Le métabolisme et les fonctions des glucides

L'HOMOPOLYSACCHARIDE DE L'HOMME ET DES ANIMAUX

↓

LE GLYCOGENE

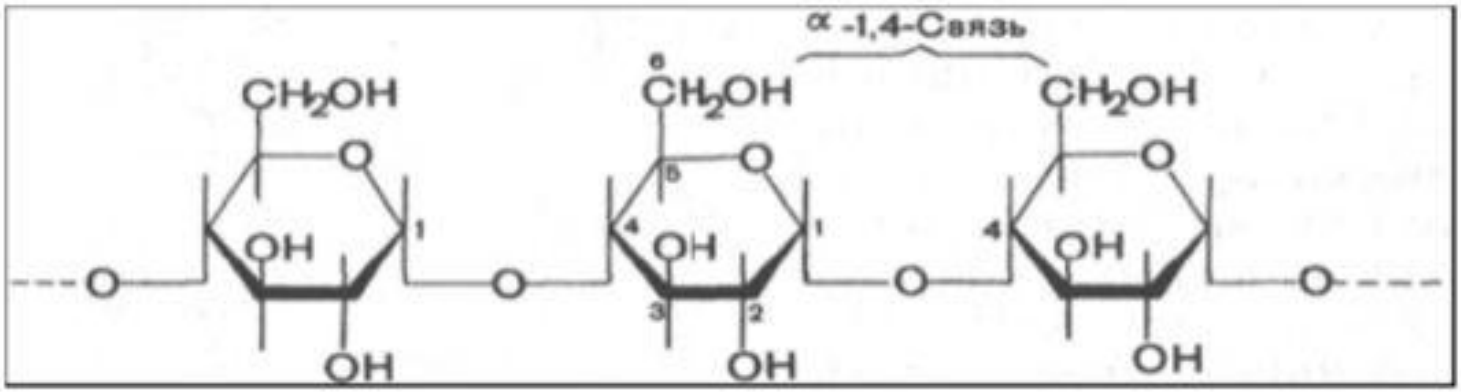
LES HOMOPOLYSACCHARIDES DES PLANTES

↙ ↘

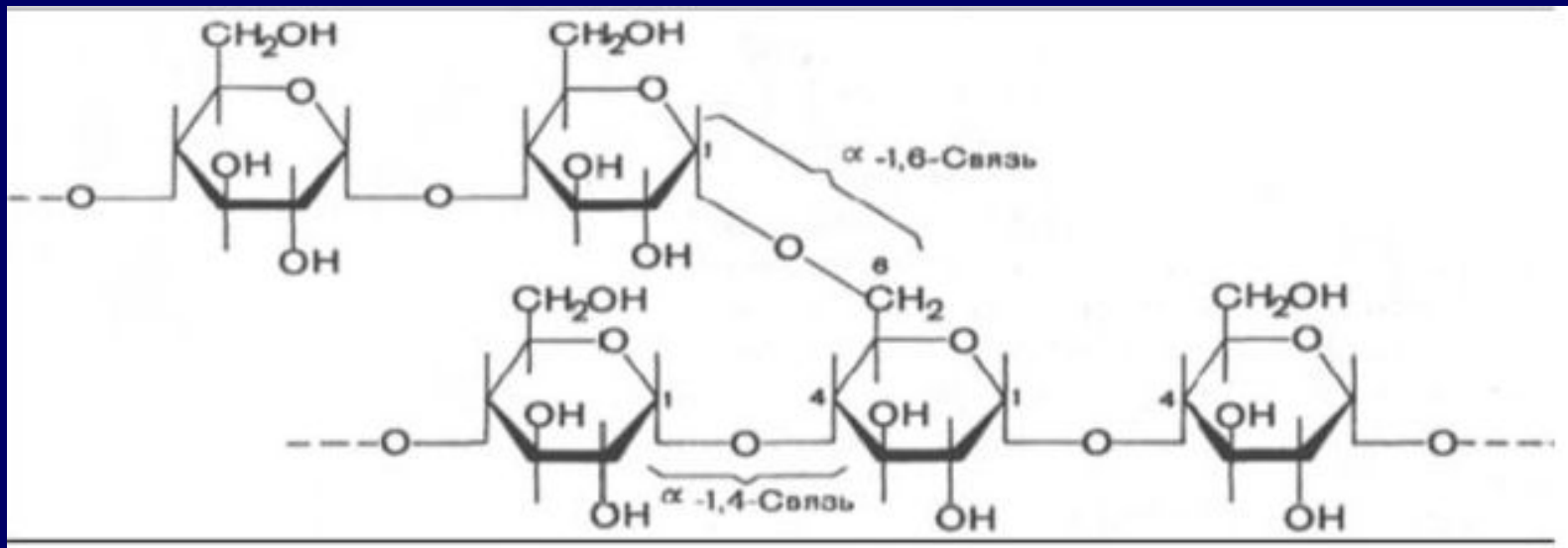
L'AMIDON

LA CELLULOSE

L’AMIDON

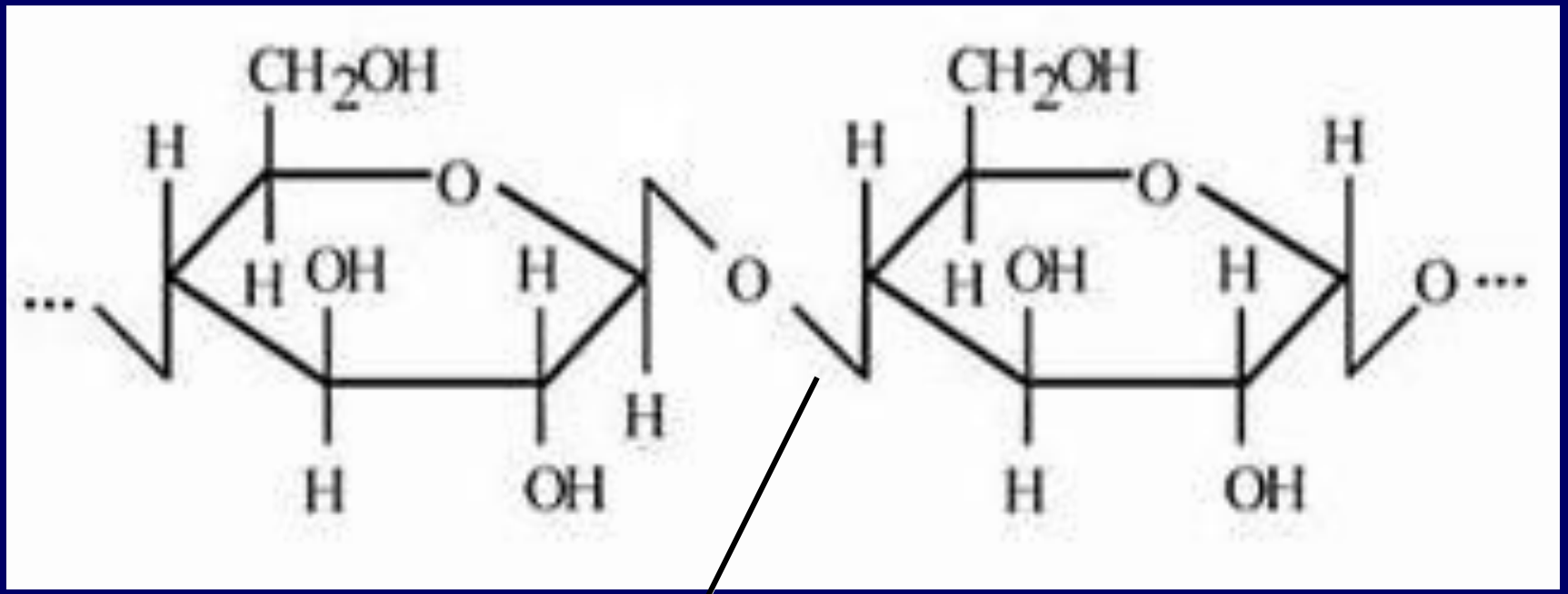


Участок молекулы амилозы



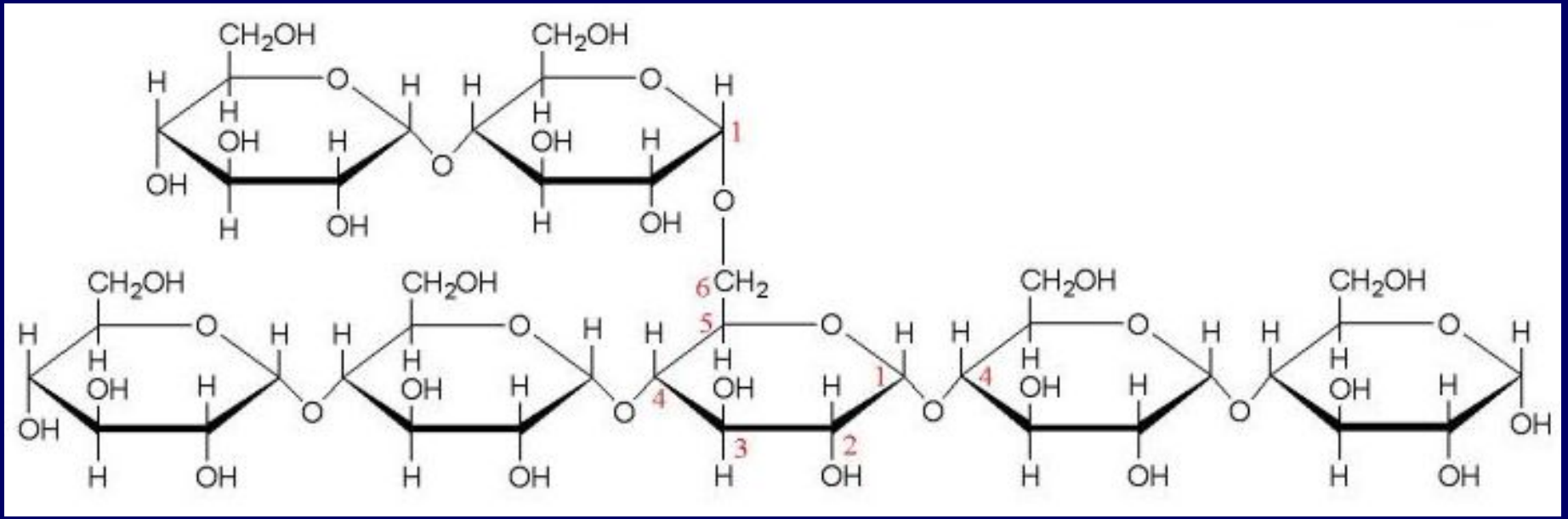
Участок молекулы амилопектина

LA CELLULOSE



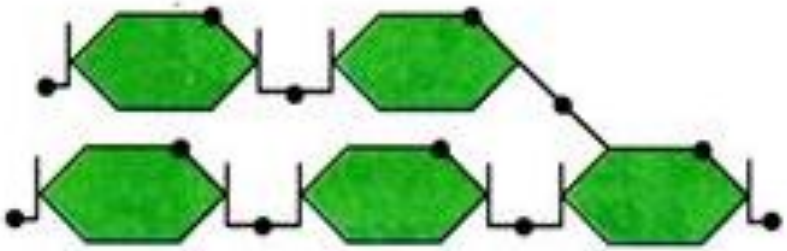
la liaison β - 1, 4 glycosidique

LE GLYCOGENE

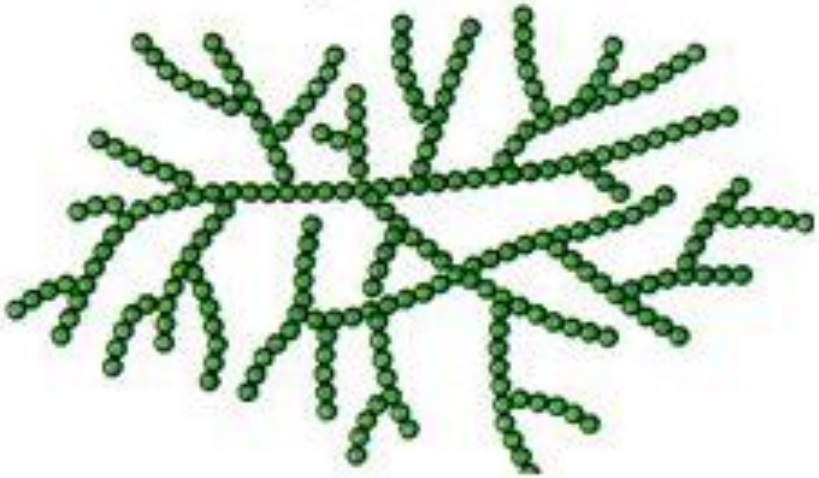


Целлюлоза

Крахмал

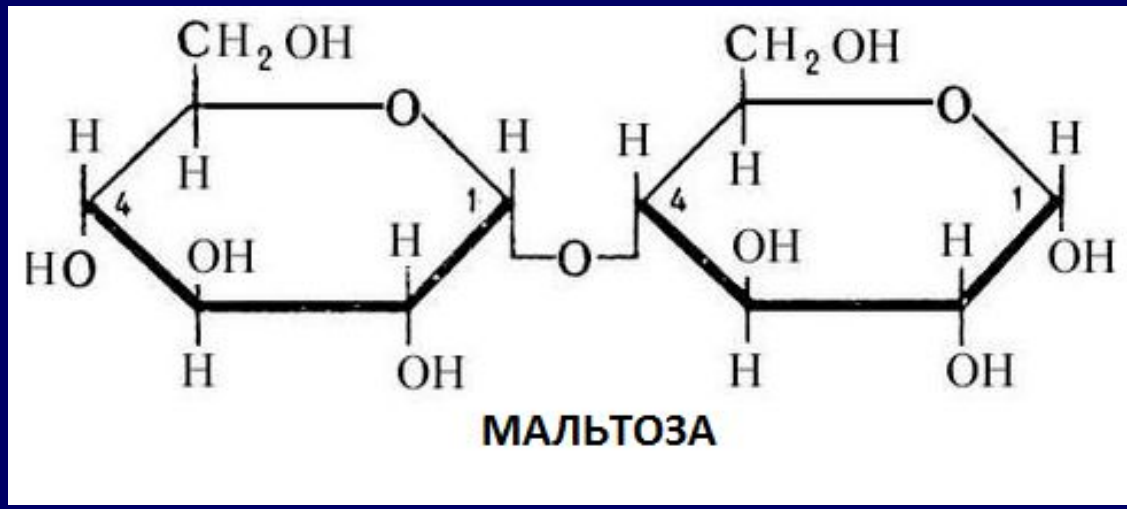


Гликоген

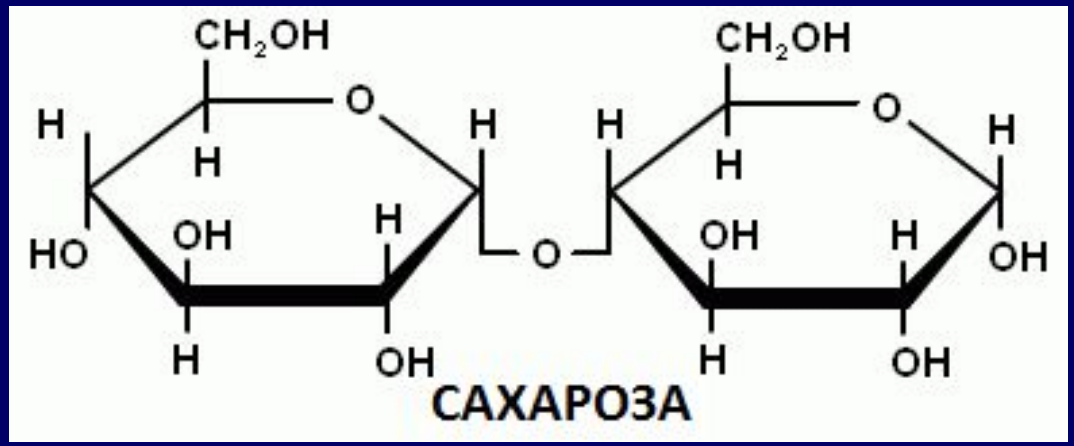


LES DISACCHARIDES

ЛАКТОЗА

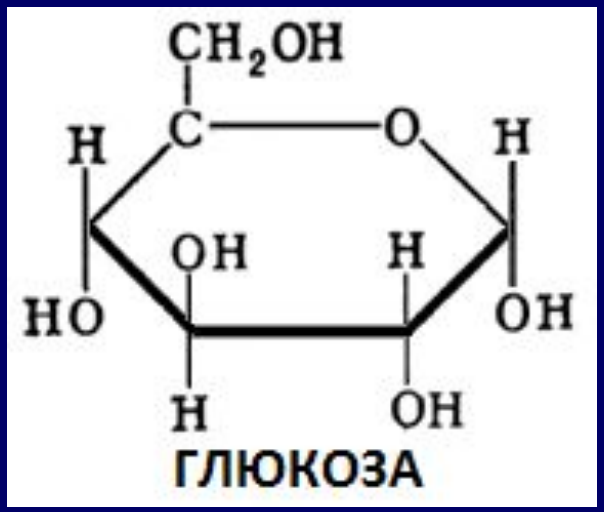


МАЛЬТОЗА

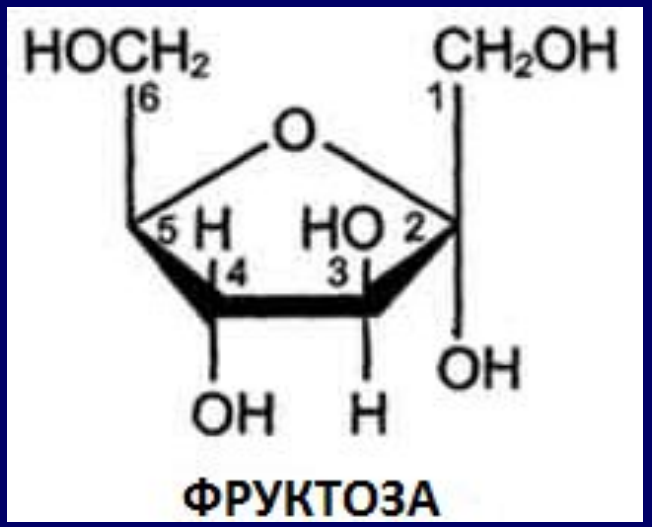


САХАРОЗА

LES MONOSACCHARIDES



ГЛЮКОЗА



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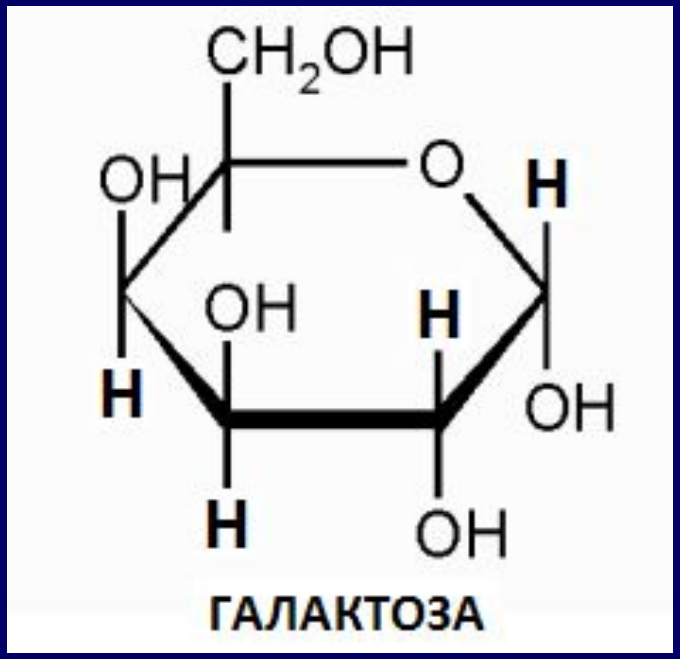

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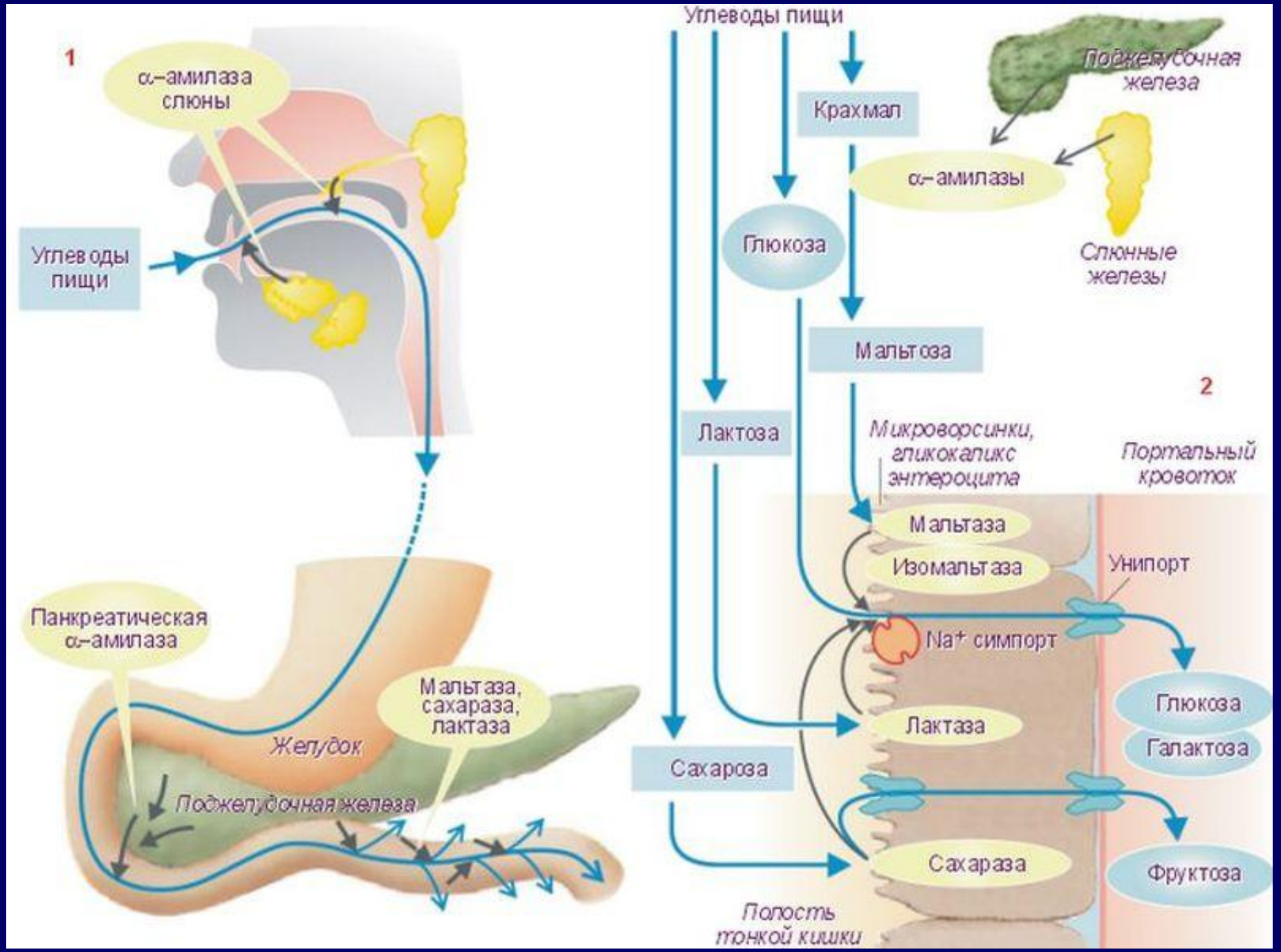
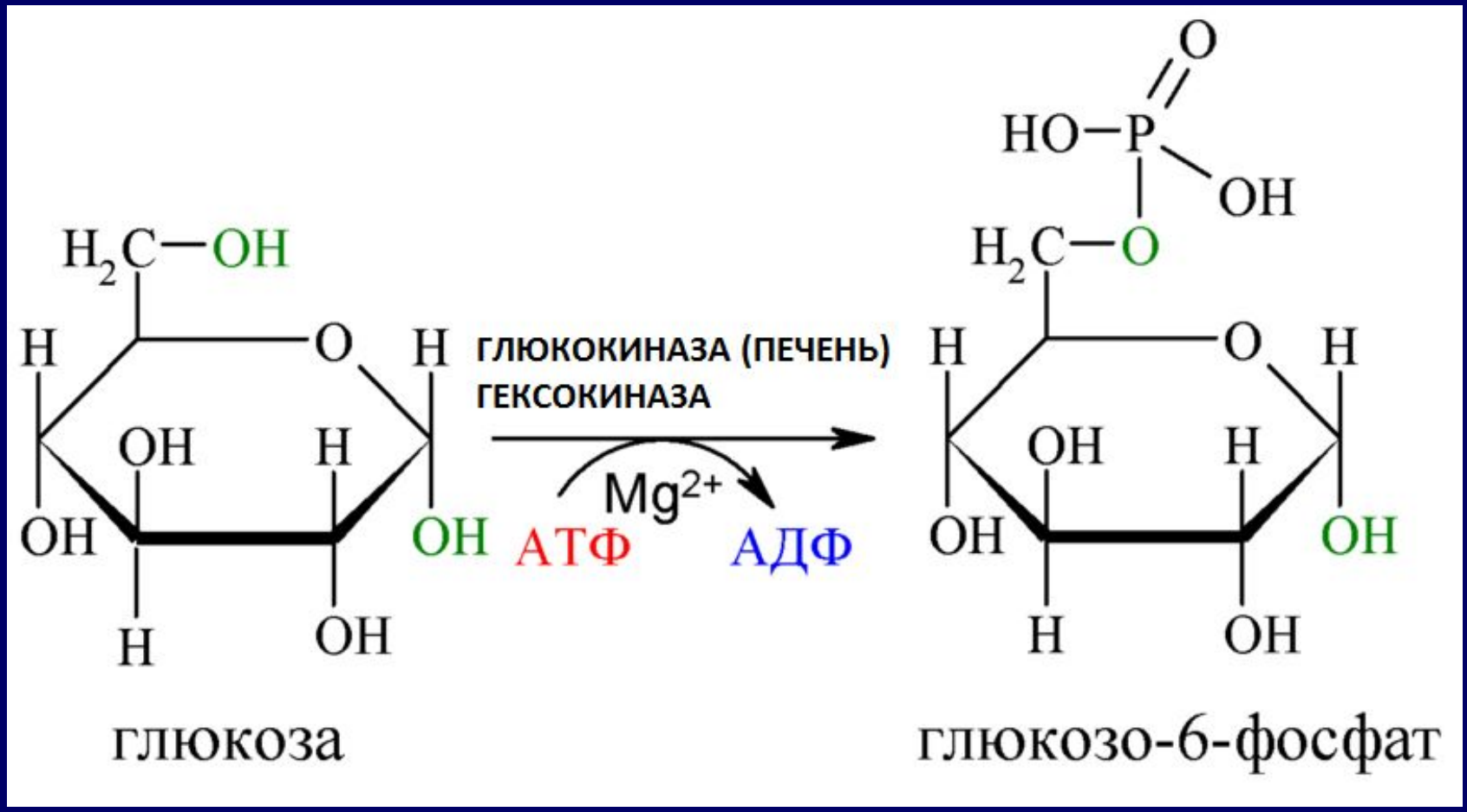
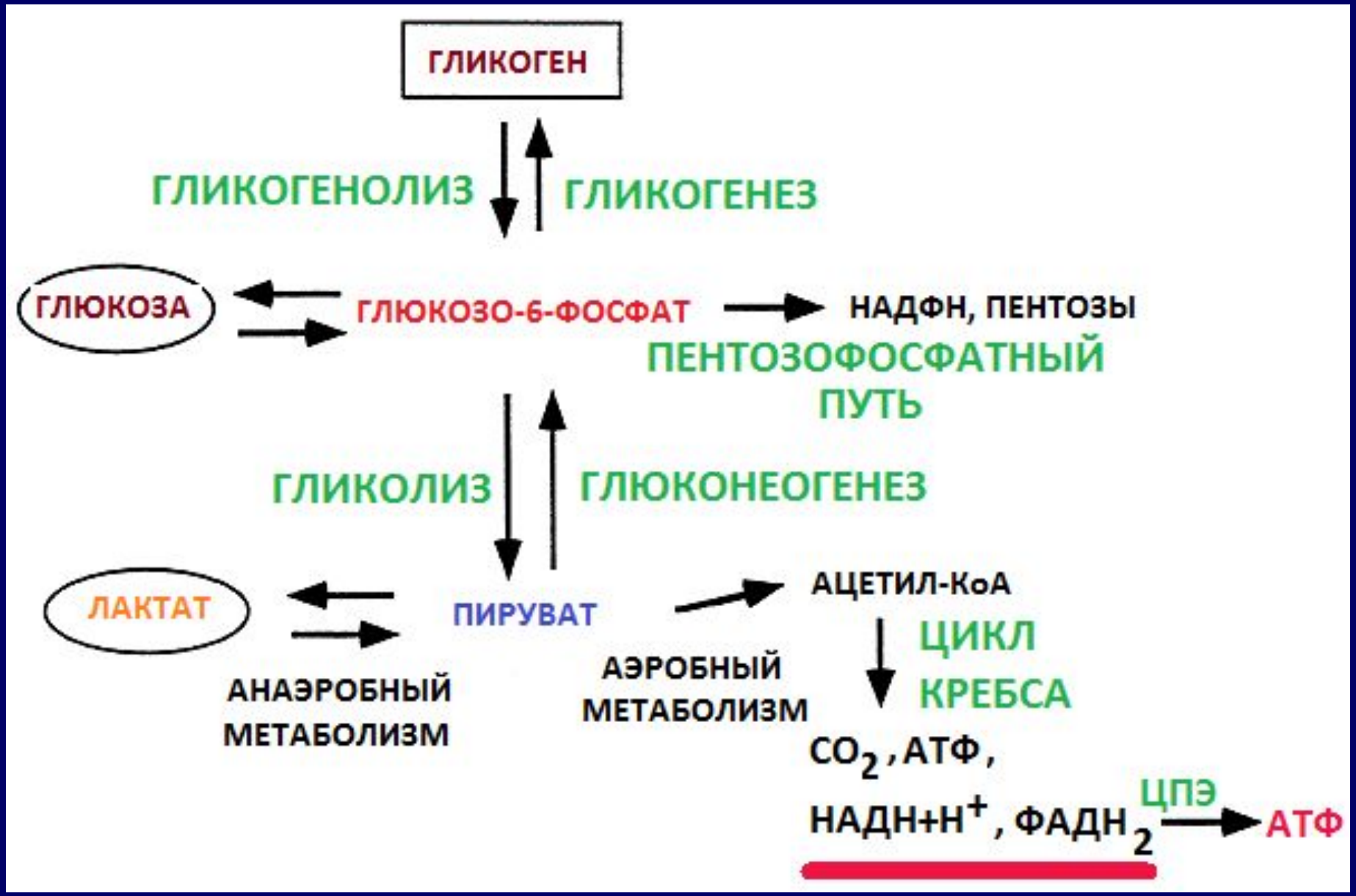

1
α–амилаза слюны
Углеводы пищи
Панкреатическая α–амилаза
Мальтаза, сахараза, лактаза
Желудок
Поджелудочная железа
Углеводы пищи
Крахмал
Поджелудочная железа
α–амилазы
Слюнные железы
Глюкоза
Мальтоза
2
Лактоза
Микроворсинки, гликокаликс энтероцита
Портальный кровоток
Мальтаза
Изомальтаза
Унипорт
Na+ симпорт
Глюкоза
Лактаза
Галактоза
Сахароза
Сахараза
Фруктоза
Полость тонкой кишки

LE GLUCOSE-6-PHOSPHATE – LA FORME METABOLIQUEMENT ACTIVE DU GLUCOSE

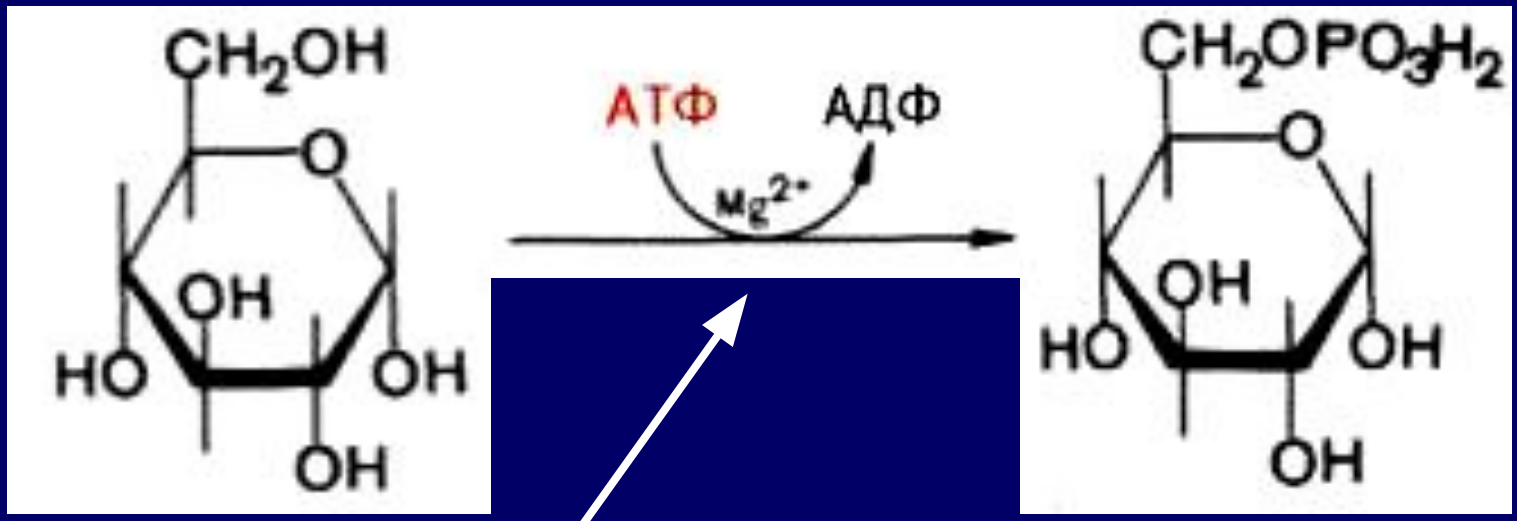


LE METABOLISME DU GLUCOSE



LA GLYCOLYSE

1) LA PHOSPHORYLATION DU GLUCOSE



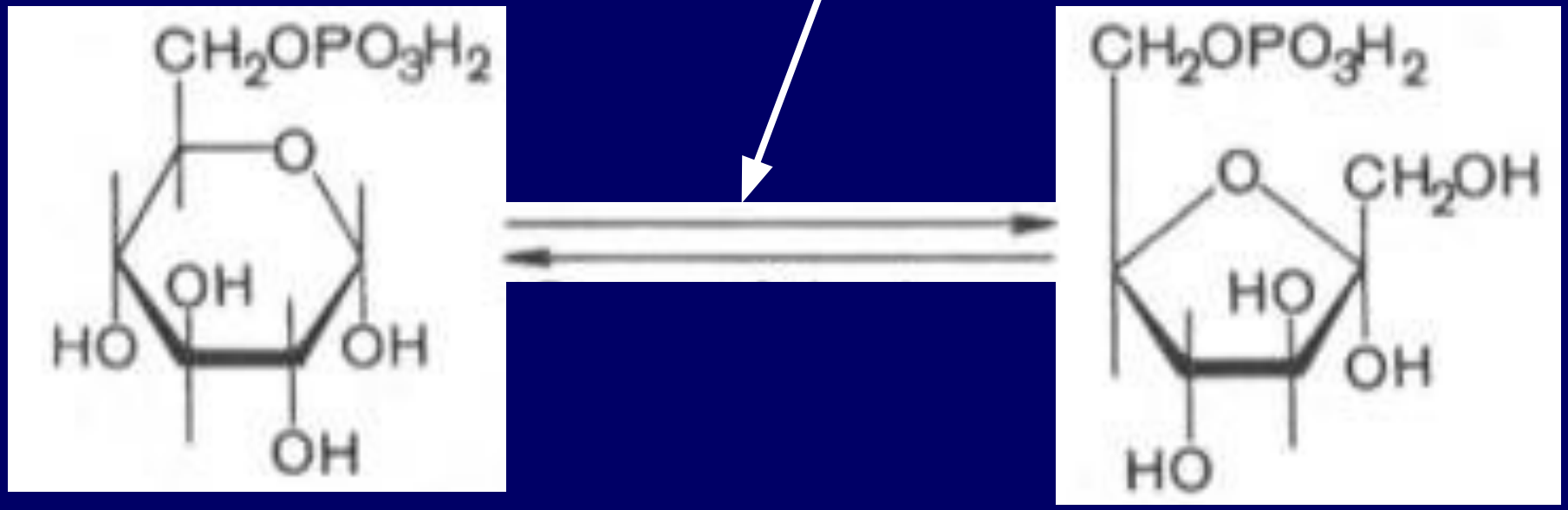
LE GLUCOSE

L'HEXOKINASE

LE GLUCOSE-6-PHOSPHATE

2) L'ISOMERISATION

LA GLUCOSE-6-PHOSPHATE-ISOMERASE

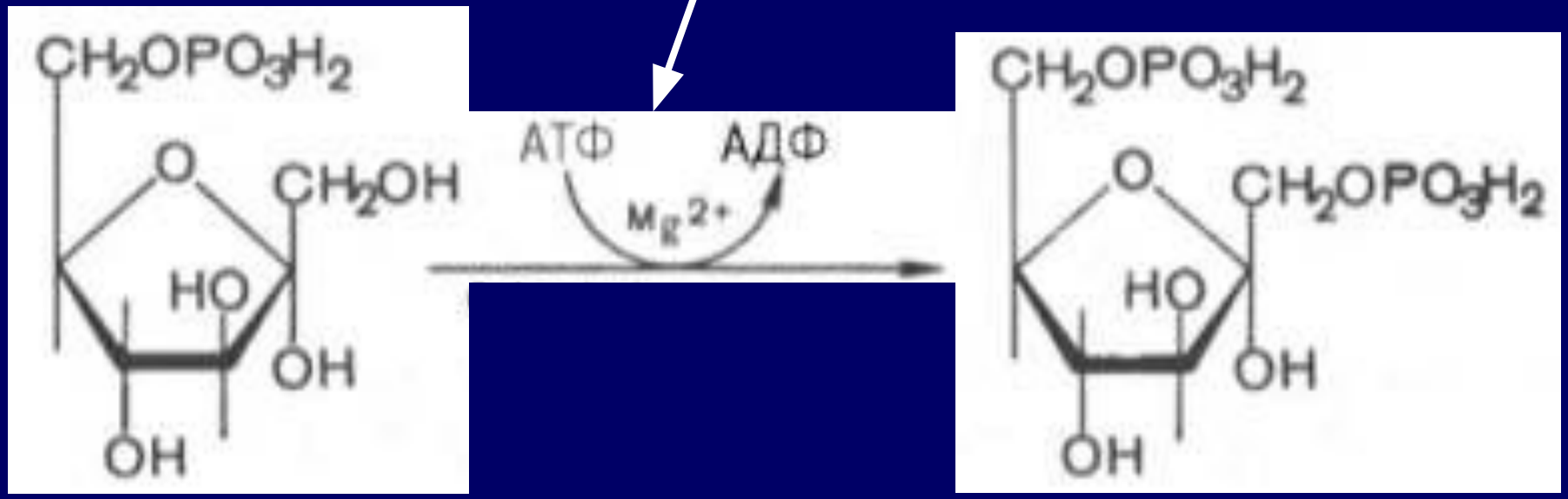


LE GLUCOSE-6-PHOSPHATE

LE FRUCTOSE-6-PHOSPHATE

3) LIMITANTE (LA REACTION DE PHOSPHORYLATION)

LA PHOSPHOFRUCTOKINASE-6



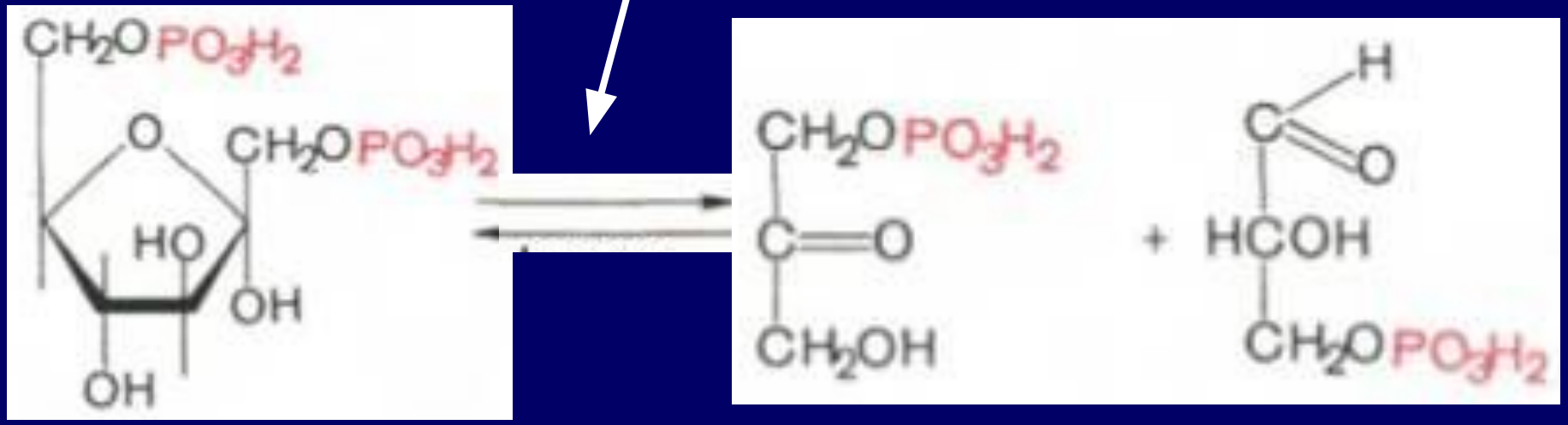
LE FRUCTOSE-6-PHOSPHATE

LE FRUCTOSE-1,6-BIPHOSPHATE

4) LA DESAGREGATION ALDOLIQUE

LE GLYCERALDEHYDE-3-PHOSPHATE

L'ALDOLASE

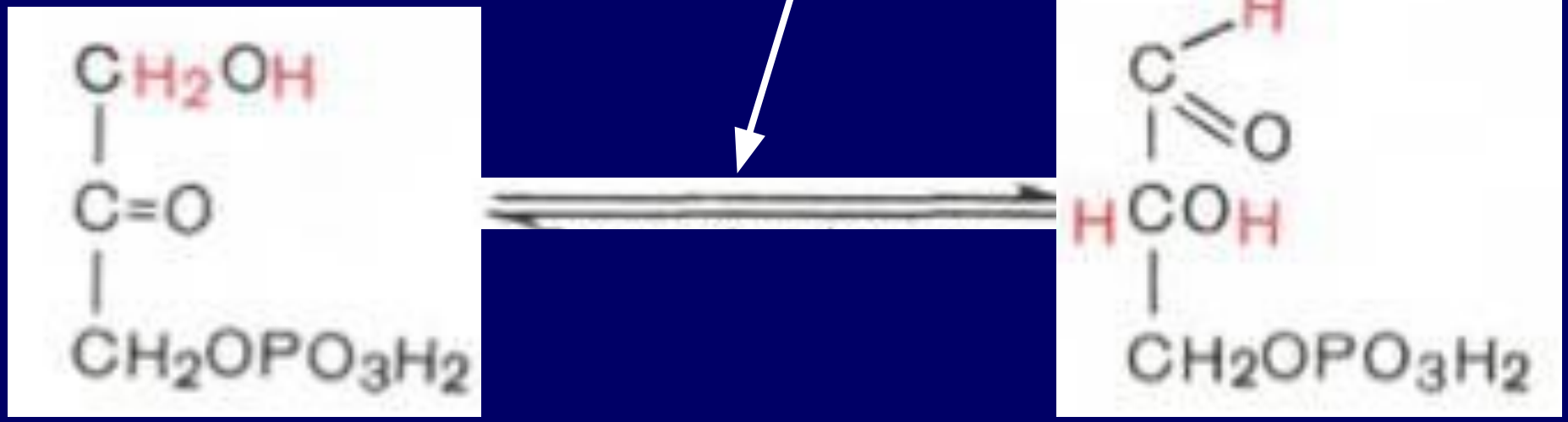


LE FRUCTOSE-1,6-BIPHOSPHATE

LE DIOXYACETONE PHOSPHATE

5) L'ISOMERISATION

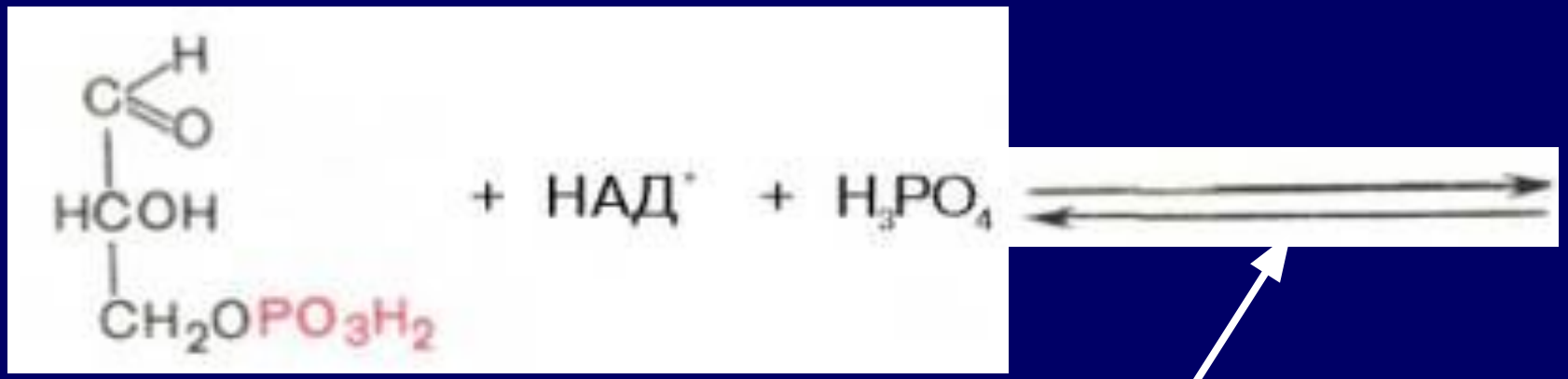
LA TRIOSE-PHOSPHATE ISOMERASE



LE DIOXYACETONE PHOSPHATE

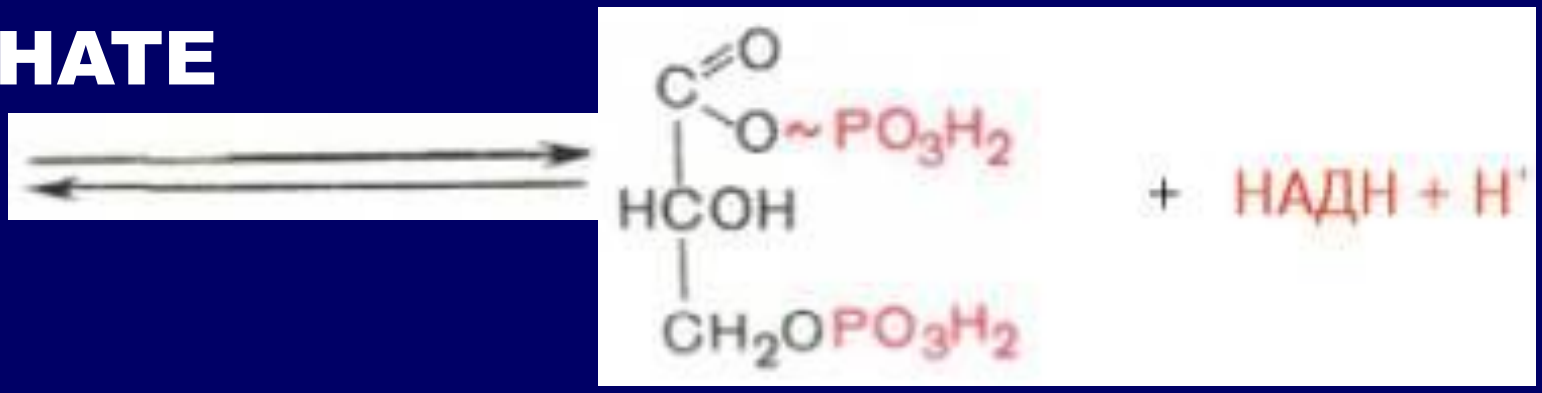
LE GLYCERALDE HYDE-3-PHOSPHATE

6) LA REACTION D'OXYDATION



LE GLYCERALDE HYDE-3-PHOSPHATE

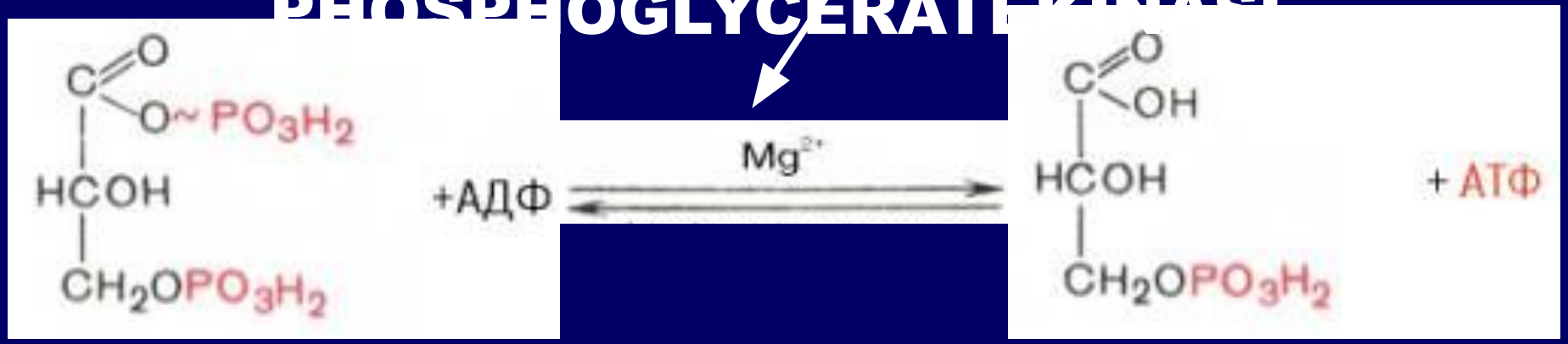
LA GLYCERALDEHYDE PHOSPHATE DESHYDROGENASE



LE 1,3-BISPHOSPHOGLYCER ATE

7) LA PHOSPHORYLATION AU NIVEAU DU SUBSTRAT

LA PHOSPHOGLYCERATEKINASE

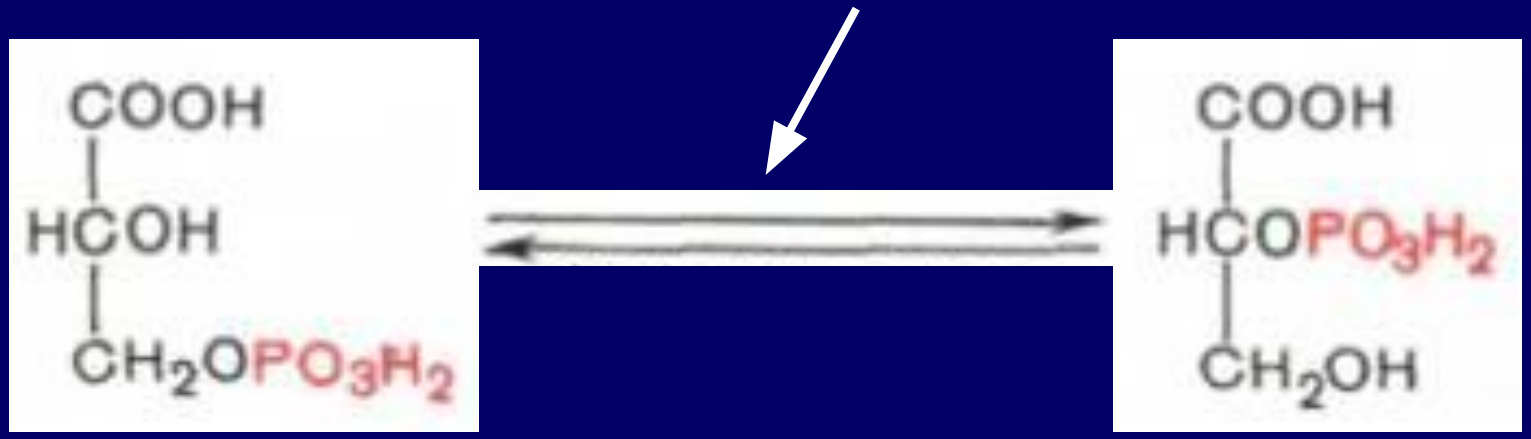


LE 1,3-BISPHOSPHOGLYCERATE

LE 3-PHOSPHOGLYCERATE

8) LE TRANSFERT INTRAMOLECULAIRE DU GROUPE PHOSPHATE

LA PHOSPHOGLYCERATE MUTASE

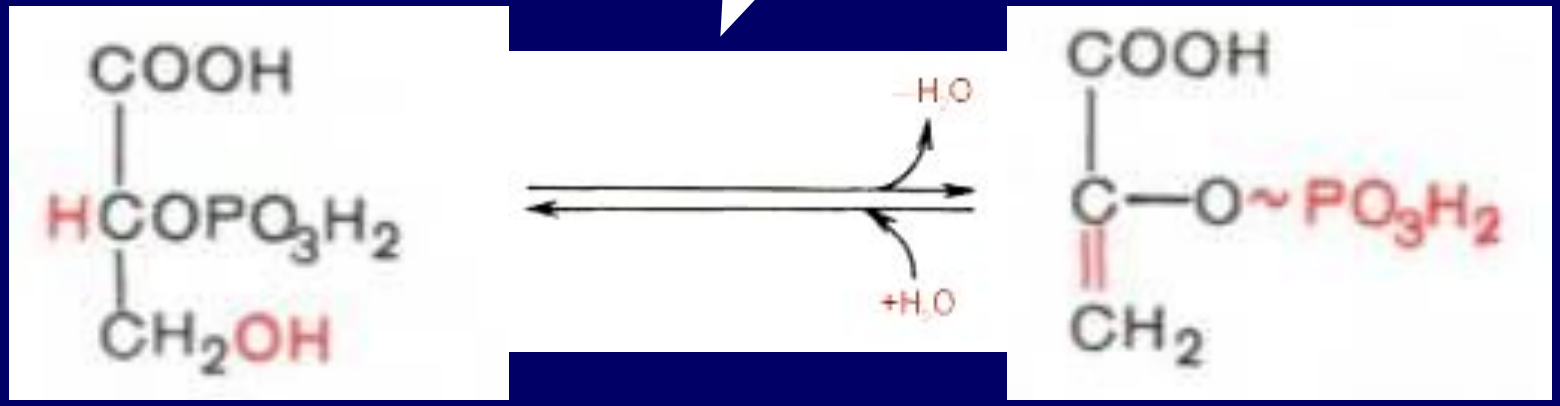


LE 3-PHOSPHOGLYCERATE

LE 2-PHOSPHOGLYCERATE

9) LA REACTION DE DESHYDRATATION

L'ENOLASE

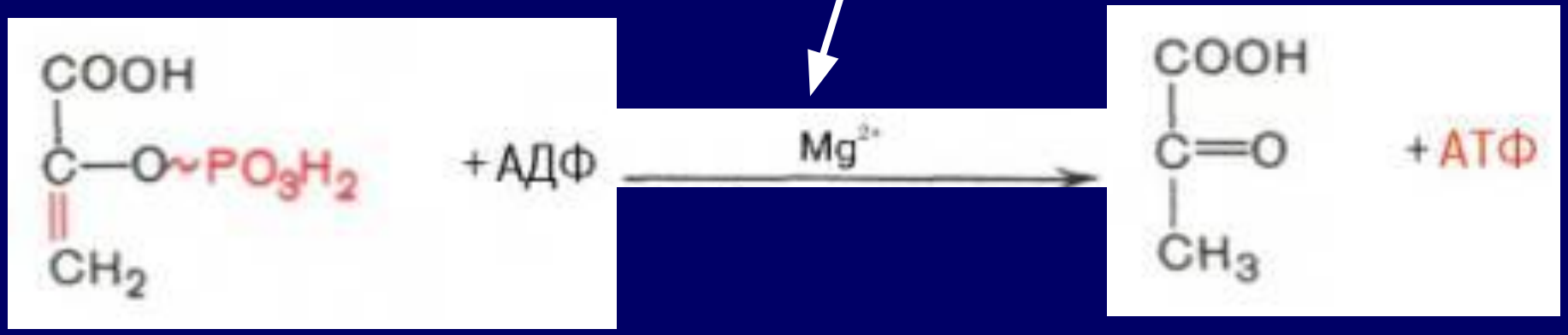


LE 2-PHOSPHOGLYCERATE

LE PHOSPHOENOL PYRUVATE

10) LA PHOSPHORYLATION AU NIVEAU DU SUBSTRAT

LA PYRUVATEKINASE

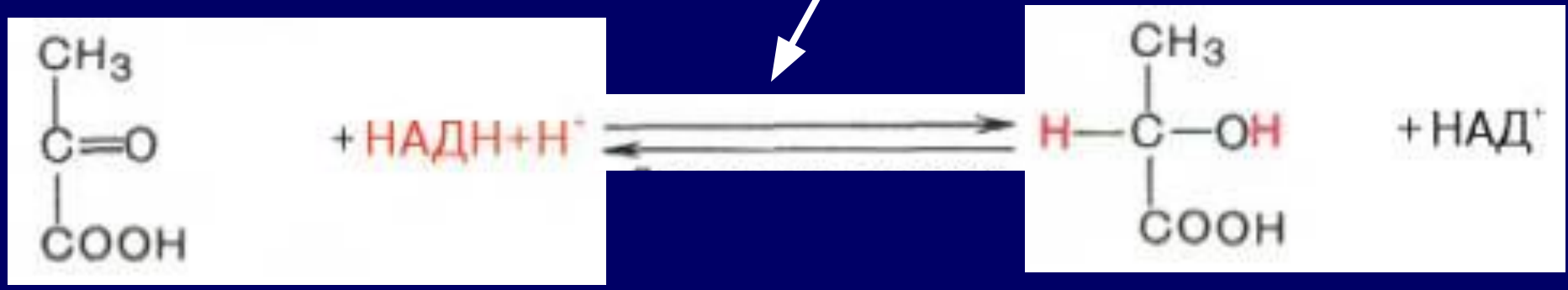


LE PHOSPHOENOL PYRUVATE

L'ACIDE PYRUVIQUE

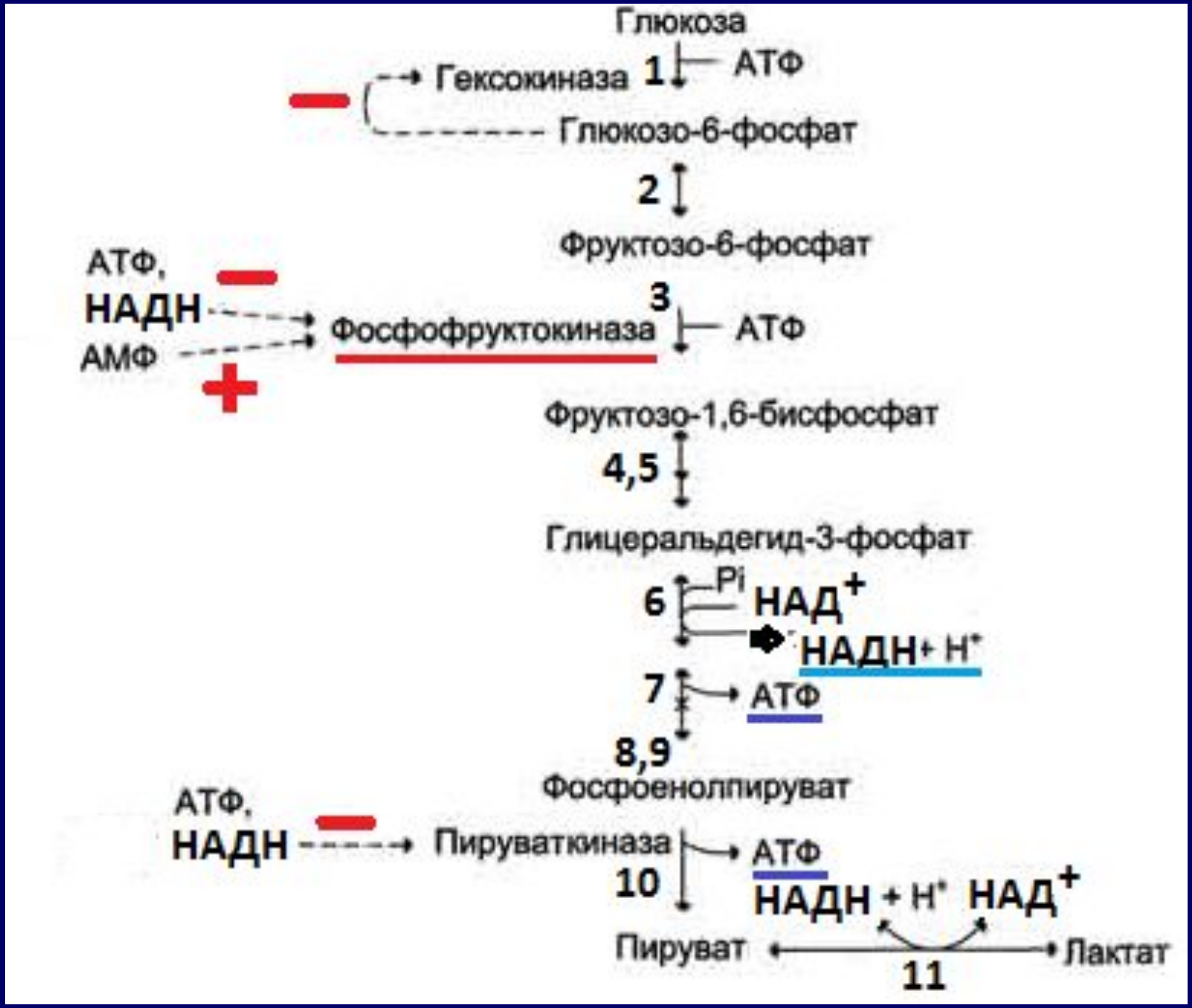
11) LA REACTION SE DEROULE SI LA GLYCOLYSE EST ANAEROBIE

LA LACTATE DESHYDROGENASE

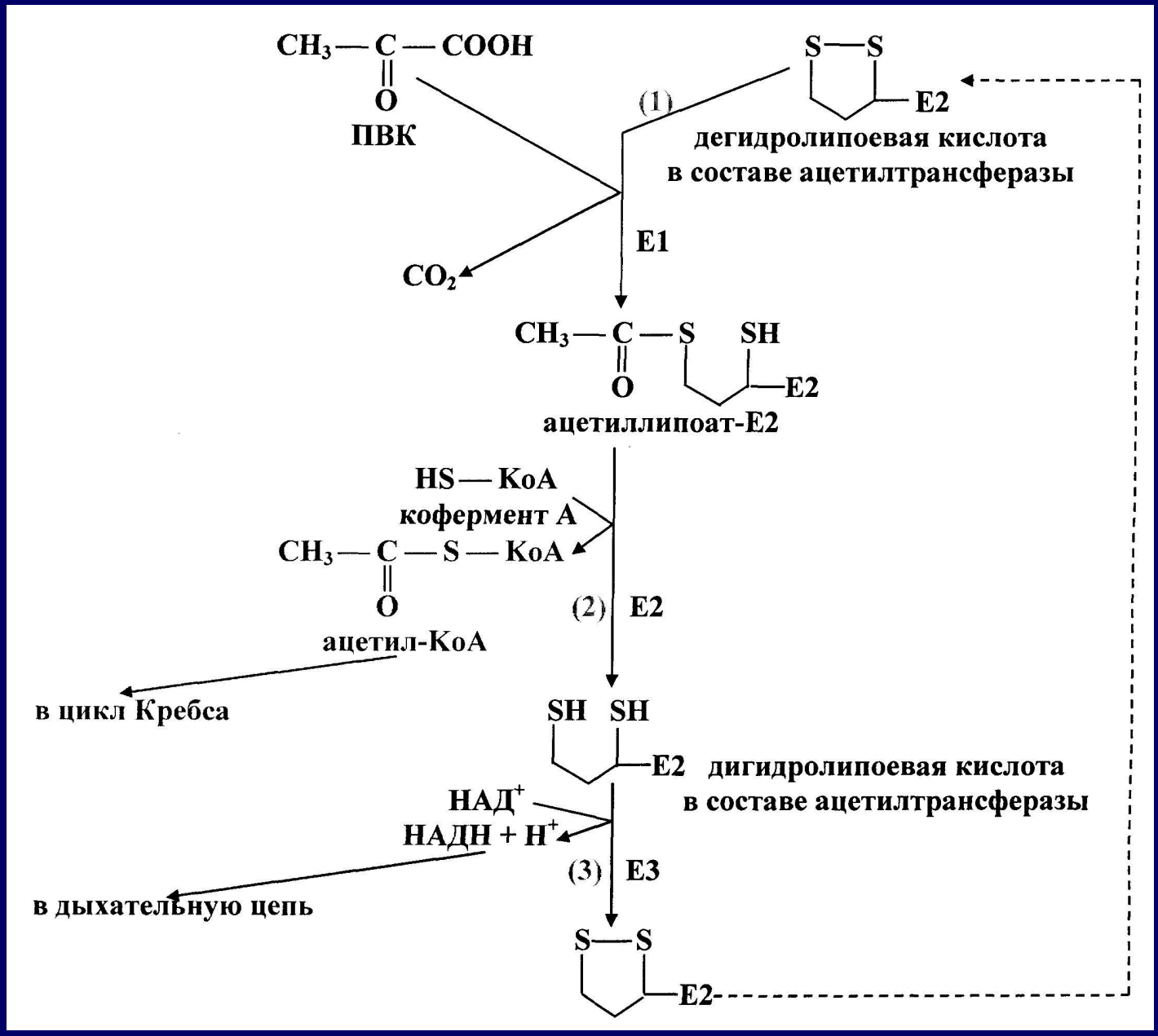


L'ACIDE PYRUVIQUE

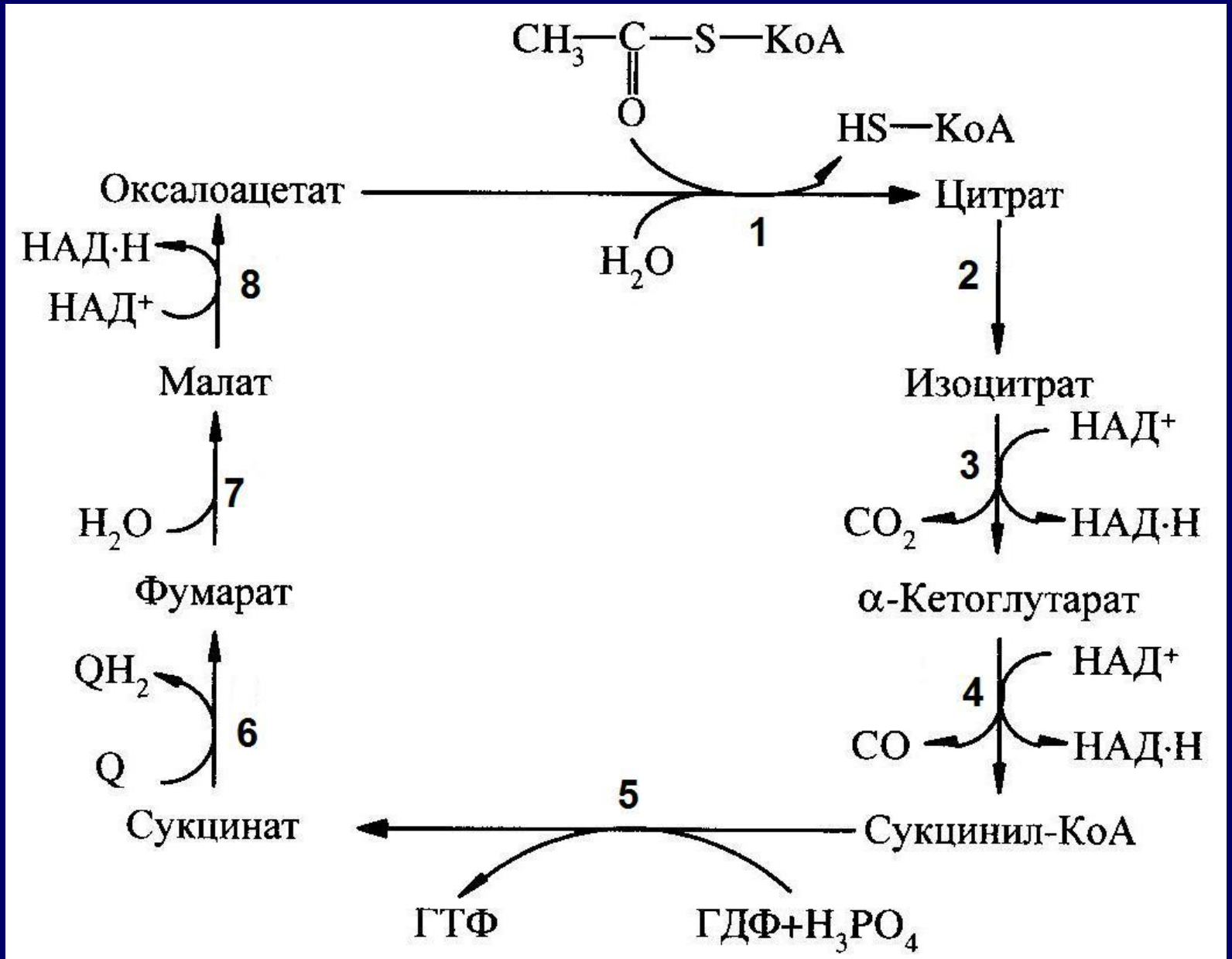
LE LACTATE (ACIDE LACTIQUE)


Глюкоза
1
АТФ
Гексокиназа
Глюкозо-6-фосфат
2
Фруктозо-6-фосфат
АТФ,
НАДН
АМФ
3
Фосфофруктокиназа
АТФ
Фруктозо-1,6-бисфосфат
4,5
Глицеральдегид-3-фосфат
6
Pi
НАД+
НАДН+ Н+
7
АТФ
8,9
Фосфоенолпируват
АТФ,
НАДН
Пируваткиназа
10
АТФ
НАДН + Н+
НАД+
Пируват
Лактат
11

LA DECARBOXYLATION OXYDATIVE DE L'ACIDE PYRUVIQUE



LE SCHEMA GENERAL DU CYCLE DE KREBS



LA SORTIE DE L'ATP LORS DE LA GLYCOLYSE AEROBIE:

- LA PHOSPHORYLATION AU NIVEAU DU SUBSTRAT (LES REACTIONS 7, 10 DE GLYCOLYSE; 5 – CYCLES) = 3 ATP

- LA REACTION DE DESHYDRATATION (6 – LA GLYCOLYSE; 3 – LA DECARBOXYLATION OXYDATIVE DE L'ACIDE PYRUVIQUE; 3, 4, 8 – CYCLES) = 3 ATP x 5 NADH = 15 ATP

- LA REACTION DE DESHYDRATATION AVEC FAD (6 – CYCLES) = 2 ATP x $FADH_2$ = 2 ATP

- LES REACTIONS 4, 5 DE GLYCOLYSE:

1 $C_6H_{12}O_6$ → 2 GLYCERALDEHYDE-3-PHOSPHATE

2 x (3 ATP + 15 ATP + 2 ATP) = 40 ATP

- DANS LES REACTIONS 1, 3 DE GLYCOLYSE 2 ATP SONT DEPENSEES, ALORS

40 ATP – 2 ATP = 38 ATP

OU:

- LA PHOSPHORYLATION AU NIVEAU DU SUBSTRAT (LES REACTIONS 7, 10 DE GLYCOLYSE; = 2 ATP;

- LA REACTION DE DESHYDRATATION (6 – LA GLYCOLYSE) = 3 ATP;

- LA DECARBOXYLATION OXYDATIVE DE L'ACIDE PYRUVIQUE = 3 ATP;

- LE CYCLE DE KREBS = 12 ATP;

- LES REACTIONS 4, 5 DE GLYCOLYSE:

1 $C_6H_{12}O_6$ → 2GLYCERALDEHYDE-3-PHOSPHATE

2 x (2 ATP + 3 ATP + 3 ATP + 12 ATP) = 40 ATP;

- DANS LES REACTIONS 1, 3 DE GLYCOLYSE 2 ATP SONT DEPENSEES, ALORS

40 ATP – 2 ATP = 38 ATP

LA SORTIE DE L'ATP LORS DE LA GLYCOLYSE ANAEROBIE:

- **LES REACTIONS 4, 5 DE GLYCOLYSE:**

1 $C_6H_{12}O_6 \rightarrow$ **2**

GLYCERALDEHYDE-3-PHOSPHATE

(COEFFICIENT «2»)

- **LA PHOSPHORYLATION AU NIVEAU DU SUBSTRAT**

(LES REACTIONS 7, 10 DE GLYCOLYSE) =

= 2 ATP x 2 = 4 ATP

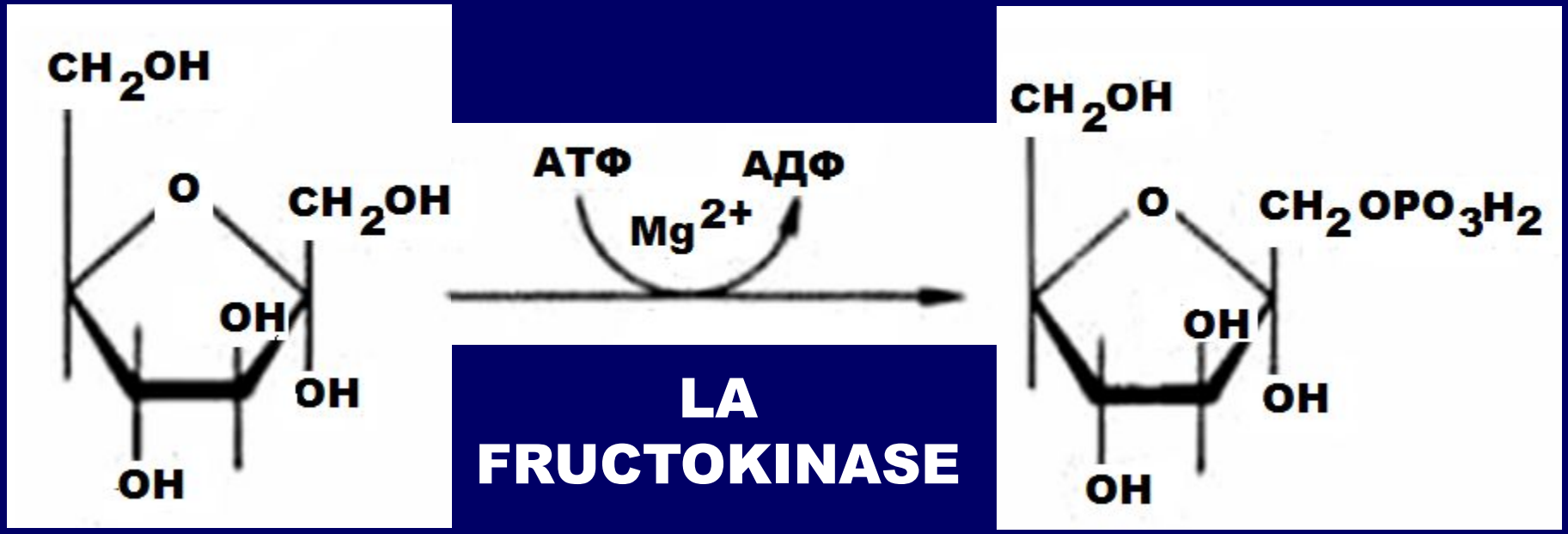
- **DANS LES REACTIONS 1, 3 DE GLYCOLYSE**

2 ATP SONT DEPENSEES, ALORS

4 ATP – 2 ATP = 2 ATP

LA PARTICIPATION DU FRUCTOSE A LA GLYCOLYSE

LE FOIE

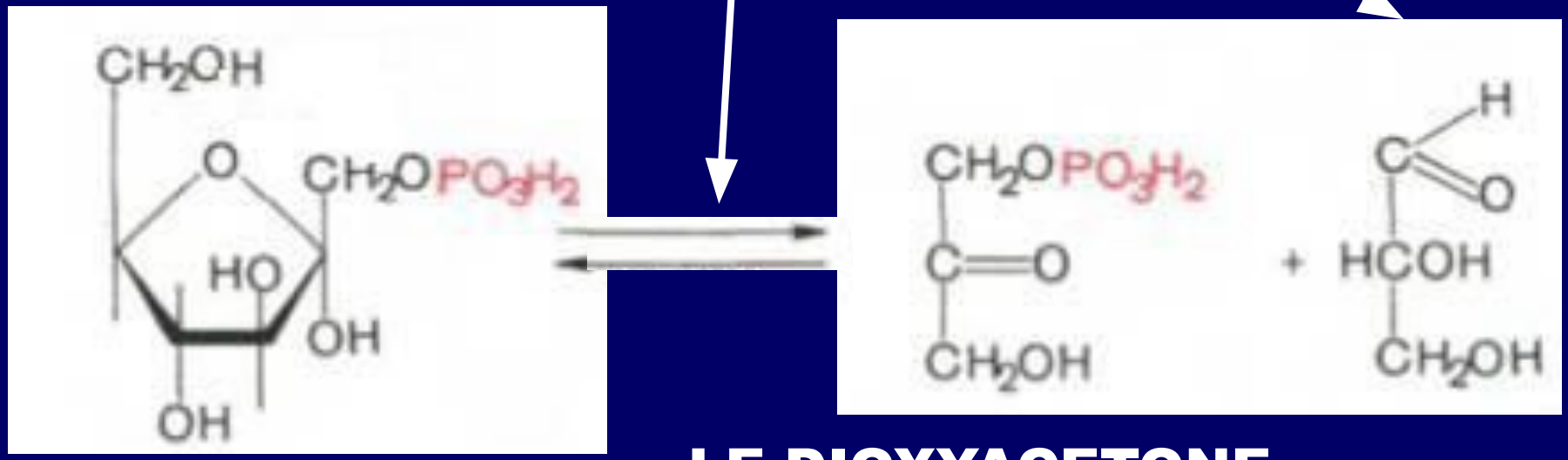


LE FRUCTOSE

LE FRUCTOSE-1-PHOSPHATE

L'ALDOLASE

LE GLYCERALDEHYDE



LE DIOXYACETONE-PHOSPHATE

LE FRUCTOSE-1-PHOSPHATE

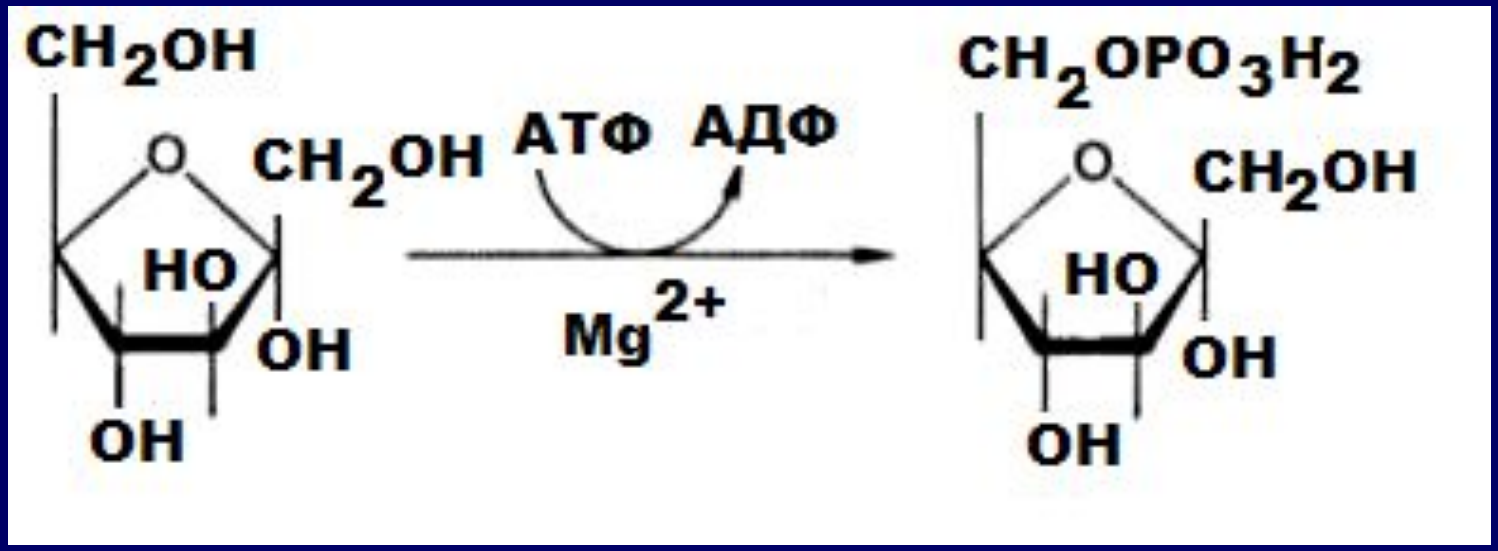
PARTICIPE A LA 5EME REACTION DE GLYCOLYSE

LE GLYCERALDEHYDE → LE GLYCERALDEHYDE-3-PHOSPHATE

PARTICIPE A LA 6EME REACTION DE GLYCOLYSE

LE TISSU MUSCULAIRE, LES REINS, LE TISSU ADIPEUX

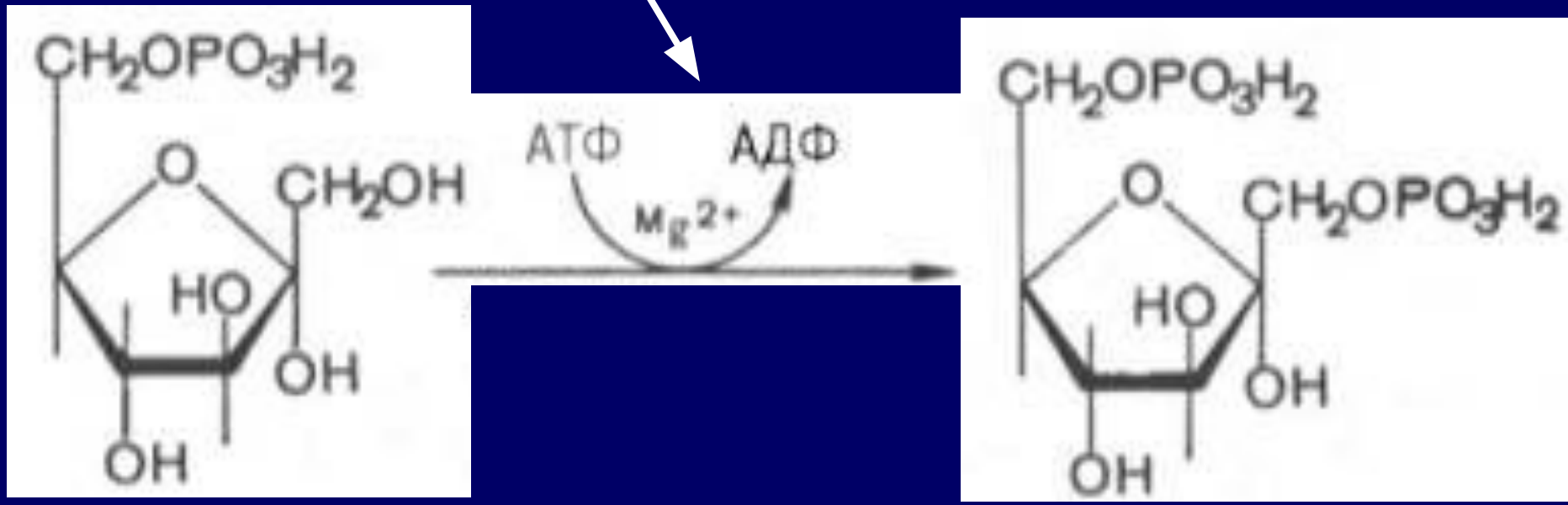
L'HEXOKINASE



LE FRUCTOSE

LE FRUCTOSE-6-PHOSPHATE

LE 6-PHOSPHOFRUCTOKINASE

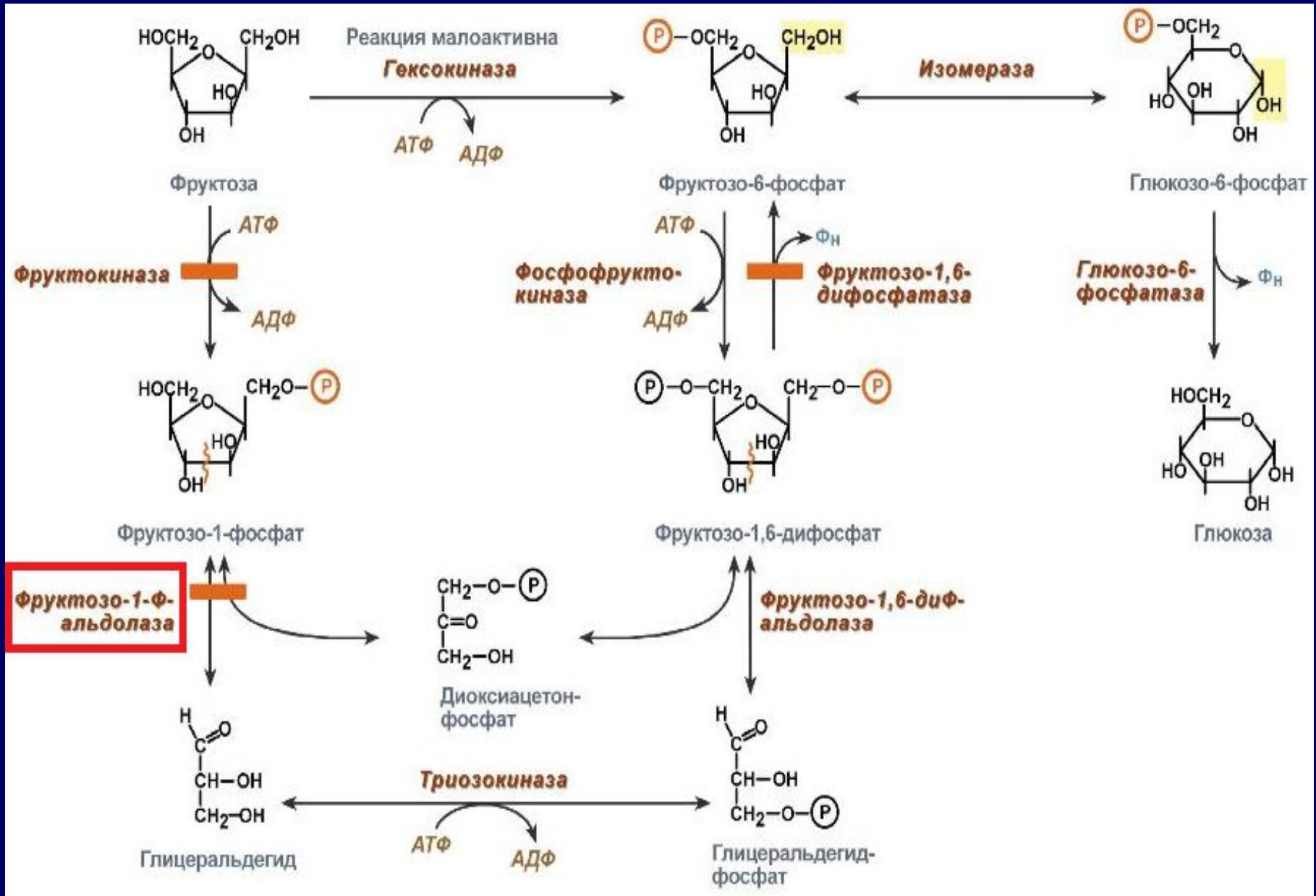


LE FRUCTOSE-6-PHOSPHATE

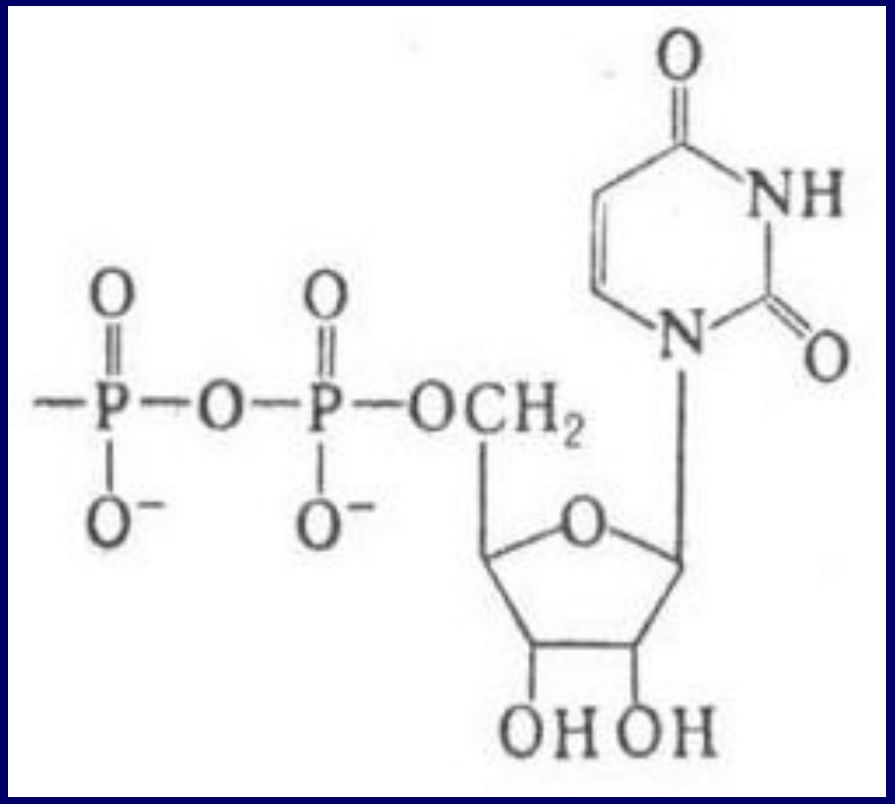
LE FRUCTOSE-1,6-BIPHOSPHATE

PARTICIPE A LA 4EME REACTION DE GLYCOLYSE

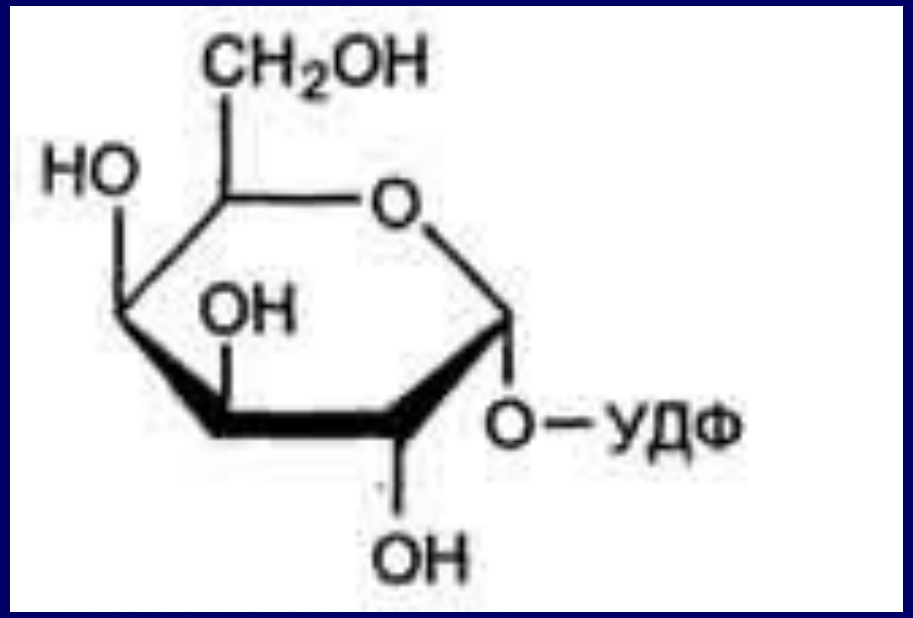
LE TROUBLE DU METABOLISME DU FRUCTOSE



LA PARTICIPATION DU GALACTOSE A LA GLYCOLYSE

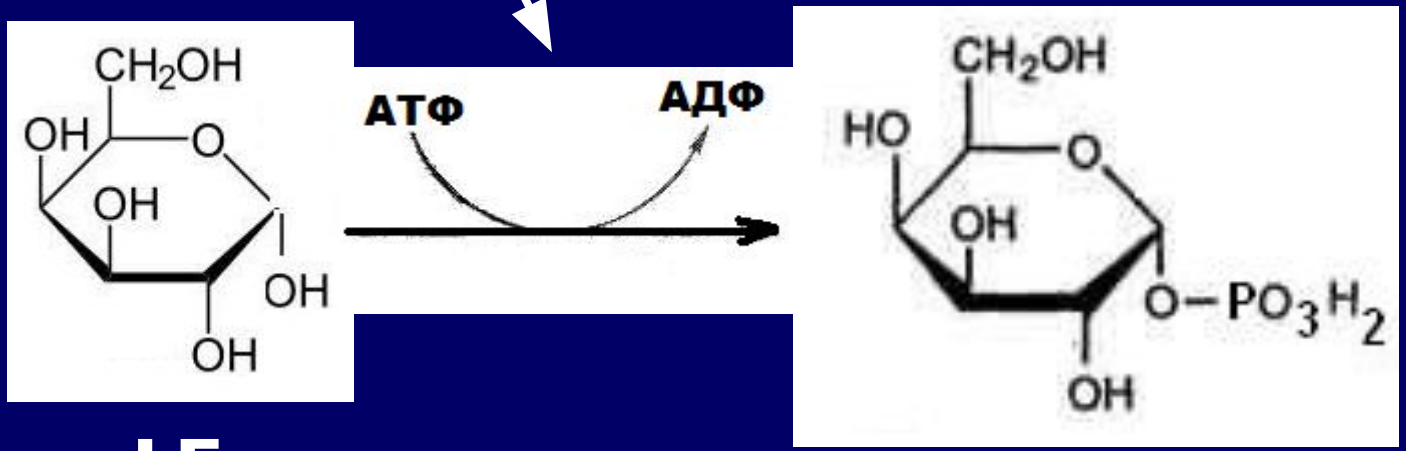


L'URIDINE DIPHOSPHATE



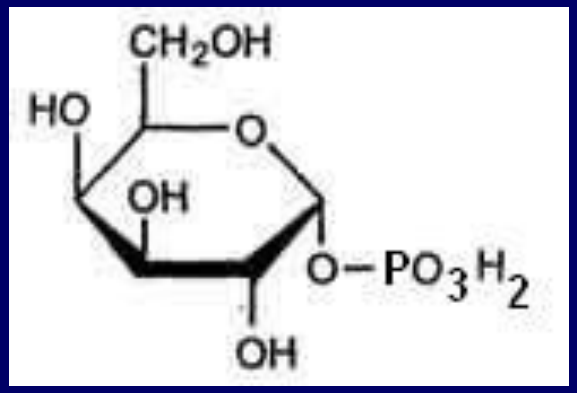
L'UDP-GALACTOSE

LA GALACTOKINASE



LE GALACTOSE

LE GALACTOSE-1-PHOSPHATE



LE GALACTOSE-1-PHOSPHATE

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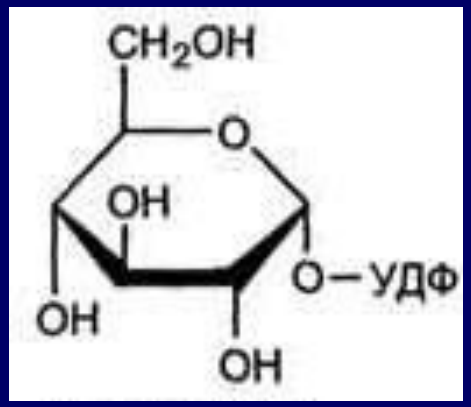
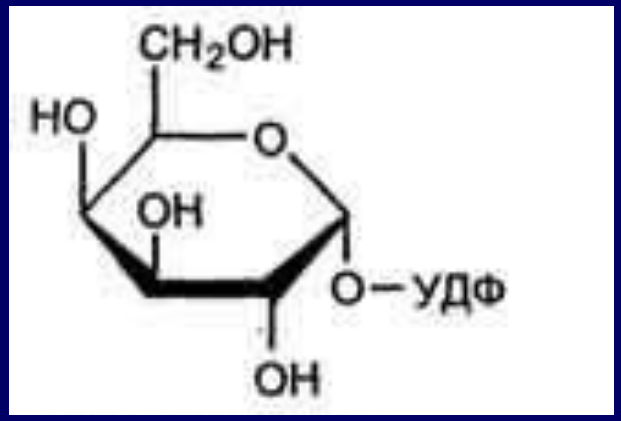


L'UDP-GLUCOSE

L'HEXOSE-1-PHOSPHATE-URYDYL-TRANSFERASE



L'UDP-GALACTOSE

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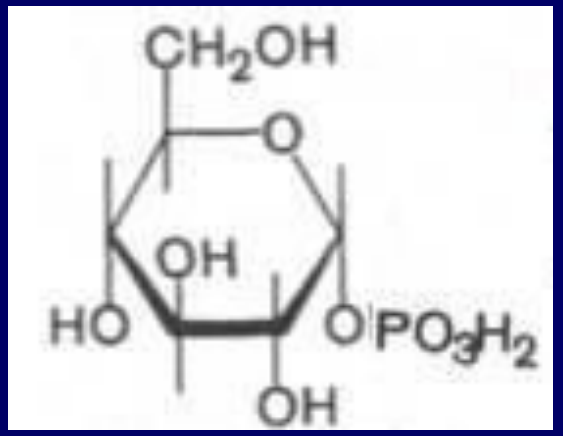
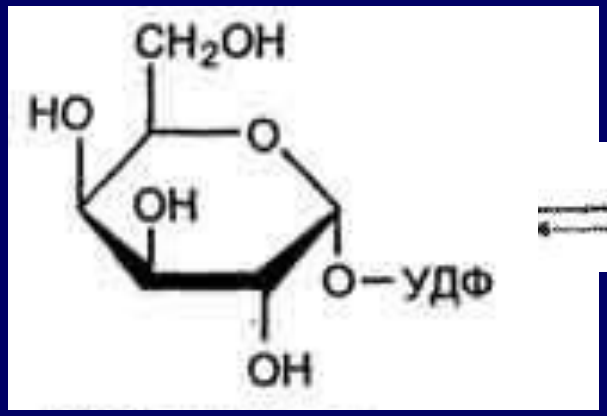
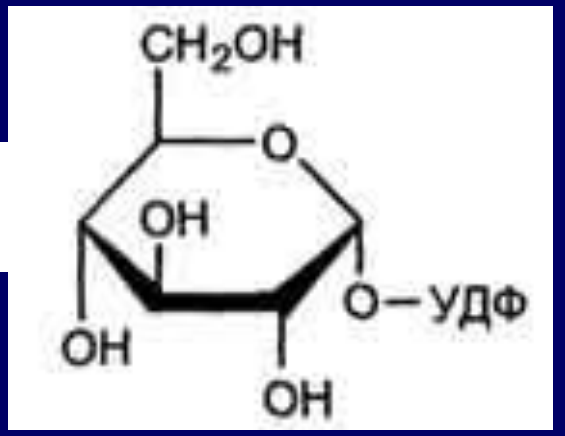


LE GLUCOSE-1-PHOSPHATE

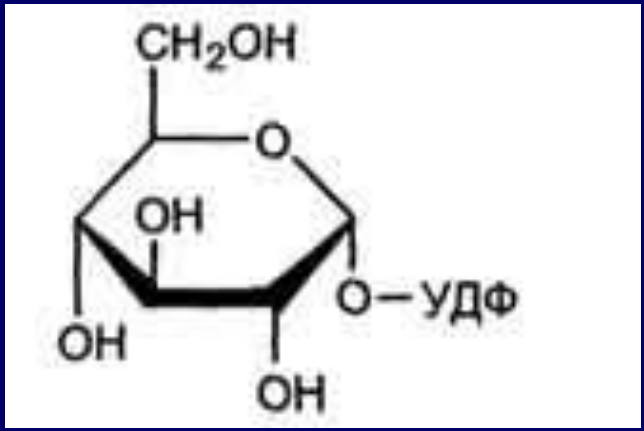
L'UDP-GLUCOSE-4-EPIMERASE



L'UDP
-GALACTOSE



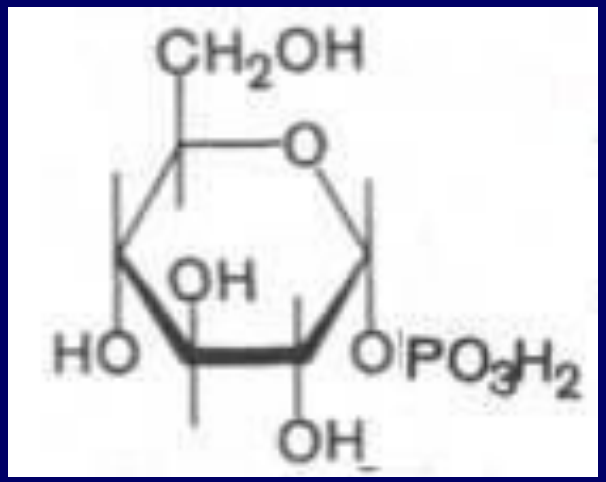
L'UDP
-GLUCOSE



L'UDP -GLUCOSE

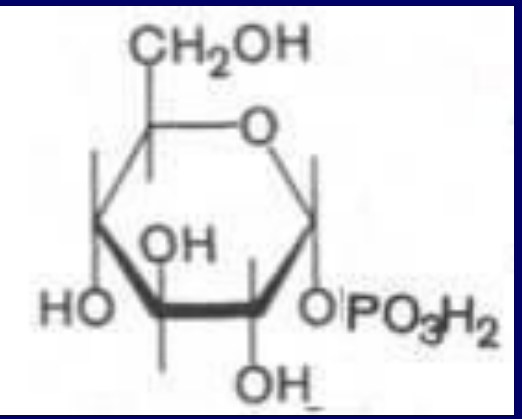
+ PP_i

L'UDP -GLUCOSE-PYROPHOSPHORYLASE

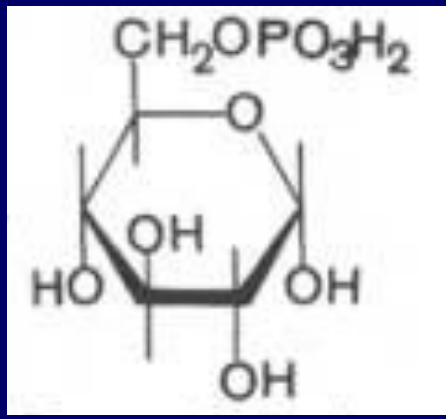


LE GLUCOSE-1-PHOSPHATE

+ UTP



LA PHOSPHOGLUCOMUTASE



LE GLUCOSE-1-PHOSPHATE

LE GLUCOSE-6-PHOSPHATE

PARTICIPE A LA 2-EME REACTION DE GLYCOLYSE

LA GALACTOSEMIE

LA GALACTOSEMIE DU TYPE I

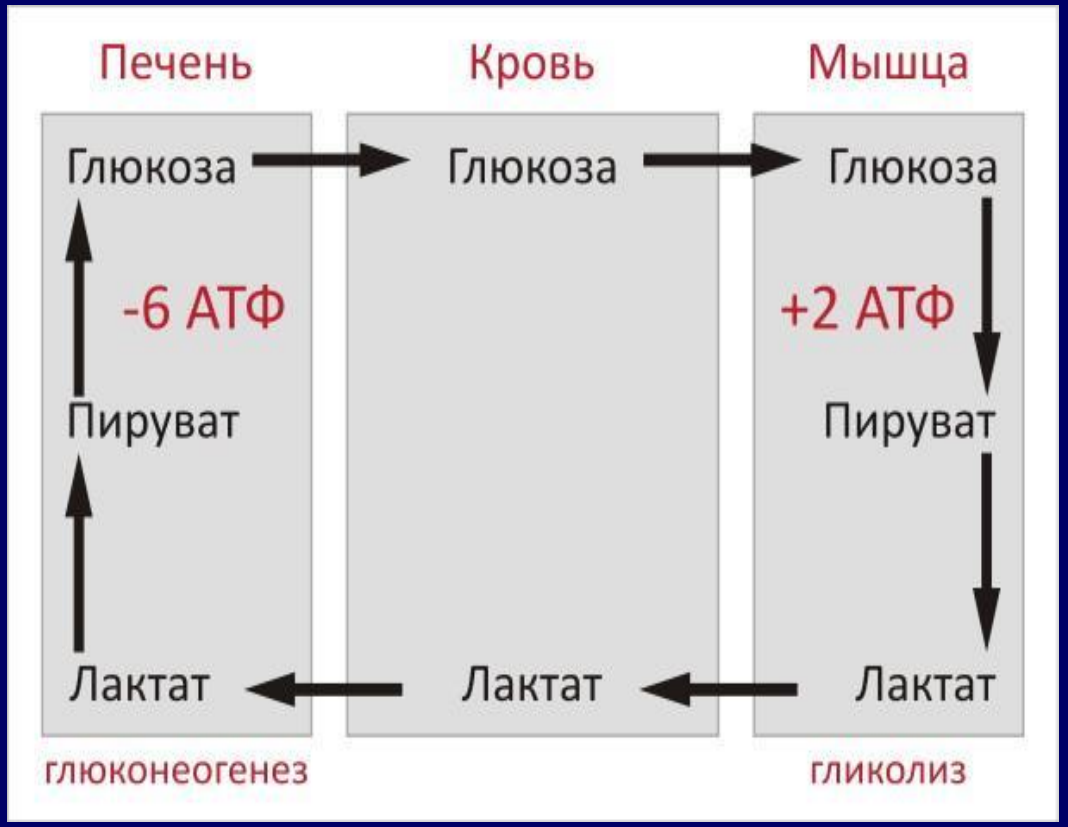
(L'INSUFFISANCE DE LA GALACTOSE-1-PHOSPHATE-URIDYL-TRANSFERASE)

LA NAVETTE DU GLYCEROL PHOSPHATE

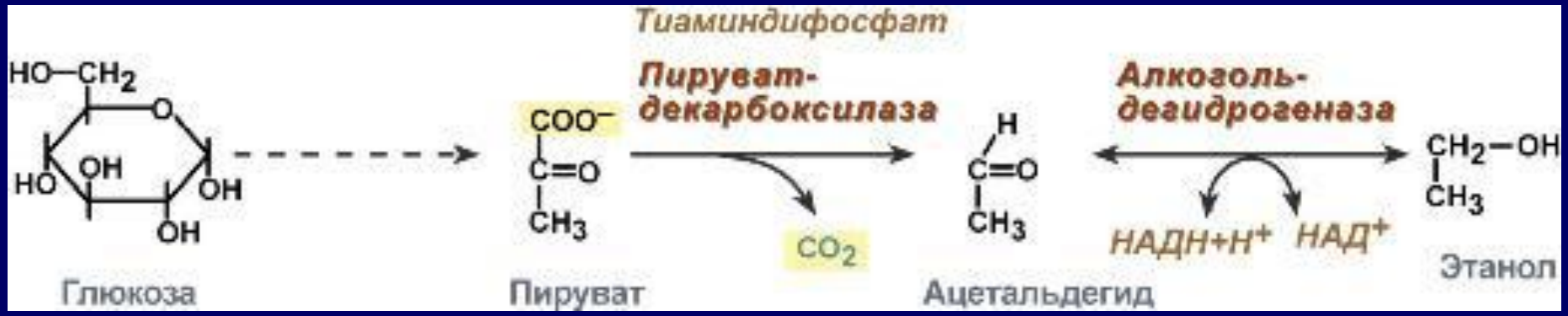
LA NAVETTE MALATE-ASPARTATE

LE CYCLE DE CORI

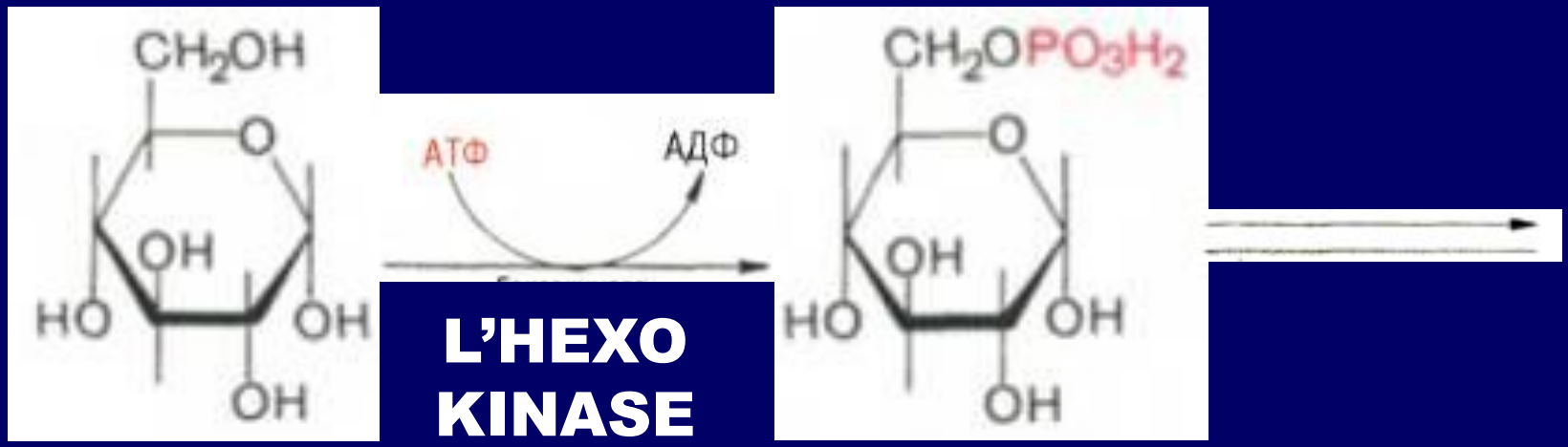
THERESA CORI



LA FERMENTATION ALCOOLIQUE

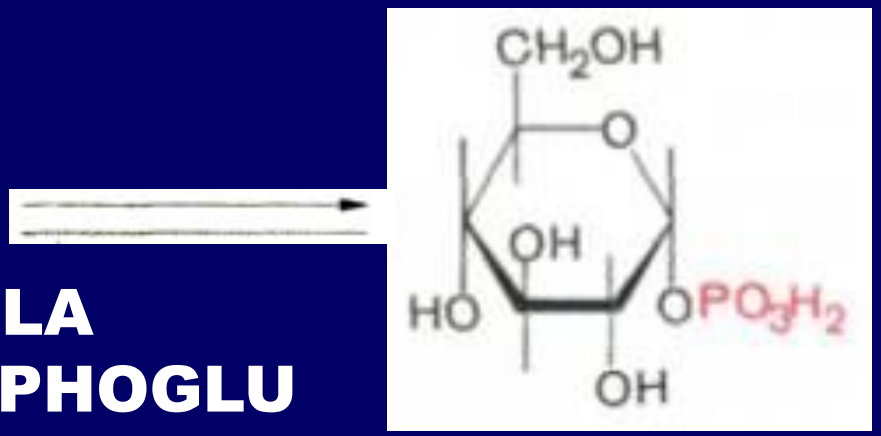


LA SYNTHESE DU GLYCOGENE (LA GLYCOGENESE)

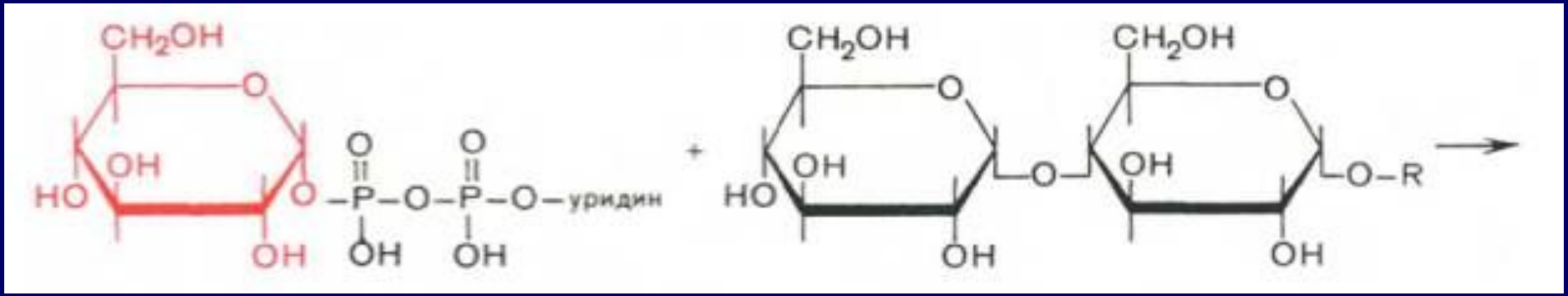


LE GLUCOSE

LE GLUCOSE-6-PHOSPHATE



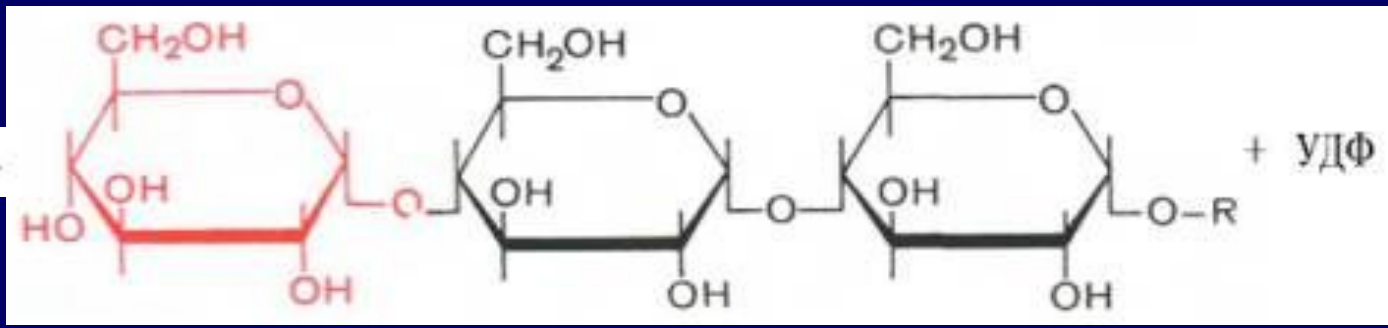
LE GLUCOSE-6-PHOSPHATE



L'UDP-GLUCOSE

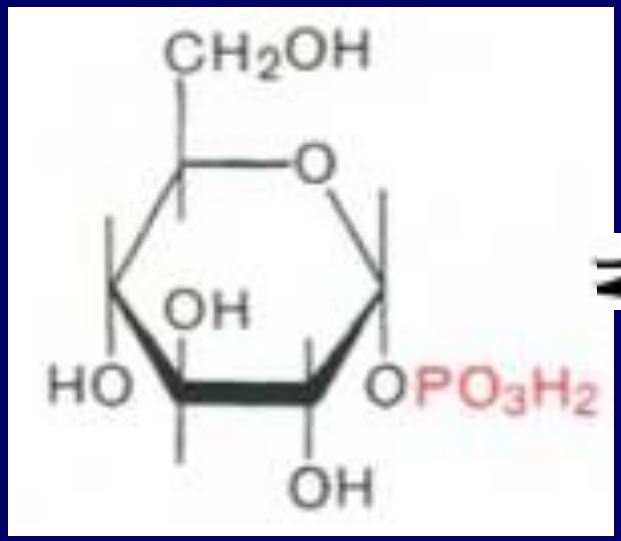
LE GLYCOGENE (n de RESIDUS)

LA GLYCOGENE SYNTHASE

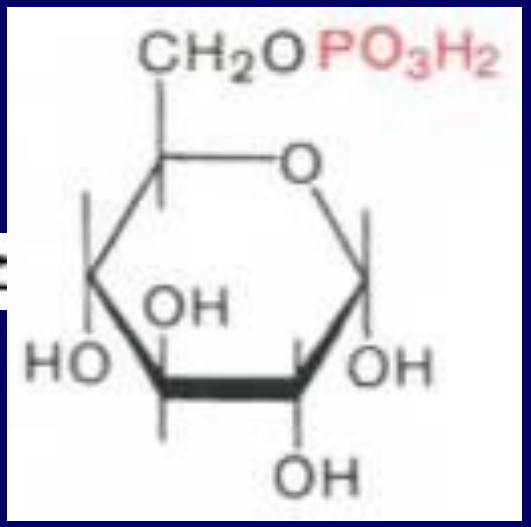


LE GLYCOGENE (n+1 RESIDU)

LA DECOMPOSITION DU GLYCOGENE (LA GLYCOGENOLYSE)

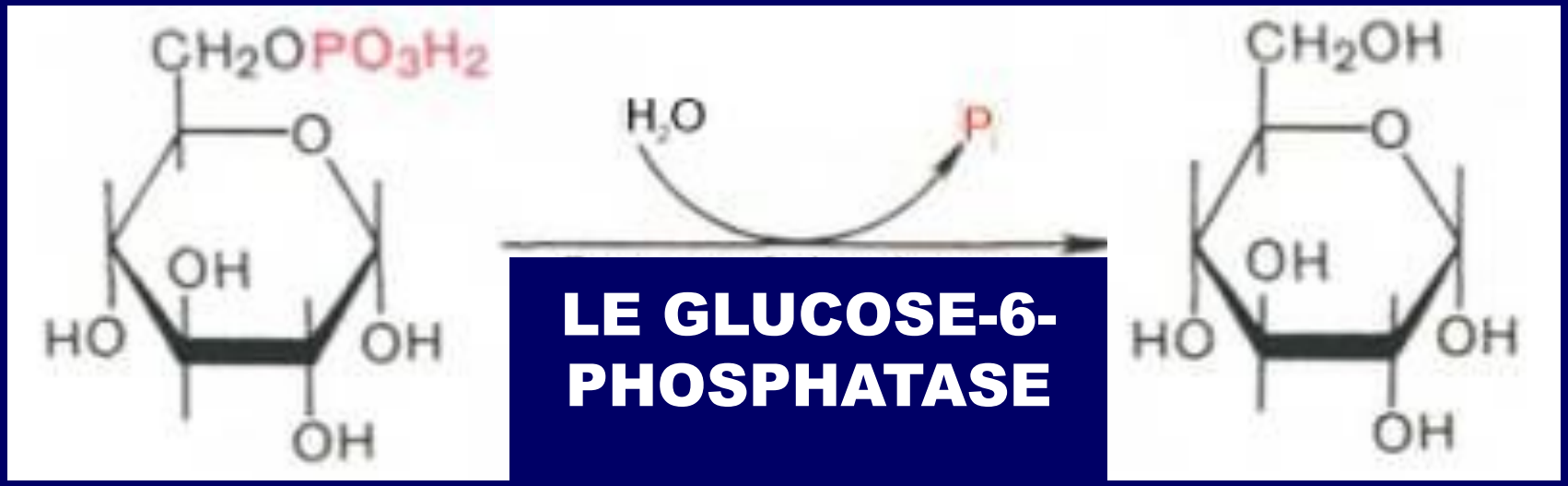


LA PHOSPHOGLUCOMUTASE



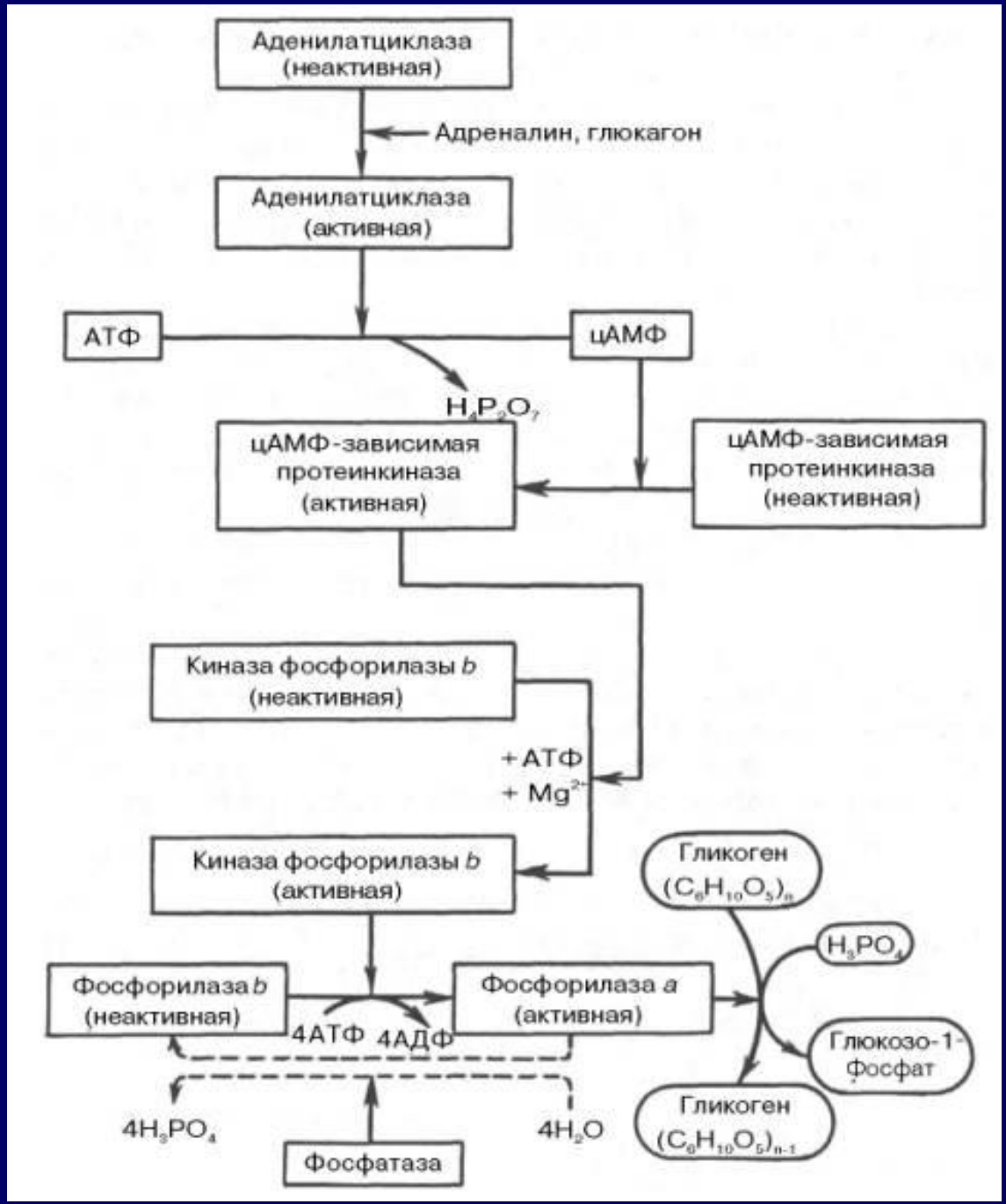
LE GLUCOSE-1-PHOSPHATE

LE GLUCOSE-6-PHOSPHATE



LE GLUCOSE-6-PHOSPHATE

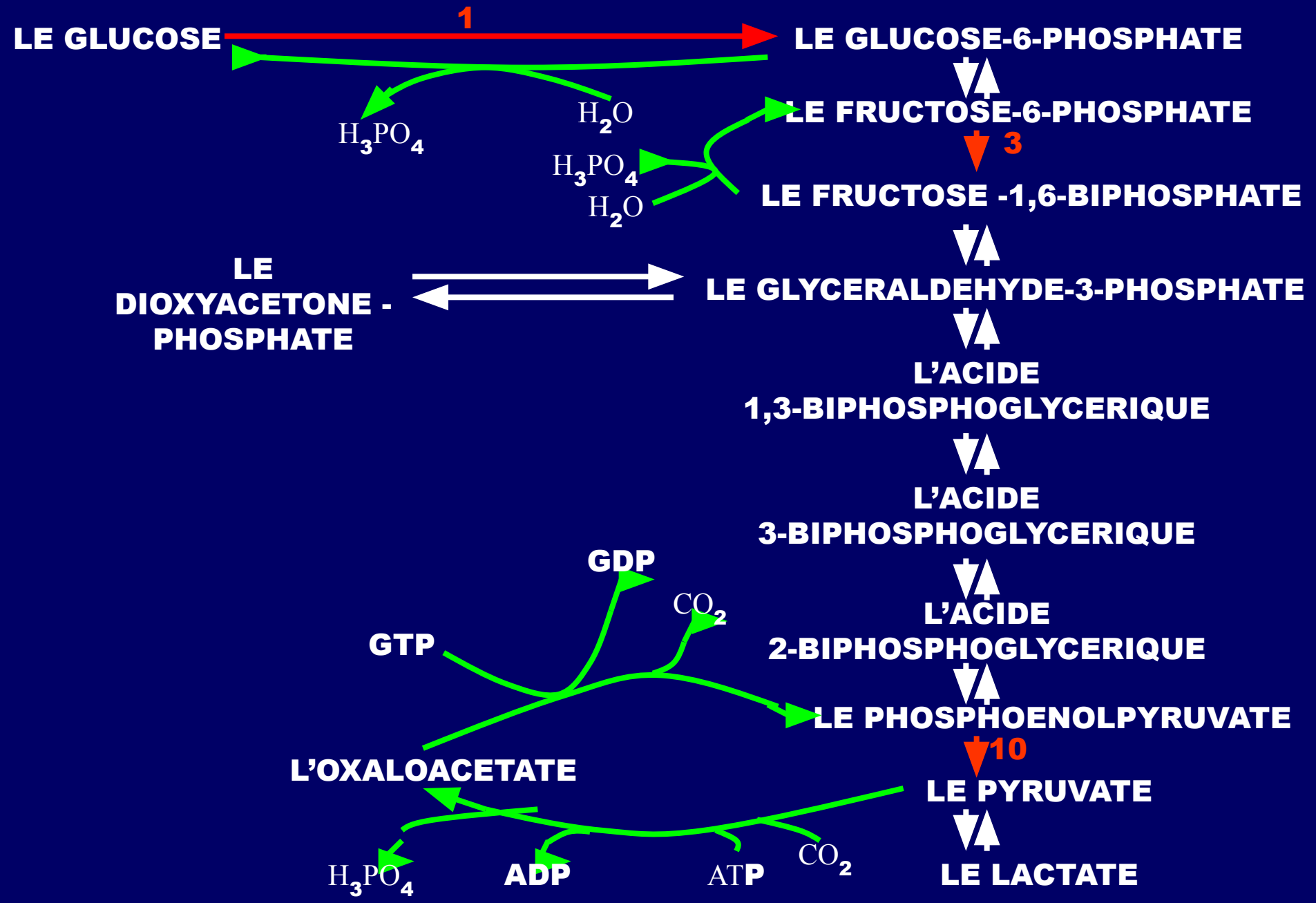
LE GLUCOSE


Аденилатциклаза (неактивная)
Адреналин, глюкагон
Аденилатциклаза (активная)
АТФ
цАМФ
$H_4P_2O_7$
цАМФ-зависимая протеинкиназа (активная)
цАМФ-зависимая протеинкиназа (неактивная)
Киназа фосфорилазы *b* (неактивная)
+ АТФ
+ Mg^{2+}
Киназа фосфорилазы *b* (активная)
Гликоген $(C_6H_{10}O_5)_n$
H_3PO_4
Фосфорилаза *b* (неактивная)
4АТФ 4АДФ
Фосфорилаза *a* (активная)
Глюкозо-1-фосфат
$4H_3PO_4$
$4H_2O$
Гликоген $(C_6H_{10}O_5)_{n-1}$
Фосфатаза

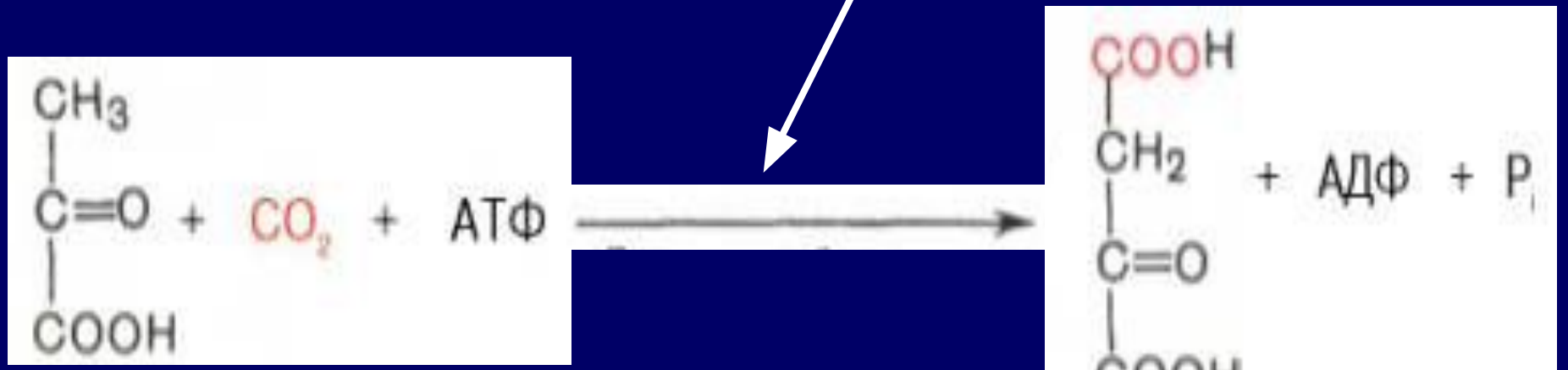
LES MALADIES GLYCOGENIQUES

Дефект фермента	Тип **болезни**
Глюкозо-6-фосфатазы →	1-й тип (болезнь *Гирке*)
Альфа-1,4- **гликозидазы** →	2-й тип (болезнь *Помпе*)
Амило-1,6- **гликозидазы** →	3-й тип (болезнь *Кори*)
гликогенветвящий фермент →	4-й тип (болезнь ***Андерсена)***
Гликогенфосфорилазы миоцитов →	5-й тип (болезнь ***Мак-Ардля)***
Гликогенфосфорилазы гепатоцитов →	6-й тип (болезнь *Гирса*)
Фосфоглюкомутазы →	7-й тип (болезнь *Томпсона*)
Фосфофруктомутазы →	8-й тип (болезнь *Таруи*)
Киназы фосфорилазы в гепатоцитах →	9-й тип (болезнь *Хага*)

LA GLYCOLYSE ET LA GLYCONEOGENESE

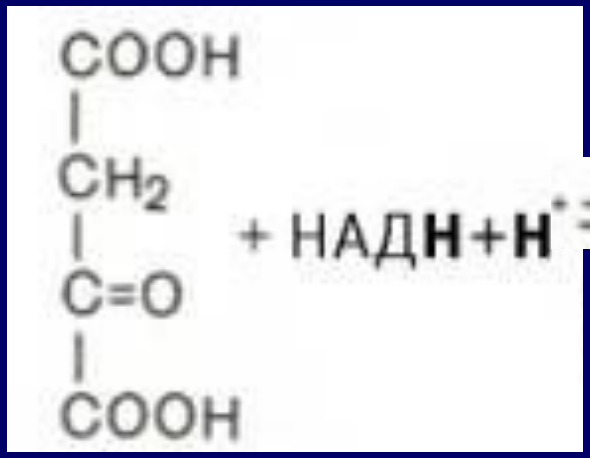


LA PYRUVATE CARBOXYLASE



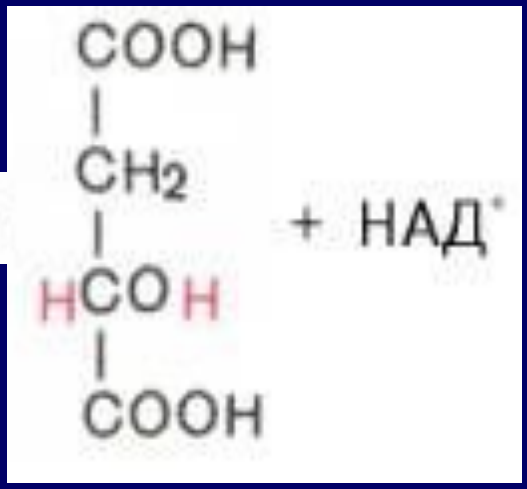
L'ACIDE PYRUVIQUE

L'OXALOACETATE

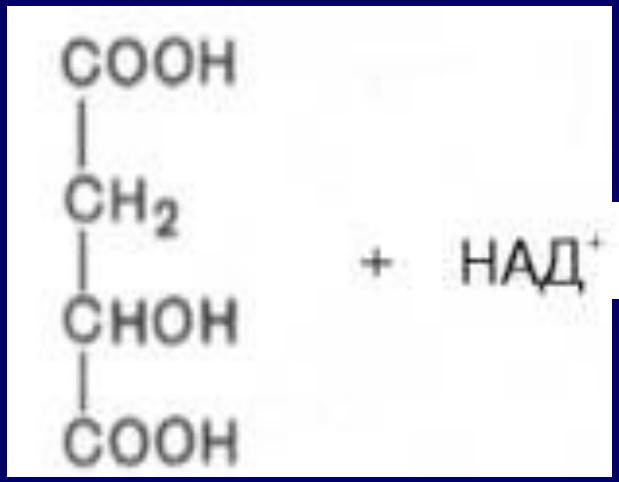


L'OXALOACETATE

LA MALATE DESHYDROGENASE (MITOCHONDRIALE)



LE MALATE



LE MALATE

LA MALATE DESHYDROGENASE (CYTOPLASMIQUE)

L'OXALOACETATE

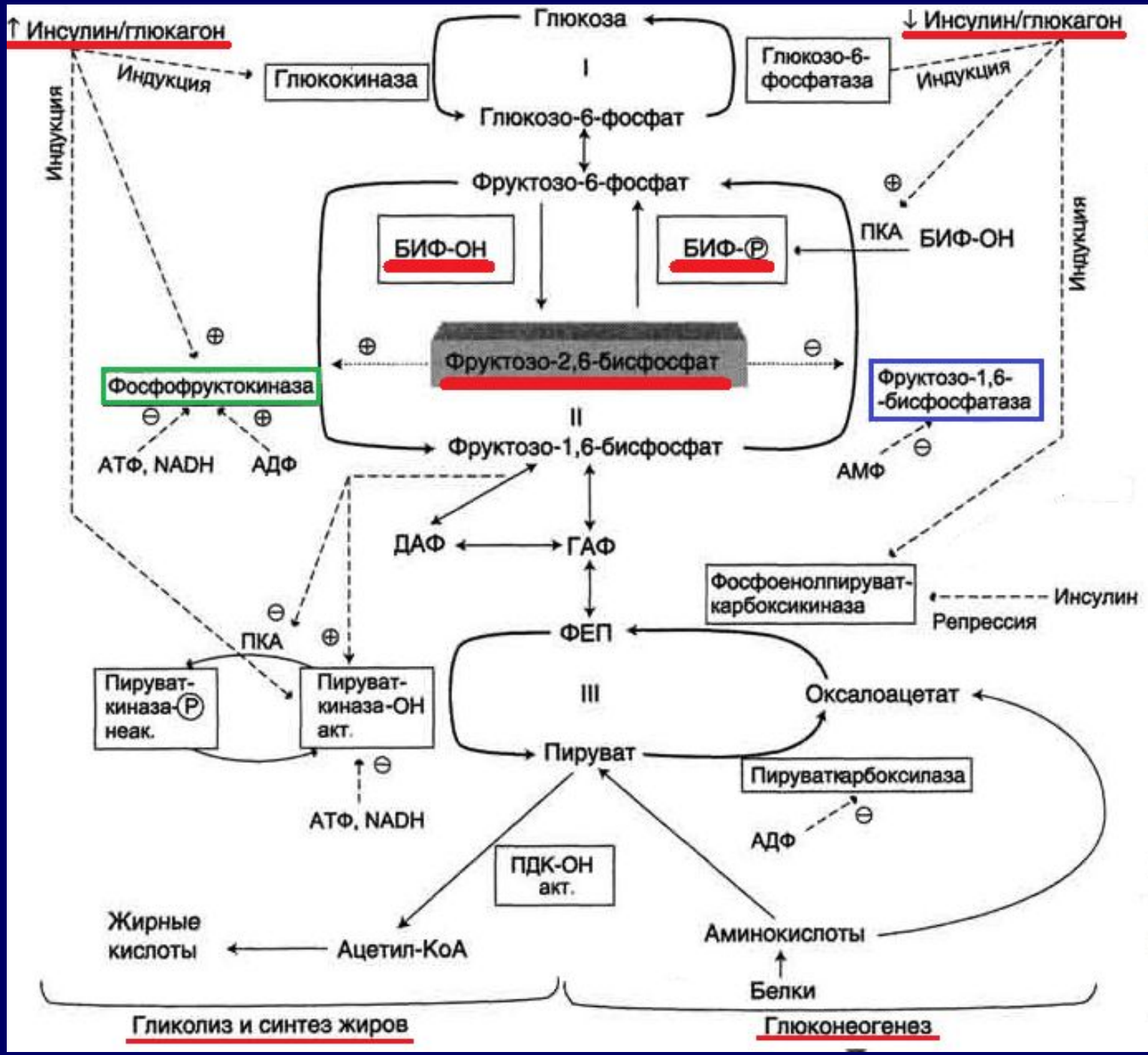
LA PHOSPHOENOLPYRUVATE CARBOXYLASE

L'OXALOACETATE

LE PHOSPHOENOLPYRUVATE


LE FRUCTOSE-1,6-BIPHOSPHATE
+ H2O
LA FRUCTOSE BIPHOSPHATASE
LE FRUCTOSE-6-PHOSPHATE
+ Pi

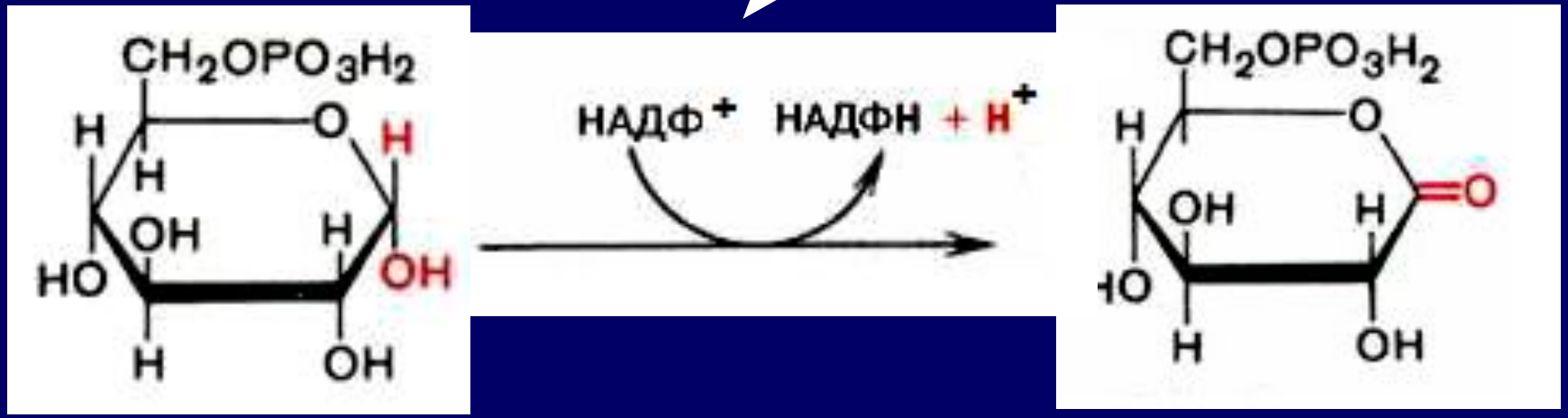

LE GLUCOSE-6-PHOSPHATE
+ H2O
LA GLUCOSE-6-PHOSPHATASE
LE GLUCOSE + Pi


↑ Инсулин/глюкагон
↓ Инсулин/глюкагон
Индукция
Глюкокиназа
Глюкоза
I
Глюкозо-6-фосфат
Глюкозо-6-фосфатаза
Индукция
Индукция
Индукция
Фруктозо-6-фосфат
БИФ-ОН
БИФ-Ⓟ
ПКА
БИФ-ОН
Фруктозо-2,6-бисфосфат
Фосфофруктокиназа
Фруктозо-1,6-бисфосфатаза
II
Фруктозо-1,6-бисфосфат
АТФ, NADH
АДФ
АМФ
ДАФ
ГАФ
Фосфоенолпируват-карбоксикиназа
Инсулин
Репрессия
ПКА
ФЕП
III
Пируват-киназа-Ⓟ неак.
Пируват-киназа-ОН акт.
Оксалоацетат
Пируват
Пируваткарбоксилаза
АТФ, NADH
АДФ
ПДК-ОН акт.
Жирные кислоты
Ацетил-КоА
Аминокислоты
Белки
Гликолиз и синтез жиров
Глюконеогенез

LA VOIE DES PENTOSES PHOSPHATES DE LA TRANSFORMATION DU GLUCOSE

LA VOIE OXYDATIVE

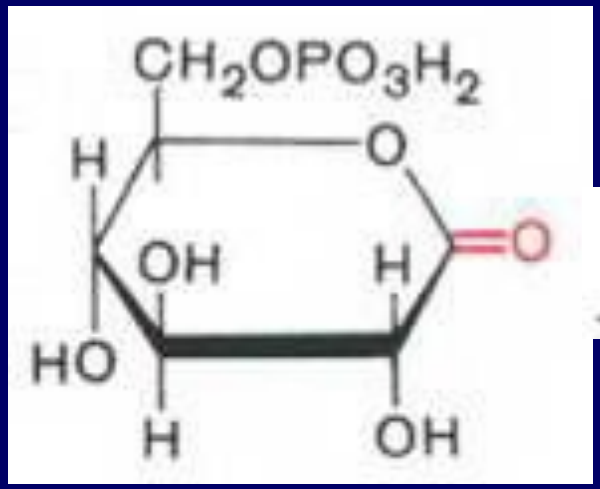
LA GLUCOSE-6-PHOSPHATE DESHYDROGENASE



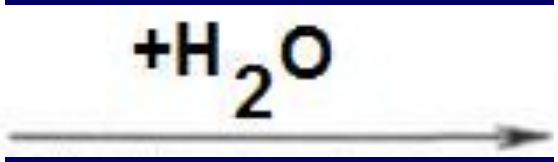
LE GLUCOSE-6-PHOSPHATE

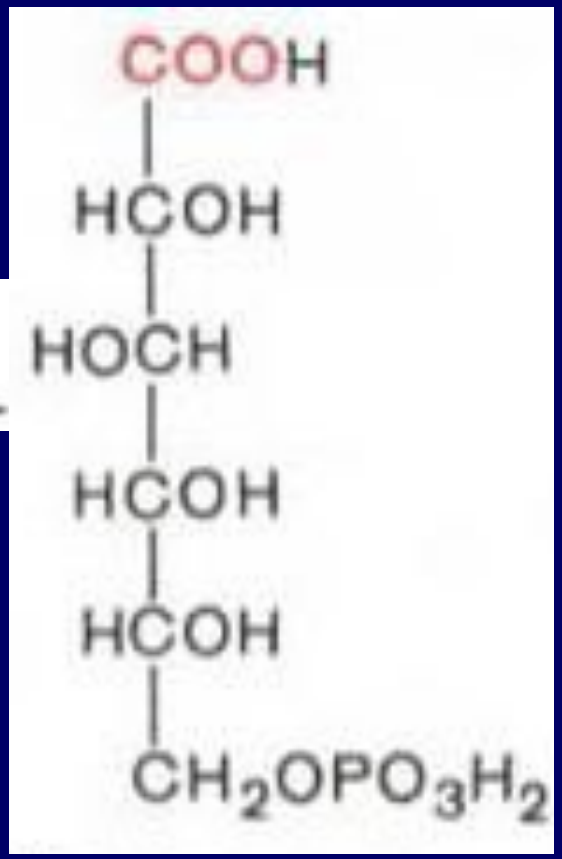
LA 6-PHOSPHOGLUCONO-

LA 6-PHOSPHOGLUCONO-LACTONASE



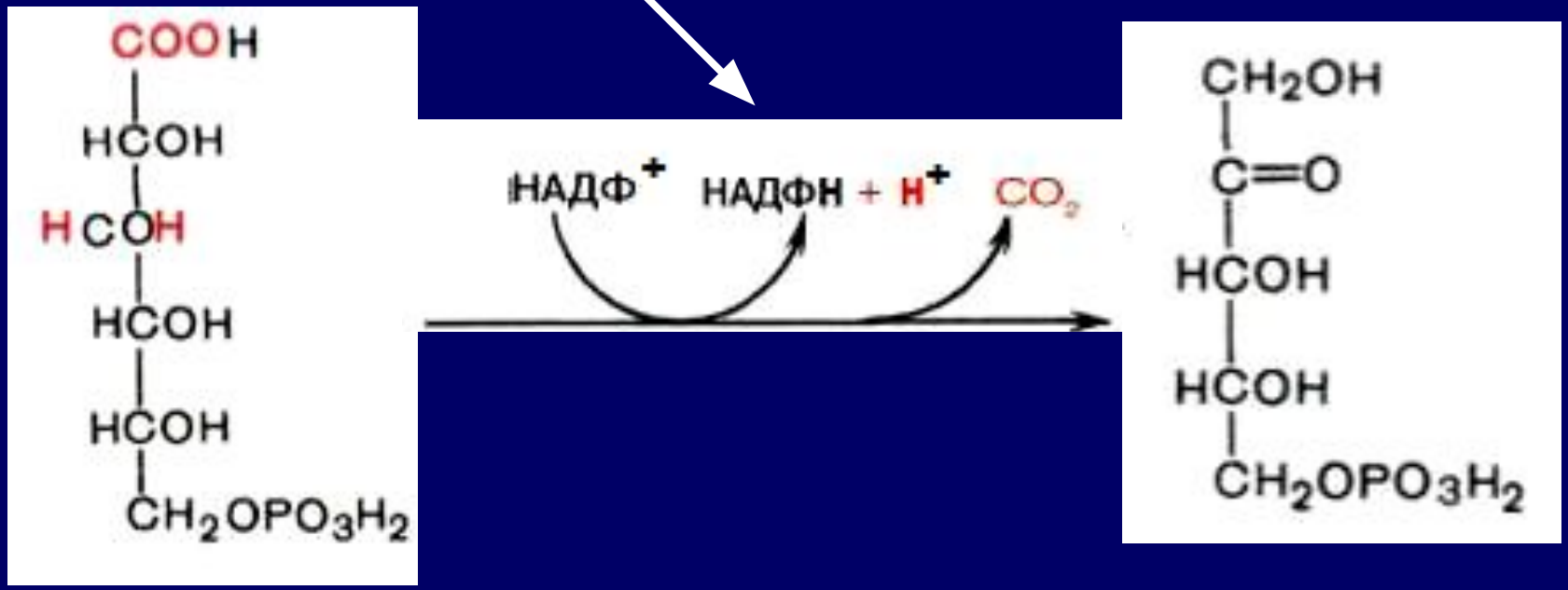
LA 6-PHOSPHOGLUCONO-δ-LACTONE





LE PHOSPHOGLUCONATE

LA 6- PHOSPHOGLUCONATE DESHYDROGENASE (DECARBOXYLEE)

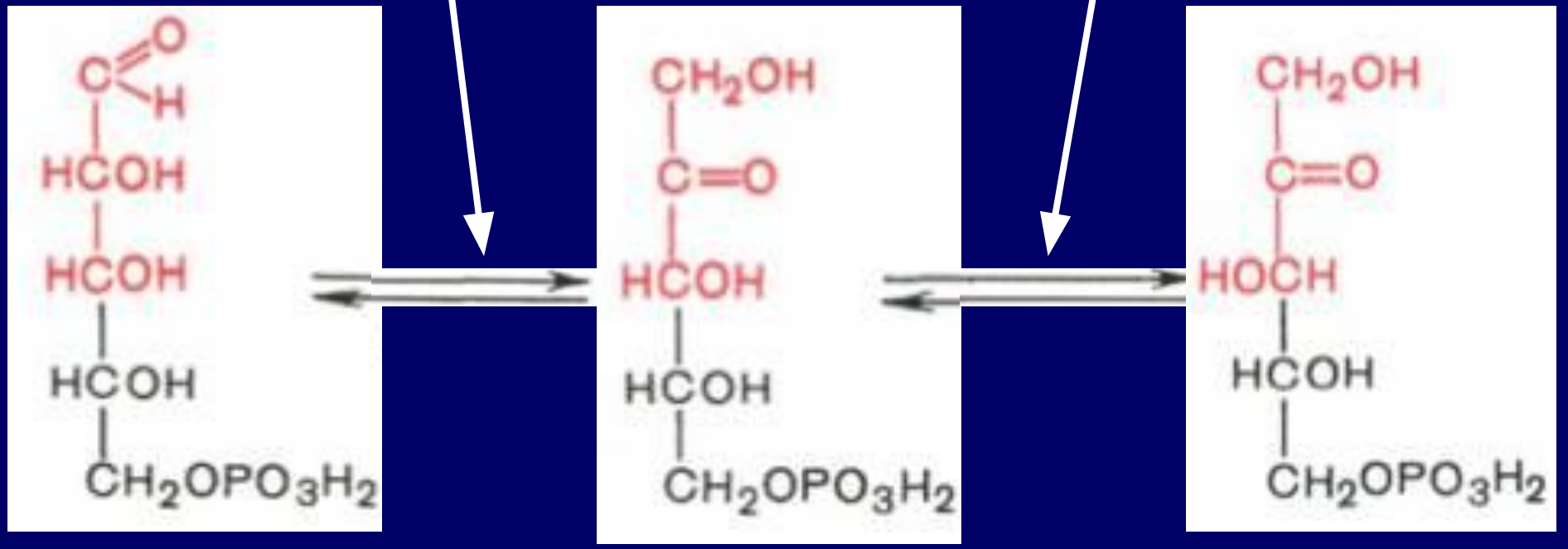


LE 6-PHOSPHOGLUCONATE

LE RIBULOSE-5-PHOSPHATE

L'ISOMERASE

L'EPIMERASE



LE RIBOSE-5-PHOSPHATE

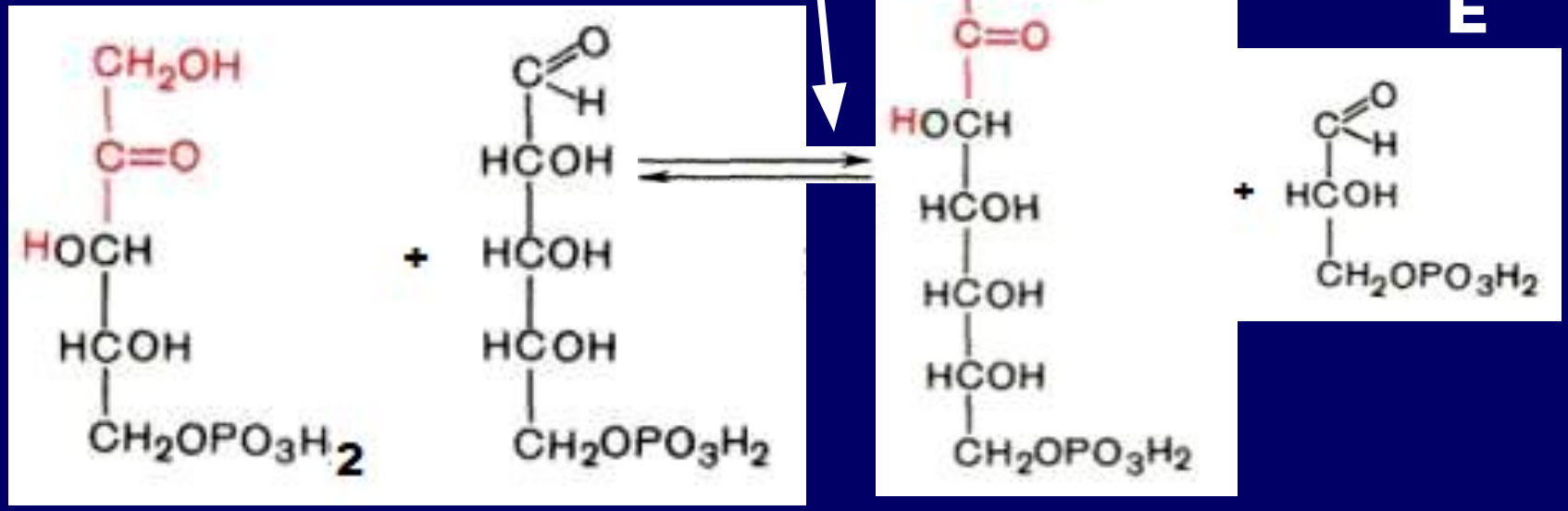
LE RIBULOSE-5-PHOSPHATE

LE XYLULOSE-5-PHOSPHATE

LA VOIE NON OXYDATIVE

LA TRANSCETOLASE

LE GLYCERALDEHYDE-3-PHOSPHATE



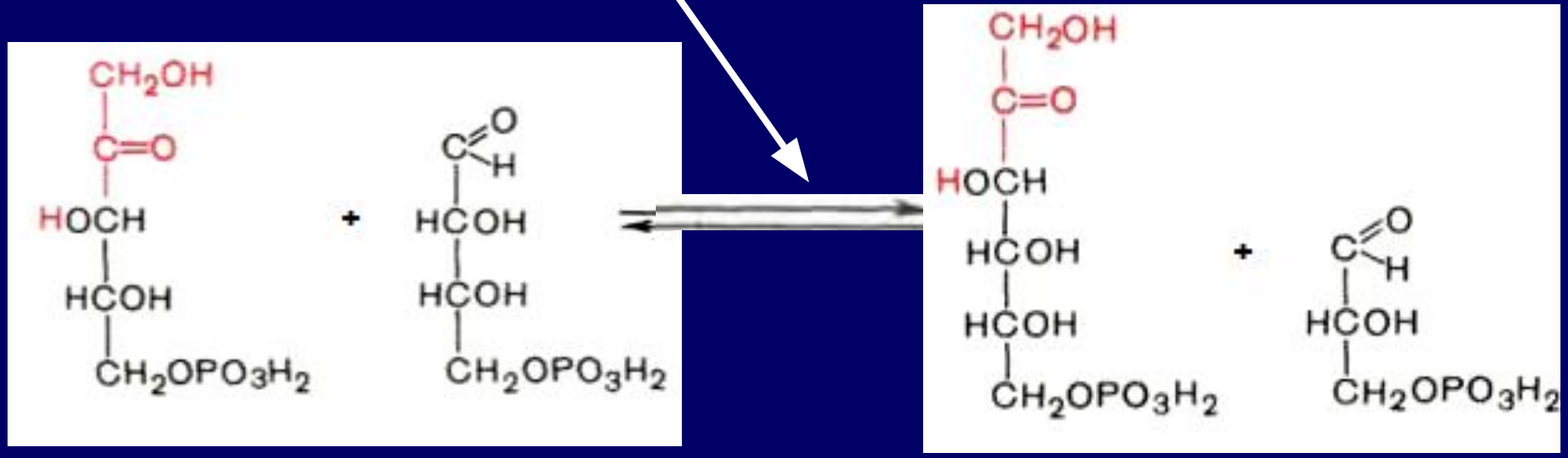
LE XYLULOSE-5-PHOSPHATE

LE RIBOSE-5-PHOSPHATE

LE SEDOHEPTULOSE-7-PHOSPHATE

LA TRANSCETOLASE

LE GLYCERALDEHYDE-3-PHOSPHATE

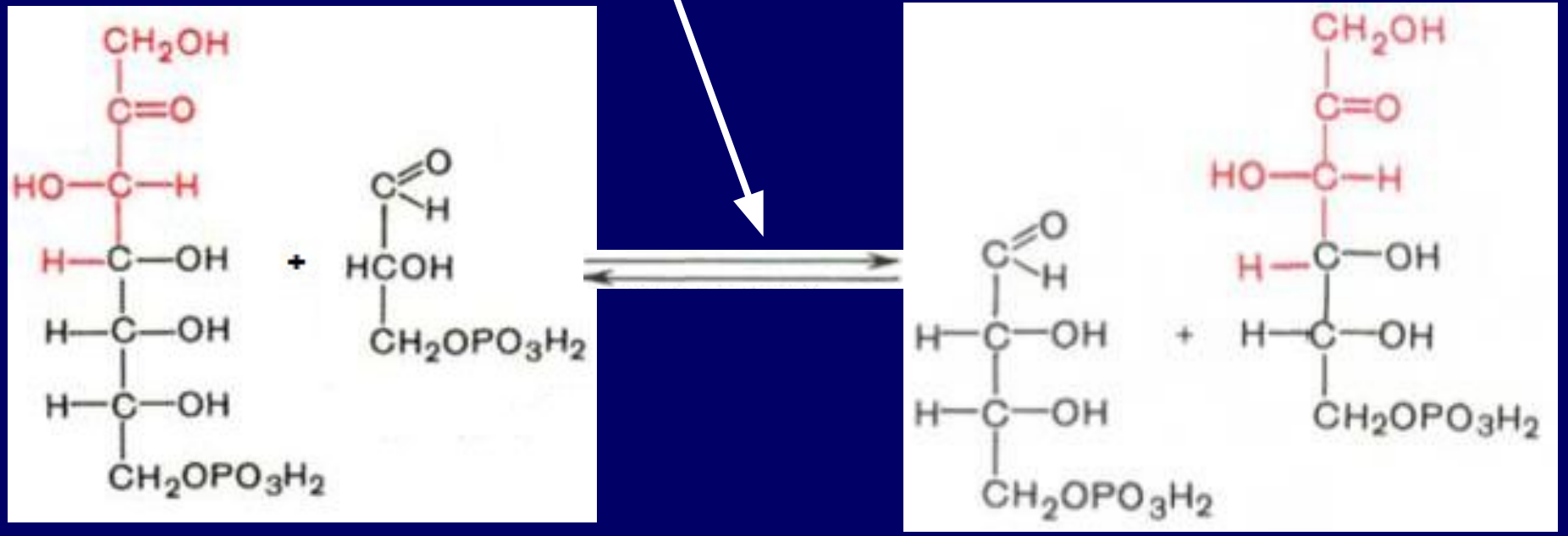


LE XYLULOSE-5-PHOSPHATE

L'ERYTHROSE-4-PHOSPHATE

LE FRUCTOSE-6-PHOSPHATE

LA TRANSALDOLASE



LE SEDOHEPTULOSE-7-PHOSPHATE

LE GLYCERALDEHYDE-3-PHOSPHATE

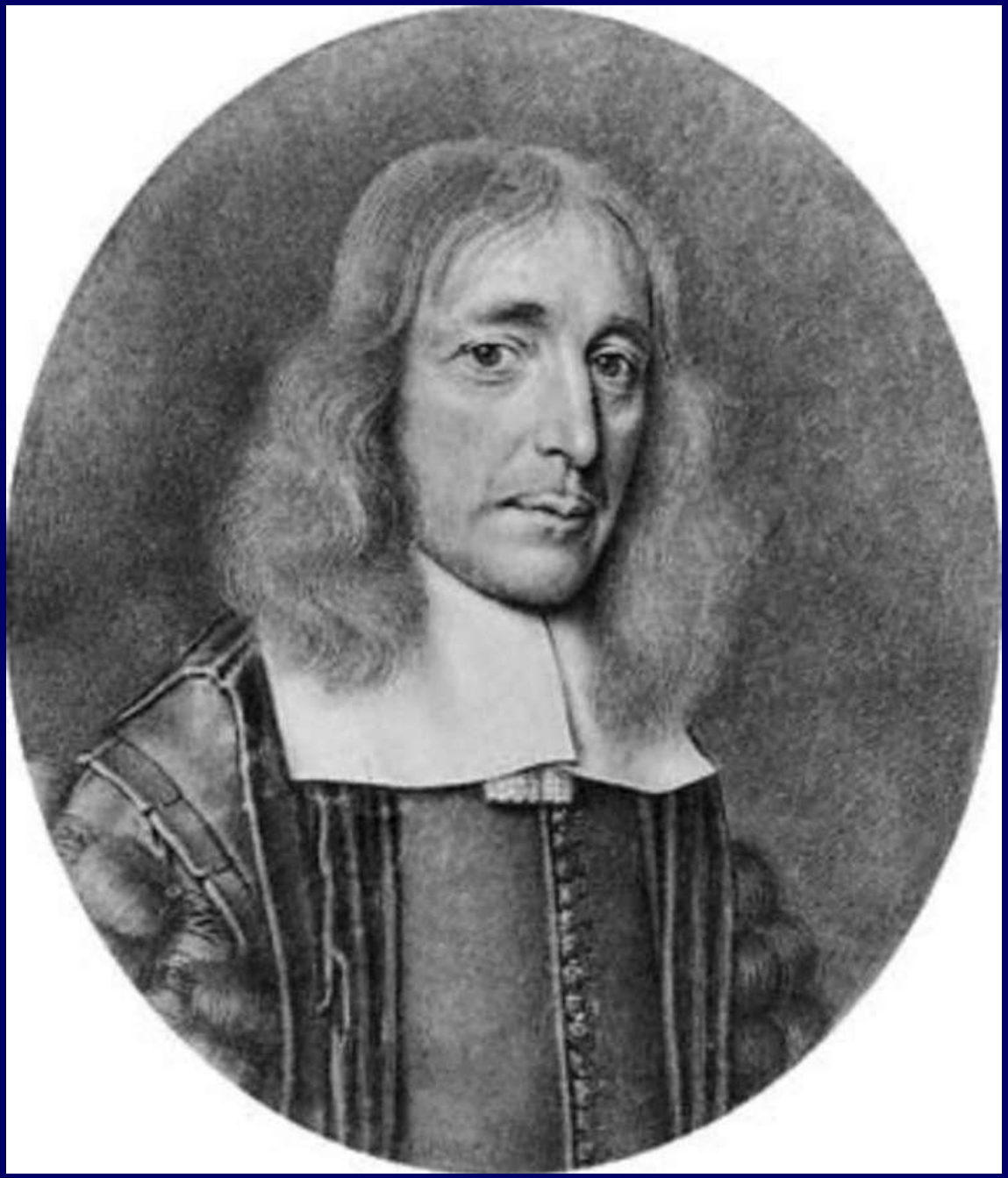
L'ERYTHROSE-4-PHOSPHATE

LE FRUCTOSE-6-PHOSPHATE

$$6\text{Glucose-6-phosphate} + 12NADP^{+} + 6H_2O =$$
$$= 5\text{Glucose-6-phosphate} + 12NADPH + 12H^{+} + 6CO_2$$

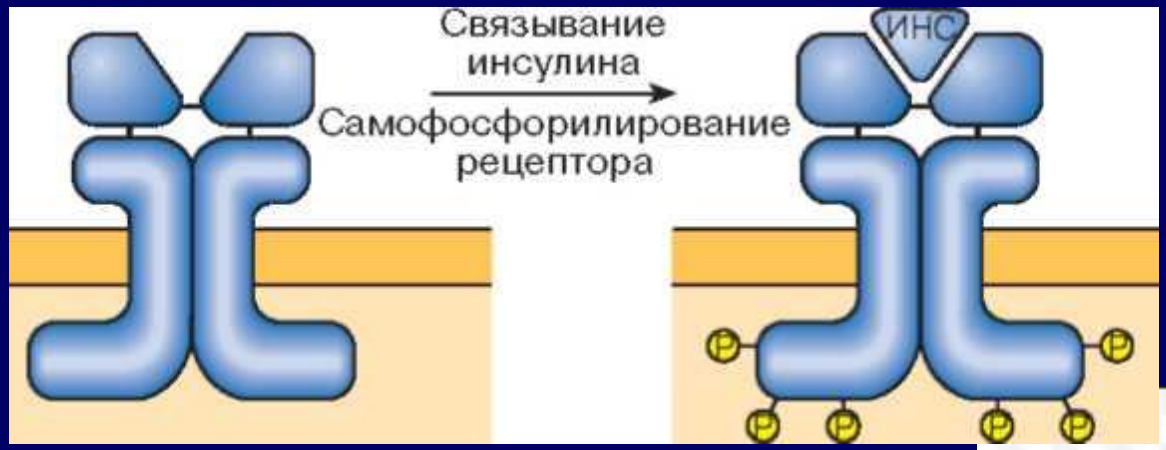

Поджелудочная железа
α-клетки
(глюкагон)
β-клетки
(инсулин)
Кровеносные
сосуды

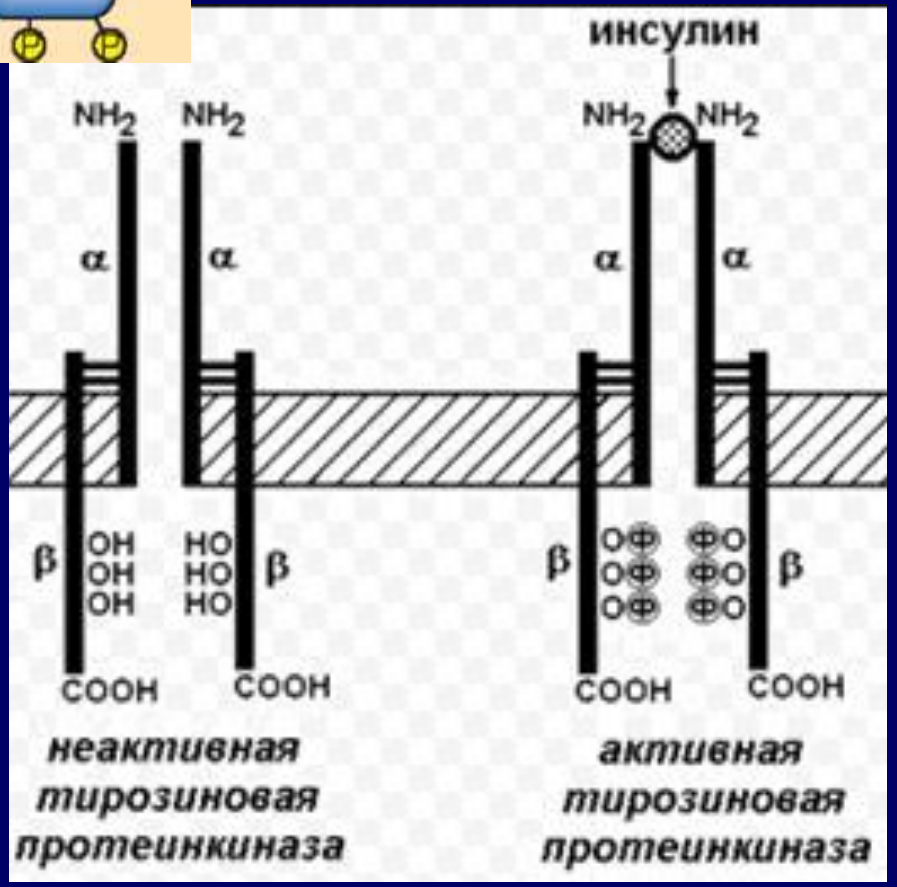
ARETEE DE CAPPADOCE
(II S. a.p. J.C.)

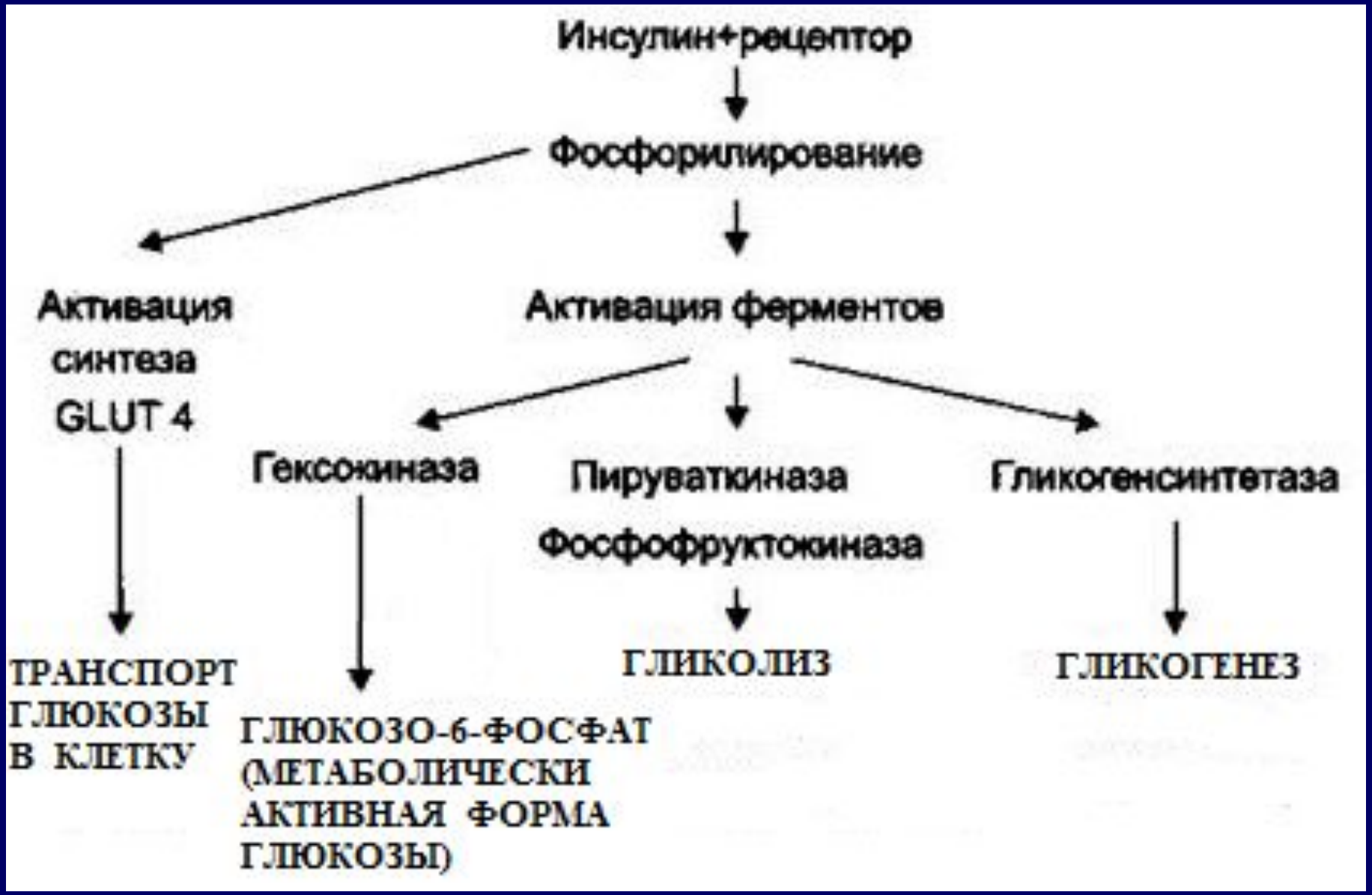


THOMAS WILLIS (XVII S.)

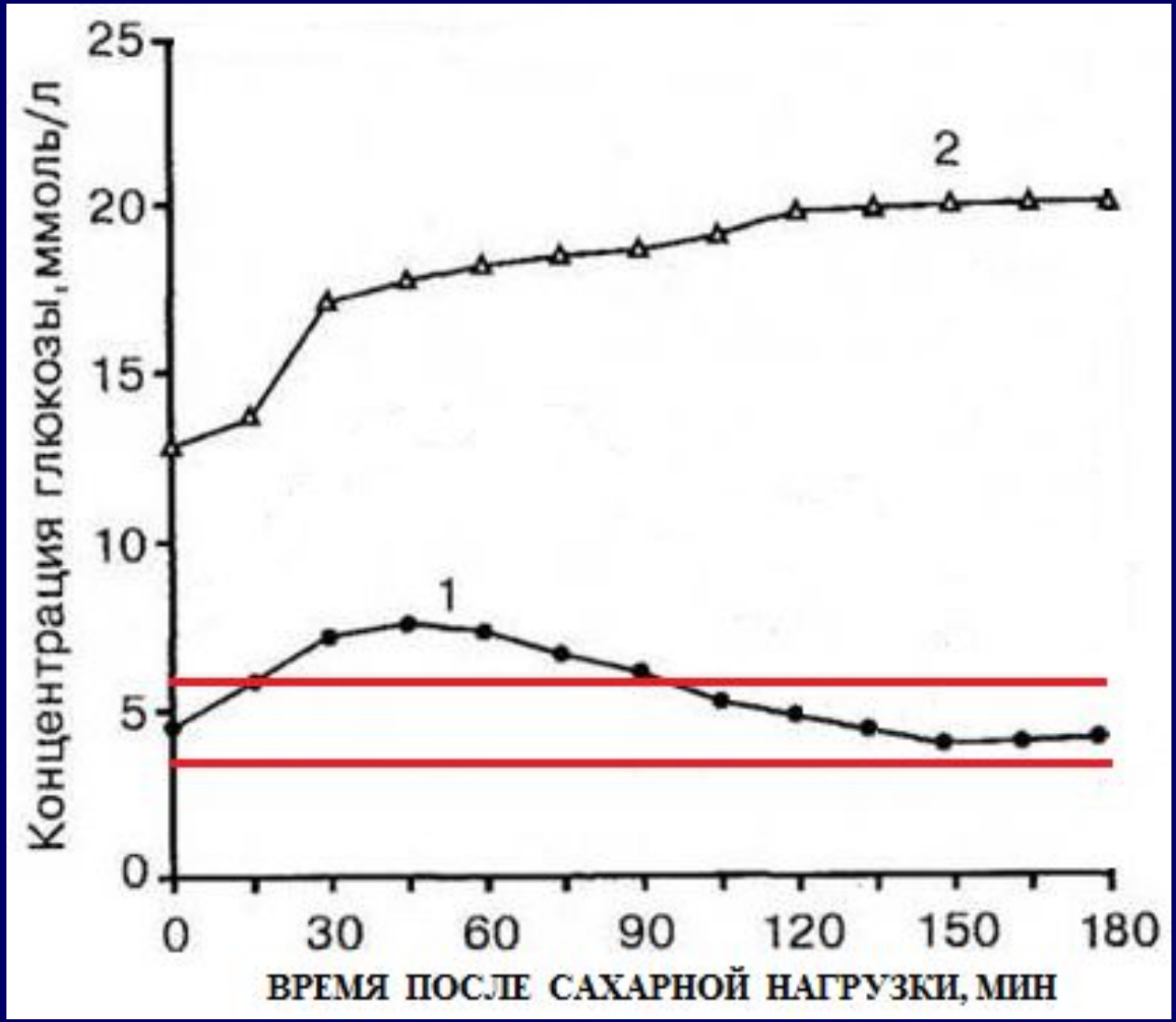
LE RECEPTEUR DE L'INSULINE



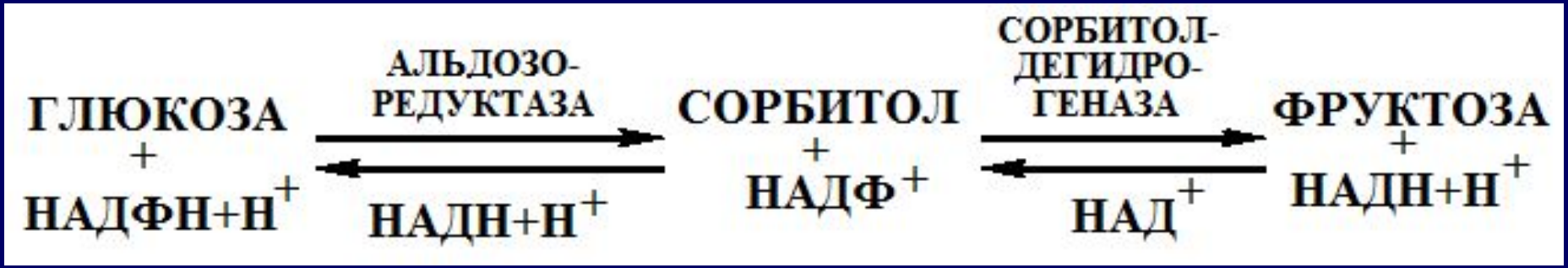



Инсулин+рецептор
Фосфорилирование
Активация синтеза GLUT 4
Активация ферментов
Гексокиназа
Пируваткиназа
Фосфофруктокиназа
Гликогенсинтетаза
ТРАНСПОРТ ГЛЮКОЗЫ В КЛЕТКУ
ГЛЮКОЗО-6-ФОСФАТ (МЕТАБОЛИЧЕСКИ АКТИВНАЯ ФОРМА ГЛЮКОЗЫ)
ГЛИКОЛИЗ
ГЛИКОГЕНЕЗ

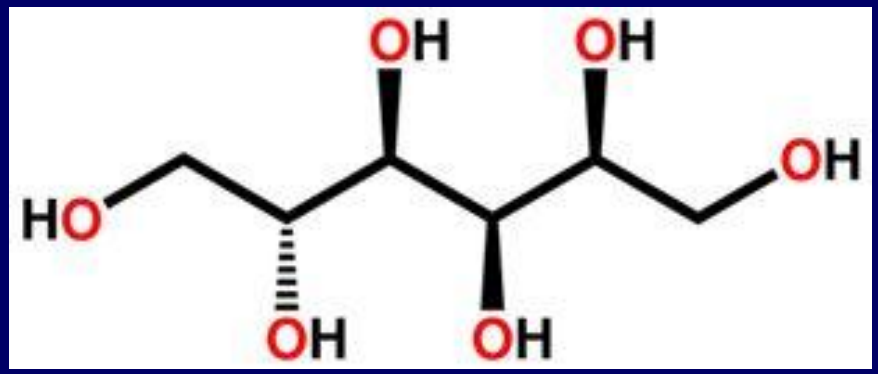
LA COURBE GLYCEMIQUE EN ETAT NORMAL (1) ET LORS DU DIABETE SUCRE (2)

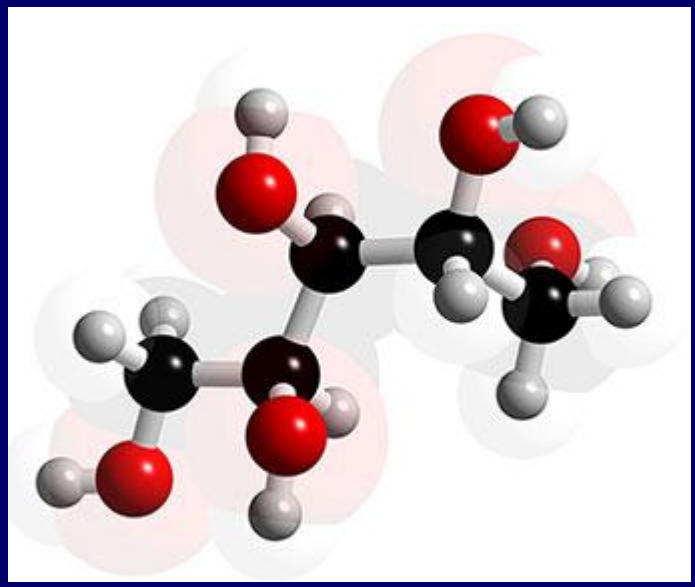


LE SHUNT DE SORBITOL



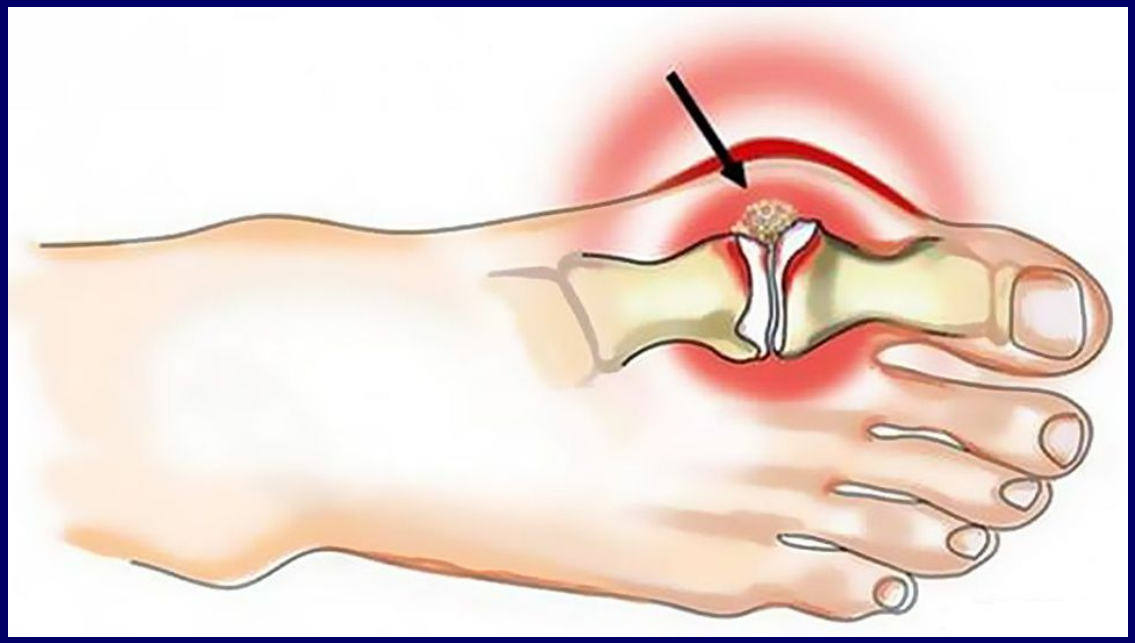
LE SORBITOL



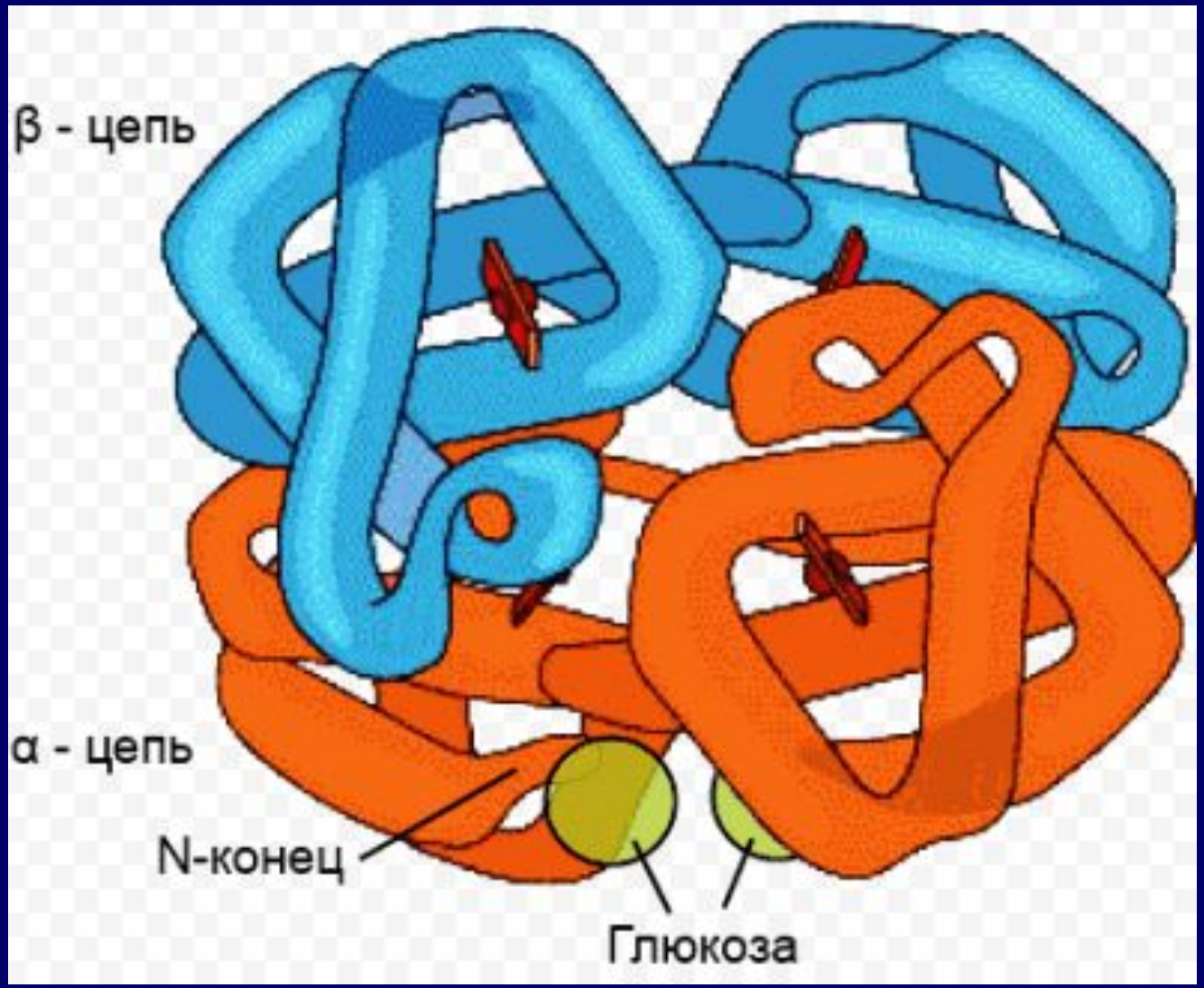


LA NEUROPATHIE DIABETIQUE

L’ARTHROPATHIE DIABETIQUE



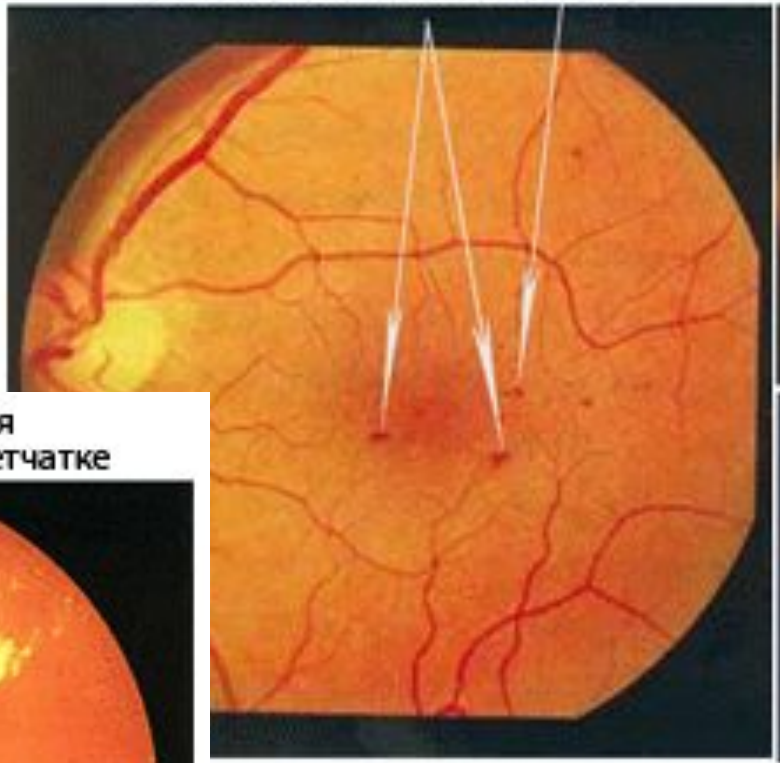
L’HEMOGLOBINE GLYQUEE (HbA1C)

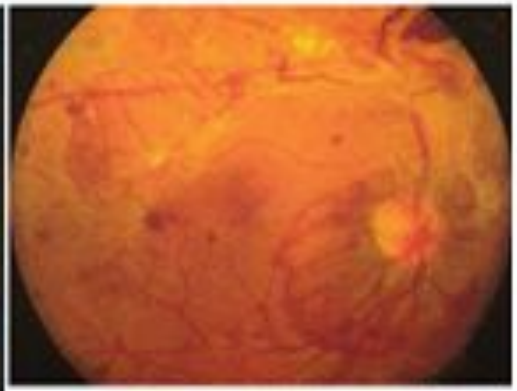


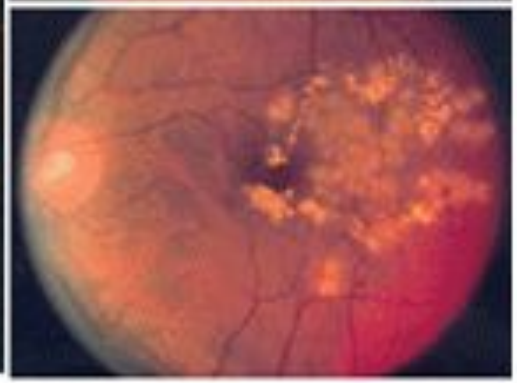
HBA1C (%)	Средний уровень глюкозы крови (mmol/L)
4	2,6
5	4,5
6	6,7
7	8,3
8	10,0
9	11,6
10	13,3
11	15,0
12	16,7

LA RETINOPATHIE DIABETIQUE

кровоизлияние в сетчатке







атрофия зрительных клеток сетчатки

патология разрастания соединительной ткани на сетчатке