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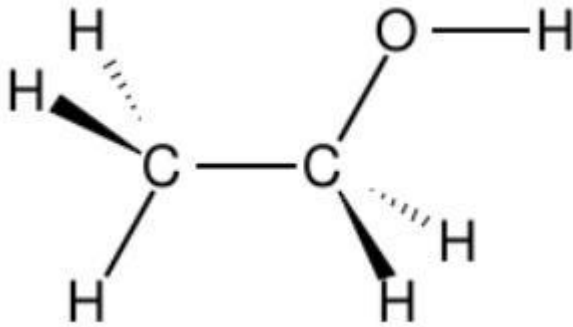
## Ethyl Alcohol

Also see our longer article, [A Small Dose of Alcohol](#).

Just the facts

Physical Information
Name: Ethyl Alcohol
Molecular Formula: $\text{CH}_3\text{CH}_2\text{OH}$
Use: solvent, intoxicant
Source: home, industry, stores, and alcoholic beverages
Recommended daily intake: not essential
Absorption: readily absorbed by intestine, food will delay absorption
Sensitive individuals: fetus (Fetal Alcohol Spectrum Disorder (FASD))
Toxicity/symptoms: developing nervous system very sensitive to low levels of exposure; kids - lowered IQ, learning and behavioral problems; adults - memory loss, inebriation, liver disease, cancer
Regulatory facts: government agencies recommend women not consume alcohol during pregnancy; blood alcohol regulated by local governments when operating a motor vehicle
Recommendations: do not consume alcohol during pregnancy, otherwise limit consumption and do not drive a motor vehicle after drinking

## Chemical Structure



## History and Introduction

Alcohol has been widely consumed for millenia for numerous reasons: part of a standard diet, for medicinal reasons, for its relaxant and euphoric effects, or for recreational purposes. The discovery of the distillation process during the 12th century made it possible to make drinks with higher alcohol content than can be achieved by the fermentation process alone (#MedLine Plus). It is from this process that alcohol got its name from Paracelsus, meaning "finely divided" in Greek which refers to distillation. It is believed that fermented beverages may date back to over 9,000 years ago, and the production and consumption of wine are mentioned several times in the Bible.

Ethanol is a psychoactive drug with a depressant effects and is widely regulated. Ethyl alcohol is generally consumed in one of a few different types of alcoholic beverage - beer, wine, distilled liquor.

Approximate concentrations of alcohol:

- an average beer is approximately 5% alcohol
- wine is usually 12-15% alcohol
- distilled liquor generally ranges from 30-50% but it can be higher.

Alcohol is one of the most widely-used drug substances in the world and alcohol abuse is a rampant sociological problem.

## Chemical Description

Ethanol's empirical formula is  $\text{CH}_3\text{CH}_2\text{OH}$ . Ethanol is a two-carbon alcohol. It is also considered a primary alcohol, meaning the carbon with the hydroxyl group has at least two hydrogens attached as well.

## Pharmacology and Metabolism

Ethyl alcohol is metabolized in the liver. Upon reaching the liver, the enzyme alcohol dehydrogenase breaks down the alcohol into acetaldehyde. The acetaldehyde is then catabolized into acetic acid by the enzyme acetaldehyde dehydrogenase. Finally, the acetate is converted into fats or carbon dioxide and water.

Ethanol's mechanism of action remains less understood than most of the psychoactive drugs. Ethanol

appears to act by modifying cell membranes rather than by binding to specific receptor sites on neurons like other compounds. Alcohol dissolves in the lipid layer of cellular membranes, causing an increase in its fluidity. This change may modify the actions of specific receptors or ion channels, resulting in the many behavioral effects of ethanol.

Specific receptors that have been associated with the effects of alcohol include gamma aminobutyric acid (GABA) and N-methyl-D-aspartate (NMDA). The inhibitory effects of ethanol may result from an enhancement of GABA receptor function, increasing the effects of this inhibitory receptor which causes most of the effects such as relaxation, relief from anxiety, ataxia, and lowering of inhibitions. A blockade of NMDA receptor function interferes with the effects of this excitatory receptor. However, pinpointing a site of action or single mechanism of alcohol effects is difficult because the drug affects virtually all neurochemical and endocrine systems (Trujillo).

### Health Effects

Alcohol is known to be therapeutic in moderate doses and, when taken moderately, alcohol has shown to decrease the risk of heart disease and the cleansing and flushing out of the kidneys. However, in doses above moderation (above 1-3 glasses of wine per week), acute toxic effects can easily occur. These acute effects include, but are not limited to, dehydrations and central nervous system depression. The latter properties of alcohol intoxication may lead to impaired sensory and motor function, slowed cognition, unconsciousness, and possible death. Below is a list of the effects of alcohol on the body in association with blood alcohol concentration (#Medline Plus):

- 0.05 - Reduced Inhibitions
- 0.10 - Slurred Speech
- 0.20 - Euphoria and Motor Impairment
- 0.30 - Confusion
- 0.40 - Stupor
- 0.50 - Coma
- Above 0.50 - Respiratory Paralysis and Death

Possible chronic toxic effects associated with the consumption of ethanol are more likely to be caused by the accumulation of acetaldehyde in the liver. This may increase the risk of cirrhosis of the liver and multiple forms of Cancer. The disease known as alcoholism may develop with the chronic use of ethanol.

### Regulation

In order to help prevent accidents and injuries caused by the effects of alcohol, there have been a few legal regulations developed. One of the laws set by the U.S. government to aid in preventing teen drinking is putting an age restriction on those purchasing alcohol. Anyone purchasing an alcoholic beverage must be at least 21 years of age.

Another law set by the government targets drinking and driving, or driving under the influence (DUI). The legal limit of blood alcohol concentration for driving a vehicle falls between 0.08 and 0.10 in most states.

## Quotes

- "Alcohol is the number one drug of choice among our Nation's youth. Yet the seriousness of this issue does not register with the general public or policymakers." Enoch Gordis, M.D. Director, National Institute on Alcohol Abuse and Alcoholism.
- "You will conceive and bear a son...now then be careful to take no wine or strong drink and to eat nothing unclean". Bible - Judges 13:3-4.

## External Links

- International Council on Alcohol and Addictions (ICAA)
- U.S. The Bureau of Alcohol, Tobacco, Firearms and Explosive (ATF), Department of Justice
- U.S. National Institute on Alcohol Abuse and Alcoholism (NIAAA)
- U.S. National Clearinghouse for Alcohol and Drug Information (NCADI)
- U.S. Center for Substance Abuse Prevention (CSAP)
- Alcoholics Anonymous (AA)
- Center for Science in the Public Interest (CSPI)
- Mothers Against Drunk Driving (MADD)
- National Council on Alcoholism and Drug Dependence, Inc. (NCADD)
- Rutgers Center of Alcohol Studies (CAS)
- FAS Bookshelf, Inc
- National Organization on Fetal Alcohol Syndrome
- The Alcohol and Temperance History Group (ATHG)

## References

- MedLine Plus Medical Encyclopedia. "Alcohol Use." 30 JAN 2008.
- University of Bristol School of Chemistry. "Famous Alchemists." 2 MAR 2008
- Forney, Robert B. and Rolla N. Harger. "Toxicology of Ethanol." Annual Review of Pharmacology Vol. 9, 1969 pp. 379-392. 30 JAN 2008
- Mehta, AK and MK Ticku. "Ethanol potentiation of GABAergic transmission in cultured spinal cord neurons involves gamma-aminobutyric acidA-gated chloride channels." The Journal of Pharmacology and Experimental Therapeutics AUG 1988 pp. 558-64. 03 FEB 2008
- Ophardt, Charles E. "Alcohol Metabolism Effects." Virtual ChemBook. 2003 Elmhurst College. 2 MAR 2008
- Rajendram, Rajkumar and Victor R. Preedy. "Effect of Alcohol Consumption on the Gut." Digestive Diseases: Clinical Reviews Vol. 23, No. 3-4, 2005 pp. 214-221. 30 JAN 2008
- Reuters. "9,000-year History Of Chinese Fermented Beverages Confirmed". ScienceDaily 7 December 2004. 2 MAR 2008
- Trujillo, Keith A. and Andrea B. Chinn. "Drugs and the Brain: Ethanol. California State University. 20 FEB 2008