GENERAL ANAESTHESIA

- **ANAESTHESIA** – is the reversible loss of response to noxious stimuli.

- **GENERAL ANAESTHESIA** – when anaesthesia is associated with loss of conciousness.

- **LOCAL ANAESTHESIA –** when conciousness is maintained during anaesthesia.

BALANCED ANAESTHESIA

- **Unconciousness**
- **Analgesia**
- **Muscle relaxation**
- **Abolition of compensatory reflex response**

General anesthetics have therapeutic indices of about 2 - 4.

PREANAESTHETIC MEDICATION

It is the use of drugs prior to anesthesia to make it more safe and pleasant.

- **To relieve anxiety – benzodiazepines.**
- **To prevent allergic reactions – antihistaminics.**
- **To prevent nausea and vomiting – antiemetics.**
- **To provide analgesia – opioids.**
- **To prevent acidity – proton pump inhibitor**
- **To prevent bradycardia and secretion – atropine.**

ANESTHESIA

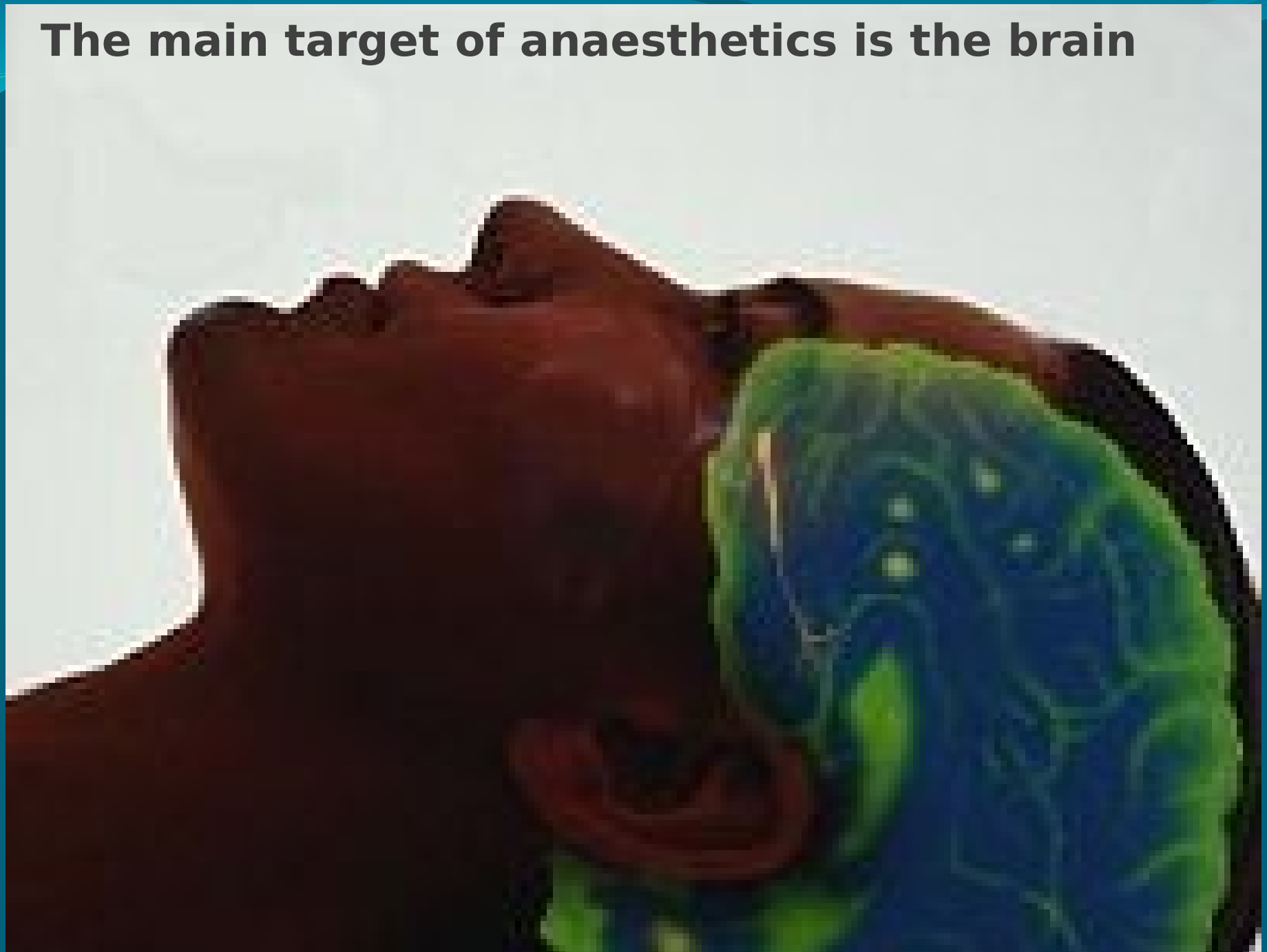
- Stage I : Analgesia
- Stage II : Excitement, combative behavior – dangerous state
- Stage III : Surgical anesthesia
  - -Plane 1- roving movements of eyeballs
  - -Plane 2- prog. loss of corneal reflex (surgery)
  - -Plane 3- pupils start dilating, muscle relaxation
  - -Plane4- only abdo respi, fully dilated pupils
- Stage IV : Medullary paralysis – respiratory and vasomotor control ceases.

MOLECULAR MECHANISM OF THE GA

- **GABA –A** : Potentiation by Halothane, Propofol, Etomidate

- **NMDA receptors** : inhibited by Ketamine &
  N2O

The main target of anaesthetics is the brain



CLASSIFICATION

There are two types of anaesthetics :

- Inhalational --- for maintenance
- Intravenous --- for induction and short procedures

Inhalation anaesthetics:

- Advantage of controlling the depth of anesthesia.
- Metabolism is very minimal.
- Excreted by exhalation.

INHALATIONAL ANAESTHETICS

Non-halogenated gas

- Nitrous oxide

Halogenated hydrocarbons

- Halothane
- Enflurane
- Isoflurane
- Desflurane
- Sevoflurane
- Methoxyflurane – nephrotoxicity.

The important characteristics of Inhalational anaesthetics which govern the anaesthesia are

- **Partial pressure of anaesthetic in inspired gas**
- **Pulmonary ventilation**
- **Alveolar exchange**
- **Solubility in the blood**

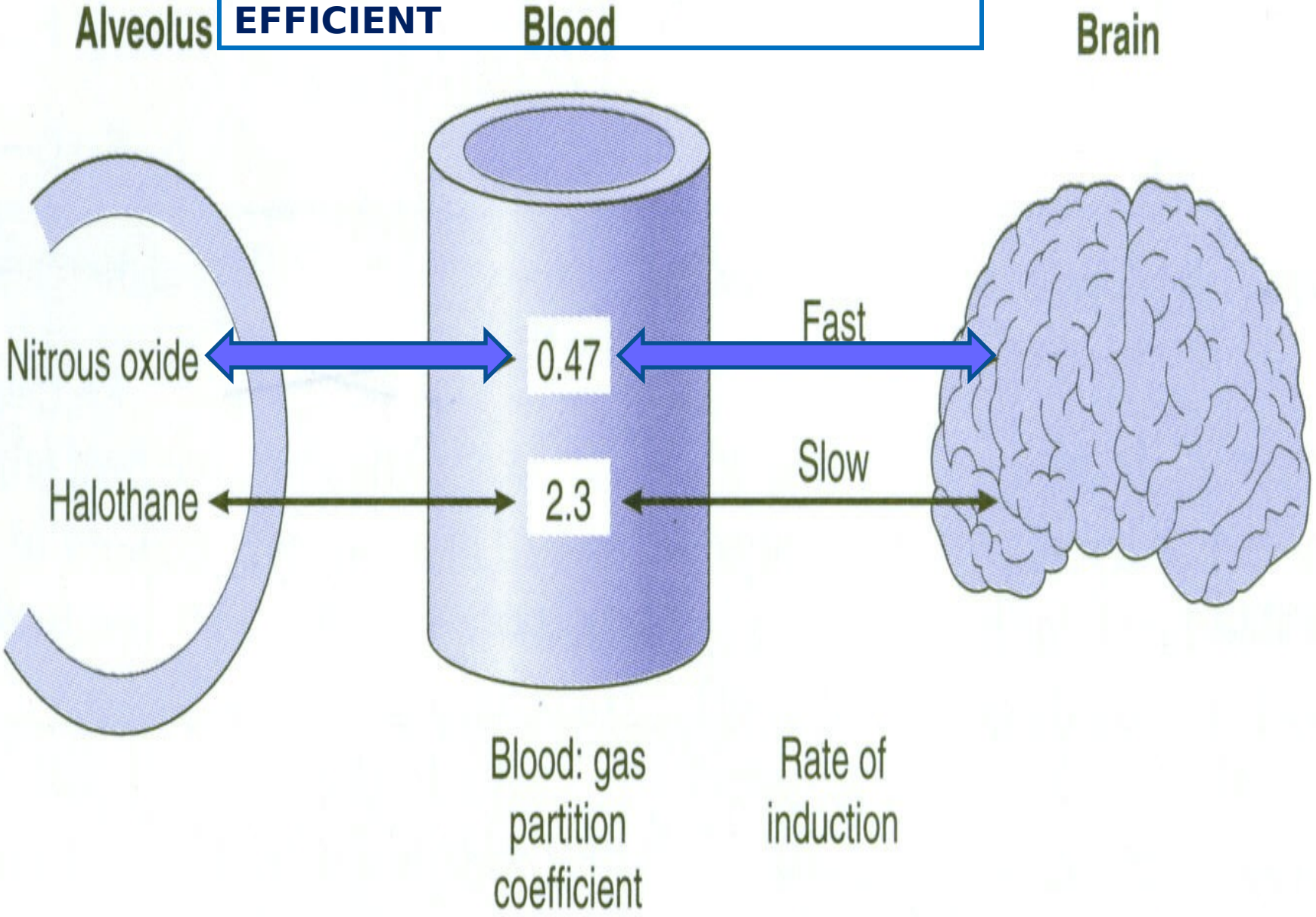
  (blood : gas partition co-efficient)
- **Solubility in the fat**

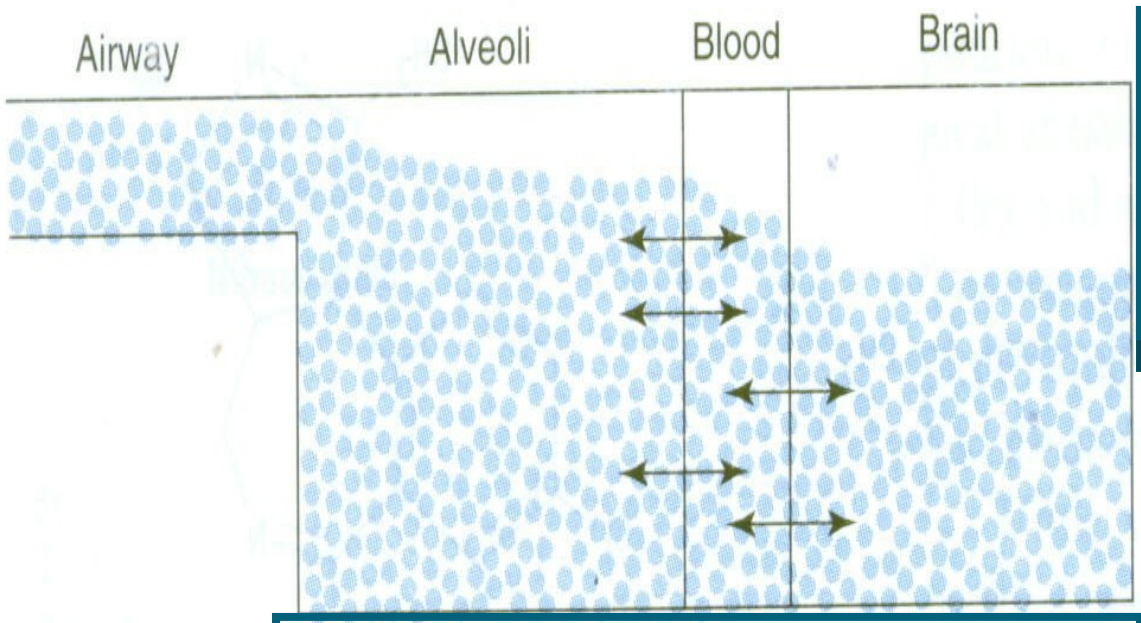
  (oil : gas partition co-efficient)

BLOOD : GAS PARTITION CO-EFFICIENT

- It is a measure of solubility in the blood.
- It determines the rate of induction and recovery of Inhalational anesthetics.
- Lower the blood : gas co-efficient – faster the induction and recovery – Nitrous oxide.
- Higher the blood : gas co-efficient – slower induction and recovery – Halothane.

BLOOD GAS PARTITION CO-EFFICIENT

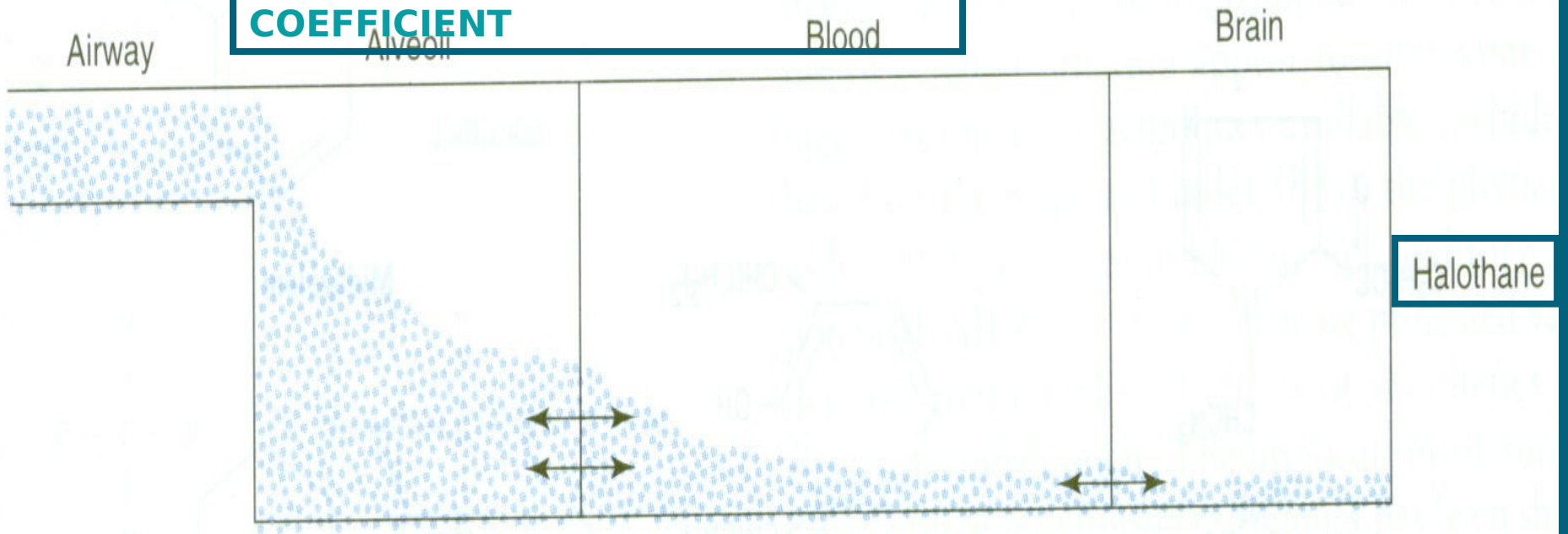




Agents with low solubility in blood quickly saturate the blood. The additional anesthetic molecules are then readily transferred to the brain.

Nitrous oxide

BLOOD GAS PARTITION COEFFICIENT



Halothane

OIL: GAS PARTITION CO-EFFICIENT

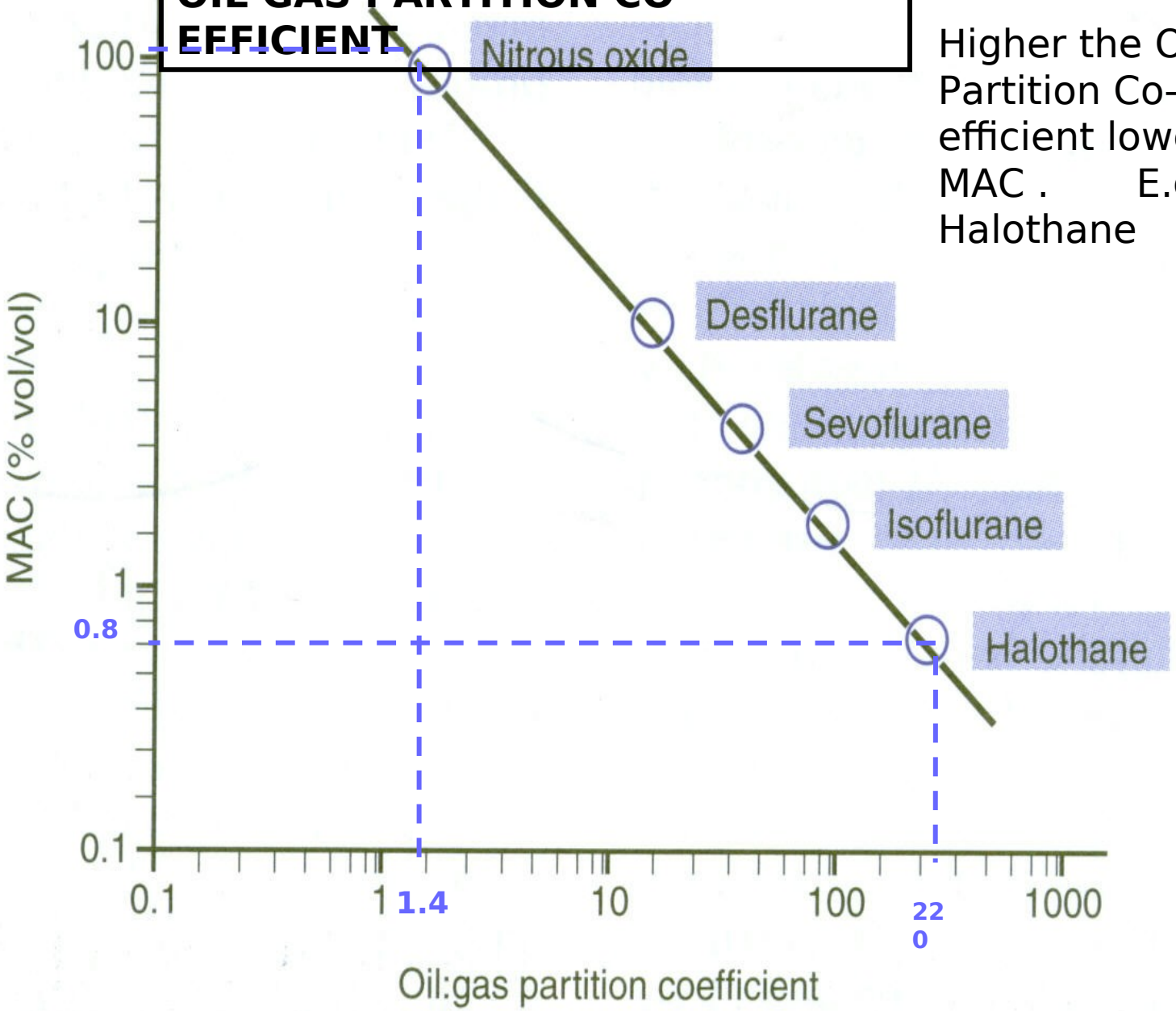
- It is a measure of lipid solubility.
- Lipid solubility - correlates strongly with the potency of the anesthetic.
- Higher the lipid solubility – potent anesthetic e.g., halothane

- **MAC value** is a measure of inhalational anesthetic potency.

- It is defined as the minimum alveolar anesthetic concentration (% of the inspired air) at which 50% of patients do not respond to a surgical stimulus.

- **MAC values** are additive and lower in the presence of opioids.
- MAC values **1.1 to 1.2** used during surgery.

OIL GAS PARTITION CO-EFFICIENT



Higher the Oil: Gas Partition Co-efficient lower the MAC . E.g., Halothane

Inhalation Anesthetic	MAC value %	Oil: Gas partition
Nitrous oxide	>100	1.4
Desflurane	7.2	23
Sevoflurane	2.5	53
Isoflurane	1.3	91
Halothane	0.8	220

Second gas effect

- Nitrous oxide is very insoluble in blood and other tissues.
- This results in rapid equilibration.
- The rapid uptake of N_2O from alveolar gas serves to concentrate coadministered halogenated anesthetics.
- This effect (the "second gas effect") speeds induction of anesthesia.

Diffusional hypoxia

- On discontinuation of N_2O administration, nitrous oxide gas can diffuse from blood to the alveoli, diluting O_2 in the lung.

- This can produce an effect called *diffusional hypoxia.*

- *To avoid hypoxia, 100% O_2 should be administered when N_2O is discontinued.*

INHALATIONAL ANESTHETICS

Nitrous oxide:

- Safest inhalational anaesthetic.
- Noninflammable, nonirritating
- Low potency anaesthetic, poor muscle relaxant but a good analgesic.
- No toxic effect on the heart, liver and kidney.
- A/E- diffusional hypoxia, megaloblastic anemia.

INHALATIONAL ANESTHETICS

Ether

- Potent anaesthetic, good analgesic, good muscle relaxants.
- Irritant, inflammable, explosive
- Induction is very slow and unpleasant (highly soluble in blood)
- Recovery is slow

INHALATIONAL ANESTHETICS

Halothane:

- It is a potent anesthetic.
- Poor analgesic, poor muscle relaxant.
- Induction is pleasant.
- It sensitizes the heart to catecholamines.
- It dilates bronchus – preferred in asthmatics.
- It inhibits uterine contractions.
- Halothane hepatitis and malignant hyperthermia can occur.

INHALATIONAL ANESTHETICS

Enflurane:

- Sweet and ethereal odor.
- Generally do not sensitizes the heart to catecholamines.
- **Seizures occurs** at deeper levels – contraindicated in epileptics.
- Caution in renal failure due to fluoride.

INHALATIONAL ANESTHETICS

Isoflurane:

- It is commonly used with oxygen or nitrous oxide.
- It do not sensitize the heart to catecholamines.
- Its pungency can irritate the respiratory system.

INHALATIONAL ANESTHETICS

Desflurane:

- It is delivered through special vaporizer.
- It is a popular anesthetic for **day care surgery**.
- Induction and recovery is fast, cognitive and motor impairment are short lived
- It irritates the air passages producing cough and laryngospasm.

INHALATIONAL ANESTHETICS

Sevoflurane:

- Induction and recovery is fast.
- It is pleasant and acceptable due to lack of pungency.
- It does not cause air way irritancy.
- Concerns about nephrotoxicity.

Anesthetic	B:G PC	O:G PC	Features	Notes
Halothane	2.3	220	PLEASANT	Arrhythmia Hepatitis Hypertermia
Enflurane	1.9	98	PUNGENT	Seizures Hypertermia
Isoflurane	1.4	91	PUNGENT	Widely used
Sevoflurane	0.62	53	PLEASANT	Nephrotoxicity
Desflurane	0.42	23	IRRITANT	Cough
Nitrous	0.47	1.4	PLEASANT	Anemia

PARENTERAL ANAESTHETICS (IV)

- These are used for *induction of anesthesia.*
- Rapid onset of action.
- Recovery is mainly by redistribution.
- Also reduce the amount of inhalation anesthetic for maintenance.
- E.g., thiopental, midazolam propofol, etomidate, ketamine.

PARENTERAL ANAESTHETICS

Thiopental *(Pentothal):*

- It is an ultra short acting barbiturates.
- *Consciousness regained within 10-20 mins by redistribution to skeletal muscle.*
- It do not increase ICT.
- It is eliminated slowly from the body by metabolism and produce hang over.
- It can be used for rapid control of seizures.
- A/E – Laryngospasm, acute intermittent porphyria

  -- pain, necrosis, gangrene on extravasation & inadvertant arterial injection

PARENTERAL ANAESTHETICS

Propofol :

- Most commonly used IV anesthetic.
- Unconsciousness in ~ 45 seconds and lasts ~15 minutes.
- **Anti-emetic** in action.
- Non-irritant to airways.
- Suited for day care surgery - *residual impairment is less marked.*
- *A/E-* pain during injection, fall in BP

PARENTERAL ANAESTHETICS

Ketamine : *Dissociative anesthesia*

- Produce - *profound analgesia, immobility, amnesia with light sleep.*
- Acts by blocking **NMDA** receptors
- Heart rate and BP are elevated due to sympathetic stimulation.
- Respiration is not depressed and reflexes are not abolished.

PARENTERAL ANAESTHETICS

Ketamine

- Emergence delirium, hallucinations and involuntary movements occurs during recovery (can be minimized by diazepam or midazolam).
- It is useful for burn dressing and trauma surgery.
- Dangerous for hypertensive and IHD.

PARENTERAL ANAESTHETICS

Neuroleptanalgesia

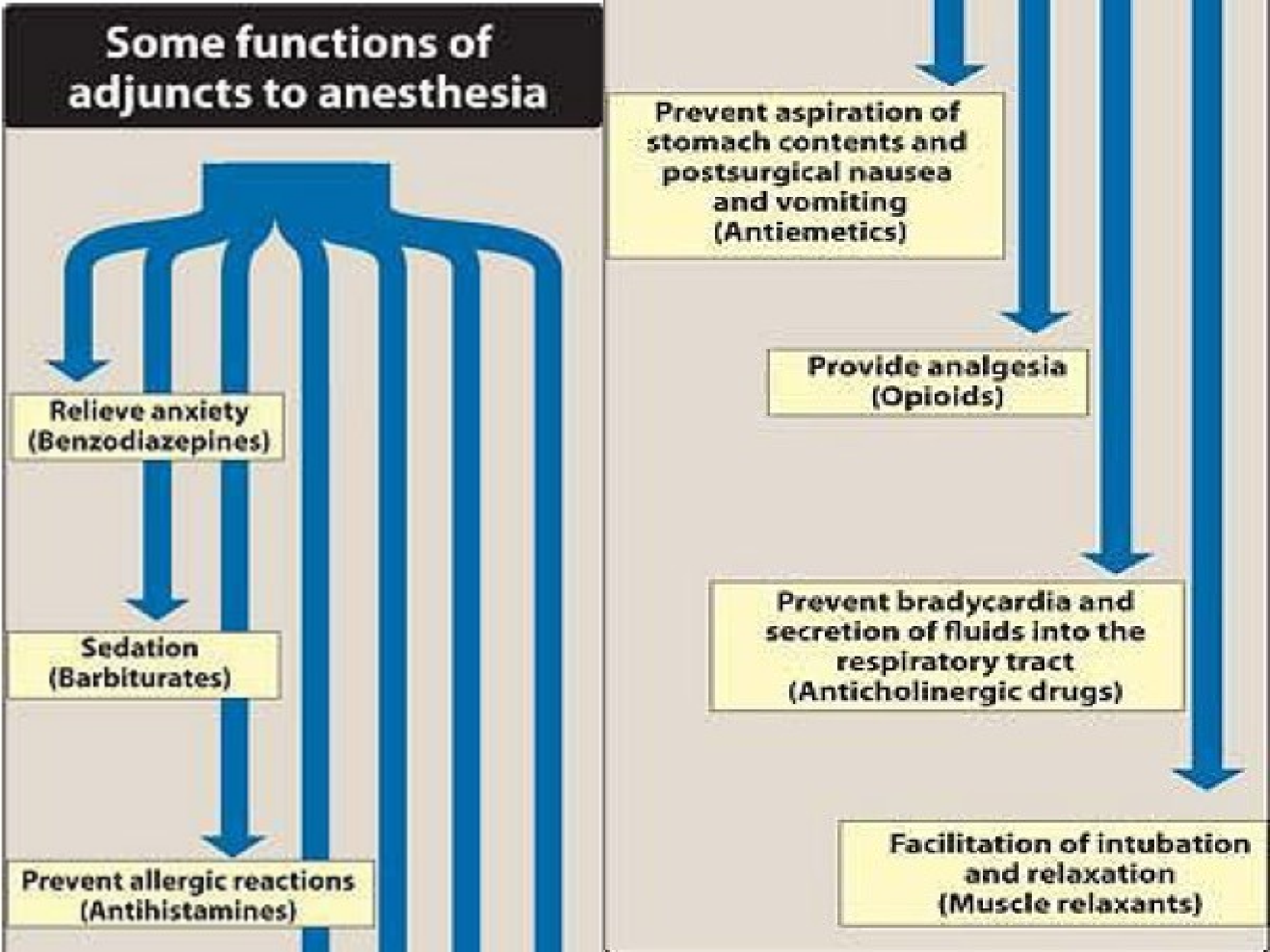
- It is characterized by calmness, psychic indifference and intense analgesia without total loss of consciousness.
- Combination of Fentanyl and Droperidol.
- A/E- chest wall rigidity

PARENTERAL ANAESTHETICS

Neuroleptanalgesia

- It is associated with decreased motor functions, suppressed autonomic reflexes, cardiovascular stability with mild amnesia.
- It causes drowsiness but respond to commands.
- Used for endoscopies, angiography and minor operations.

Anesthetic I.V	Duration mins	Analgesia	Muscle relaxation	Others
Thiopental	5 - 10	---	---	Respiratory depression
Propofol	5-10	---	---	Respiratory depression
Ketamine	5-10	+++	---	Hallucinations
Midazolam	5-20	---	+++	Amnesia
Fentanyl	5-10	+++	---	Respiratory


Some functions of adjuncts to anesthesia
Relieve anxiety (Benzodiazepines)
Sedation (Barbiturates)
Prevent allergic reactions (Antihistamines)
Prevent aspiration of stomach contents and postsurgical nausea and vomiting (Antiemetics)
Provide analgesia (Opioids)
Prevent bradycardia and secretion of fluids into the respiratory tract (Anticholinergic drugs)
Facilitation of intubation and relaxation (Muscle relaxants)

STAGES OF ANESTHESIA

I

Loss of pain sensation



II

Combative behavior



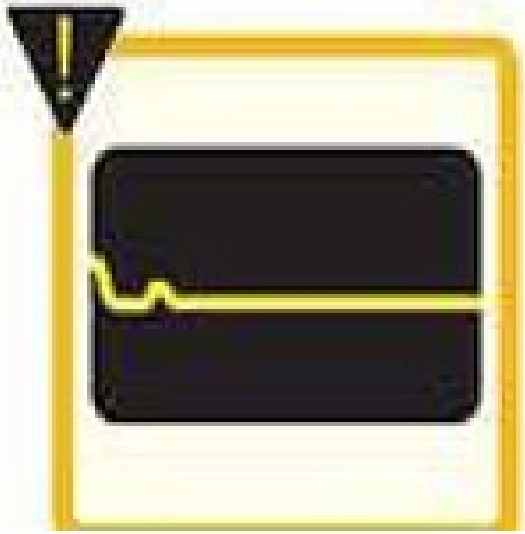
III

Surgical anesthesia



IV

Medullary paralysis and death



Alcohol

Effects of alcohol

CNS

- Depressant
- excitation and euphoria are experienced at lower plasma concentrations
- promotes $GABA_A$ receptor
- inhibits NMDA receptors
- Turnover of NA in brain is enhanced.

CVS

- Moderate doses

  -tachycardia

  -mild rise in BP
- Large doses

  -direct myocardial & vasomotor centre depression

  -fall in BP
- chronic alcoholism

  -hypertension

  -cardiomyopathy

  -cardiac arrhythmias

GIT

- dilute alcohol (10%)
  -↑gastric secretion

- Higher concentrations(20%)
  -↓ gastric secretion
  - vomiting
  - gastritis

- heavy drinking
  -Acute pancreatitis

Acute alcoholic toxicity

Signs & Symptoms

- Hypotension
- Gastritis
- respiratory
- Depression
- coma and death.

Treatment

- Gastric lavage
- Fluid
- glucose
- PPR

Withdrawl syndrome

- Anxiety
- sweating
- Tremor
- Confusion
- Hallucinations
- delirium tremens
- convulsions
- Collapse

Treatment

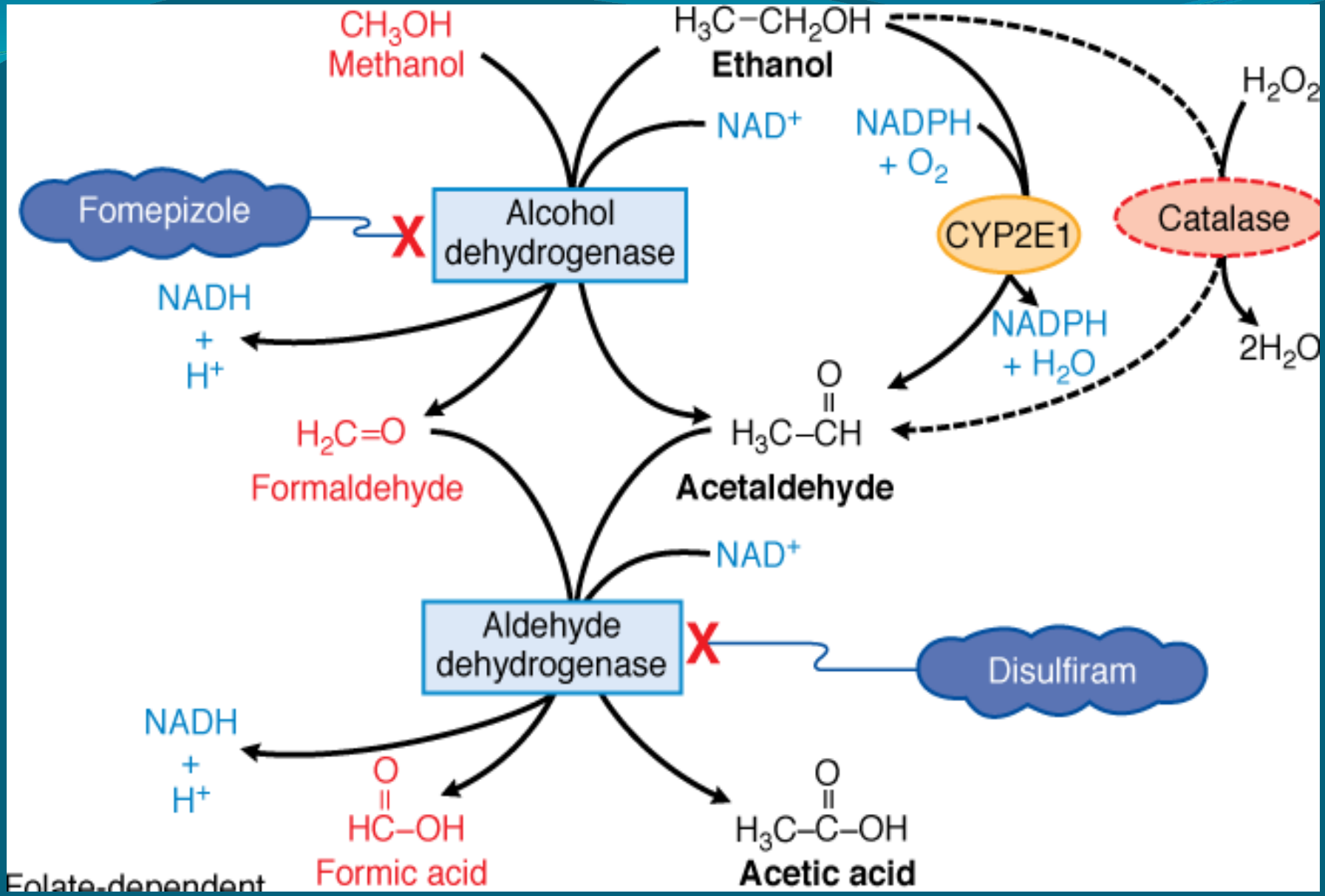
benzodiazepines

- Chordiazepoxide or
- diazepam

Disulfiram- Aldehyde dehydrogenase inhibitor

Aldehyde syndrome

- flushing
- burning sensation
- headache
- Perspiration
- tightness in chest
- Dizziness
- vomiting, visual disturbances
- Mental confusion
- Collapse


CH_3OH
Methanol
$H_3C–CH_2OH$
Ethanol
NAD^+
NADPH
$+ O_2$
H_2O_2
Fomepizole
X
Alcohol dehydrogenase
CYP2E1
Catalase
NADH
+
H^+
NADPH
$+ H_2O$
$2H_2O$
$H_2C=O$
Formaldehyde
$H_3C–CH$
Acetaldehyde
NAD^+
Aldehyde dehydrogenase
X
Disulfiram
NADH
+
H^+
HC–OH
Formic acid
$H_3C–C–OH$
Acetic acid
Folate-dependent

Methanol poisoning

Toxic effects are due to formic acid

- vomiting, headache, epigastric pain, uneasiness, dyspnoea, bradycardia and hypotension, delirium
- blindness
- death due to respiratory failure

Treatment

- Symptomatic
- Ethanol
- Haemodialysis
- Fomepizole (4-methylpyrazole)
- Folate therapy (Calcium leucovorin)

MCQs

Q1. Preanaesthetic medication is given:

A. to decrease the duration of surgery

B. to make the anaesthetic procedure pleasant and safe

C. to control patients comorbidity

D. to maintain blood pressure

Ans. B

Q2. Which of the following is NOT used as preanaesthetic medication:

A. Glycopyrrolate

B. Pethidine

C. Pantoprazole

D. Adrenaline

Ans. D

Q3. Dissociative anaesthesia' is induced by:

A. Thiopentone

B. Midazolam

C. Ketamine

D. Nitrous oxide

Ans. C

Q4. Malignant hyperthermia may be a complication of use of the following anaesthetic:

- A. Ether
- B. Halothane
- C. Nitrous oxide
- D. Propofol

Ans. B

Q5. The following general anaesthetic has good analgesic but poor muscle relaxant action:

A. Halothane

B. Nitrous oxide

C. Ether

D. Isoflurane

Ans. B

Q6. 'Second gas effect' is exerted by the following gas when coadministered with halothane:

- A. Nitrogen
- B. Nitrous oxide
- C. Nitric oxide
- D. CO_2

Ans. B

Q7. Which general anaesthetic selectively inhibits excitatory NMDA receptors:

A. Propofol

B. Halothane

C. Desflurane

D. Ketamine

Ans. D

Q8. Which of the following is NOT a component of anaesthetic state?

A. Amnesia

B. Analgesia

C. Hyperthermia

D. Unconsciousness

Ans. C

Q9. The minimal alveolar concentration of an inhalational anaesthetic is a measure of

A. Therapeutic index

B. Potency

C. Efficacy

D. Diffusibuity

Ans. B

Thank you

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