Carbohydrates

- how is starch stored

Glycogen

- Animal equivalent of starch
- Found in liver and skeletal muscles of vertebrae and in many fungi
- Structurally similar to amylopectin
- But more branching

Starch and glycogen

- their molecules have many side branches where glucose molecules can be removed from their tips (by enzymes)
- their insolubility stops them from interfering with osmosis
- their compactness provides an efficient way to store lots of glucose for future cellular respiration

Cellulose

- most abundant organic molecule on earth
- major component of cell wall in plants
- made from long straight unbranched chains of glucose
- chains crosslinked by h-bonds which holds them tightly together (excludes water)
- chemically very inert and insoluble - few ‘tips on molecule make it difficult to digest
- many molecules form strong fibrils
- only some bacteria, fungi and a very small number of animals can secrete cellulose enzymes

Function of carbs

- building blocks for larger molecules eg. dna, cellulose, starch, glycogen
- source of respiratory energy
- Structural
    - Cellulose cell wall (plant)
    - Chitin (insects/crab/shrimp)

Protein

- subunits of proteins- amino acids
- joined by peptide bonds (condensation)--> polypeptide
- enzymes are catalysts and are made up of proteins (ALL ENZYMES ARE PROTEINS)
- heat up enzyme, denature, destruction of protein structure
- pH Sensitive
- Amylase digests starch
- Some enzymes:
    - amyl**ase** (carbohydrate)
    - lip**ase** (lipid)
    - prote**ase** Shape determines function

- Enzymes→ a special group of proteins
    - they can break down other proteins by attacking the peptide bonds
- proteins contain CHONS
- there are about 20 essential amino acids found in proteins
-
- the amino acids differ in the nature of the ***R*** group
- ***R determines your name.***
- Groups
    - Neutral, non-polar
    - Neutral, polar
    - Basic
    - Acidic
- 2 amino acids form dipeptide bond, 1 water released

Primary structure

- Straight line, specific linear order

Secondary structure

- One segment may be coiled up (alpha helix)
- Regular folding of segments and beta pleated sheet (hydrogen bonds)

Tertiary structure

- Overall shape of a polypeptide resulting from interaction between R groups of the various amino acids in the polypeptide
- Stabilized by disulphide and hydrogen bond
- 4 types: (they keep the polypeptide together and folded)
    - Ionic Bond
    - Disulfide Bond (strong bond)
        - Formed between the groups of cysteine residues by the process of oxidative formation
    - Hydrogen Bond
    - Hydrophobic Interaction (folding in due to some silly hydrophobia)

Quaternary Structure

- Association from 2 or more polypeptides

Different kind of bonds

- ionic bonds
- peptide bonds
- disulphide bonds

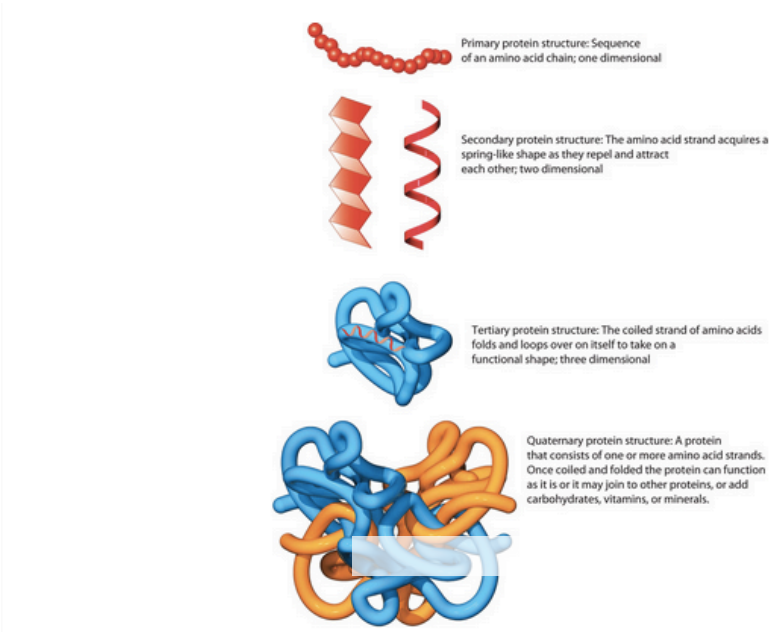
Rebonding:

- Heating to break disulphide bonds in hair

Classification

- Fibrous (CAN BE DIGESTED, Cellulose→ digestive fibre, cannot be digested)
    - Insoluble
- Globular
    - Compact
    - Tertiary or quaternary

    - Polypeptide chain fold into a compact spherical structure
    - making it soluble in aqueous solution
- Roles
    - Homeostatic
        - Soluble protein acts as buffer
        - If your pH change, it will alter your pH back to norm
    - Structural
        - Collagen of connective tissues, keratin
    - Hormonal
        - eg. Insulin and glucagon
    - Enzymic
        - All enzymes are proteins
    - Transport
        - Cell membrane protein, haemoglobin, myoglobin
    - Protection
        - Antibodies, Fibrinogen, Thrombin
    - Contractile
        - Myosin, Actin
    - Storage
        - Casein in milk, aleurone in skin



A protein has four different structural levels.

COLLAGEN DOES NOT HAVE ALPHA HELIX, ONLY TRIPLE HELIX (like a pleat, not a coil)

Gurl are you an enzyme cos you so hot you denature ma proteins
Gurl I'm an active site. Are you a substrate? Cos you complement me. <3
What is the enzyme that digests ice cream called? Haagen dase

Activation energy: energy needed to get molecules to transition state
amount of energy needed to start a reaction
minimum amount of energy to start reaction
Can prevent reaction from occurring except very slowly
Without catalysts, reactions will occur too slowly for life
Each enzyme is specific for only one reaction
Fit between enzyme and substrate is lock-and-key model or induced-fit model where enzyme moves slightly to bind substrate more firmly.

The only enzymes not ending with 'ase' are pepsin, rennin and trypsin (they were discovered before -ase)
DON'T NEED TO KNOW THE CLASSIFICATION WITH THE INSANELY LONG WORDS all the trans dunno what

Uncatalyzed reaction take longer time to get product
Catalyzed reactions have a higher rate of reaction, product obtained faster
Transition state: the highest point of the graph

Energy released by formation of product is same whether it's an uncatalyzed reaction of catalyzed
Lock-and-key: enz***y***me is the lock and substrate is the ke***y***
how to remember: The 'y's can't go together so enz**y**me isn't the ke**y**

Glucose + glucose ← maltose
Maltase binds with the maltose molecules to form an enzyme-substrate complex which is 2 glucose molecules
After reaction: you have your enzyme and your product
Enzyme remains unchanged so enzyme can be reused

Enzyme	Substrate
Maltase	Maltose
Sucrase	Sucrose
Lactase	Lactose

trypsin in the duodonum

Breaking down: catabolism
Synthesis: anabolism
Catabolism + Anabolism = metabolism metapod

BOLISMS UNITE

ENZYMES ARE GLOBULAR PROTEINS
Active site must match shape of substrate
They must be COMPLEMENTARY

Can recognise only one substrate

The enzyme song

Lyrics:

They're the protein catalysts in every organism
ENZYMES!
Through enzymatic action your metabolism's driven
ENZYMES!
In staphylococcus, jellyfish, tarantulas and trees,
They lower activation energy
Enzymes, in you and me now
ENZYMES!

You got 'em in your cells where they do cellular digestion,
ENZYMES!
You got 'em in your mouth and in your stomach and intestines
ENZYMES!
The thing an enzyme acts upon is called a substrate.
They fit like lock and key with complementary shape
Enzymes, speed up reaction rates
ENZYMES!

An enzyme binds its substrate at its active site
ENZYMES!
Bound together in a complex where they snuggle so tight,
ENZYMES!
New bonds will form and break due to the active site's chemistry
Reactants become products, it's the enzyme's specialty,
Product gets release enzyme repeats its action readily
ENZYMES!

Like any molecule an enzyme's shape defines its function.
ENZYMES!
Environmental change that changes shape leads to malfunction,
ENZYMES!
Every enzyme has a pH where it catalyzes best,
a pH change will set enzyme activity to rest.
Enzymes are so sensitive they're easily upset
ENZYMES!

More heat until a certain point increases their efficiency
ENZYMES!
But too much heat denatures them destroying their activity
ENZYMES!
That's why a fever running high's a dangerous situation,
All that heat can alter enzymatic conformation.
Keep it 98.6 for enzyme optimization
ENZYMES!

Enzymes in saliva will break starch into glucose
ENZYMES!
If you lack the enzyme lactase then you won't enjoy milk lactose,
ENZYMES!
Tay-sachs, galactosemia and PKU disease,
All caused by inherited enzyme deficiencies
ENZYMES, they're what everybody needs
ENZYMES!

- lower activation energy
- cellular digestion
- speed up reaction rate
- bind at active sites
- reactants become products
- shape defines function
- environmental change the shape
- pH that catalyses best
- denaturation occurs after optimum temperature
- heat can cause the enzyme to change form and structur

Lactase→ globular protein (soluble)

How enzymes work: (catabolism)

- Complementary substrate binds to active site of enzyme (MUST BE COMPLEMENTARY)
- Enzyme-substrate complex is formed (temporary structure)
- Enzyme cause a certain strain on substrate, break up bonds, get product and enzyme
- Product is released from enzyme

Anabolism: two substrates come together, form and become a product
Metabolism: Anabolism + Catabolism
ACTIVATION ENERGY

More substrates → higher rate of reaction. It will increase until it reaches the limit at which the enzymes can break down the substrate and will be steady (when all the active sites are used up)

What is going on at A?
they are increasing.

Inhibitors go around poking enzymes and then run away going 'NOTHING HUEHUEHUE'

As the temperature increases to the optimum temperature from 0 to 40, this increases the rate of reaction linear with increase in temperature/ kinetic energy of the substrate and enzyme...substrate and active stires, increasing th rate of formation of enzyme-substrate complex. enzyme activity is highest at its optimum temperature of 40 for most cases.

If the temperature increases above 40,
a decrease in the rate of reaction occurs despite the increasing frequency of collisions. thermal agitation of enzyme molecule breaks the hydrogen bonds, ionic bonds and hydrophobic interactions that stabilize the precise 3d conformation of the enzyme the 3d conformation of the enzyme and that of its active site is altered so that it is no longer be a complementary fit with the substrate. the enzyme is said to be denatured and loses the catalytic function.

All enzymes have an optimum ph at which they will work most efficiently. at optimum ph, the rate of reaction is at a maximum and enzymes maintain the its specific 3d conformation and so the active site could fit tand bind the substrate.at pH values onl slightly avoce and below the pH level, the enzyme will denature or not work respectively. (i think)

Pepsin denatures proteins (peptite bond). Pepsin's optimum pH level is very acidic due to the Hydrochloric acid. wait is it the pepsin in HCl cos it only works in acidic conditions or did it adapt?

in between liver secretes bile and pancreas secrete pancreatic juice (sodium bicarb) which neutralises the acid from stomach

trypsin: duodenum. environment is more alkaline/neutral, which is the optimum ph level for trypsin to work.

Inhibitors:
Competitive inhibitor: similar shape as normal substrate and hogs the active site like a selfish potato.
Non-competitive inhibitor: Different shape as normal substrate but binds to allosteric site and destroys the enzyme like another selfish potato.

When graph A line follows the no inhibitor line and joins together at the max velocity (competitive inhibitor):

- An increase in the substrate concentration reduces the effect on inhibition
- The substrate and the inhibitor are in direct competition for the enzymes' active sites
- The greater the proportion of the substrate molecules, the greater the chance a substrate can out-compete the inhibitor to enter the active site.
- At high substrate concentration, the concentration of inhibitor is negligible and the rate of maximum (in the absence of inhibitor) can be attained

When graph B line follows the no inhibitor line but doesn't reach max velocity (non-competitive inhibitor):

- When substrate concentration is very high, the rate of reaction in the presence of inhibitor does not reach the maximum velocity (rate) as the reaction that is uninhibited
- The binding of non-competitive inhibitor to a site other than the enzyme's active site prevents the substrate molecules from binding
- Due to a change in the conformation of the enzyme's overall three dimensional structure and that of its active site
- the effect of such inhibition is similar to a reduced enzyme concentration (as a certain proportion of the enzyme molecules are not functional)
- as the substrate and the inhibition are not in direct competition for the same site, an increase in substrate concentration has no effect on the inhibition.