**General:**
- Body temperature can be measured at various sites including:
  1. Rectal
  2. Nasopharyngeal
  3. Oesophageal
  4. Tympanic
  5. Skin
  6. Pulmonary artery
  7. Urinary bladder
- Nasopharyngeal and tympanic temperature are close to brain temperature.
- Core temperature is best measured via PA catheter or urinary catheter with thermistor or via oesophagus.

**Problems with rectal temperature measurement:**
1. Temperature of surrounding faeces may affect measurement.
2. Very small risk of perforation.

**Problems with nasopharyngeal temperature measurement:**
1. May be affected by respiratory gases when not intubated.

**Problems with tympanic temperature measurement:**
1. Danger of tympanic membrane perforation.

Skin temperature is dependent on cutaneous blood flow and hence is a poor representation of core temperature. Measuring toe to core temperature gradient may be useful to monitor the adequacy of the circulation in shock or low-output states.

**Temperature measurement devices:**
- Temperature is measured by a thermometer which may measure temperature directly or indirectly:
  1. Direct:
     1. Liquid expansion
     2. Bimetallic strip
     3. Chemical
  2. Indirect:
     1. Resistance wire
     2. Thermistor
     3. Thermocouple

**Liquid expansion:**
- Body temperature can be measured at various sites including:
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**Bimetallic strip:**
- Consists of two metals with different coefficients of expansion that are fastened together throughout their length so that the combined bimetallic strip will bend when heated.
- Used in cheap but not very accurate thermometers for measuring air temperature.
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**Chemical:**
- Consists of a strip containing several rows of small cells along its length each of which is filled with a unique mix of chemicals that melt at a particular temperature with the range of cells being chosen to suit the desired accuracy and temperature range.
- The chemicals melt within about 30 seconds and in doing so release a dye with the temperature indicated by the number of cells that have changed colour.
- Reversible thermometers are available.

**Resistance wire:**
- Based on the principle that resistance of certain metal wires increases as their temperature increases.
- The metal used most commonly for this purpose is platinum since it resists corrosion and has a large temperature coefficient of resistance.
- The resistance change is measured by a battery-operated handpiece which grips the two terminal at the distal end of the probe.

**Thermistor:**
- Consists of a semiconductor made from fused oxides of heavy metals such as cobalt, manganese & nickel and can be made to have positive or negative coefficients. There resistance varies markedly with temperature but the change is non-linear.
- Temperature coefficient is much greater than that of a resistance wire element so it can be used to detect very small temperature changes.

**Thermocouple:**
- Work on the principle that two dissimilar metals when joined to create an electrical circuit with the junctions at different temperatures, generate an electrical current from one metal to another (Seebeck effect).
- Common combinations of metals used to make thermocouples are copper-constantan and platinum-rhodium.
- The advantage of the thermocouple is that all junctions made from the same material behave identically and are very inexpensive.

**Disadvantages:**
- Resistance of individual thermistors in a batch tends to vary.
- Thermistors tend to ‘age’ or show a change in resistance with time.
- They tend to exhibit hysteresis so that the value of a given temperature recorded during the heating cycle is less than the value recorded at the same temperature in a cooling cycle.

**Advantages:**
- Temperature coefficient is much greater than that of a resistance wire element so it can be used to detect very small temperature changes.

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