تبديض الاطرة كاريز

*) What is the active site, what are the character of the active site

→ active site is where the substrate is binding into the enzyme

*) small clefting of enzyme is activesite

→ 1) has a specific chain → (3D configuration) يكون *
↳ to be complementary to the active site

3Dconfiguration ← لازم يكون — عشان يكون مقيد

specific reactive groups

- acitic aminoacids
- hydroxy containing aminoacids
- basic aminoacids
- sulpha-hydrel containing aminoacids

it should be stabilized

*enzyme Function

*) accelerating the reaction

*) decreasing the energy of activation

needed for ~~substrate of molecule~~ the molecule of substrate to be in the transition state

*) processes at the active site

1) catalysts by proximity اقتراب

يقرب الـ substrate الـ active site

* should be have 2 types of proximity :-

* should be have proximity of the reactive group in the active sites on the enzyme in the binding of substrate

binding ← ازاي يعمل the substrate

وظيفة الـ enzyme في حالة الـ binding

(local region of high substrate) يعمل ما يسمى concentration

* يعمل تزاحم في البيئات substrate to the active site

*) they are pushing around each other

يعمل ← ~~crowdness~~ يعمل crowdness

A) Proximity of reactive groups in the active site of the enzyme and its the binding site of substrate

* اذا عندنا ٢ معلومة في نهاية الاوبجكت :

① ← ما راح يصير اي تفاعل الا اذا كانت molecule which will react in bond forming distance

② ← enzyme بيركز بالتفاعل يعمل crowdness of substrate molecule around active site

proximity of the reactive group ← pushing the substrate molecule into active site

orientation ← هذا الترام يؤدي إلى ٣

of these reactive groups into the active site and the binding site of substrate

(Stabilization of the substrate molecule into active site of enzyme) ← ١ انه اهنا نوصل موضوع

→ if there are no stabilization the reaction will be not carried out efficienty

2) Acid base catalysis

*) ionizable groups in the active site of enzyme and binding site in the substrate

(٢)

acidic amino acids مثلاً

*) they can be ionized ↵

→ carring a charge to allow the reaction between another reactive groups, also, ionized in the binding site

* مشروح كيف تفاعل ابدأ اذا كان

[ionzation of reactive groups] في

in the active site of enzyme

and ionization of another reactive groups in the binding site of substrate

* الاحماض والقواعد الموجودة تعمل important role in the formation of bonds between enzyme and substrate and stabilization of subtrate in the active site (transession state) حالات توصل

- General acid catalysis

partial هي *
transfer of proton from a donar

- General base catalysis

هي *
partial proton abstraction from an acceptor also for the ionization of particular groups to allow the bonding between reactive groups to all the activation energy to be at the transession state.

*) catalysis by strain :

→ is not for all enzyme

*lytic enzyme → lysis (digestive)

*) what is the benefit of highly branched of enz starch? [redacted] For storage

These enzyme loss covalent bond

[redacted]

يربط substrate الـ active site of enzyme slightly unfavorable يربط for the bond

*) particularg specfic for the lytic enzymes

4) covalent catalysis :

→ reaction will be carried out by forming the covalent bond between substrate and the enzyme for more stabilization

↳ energy of activation needed to be in the transession state will be decrease → facilitating of molecule of substrate to be in a transession state

energy of activation

molecule of substrate will be in the transession state →

product

Three stages in covalent catalysis :

1) nucleophilic reaction between enzyme and substrate

2) Electrophilic withdrawl of electrons from substrate

3) Elimination reaction (reverse of stage 1)

*) covalent bond will be broken
(between substrate and enzyme)

ان سهل كلما [energy of activation] كلما قلت

molecule of substrate in the enzyme be in transession state and converted from substrate into product

كلما زاد (removal of electrons) كلما سرع ←
(reactive groups in the active site of enzyme) , (molecule of substrate) من

bonding ال كان (ionized state) في حالة

between substrate and active site of the enzyme

stronger ⟶ transession كلما كان في حالة ⟶ converted into product

5) metal ion catalysis : ⊡ نقيضة أخرى فيزيك الأول

- Two classes of metal ion dependent enzymes :-

1) Metalloenzymes

→ tightly bound into the enzyme

→ if the metal ion is removed from this type of enzyme there will be no reaction

[Fe^{+2} / Fe^{+3} / Cu^{+2} / Zn^{+2} / Mn^{+2}]

→ the enzyme will never act without the pressence of metal ion

2) metal activated enymes

* the metal ion is not essential part of enzyme

-8 (metal ion) ⊡ لو مش موجود بالتفاعل

*) the reaction will be carryout but not effeciency

Metal ions function :

*) Binding to and orientation of substrates

شغل اللي ←

metal ion ← رح نفترض انه

between substrate and enzyme

attracting the substrate to the active site of enzyme

*) bridge → enzyme metal substrate bridge

*) Mediating redox reaction by changing oxidation state in the active site of enzyme

→ removal of electrons (ionization)

↓

Facilitating ~~binding of~~ the interaction between the reactive groups in the active groups of enzyme and binding site of ~~enz~~ substrate.

* Electrostatic stabilization

→ shelding of negative charges

*) There is no need for more ionization

لو حصل ionization هيزيد شحنة سالبة

(electron by shelding the negative charges in the active sites of enzyme.) يعني تأثير

6) Electrostatic catalysis

enzyme function : distribution and arrangement of the charges in the active sites of the enzyme

active site ← substrate ← يجذب ايونات

water molecule ← removal يعمل
from active site

→ to generate dielectric constant in the active site

Enzyme specificity

① Absolute specificity

→ one enzyme is acting on one substrate

② Group specificity

→ enzyme acting on particular chemical group

③ linkage specificity:

→ enzyme will act on a particular type of chemical bond regardless of the rest of the molecular structure

4) stereo chemical specificity

→ is acting on one isomer only

*) which type of amino acid can be found in our body?

*) → L-form

glucose/fructose السكريات الطبيعية ← Good ✓

*) amino acids in our proteins is in L-form ★

D-amino acid ← لو كانت كذا

→ all enzyme in our cells acting on amino acid (act only on L-form)

→ will not be absorp / if this absorp this is will mistake.

D-aminoacids ← لو دخل غلط وتم امتصاص

* البنج ؟

→ amino acid is essential components of our cells but we are taking D-aminoacid which will not be used. they will be excreted with urine

(aminoaciduria)

↳ have dangerous effect in kidney

(genetic disease)

cofactors العوامل المساعدة

- metals
- small organic molecules (coenzymes)

→ small organic molecules are derivatives of vitamines (vitamine B complex)

(by covalent or noncovalent) مرتبط (cofactor) لوكانت ال ←

but tightly to the enzyme → غير مرتبط اي (prosthetic group)

→ binding in a transession dissaubable form ←
(coenzyme)

cofactors

اذا

- Prosthetic group (مرتبطة بالانزيم ارتباط قوي)
  - metal ions
  - Vitamines derivatives
- coenzymes
  - lossly bound to the enzyme ارتباط ~~متوسط~~ بسيط / غير قوي
    - metal ions
    - Vitamines derivetive

(transient)

prosthetic groups

→ tightly bound to the enzyme (covalent or non covalent)

1) pyridoxal phosphate ← derives from (vitamine b6)

~~2) Flavin~~

2) FMN
3) FAD
] → b2

4) Thiamin pyrphosphate → V B1

5) Biotin → V B7

*) metal ions → co/cu/Mg/Mn/Zn

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roles of metal ions

metalloenzymes — metalactivatedenzyme

ايونات معدنية — عكس تواجد

nonessential / essential

→ binding and orientation of the substrate

→ Change in the oxidation status in the active site of enzyme

→ electrostatic shelding to prevent the affect of extra negative charge

Coenzymes / derivative from vitamine

→ transfer group agents

groups توخذ ال

From donar to acceptor

* loosly bond to the enzyme (neutrilization)

ارتباط ضعيف

* recycly shapes

---

enzymes are diagnostic agent (تشخيص المرض الأمراض)

and the are many chemical compound that can help in estimating

(glucoseoxidase) → كم مستوى الغلوكوز في الدم

(enzymes to help in the dignosis of diseases) ممكن نشخص ال

enzyme ال ← ممكن نشخص

toestimate the concentration of other compound

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*) There are new classification For enzymes acoording as dignostic markers

*) Functional plasma enzymes → (plasma derived enzymes)

موجودة في الدم من موجودة ال cells

* طبيعي نلاقيه [high concentration of these enzymes in blood]

the enzyme is existing in the place where the substrate is acting

Abnoranal state ← cells في ال high concentration لو وجدنا

~~High concentration~~ ~~طبيعي~~ (*)

(7) طبيعي جدا ان يكون في

high concentration of the enzyme in blood sample

high concentration لكن لو لقينا

in cells → damage in membrane of cells and the enzyme exist in wrong place because the substrate is not in the site of cell

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2) Non Functional plasma enzymes

[Cells derived enzymes]

*) exist in the cells

*) normally we can ~~find the~~ Find a low concentration of these enzyme

[during a cell turn over] يحصل ← في تركيز قليل جدا في الدم

الخلايا تتجدد وتنتج خلايا جديدة باستمرار على الـ

breaking down → Leakage يحصل

لـ low concentration

§ high concentration في الدم ←

*) continous damage or severe damage or necrosis of the cell

---

*) isoenzymes

are particulary cell derived enzyme

*) الأشكال المختلفة لانزيم معين
تتشابه في ٣ أمور وتختلف في ٣ أمور أخرى

تتشابه في كل اللي علاقة بالتفاعل
[lactate dehydrogenase enzyme] لـ 5 صور عندنا في الـ in our cells

1. reaction they are catalyze — كلهم بيعملوا نفس التفاعل
2. the substrate is acting on — لكلهم بيشتغلوا على lactic acid
3. product they are given — بيعملوا الـ oxidation وبيحولوا الـ pyruvate acid

بتختلف عن بعض في:
*) origin / *) physical character
Eg: (molecular weight)
chemical composition
*) different in the effect of inhibitors and activators

*) Lactate dehydrogenase enzyme is tetrameric molecule → consist of 4 polypeptide chain

نوعين

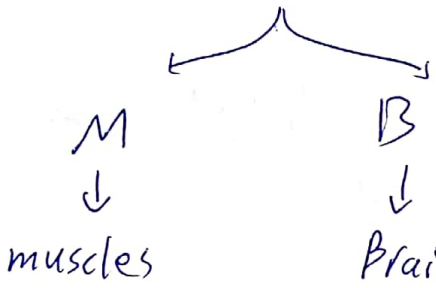
heart ← (cardiac muscle) — M → skeleton Muscle

اكبدول بالسلايد رقم 25 معم

← أهم مرحلة من صفاتها تكون specific biomarker

CK / CPK isoenzyme

*) 2 polypeptide chains only



اكبدول بالسلايد رقم ٢٦ معم

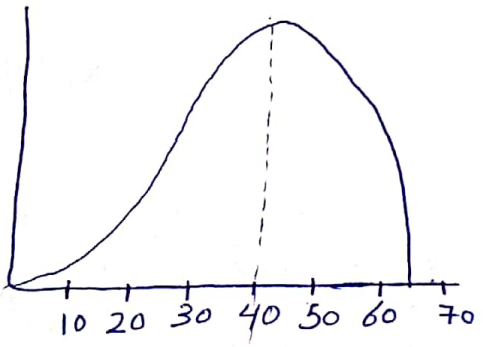
An overview 2

*| First factor affecting on enzymatic activity is ~~temperature~~ temperature

→ we started with temperture zero, then. the temperture is graduallly increase.

activity enzyme تبدأ تزيد لحد ما توصل to the maximum level

* no more increase in enzymatic activity



→ optimum temperture = temperture at which the enzyme is acting maximaly (37°)

* لنفرض انه enzyme كما هاي النقطة

*) What happen in the enzymatic activity

there are gradually dicrease in the activity of enzyme

enzyme activity ← effect ← مش رح تلاقي اي

in our cells except in two cases

- Fever (حمى)
- hypothermia (انخفاض في درجة الحرارة)

→ second factor is affect on enzymatic activity is **enzyme concentration**

* في هاي الجزئية نثبت كل العوامل باستثناء متغير واحد (enzyme concentration)

كلما زادت enzyme concentration ← زادة الـ activity of enzyme

* مش رح يتوقف الـ enzyme عن العمل في هذه الحالة ~~...~~

~~...~~ turnover number ↓

لـ substrate يخلص

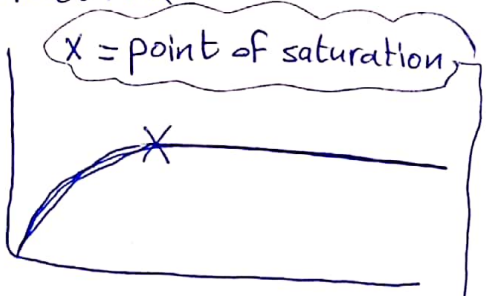
*) Effect of pH on enzyme activity

*) most of our enzymes acting maximaly at the physiological (pH) → 7.35 in the blood and 6.9 intracellulary

For sure ← pH وزيادة pH تقلل
It will result breaking down of some reaction between subtrate and active site of enzyme

*) Effect of subtrate concentration

subtrate concentration ← كلما زيد
↓
rate of reaction تزيد
(enzyme activity)



all subtrate molecule occupied by enzyme activity

if we are added another subtrate molecule there are no reaction

*) zero order reaction : no effect of factor on the enzymatic activity

*) first order reaction : direct relationship between the activity of the enzyme and subtrate concentration