

UNIT-III

NUTRITIONAL ENERGETICS: DEFINITION AND FORMS OF ENERGY PARTITIONING

Introduction

- Fish required energy to carry out their vital functions
- That energy comes from the oxidation of organic compound
- Organic compound comes from food or digestion of food
- The energy requirement of fish depend upon the species and physiological stage of the animal itself
- Other environmental factor affect the energy requirement like water temperature

Energy production in cell in three stages

- Formation of acetyl CoA
- Degradation of acetyl CoA group through the tricarboxylic cycle or citric acid cycle
- Transfer of hydrogen electron towards oxygen/Phosphorylation

Energy partition

Partition of dietary energy from food in fish

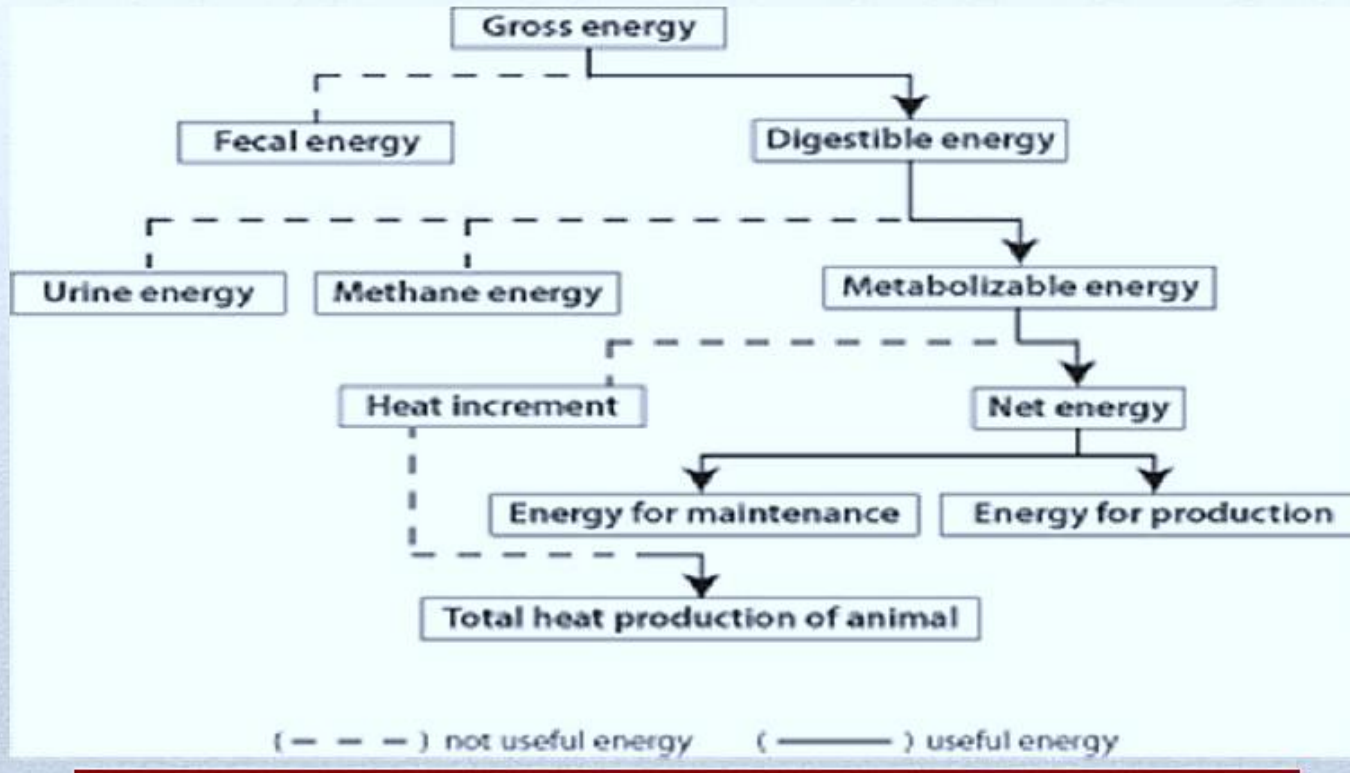
Energetics

Is the study of energy requirement and flow of energy within a system

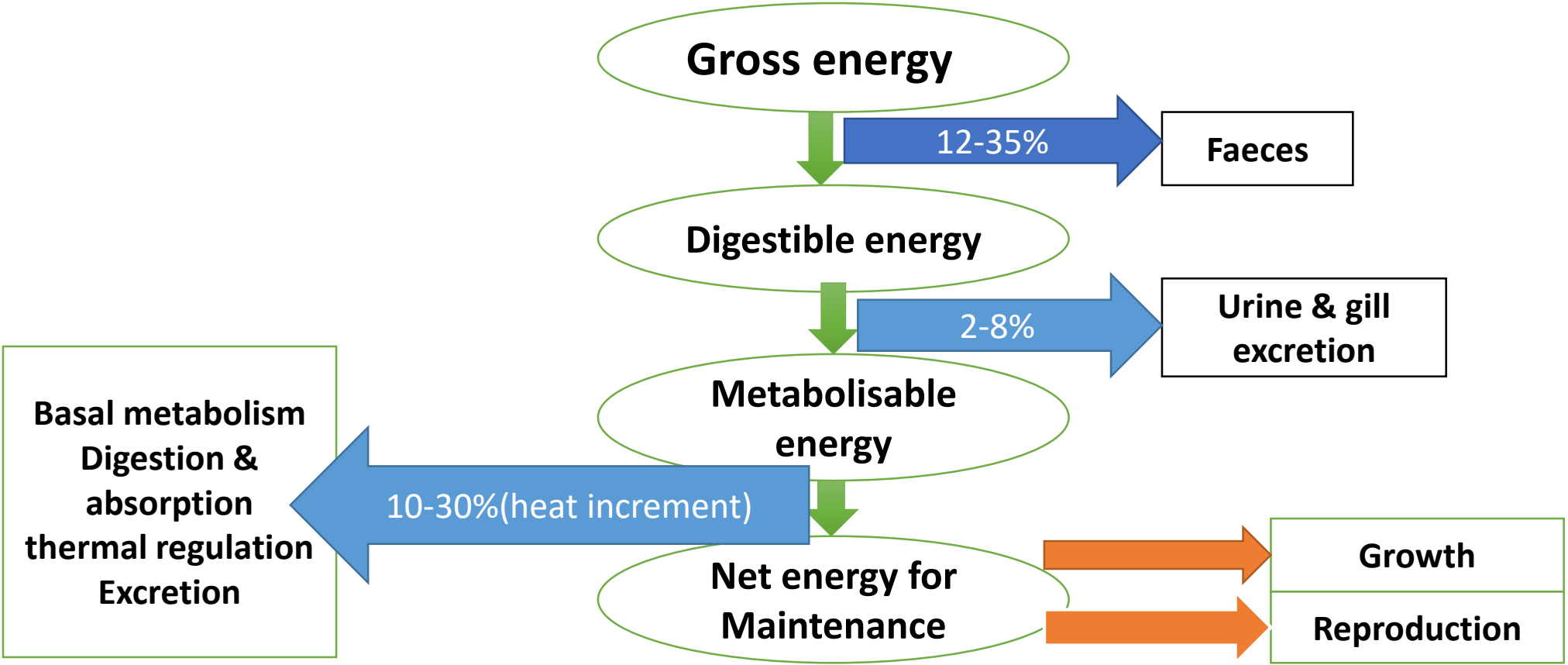
Bioenergetics

Study the transformation of energy in living organism

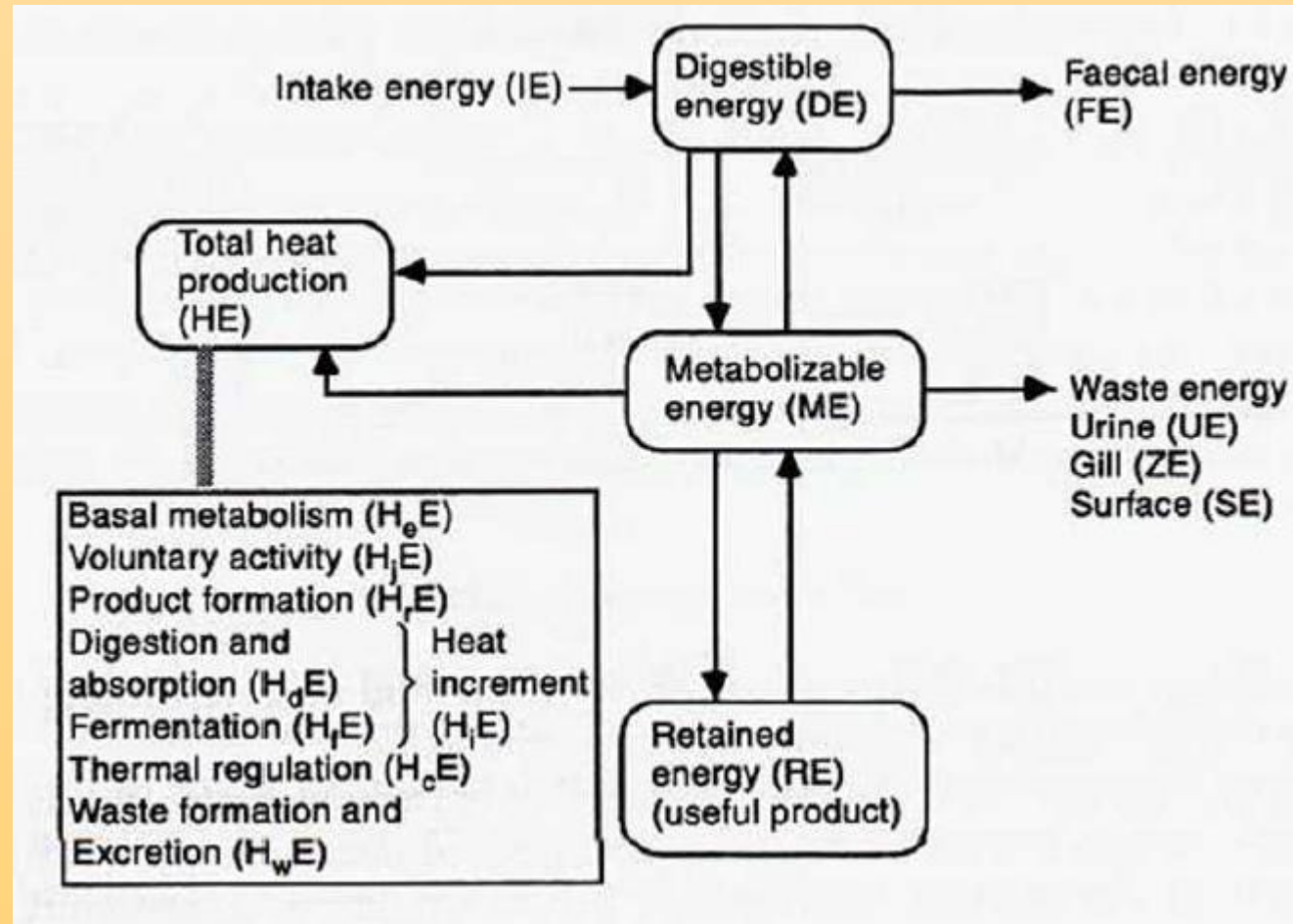
Energy flow in fish and shell fish



Partition of dietary energy in fish



Energy flow in aquatic organism



Gross energy(G.E.)-

- Energy that released as heat when a substance is completely oxidised to carbon dioxide or water
- The total gross energy of the feed measured by bomb calorimeter
- Intake Energy (I.E.)- The gross energy consumed by an animal in the food. Majority of intake energy is present in the form of carbohydrate, protein, Lipid
- Fecal energy (F.E.)-is the gross energy of faeces consist of undigested food

Digestible energy (D.E.)-

- Digested energy within a food is called apparent digested energy
- D.E. Determine as the energy in food minus the energy in faeces

$$D.E.=I.E.-F.E.$$

Urinary energy (U.E.)-

The gross energy of urinary product

Gill excretion Energy (ZE)

The gross energy of the compound excreted through gill of aquatic animal

Surface energy (S.E.)

S.E. Energy is the energy loss from the surface

Metabolisable energy (M.E.)

- M.E. is the energy in food less the energy loss in faeces, urine and through excretion. That energy available for conduct the metabolic process

$$\mathbf{M.E. = I.E. - (F.E. + U.E. + Z.E.)}$$

Heat energy(H.E.)-

- is the energy is the loss from the animal in the form of heat
- Heat energy is produced result of metabolism and so H.E. is measure of metabolic rate of an animal
- Heat energy can be determine either by measuring an animal temperature change or be determining the metabolic rate of the animal by measuring oxygen consumption

Heat energy can be divided into different component

Basal metabolic rate (BMR) (H_eE)- BMR is the heat energy produced by the conduct of those activity that are necessary to maintain the life of the animal. The fish BMR only determine when animal is not developing gonads

The Heat activity (H_aE)- heat activity is the heat produced by muscular activity associated with locomotion and maintaining position in the water column

Heat of thermal regulation(H_tE)- heat produced as a result of a animal effort to maintain body temperature when environmental temperature goes to above the zone of thermal neutrality

The heat of waste formation (H_wE)

- The waste formation is associated with the synthesis and excretion of waste products

Heat increment (H_iE) or specific dynamic action(SDA)-

- Is the increase heat production after consumption of food

Heat production may be summarized

$$HE = H_wE + H_iE + H_eE + H_jE + H_cE$$

FACTORS AFFECTING ENERGY REQUIREMENTS

- *Fish species*
- *Fish size*
- *Fish age*
- *Type of feeder*
- *Physiological activity*
- *Light exposure*
- *Environmental factors*
- *Water chemistry*
- *Fish activity*
- *Diet composition*
- *starvation*