Regulation of the Glycolytic Pathway

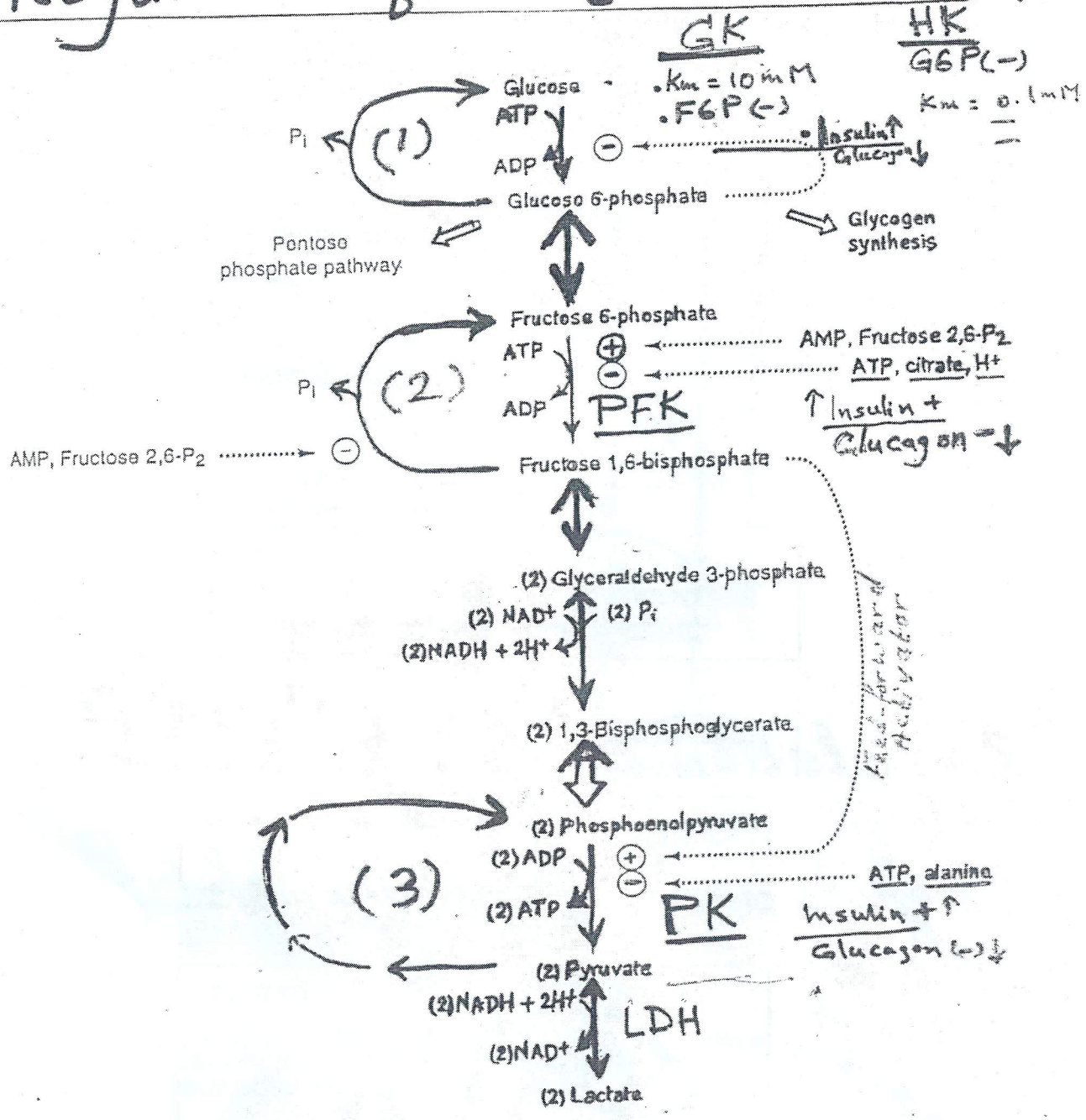
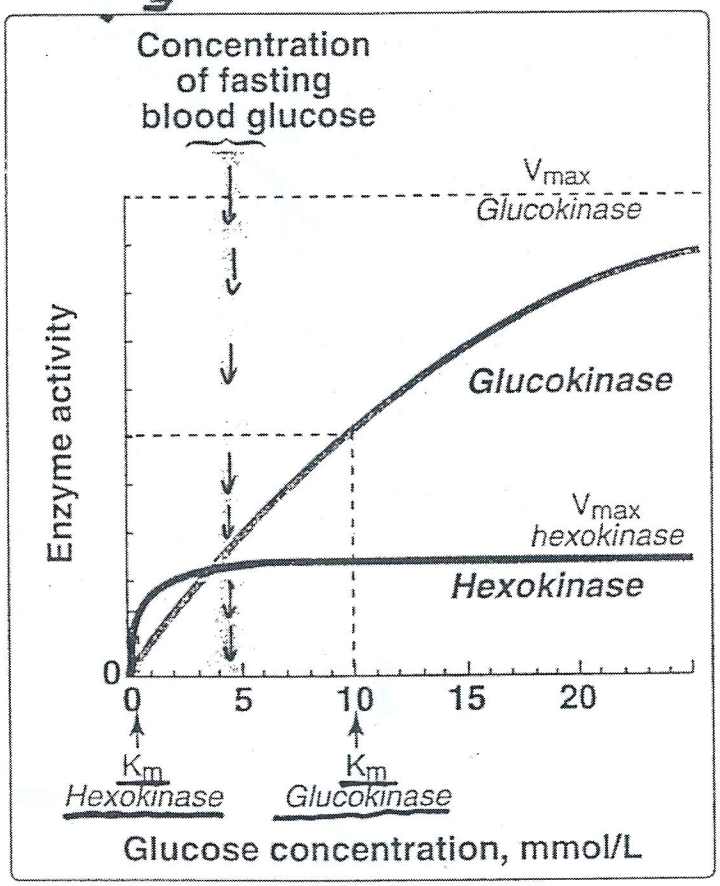


FIGURE 7.13
Important regulatory features of the glycolytic pathway.
Because of differences in isoenzyme distribution, not all tissues of the body have all of the regulatory mechanisms shown here.

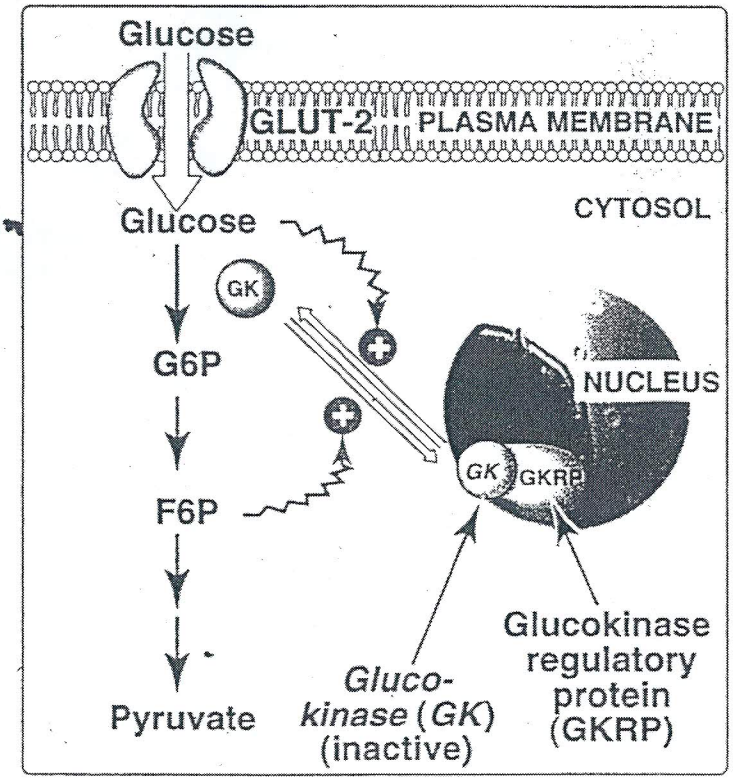
Effect of [Glucose] on HK and GK



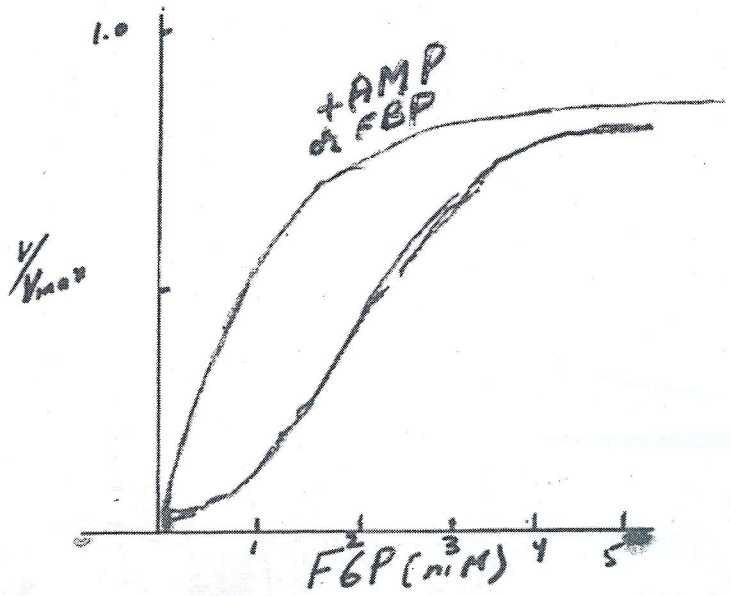
Regulation of GK by "GKRP

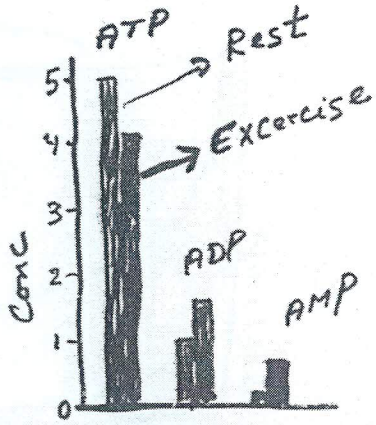
2)

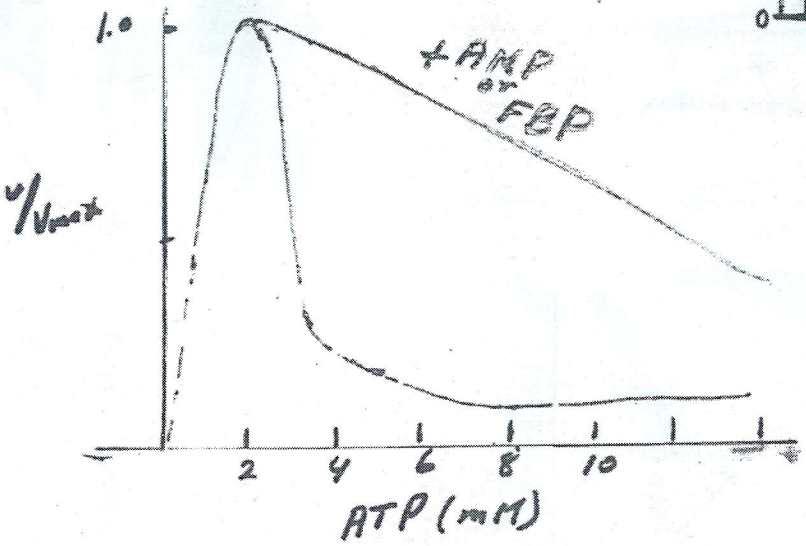
Insulin → ↑ GK transcription



Regulation of PFK by AMP and ATP

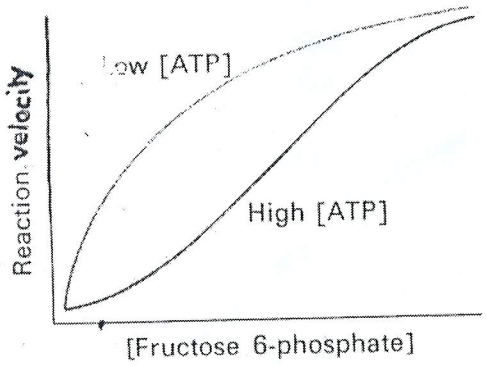


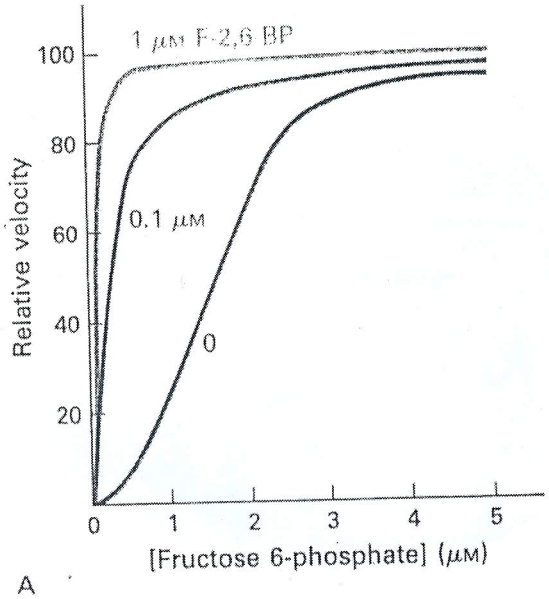


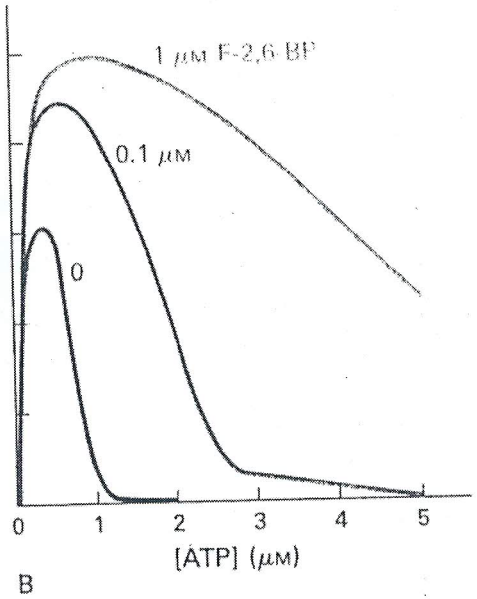


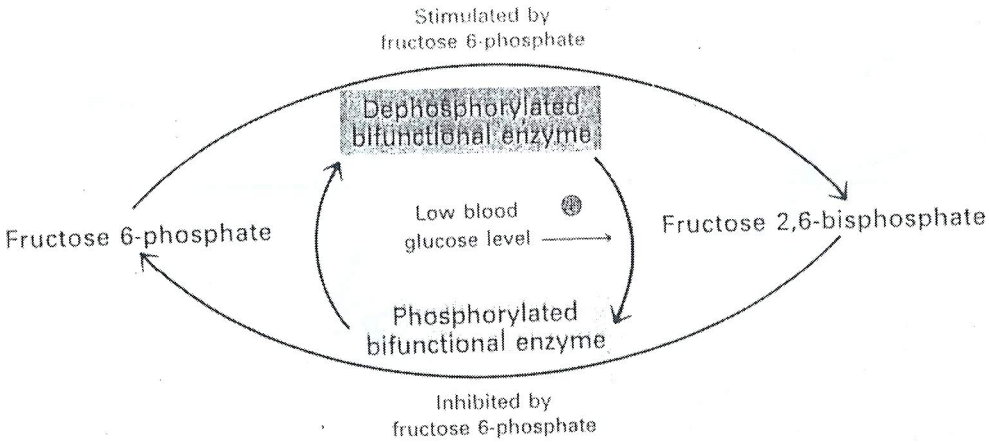
$$F6P + ATP \xrightarrow[PFK]{} F1,6BP + ADP$$

Regulation of PFK







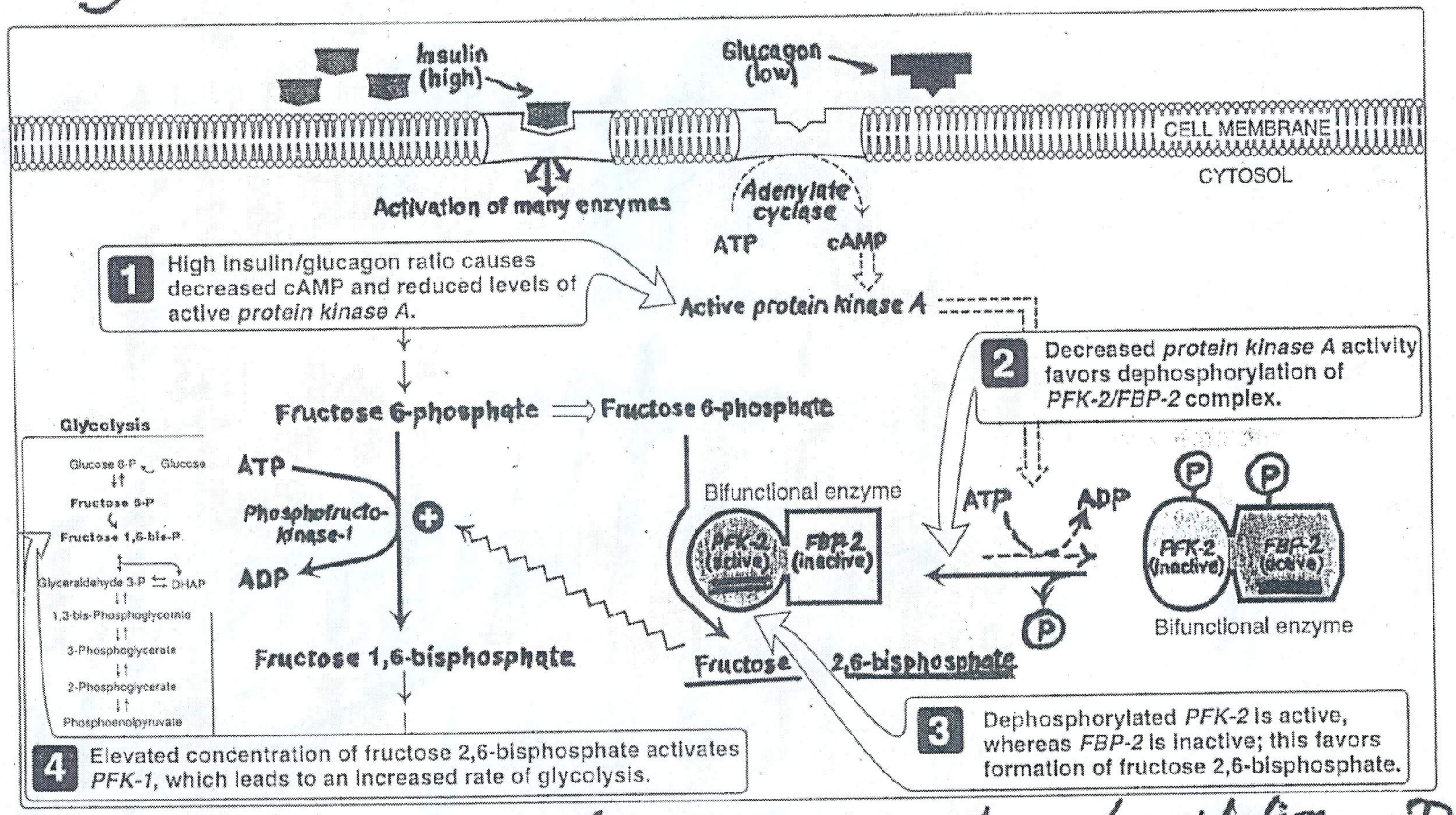


T-57

Figure 19-6, page 493; Figure 19-7, page 494; Figure 19-8, page 495

Set I

Regulation of Fru-2,6-BP Level



Regulation of PK by phosphorylation – Dephosph

Distribution of Glucose:

free glucose in E.C.F. = 20 gr ≡ 80 K.

" as glycogen in liver = ~ 75 gr

" " " " muscle = ~ 400 gr

- liver glycogen maintain blood glucose ⇝ 16 h
- Brain use ~ 120 gr of glucose / day
- 70 kg man has ~ 15 Kg fat ≡ 130,000 Kcal

  " supply energy ⟶ 60 - 90 days

- Conc of ATP in muscle ~ 5 mM

  " " Creatine phosphate (CP) " ~ 20 mM

  Upon vigorous excercise

  ATP ⟶ 2 to 4 sec

  CP ⟶ 20 sec

- Post absorptive resting muscle or with moderate excercise ⟶ F.A. main source

  80% of glucose is utilized by brain & rbc

- During prolonged fasting, utilization of F.A. by all tissues (except brain & rbc) is increased 4 to 5 times & ketone bodies by more than 100-times

GLUCONEOGENESIS

- Glucose Synthesis is Required for Survival

- Pathways of Gluconeogenesis

(2) Lactate → (2) Pyruvate ← Amino acids

↓

Amino acids → (2) Oxaloacetate ← (2) Propionate

↓

(2) Glycerol → (2) Triosephosphates ← Fructose

↓

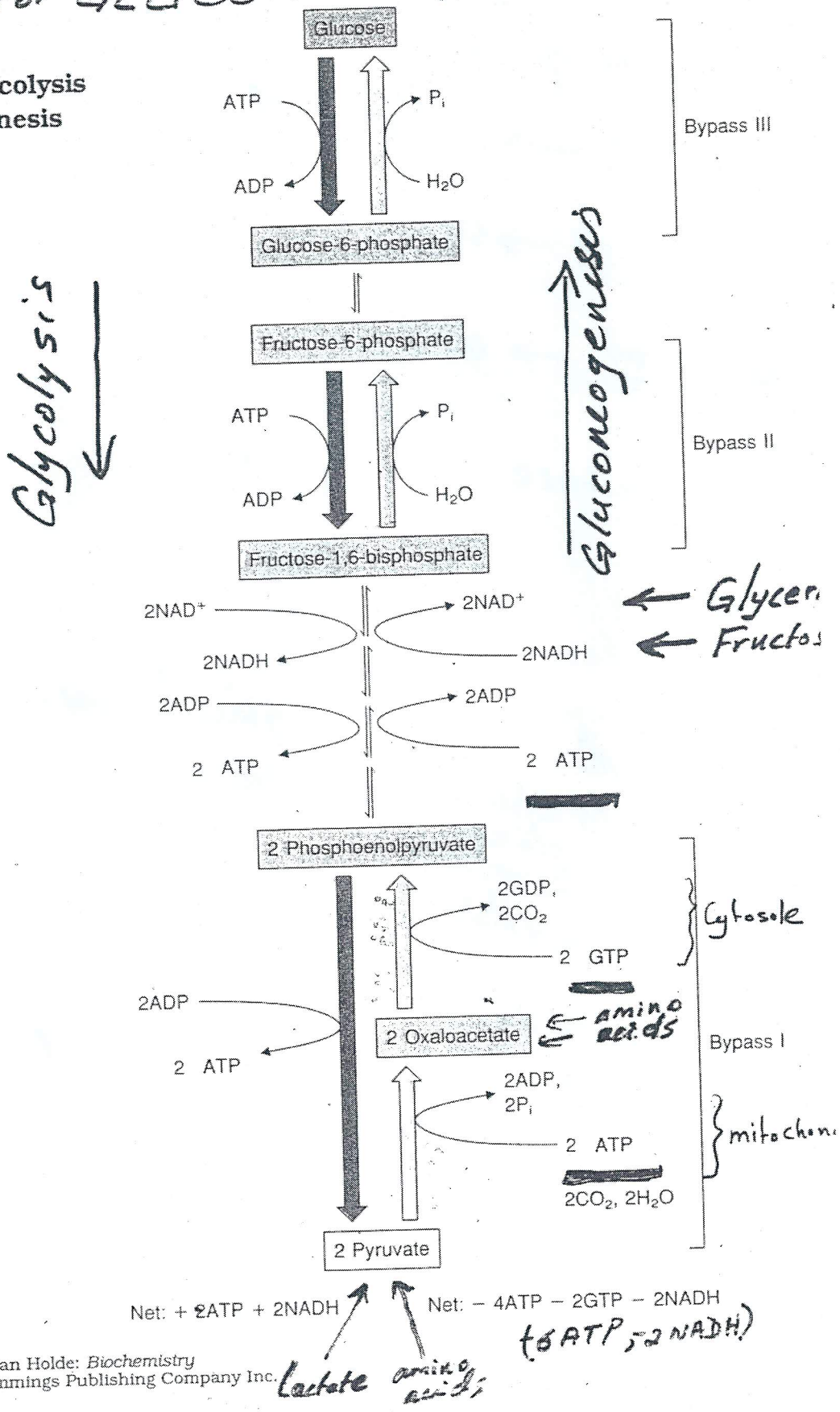
Galactose → Glucose

	Liver Gluconeogenesis	Peripheral Tissues
ex. exercise (muscle) Tissues that do not oxidize Glucose Completely → $CO_2 + H_2O$ (e.g. rbc)	→ Lactate	⇒ Glucose
(muscle) A.A.	→ Alanine	
(A.T.)	→ Glycerol	

ENERGY For GLUCONEOGENESIS

Reactions of glycolysis and gluconeogenesis

Figure 16.3



Key Reactions of Gluconeogenesis

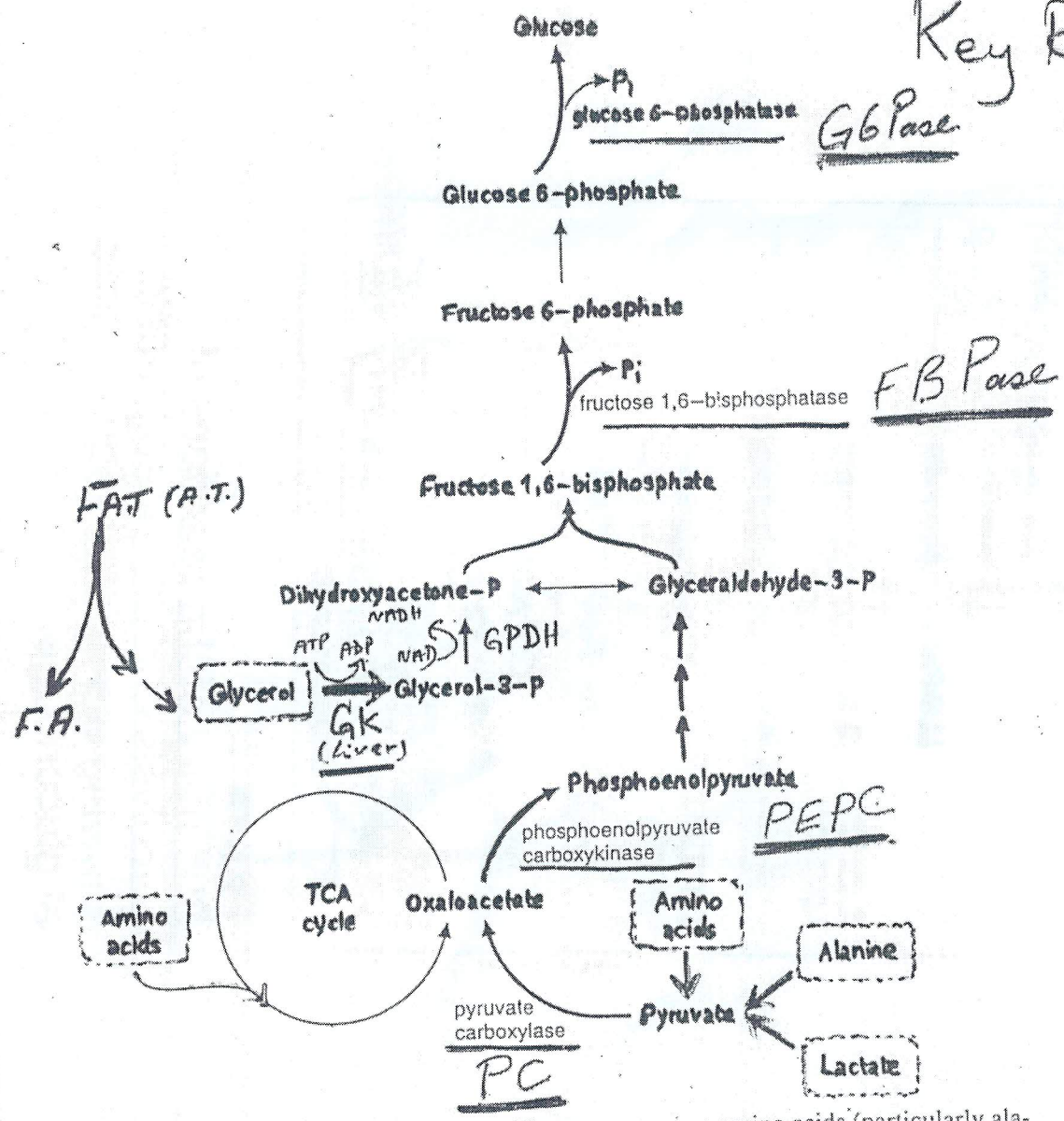


Fig. 27.6. Key reactions of gluconeogenesis. The precursors are amino acids (particularly alanine), lactate, and glycerol. Heavy arrows indicate steps that differ from those of glycolysis.

9

Energy Requirements of Gluconeogenesis

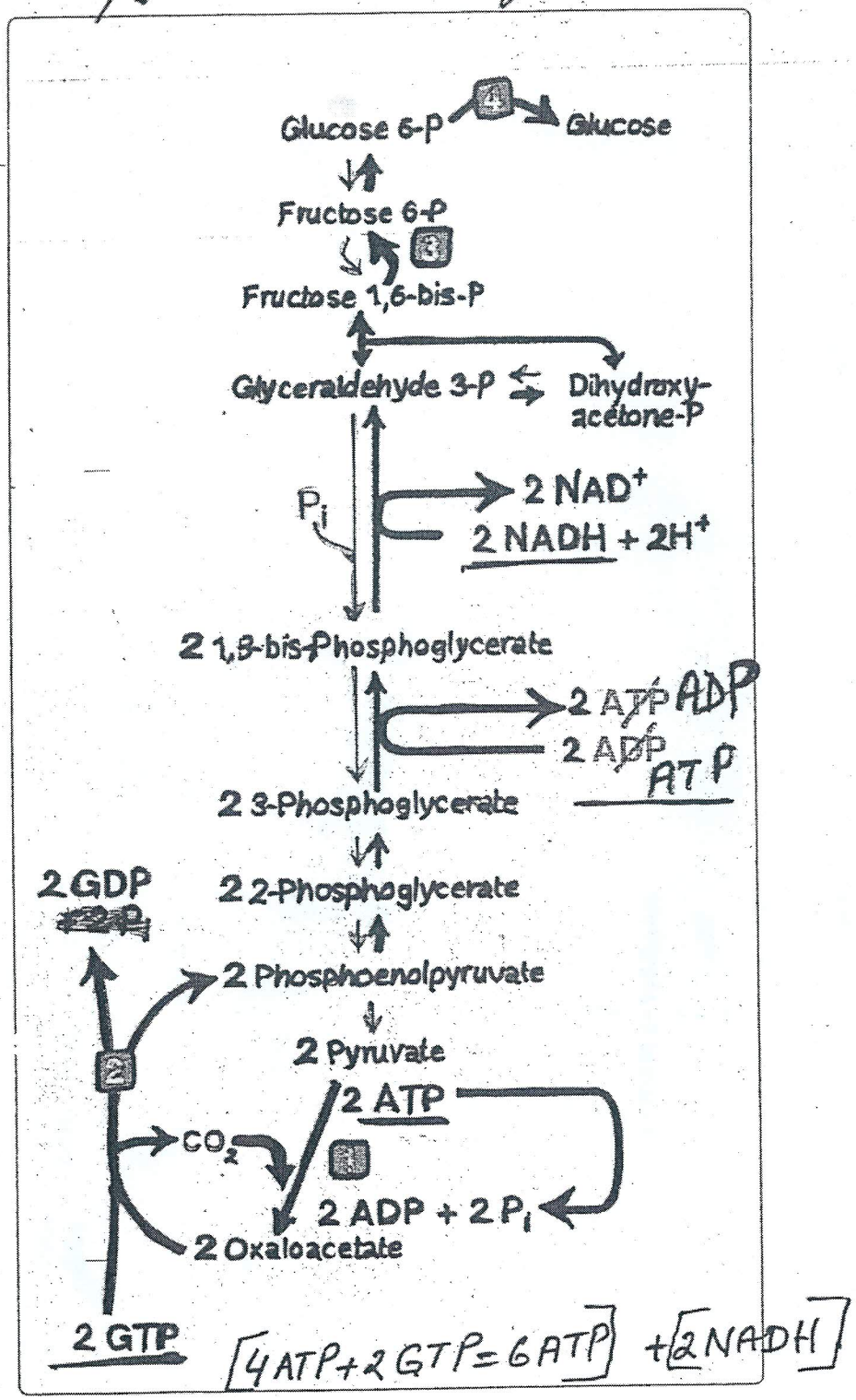


Figure 10.7
Summary of the reactions of glycolysis and gluconeogenesis, showing the energy requirements of gluconeogenesis.

Regulation of Gluconeogenesis and Glycolysis

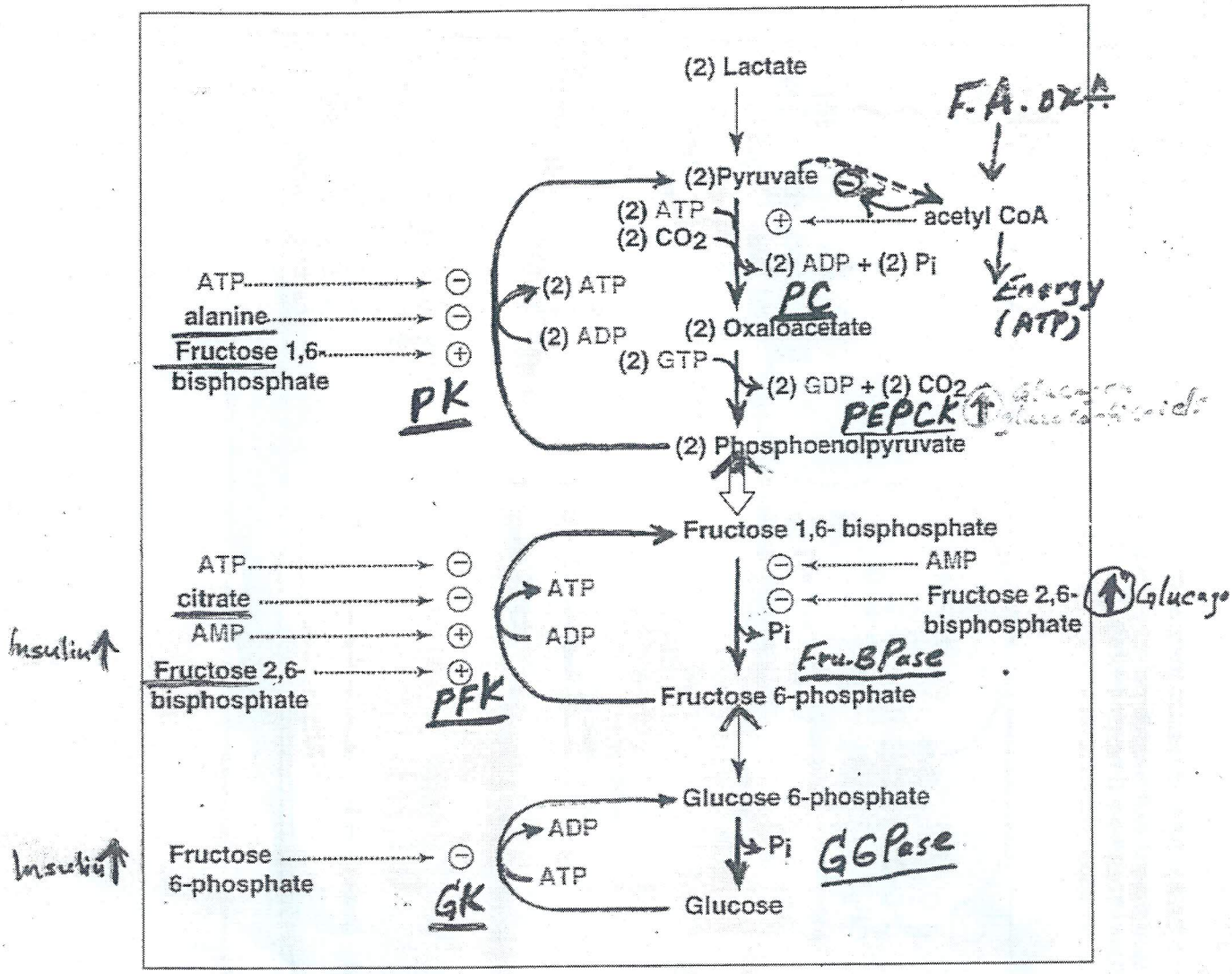
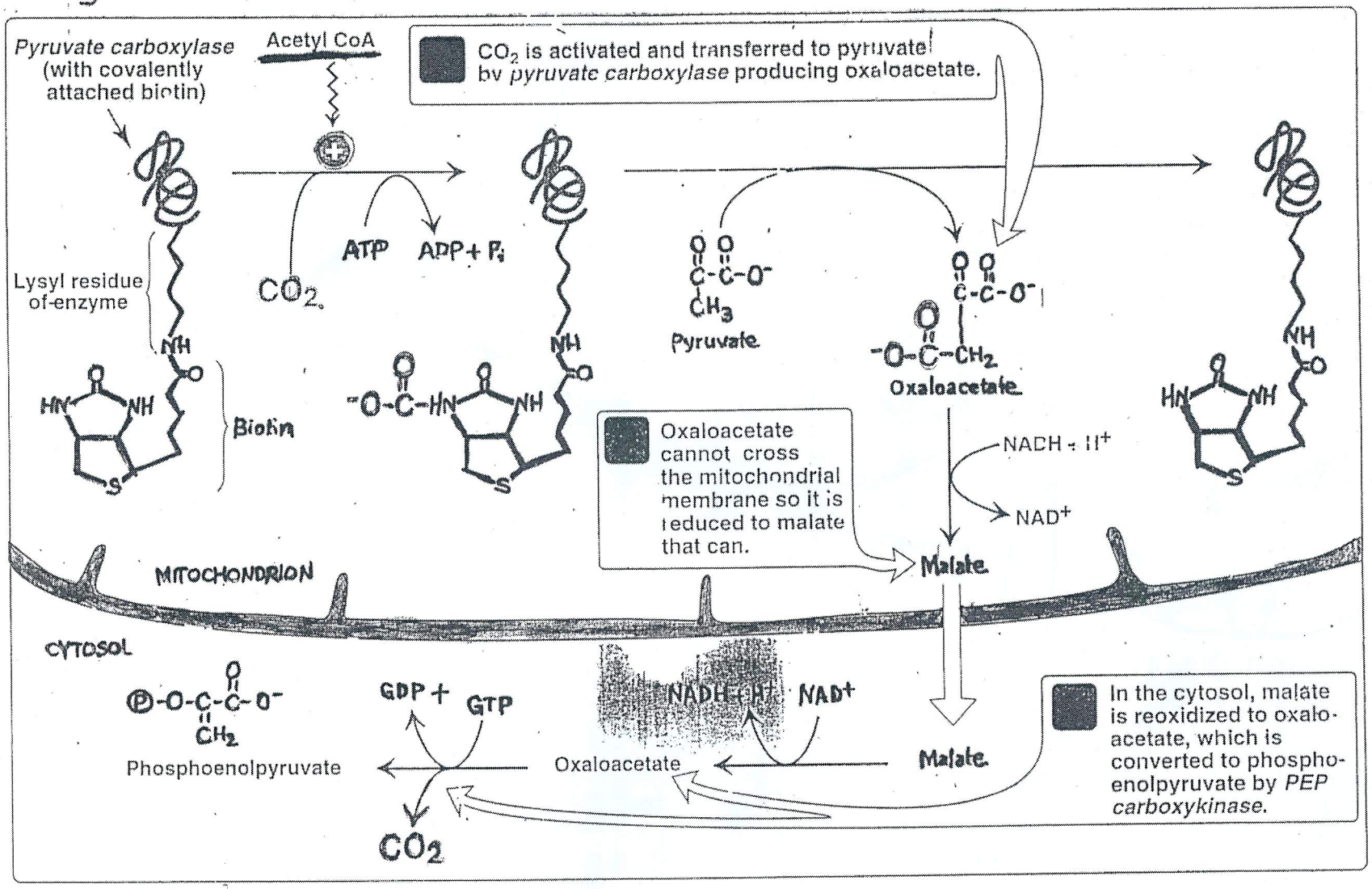
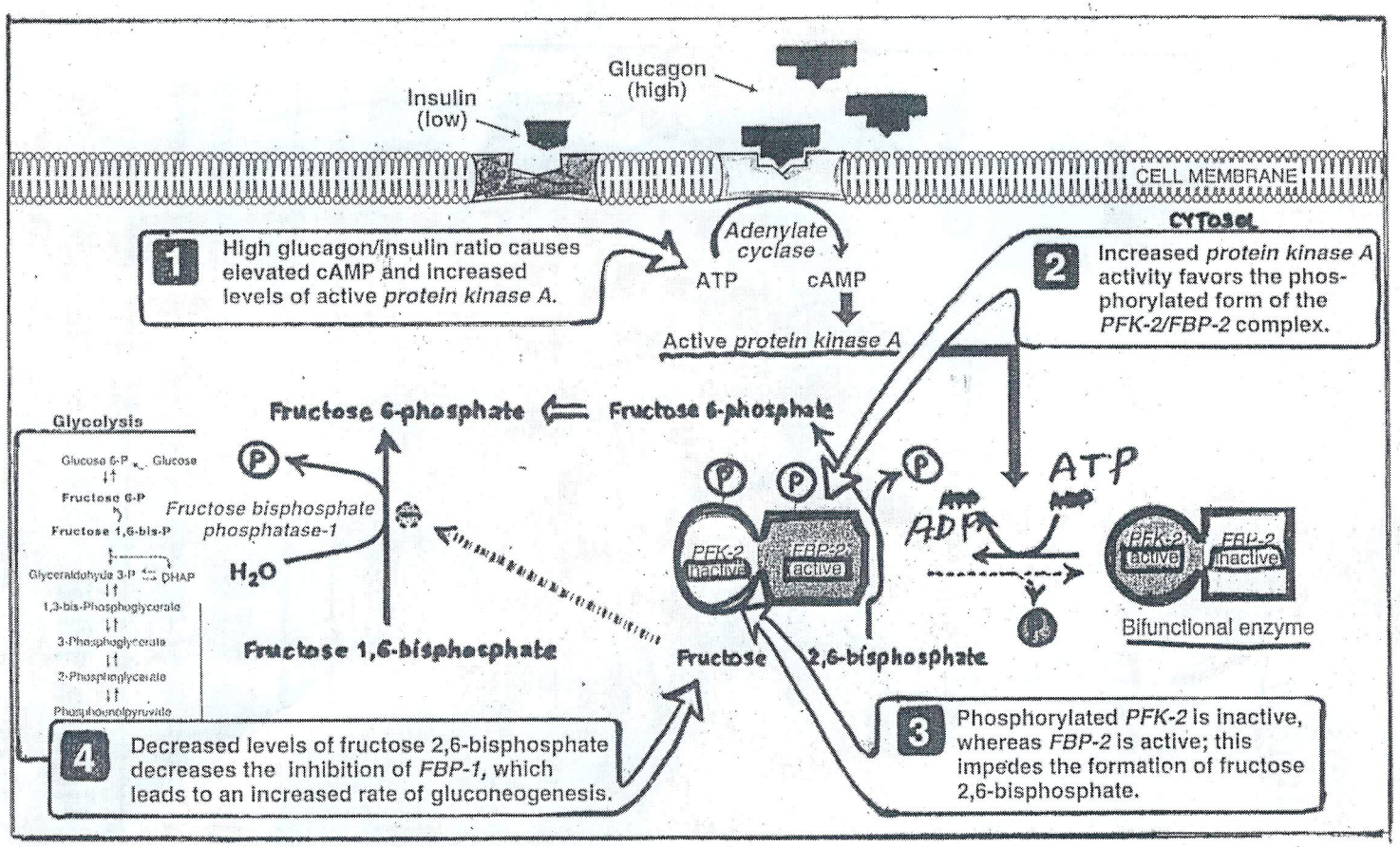


Figure: 07_45
Important allosteric regulatory features of the gluconeogenic pathway.

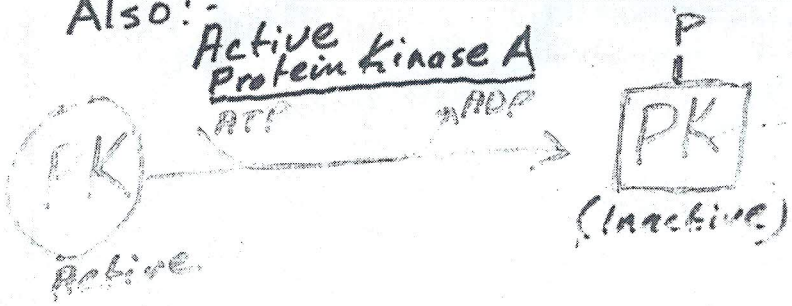
Pyruvate Carboxylase :-



Deinhibition of fru-1,6-bisphatase



Also:- Active Protein Kinase A



Net results:

- Inhibition of glycolysis PFK↓ PK↓
- Removal of inhibition of (Deinhibition) gluconeogenesis F-2,6-BPase↑

(3)

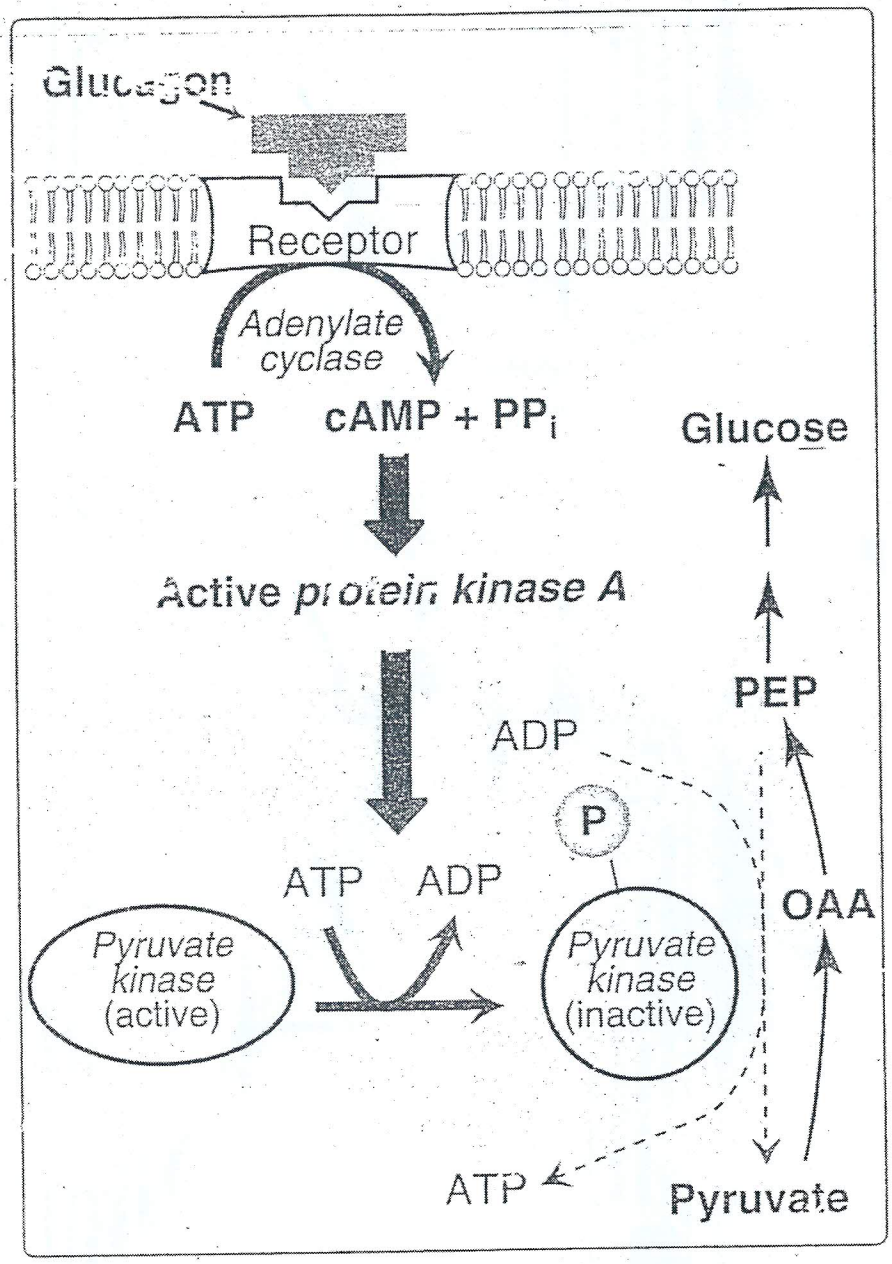


Figure 10.8
Covalent modification of *pyruvate kinase* results in inactivation of the enzyme. OAA = oxaloacetate.

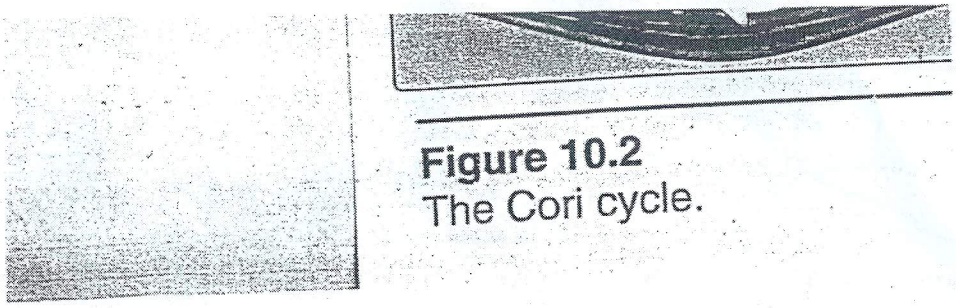
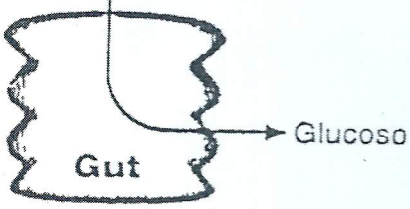


Figure 10.2
The Cori cycle.

Maintenance of Blood Glucose

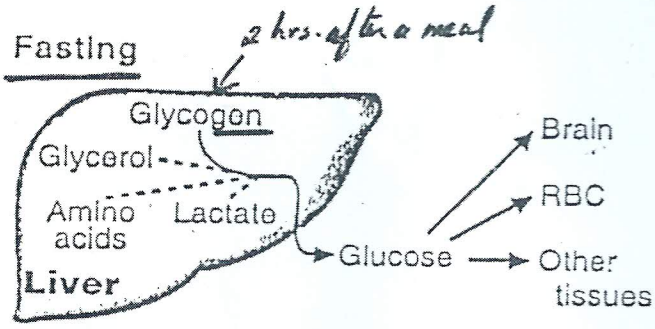
Sources of Blood Glucose:-

Fed



Glycogen Breakdown (mainly) + gluconeogenesis

Fasting



Starved

Gluconeogenesis (mainly)