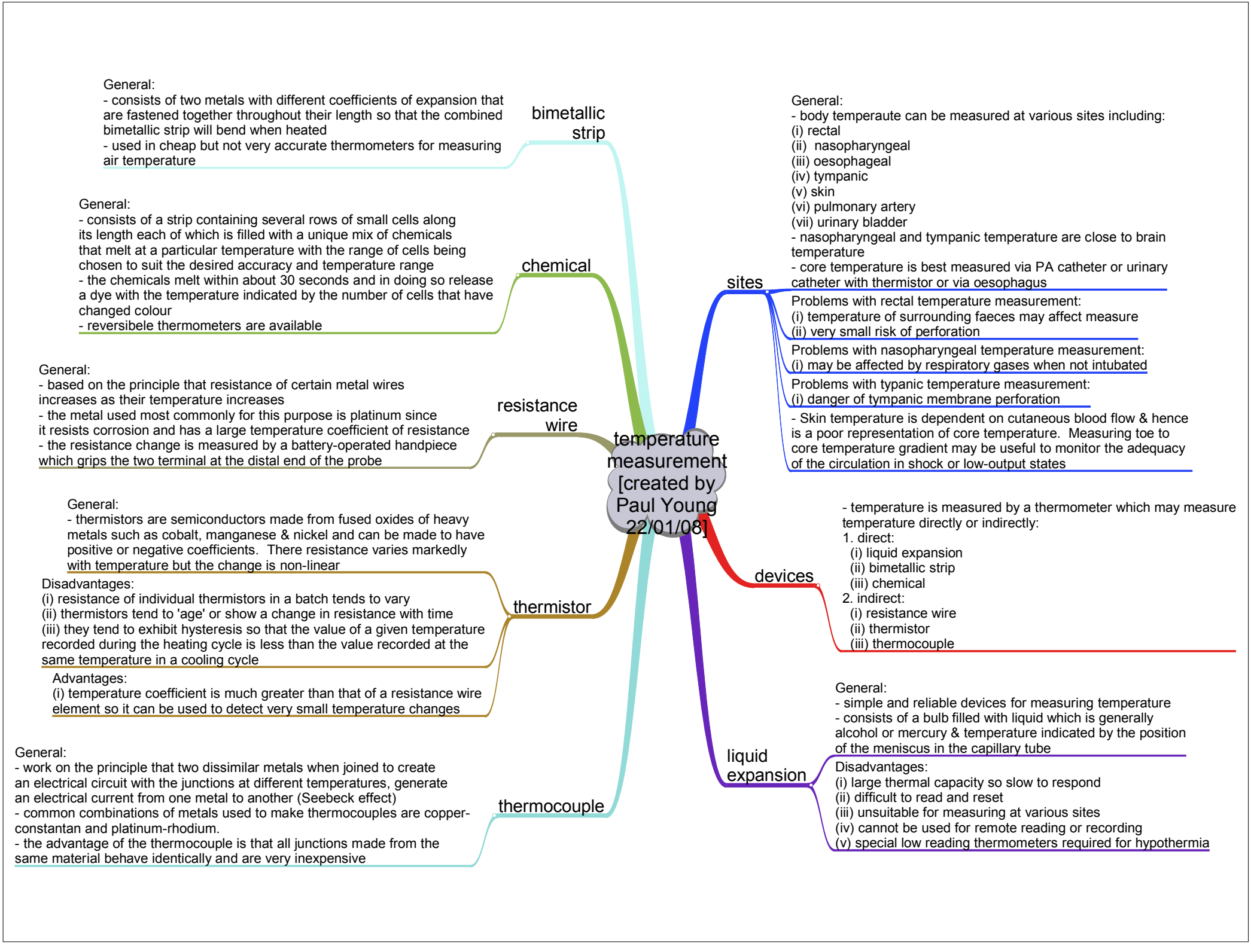
temperature measurement [created by Paul Young 22/01/08]
bimetallic strip
General:
- consists of two metals with different coefficients of expansion that are fastened together throughout their length so that the combined bimetallic strip will bend when heated
- used in cheap but not very accurate thermometers for measuring air temperature
chemical
General:
- 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
- reversibele thermometers are available
resistance wire
General:
- 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
General:
- thermistors are semiconductors 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
Disadvantages:
(i) resistance of individual thermistors in a batch tends to vary
(ii) thermistors tend to 'age' or show a change in resistance with time
(iii) 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:
(i) temperature coefficient is much greater than that of a resistance wire element so it can be used to detect very small temperature changes
thermocouple
General:
- 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
sites
General:
- body temperaute can be measured at various sites including:
(i) rectal
(ii) nasopharyngeal
(iii) oesophageal
(iv) tympanic
(v) skin
(vi) pulmonary artery
(vii) 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:
(i) temperature of surrounding faeces may affect measure
(ii) very small risk of perforation
Problems with nasopharyngeal temperature measurement:
(i) may be affected by respiratory gases when not intubated
Problems with typanic temperature measurement:
(i) danger of tympanic membrane perforation
- Skin temperature is dependent on cutaneous blood flow & 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
devices
- temperature is measured by a thermometer which may measure temperature directly or indirectly:
1. direct:
(i) liquid expansion
(ii) bimetallic strip
(iii) chemical
2. indirect:
(i) resistance wire
(ii) thermistor
(iii) thermocouple
liquid expansion
General:
- simple and reliable devices for measuring temperature
- consists of a bulb filled with liquid which is generally alcohol or mercury & temperature indicated by the position of the meniscus in the capillary tube
Disadvantages:
(i) large thermal capacity so slow to respond
(ii) difficult to read and reset
(iii) unsuitable for measuring at various sites
(iv) cannot be used for remote reading or recording
(v) special low reading thermometers required for hypothermia