

بسم الله الرحمن الرحيم
بداية لا تنسوا الدعاء لإخوتنا بغزة

و في بيتين شعر حلوين افتتحت الدكتورة فيهم المحاضرة
و هم :

العلم يبني بيوتاً لا عماد لها و الجهل يهدم بيت العز و الكرم

ذو العقل يشقى في النعيم بعقله و أخو الجهالة في الشقاوة ينعم

و هون بدنا تعرفوا انه الوضع الصحي و الطبيعي تكون تعبان من علمك عشان تتأكد انه انت بتعمل الصح

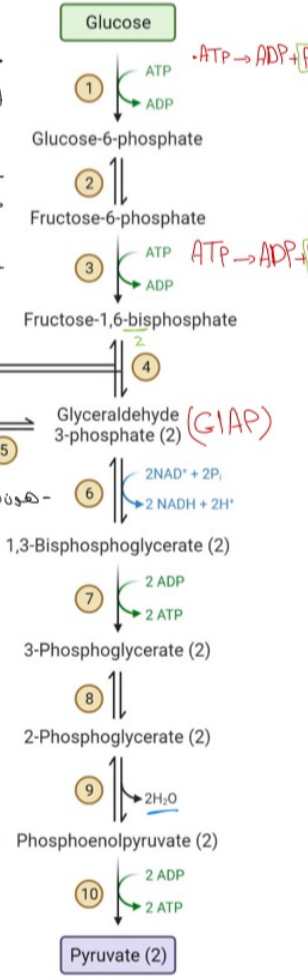
Suggested Reading:

Lippincott's Illustrated reviews: Biochemistry

* عملية Glycolysis في صورة

Glycolysis and Glycolytic Enzymes

يحتاج P عنان نقل trapping
 ل Glu عنان هذه بكم ATP
 - نفس عن الادوية من الله بغير
 مترادف (isomers)
 - لحفظ زونا في المركب



ENZYMES	
1	Hexokinase
2	Phosphoglucose isomerase
3	Phosphofruktokinase-1
4	Aldolase → <i>break down</i>
5	Triosephosphate isomerase
6	Glyceraldehyde 3-phosphate dehydrogenase
7	Phosphoglycerate kinase
8	Phosphoglyceromutase
9	Enolase
10	Pyruvate kinase

PRODUCTS	
2 ATP	2 Pyruvate
2 NADH	



لحفظ ما العود وقت في رنة عنا جزئين من كل خطوة عنان هذه
 بطول 2 ATP .. كما ان سعة الناتج المتكافئ ل ATP هو 2 وليس 1 عنان
 في صنف عونها اذل مرحلت هارت لما استهلكنا فيها 2 ATP

* عنان هت oxidation يجب ان يوافق التفاعل reduction لذلك بين اعمار التفاعل بوجود
 NAD+ حيث يتحول ل NADH وهنا اذل NADH يخرج

* اذل في ياتل مركب ADP يتفاعل معها وينتج ATP ولكن 2 ATP تذكركت
 تتفاعل مع مركبين في هذه المرحلة

(شرح مبسط لعملية ال glycolysis)
 ال رابط هت

STAND WITH GAZA

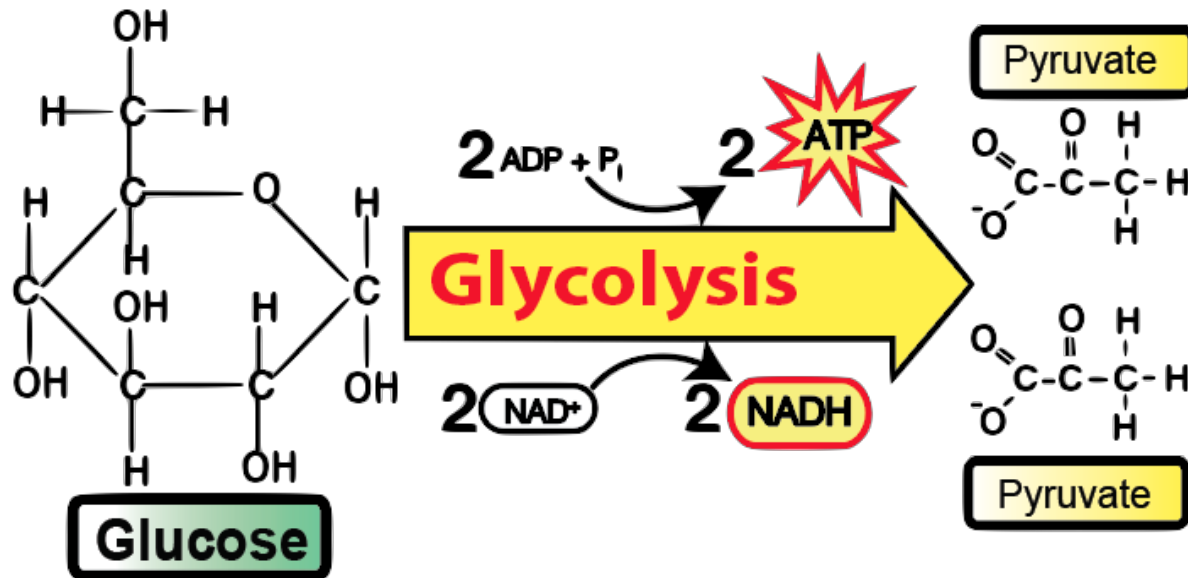
<https://youtu.be/bxt9Sr5jRDo?si=0sNN6itBQ72TQ5de>

الحلوله copy دانته
 من اليوتيوب



Glycolysis

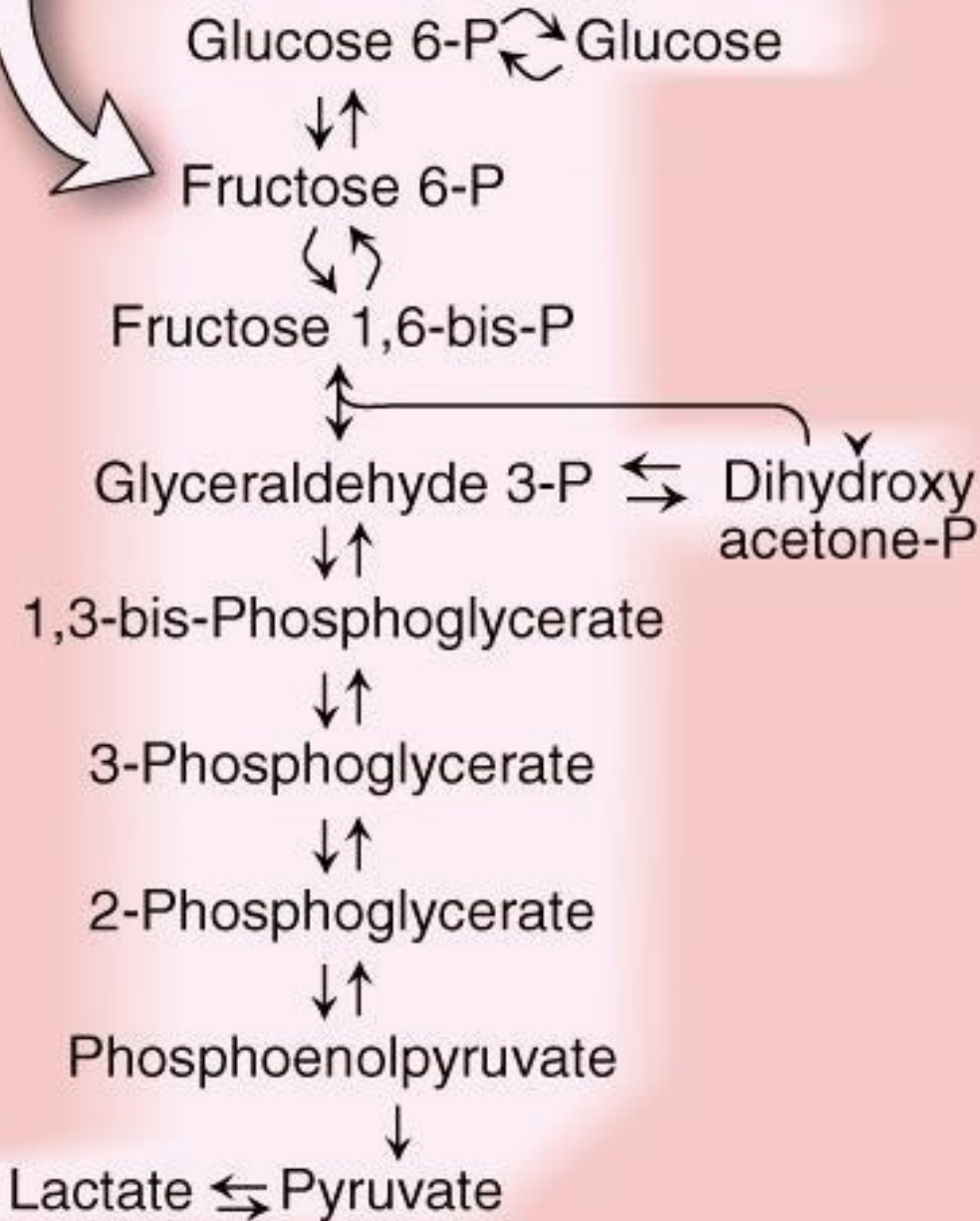
Reactions and Regulation



Dr. Diala Abu-Hassan

Suggested Reading:

Lippincott's Illustrated reviews: Biochemistry



- Some cells as RBCs and Brain cells rely on Glycolysis as a source of energy.

Glycolysis is an example of metabolic pathway

- Glycolysis is a linear pathway which means that the product of the first reaction is the reactant of second reaction.

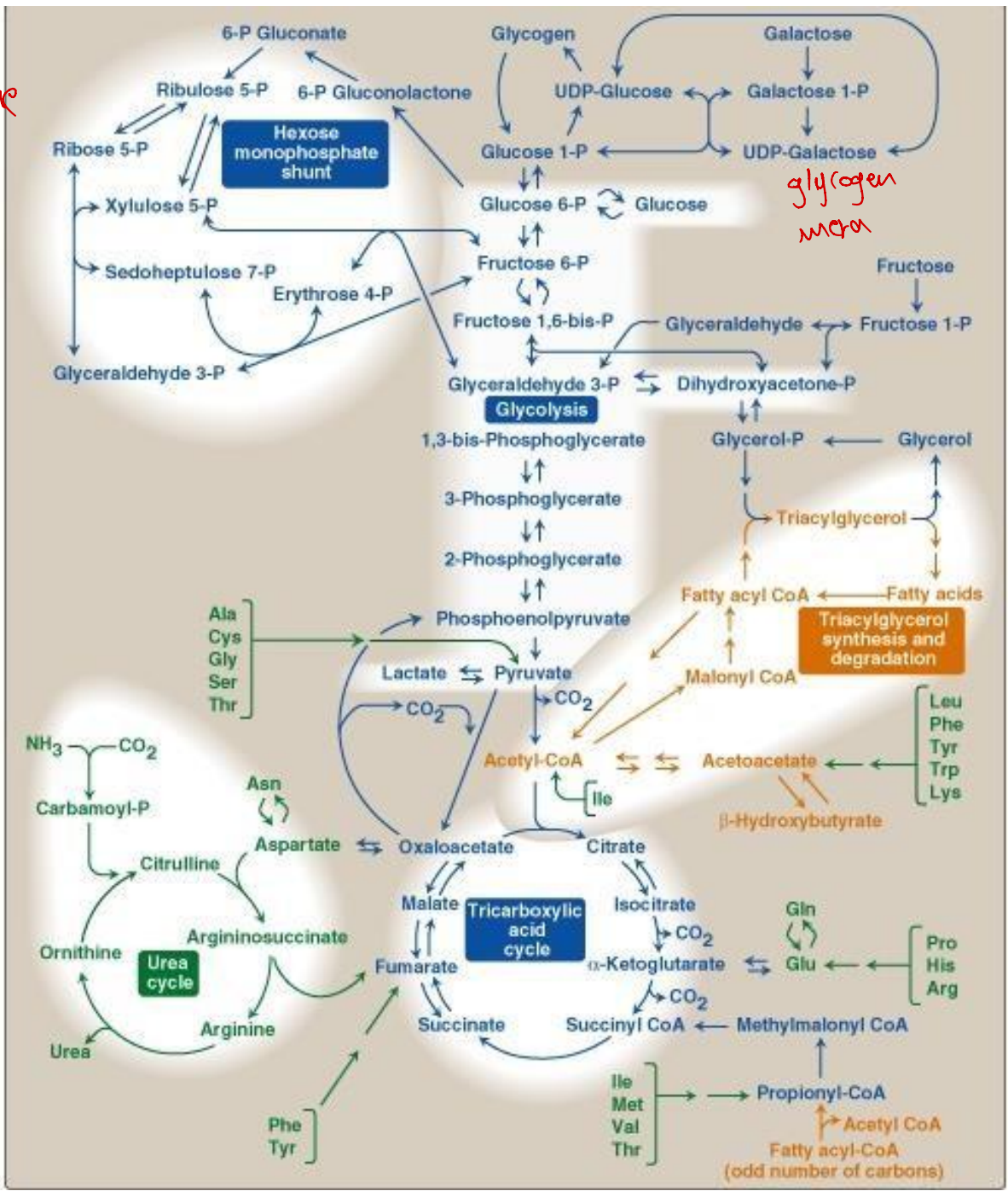
↳ None of the intermediate will consume

The product of one reaction is the substrate of the next reaction

- Glycolysis is composed of ten steps seven are reversible and three irreversible

-reversible step can be reversed by the same enzyme while irreversible can't be reverse by the same enzyme (other enzyme)

Metabolic pathways intersect to form network of chemical reactions

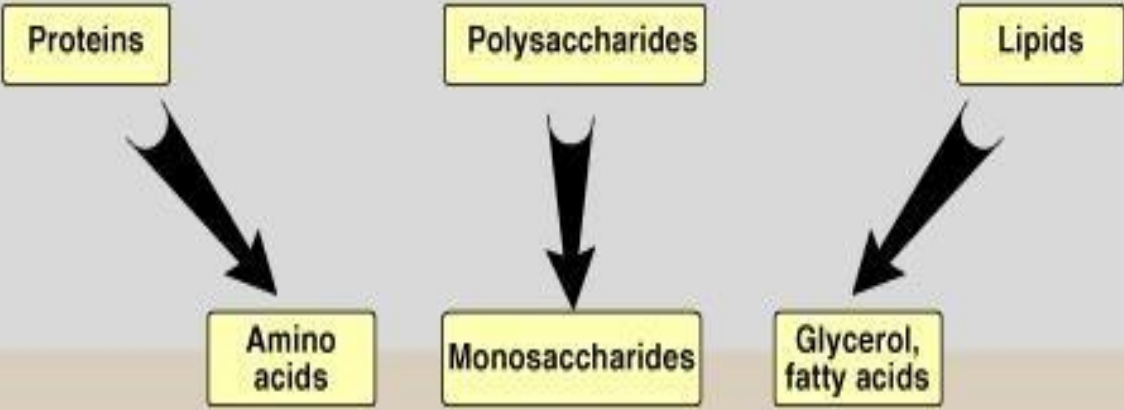


ما تفتقره ← العوزح تفتقر
 ← العوزح تفتقر

General Stages of Metabolism

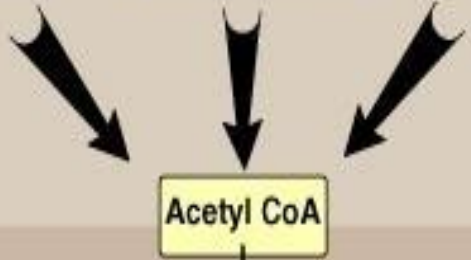
Stage I:

Hydrolysis of complex molecules to their component building blocks



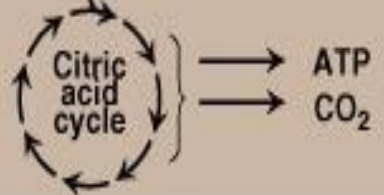
Stage II:

Conversion of building blocks to acetyl CoA (or other simple intermediates)



Stage III:

Oxidation of acetyl CoA; oxidative phosphorylation



- Metabolism = Anabolism + Catabolism

- Anabolism → need energy

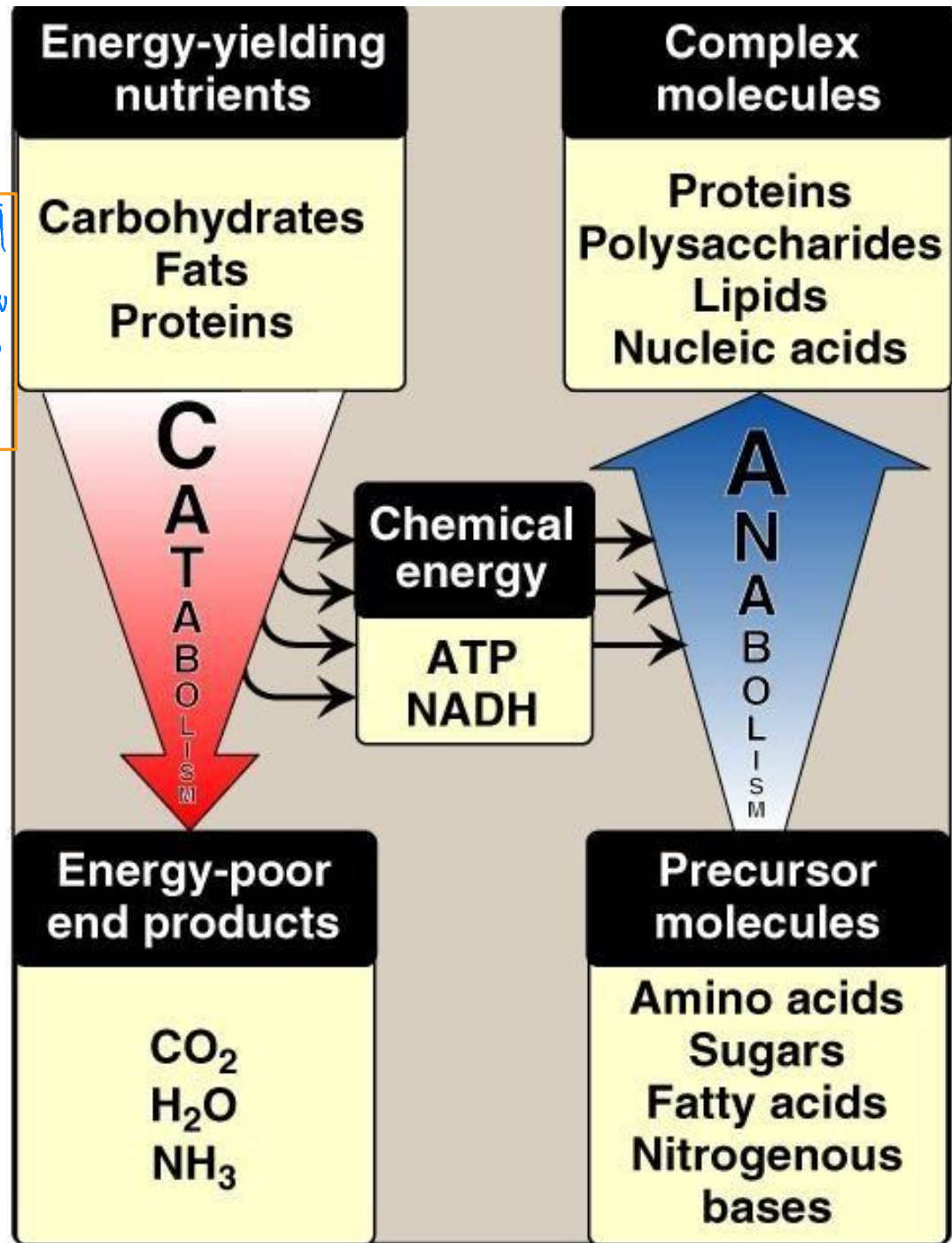
- Catabolism → release energy

أنا ← Ana
 يعنى اتوا
 بين يكونوا
 بناء

الحرارة ← كدنبغ التميز بينهم في حرك
 ينخرطوا معاً

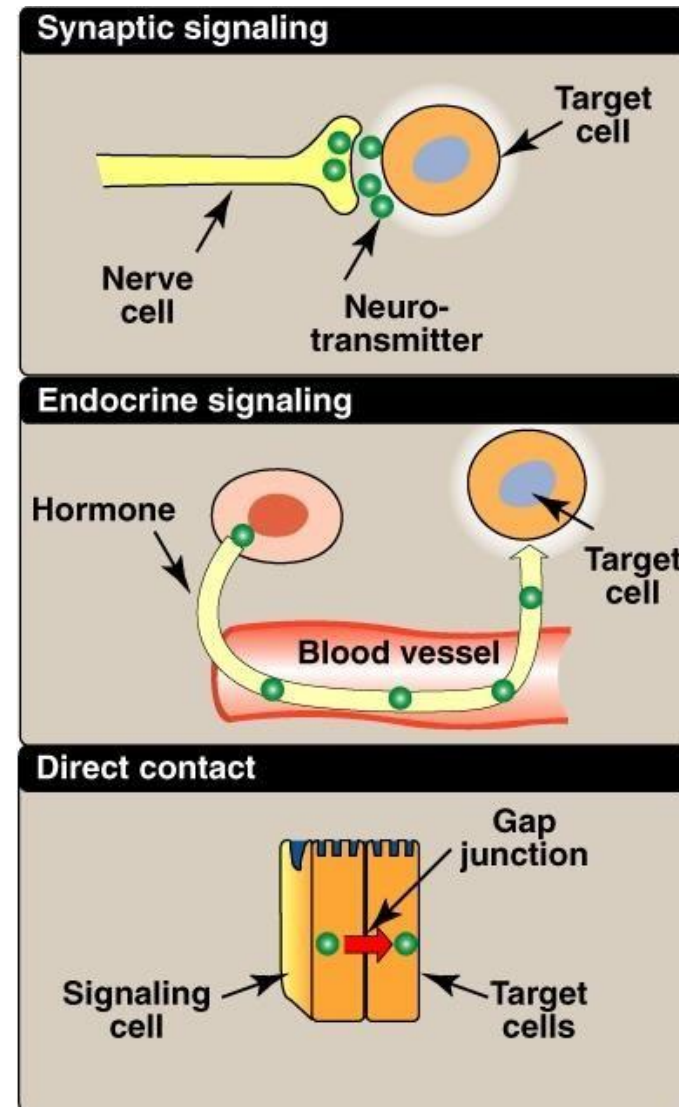
Types of Metabolic Pathways

reduction ← عاده عاده عاده عمليات البناء
 oxidation ← عمليات الهدم



Regulation of Metabolism

- Signals from within the cell
 - Substrate availability, product inhibition, allosteric
 - Rapid response, moment to moment
- Communication between cells (intercellular)
 - Slower response, longer range integration
- Second messenger
 - Ca^{2+} / phosphatidylinositol system
 - Adenylcyclase system



Commonly used mechanisms of communication between cells

How Do we Regulate Metabolic pathway in general?

- We may have some regulation within the cell itself or we may have from outside sources.

. From inside \rightarrow The signal affect the concentration of enzyme, as well as the availability of substrate and the regulatory models of this enzyme as we have allosteric enzyme, even the availability of co-enzyme would be affected by signal and play a role in reaction occurrence (if it will happen or not).
and another example is feedback inhibition (all of those examples come from inside the cell so they result in rapid response)

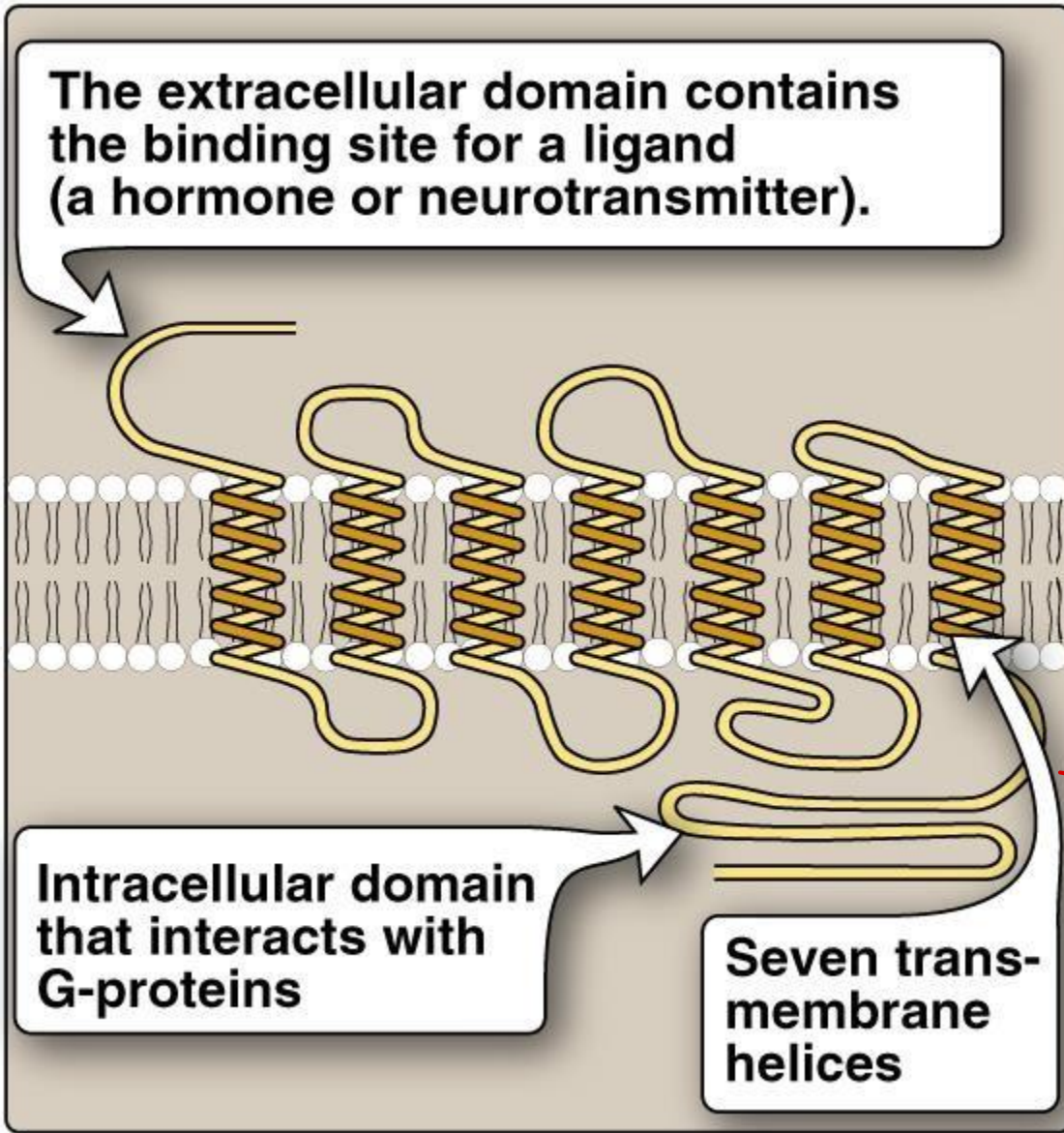
. From outside \rightarrow As synaptic signaling على إشارات كيميائية بتوصيل وقت أطول

And we may have some direct communication as between the epithelial cell by gap junctions (Don't allow to larger molecules to pass)

Another way of exogenous regulation is the second messenger

- Metabolic pathway: A certain reaction to produce a certain products
- Signaling pathway: More branched pathway \rightarrow Metabolic pathway متمركزة

Communication between Cells through Receptors- GPCR



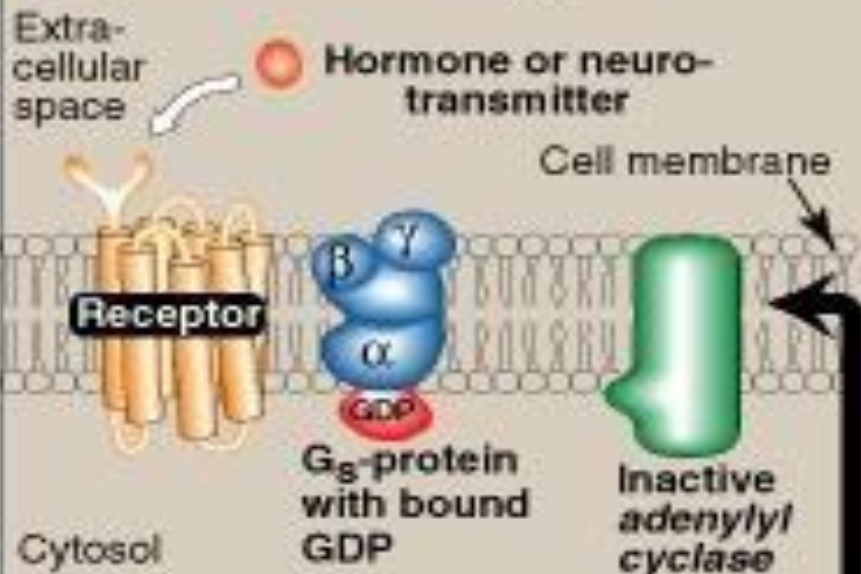
G protein-coupled
receptor of plasma
membrane

receptor يا سات الل ، بي جي
هرمون هيت بيتكش عليه
مع ، بالانك
activation
activation for G protein

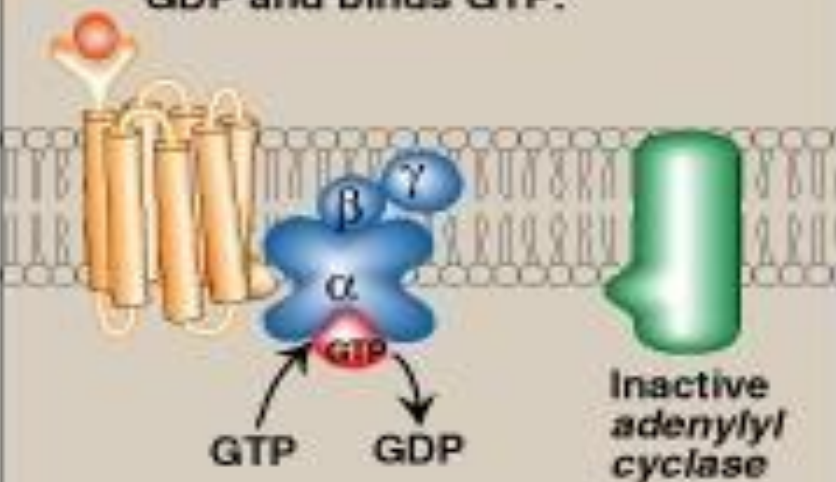
Cyclic AMP .
مثال

↳ the first molecule with
separate from membrane
we call it second messenger

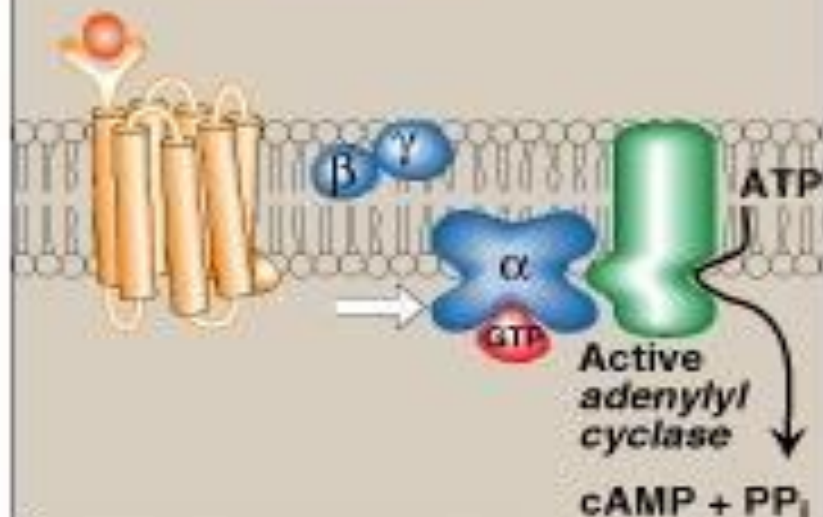
1 Unoccupied receptor does not interact with G_s -protein.



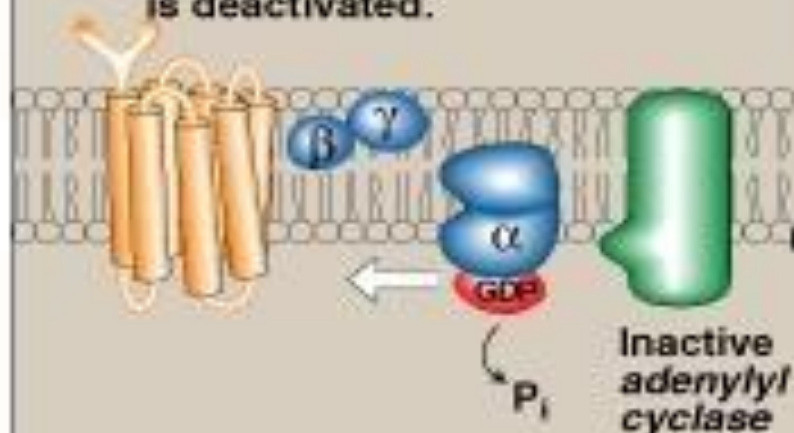
2 Occupied receptor changes shape and interacts with G_s -protein. G_s -Protein releases GDP and binds GTP.

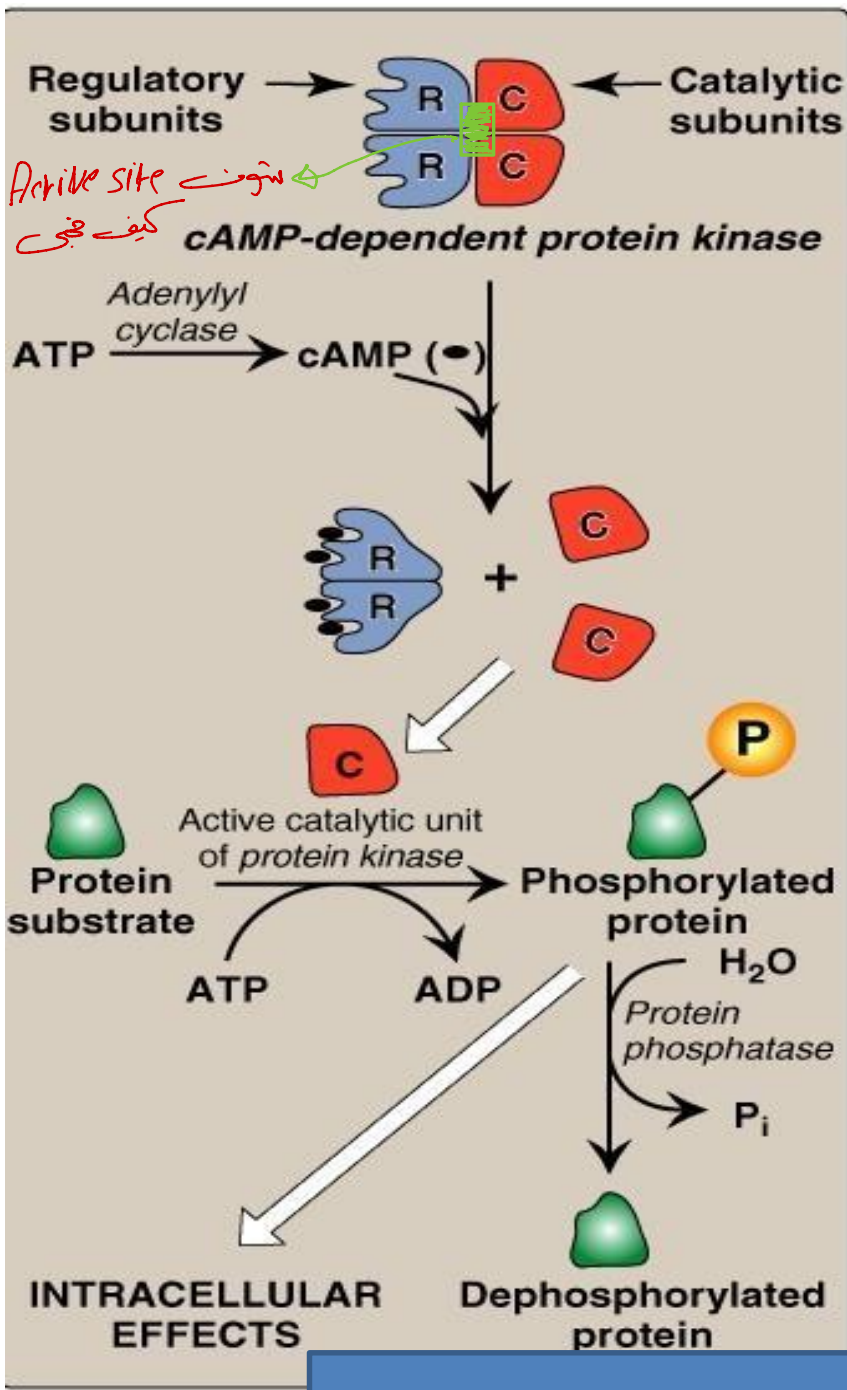


3 α Subunit of G_s -protein dissociates and activates adenylyl cyclase.



4 When hormone is no longer present, the receptor reverts to resting state. GTP on the α subunit is hydrolyzed to GDP, and adenylyl cyclase is deactivated.





آپ کے پاس دو گھومتی ہوئی گولیاں ہیں۔
 ایک (C) اور دوسری (R)۔

—once cAMP binds to the regulatory subunit, the two catalytic sites will dissociate from the two regulatory which result in the exposure of the Active site to substrate to bind.

INTRACELLULAR EFFECTS

- ✓ Activated enzymes
- ✓ Inhibited Enzymes
- ✓ Cell's ion channels
- ✓ Bind to promoter

—To inhibit the signal here dephosphorylation will occur to remove phosphate by phosphatase

-your cells can deal with other sugar rather than glucose.

GLYCOLYSIS

✓ Breakdown of glucose to pyruvate
Pathway characteristics

➤ Universal Pathway: In all cell types

➤ Generation of ATP

➤ With or without O₂ → Not relative to the availability of oxygen. either it aerobic or anaerobic respiration.

➤ Anabolic Pathway:

→ biosynthetic precursors

→ -Glycolysis is considered as Catabolic pathway for glucose and Anabolic for other substances.

The Two Phases of the glycolytic Pathway

Preparative Phase

1 Glucose (C6)

1 ATP

1 ATP

1 Fructose 1,6 bisphosphate (C6)

2 Triose Phosphate (C3)

2 NADH

2 ATP

2 ATP

2 Pyruvate (C3)

ATP-generating Phase

یہی اہم جزئیہ ایٹو گوز
ہیٹ لہا اتطلع علیہ ایٹر
اسیہ لجزئیہ سبب یجین
(two almost identical)

- I have 3 carbons molecules
and I rearrange these molecules
to extract the energy from
the chemical bond to form ATP.

Types of Glycolytic Reactions

- Phosphoryl transfer
- Isomerization
- Cleavage
- Oxidation reduction
- Phosphoryl shift
- Dehydration

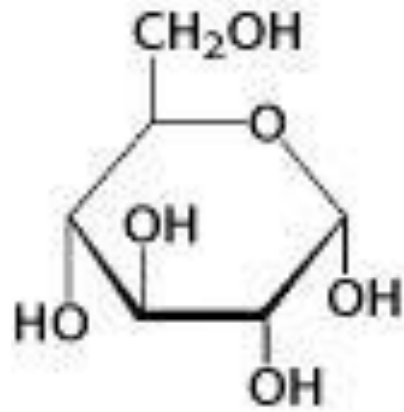
- فرزوا الفيزيوي الي حطيت الي رابط (سهل عليكم تسكيك)
ستويته مثال من عن اول خطوط:

- بتدركوا بالمحاور الي كانت طاهفنا السكر ودخل مع الخلية عن طريق Glus and SGT
التن لازم تتأيد على ونقل الي trapping عن طريق phosphate للسكر عنك
ماطلع من الخلية ، وفي عن انزيمات ممكن يتلوا هالخطوة هم Hexokinase and glucokinase

Steps of Glycolysis

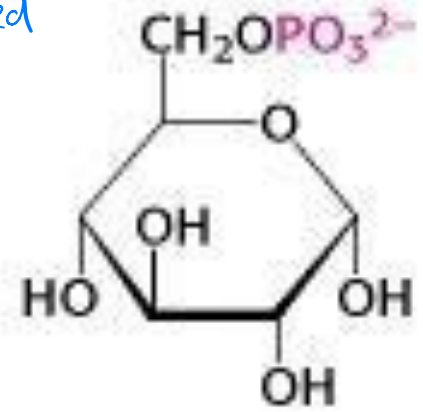
- كبتا في قوة بين ال انزيمات من حيث K_m الله ، تتلوا في عن Hexokinase والي
عن low K_m عنك ليع شتال ، والسبب في ذلك لو اننا عنك low conc. of
substrate to reach half maximal velocity which indicate low value of K_m that mean
even if we have low amount of glucose in cell it will reach the V_{max} So fast
sugars and glucose is liver ادر عطر ، ادر عطر
- بينا لوداه ماكد حوت كنانة طبات قطر ، ادر عطر
where the glucokinase will activate in the high conc of glucose because of its high
 K_m it need more conc. than hexokinase to reach the V_{max} .

Step 1



Glucose

irreversible step. but not the committed step.



Glucose 6-phosphate (G-6P)

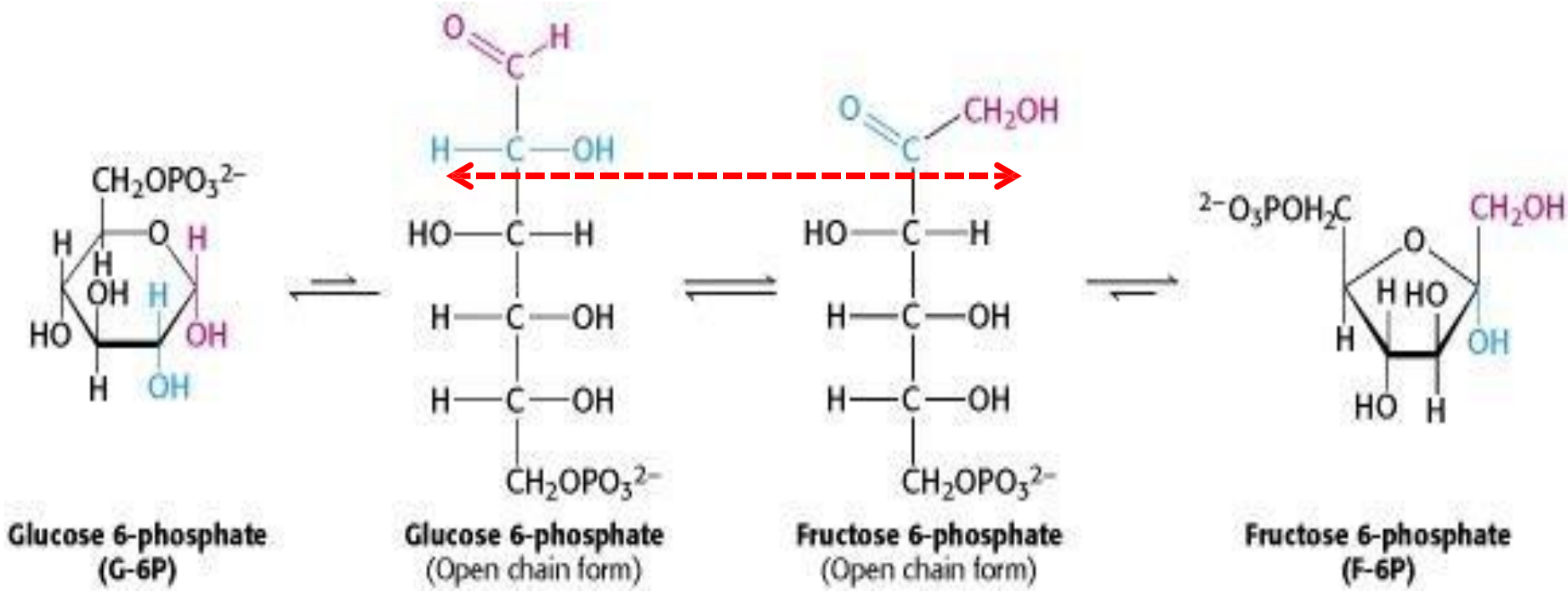
- This step although it is considered the 1st step of glycolysis but not necessarily mean that glu 6-P will go into glycolysis + ADP + H⁺

ماتج مع صبأ قليل دائم
كما تقول انه كتودي
فهو دائما متشال

- هذا متشال مع نظام
الفرجة (الماتجوه منا
كيت غلو كوز)

	Hexokinase	Glucokinase
Occurrence	In all tissues	In liver
Km	< 0.02 mM	10-20 mM <i>من 1000</i>
Specificity	Glc., Fruc, Man, Gal	Glc.
induction	Not induced	↑ insulin, Glc
Function	At any glucose level	Only > 100 mg/dl

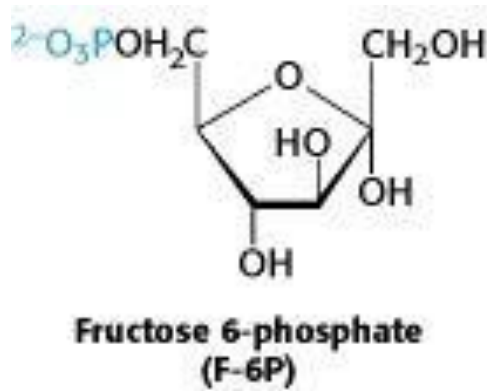
Step 2



**Phosphoglucose
Isomerase**

- Here we convert the glucose-6 phosphate to fructose-6-phosphate by phosphoglucose isomerase.

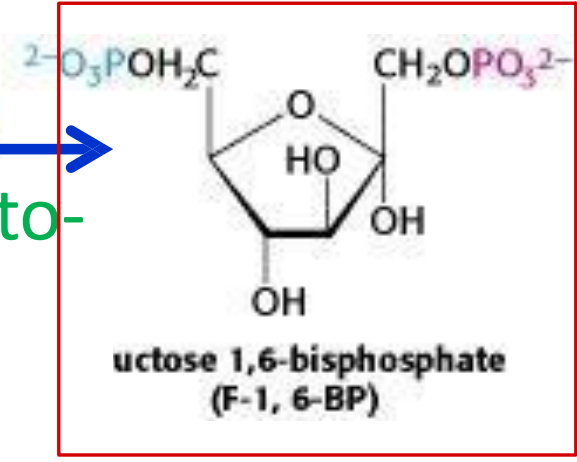
Step 3 \rightsquigarrow This is the Committed Step.
(Rate limiting step).



+ **ATP**

Phosphofructokinase

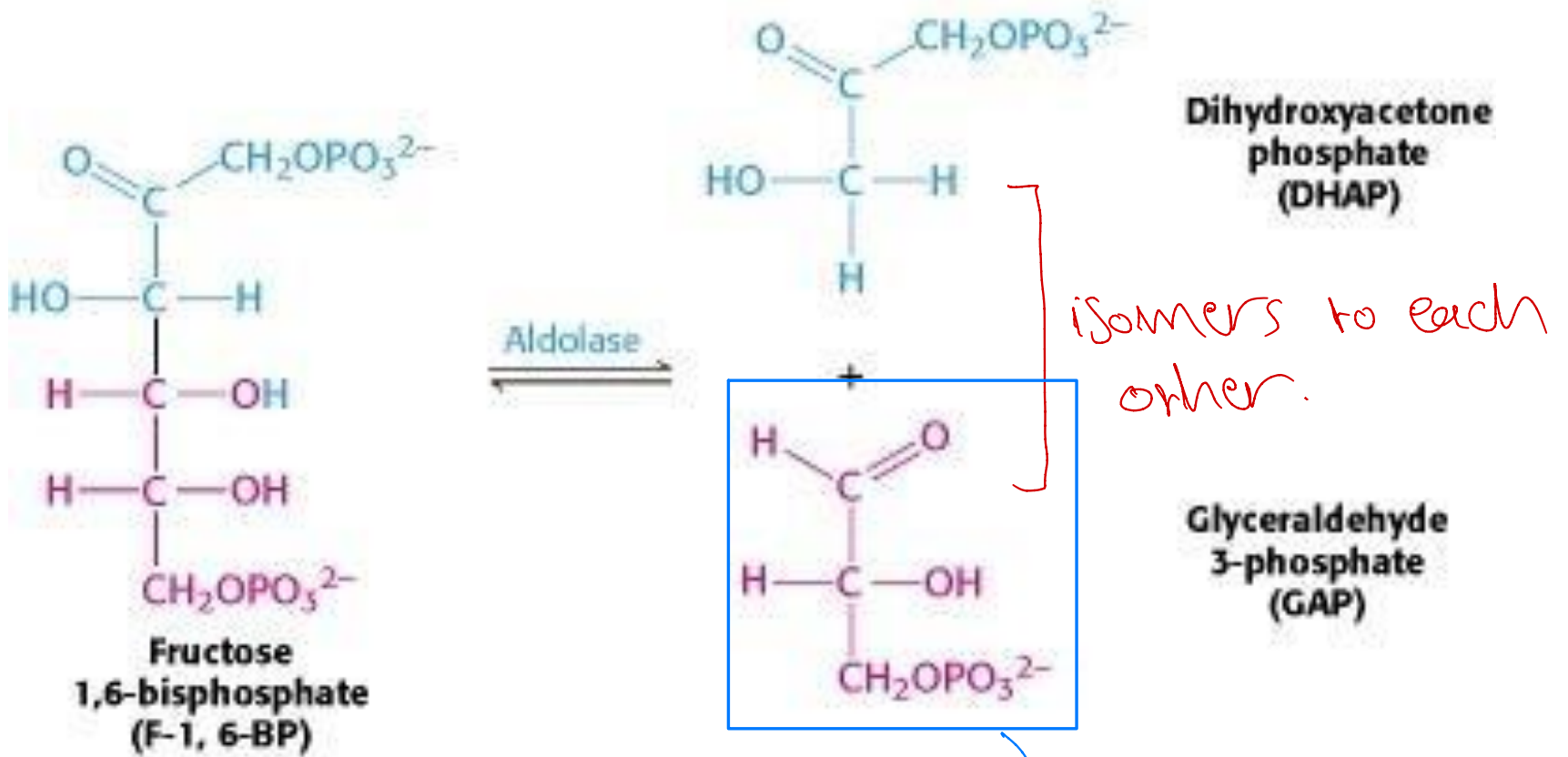
Phosphfructo-
kinase



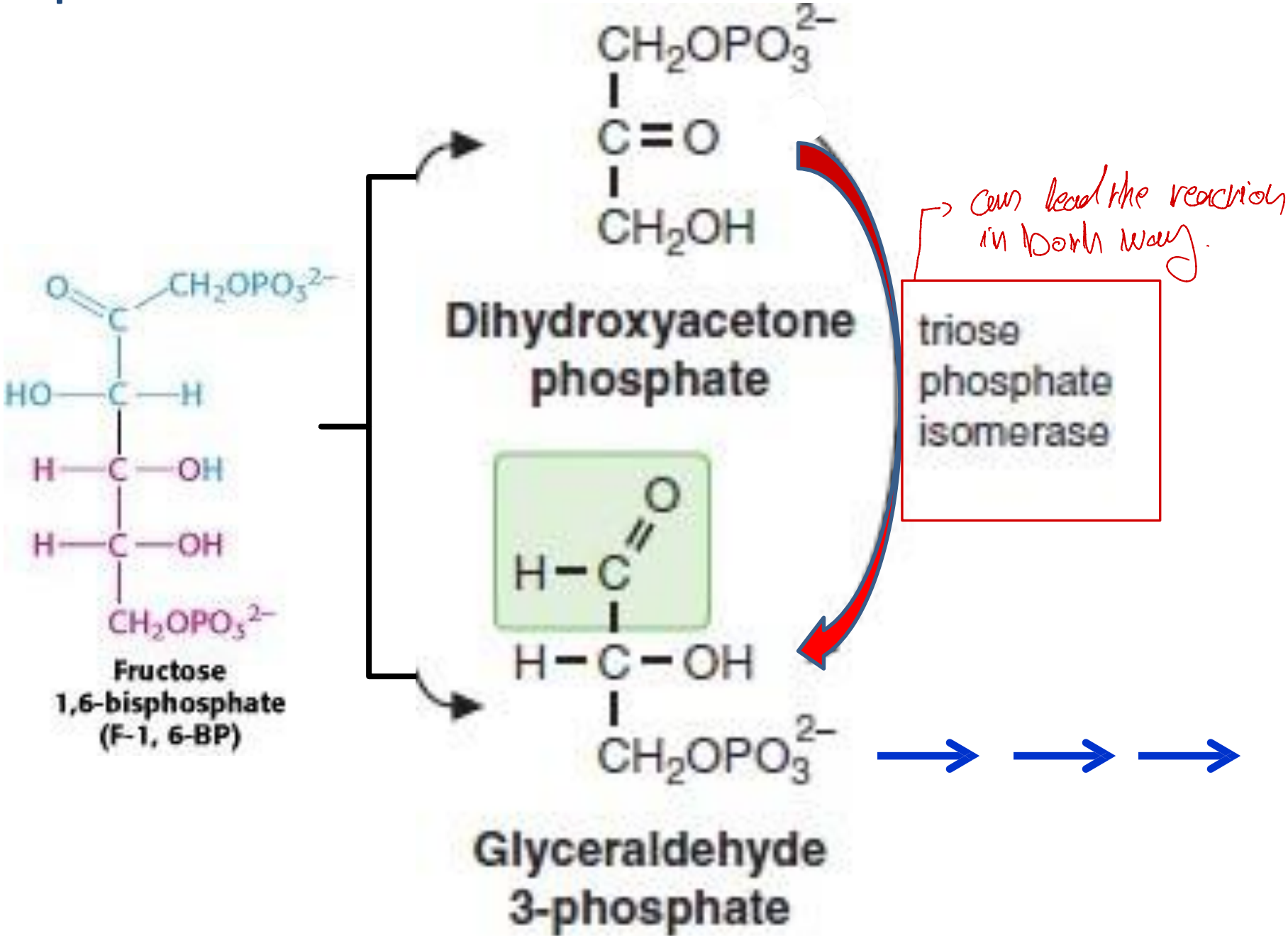
+ ADP + H⁺

اسٹوف کیفے زینچنا
تھک اہر کب عنات
تھار لستہ لجنین
مست واپتے

Step 4

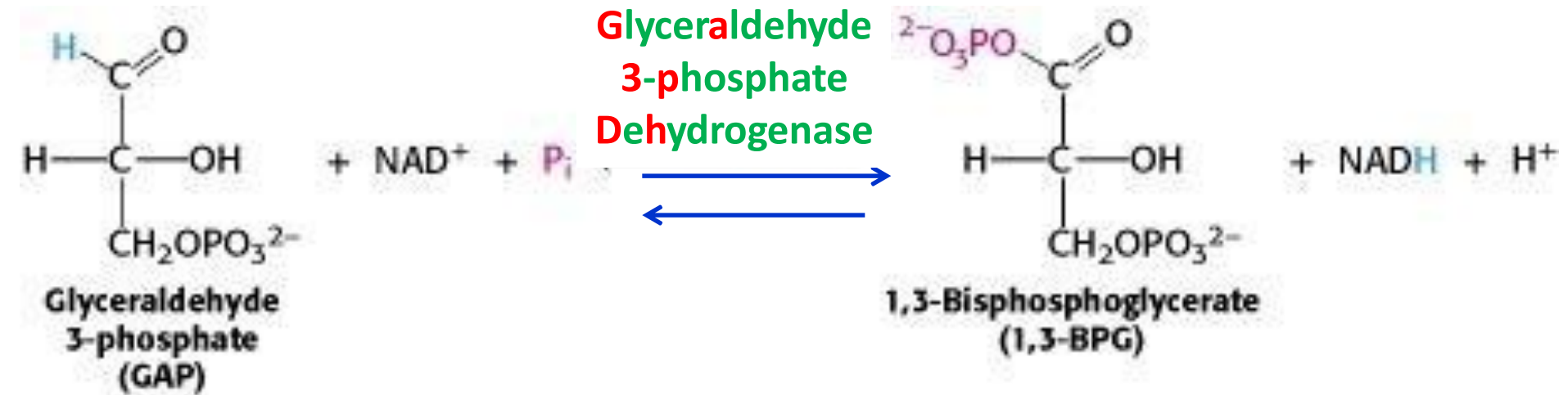


Step 5

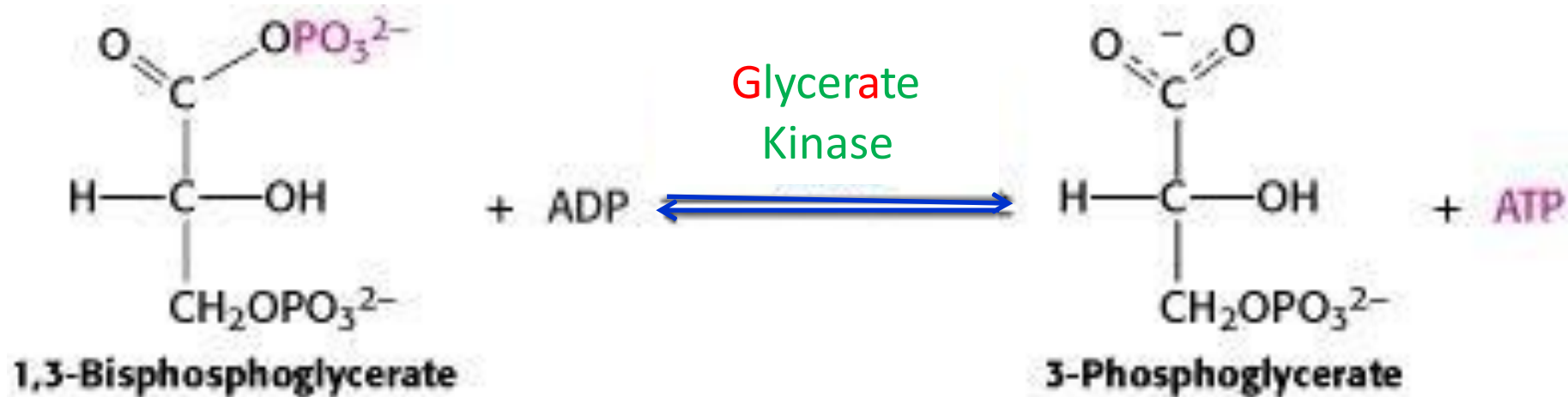


Step 6

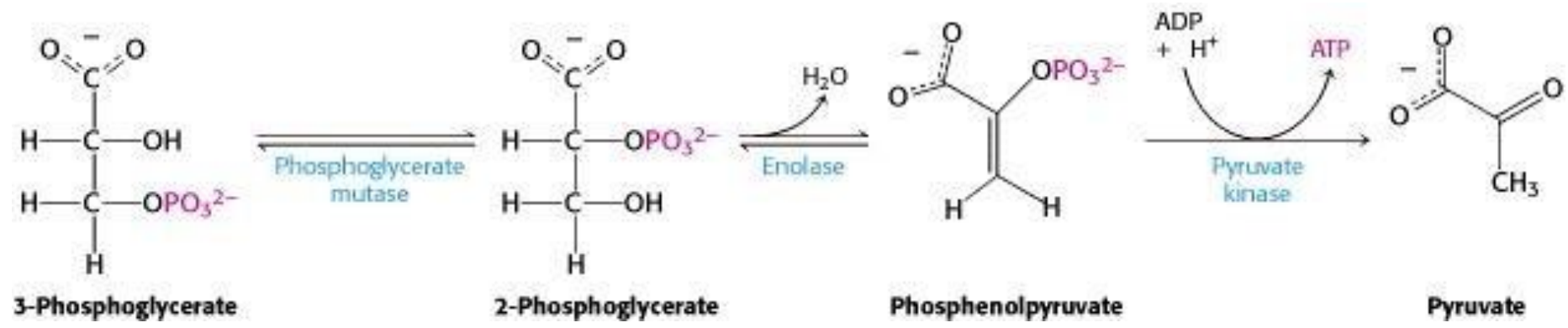
-here we produce 2 NADH molecules.



Step 7 — Here we produce 10 ATP molecules.



Step 8-10 - 2 ATP molecules will be produced in step 10.
 - The second phase is repeated twice.



- Luqman Ahmad