

Ch 7 - Forensic Toxicology

1. Toxicologist - individual whose job is to detect & identify drugs & poisons in body fluids, tissues, & organs
 - A. work in crime labs & medical examiner's offices
 - B. work in hospital labs
 - C. work in health facilities that monitor the intake of drugs & other toxic substances

2. Toxicology of Alcohol

A. The metabolism of alcohol

(i) metabolism - transformation of a chemical in the body to other chemicals to facilitate its elimination from the body

(2) absorption & distribution of alcohol

(a) alcohol appears in your blood w/i minutes after being consumed & slowly increases in concentration while being absorbed from the stomach & small intestine

(b) once absorbed, alcohol becomes uniformly distributed throughout the water portions of the body (~ 2/3 of the body's volume)

(c) factors affecting the rate of alcohol absorption

(i) time it takes to consume the drink

(ii) alcohol content of the drink

(iii) amount of alcohol consumed

(iv) quantity & type of food present in the stomach at the time of consumption

- alcohol consumed on an empty stomach absorbs faster

(v) beer takes longer to absorb than other alcohols b/c of the carbohydrates in it

• The longer the total time required for total absorption, the lower the peak blood alcohol concentration (BAC)

• Under normal social drinking: it takes 30-90 min. for total absorption

• It can take up to 2-3 hours under certain conditions

(3) elimination - 2 mechanisms

(a) oxidation - combination of alcohol w/ oxygen in blood stream to produce CO_2 & H_2O
(95-98% of all alcohol consumed)
in the liver

alcohol \rightarrow acetaldehyde \rightarrow acetic acid \rightarrow $\text{CO}_2 + \text{H}_2\text{O}$
'in presence of the enzyme - alcohol dehydrogenase'

(b) excretion - through breath, urine, & perspiration

(i) amount of alcohol exhaled is directly proportional to the concentration of alcohol in the blood

(4) Blood-Alcohol Concentration (BAC)

not very feasible \leftarrow

(a) best way to determine the quantity of alcohol a person consumed - remove a portion of brain tissue & analyze it

(b) 2nd best way - using blood

(c) for a forensic toxicologist - if blood is unavailable, they can use a water-rich organ: brain, cerebrospinal fluid, or vitreous humor (eye)

B. Alcohol in the Circulatory System

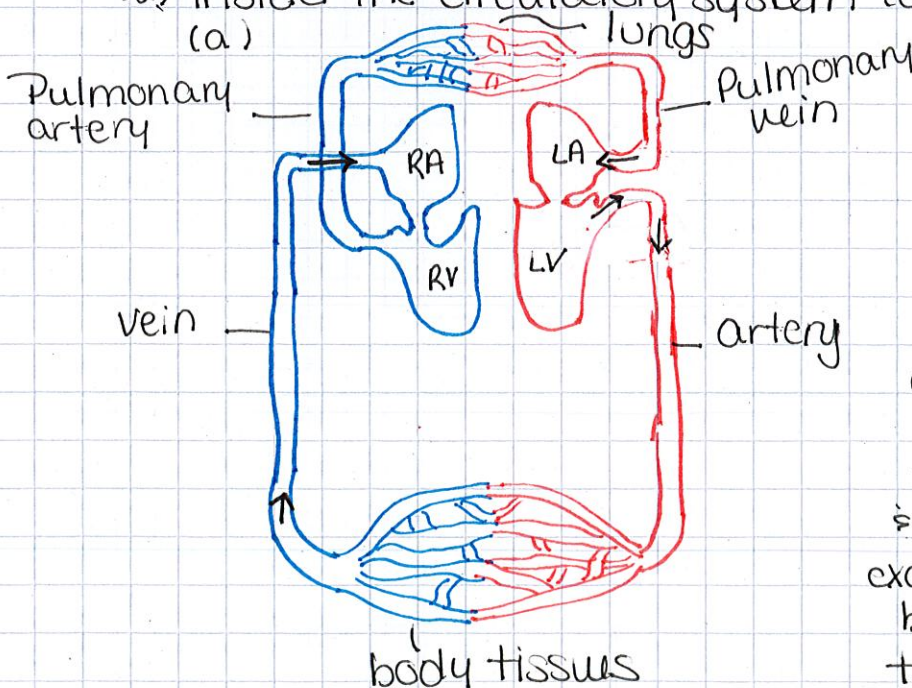
(1) extent that an individual is under the influence of alcohol is measuring the quantity of alcohol in the blood in one of 2 ways

(a) analyzing the blood

(b) measuring alcohol content of breath

(2) inside the circulatory system (closed system)

(a)



(a) artery - blood vessel that carries blood away from the heart

(b) vein - blood vessel that carries blood to the heart

(c) capillaries - tiny blood vessels that receive blood from arteries & carries it to veins, & exchange materials b/w blood & tissue through their walls

B. Alcohol & Circulatory system

(3) ingestion & distribution of alcohol through the circulatory system

(a) 20% of alcohol is absorbed through the stomach walls into the portal vein

(b) 80% passes into the blood stream through the walls of the small intestine.

(c) once in the blood, alcohol is carried to the liver where enzymes begin to break it down

(d) blood (still carrying alcohol) leaves the liver & heads to the heart - forced into the lower right ventricle (contains little O_2 but lots of CO_2)

(e) from the heart, the blood goes to the lungs through the pulmonary artery to be replenished w/ O_2 .

(4) aeration

(a) respiratory system bridges w/ circulatory system so that oxygen can enter the blood & CO_2 can leave at the alveoli - small sacs in the lungs where gases are exchanged through the walls Some Alcohol is also leaving the blood along w/ the CO_2 into the air

(b) alcohol still in your blood travels from the lungs back to the left aorta & then to all other parts of the body & back into veins to repeat the process

(c) BAC tends to have a 41% higher concentration in arterials than in veins due to rapid diffusion into body tissues.

3. Testing for Intoxication

A. Breath Testing for Alcohol

(1) breath tester collects & measures alcohol content of breath

(a) tests taken during absorption phase may show higher BAC than results taken from a blood test (venous) once absorption is complete, they should have similar results

(2) breath-test instruments

(a) breathalyzer - developed in 1954, phased out in 1970s

(b) light absorption devices & fuel cell devices - modern use
- ratio of alcohol in blood to breath is
2100 to 1 at mouth temp. of $34^\circ C$ ($93^\circ F$)

(3) considerations in breath testing

(a) compare suspect sample to a known standard

(b) must ensure to get a deep lung breath

~ 1.1-1.5L of breath blown for a minimum of 6 seconds (avoid "mouth alcohol" from recent drinks)

(c) instrument only accepts a sample when

consecutive breath measurements show little to no change in BAC (ensures a good deep lung breath)

(d) do not allow someone to take anything into their mouth for 15-20 minutes before the test - avoid

"mouth alcohol" (Hopefully they won't have belched or regurgitated either)

(e) take 2 tests - 2 minutes apart

B. Field Sobriety Testing - series of preliminary tests done before ordering a breath test or blood test.

(1) series of psychophysical tests & a prelim. breath test w/ a portable, hand-held device

(a) horizontal-gaze nystagmus - involuntary jerking of the eye as it moves side to side (follow light or finger) uncontrollable by person

- starts @ BAC of .10

- can also happen if someone has ingested

phenylethylamine, barbituates, & other depressants

(b) walk and turn & one leg stand (divided attention tests) can you comprehend & carry out 2 or more simple instructions at one time.

touching heel to toe

stand on 1 foot for 30s while counting out loud