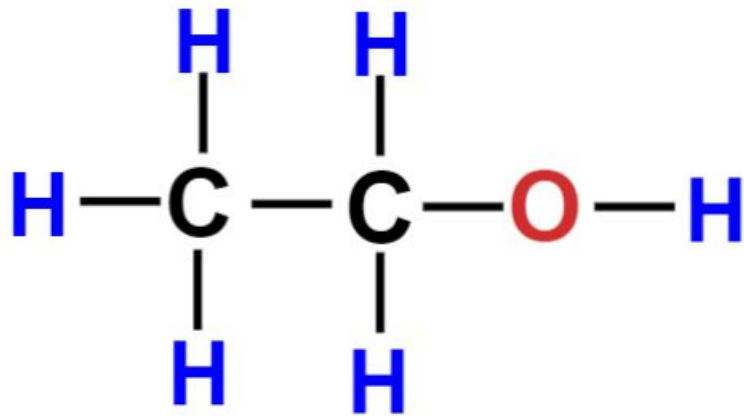


Alcohol Metabolism  
&  
It's  
Biochemical effect

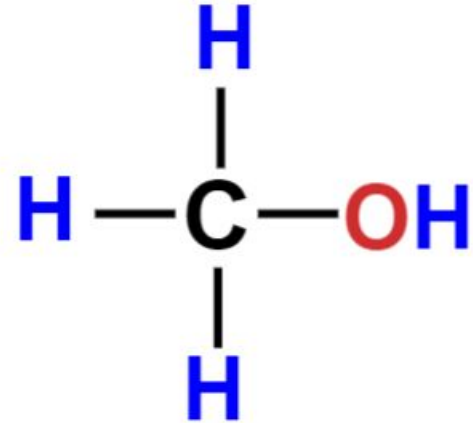
**Dr Piyush Tailor**

Professor & Head  
Department of Biochemistry  
GMC, Bhavnagar

# Type of Alcohol



**Ethanol**



**Methanol**



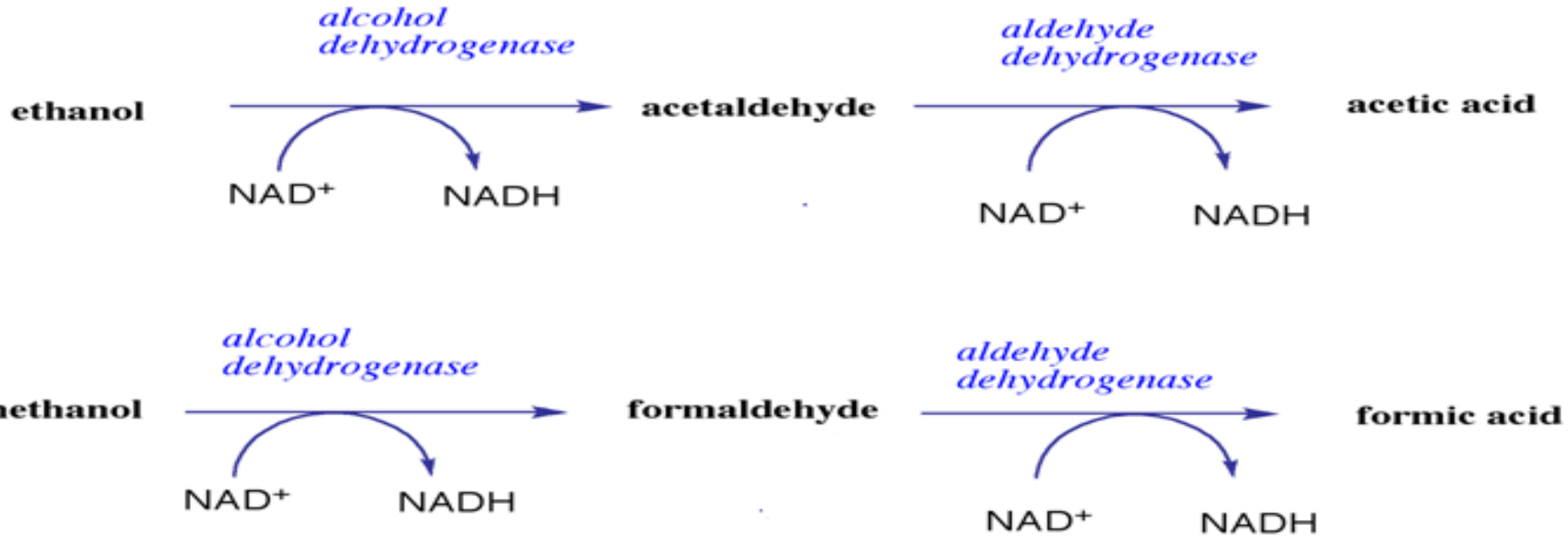
# Difference

- Concentration
- Fermentation & Distillation– Process
- Presence of **Congener**
  - Methanol
- Brand
- Price

# Congener

- Acetone
- Acetaldehyde
- Esters
- Tannins
- Aldehydes

# Alcohol Metabolism



# Methanol Poisoning

မုန့်



# Ethanol is use as antidote in methanol poisoning.

- Ethanol is analogues to methanol
- Alcohol dehydrogenase has higher affinity to ethanol than methanol.
- So Ethanol causes competitive inhibition of methanol metabolism.
- So Decrease production of formaldehyde and decrease toxicity of methanol
- Therefore, Ethanol is use in methanol poisoning.



# Alcohol Metabolism

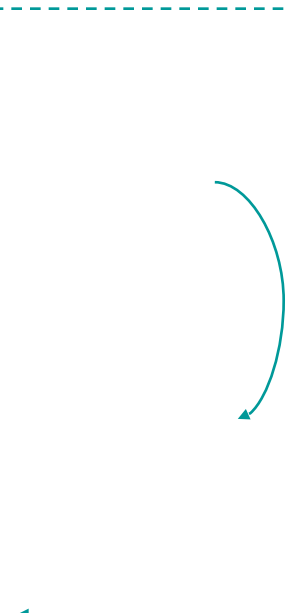
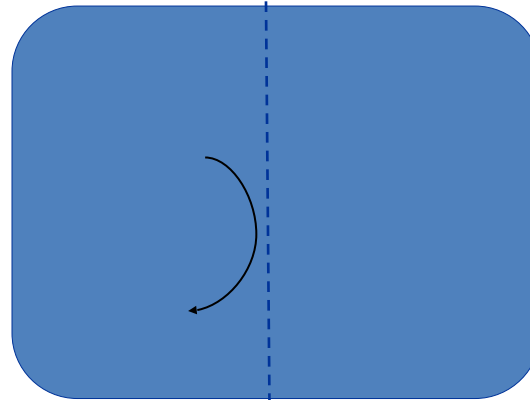
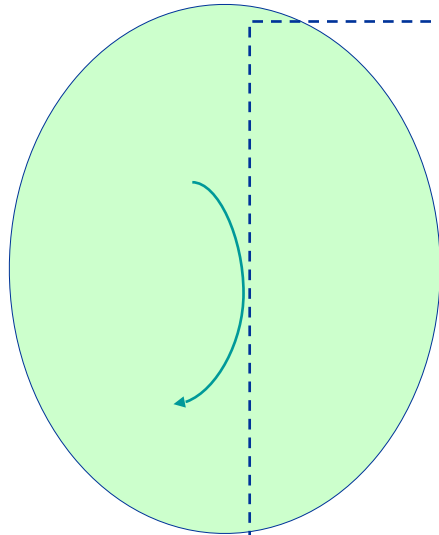
- Cytoplasm
- Mitochondria
- Peroxisome
- Endoplasmic Reticulum - Microsome

# Ethanol

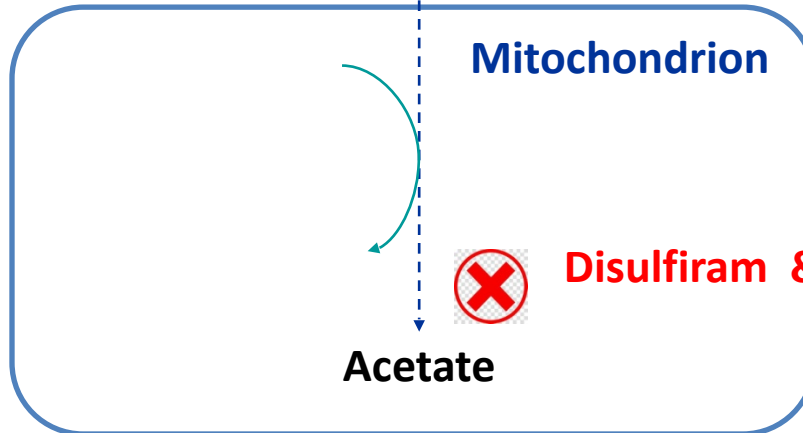
Peroxisome

Endoplasmic Reticulum

Cytosol



Acetaldehyde



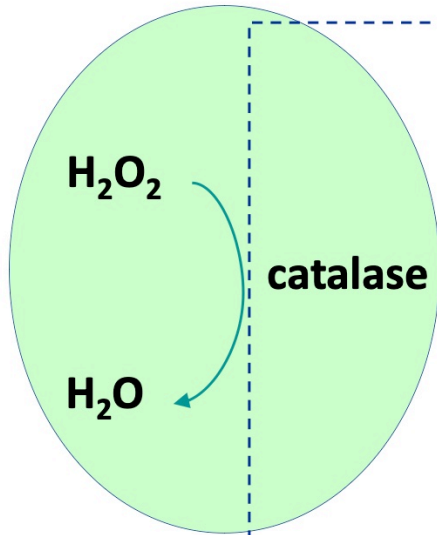
Acetate



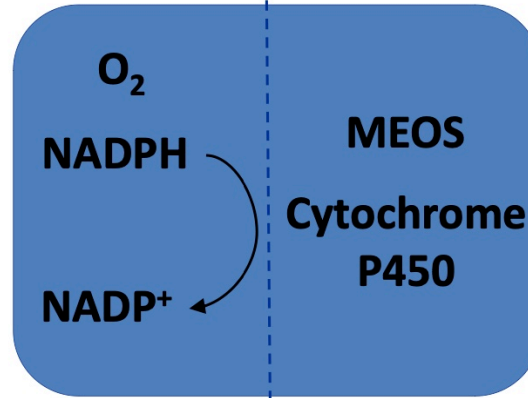
Disulfiram & Chlorpropamide

# Ethanol

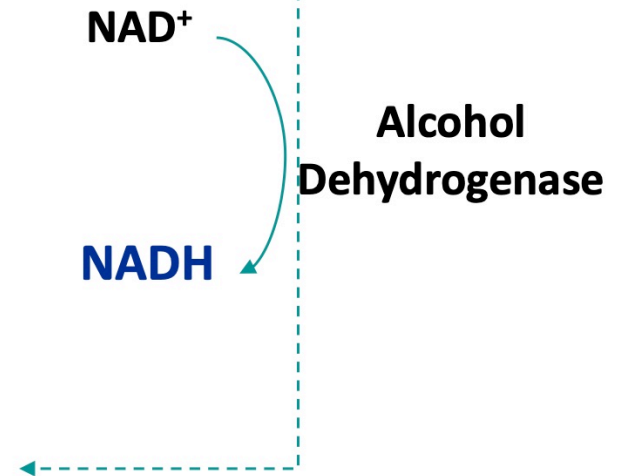
## Peroxisome



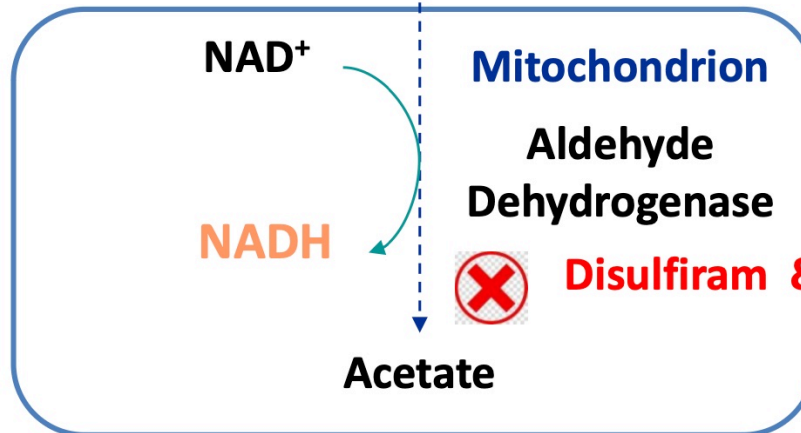
## Endoplasmic Reticulum



## Cytosol



Acetaldehyde



# Microsomal Ethanol Oxidizing System

- Microsomal Enzyme
- Use NADPH & Oxygen
  - Decrease reduction ROS (Reactive Oxygen Species)
- Cytochrome P – 450 is also involve in this reaction.

# Barbiturate Drugs

- Metabolized / Catabolised By
- **Cytochrome P 450 – Microsome**
  - Enzyme
  - With **Heme** as Cofactor
- With Alcohol consumption , Enzyme level will be induce.
- ***Effect of Drug ?***

# General Knowledge Base Question

- Who get more effect of Alcohol?
  - Indian
  - European
- Who does get very easily “High” effect of Alcohol?
  - Regular Drinker
  - Occasional Drinker
- Who get more Complication of Alcohol ?

# Activity of ADH Vs ALDH

**ADH > ALDH**

Activity of ALDH is in  
Indians < Europeans

Accumulation of Acetaldehyde

# Advantage

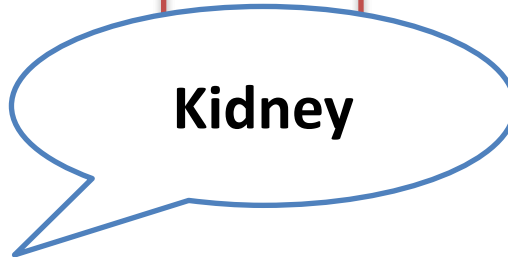
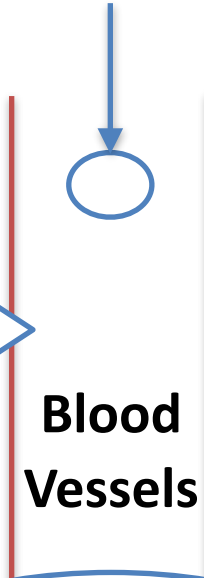
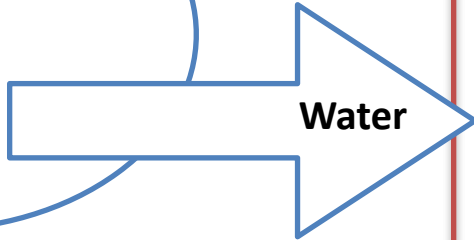
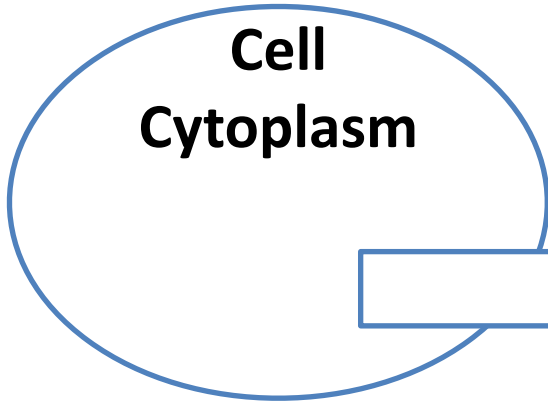
- NADH – Energy - ????
- Euphoria
- Decrease Mental Inhibition



# Disadvantage

- Alcohol – Osmotically Active
- Absorption – Direct
- Free form in Blood
- Freely Filter in Kidney

**Alcohol**



**Increase Urination**

Alcohol

+

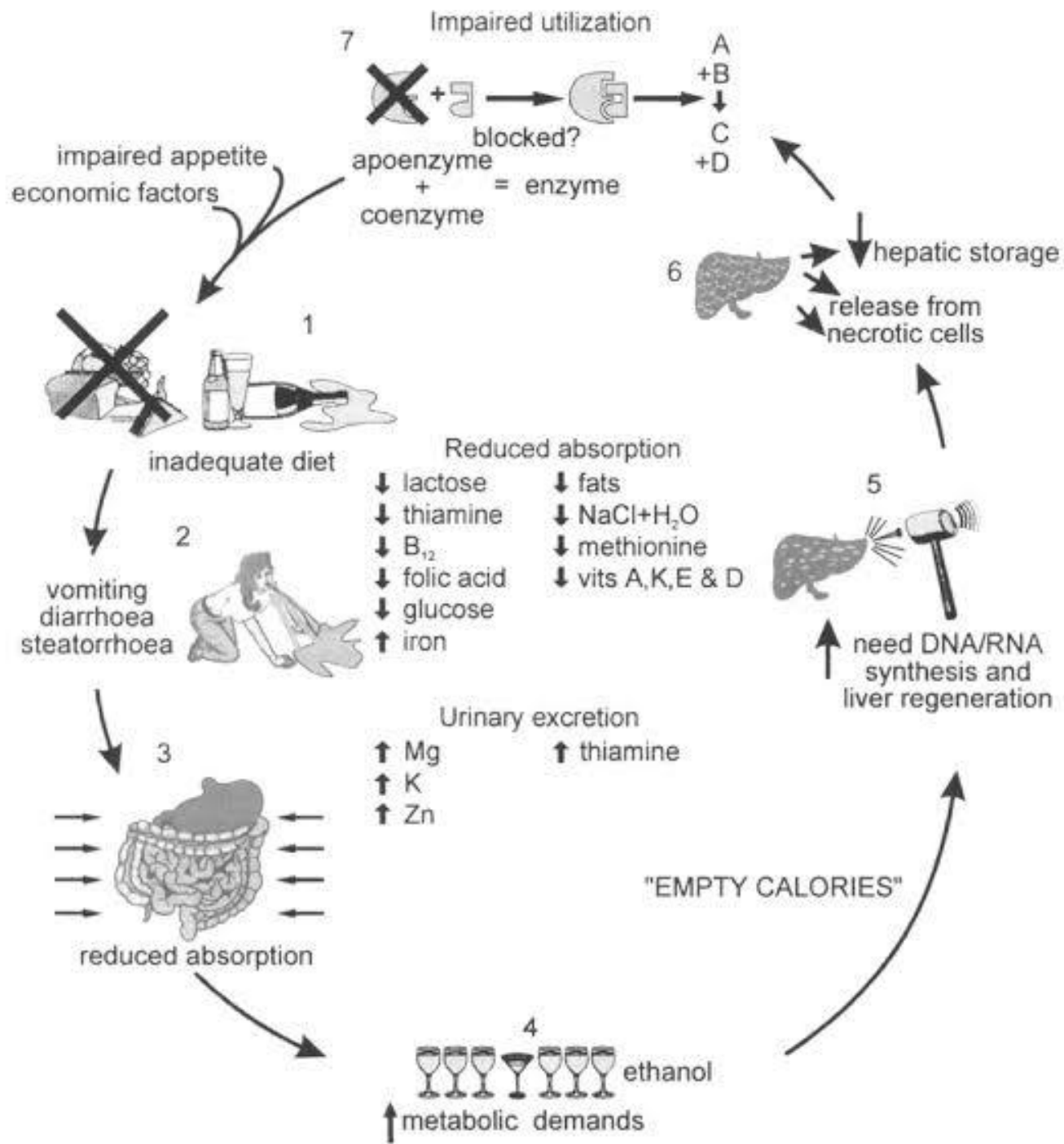
Water

# Disadvantage

- Alcohol – Osmotically Active
- Cellular dehydration
  - Decrease Cell Life
- Hangover
  - Cerebral dehydration
  - Electrolyte loss
- Gastric Mucus - Dehydration
  - Gastric Ulcer - Gastric Malignancy
  - Decrease Food Absorption
  - Malnutrition - Vitamin, Protein Loss

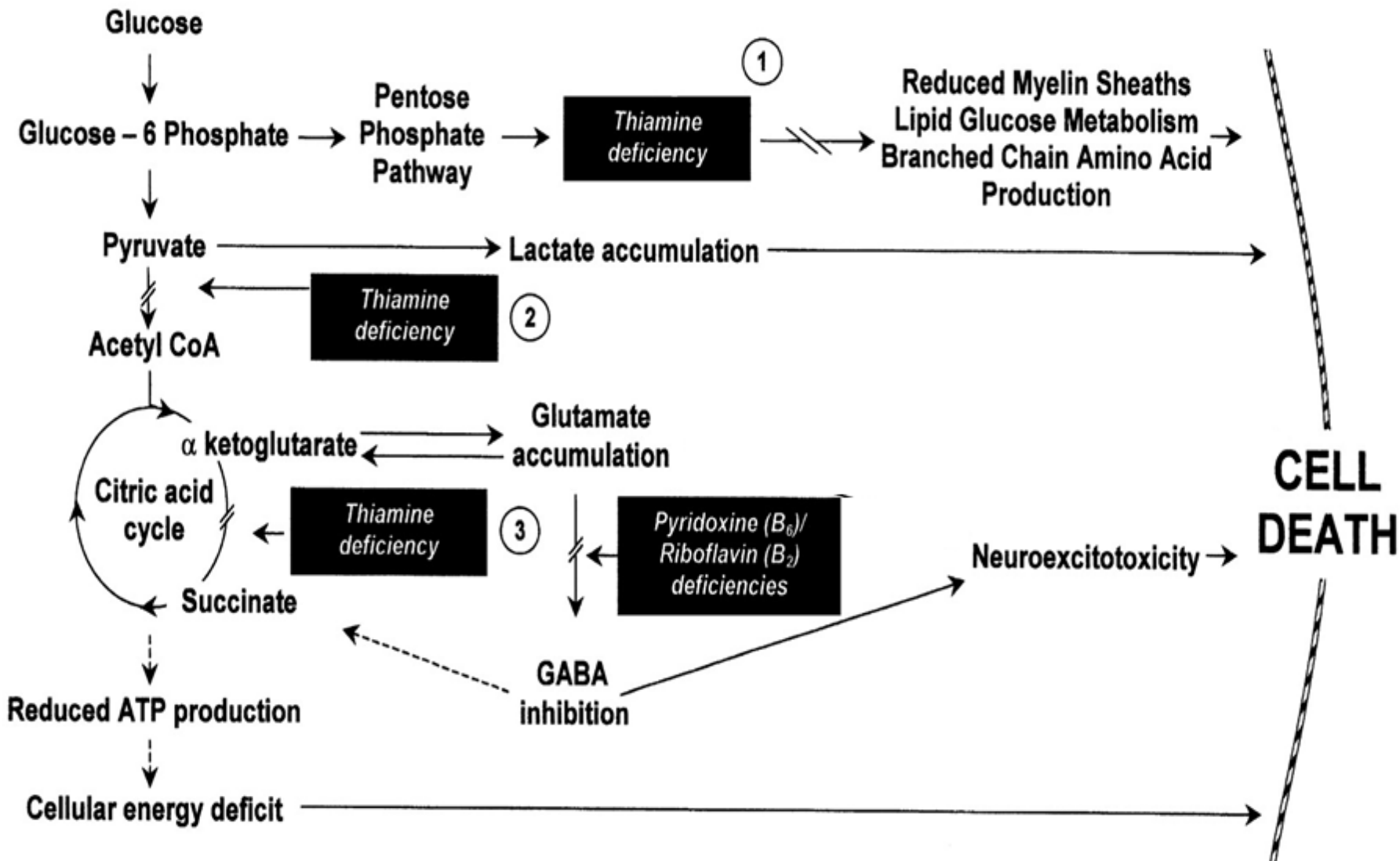
# Disadvantage

- Loss of Water Soluble Vitamin
  - Decrease absorption
  - Increase loss in Urine
  - Liver Cirrhosis - Loss of Storage



# Thiamine Deficiency Due to Alcoholism

- Reduce GI Absorption
- Inadequate Diet
- Hepatic Damage
- Decrease Hepatic Storage
- Increase Diuresis
- Increase Metabolic demand



Thiamine dependent enzymes:-

- ① Transketolase
- ② Pyruvate dehydrogenase complex
- ③ α-Ketoglutarate dehydrogenase complex

# Thiamine + Dextrose

Should be given

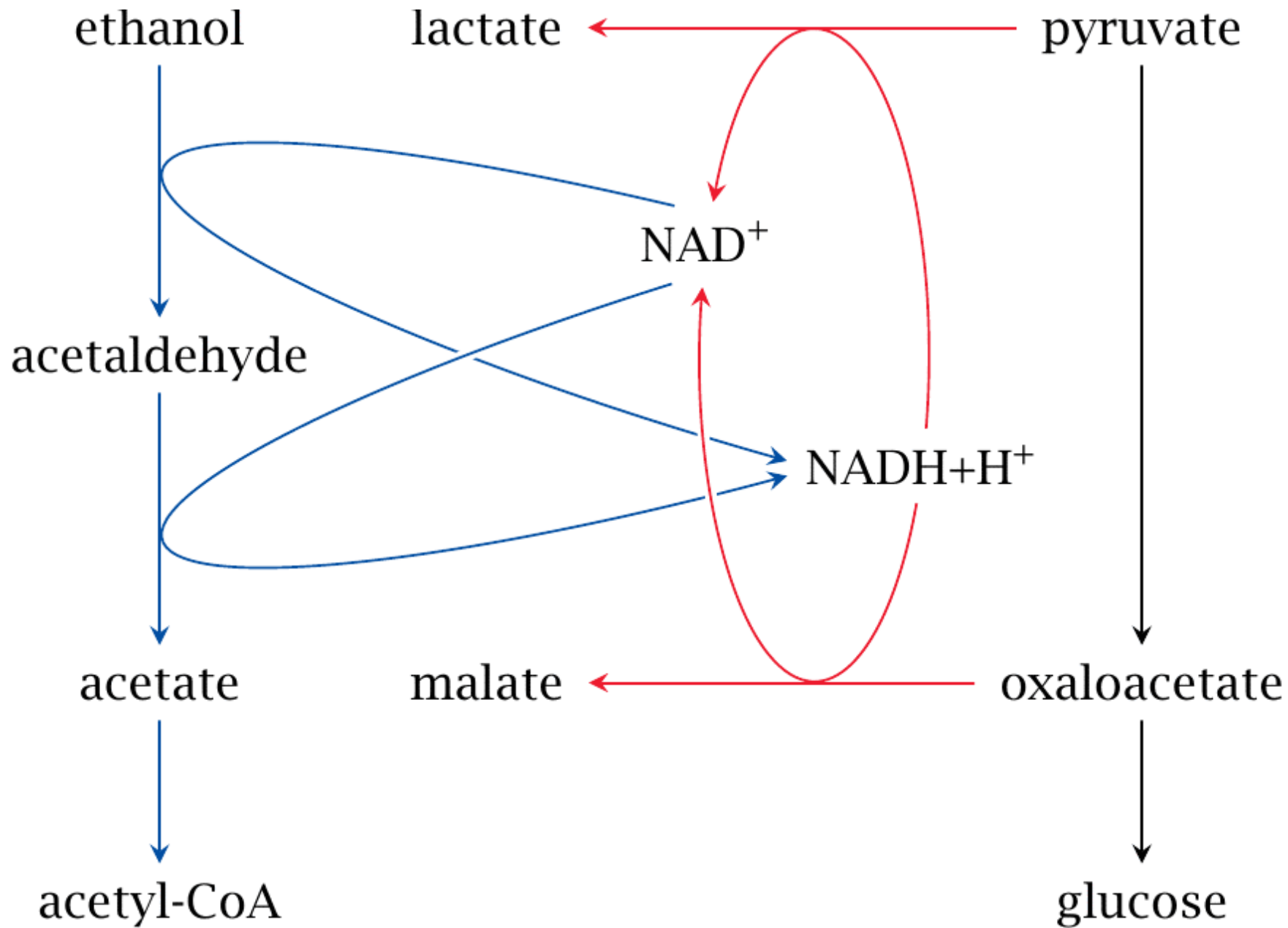
## If Chronic Alcoholic represent with Hypoglycemia

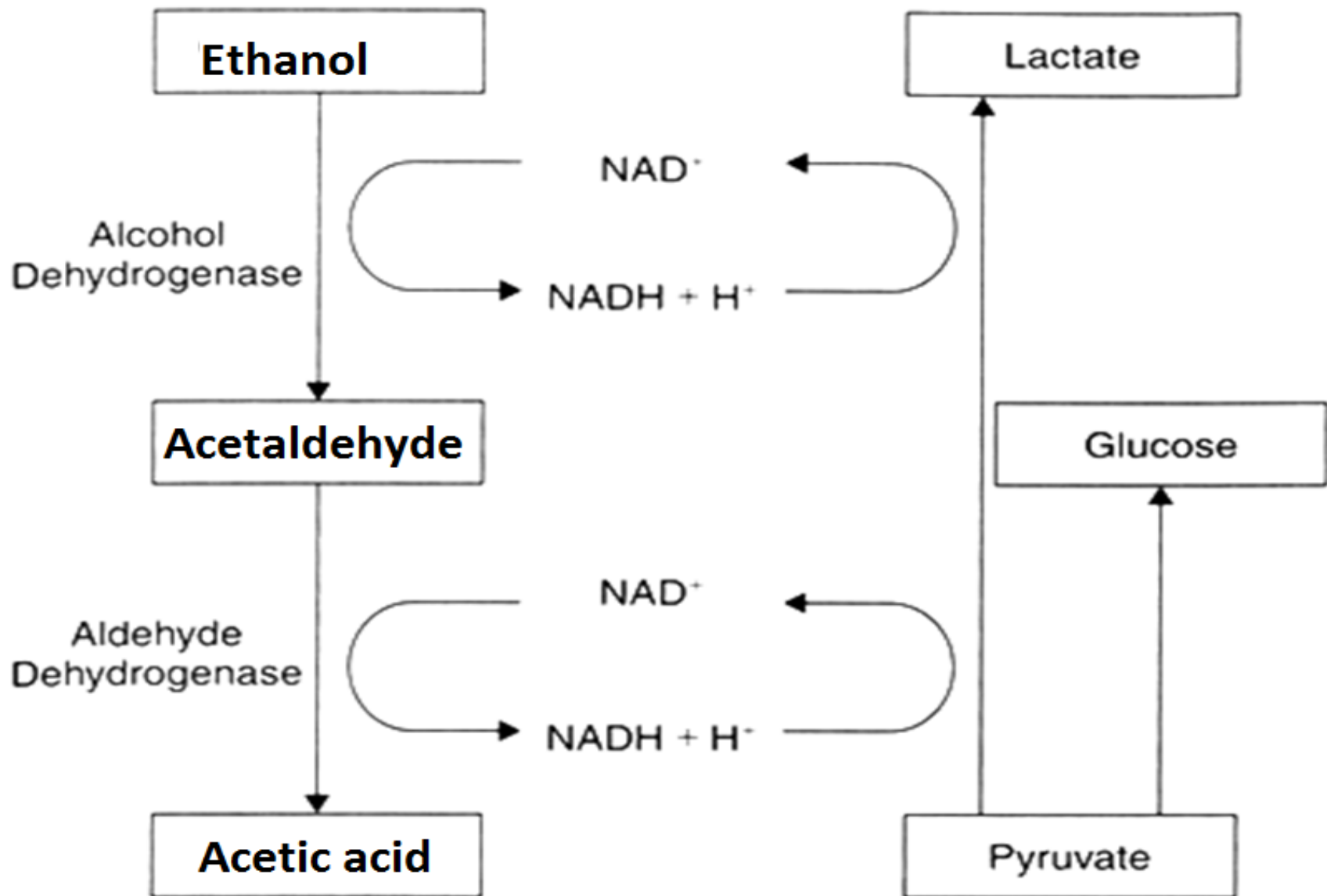
- Hypoglycemia - Corrected With Only Dextrose
  - It used up available “Thiamine” in Circulation
  - Already - Low Thiamine
  - Dextrose - decreases availability of “Thiamine”
- For **complete utilisation of Glucose** - Thiamine is Must - **Co-Factor** for **Enzyme** of Carbohydrate Metabolism



# Wernicke Korsakoff Encephalopathy

- Mental confusion
- Vision problems
- Coma
- Hypothermia
- Low blood pressure
- Lack of muscle coordination (ataxia)
- Dis-Orientation





# Alcohol inhibit Gluconeogenesis.

- Main **substrate** for **gluconeogenesis** are
  - Pyruvate
  - Oxaloacetate
  - Intermediate of TCA cycle
- Ethanol and Methanol both **increase NADH:NAD ratio**.
- The high concentration of NADH
  - Convert all **Pyruvate into Lactate**.
  - Convert all **Oxaloacetate to Malate**.
  - **Inhibit TCA cycle**
- Because of increase concentration of NADH, availability of main substrate for gluconeogenesis is decrease and it become slow and inhibited.

# Chronic alcoholism cause Gouty Arthritis.

- Ethanol and Methanol both **increase NADH:NAD ratio**.
  - Convert all **Pyruvate to Lactate (lactic acid)**.
  - Increase lactic acid concentration
- **Lactic acid compete with Uric acid** for excretion in renal.
- Decrease excretion of uric acid.
- Increase uric acid level
- Due to high lactic acid level
  - Metabolic acidosis
  - Acidic pH converted **uric acid into sodium urate crystal**.
- Hence, Chronic alcoholism cause gouty arthritis.