

# CLIMATOLOGY

**Climatology-** It is the branch of science which deals with the study of climatic conditions viz; temperature regulation, wind velocity, atmospheric pressure, solar radiation, rainfall humidity etc

### **Factors affecting climate & their importance:**

#### **■ Environmental temperature & atmospheric pressure –**

- It tends a great variation amongst different animals in respect of internal & external appearance, food habits & behavioral & adaptive aspects
- It also affects the reproduction, lactation, BMR & normal physiology of animals
- Nevertheless, animals have different body shape & size according to their surrounding
- In cold temperate, warm blooded animals have  $\uparrow^{ed}$  or large body size with less body surface towards the high temperature or tropics, while short extremities & compact body size in cold climates
- Well furnished fur/wool & thick skin persists in cold climate animals

- Hot climate animals tends to voluntary anorexia for ↓<sup>ing</sup> metabolic activities
- Hot climate animals pursue heat loss by the way of evaporation & sweating to maintain homeotherm in extend hot

### ■ **Wind velocity, humidity & rainfall-**

- ❖ These are direct related to the temperature altitude & latitude
- ❖ The tropical areas, high environmental temperature is balanced by corresponding heavy rainfall except in deserts due to lack of humidity or moisture percentage due to the geographical status of that area
- ❖ In different climatic condition different types of animal use to live perspect of their need

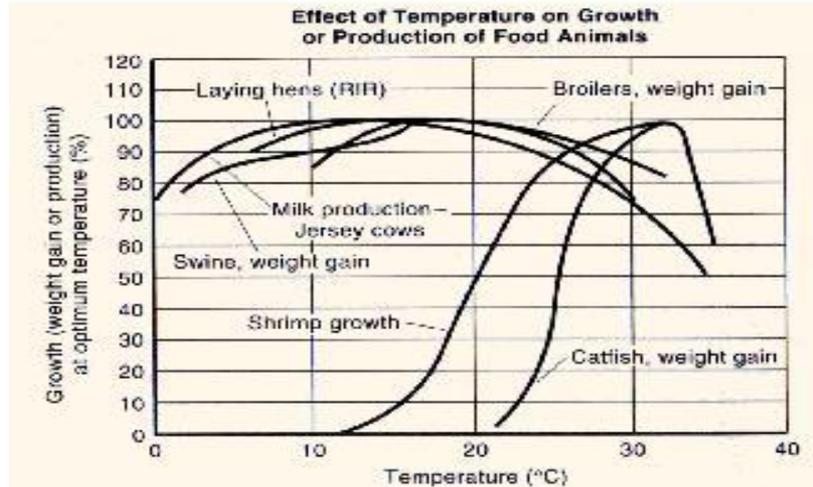
- ❖ These animals modify or adapted their body confirmation, adaptive factors & behavioral habits to their surroundings so that they can justify their needs in relation to their climatic condition
- ❖ In tropics, animal feel cold by evaporation & sweating
- ❖ On ↑<sup>ed</sup> humidity, animals tend to sweat & pant to maintain homeotherm
- ❖ On going rainfall, the water accumulated at the base & is of fullness to the thirst & to prevent itself from the heat

## **Reaction of animals to temperature & fever:**

### **Temperature-**

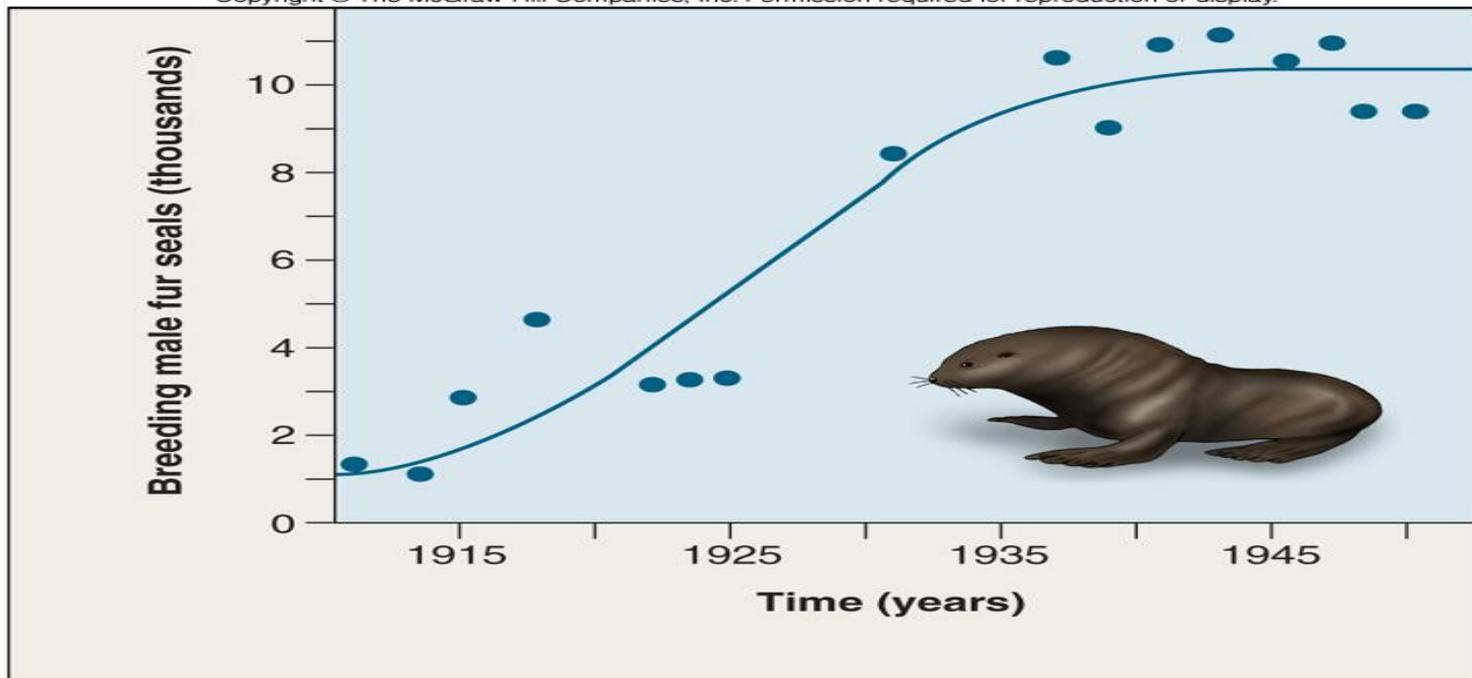
- 🌿 It stands a lot for the animal regarding their habitats, food, reproduction, appearance & their activities
- 🌿 Animals maintain homeotherm by different physical changes

# Temperature and Growth of Food Animals



What is the optimum Temperature for Hens, catfish, shrimp?

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- It mainly depends upon the amount of heat produced and heat exchange i.e. heat gained minus heat lost
- Surface area, shelter & ability of heat conductance are the factors for heat transfer where surface area if  $\uparrow^{es}$ , the animal may dissipate heat more
- Shelter provides the heat transfer depending upon directly comes in contact to the ambient temperature
- The size of skin & fur allows to maintain conductance through their body surfaces
- The fur/feather also holds the air which has low thermal conductivity & maintain homeotherm
- The animals also regulate the exchange of heat to their environment by following mechanisms:-
  - **Behavioral control-** The animals adjust their posture controlling the surface area to maintain homeotherm. In hot humid or semi arid areas they use to live under burrow or seeks in the root of thorny plants or bushes

- **Automatic control-** Flow of blood towards the periphery & skin influences the temperature gradient & heat flux from the body surfaces. Sweating & salivation also accommodate during painting causes evaporation as cooling & soothing effect
- **Adaptive control-** It includes sub-dermal fatty layer insulation probably for controlled heat loss through evaporate or sweating. In cold climate, birds have large & broad wings to maintain homeotherm

## **Rules followed in climatology-**

**Bergmann's rule-** He states that warm blooded animal/species in the colder climates tend to be larger in size then that of comparable warmer regions.

Cold climate animals have a large body with relatively smaller surface area while in hot humid areas a small body with relatively larger surface area to dissipate heat.

**Allen's rule-** There was a general tendency for the enlargement of the peripheral parts under high temperature zone.

Increased periphery  $\propto$  temperature

**Wilson's rule-** In cold countries animal tended towards the fleecy coat whereas in warm regions hair was more strongly developed & wool almost totally absent

Wool  $\propto$  temperature

while hair  $\propto$  temperature

**Gloger's rule-** Animals inhabiting warm region show greater melanin pigmentation than the same species in cooler or drier regions. In arid desert region the skin is characterized by yellow or reddish brown phaeomelanin pigmentation due to anticipated or protection from ultraviolet rays

**Fever-** It is a condition when hypothalamic regulatory center becomes sensitive to certain chemicals collectively termed pyrogens may be of internal (body's tissue or cell originated from bacteria) or from other external source (infection from microorganisms)

- It is related to positive heat balance in regarding to ambient
- A rise in body temperature may induce the metabolism but in respect to  $\uparrow$  in body temperature the rate of metabolic activity  $\uparrow^{es}$  faster & disturb the whole system
- In certain fever, blood becomes concentrated & leads to insufficient elimination of heat through body surfaces

### **Central control of heat regulation-**

- Cerebral cortex & lower in the medulla & spinal cord have integrated action on the thermoregulation and homeotherm center's of the animal body
- There are two centers in the hypothalamus associated with overheating and overcooling having certain sensitive cells which act on change in blood temperature

- So, the efferent nerves of hypothalamic center cells identify by sensation & send the message to act their target cells to maintain heat or cold
- If the sensitive cells situated at hypothalamus receive cold/heat they allow to make change in physical reaction so that the body can maintain homeotherm by the help of (conduction, convection or evaporation)

## **Temperature regulation in birds:-**

### **Endothermic control-**

- **Nervous control of body temperature-** The center for heat regulation is situated in the mid brain which is sensitive to change in blood temperature. On initiating polypnoea evaporative cooling also  $\uparrow^{es}$
- **Insulation-**
- ❖ **Sub-cutaneous fat-** Fat is present mainly in the abdomen & therefore it plays a little part in temperature regulation except- penguins, goose & domestic duck

❖ **Feathers-** The down feathers are designed to hold minimum volume of air. The feathers can interlock themselves to attain the temperature they live/survive. Different types of feather used the birds for different climatic condition as we use the cloth

The preen gland secreted oil to prevent wetting of feather from water. The flight feathers are flat & windproof for performing during flight

❖ **Metabolism related to climate & body size-** The cold region birds attain a higher basal metabolism. Birds of cooler region have larger intestines to that of hotter region. Also the body size is larger than that of hot climate birds

❖ **Cardiovascular reactions-** Birds have no sweat gland, but they can dissipate their heat through lungs & feathers much better than the tissue. If they open the interlocking of the feathers they can much better dissipate the heat & by evaporation through the lungs. Heart rate also  $\uparrow^{es}$  in cold with  $\uparrow^{ed}$  metabolism to maintain homeotherm

## Exothermic control-

- **Posture & activity-** Birds use to be in flock in cold climate to maintain homeotherm & less their body surface area minimum to the air, the head, neck & feathers lie down to attain minimum surface area. In hot climates, birds drink more water. Splash water to their feathers & body to become cold
- **Migration-** Birds can tolerate minimum to starvation and they can fly from unsuitable to favorable environment in search of food & spring climatic condition. Non-fly birds use to live in their nests or shelter.

