

Heat loss and heat gain in Poikilotherms for regulation of body temperature

- **Poikilotherms cannot alter metabolic rate.**
- **Low $T_a \rightarrow$ low metabolic rate**
- **High $T_a \rightarrow$ high metabolic rate**
- **Even then they try to maintain T_b constant by various phenomena**

i) Gradient selection behaviour

- **Animals show movement towards a particular temperature, suitable for their survival.**

**e.g. 1) Free living Nematodes –
When exposed to thermal gradient,
shift to middle part.**

- **Parasitic nematodes select warmer temperature even if they suffer damage.**

2) Housefly larvae – select warm (feeding) temperature 15°C to 33°C.

- But pupating larvae selects cold temperature because warm temperature will be harmful to pupa.**
- This type of gradient selection can be altered by acclimation.**

ii) Metabolic Warming –

- This is also a behavioural adaptation in poikilotherms.**
- Eg. Butterflies show warming up movement of wings.**
- Female Python coils around eggs & keeps her body warm by muscle contraction.**

- **Cold water fishes like Tuna & Sharks swim fast to maintain high T_b (140C higher than T_a) They die if prevented from swimming . Hence they are kept in circular tank.**
- **Due to fast swimming gaseous exchange also is possible.**

iii) Heat gain from environment or heat loss to environment –

- **Desert locust remain inactive in morning when temp. (T_a) below 17°C & start moving at T_a 17°C to 20°C . Make body perpendicular to sunlight so that body is exposed to more sunlight and heat is gained to make the body warm.**

- **During noon → $T_a = 400C$**
- **Therefore the locusts rest in bush and keep body parallel to sun rays so that minimum surface is exposed and heat gain is minimum.**
- **In the Evening – Again keep body perpendicular to sunrays to gain heat by absorption.**

- **Butterflies – bask in sunlight to gain heat by ectothermy.**
- **Lizards – Bask in sunlight for absorption of heat. To avoid heat loss to cool substratum , keep body on dry grass.**

Body colour of poikilotherms also helps in losing or gaining heat

- **Snout Beetle** – Living in hot environment has light colour. Absorb only 26% heat.
- **Carrion Beetle** – living in cold environment. Body is therefore dark & absorb 95% heat.

- **Nocturnal moths**- have furry insulation to prevent heat loss. They show shivering thermogenesis of thoracic muscles.
- **Iguana** in cold environment – has Dark colour absorb 74% heat & Reflect 6%.
- **Phrynosoma** (**horned toad**) – is light colour in hot environment & dark in cold environment & absorb 65% of heat.

- **Earless lizard** – lives in Desert & in night burries in the sand.
- Takes head out in the morning. Blood filled sinuses in the head region get heated in sunlight. When warm blood spreads in the body, the lizard emerges out.
- **Snakes in Arctic region** have longer body so that they can absorb more amount of heat by increasing surface area.

- **Lizard chuck walla shows panting for evaporative cooling.**
- **Use of evaporative heat loss by Bee, for cooling—In summer bees bring water to the hive and do fanning to increase evaporative heat loss to achieve cooling**
- **In winter bees show clustering to prevent heat loss and keep the hive warm & they keep on changing their places.**

- **Reptiles in cold reduce cutaneous flow & in hot the cutaneous flow increases.**
- **In insects they have waxy layer on cuticle.**
- **Ta > 30°C layer melts evaporation rises therefore cooling is achieved.**
- **Ta less than 30°C the wax layer prevents evaporation.**
- **Snakes in northern region show viviparity for survival. (e.g. Vipers)**

- **In Poikilotherms the Thermostat is C.N.S,**
- **Peripheral Receptors send stimuli to C.N.S. & according to the signals sent the CNS modifies the insect behaviour so that heat is gained or lost. Thus through regulation of heat loss and heat gain , the poikilotherms also try to regulate the body temperature.**