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Anticonvulsants

Presented By;-

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Specialization:- Pharmaceutical Chemistry

Anticonvulsants

- ❑ **Anticonvulsants** are a class of drugs that **control seizures by managing abnormal electrical activity in the brain.**
- ❑ They are primarily used to **treat epilepsy** but are also prescribed for other conditions, such as **bipolar disorder, nerve pain, and fibromyalgia.**

Classification of Anticonvulsants

1. **Barbiturates:-** Phenobarbitone, Methabarbital.
2. **Hydantoins:-** Phenytoin*, Mephenytoin, Ethotoin
3. **Oxazolidine diones:-** Trimethadione, Paramethadione
4. **Succinimides:-** Phensuximide, Methsuximide, Ethosuximide*
5. **Urea and monoacylureas:-** Phenacemide, Carbamazepine*
6. **Benzodiazepines:** Clonazepam
7. **Miscellaneous:-** Primidone, Valproic acid , Gabapentin, Felbamate

Mechanism of Action of Anticonvulsants

Anticonvulsant drugs work by reducing abnormal neuronal firing and preventing the spread of seizures.

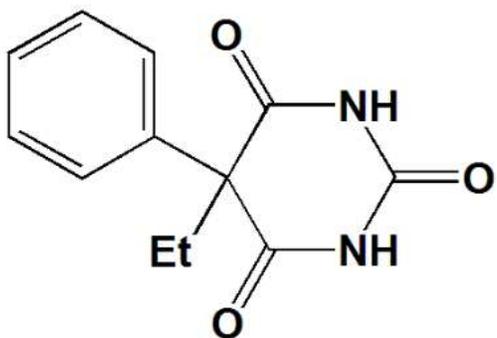
Anticonvulsants **prevent seizures** by blocking **Na⁺ or Ca²⁺ channels**, enhancing **GABAergic inhibition**, or reducing **glutamatergic excitation**, thereby stabilizing neuronal firing.

1. Barbiturates

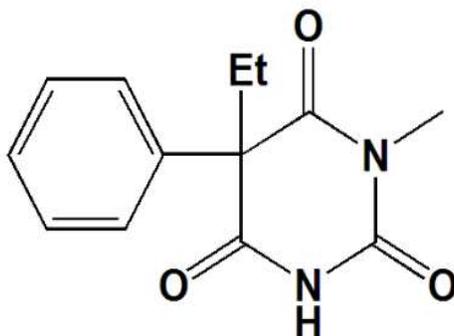
Drug	Introduction	Mechanism of Action (MOA)	Uses
Phenobarbitone (Phenobarbital)	Oldest antiepileptic; long-acting barbiturate.	Enhances GABA-A → ↑ duration of Cl ⁻ channel opening; ↓ neuronal firing.	Generalized tonic-clonic seizures, partial seizures, status epilepticus.
Methabarbital	Methylated derivative of barbital; moderate CNS depressant.	Potentiates GABA-mediated inhibition; ↑ Cl ⁻ entry.	Generalized & partial seizures (less common now).

2. Hydantoin

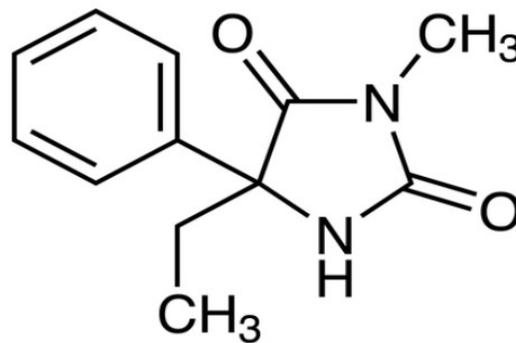
Drug	Introduction	MOA	Uses
Phenytoin*	Prototype hydantoin anticonvulsant.	Blocks voltage-gated Na ⁺ channels → prevents high-frequency firing.	Generalized tonic-clonic & partial seizures; status epilepticus (IV).
Mephenytoin	Older hydantoin; less used due to toxicity.	Na ⁺ channel inhibition; stabilizes neuronal membranes.	Partial & generalized seizures (rare use).
Ethotoin	Less potent hydantoin; better tolerated.	Prolongs inactivation of Na ⁺ channels.	Partial seizures; adjunct in generalized seizures.



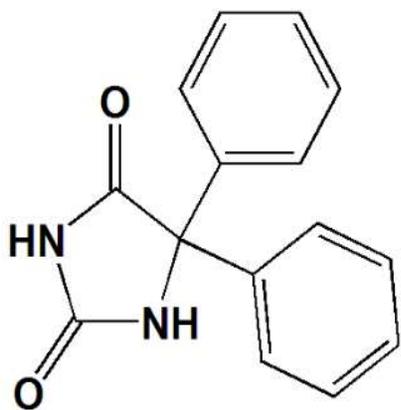
Phenobarbitone



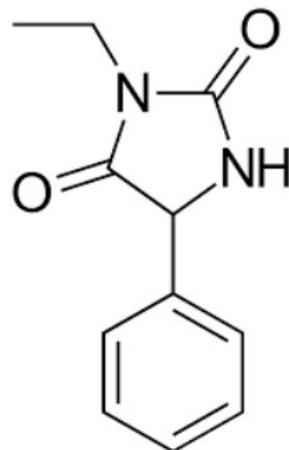
Methabarbital



Mephentyoin



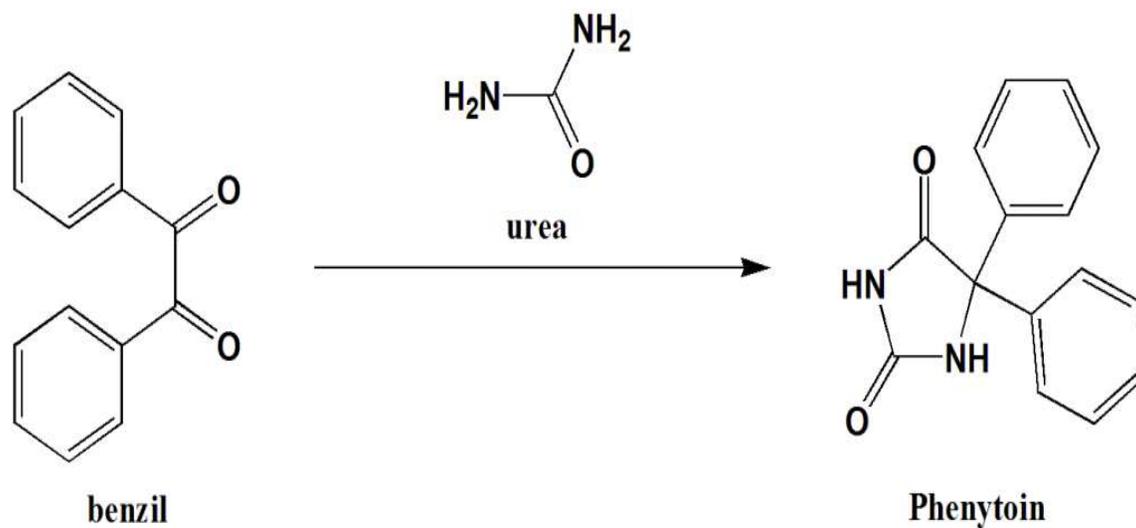
Phenytoin



Ethotoin



Synthesis of Phenytoin

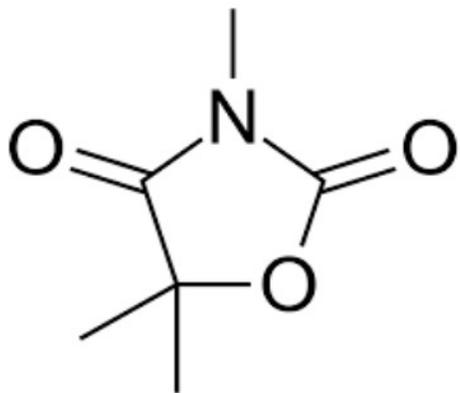


3. Oxazolidinediones

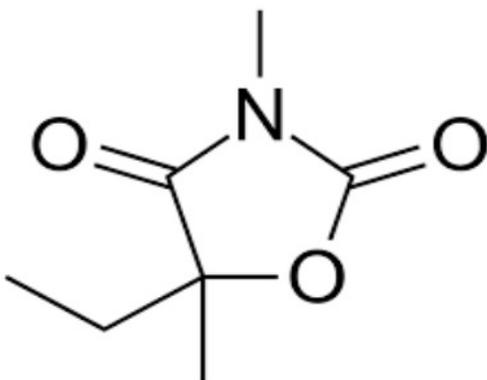
Drug	Introduction	MOA	Uses
Trimethadione	Prototype oxazolidinedione; used for absence seizures.	Blocks T-type Ca^{2+} channels in thalamic neurons.	Absence (petit mal) seizures (now rarely used due to toxicity).
Paramethadione	Less toxic than trimethadione; same class.	Inhibits T-type Ca^{2+} currents \rightarrow reduces thalamic firing.	Absence seizures.

4. Succinimides

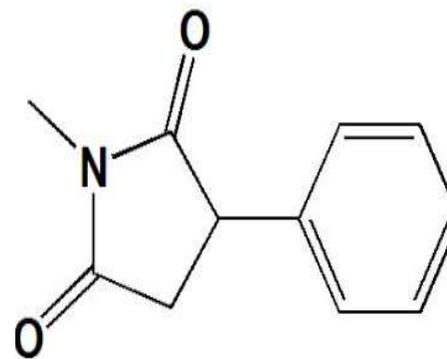
Drug	Introduction	MOA	Uses
Phensuximide	Succinimide derivative; mild GI irritation.	Blocks T-type Ca^{2+} channels in thalamus.	Absence seizures.
Methsuximide	More potent succinimide derivative.	T-type Ca^{2+} channel blockade.	Refractory absence seizures, atypical absence.
Ethosuximide*	Drug of choice for absence seizures.	Selectively blocks T-type Ca^{2+} channels in thalamus.	Absence seizures (first choice).



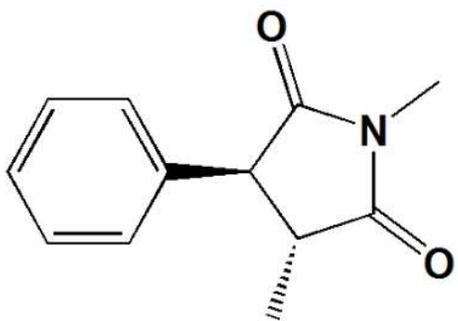
Trimethadione



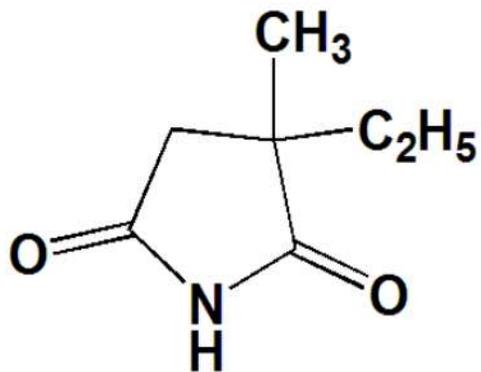
Paramethadione



Phensuximide

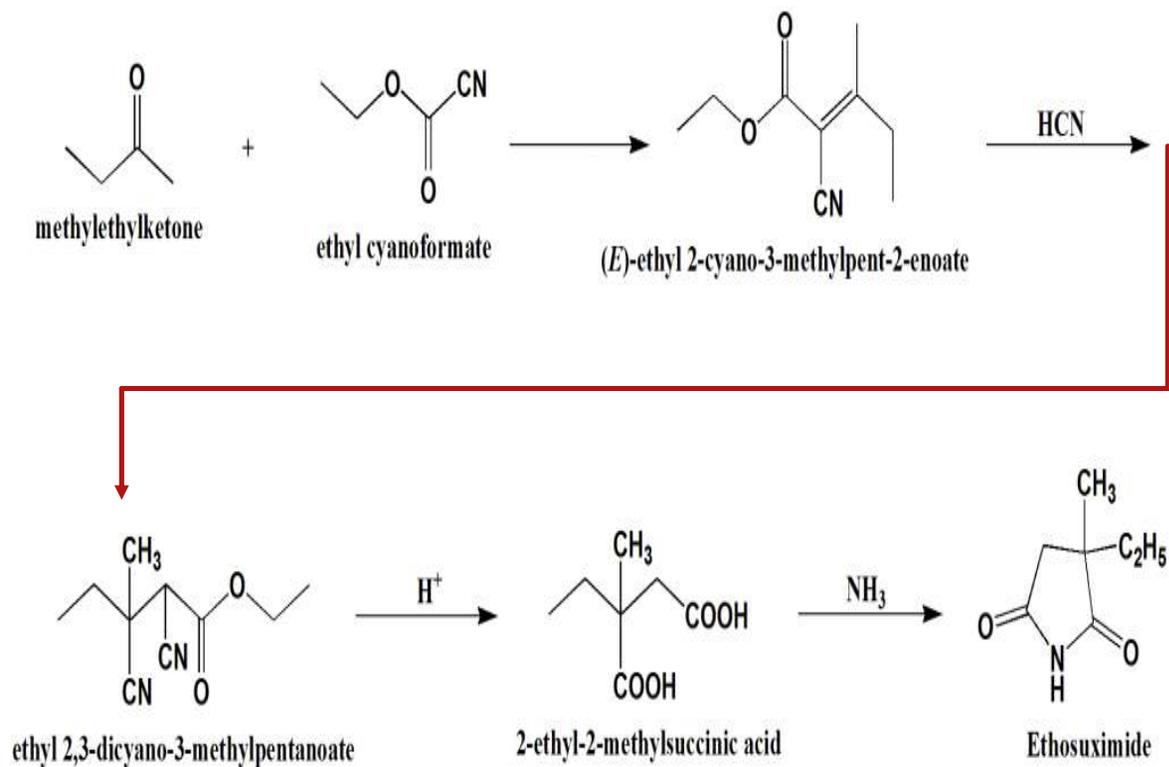


Methsuximide



Ethosuximide

Synthesis of Ethosuximide

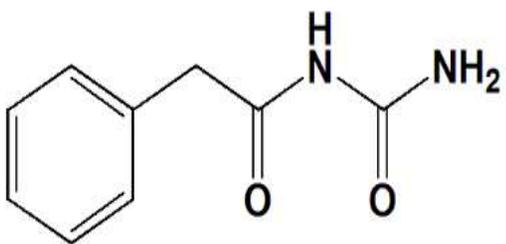


5. Urea & Monoacylureas

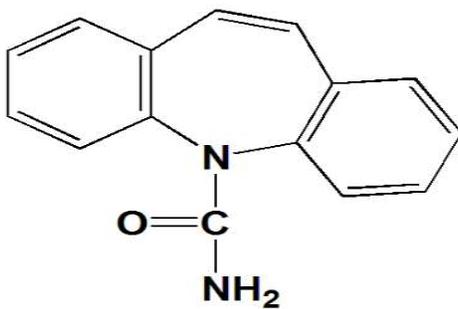
Drug	Introduction	MOA	Uses
Phenacemide	Acylurea anticonvulsant; rarely used (toxicity).	Blocks Na ⁺ channels + reduces seizure spread.	Refractory epilepsy.
Carbamazepine*	Iminostilbene derivative; major antiepileptic.	Blocks voltage-gated Na ⁺ channels → stabilizes hyperexcitable neurons.	Partial seizures, generalized tonic-clonic seizures, trigeminal neuralgia, bipolar disorder.

6. Urea & Monoacylureas

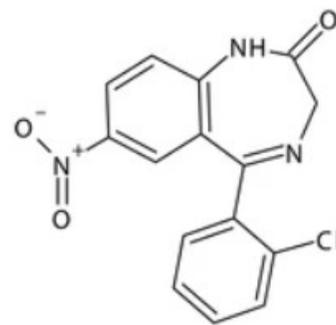
Drug	Introduction	MOA	Uses
Clonazepam	Potent benzodiazepine with strong anticonvulsant action.	Enhances GABA-A → ↑ frequency of Cl ⁻ channel opening.	Absence & myoclonic seizures, infantile spasms, akinetic seizures.



Phenacetamide



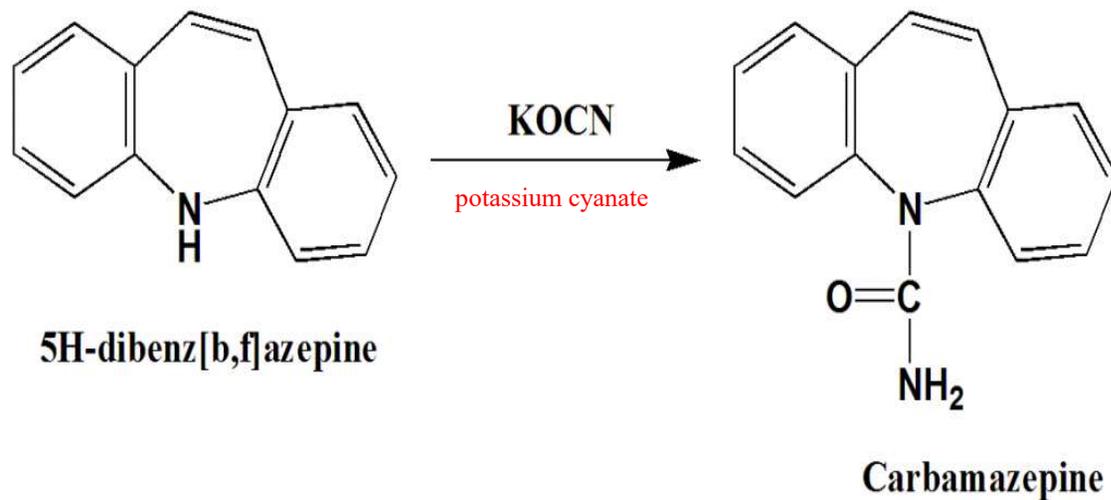
Carbamazepine



Clonazepam

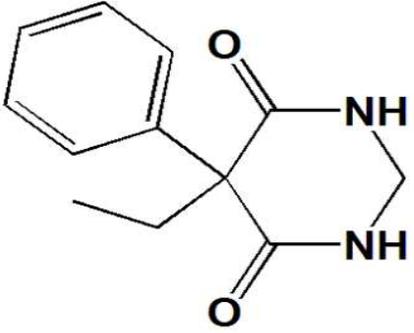
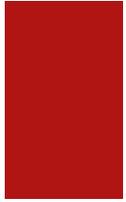


Synthesis of Carbamazepine

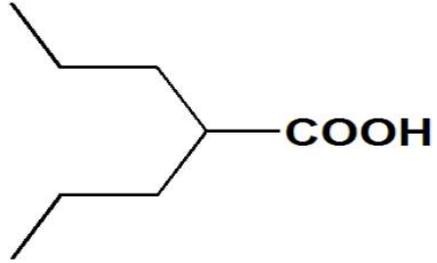


7. Miscellaneous Anticonvulsants

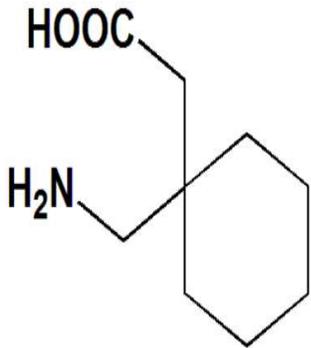
Drug	Introduction	MOA	Uses
Primidone	Converted to phenobarbital & PEMA; broad-spectrum.	Metabolized to active compounds that ↑ GABA and block Na ⁺ channels.	Partial & generalized tonic-clonic seizures.
Valproic acid (Valproate)	Broad-spectrum anticonvulsant.	Blocks Na ⁺ channels, blocks T-type Ca ²⁺ channels, ↑ GABA by inhibiting GABA-T.	Absence, myoclonic, generalized tonic-clonic seizures; bipolar disorder; migraine prophylaxis.
Gabapentin	GABA analog; does NOT act on GABA receptors.	Binds α _{2δ} subunit of Ca ²⁺ channels → ↓ excitatory neurotransmitter release.	Partial seizures, neuropathic pain, fibromyalgia.
Felbamate	Broad-spectrum; used last-line due to toxicity.	Blocks NMDA receptors; potentiates GABA; inhibits Na ⁺ channels.	Refractory partial seizures, Lennox–Gastaut syndrome.



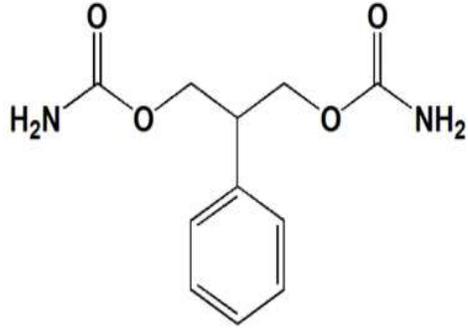
Primidone



Valproic acid



Gabapentin



Felbamate



Thank You

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