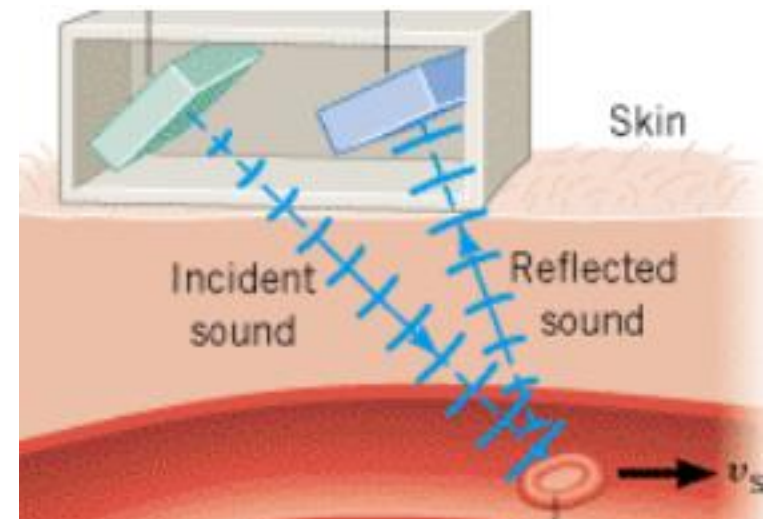
- t - transit time
- D - Distance between the transducers
- c - Sound velocity
- u - blood flow velocity



Non Invasive Blood Flow Measurement

Ultrasonic Doppler

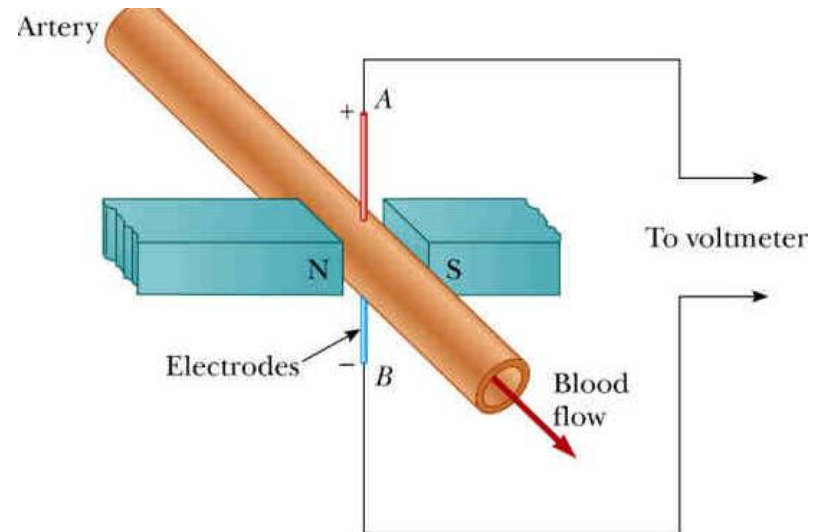
- Reflected ultra sound is proportional to blood flow



Non Invasive Blood Flow Measurement

Magnetic sensor

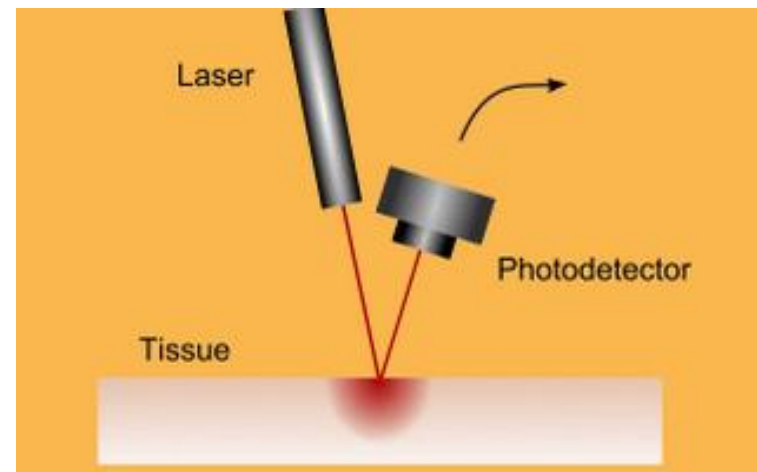
- Blood flow in the magnetic field generates a voltage proportional to blood flow



Non Invasive Blood Flow Measurement

Laser Doppler

- Reflected laser beam is proportional to blood flow



STUDY MATERIAL

Blood Pressure Measurement

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

