Biological molecules

Carbohydrate

elements: C, H, O

Function

> - **Quick energy**: *glucose* in animal; sucrose in plant
> - **Short-term storage**: *glycogen* in animal; *starch* in plant
> - **Structure**: *cellulose* in plant

Notes

> **Simple**: Glucose(葡萄糖), Sucrose(table sugar)(蔗糖), Lactose(乳糖)
> **Complex**: Starch(淀粉), Glycogen(糖原), Cellulose(纤维素)

Note

Complex carbohydrate are made from *simple* carbohydrate.
Glucose is the monomer (subunit) of glycogen, cellulose, starch
Complex carbohydrate are *insoluble*
broken down by *enzymes* in organism

Testing

Starch

for ***Starch***: Reagent used: **Iodine solution**
(*blue black* for positive else *yellow brown*)

Glucose

for ***glucose/reducing sugar(还原糖)***: Reagent used: **Benedict's Solution**(copper (II) sulphate and the Cu2+ ions) with **HEAT**
(*brick red* for positive, *green&orange* for slightly positive, else *blue*)

⚠ **Warning**

glucose: (葡萄糖)
glycogen: (糖原)
glycerol: (甘油)

Fats

elements: C, H, O

Function

> - Long-term Storage
> - Thermal insulation
> - Buoyancy for marine animals
> - Component of cell membrane

Example : triglyceride(甘油三酯) (1 glycerol ($C_3H_8O_3$), 3 fatty acids(脂肪酸))
Fat and oil are *insoluble*
-phobia : fear of something

Testing

Lipids

Ethanol Emulsion Test, Reagent used: *ethanol* and *water*

1. food sample is placed in a test tube with ethanol
2. test tube is shaken and the fat dissolves into the ethanol. Add water and shake
3. RESULT: *Cloudy* for Positive and *Transparent* for Negative

Proteins

elements: C, H, O, N

Function

> *Growth* and *repair* of tissues
> Transport: Part of RBC
> Protection: Part of immune system

Example:

> Enzymes(酶), antibody(抗体), insulin(胰岛素)

Notes

> Proteins are made up of **amino acids**(氨基酸) (*20* different types of amino acid)

Tests

Proteins

Reagent used: *Biuret Solution*
purple for Positive and *blue* for **Negative**

Vitamin c

Reagent used: DCPIP Solution
Add food juice into DCPIIP
Transparent for Positive and *blue* for Negative

This reaction is a redox reaction: vitamin C (ascorbic acid) is oxidized to dehydroascorbic acid, and DCPIP is reduced to the colorless compound DCPIPH2
DCPIP (blue) + H+ → DCPIPH (pink)
DCPIPH (pink) + vitamin C → DCPIPH2 (colorless)

Water

Note

solvent
essential for *digestion* to provide a medium for enzymes to *act in*
transport *solutes* around the body and transport *waste* products to be excreted

DNA

Notes

Structure: *double helix*(双螺旋)
Subunit: *nucleotide*(核苷酸)

Three components of a nucleotide:

- sugar - *deoxyribose*(脱氧核糖) ($H-(C=O)-(CH_2)-(CHOH)_3-H$)
- phosphate(磷酸盐)
- base

Sugar + phosphate

> Sugar phosphate backbone (糖-磷酸骨架)

Bases

base sequence makes up genes, which code for proteins
Function: **storing, coding and transferring** biological information though its unique structure.
Four types: *A, T, C, G*
Base pairing: A to T, C to G, complementary(互补)
Example: ATTCGCTA - TAAGCGAT