Systemic effects of glucose load

- After meal the liver extract most of glucose coming from the portal plasma , some glucose pass the liver and cause an increasing in systemic concentration this will stimulate B-cells of pancreas to secrete insulin.
- Insulin will enhance hepatic and muscle glycogenesis and stimulate entry of glucose into adipose tissue and muscle cells so the systemic glucose concentration falls to near the fasting levels .
- In adipose tissue and muscle conversion of glucose to G6P is catalyzed by hexokinase which is of a higher affinity to glucose than hepatic glucokinase so it needs lower glucose concentration . high insulin level after meal inhibit lipolysis and proteolysis

- In the adipose tissue and Muscles

Glucose ---------- Hexokinase----------→ G6P

In the Liver

Glucose------Glucokinase----------→ glucose 6 phosphate (G6P).

Glucokinase is of low affinity for glucose, and it induced by insulin .

Hypoglycemia

- By definition hypoglycemia is present if plasma glucose concentration is less than 45 mg/dl , symptom of hypoglycemia may develop at higher concentration if there has been a rapid fall of previously high concentration → adrenalin secretion cause sweating , tachycardia and agitation .

symptom of hypoglycemia may resembles those of cerebral hypoxia ,faintness , dizziness or lethargy progress to coma ,if not treated may cause permanent cerebral damage or death .

Hypoglycemia in adults is of tow types :-

1-fasting hypoglycemia usually occurs at night or early morning , the principle causes in adult are :-

a-inappropriately high insulin concentration due to pancreatic tumor (insulinoma), or pancreatic islet hyperplasia .

b- Glucocorticoid deficiency(pituitary or adrenal gland insufficiency) .

c-Sever liver disease .

d-Some non pancreatic tumors (insulin like growth factor).

e-hypoglycemia may due to prolong fasting ,when glycogen stores are depleted .

2- non fasting hypoglycemia , typically occurs 5 to 6 hours after meal , it provoked by :-

a. Drugs like insulin or sulphonylureas .
b. Alcohols .
c. Glucose (reactive hypoglycemia) occurs 2 to 4 hours after meal or glucose load . similar symptoms may follow gastrectomy (dumping syndrome) .

Hypoglycemia in infants and children

- Hypoglycemia is not uncommon in infancy , it may cause permanent brain damage especially in the first months of life .
- there may be no clear signs of hypoglycemia even if plasma glucose concentration below 30 mg/dl in the first 72 hours of life and below 40 mg/dl in early neonatal period , and even below 20 mg/dl in very premature infant.

It is recommended that the plasma glucose concentration should be maintained above 40 mg/dl. If clinical signs of hypoglycemia appears (convulsion ,tremors ,attacks of apnea with cyanosis) urgent treatment is needed .

Causes of hypoglycemia in infant and children

- Neonatal period

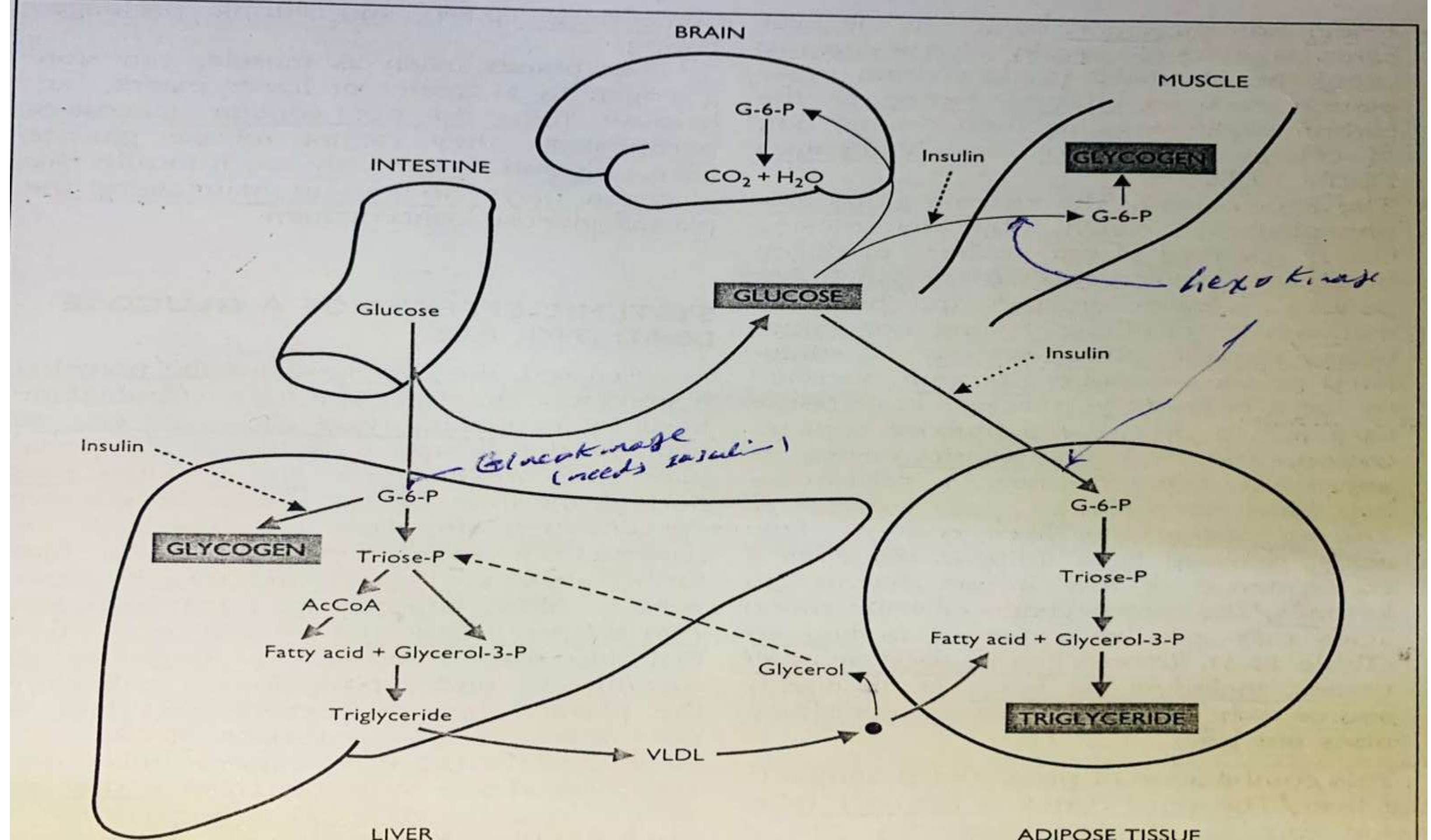
1 -Small for date infant .
2--Hypoxia at birth .
3--infant of diabetic mother, fetal islet-cells hyperplasia which occur because of maternal hyperglycemia →hyperinsulinism .
4--erythroblastosis fetalis (hemolytic anemia of fetus because of mother fetus blood incompatibility)

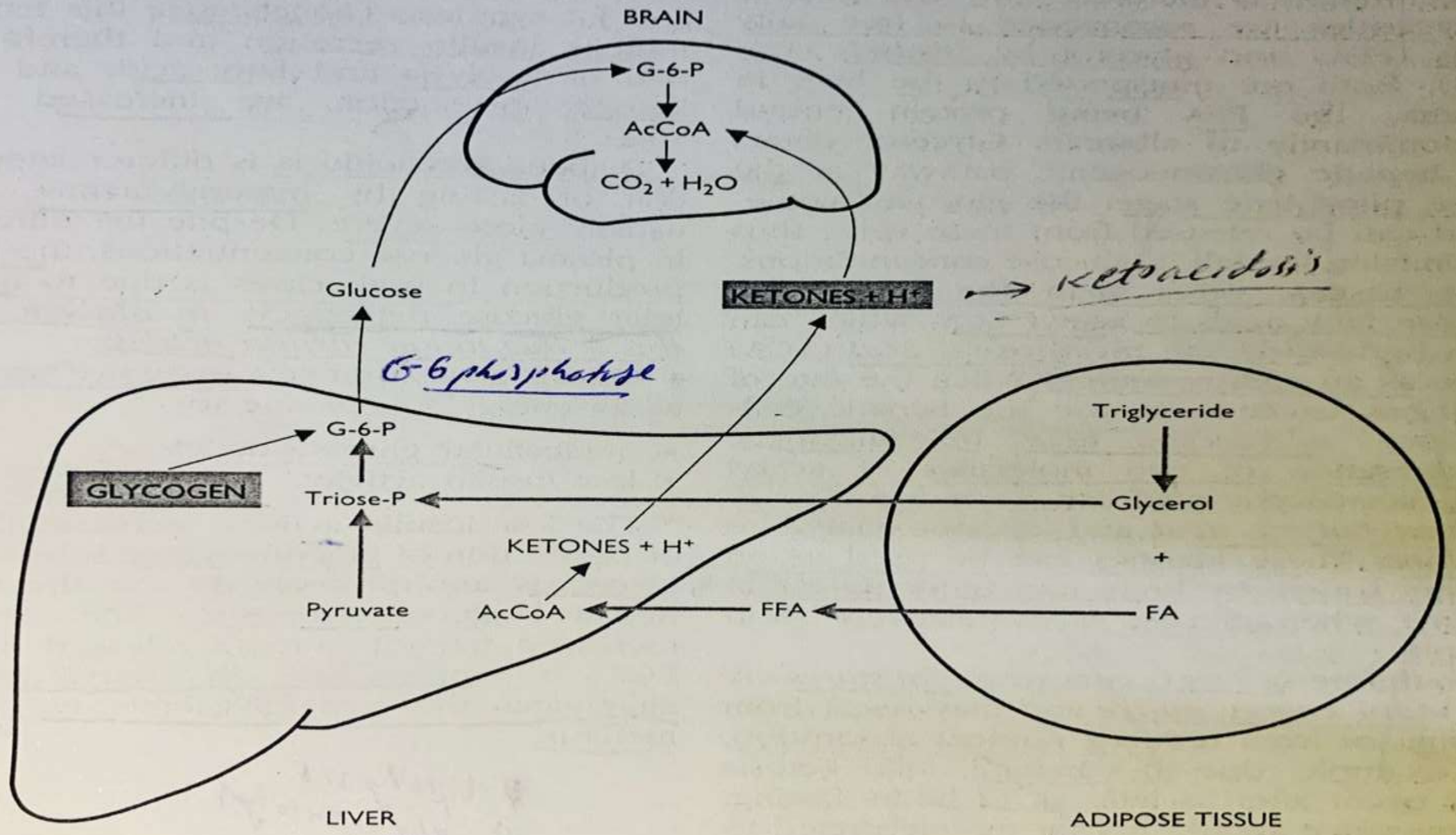
- Early infancy

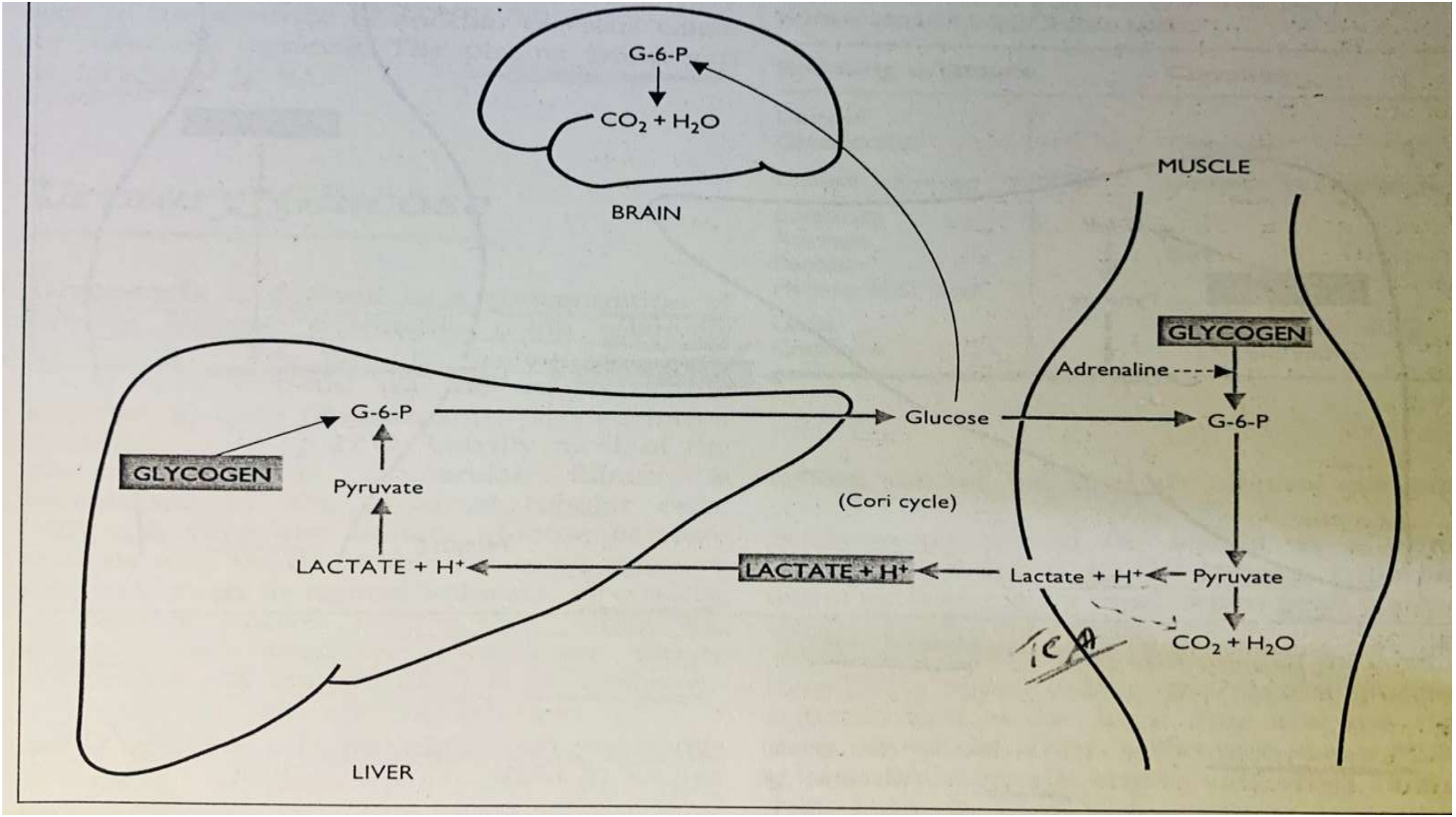
1 - hypopituitarism .
2 - adrenal insufficiency .
3 - inborn error of metabolism (glycogen storage disease and hereditary fructose intolerance)

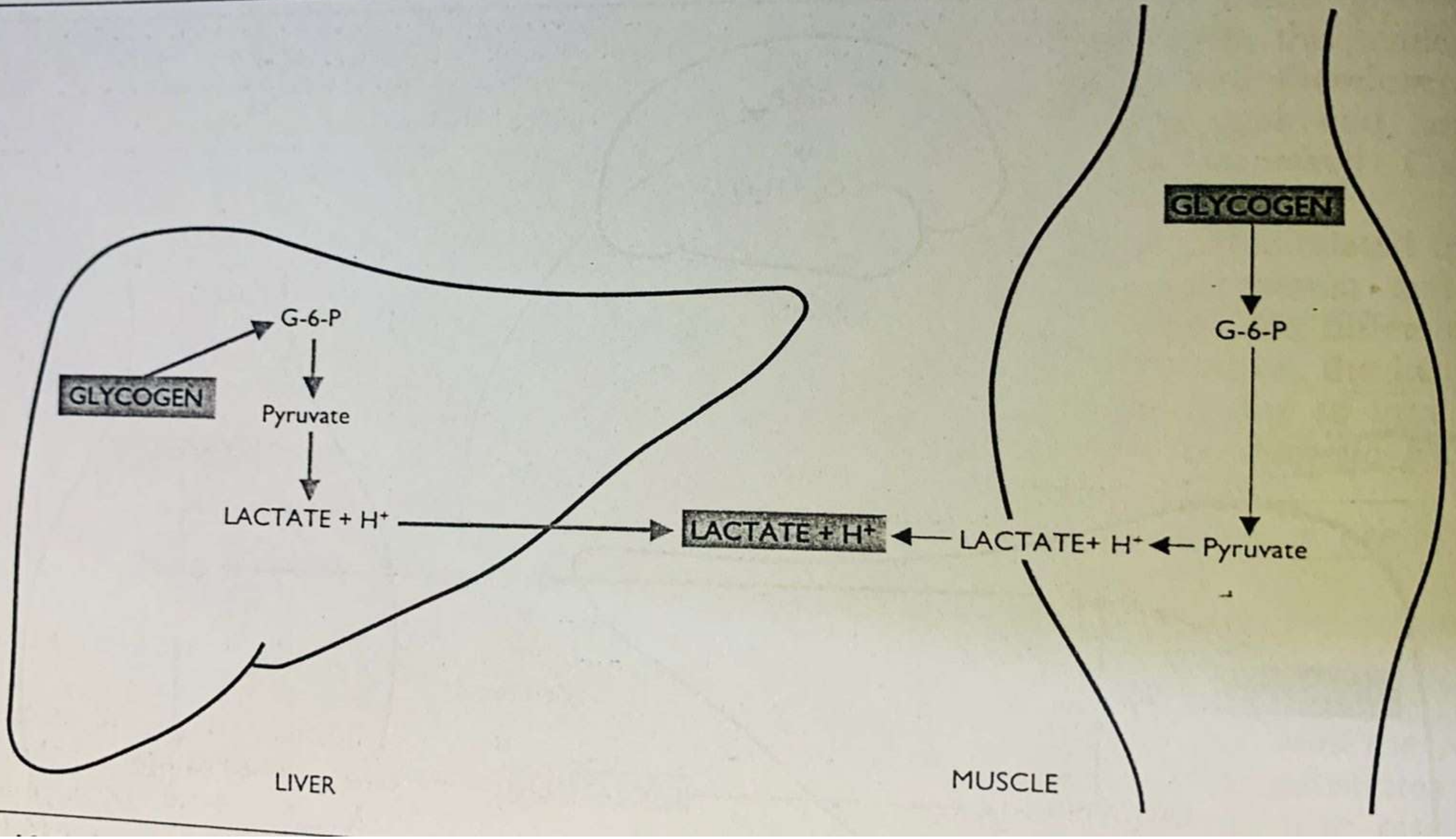
- late infancy .

1 - ketotic hypoglycemia of infancy .
2 - islet cells hyperplasia .
3 - leucin sensitivity .


BRAIN
G-6-P
$CO_2 + H_2O$
MUSCLE
GLYCOGEN
Insulin
G-6-P
INTESTINE
Glucose
GLUCOSE
Hexokinase
Insulin
Insulin
Glucokinase (needs insulin)
G-6-P
GLYCOGEN
Triose-P
AcCoA
Fatty acid + Glycerol-3-P
Triglyceride
VLDL
Glycerol
G-6-P
Triose-P
Fatty acid + Glycerol-3-P
TRIGLYCERIDE
LIVER
ADIPOSE TISSUE


BRAIN
G-6-P
AcCoA
$CO_2 + H_2O$
Glucose
KETONES + H+
→ ketoacidosis
G-6phosphatase
G-6-P
GLYCOGEN
Triose-P
Pyruvate
KETONES + H+
AcCoA
FFA
Triglyceride
Glycerol
+
FA
LIVER
ADIPOSE TISSUE


G-6-P
$CO_2 + H_2O$
BRAIN
MUSCLE
GLYCOGEN
Adrenaline
G-6-P
Glucose
G-6-P
GLYCOGEN
Pyruvate
(Cori cycle)
LACTATE + H+
LACTATE + H+
Lactate + H+
Pyruvate
TCA
$CO_2 + H_2O$
LIVER


GLYCOGEN
G-6-P
Pyruvate
LACTATE + H+
LACTATE + H+
LACTATE+ H+
Pyruvate
GLYCOGEN
G-6-P
LIVER
MUSCLE