PHYSICAL THERMOREGULATION IN ANIMALS BIO 3610
07

I. RESOURCES: Texts – Marchand, pp. 98-105; and p. 113 Fig. 36; Smith, Ch. 8, 127-8
Coordinated with Laboratory on "Small Mammal Metabolism"

II. OVERVIEW OF THERMOREGULATION --- organismic response to environment

A. CLASSIFICATION -- BASED UPON

1. MECHANISM OF HEAT GAIN OR LOSS:

Two Groups: ________________________ and ________________________

2. PATTERN OF BODY TEMPERATURE -- Three major groupings

a. Homeotherms: ____

b. Poikilotherms: ____

c. Heterotherms ____

B. HOMEOTHERMS -- MAINTAIN BODY TEMPERATURE AT or near a "SET POINT"

C. The "thermoregulatory challenge"

1. ENVIRONMENTAL CONDITIONS ___________________

2. LIVING SYSTEMS HAVE RELATIVELY NARROW_____________________.

3. HOMEOSTASIS = maintaining internal conditions WITHIN a TOLERANCE RANGE amid environmental fluctuations.

D. REQUIREMENTS FOR HOMEOSTATIC CONTROL:

1. Energy Exchange with Environment –

2. Sensory System to Monitor Environment –

3. Set Point –

4. Negative Feedback Mechanism –

III. PHYSICAL *versus* PHYSIOLOGICAL THERMOREGULATION

A. PHYSICAL –

B. PHYSIOLOGICAL –

NOTE: Hard to separate the two

IV. PHYSICAL THERMOREGULATION -- ENDOTHERM - HOMEOTHERM IN WINTER

A. INPUT–OUTPUT MODEL

1. HEAT INPUTS -- negligable from RADIATION (IR)...mostly METABOLIC
2. HEAT OUTPUTS–via ____________________ (BUT several assumptions):
   a. V (latent heat loss) is __________________________________
   b. METABOLIC HEAT is _________________________________
   c. LOSSES BY C, L, IR can be grouped under CONDUCTION
   (since conduction from body core is major determiner of body surface temperature

B. MATHEMATICAL MODEL -- for Conduction

RELATIONSHIP: $$Q_c = kA \frac{(T_b - T_a)}{d}$$

Q_c = heat loss (Watts)
k = thermal conductivity
T_b = body core temp.
T_a = air temperature
A = area (cm^2)
d = distance (cm)

C. DISCUSSION:

2. How does model show a cooling environment?

3. How does model suggest animal strategies for conserving?

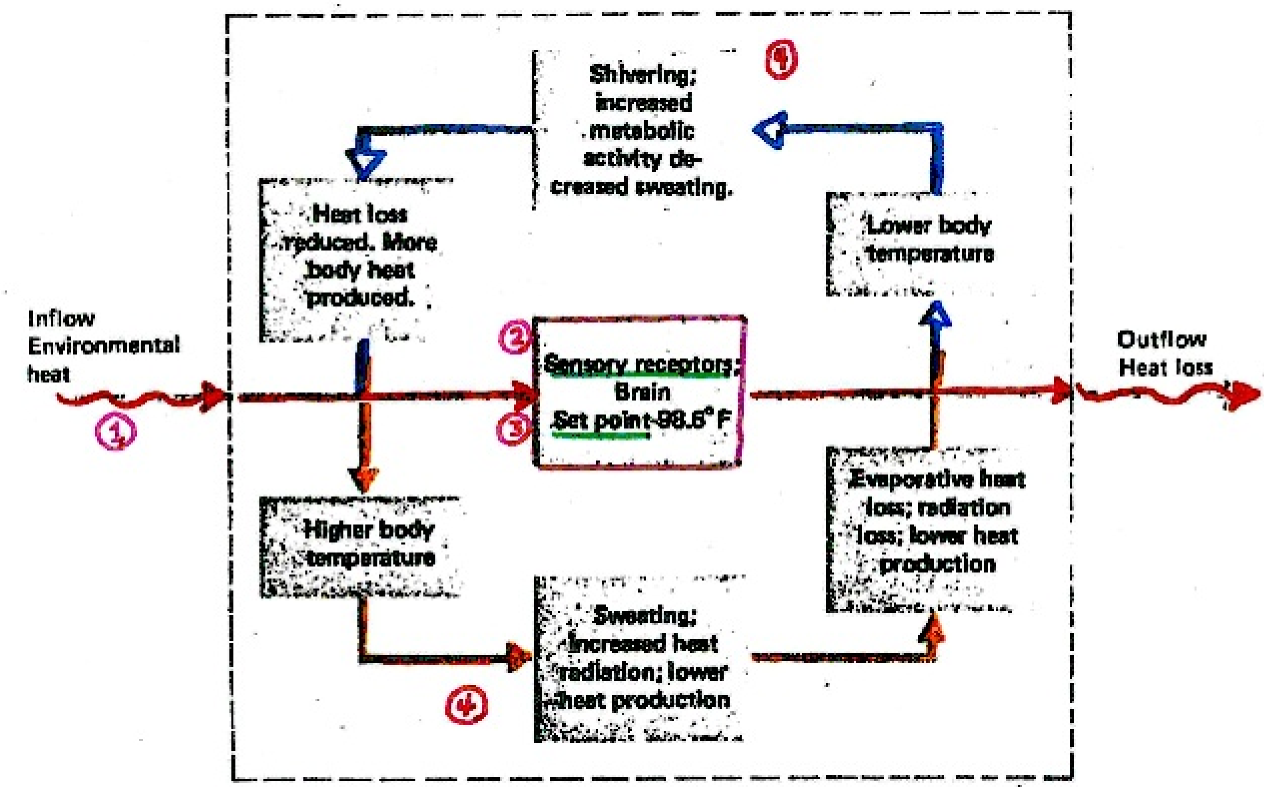
   a.

   b.

   c.

   d.

IV. Next Topic: How the above principles are applied during acclimation to winter.


Inflow
Environmental
heat
Shivering;
increased
metabolic
activity de-
creased sweating.
Heat loss
reduced. More
body heat
produced.
Lower body
temperature
Sensory receptors;
Brain
Set point 98.6° F
Outflow
Heat loss
Higher body
temperature
Evaporative heat
loss; radiation
loss; lower heat
production
Sweating;
increased heat
radiation; lower
heat production