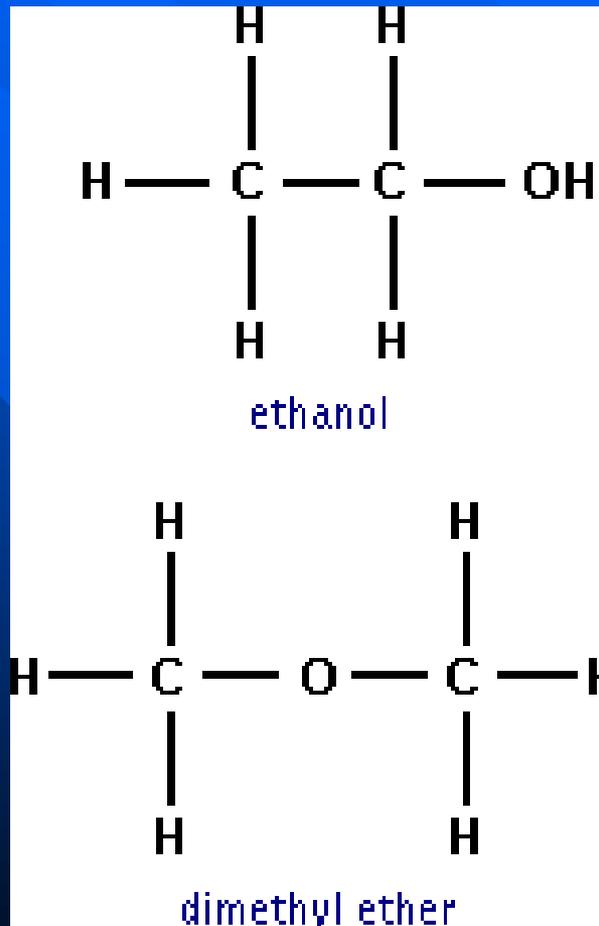


**WELCOME TO
THE SCIENCE OF ALCOHOL
AND ALCOHOLISM**

Element- A substance which cannot be decomposed into simpler substances by chemical reactions. Some important biological elements:

- Oxygen (O)
- Carbon (C)
- Phosphorus (P)
- Calcium (Ca)
- Potassium (K)
- Iron (Fe)
- Hydrogen (H)
- Nitrogen (N)
- Sulfur (S)
- Sodium (Na)
- Magnesium (Mg)

CHEMICAL ISOMERS
BOTH CHEMICALS ARE H_6C_2O ,
BUT THEY ARE NOT THE SAME
CHEMICAL!



Types of Alcohol

- Isopropyl ("rubbing alcohol")
- Methyl ("wood alcohol") (CH_3OH)
- Ethyl (beverage alcohol/ethylene/ethanol) $\text{H}_5\text{C}_2\text{OH}$

ALCOHOL EQUIVALENTS

12 Oz. Beer @ 6% alcohol =

4 oz wine @ 12% alcohol =

**1.25 oz spirits @ 80 proof (40%) alcohol
=**

1 oz spirits @ 100 proof (50%) alcohol

Absorption of alcohol

- Mouth
- Stomach
- Small intestine
- Rate depends on presence/absence of food

Metabolism of alcohol

- Occurs primarily in the liver
- Proportionate to body weight

Metabolism of alcohol

- Metabolized at the rate of .015 of blood alcohol concentration (BAC) per hour.
 - Person with 0.15 BAC will have no measurable alcohol in the bloodstream after ten hours (.15 divided by .015 = 10)
 - .08: 5.5 hours
 - .05: 3.4 hr
 - .02: 1.5 hr

Metabolism of alcohol

Alcohol

alcohol dehydrogenase (ADH)

Acetaldehyde-

acetaldehyde dehydrogenase (ALD-H)

Acetic acid (acetate)

CO₂ & H₂O

Metabolism of alcohol

- Heavy alcohol drinkers may show ↑ liver enzymes
 - SGOT (serum oxaloacetic tranaminase)
 - SGPT (serum glutamic pyruvic tranaminase)

Variations in alcohol metabolism

- 50% of persons of Japanese ancestry have a variant form of ALDH which is less able to metabolize alcohol. Also present in some persons of Chinese ancestry.
- Levels of acetaldehyde may be 10X higher than in persons with normal ALDH

Variations in alcohol metabolism

- **Excess acetaldehyde produces “alcohol flush reaction”**
 - **Facial flushing**
 - **Vasodilation**
 - **Tachycardia**
 - **Headache**
 - **Nausea**
 - **Vomiting**
 - **edema (fluid build-up/”water weight”)**
 - **hypotension**

Alcohol Flush Reaction

- Same reaction occurs when individuals on Antabuse drink
- Presence of ALDH variant seems to lessen tendency to drink alcohol
- The ALDH variant is rare in Japanese alcoholics with liver disease

Blood alcohol level (BAL)/Blood alcohol concentration (BAC) & Behavior

BAL

Behavior

0.05%

Relaxation, decreased inhibitions & alertness, possible personality change

0.08

Legal level in Illinois for DUI

0.10

Slowed reaction time, impaired judgment, personality changes

0.15

Large, consistent in reaction time mood/personality changes

Blood alcohol level (BAL)/Blood alcohol concentration (BAC) & Behavior

BAL

Behavior

0.20

Significant impairment of sensory and motor functions, marked intoxication

0.25

Severe motor and sensory disturbance, staggering gait, marked intoxication

.30

Semi-stupor, marked decrease in awareness and breathing rate, blackouts

.35

Surgical anesthesia, level of LD₁, minimal level normally required to cause death

Blood alcohol level (BAL)/Blood alcohol concentration (BAC) & Behavior

BAL

Behavior

0.40

LD₅₀

- On average, fifty percent of drinkers with a blood alcohol level of 0.40 will die of alcohol poisoning.

“HE IS.....”

WHAT ABOUT “SHE”?

SEX DIFFERENCES AND ALCOHOL INTOXICATION

IN GENERAL, AT THE SAME LEVEL
OF ALCOHOL CONSUMPTION, WOMEN
ACHIEVE A HIGHER BAC THAN MEN

SEX DIFFERENCES AND ALCOHOL INTOXICATION

- Women's body weight is usually less than men's
- Women tend to have less water in their bodies and a higher percent of body fat, so there is less tissue in which alcohol can dissolve
- Women tend to metabolize alcohol less efficiently than men.
- Men tend to drink and snack, increasing amount of food in the stomach
- Women tend to diet more than men/may not eat very much prior to drinking

PHYSIOLOGICAL EFFECTS OF ACUTE ALCOHOL CONSUMPTION

- Dilation of the peripheral blood vessels = flushing, increased warmth of skin, possibly sweating.
- Small doses produce slight in respiration. Large doses ($>.39$) can produce respiratory arrest.
- Slowing of brain waves
- Appearance of nystagmus at $\sim 0.10\%$ and above.
- Increase in blood sugar/glucose (hyperglycemia) for \sim one hour

GASTROINTESTINAL (G.I.) SYSTEM: THE G.I. TRACT

- mouth
- esophagus
- stomach
- small intestine
- large intestine (colon)
- rectum
- anus

GASTROINTESTINAL (G.I.) SYSTEM : ACCESSORY ORGANS

- salivary glands
- pancreas
- liver
- gallbladder

EFFECT OF ALCOHOL ON THE GASTROINTESTINAL SYSTEM

Responsible for:

- ingestion, digestion, absorption of food
- ingestion, absorption, and breakdown of some drugs
- the elimination of solid wastes.

EFFECT OF ALCOHOL ON THE GASTROINTESTINAL SYSTEM

- Esophagitis
- Peptic Ulcer Disease
- Hemorrhagic pancreatitis
- Uric acid elevation---
Gout
- Hyperglycemia
- Alcoholic hepatitis
- Gastritis
- Pancreatitis
- Pancreatic insufficiency
- Hypoglycemia
- Alcoholic fatty liver
(hepatosis)
- Cirrhosis

Gastritis

- Presence of alcohol in the stomach initiates release of gastric juices
- If no food is present, the stomach can become irritated
- Alcohol does not cause ulcers, but if one is already present, both alcohol and unabsorbed gastric juices can make it worse
- If stomach lining is ulcerated enough, bleeding can occur

Pancreatitis

- Pancreas secretes digestive enzymes into the small intestine via the pancreatic duct.
- Alcohol can block the duct by inflaming the small intestine
- Digestive enzymes “stuck” in pancreas; begin to irritate and digest it

Pancreas



Pancreatitis

- Most common symptom pancreatitis is pain.
- May come on suddenly or build gradually.
- Pain usually centered in the upper middle or upper left part of the abdomen.
- May feel as if it radiates through to the back.
- Often begins or worsens after eating.
- Typically lasts a few days, unless drinking continues

Pancreatitis

■ Other symptoms:

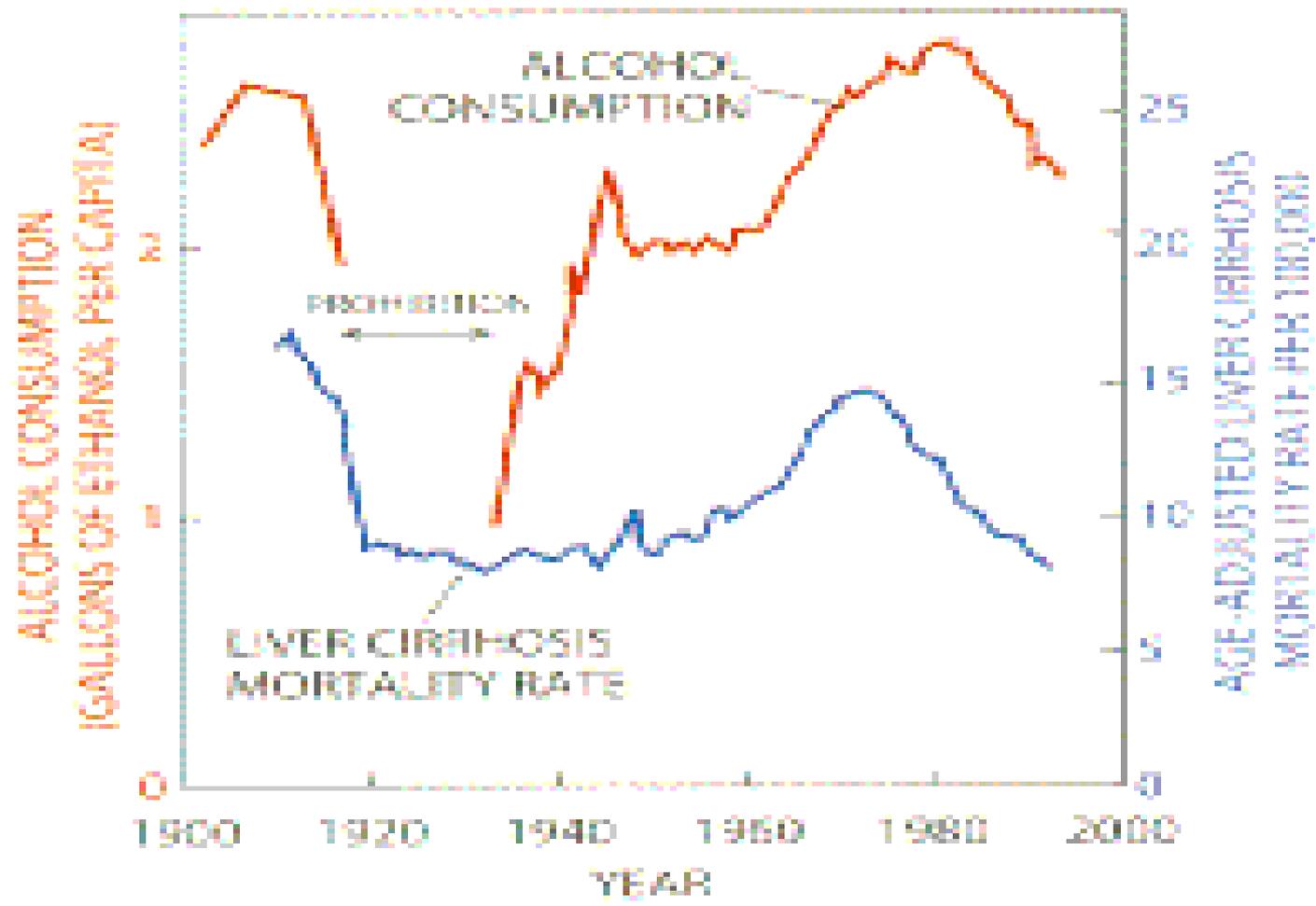
- Abdomen swollen and tender to the touch
- Tachycardia (May indicate internal bleeding)
- Dehydration
- Low blood pressure
- If blood pressure ↓ too much, circulatory shock

Hemorrhagic Pancreatitis

- Pancreatic enzymes eat through wall of pancreas, causing bleeding in the abdominal cavity

Pancreatic insufficiency

- Pancreas is sufficiently damaged that it stops producing digestive enzymes
- Production and secretion of insulin may slow or stop.
- Tx=Supplemental enzymes and insulin



SOURCE: National Institute on Alcohol Abuse and Alcoholism

PROHIBITION

ALCOHOL AND LIVER DISEASE

- Alcohol-induced liver disease (ALD) is a major cause of illness and death in the United States.
- Alcoholic fatty liver (hepatosis) reversible with abstinence.
- At least nine out of ten chronic alcoholics will develop alcoholic fatty liver.
- Placques of fat invade structure of the liver
- No obvious symptoms.
- Detected by physical exam and blood laboratory studies.

HEPATOSIS

- If a person stops drinking, fatty liver will disappear on its own in 4 to 6 weeks without formalized medical treatment.
- If drinking continues, fatty liver may progress to hepatitis.

ALCOHOL AND LIVER DISEASE

■ More serious ALD:

- alcoholic hepatitis (persistent liver inflammation)
- cirrhosis (progressive scarring of liver tissue).

ALCOHOLIC HEPATITIS

- **Hepatitis" is a general word that refers to swelling or inflammation of the liver.**
- **Alcoholic hepatitis is caused by the toxic effects of alcohol on the liver after long-term use.**
- **Alcoholic hepatitis usually occurs after fatty liver but may appear without any previous liver dysfunction.**

CIRRHOSIS

- Five to ten percent of all alcoholics develop cirrhosis of the liver
- Usually develops after long history of excessive alcohol intake.
- The disease may follow alcoholic hepatitis or may occur without any previous symptoms

ALCOHOL AND LIVER DISEASE

CONSEQUENCES OF LIVER DISEASE

- inability to synthesize protein
- inability to manufacture clotting factors
- inability to eliminate estrogen
- lessened ability to store vitamins
- diminished tolerance

EFFECT OF ALCOHOL ON THE CIRCULATORY SYSTEM

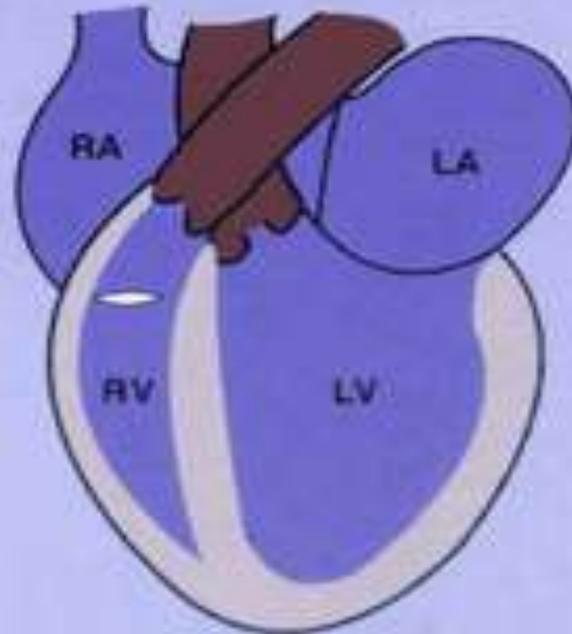
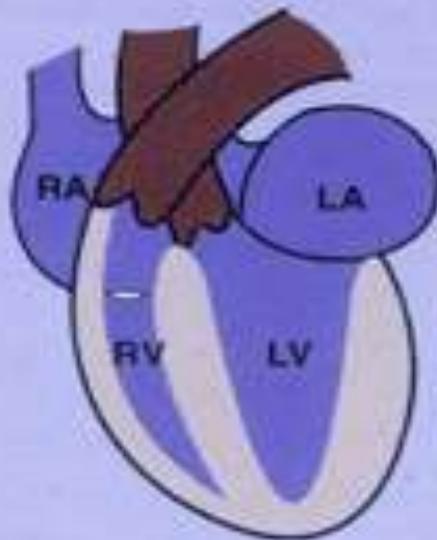
- Small amounts of etoh (~ 1 alcohol equivalent/day) seem to be good for the circulatory system
- Alcohol affects the entire circulatory system as well as the heart.
- Alcohol can produce:
 - High blood pressure
 - An enlarged, weakened heart
 - Irregular heartbeat

EFFECT OF ALCOHOL ON THE CIRCULATORY SYSTEM

- Poor diet = blood problems
 - anemias
 - decreased WBC Count
 - “Weak” WBCs
 - decreased platelets
- Alcoholic cardiomyopathy
 - palpitations
 - labored breathing

Normal Heart

Dilated Cardiomyopathy



Muscle



Chambers



Major Vessels

LA = Left Atrium

LV = Left Ventricle

RA = Right Atrium

RV = Right Ventricle

EFFECT OF ALCOHOL ON THE RESPIRATORY SYSTEM

- Paralysis of cilia
- Fluid accumulates in the nose, pharynx, larynx, and vocal chords ("whiskey voice"/hoarseness)
- Lung/esophageal cancer

EFFECT OF ALCOHOL ON THE ENDOCRINE SYSTEM

- decreased testosterone levels
- increased estrogen levels

EFFECT OF ALCOHOLISM ON THE NERVOUS SYSTEM

- Compared to non-alcoholics, the brains of alcoholics:
 - contain fewer nerve cells, fewer connections among cells, less white and grey matter, and larger ventricles.
- This “cerebral atrophy” is associated with impairment of intellect.
- The underlying mechanism of brain damage appears to be a direct toxic action of alcohol on nerve cells

EFFECT OF ALCOHOLISM ON THE NERVOUS SYSTEM

Wernicke Korsakoff Syndrome

- Results from thiamin deficiency
- Disorientation
- Confusion
- Apathy
- Inattentivenss
- Nystagmus
- Ataxia
- Korsakoff: Severe memory problems (retrograde and antegrade)
- Confabulation

INDIRECT EFFECTS OF ALCOHOLISM ON THE NERVOUS SYSTEM

- Liver damage = Deactivation of many toxins found in the normal diet.
- Toxic compounds (e.g., ammonia) released into the bloodstream.

ALCOHOL AND CANCER

■ Mechanisms

- irritation of cells
- liver damage
- nutritional deficiencies
- carcinogenic congeners
- interaction with tobacco (effect on lungs and inhibition of salivation)

ALCOHOL AND CANCER

■ Types of Cancer

- head/neck
- esophagus
- lung
- liver
- breast

ALCOHOL AND BREAST CANCER

- Intake of 2-5 drinks/day is associated with increased risk of breast cancer
- After 5 drinks/day, risk did not increase significantly
- “Among women who consume alcohol regularly, reducing alcohol consumption is a potential means to reduce breast cancer risk. “

Source: Smith-Warner, et. al. (1998)

BEER, BEEF AND CANCER

- Some evidence exists that moderate intake of beer may neutralize some of the carcinogens (heterocyclic amines/HAs) that form when meat is cooked.

ALCOHOL AND PREGNANCY

- Women who consume two or more drinks per week while pregnant have a higher risk of spontaneous abortion.
- Most spontaneous abortions occur during the second trimester.
- Drinking while pregnant increases the risk of stillbirth.
- Stillbirths can occur after heavy drinking in the last trimester.

FETAL ALCOHOL SYNDROME & FETAL ALCOHOL EFFECT

- Prenatal alcohol exposure one of leading known causes of mental retardation
- Prenatal and/or postnatal growth retardation (weight and/or length below the 10th percentile);
- Poor coordination or clumsiness
- Low muscle tone
- Irritability
- Jitteriness,
- Hyperactivity

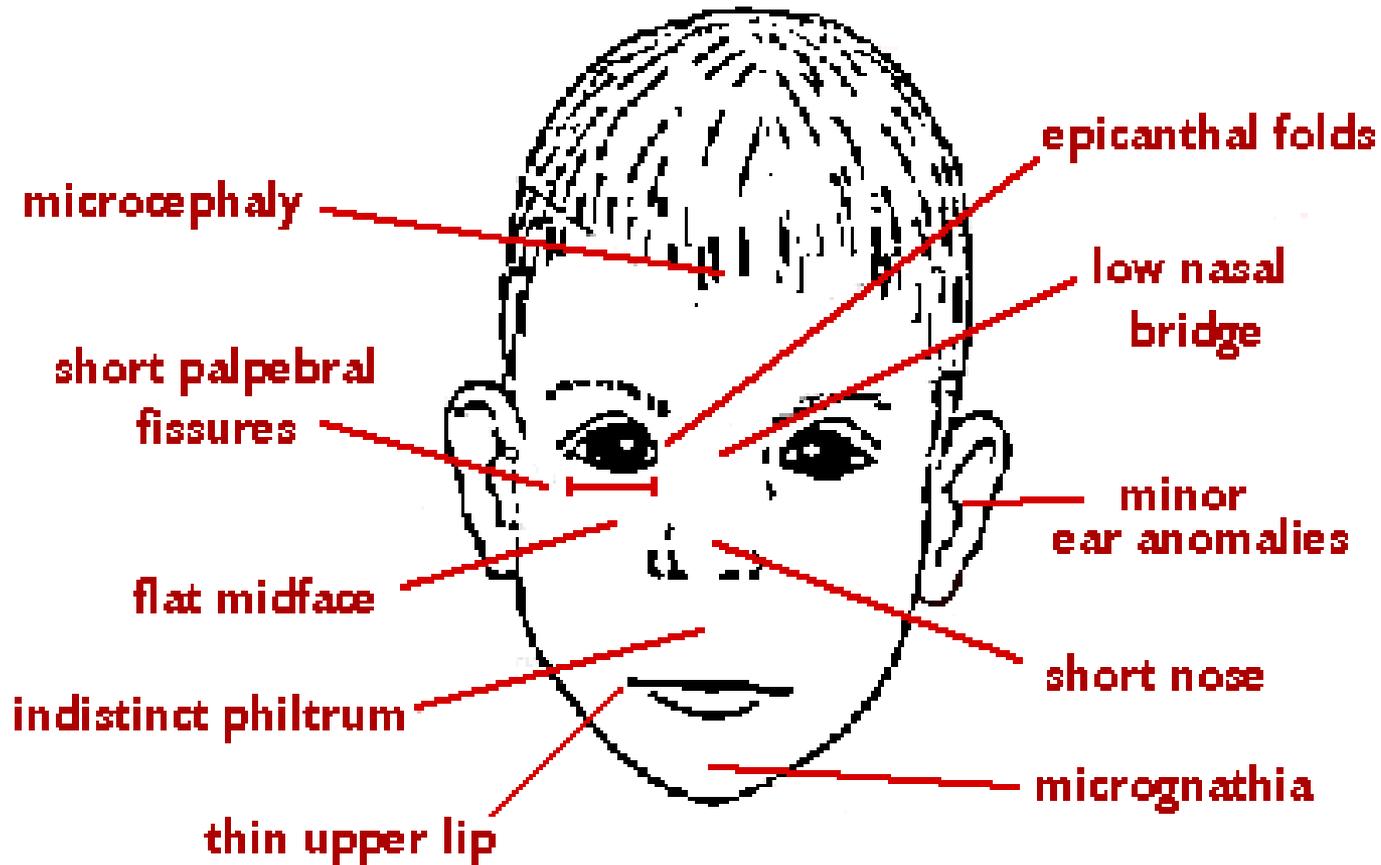
FETAL ALCOHOL SYNDROME & FETAL ALCOHOL EFFECT

- Central nervous system involvement, including:
 - neurological abnormalities
 - developmental delays
 - behavioral dysfunction
 - intellectual impairment
 - skull or brain malformations

FETAL ALCOHOL SYNDROME & FETAL ALCOHOL EFFECT

- A characteristic face with
 - short palpebral fissures (eye openings)
 - thin upper lip
 - elongated, flattened midface and philtrum

Typical Physical Features of Fetal Alcohol Syndrome



FAS: Upper Lip Features











