Medical physics

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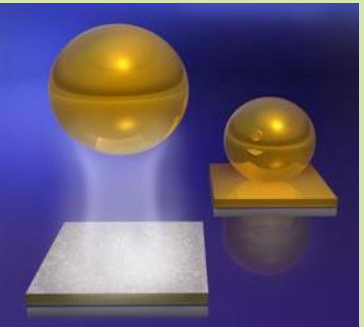
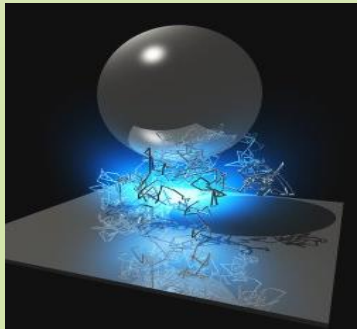
A lecture submitted in partial fulfillment of the requirements
For the degree of Bachelor of pharma
In College of Pharmacy
At Al-Muthanna University
spring Term
2024





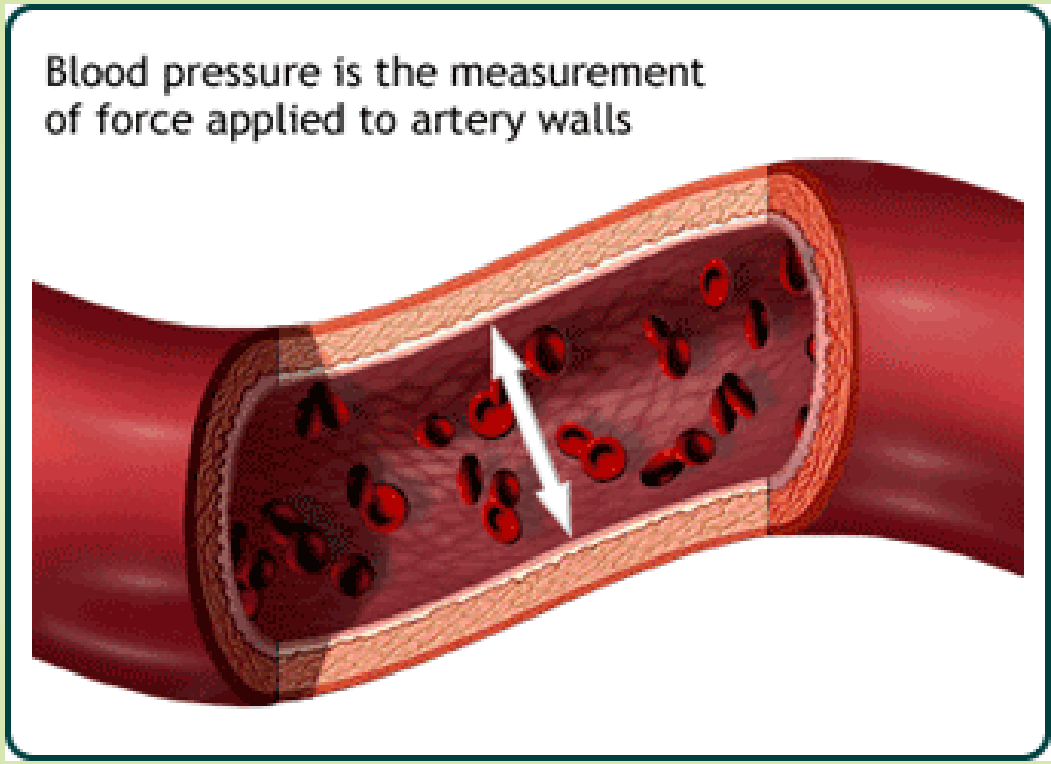
PRESSURE

- The concept of pressure as it relates to fluids in the body. blood in the heart and circulatory system, and air in the lungs and respiratory system.

❖ Pressure is a force per unit area in gas and liquid.

❖ For solid the quantity force per unit area is referred to as stress

❖ Transition of the force in liquids and solid



Unite of atmospheric pressure

- The SI unit for pressure is the Pascal (Pa)

❖atmospheric pressure is about 10^5 N/m^2

- None of these unites is common use in medicine:

❖The most common method of indicating pressure in medicine is by the heights of a column of mercury (mmHg) or torr.

- A peak (systolic) blood pressure is 120mm Hg and the diastolic pressure (~80 mmHg).

Unite of atmospheric pressure

- The pressure of a fluid column is given by $P = \rho g h$, where ρ is the fluid density, g is the gravitational constant, and h is the height of the column. For mercury
- For mercury ρ is 13.6 g/cm^3. For water ρ = 1.00 g/cm^3 at 4◦C. The density of whole blood is a bit higher, 1.06 g/cm^3 at 37◦C.

Measuring the Pressure in the body

- discussing *absolute pressure*, P_{abs} *which is the total force per unit area*

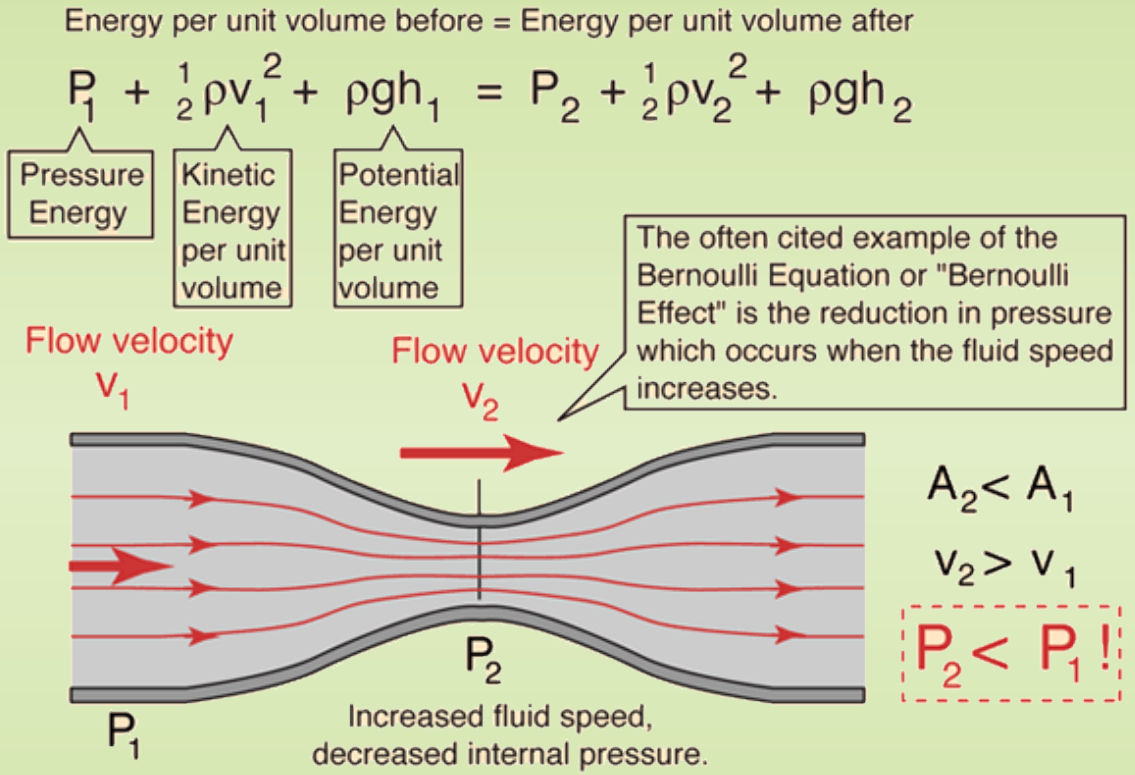
- very common to cite the *gauge pressure*, P_{gauge}, which is the pressure relative to a standard, which is usually atmospheric pressure

$$P_{gauge} = P_{abs} - 1$$

- where the pressure is lower than atmospheric pressure or negative during breathing, the pressure in the lungs is lower than that outside the body and so the internal (gauge) pressure is negative

Measuring the Pressure in the body

- Pascal's Principle
- Bernoulli's equation which gives the relationship between velocity, pressure, and elevation in a line of flow(idealization)
- In a real flow of fluids, the molecules attract each other; consequently, relative motion between the fluid molecules is opposed by a frictional force(Viscosity)
- the rate of flow Q through a cylindrical tube of radius R and length L is given by Poiseuille's law



$$Q = \frac{\pi R^4 (P_1 - P_2)}{8\eta L} \text{ cm}^3/\text{sec}$$

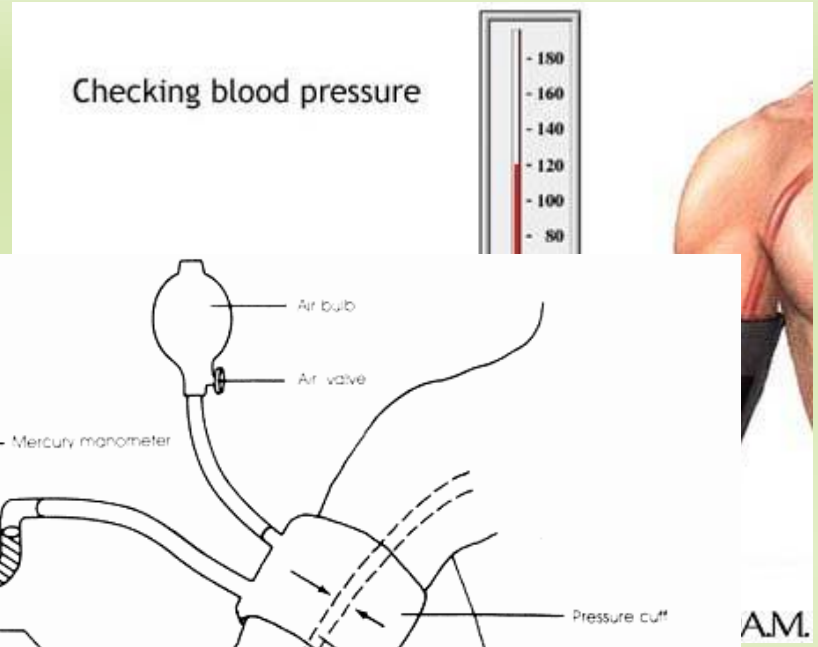
Measuring the Pressure in the body

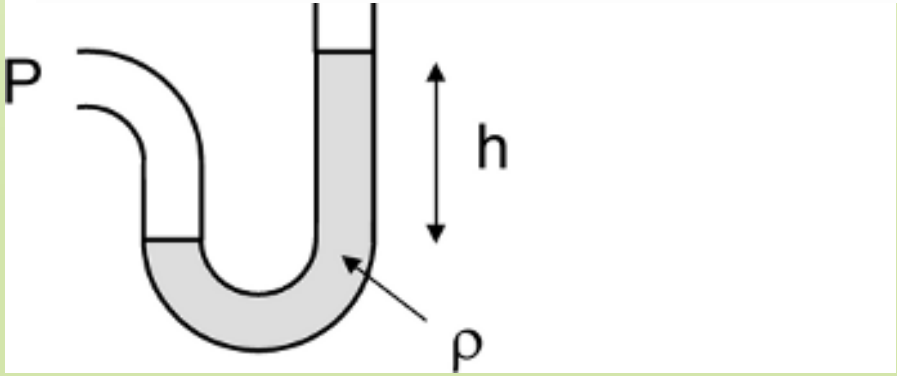
- The classical method of measuring pressure is to determine the height of a column of liquid that produces a pressure equal to the pressure being measured

$$P = \rho g h$$

An instrument that measures pressure by is called a ***manometer***

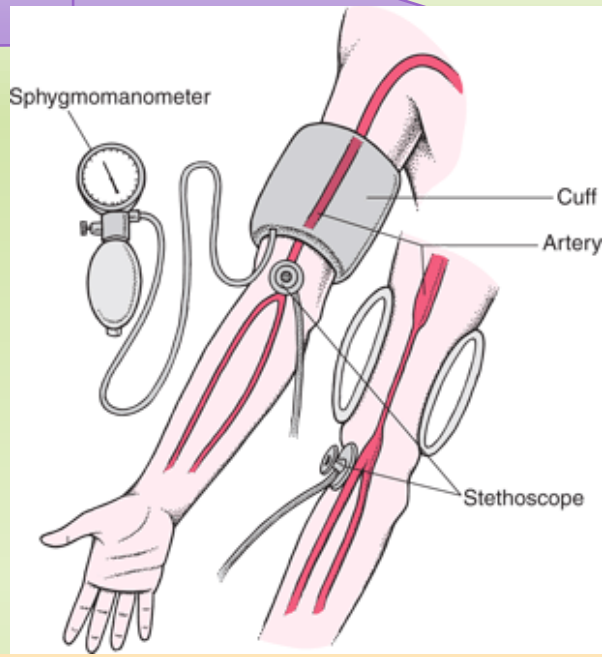
manometer is a U-shaped tube containing a fluid that is connected to the pressure to be measured.

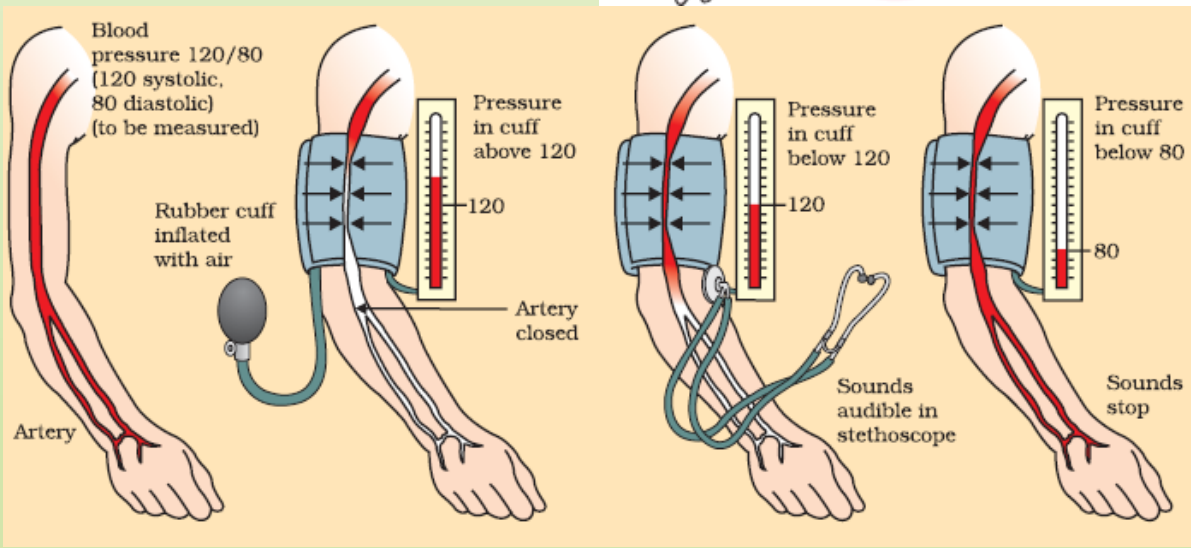




sphygmomanometer

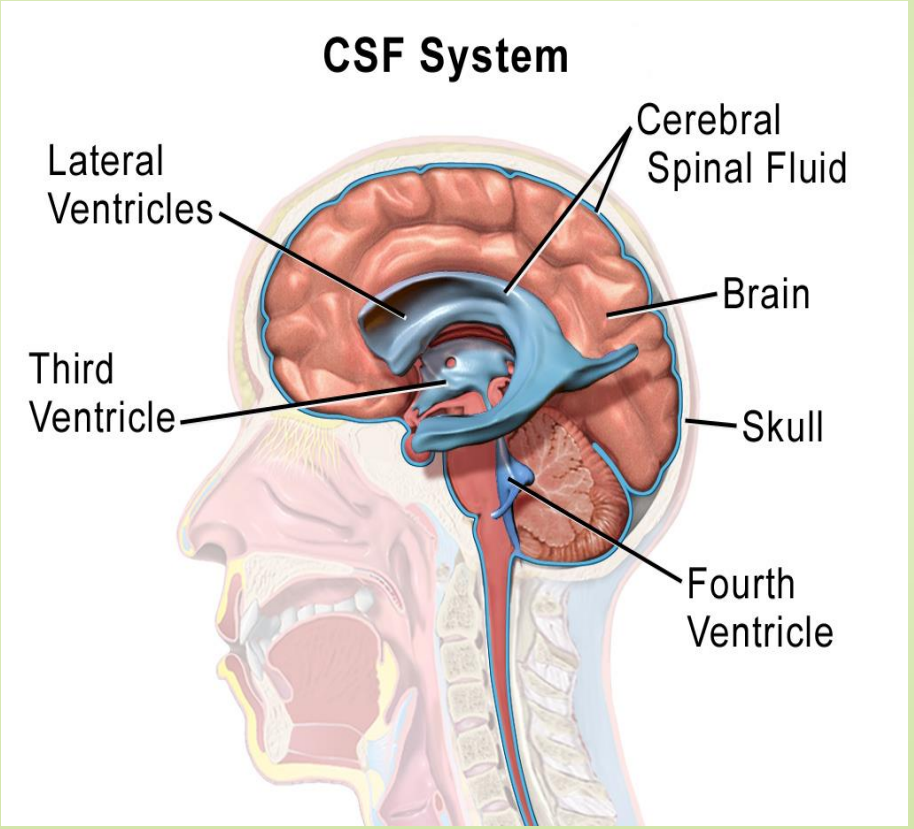
- The most common clinical instrument
- The cuff is the balloon-like jacket placed about the upper
- stethoscope is placed on the lower arm
- the K(*Korotkoff*) major arteries varies between the systolic and the diastolic





Pressure inside the skull

- The brain contains approximately 150 cm^3 of cerebrospinal fluid (CSF)
- If at birth this opening is blocked for, the csf is trapped that increases.the increased pressure causes the skull to enlarge
- *hydrocephalus* which is a moderately common problem in



measure the csf pressure

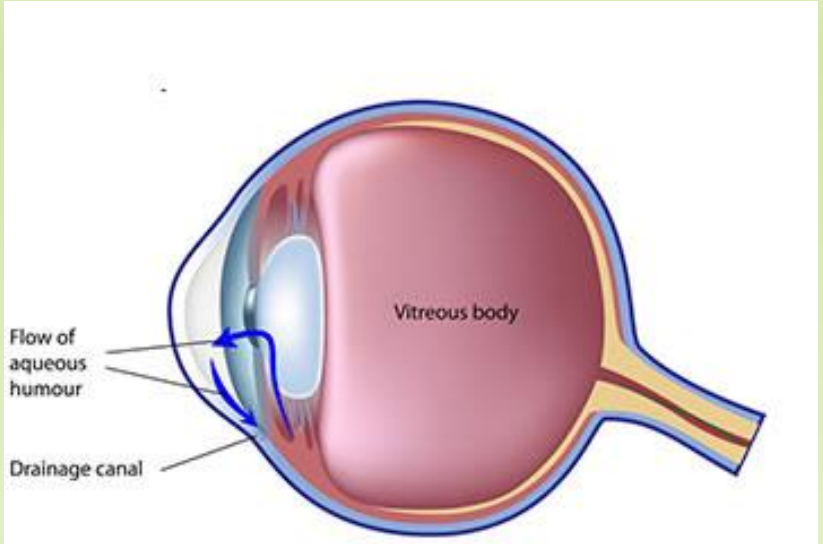
- to measure the circumference of the skull just above the ears. Normal value of new born infants is from 32 to 37 cm

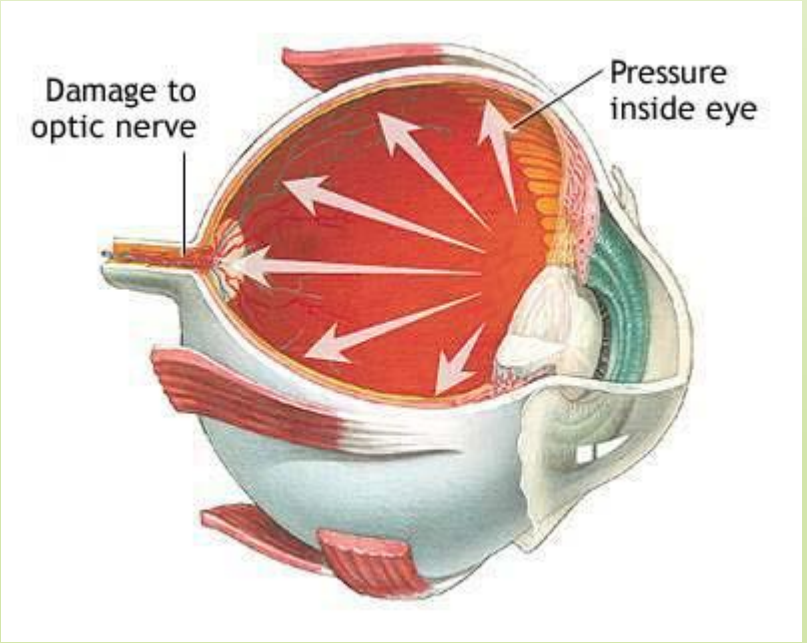
- use of the lights scattering properties of the rather clear CSF inside the skull. computed tomography (CT) scan or magnetic resonance imaging (MRI) scan may be necessary to confirm the diagnosis.
- **Intracranial Pressure(ICP).** The normal

  pressure of CSF 70 - 180 mm H2**O**

eye pressure

- known as intraocular pressure (IOP)
- The eye is a closed ball filled with clear jelly (vitreous humor) in the back behind the lens
- aqueous humor in the front, between the iris and the cornea
- The pressure in normal eyes ranges from 12 to 23mm Hg.
- *Glaucoma* is caused by increasing the pressure

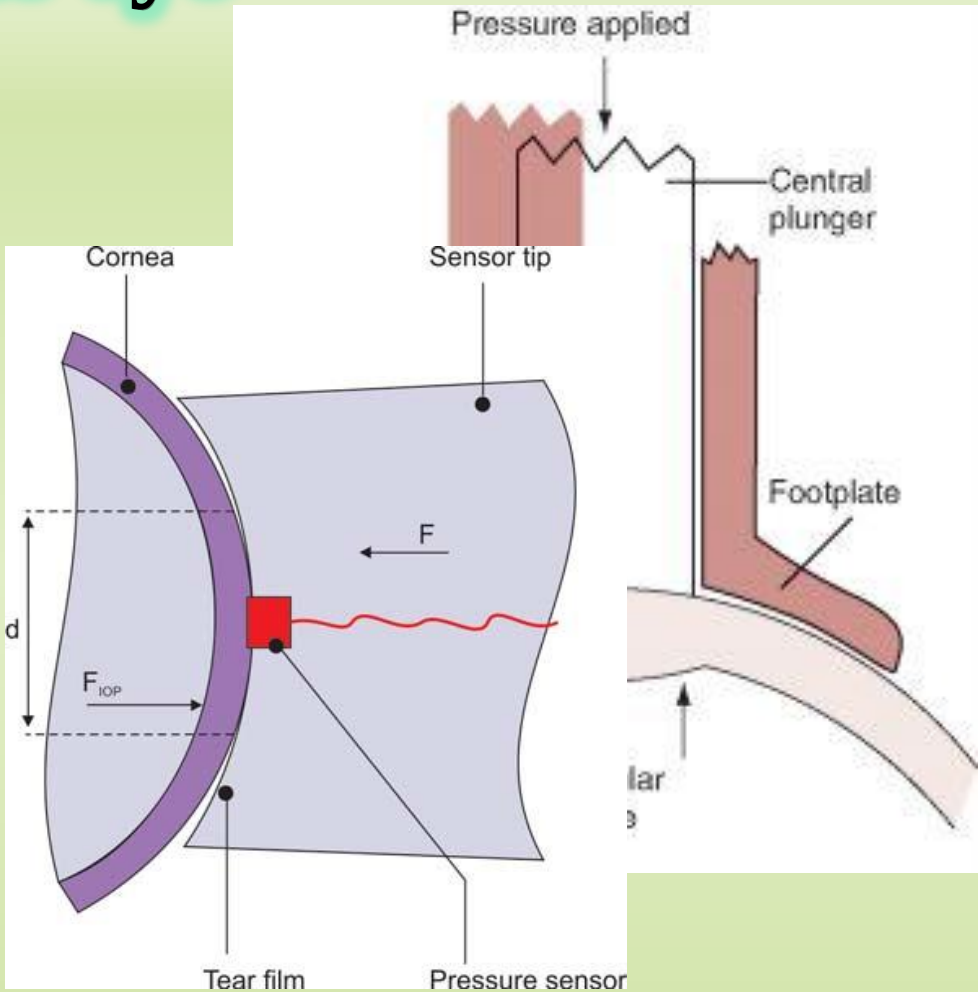




they pressed on the eye

- Physicians estimated the pressure inside the eye by “feel” as they pressed on the eye with their fingertips
- Now pressure in the eye is measured with several different instruments, called tonometer

- that measure the amount of indentation produced by a known force.
- **airpuff tonometer** an instrument for mea suring intraocular pressure by sensing deflections of the cornea in reaction to a p uff of pressurized air.



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Thank you