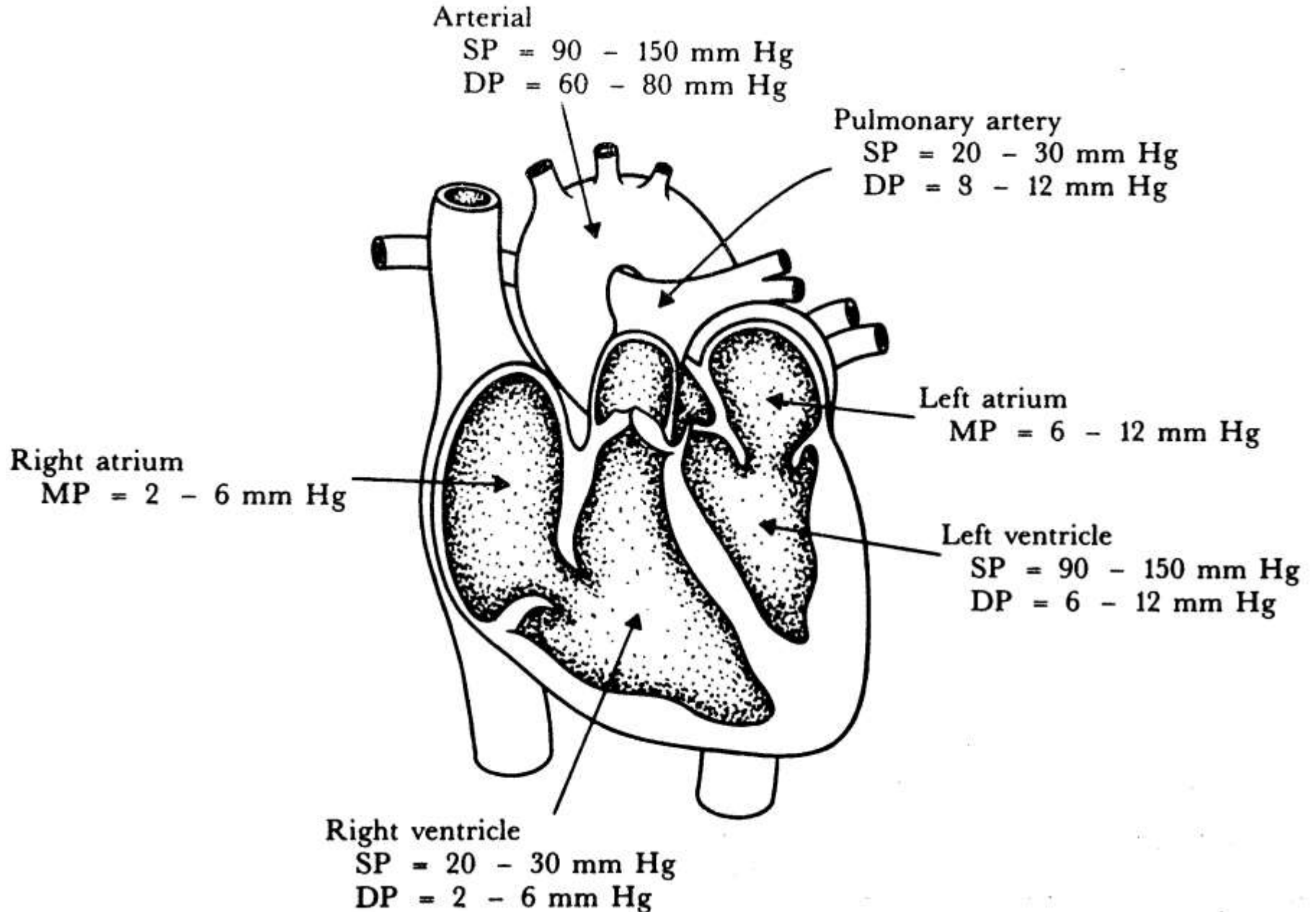


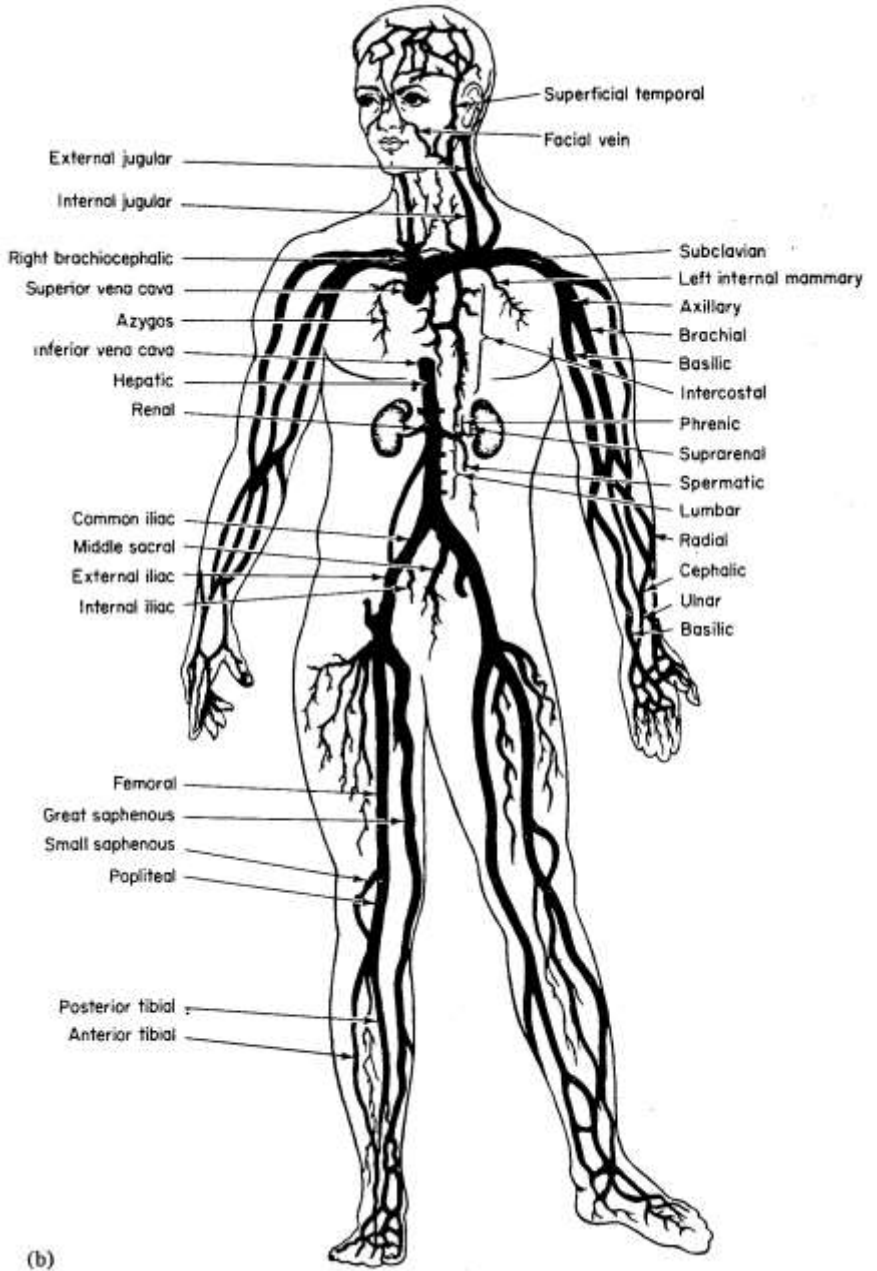
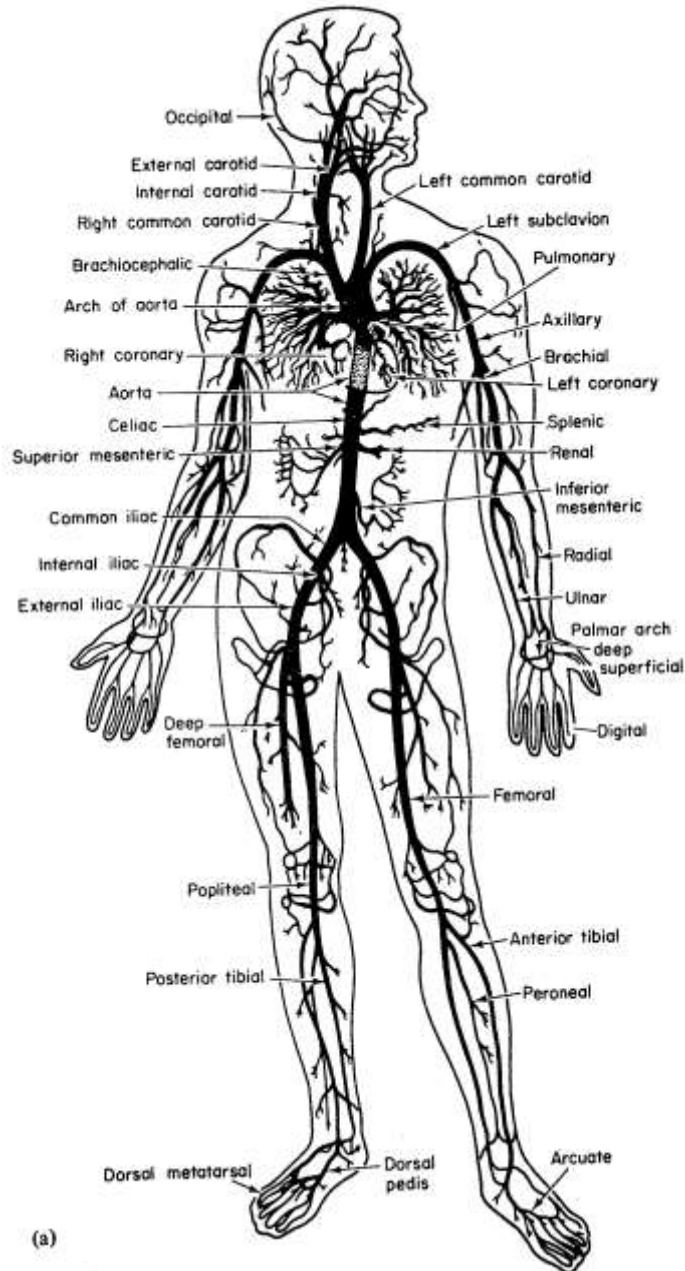
Blood Pressure

- An Individual's blood pressure is a standard clinical measurement
- Is considered a good indicator of the status of the cardiovascular system.
- Blood pressure values in the various chambers of the heart and in the peripheral vascular system help the physician determine the functional integrity of the cardiovascular system.

Blood Pressure inside the heart chambers



Major Arteries & Veins of the Body



(a)

(b)

Cardiovascular system-typical values

<i>Vessel</i>	<i>Number (thousands)</i>	<i>Diameter (mm)</i>	<i>Length (mm)</i>	<i>Mean Velocity (cm/sec)</i>	<i>Pressure (mm Hg)</i>
Aorta	—	10.50	400	40.0	100
Terminal arteries	1.8	0.60	10	<10.0	40
Arterioles	40,000	0.02	2	0.5	40–25
Capillaries	> million	0.008	1	<0.1	25–12
Venules	80,000	0.03	2	<0.3	12–8
Terminal veins	1.8	1.50	100	1.0	<8
Vena cava	—	12.50	400	20.0	3–2

Blood Pressure Measurement

- **Direct (invasive)**
 1. **Extravascular Method**
 - The vascular pressure is coupled to an external sensor element via a liquid filled catheter.

[**Catheter** – is a long tube introduced into the heart or a major vessel by way of a superficial vein or artery.]

2. **Intravascular**

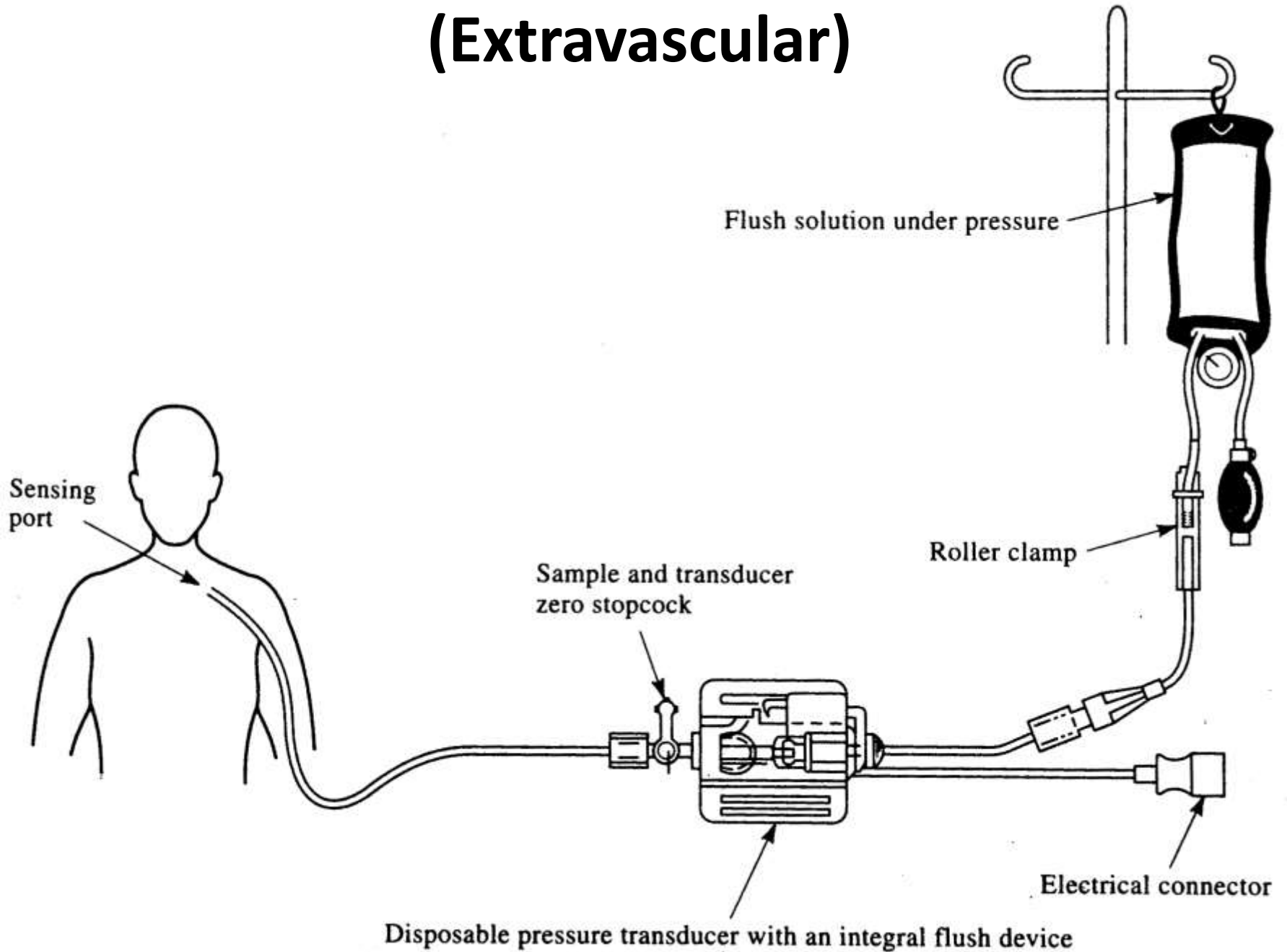
- A sensor is placed into the tip of a catheter that is placed in the vascular system.

- **Indirect (non invasive)**

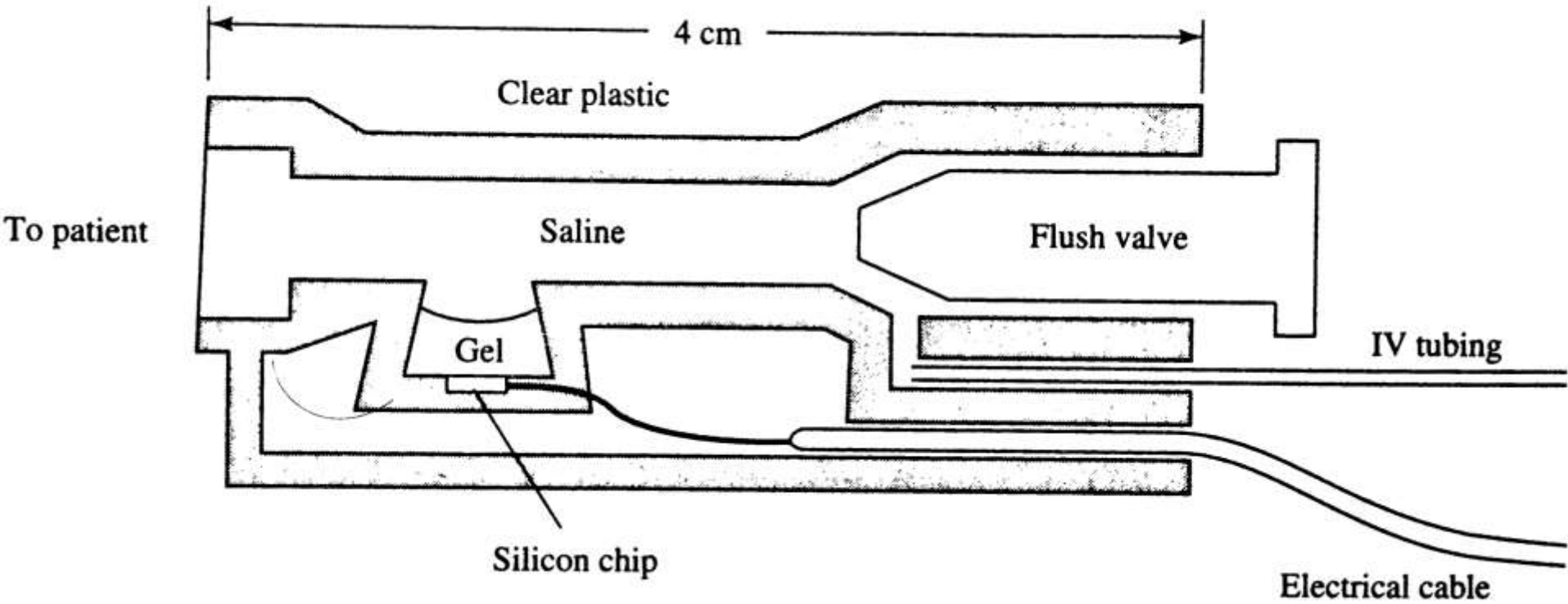
- **Sphygmomanometer**

- Consists of an inflatable pressure cuff and a manometer to measure the pressure in the cuff.

Direct Measurement (Extravascular)



Disposable blood-pressure sensor with integral flush device



Direct Measurement

Extra Vascular

- The extra vascular sensor system is made up of a catheter.
- The catheter is connected to a three way stopcock and then to a pressure sensor
- It is filled with a saline-heparin solution.
- It must be flushed with solution every few minutes to prevent blood clotting at the tip.

Direct Measurement

Extra Vascular *contd...*

- Physician inserts the catheter
 - Either by means of a *surgical cut-down*, which exposes the artery or vein.
 - or by means of *percutaneous insertion* which involves the use of a special needle or guide-wire technique.
- Blood pressure is transmitted via the catheter column to the sensor and finally to the diaphragm which is deflected.
- The displacement of the diaphragm is sensed electronically.

Direct Measurement

Extra Vascular *contd...*

- **Disadvantages**
 - The frequency response of the catheter-sensor system is limited by the hydraulic properties of the system.
 - Creates time delay in detection of pressures when a pressure pulse is transmitted.

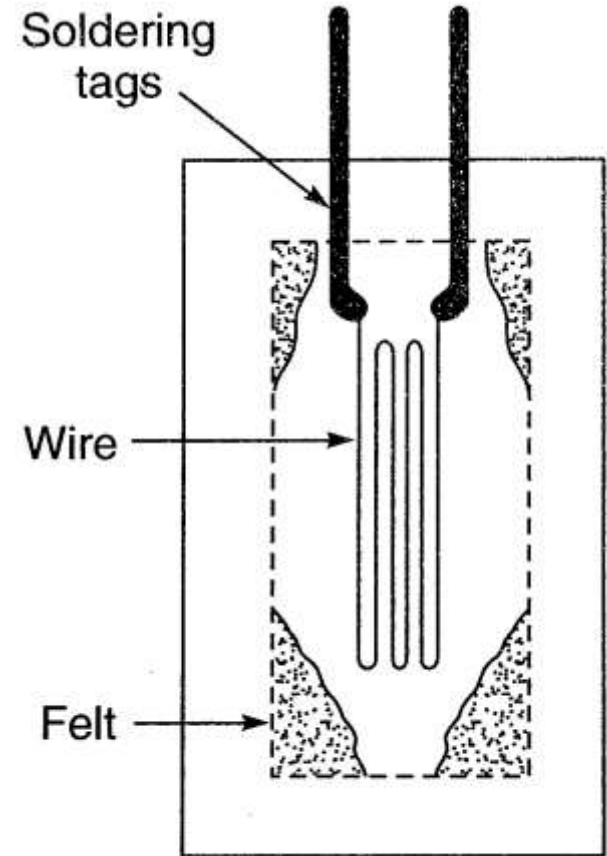
Direct Measurement

Intravascular

- The sensor is placed at the tip of the catheter.
- Enables the physician to obtain a high frequency response in detection of pressures at the tip of the catheter.
- Types of sensors
 1. Strain-gage systems
 - bonded onto a flexible diaphragm at the catheter tip.
 2. Fibre-optic device
 - Measures the displacement of the diaphragm optically by varying reflection of light from the back of the deflecting diaphragm.

Bonded Strain Gage pressure transducer

- Consists of strain-sensitive gages which are firmly bonded with an adhesive to the membrane or diaphragm whose movement is to be recorded.
- Made by taking a length of a very thin wire or foil which is formed into a grid pattern and bonded to a backing material.
- Is then attached to the diaphragm.
- Deflection of the diaphragm causes corresponding strain in the wire gage.
- Causes a corresponding change in the resistance which is proportional to the pressure.



Fiber optic type pressure transducer

- Measures the displacement of the diaphragm optically by the varying reflection of light from the back of the deflecting diaphragm.
- Inherently safer electrically

