

THERMOREGULATION



Homeostasis



Body temperature

- Temperature of periphery – poikilothermic regulation
- Temperature of core – homoiothermic regulation

Social thermoregulation



HEAT INTAKE

THERMOREGULATION

HEAT LOSS

HEAT PRODUCTION

T.BEHAVIOUR

HEAT OUTPUT

HEAT INTAKE

- Radiation (irradiation, without touch, IR)
- Convection (temperature gradient, touch)

HEAT PRODUCTION

- Depends on energetic exchange (10% of BM - 1°C)
- Difference between rest and exercise (increases muscle rate – up to 90%)
- Shivering and **nonshivering** thermogenesis (voluntary and non-voluntary thermogenesis)
- **Brown adipose tissue** (β_3 adrenoreceptors, NA, lipolysis, expression of lipoproteinlipase and thermogenin, uncoupling of oxidative chain)

HEAT „CONVECTION“

- Inner heat convection (between inner organs and skin)
- Outer heat convection – **heat output**

HEAT LOSS (OUTPUT)

- Heat **radiation**

no touch

- **Convection** of heat to environment (wind) *touch*

- **Evaporation** – **sweating** perspiratio sensibilis,

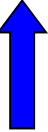
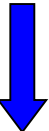
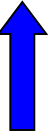
p. insensibilis (sweating glands, diffusion)

1 litre of evaporated sweat – 2428 kJ

Temperature limit: **33°C** at high humidity

Piloerection and horripilation. Tachypnoe.

up to **36°C**

WAY OF OUTPUT	% (at 21°C)	Higher temperatures 
radiation and convection	70	
evaporation	27	
breathing	2	-
excrements	1	-

THERMOREGULATORY MECHANISMS

ACTIVATED BY COLD	Increase of heat production
Muscle shivering	+
Hunger	+
Increase of intentional movements	+
Increase of CA secretion	+
	Decrease of heat output
Skin vasoconstriction	+
Twisting	+
Horripilation	+
ACTIVATED BY HEAT	Increase of heat output
Skin vasodilatation	+
Sweating	+
Increase of ventilation	+
Loss of appetite, apathy, inactiveness	Decrease of heat production

CONTROL OF THERMOREGULATION

Afferentation: TRP channels – 2 types (TRPM8-cold, TRPV1-hot)

- Central thermoreceptors
- Peripheral thermoreceptors (skin – cold)

Mediators:

- NA – mechanisms activated by heat
- Serotonin – m.a.cold

Mechanisms:

- Vegetative
- Somatic
- Endocrine (CA, thyroxin, TSH)
- Modification of behaviour

Thermoregulatory centres – CENTRAL THERMOSTAT:

- Posterior hypothalamus – reaction to cold
- Anterior hypothalamus – reaction to heat
- Upper part of middle brain - ?

Temperature (C)	Symptoms
28	muscle failure
30	loss of body temperature control
33	loss of consciousness
37	normal
42	central nervous system breakdown
44	death

Constitution hyperthermia
Malignant hyperthermia

Hypothermia

PATHOGENESIS OF FEVER

Endotoxin
Inflammation
Other pyrogenic products



Monocytes
Macrophages
Kupfer cells



Interleukin 1

Area preoptica hypothalami



Prostaglandins ???

New set-up of „thermostat“



FEVER