Alcohols

- beverage alcohol = ethanol or ethyl alcohol
- rubbing alcohol = isopropyl alcohol (also in antiseptics, aftershave, window washer fluid)
- methanol or methyl alcohol - common industrial/chemical form of alcohol (antifreeze, Sterno, solvents)
- All are toxic but latter 2 extremely so. Liver turns methanol into formaldehyde, causing blindness and brain damage.

Ethanol

- Produced by the action of yeast on a sugary mixture ("fermentation")
- Also can come from starches by stimulating their conversion to sugar
- Fermentation yields a max of about 15% alcoholic beverage
- Distillation must be used to produce stronger spirits
- “Proof” = 2 x %

A Sampling of Concentrations

<table>
<thead>
<tr>
<th>Alcohol Type</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 fl oz of regular beer</td>
<td>about 5% alcohol</td>
</tr>
<tr>
<td>8 fl oz of wine</td>
<td>about 5% alcohol</td>
</tr>
<tr>
<td>3.5 oz of hard liquor (vodka, rum, etc.)</td>
<td>about 17% alcohol</td>
</tr>
<tr>
<td>2 oz of hard liquor (whiskey, gin)</td>
<td>about 20% alcohol</td>
</tr>
<tr>
<td>1 oz of hard liquor (brandy, liquor)</td>
<td>about 40% alcohol</td>
</tr>
<tr>
<td>1.5 oz of 80-proof moonshine</td>
<td>about 40% alcohol</td>
</tr>
</tbody>
</table>

Alcohol Absorption

- Fat & water soluble molecule easily gets into all tissues; no digestion necessary
- Alcohol provides calories but no nutrients
- ~20% absorbed from stomach, 80% from intestines
- Stomach contents, alcohol concentration, carbonation, gender, drug interactions (e.g. aspirin, anti-ulcer) all affect absorption
- Other factors influencing intoxication: Speed of consumption, speed of gastric emptying, individual sensitivity, expectancy effects
- We are terrible judges of our impairment.

Typical Effects on the Body

- Dilation of blood vessels in skin leading a warm surface flush (but drop in core body temp)
- Decreased Anti-diuretic Hormone (ADH) leading to increased urination & dehydration
- In moderate doses, increased HDLs (good) and lowered LDLs (bad), except in smokers
- Gastric irritation

Actions of Alcohol on the Brain - multiple actions

- Produces most depressant actions by enhancing the inhibitory effects of GABA
- (A drug (RO 15-4513) which keeps alcohol from binding to GABA receptor acts as a "sober-up" drug)
- Alcohol also blocks excitatory effect of glutamate so is "extra-depressant" in its effects
- These actions, in turn, lead to the release of SHT, DA, endorphin and anandamide producing rewarding/mood elevating effects
Typical Acute Effects of Different Doses of Alcohol

<table>
<thead>
<tr>
<th>BAC (mg/dl)</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 - 0.02</td>
<td>Slight changes in feeling, sense of warmth and self-esteem.</td>
</tr>
<tr>
<td>0.02 - 0.06</td>
<td>Feelings of elation, slight confusion, happiness, skin may feel warm. Sensory perception may be altered.</td>
</tr>
<tr>
<td>0.06 - 0.10</td>
<td>Effects may be more noticeable. More exaggerated changes in mood, impaired judgment, and lowered inhibitions. Coordination may be impaired. Reaction time may increase slightly. Sensory changes may be noticeable. Sometimes feelings of euphoria.</td>
</tr>
<tr>
<td>0.10 - 0.15</td>
<td>Impairment of motor coordination and reaction time. Racing heart rate and free speech. Legal limit of intoxication in 25 of the United States.</td>
</tr>
<tr>
<td>0.15</td>
<td>Major impairment in balance and movement. Large decrease in reaction time. Large impairment in judgment and perception.</td>
</tr>
<tr>
<td>&gt;0.15</td>
<td>Typically, inability to walk, speech becomes slurred, face becomes flushed. Difficulty standing or walking.</td>
</tr>
<tr>
<td>0.25</td>
<td>Confusion and stupor. Difficulty understanding what is going on. Possible loss of consciousness (coma).</td>
</tr>
<tr>
<td>&gt;0.30</td>
<td>Typically, unconsciousness, seizures and hallucinations of the skin. Alcohol poisoning and death.</td>
</tr>
</tbody>
</table>

Alcohol Expectancy Effects (balanced placebo design)

- In separate studies, males who expected to receive alcohol showed:
  - if you expect to get drunk you act drunker
  - more subjective arousal & sexual disinhibition whether or not they got alcohol
  - more aggressive behavior whether or not they actually received alcohol
  - So not only does alcohol disinhibit behavior but just the expectation of alcohol does as well

Impairment of Driving
- impairs attention, judgment, reaction time, alertness, coordination
- 41% of traffic fatalities involve someone legally intoxicated (60% of teen fatalities)
- Even a BAC of 0.02-0.04 → 40% increase in accidents
- 0.05-0.08 BAC → 4x greater risk than sober
- 0.10-0.14 BAC → 6-7x greater risk
- 0.15 BAC → 25x greater risk
- >100 countries have set legal limit at 0.05 & the National Traffic Safety Board is campaigning that the US do the same

Loss of Judgment & Self-Control
- Cognitive inhibition + disinhibition of behavioral/emotional control is a dangerous combo!
- Alcohol is involved in:
  - 50% of police arrests
  - 50-60 % of murders
  - 40% males committing sexual assault
  - 60-70% males committing domestic abuse
  - 60% of child molestation & abuse
  - 35% of suicides

Metabolism
- In males ~15% of alcohol can be metabolized in stomach before its even absorbed; women may have half as much metabolized here.
- The rest is metabolized in liver → 1 standard drink/ hr by a healthy liver
- Alcohol dehydrogenase converts alcohol into acetaldehyde, a rather nasty byproduct
- Aldehyde dehydrogenase breaks down acetaldehyde into acetic acid
- Acetic acid is oxidized into oxygen, carbon dioxide, and calories
Why Do We Experience Hangovers?

- Mini-withdrawal from alcohol (rebound hyperexcitability)
- Toxic reaction to congeners
- Toxic reaction to alcohol & its byproduct acetaldehyde
- Fatigue, dehydration, hypoglycemia, loss of vitamins, etc. due to partying

Congeners:
- other alcohols, oils, and organic substances added or formed during the production of an alcoholic beverage
- Congeners give these beverages their distinctive color, odor and taste
- Congeners are 1 of the factors influencing hangover
- Highest in congeners: bourbon, scotch, brandy, tequila, red wine, dark beers

Alcohol Poisoning/Overdose

- Symptoms:
  - Stuporous or unconscious; can’t be roused
  - Cool or damp skin; pale or bluish skin
  - Shallow slow or irregular breathing <8/min
  - Vomiting while unconscious
  - Weak rapid pulse
- Can be fatal or cause brain damage – call 911
- 30,000 college students/yr treated for alc. overdose – untreated, many die

- Nearly 31,000 Americans die each year from the adverse effects of alcohol on their health.
  - Almost half of these deaths due to cirrhosis of liver.

- On average, 6 deaths/day in US due to alcohol poisoning
Health Risks of Chronic Heavy Drinking

• Nervous system dysfunction & brain damage (Wernicke-Korsakoff’s syndrome) affecting memory, motor function; alcoholic dementia
• Fatty liver; alcoholic hepatitis; cirrhosis (7th leading cause of death in US)
• Impaired reproductive functioning
• Gastritis, pancreatitis
• Co-carcinogen increasing risk of oral, throat, stomach, intestinal, liver and possibly breast cancers. Increases cancer risks of smoking.
• Impaired immune function

Fetal Alcohol Spectrum Disorders

2,600,000 alcohol-exposed US babies/yr!
• May be subtle or severe depending on degree & timing of exposure
• 3rd most common cause of birth defects, retardation and learning disabilities (& the most preventable)
• Seen in 30-50% babies born to alcoholic mothers, but symptoms may also be seen with as little as 2 drinks twice a week.
• Binge drinking particularly damaging
• http://www.cdc.gov/NCBDDD/fasd/facts.html

Symptoms:

• Reduced growth (75% of FAS babies are less than 5 lbs). This low birth weight is associated with increased infant mortality.
• Physical abnormalities (small head & brain, distinctive facial features, hand, eye, ear, heart & organ abnormalities)
• CNS abnormalities causing mental retardation, poor motor skills, a variety of learning/behavioral disabilities
• Developmental & behavioral problems even in the absence of physical symptoms
• Partial symptoms = FAE or ARND
• You do not have to be the “drunk lying in the alley” to experience these alcohol related problems.
• Men who drink 5 or more drinks/day or 15 or more drinks/week and women who drink 4 or more drinks/day or 8 or more drinks/week are at increased risk of alcohol problems.
• NIAAA has asked all physicians & mental health workers to screen for this in their patients & provide counseling on risks.

Alcohol Withdrawal

• Without the depressant you are overstimulated by the “hyperexcitability rebound”
• tremors (“the shakes”)
• agitation, anxiety (“the jitters”)
• insomnia - if you do sleep, vivid nightmares
• sweating, nausea, vomiting
• increased HR & BP
• alcoholic hallucinosis
• grand mal seizures in about 10%, usually 12-48 hrs after last drink but may be sooner if susceptible
• For some, these early symptoms worsen→
Alcohol Withdrawal - the “DT’s”
Delirium tremens
- Usually begins 2-4 days after last drink and lasts 1-7 days
- Disorientation, agitation, confusion, terrifying hallucinations, delusions, as well as nightmares, violent behavior
- More extreme bodily stimulation & autonomic instability (sweating, high fever, risk of heart failure as well as seizures) – death in 5%

Pharmacological Aids to Treatment
- During detox:
  - Use of another depressant (benzodiazepine like Librium, Ativan or Valium or another anticonvulsant) to gradually withdraw individual & try to avoid seizures.

After Detox
- Anti-relapse:
  - Alcohol-Sensitizer - Antabuse (disulfiram);
  - Various anti-craving Drugs:
    - Narcotic antagonists: Revia (naltrexone) blocks opiate receptors – both oral & extended-release injection available
    - Campral (acamprosate) helps restore GABA balance & blocks glutamate
    - Antidepressants (most often SSRIs) – antidepressant, anti-anxiety effects
    - Anticonvulsant mood stabilizers (topiramate, valproate, gabapentin) are looking promising

  - These should be combined with meetings and/or psych interventions

Note:
- Last couple pages in alcohol chapter are on “inhalants of abuse” and will be covered later in the semester.
- Time to do more summary sheets to help you review drug families we have finished!
- Test 2 is a week from Tuesday!