a) contact with each other, thermal energy transferred)
b) Convection (transport of heat by movement of the substance, usually a fluid, increases heat loss by conduction, depends on skin temperature compared to fluid, area of skin contact, velocity of fluid over skin)

Insulator zone:
- Air close to the skin can be trapped by fur, feathers or clothing
- Insulator zone reduces heat loss to exterior
- Thickness can be increased by fluffing of feathers or erection of hairs

Water vs. Air
- Water has high specific heat capacity
- Water has greater conductivity → no insulator zone
- Therefore heat loss to water is much greater than to air at the same temperature (at moderate temperatures)

c) Radiation (transfer of heat by infrared electromagnetic radiation, all objects not at absolute zero radiate, nude person at room temp will have 60% of total heat loss by radiation

Note that conduction, convection and radiation can also be routes of heat gain by the body

d) Evaporation (vaporization of water occurs in the mouth, respiratory tract and skin, vaporization of water loses 0.58kcal of heat/gram, only method of heat loss when surrounding temperature is greater than skin temperature
e) Urine and faeces

Metabolic rate/heat production = sum of all heat loss/gain
Difference between loss and production = heat storage

Can maintain normal core temp between 15-50 degrees, thermo neutral zone is 27-31 degrees

Set point: Temperature control systems try to maintain body temp at certain point, regulation occurs at the hypothalamic regulating centres (anterior nucleus and preoptic area control responses activated by warmth, posterior nucleus controls reflexes activated by cold)

Afferents
a) Temperature sensitive cells in the hypothalamus (75% heat sensitive i.e. fire in heat, 25% cold sensitive)
b) Cutaneous temperature receptors (mostly cold receptors on skin)
c) Deep body temperature receptors (mainly cold)

Hypothalamus and deep body sense core temp, skin receptors sense shell temp

Efferents activated by cold (to increase heat production)
a) Shivering – controlled by dorsomedial portion of posterior hypothalamus, occurs in bursts, 4-5 fold increase in heat production
b) Hunger
c) Increased voluntary activity
d) Sympathetic activation
e) Thyroxine

Efferents activated by cold (to decrease heat loss)

a) Cutaneous vasoconstriction
b) Curling up
c) Piloerection (goose bumps)

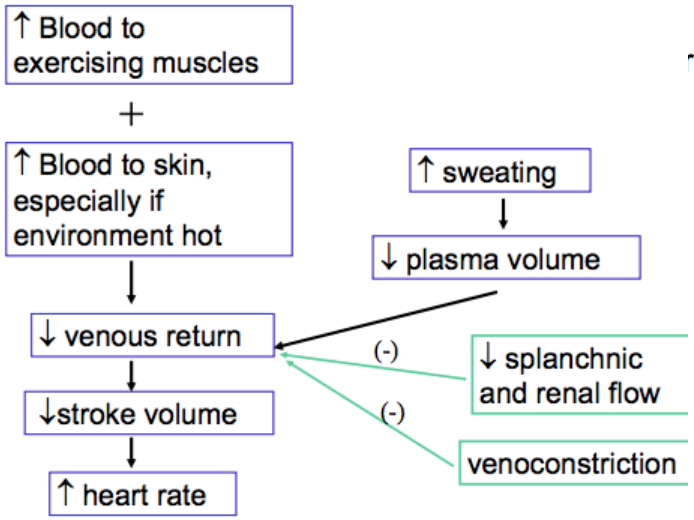
Efferents activated by heat (to increase heat loss)
a) Cutaneous vasodilation (more heat transfer to skin)
b) Sweating
c) Increased respiration

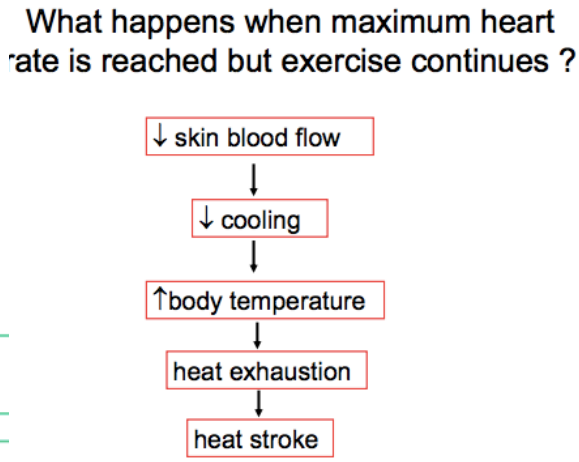
Above 37 degrees, evaporative heat loss increases dramatically
Below 37 degrees heat production increases

Sweat glands
- Sweat composition varies with flow rate
- Low flow – low NaCl, high flow – high NaCl

Efferents activated by heat to decrease heat production
a) Less hunger
b) Apathy and inertia
c) Inhibition of shivering and chemical thermogenesis

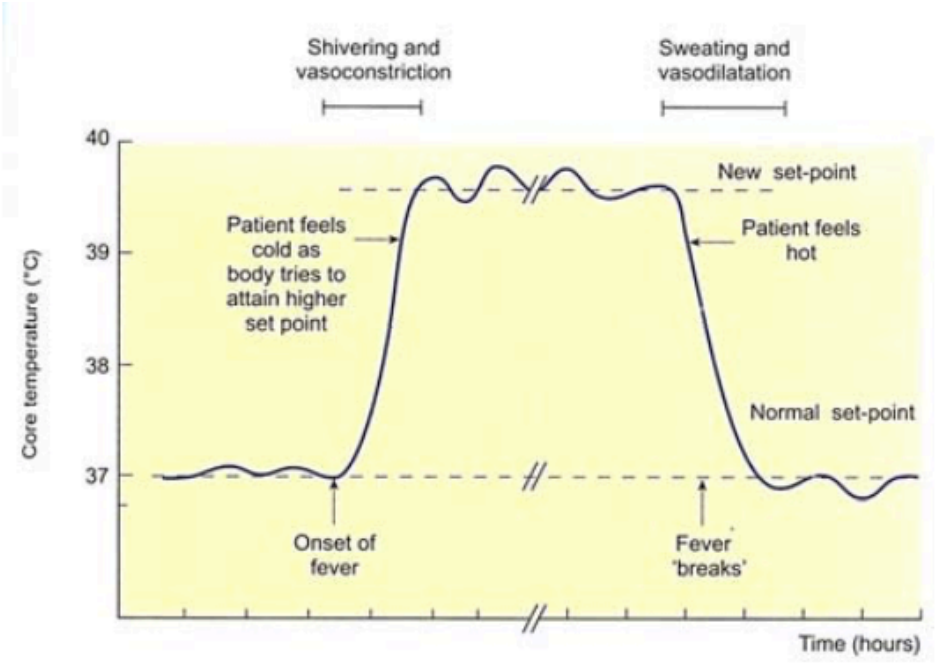
Exercise in the heat can stress cardiovascular system



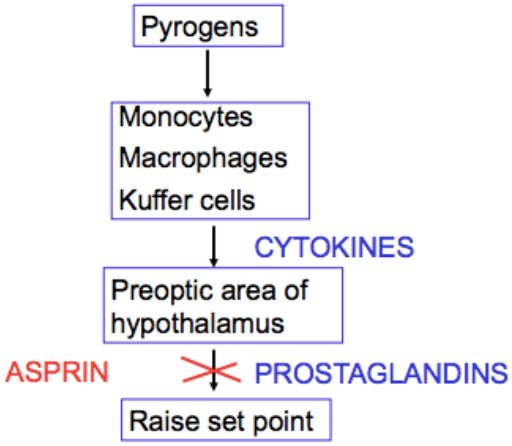

Heat acclimatization
- Increased tolerance to heat
- Develops in 1-3 weeks of exposure to heat for several hours a day
- Decreases core temperature, less rise in temperature with exercise, less rise in heart rate for a particular activity
- Changes in sweating (can sweat more, less sodium loss)

Fever
- Body temp above normal range
- Usually indicates disease
- Hypothalamic set point is increased




Pyrogens

- Substances which cause the thermostat to rise
- Includes bacterial toxins, breakdown products of degenerating tissues etc.




**PHSL2201 – Endocrinology**

**Lecture 1 – Mechanisms of hormone action**

Endocrine organs
Primary – pineal gland, hypothalamus, pituitary gland, thyroid gland, thymus and parathymus, adrenal gland, pancreas, ovaries/testes
Secondary – heart, stomach, liver, kidney, small intestine, skin, placenta

Hormones and the GI tract

- Gastrin in the stomach
- Cholecystokinin (CCK), glucose dependent insulinotrpic peptide (GIP) in the small intestine
- Regulation of appetite