How does GABA inhibit neurons?

Dr. Amanda Freeman
Different Types of GABA Receptors

$\text{GABA}_A$  $\text{GABA}_B$
Different Types of GABA Receptors

$\text{GABA}_A$

Inside neuron

Outside neuron

Important target for
- Tranquilizers
- Anesthetics
- Anticonvulsants

GABA

Chloride (Cl$^-$)
Different Types of GABA Receptors

$\text{GABA}_A$  $\text{GABA}_B$

Inside neuron  Outside neuron

Important target for
- Muscle Relaxants
- Antiepileptics

GABA<sub>A</sub> Receptor

From the side

From the top

GABA<sub>B</sub>
GABA<sub>A</sub> Receptor

**GABA binding sites**

From the side

From the top

GABA<sub>A</sub> Receptor

**Ethanol and volatile anesthetic binding sites**

From the side

From the top
**GABA<sub>A</sub> Receptor**

*Benzodiazepine binding site*

*From the side*  
*From the top*

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<table>
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<tr>
<th>GABA&lt;sub&gt;A&lt;/sub&gt; receptor subtype</th>
<th>Percentage of all GABA&lt;sub&gt;A&lt;/sub&gt; receptors</th>
<th>Function</th>
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</table>
| $\alpha_1$ ($\alpha_3\beta_2\gamma_2$) | 60% | Anesthetics  
Sedation*  
Amnesia*  
Anticonvulsant* |
| $\alpha_2$ | 15-20% | Anxiolytic* |
| $\alpha_3$ | 10-15% | Muscle relaxation*  
Anxiolytic* |
| $\alpha_5$ | <5% | Learning and Memory |

* Effects of Benzodiazepines

What does GABA have to do with sleep?
Wake Promoting

Histamine
Serotonin
Norepinephrine
Acetylcholine
Hypocretin/Orexin

Sleep Promoting

GABA
From Ventrolateral Preoptic Area (VLPO)
Modulation of Vigilance in the Primary Hypersomnias by Endogenous Enhancement of GABA<sub>A</sub> Receptors

David B. Rye, Donald L. Bliwise, Kathy Parker, Lynn Marie Trotti, Prabhiyot Saini, Jacqueline Fairley, Amanda Freeman, Paul S. Garcia, Michael J. Owens, James C. Ritchie, Andrew Jenkins


Wake
Histamine
Serotonin
Norepinephrine
Acetylcholine
Hypocretin/Orexin

Sleep
GABA