

hello everyone i welcome you all in the series of lectures on bio molecule ah today we are going to discuss about the tenth lectures ah before going to the details of todays lecture i would like to give a recap of last lecture in the last lecture we talked about the structure of proteins and there we discussed about the primary structure secondary structure tertiary structure and quaternary structure in today's ah lecture we we will talk about ah enzymes another bio molecule enzyme so lets discuss about the enzymes enzymes water enzymes essentially all organic reactions all organic reactions that occur in cell in cells require a catalyst so essentially basically catalyst you know you all are familiar that when we talk about a chemical transformation when two reactants react with each other and lead to the product generally to you know push this reaction in forward direction or to happen this reaction we use another entity which promotes this process and that is called as catalyst similarly ah all organic reaction which are whichever happens in the sales are you know ah i mean getting ah are required to have a catalyst and these biological catalyst most of most biological catalysts are called enzymes are enzymes are enzymes and these enzymes are which are globular proteins which are globular protein each biological reaction is catalyzed by a different enzyme so they are very specific each biological reaction is catalyzed by a different enzyme by a different enzyme so to make it in the equation form i will so substrate is getting converted to product as we talk about you know chemical transformation so here also it requires enzyme how things happen in the biological system see in the chemical reaction what do we do we take create two reactants and there we add catalyst in the same one part and things happen it leads to the product formation how things happen in the biological system in the biological system basically substrate reacts at the active site of you know enzyme and that enzyme active site brings true reactant in the vicinity and that protonates lead to the you know product formation where they can interact with each other so the enzyme binds its substrate at its active site a pocket in the cleft of the enzyme what is active site basically active site a pocket in the cleft of the enzyme cleft of the enzyme so let me make the structure of enzyme so this is a structure of enzyme and as we are talking about the cleft this is the cleft

so enzyme and this is the active site this cleft where you know the substrate is bound at that tissue basically the substrate is bound at the active side active side now the specificity of an enzyme how as i mentioned ah i will like to mention here that you know enzymes are very specific

so if you have one enzyme it will not work for the all the transformation for party one particular transformation only one enzyme is there and how do they attain this specificity

so the specificity of an enzyme the specificity of an enzyme results from the confirmation results from its confirmation and the particular amino acid side chain particular amino acid side chains that are at the active sites

so this is the active site i have made and they they kind of fold in a specific fashion and that way they make a you

know particular i can say the cleft are you know groove where this substrate you know particular substrate will go and ah react at the active site

so the specificity of iron enzyme results from its conformation it attains a particular conformation and the particular amino acid because that

particular amino acid will be responsible for the binding you know

so amino acid and

its a conformation both factors are there particular amino acids and side chains that are at the active site at the active site for example an amino acid with a negatively charged ison an amino acid with a negatively charged side chain negatively charged side chain at the active site at the active site can bind with a substrate which has a positively charged group which has a positively charged group also here hydrogen bond hydrogen bond you know interactions are possible

so hydrogen bond donor hydrogen bond donor with hydrogen bond acceptor on the substrate

here this is at the active side hydro hydrogen bond donor with hydrogen bond acceptor acceptor and a hydrophobic amino acid side chain hydrophobic amino acid side chain side chain can you see it with

hydro phobic groups on the substrate can associate with hydrophobic groups on the substrate hydrophobic groups on the substrate and to explain all these interaction emil

fixture propose the lock and key model email fixture proposed the lock and key model lock and key model lock and key model to account

for the specificity of enzyme for the specificity city of an enzyme for its substrate enzyme for its substrate for a substrate

so let me represent it in a pictorial

way

so i will first draw you know lock and key model

so this is a basically i am making this active site of this enzyme now now you can see here it highly specificity the groups of the active site

only can fit to the substrate and this can lead to the the complex now this you can see that you know substrate

binds with the enzyme active site and make the you know enzyme substrate complex

ok this is called lock and key model this is very old 1894 it was proposed by you know imel fisher half a century back there was another model came in existence and that is called induced fit model in induced fit model basically it was proposed that you know ah the substrate comes vicinity of the enzyme and even if it does not fit to the active site through the interaction slight interaction will start and slowly slowly it will get fit to the active site so to make it that to understand ah i will again read one more pictorial presentation so so this is a enzyme now you if you look over the structure of active site and let me draw the substrate substrate is same now the substrate does not fit you know here it does not have this this active site is not matching one is matching another is not matching however when they come in vicinity this interaction leads to the you know so now it it gets fit actually and this is called induced because after coming in vicinity this you know sub state is able to ah fit with the enzyme and this model is called basically induced fit model so this is induced fit model and this was presented in nineteen fifty eight by daniel and cause land this is called induced fit model now we will talk that you know how ah catalyst basically the enzyme catalyzing the reactions how how do they catalyze basically catalyzing the reaction so how how do they catalyze lets talk about that the how the enzyme works so some of the amino acid side chains are acidic some are basic and some are nucleophilic and because of this characteristic they you know ah portray that kind of interaction with the substrate so as i mentioned that some of the amino acid side chains as we know that you know ah enzymes are made up of amino acids ok so ah basically it is made up of you know peptide and peptide chains are made up of amino acid so some of the amino acid side chains of the enzyme enzyme serve as a service acid base and a nucleophilic catalyst nucleophilic catalyst and many enzymes also have metal ions at their active site a many enzymes have metal ions at their active site that a tagic at least that act as catalyst these species are positioned relatively to the substrate precisely where they are needed for catalysis basically these should not be embedded inside these substituent should be positioned you know at the outer periphery where they can get exposed to the you know um substrate and so that they can act precisely so ah and ah and because of ah the availability of these substituent they inherit you know that nature the whole active site you know start behaving like that and that leads to the you know particular

catalysis

particularly if it has acid substituent on the amino acid side chain it will show

that particular acid catalysis if it has base at the side chain then it will it

can

so you know ah basic catalysis

so this factor is analogous to the way intra molecular catalysis intramolecular catalysis intramolecular catalysis by acids bases nucleophiles and metal ions

so let me repeat again how the enzyme

catalyzes the reaction basically some of the amino acid side chain of the enzyme

serve as a a acid or base are nucleophile catalyst and even many enzymes have metal ions

at their active site and these are the functional group are the metal ions

are responsible for the catalysis because the you know enzymes are made up of the these amino acids and ah the these substituents are you know these

species are

possible positioned at the periphery of the you know ah this ah structures particularly

enzymes and

so that it can get exposed to react with the substrate when the substrate comes in vicinity and the this this whole thing you know ah you can say that

once the

substrate comes in vicinity of the enzyme ah it is almost like that you know how the reaction

happens in a you know one entity like that in a intermolecular fashion you know you can say ah

basically ah the intra molecular acid or base or nucleophilic ah our reaction with the metal ah ions you know ah that leads to the enhancement in the rate of the you know particular transformation

so if we talk individually about

all these influencing factors so an acid catalyst increase the

rate of reaction how does it do increases the rate of reaction by donating a proton to the substrate proton to the substrate a base catalyst increases the

rate of reaction by removing a proton from the substrate removing a proton from the substrate a nucleophile catalyst

increases the rate of reaction increases the rate of reaction by forming a new covalent bond with the substrate by forming a covalent bond with the substrate

amino is also one important ah information i will like to pass on that you know amino

acid side chains can stabilize transition state can stabilize transition state by london respond dispersion forces by london this person forces forces

electrostatic interaction and hydrogen bonding and hydrogen bonding they are generally enzymes are generally named after the compound or class of compound

upon

which they work

so how are they named enzymes are generally named after the compound are class of compound upon which they work compound upon which they work upon which they

work for example the enzyme that catalyzes

hydrolysis of maltose is called maltase the enzyme that catalyzes hydrolysis of hydrolysis of maltose into glucose is named as maltase is named as maltis

so for i can write it in

the equation form

so if here is the maltose and in presence of maltase it gets converted to two glucose molecule c six h twelve o six it gets converted to two glucose molecule sometimes enzymes are also named after the class of transformation ah you know they ah perform sometimes enzymes are also named after the reaction after the reaction where they are used easy for example enzymes which catalyzes the oxidation of one substrate which catalyzes just catalyze the oxidation of one substrate with the simultaneous reduction of another substrate with the simulator reduction of another substrate are named as oxido reductase enzyme oxido reductase enzyme so this is called oxido reductase enzyme this much ah about the enzymes so ah we saw that ah enzymes are basically a which you know ah can be ah named after the class of substrate on which they ah you know react for example we saw in that you know how it can hydrolyze ah maltose to the two unit of sucrose ah sorry two unit of ah glucose and the the the enzyme is called multis and the type of reaction you know ah if enzyme ah is uh you know working for the oxidation and the simultaneously another ah substrate is getting reduced one substrate is getting oxidized another substrate is getting reduced then then it is called oxidoreductase enzyme so i will like to stop here ah now in the next class ah i will start with the you know um vitamins you know vitamins um we will start vitamins that what are the ah beta means basically and you know ah their types and how do they work basically ah thank you very much for listening you