Anesthetics

An anesthetic is a drug that causes anesthesia—reversible loss of sensation. They contrast with analgesics (painkillers), which relieve pain without eliminating sensation.

Anesthetics are categorized into two classes:

1. Local anesthetics (which blocks peripheral nerve)
2. General anesthetics (Act on CNS)

Local anesthetics

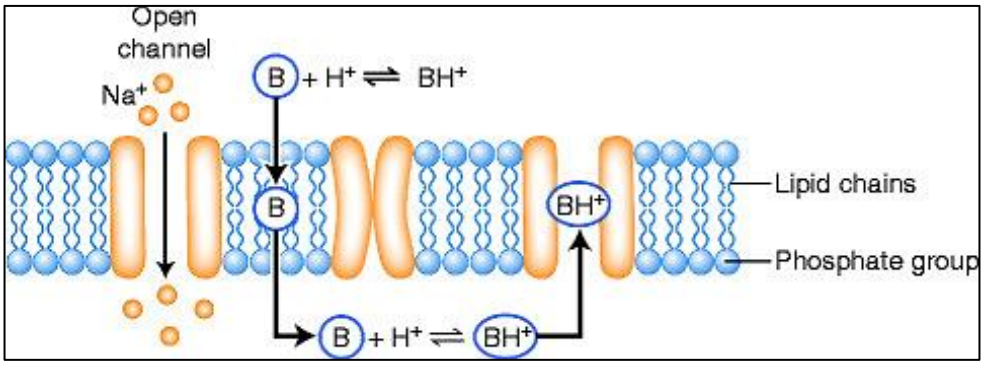
Local anesthetics are the agents that cause a reversible loss of sensation for a limited region of the body while maintaining consciousness and memory.

They are used in -

- Minor surgery
- Dentistry
- Ophthalmology

Mechanism of action

They act on sodium channel and inhibit sodium influx through the channel. At physiological $_{P}H$, local anesthetic remains charged which interacts with the receptor of sodium thus causing neuronal blockade. As a result, action potential cannot arise and signal conduction is inhibited.



Local anesthetics are of two types, such as-

1. **Ester local anesthetics:** Procaine, amethocaine, cocaine, benzocaine, tetracaine
2. **Amide local anesthetics**: Lidocaine, prilocaine, bupivacaine, ropivacaine, mepivacaine, dibucaine and etidocaine

Lidocaine

Lidocaine is the most widely used local anesthetic. Epinephrine is used with lidocaine because epinephrine causes constriction of blood vessel. As a result, lidocaine will not be absorbed. No side effects (CV collapse) will occur. So duration of action of lidocaine will increase.

General anesthetics

General anesthetics are the agents that cause a reversible loss of consciousness and memory.

They are used in major surgery.

Properties

- They must have analgesic property.
- They must cause amnesia (temporary loss of memory)
- They must cause loss of consciousness.

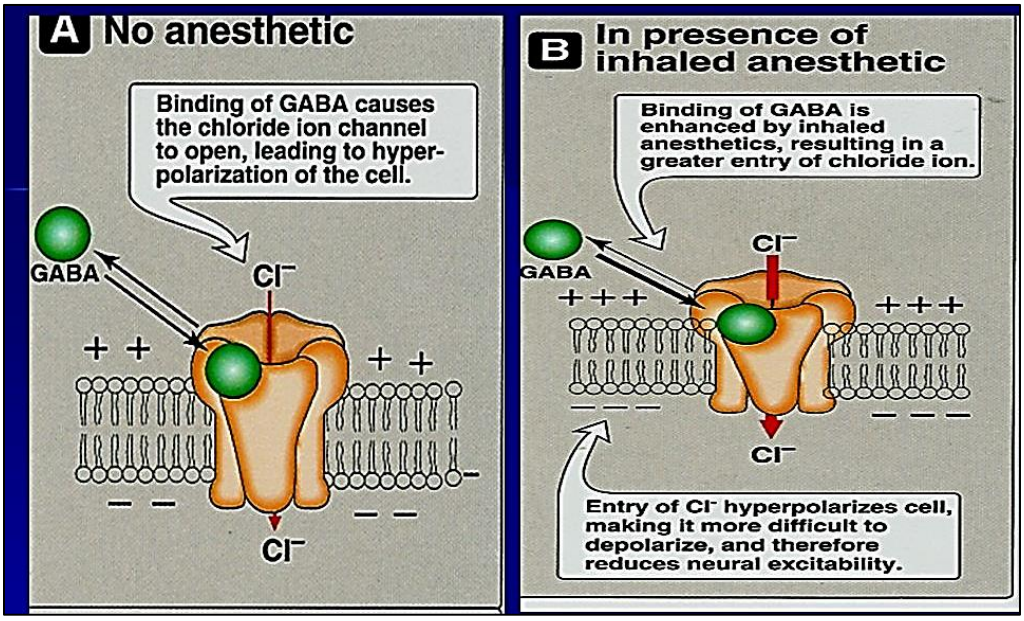
Classification

They are classified into three groups, such as,-

1. **Pre-anesthetic medications** (such as- Anticholinergic, Antiemetic, Anti-histamine, Barbiturates, Benzodiadzepine, Opioids)
2. **Intravenous anesthetic** (Barbiturates, Benzodiazepines, Etomidate, Ketamine, Opioids, Propofol)
3. **Inhalational anesthetic** (Desflurane, Enflurane, Halothane, Isoflurane, Nitrous oxide, Sevoflurane)

Mechanism of action

A general anaesthetic (or anesthetic) is a drug that brings about a reversible loss of consciousness. It has long been believed that general anesthetics exert their effects (analgesia, amnesia, immobility) by modulating the activity of membrane proteins in the neuronal membrane.



Why are preanesthetic medications used?

- Benzodiazepines such as midazolam or diazepam to allay anxiety and facilitate amnesia.
- Barbiturates such as pentobarbital for sedation.
- Antihistamine such as diphenhydramine for prevention of allergic reaction,
- Rantidine to reduce gastric acidity.
- Antiemetics such as ondansetron to prevent possible aspiration of stomach contents.
- Opioids such as fentanyl for analgesia.
- Anticholinergic such as scopolamine for their amnesic effect and prevention of bradycardia and secretion of fluids into the respiratory tract.

Stages of general Anaesthesia:

Guedel's classification, designed by Arthur Ernest Guedel in 1937, describes the four stages of anesthesia. Modern anesthetics and updated delivery methods have improved the speed of onset, general safety, and recovery, but the four stages remain essentially the same:

Share on Pinterest General anesthesia is similar to a comatose state and different from sleep.

Stage 1, or induction: This phase occurs between the administration of the drug and the loss of consciousness. The patient moves from analgesia without amnesia to analgesia with amnesia

Stage 2, or excitement stage: The period following a loss of consciousness, characterized by excited and delirious activity. Breathing and heart rate becomes erratic, and nausea, pupil dilation, and breath-holding might occur.

Because of irregular breathing and a risk of vomiting, there is a danger of choking. Modern, fast-acting drugs aim to limit the time spent in stage 2 of anesthesia

Stage 3, or surgical anesthesia: Muscles relax, vomiting stops and breathing is depressed. Eye movements slow and then cease. The patient is ready to be operated on

Stage 4, or overdose: Too much medication has been administered, leading to brain stem or medullary suppression. This results in respiratory and cardiovascular collapse.

The anesthetist's priority is to take the patient to stage 3 of anesthesia as quickly as possible and keep them there for the duration of the surgery.

How does general anesthetic work?

The exact mechanisms that conspire to produce the state of general anesthesia are not well known. The general theory is that their action is induced by altering the activity of membrane proteins in the neuronal membrane, possibly by making certain proteins expand.

Of all the drugs used in medicine, general anesthetics are an unusual case. Rather than a single molecule acting at a single site to produce a response, there is a huge variety of compounds, all of which generating quite similar but widespread effects, including analgesia, amnesia, and immobility.

General anesthetic drugs range from the simplicity of alcohol (CH_3CH_2OH) to the complexity of sevoflurane (1,1,1,3,3,3-hexafluoro-2-(fluoromethoxy) propane). It seems unlikely that just one specific receptor could be activated by such different molecules.

General anesthetics are known to act at a number of sites within the central nervous system (CNS). The importance of these sites on the induction of anesthesia is not fully understood but they include:

Share on PinterestThere are multiple sites that general anesthetics can work at in the brain.

- **Cerebral cortex:** The brain's outer layer involved in tasks relating to memory, attention, perception among other functions
- **Thalamus:** Its roles include relaying information from the senses to the cerebral cortex and regulating sleep, wakefulness, and consciousness.
- **Reticular activating system:** Important in regulating sleep-wake cycles
- **Spinal cord:** Passes information from the brain to the body and vice versa. It also houses circuitry that controls reflexes and other motor patterns.

A number of different neurotransmitters and receptors are also known to be involved in general anesthesia:

- ***N*-Methyl-D-aspartic acid (NMDA) receptors:** some general anesthetics bind to NMDA receptors, including ketamine and nitrous oxide (N_2O). They are known to be important in controlling synaptic plasticity and memory functions
- **5-hydroxytryptamine (5-HT) receptors:** normally activated by the neurotransmitter serotonin, they play a part in controlling the release of a number of other neurotransmitters and hormones
- **Glycine receptor:** glycine can act as a neurotransmitter and has a number of roles. It has been shown to improve sleep quality.

Although general anesthetics hold many mysteries, they are hugely important in surgery and the field of medicine at large.

Inhalational anesthetic

Halothane

- It is the best agent in pediatric patients.
- It causes bronchial smooth muscle relaxation which is suitable for patients with asthma.

Nitrous oxide

- It is a good analgesic.
- It promotes rapid recovery
- It has rapid onset of action.
- It is safe and non-irritating.

Isoflurane

- It is a good muscle relaxant.
- It causes rapid recovery.
- It keeps cardiac output stable.
- It does not raise intracranial pressure.

Sevoflurane

- It promotes rapid recovery.
- It has rapid onset of action.
- It is useful in children.

Intravenous anesthetic

Thiopental

- It has rapid onset of action.
- It is potent anesthetic.

Ketamine and Fentanyl

- They produce good analgesia**.**

Propofol

- It has rapid onset of action.
- It lowers intracranial pressure.