بسم الله الرحمن الرحيم

A

تلخيص لمادة

علوم الحياة Bio101

Campbell Biology

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إعداد الطالبة

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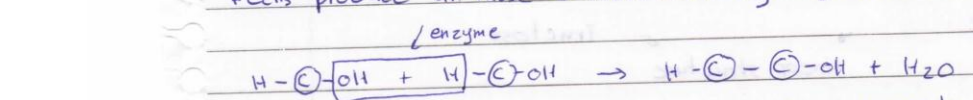
Chapter 5 (Biological macro molecules)

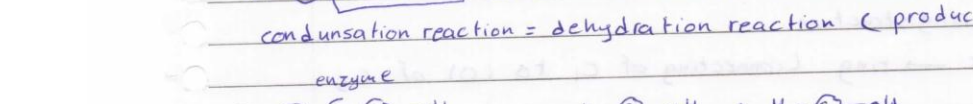
* monomer :- small building unit → identical / similler
* polymer : group of monomers

* macromolecules :- 1) carbohydrates (polymers) 2) proteins (polymers) 3) lipids (not polymers) 4) nucleic acid (polymers)

* Cells produce all these 4 substances by synthises reaction :-



condunsation reaction = dehydration reaction (produce water)



breakdown = hydrolyses reaction

1] carbohydrates (sugar) → monosaccharide = monomers 3-7 carbon
→ disaccharide
→ polysaccharide

* Function of monosaccharide : 1] Fuel for cells 2] building molecules

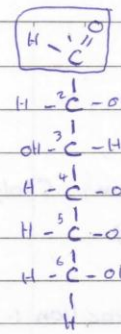
C : H : O
1 : 2 : 1

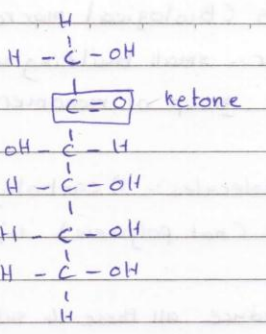
eg :- $C_6H_{12}O_6$

eg :-
Glucose
Fructose
ribose
galactose

* classification :-
1] numbers of C :-
Hexoses (6C) :- Fructose, Glucose / pentose (5C)
triose (3C).
2] The carbonyle group :-
Glucose :- aldose => aldehide
Fructose :- ketose => ketone.

(eg : Glucose and galactose) ← 3] arrangment of substances around the same (C)

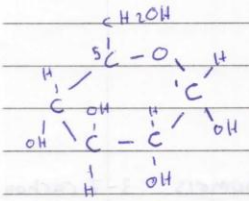




Glucose → linear structure ← Fructose

* in water = ring structure

Glucose: linear ⟶ ring (connecting of C_1 to (O) of C_5

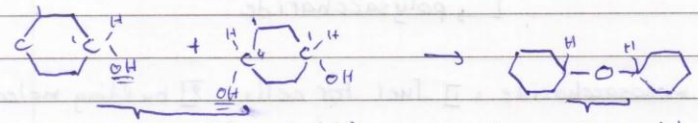


α Glucose when (OH) of C_1 is down

β Glucose when (OH) of C_1 is up

* disaccharide :-

Glucose + Glucose → maltose



we ommit one(H) and (OH)

α 1:4 Glycosidic bond

covelant bond

Glucose + Fructose → sucrose

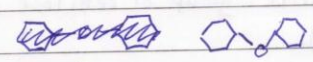
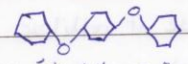
" + galuctose → lactose

Polysacchrides (depend on → sugar monomers, position of glycosidic linkage)

storage
monomers = $(\alpha\text{-glucose})_n$ (100 - 1000)

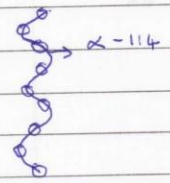
structurer
monomers = $(\beta\text{-glucose})_n$
eg:- cellulose (plant)
chiten (insects)

egs:-
1) starch : storage polly sacchride in plants
2) Glycogen : storage pollysacchride in animals (in liver and muscles cells)

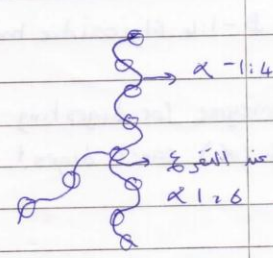
* starch bond : α 1:4 glycosidic 
* cellulose bond : β -1:4 " 
مستوى الرابطة علوي وسفلي

(مستوى الرابطة سفلي)

* starch → simple (unbranched)
→ complex (branched)



Amylose (simple)
helecal shape
25% in plants



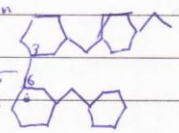
Amylopectin (complex)
75% in plants

* Glycogen :- more branched than amylopectin and every thing else is the same.

* structural polysaccharide :-

1] cellulose :- is available in cell wall of plants

unit :- [β glucose]n



H-bond between C_1/C_6

shape : linear / unbranched

*microfibrils :- group of cellulose which are grouped (give strong building to plants).

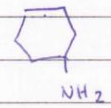
* paper / cotton is made of cellulose

* in food package it's called = insoluble fibre

2] Chitine :- 1] in exoskeleton of arthropods 2] cell wall of fungi

unit :- [β - Glucose amine]n

bond :- β - 1:4 Glycosidic bond



(NH2 ← OH

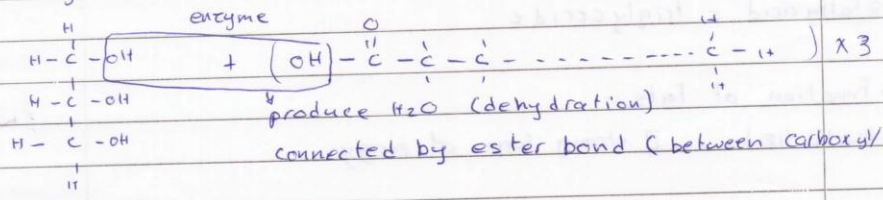
* The enzyme for digesting starch (α) can't digest cellulose (β)

lipids (not polar because they consist alot of C-H

* lipids are diverse, the common thing of all lipids that they are hydrophobic

] fats and oil :- made of two component → Glycerol
→ 3 Fatty acid

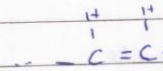
Glycerol



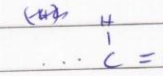
produce H_2O (dehydration)

connected by ester bond (between carboxyl/hydroxyl)

* number of carbon could be as long as 24 carbon / usually (16-18) carbon
* fatty acid is saturated = all bonds are single (linear shape)
* " " " unsaturated = at least there is one double bond

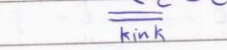


(H) in same level = cis-fatty acid = usefull



(H) not at same level = trans fatty acid = harmfull for human

* when double bond is available abinding occure = kink



* cis / trans are Geometric isomer يتغير موقع الذرات حول الرابطة
* cis is changed into transe by heat

* group of fatty acid which are saturated = solid at room temp.
= fat = polly saturated fat = in animals

* oil = at least one unsaturated fat = liquid at room temp.
= in plants and Fish

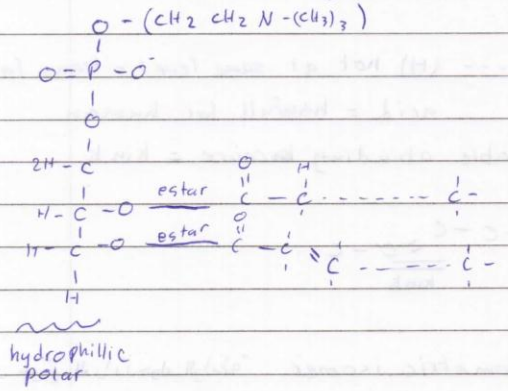
3 fatty acid = triglyceride

* Function of fats :-
1] build lipids 2] strong form of energy

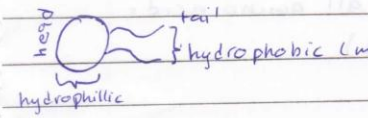
* Fatty acids differs in length / location of double bond

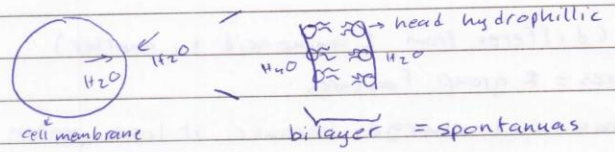
2] Phospholipids :- (cell membrane)

Glycerol — 2 Fatty acids — phosphate

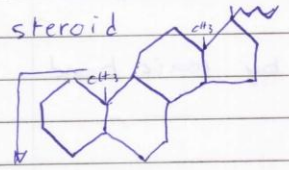


* symbol of phospholipids:





3] steroid

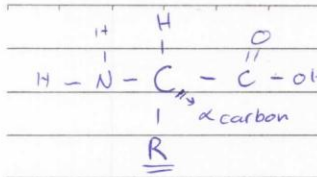


Cholestrol : used to make sex hormones (estrogen / testosteroul)

تختلف الستيرويدات بالمجموعات المرتبطة

* Proteins = polymer = amino acid monomers = 50% Dry mass of cell
↓
are must in any living system / vital

* Function :- 1] make some enzymes (digestive enzyme)
2] work as hormones eg:- ansolyne
3] work as reseptors
4] structural protein (support) eg:- © collagen
© keratin < hair / nail / Feather
5] transport eg:- Hemoglobin
6] Contractile eg: actin / myosin
7] defence (anti bodies)
8] storage eg:- protein of milk

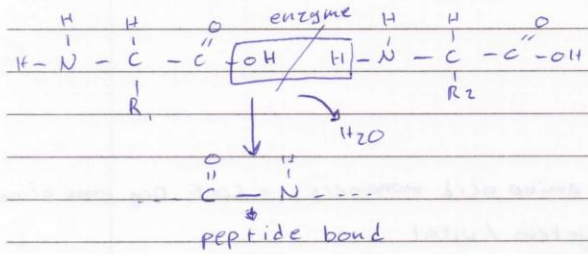


common In all amino acids (backbone)

side group chain (differes from 1 amino acid to another)

aminoacid Features = R group Features

* acidic amino acid has (-) charge because it loses proton
* Basic " " " (+) " " " gains "
* both are charged = hydrophillic
* they could be connected togather by ionic bond



(dehydration rxn)

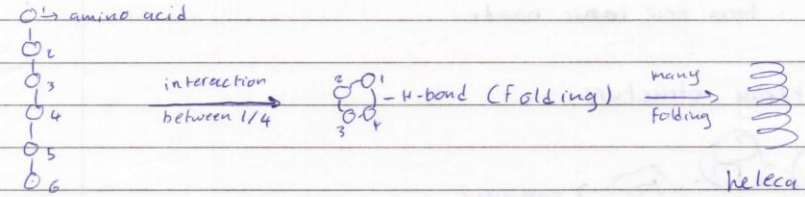
* protein = polypeptide
* protein always has two ends → amino end (N-terminus) / → carbonyl end (C-terminus)

* every protein has specific amino acid sequence = primery structure
  determines the 3D structure
  protain " have
* peptide bond stablize the primery structure of protein
* Frederik sunger determind the amino acid sequance

* primary structure (amino acid sequence)

H-bond between different amino acids

* secondry structure :-



helecal shape

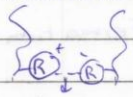
* interactions happen between backbone of different amino acid.
* H-bond stablize the secondry structure
* secondry structure :-

1] α-helix 2] β-pleated shape 

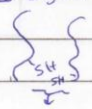
* secondry structure because of H-bond between different back bone of amino group

* proteins don't stay at secondry structure because R-group is able to interact.
* R-group interactions :-

1] ionic bond 2] dysulfide bridge 3] hydrophobic interactions 4] H-bond



ionic bond



R-group interactions ⟶ Tertiary structur : the final shape if the protein was made of one-polypeptide

* The final structure is responsable for protein nature / function

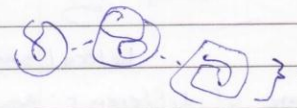
1) Heat ⟶ removes H-bond $\xrightarrow{\text{denaturation}}$ change in function / nature

2) strong acids / Bases ⟶ change pH ⟶ destroy H-bond, covalent bond

active $\xrightarrow{\text{denaturation}}$ inactive

3) salt :- form new ionic bonds

* Quarterny structure :-

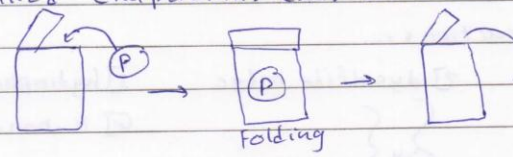


3 subunits — interactions (H-bond / ionic bond) between backbone or (R) group

eg: Hemoglobin / collagen

Hemoglobin	collagen
4 subunits	3 subunits
Globular	Fibrous

* if folding happens in cell (changing pH / solute), different conformation will accure. (so folding must happen in state environment which is called chaperonins (has silender)



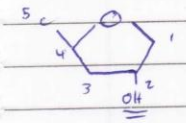
Nucleic Acids = polymers = Nucleotide monomers (polynucleotide strand)

DNA (carries the genetic information)
one type
made of double strand

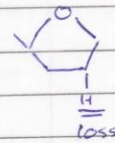
RNA
many types
made of one strand

* nucleotide → ribose sugar (pentose)
→ nitrogen base
→ PO_4 group

* ribose :- it makes RNA

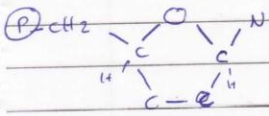


* deoxyribose (DNA)



loss of (O)

* nucleotide :-



* N-Bases that make RNA, DNA are ring structure

(pyrmidine) one ring → C, T, U

two ring (purine) → A, G

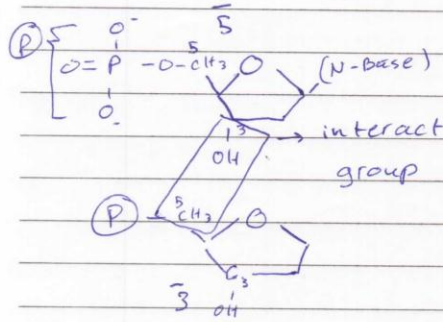
C cytosin, T Thymin, U uracil, A adenin, G Guanin

* A, C, G are common in RNA and DNA
* T → DNA
* U → RNA

* the differences between RNA, DNA :-

1] N-base
2] sugar kind
3] strand number

* Nucleotide = sugar + (P) + N-Base
* Nucleoside = sugar + N-Base



→ interaction between OH of C_3 and (P) group = (phosphodyestar bond)

(sugar + PO_4) are common between all DNA or RNA = Backbone

* They differ in Base sequance
* every DNA has specific base sequance