ALCOHOL AND IT' S EFFECTS ON THE BODY

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To produce a graduate who will be able to examine victims and suspects involved in criminal/civil or traffic offences where an allegation of alcohol consumption or intoxication is present and provide an opinion to the court

Examine individuals who are dead due to alcohol or alcohol related illnesses and assist courts

Knowledge, skills and attitude

How it is achieved

- Knowledge on the effect of alcohol in the body (short & long term)
- Knowledge on how a diagnosis of intoxication is arrived by History, examination , & investigation
- Knowledge on the effect of alcohol in the body in relation to driving ability
- Develop skills on examination and forming opinions based on findings

Alcohol

- Stages of intoxication -A
- Clinical examination for drunkenness -A
- Other methods available to establish drunkenness - A
- Effects of alcohol on the ability to drive -A
- Laws related to drunkenness -A
- Differential diagnosis of alcohol intoxication -A
- Sudden death due to alcohol abuse -B

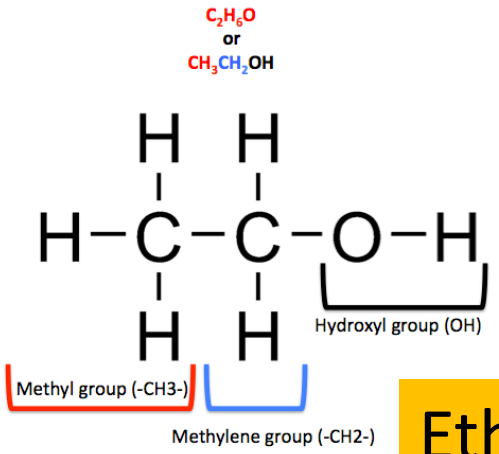
(A) Comprehensive knowledge of specified area and competency in specified medico-legal work
(B) Knowledge of the basic principles with ability to identify where referral is needed
(C)Nice to know

Alcohol & Forensic

- Association of Crime statistics and heavy drinking and criminal behaviors
- Relationship of alcohol to violent(24 to 85%) vs non violent crimes 12–38%
- Alcohol and ability to drive
- Alcohol and accidents
- Alcohol related natural deaths
- Alcohol and fitness for detention in custody

Alcohol VS Liquor

Liquor- beverage containing alcohol



In chemistry, an alcohol is any organic compound where a hydroxyl functional group (-OH) is bound to a carbon or hydrogen atoms

Ethanol produced by the fermentation of sugar by yeast

Ethanol (C2H5OH) is the alcohol found in alcoholic beverages

Alcohol is ethanol

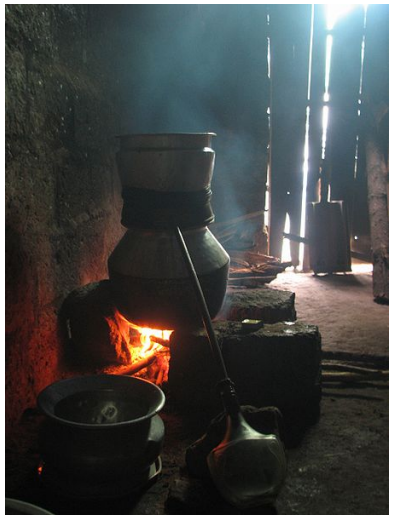
Content of alcohol in various liquors

- Fortified Wine GLASS: 60ml
  ALCOHOL CONTENT: 10.ml - 17.5%
- Beer GLASS: 285ml
  ALCOHOL CONTENT:11.4ml - 4%
- Wine GLASS: 100ML
  ALCOHOL CONTENT: 11.5ml-11.5%
- Spirit GLASS: 200ML
  ALCOHOL CONTENT: 11.4ml
  - contains one 30ml nip of spirits (38%)

- Fruit Juice < 0.1%
- Pilsner 3–6%
- ESB (Bitter) 3-6%
- Lager 4-5%
- Porter 4-5%
- Alcopops/Breezers/Coolers 4–7%
  PA (India Pale Ale) 6-7%
  Cider 4–8%
  Sparks 6-7%
  Stout 5-10%
  Sparkling Wine 8 – 12%
  Table Wine 8 – 14%
  Retsina 10–11%
  Barley Wine 10–15%
- Wine (general) 10–15%
- Port Wine 20%
- Fortified Wine 17 – 22%
- Liqueur 15–55%
- Light Liquors 20%
- Liquor/Spirits (general) 40%
- Cask Strength Whisky/Rum 60%
- Absinthe 55–89.5%
- Neutral Grain Spirit 95%
- Rectified Spirit 96%
- Absolute Alcohol 99-100%

Contents of alcohol & in liquors used in Sri Lanka

- Arrack 30-50%
- Toddy 4%- 6%
- Pot Arrack- 25-30%
- Kassipu- 20%
- Beer- 4%-6%



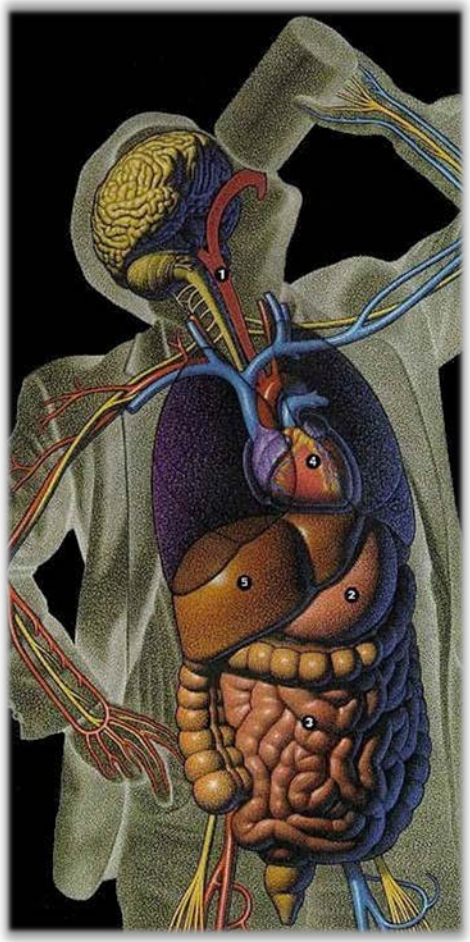
Effects of alcohol in the body

Entry
- GIT
- ? RS,SKIN v(50 mg/100 mL after breathing alcohol/air mixtures several hours),

Absorption
- Mouth & oesophagus (small)
- Stomach
- Intestine (duodenum highest)

Blood
- Carried in water
- Circulation and effects in the systems

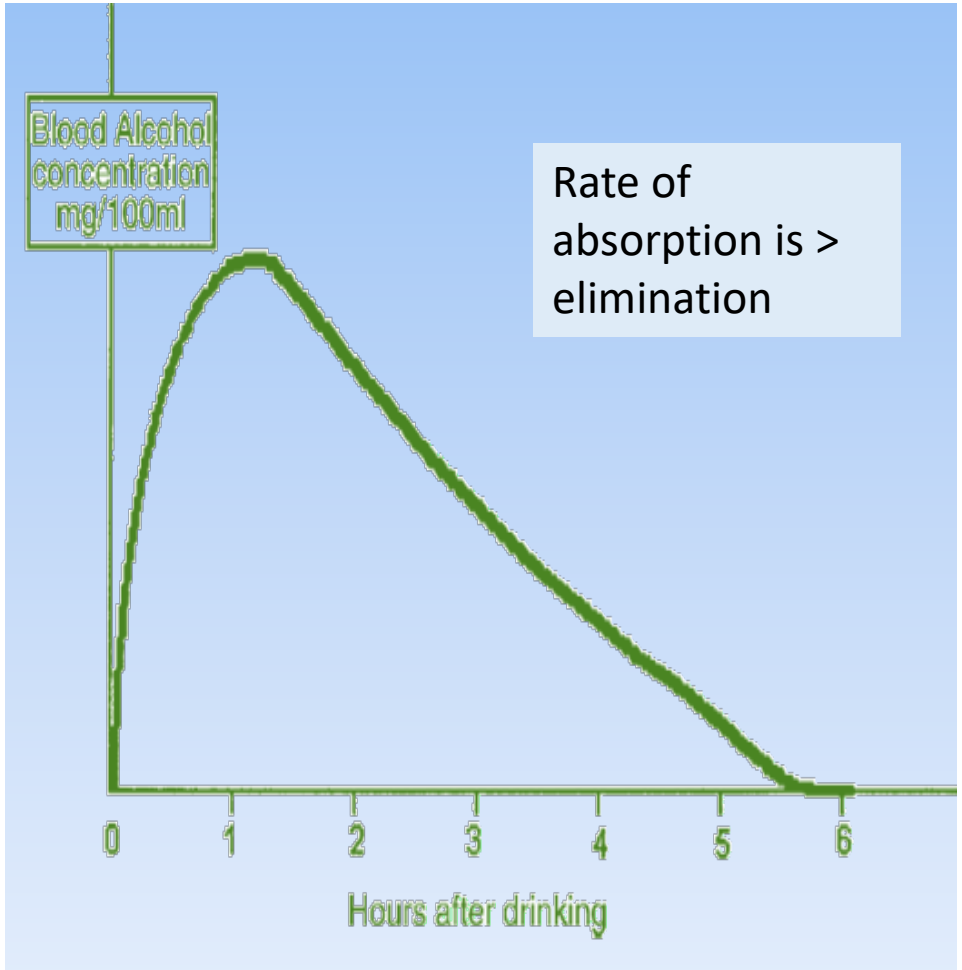
Excretion
- 5-10% excreted unchanged in breath, urine, and sweat
- 90–95% of oxidized in the liver by alcohol dehydrogenase – acetaldehyde & acetate (acetic acid)



Ferner, R Forensic pharmacology 1996Baselt, R. C 1996, Stark MM, Norfolk GA, 1986

Blood alcohol curve

BLOOD ALCOHOL CURVE



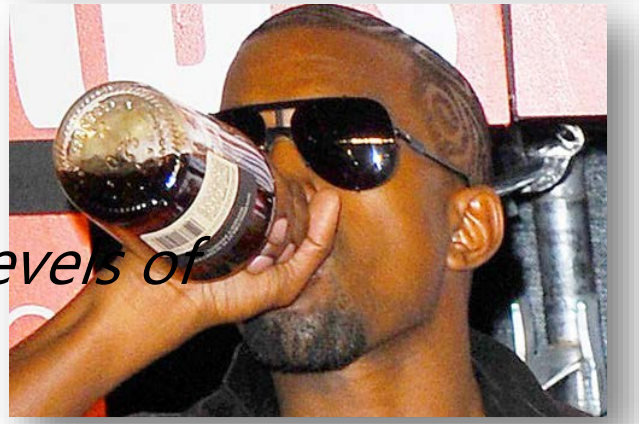
Important

- Allows to measure the alcohol content in the body
- Curves varies from person to person and within the same person over a time
- Alcohol is distributed in body water
- Alcohol Dehydrogenase is saturated at low alcohol concentrations , therefore elimination is constant

Holford, N. H. G. 1987

Blood alcohol level may vary

- *Sex & weight*
  - Male vs females i.e. females become more drunk than male due to body fat
  - body water (weight i.e. smaller body size higher peak)
- *Duration of drinking*
  - *Volume of alcohol longer period- elimination starts & low levels of blood alcohol is reached*
  - *Sipping of a drink vs gulping of drink*
- *Nature of the Drink Consumed*
  - *Beer, Wine, Sprits*
  - *>20% alcohol in a drink slows gastric emptying by irritation of gastric mucosa*



- *Food in the Stomach*
  - full meal before drinking can reduce the peak alcohol level by an average of 9–23%
  - *Fat containing food slower more*
  - *Carbonated water increases absorption more*

- *Physiological Factors*
  - *Stomach wall permeability, blood supply to intestine*
  - *Gastric surgery*

- *Genetic Variation*
  - *Chinese races low alcohol dehydrogenase*
- *Drugs that affects the rate of stomach emptying and alcohol absorption-* atropine; chlorpromazine; tricyclic antidepressants, amphetamines, antidiarrheal medicines; codeine and dihydrocodeine; diamorphine (heroin); methadone; dextropropoxyphene (in co-proxamol) metoclopramide; cisapride; erythromycin

- *Rate of Elimination*
  - *Chronic alcoholics AD enzyme stimulated*

Social drinker

Problem drinker

Health drinker

Types of alcohol drinkers

Underage drinker

Binge drinker

Alcoholic

Effects of Alcohol

- Alcohol acts as a CNS depressant
  - small doses interferes with cortical function,
  - larger doses may depress medullary processes.

- The apparent stimulatory effects : acts higher centers of the brain that govern inhibition

Effects are more pronounced when blood alcohol levels are rising than when falling. (Mellan by effect)

Manno, J. E. and Manno, B. R 1996

Sequence of Central Nervous Depressant Effects of Alcohol

Stage of influence	Blood alcohol concentration mg/100 mL	Clinical effect
Sobriety	10–50	• Often no obvious effect; may feel "relaxed"
Euphoria	30–120	• Mild euphoria with increased talkativeness • Decreased inhibitions • Increased self-confidence • Impaired fine motor skills
Excitement	90–200	• Emotional instability • Poor sensory perception • Impaired memory and comprehension • Incoordination and loss of balance
Drunkenness	150–300	• Disorientation, mental confusion • Disturbances of vision (e.g., diplopia) • Decreased pain sense • Increased incoordination with staggering gait • Slurred speech
Stupor	250–400	• General inertia approaching paralysis • Marked lack of response to stimuli • Inability to stand or walk • Vomiting, incontinence of urine and feces
Coma	350–500	• Coma and anesthesia • Depressed or absent reflexes • Cardiovascular and respiratory depression • Possible death
Death	Over 450	• Death from respiratory depression

Garriott, J. C. 1996

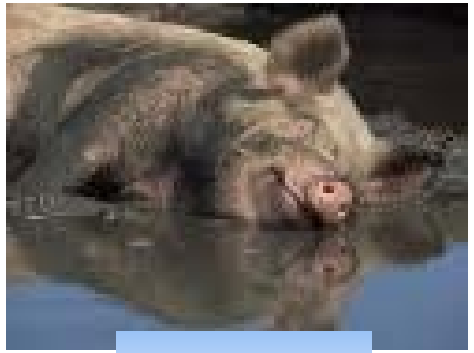
Stages of drunkenness & sobering up

- Clever
- Attractive
- Rich
- Invincible
- Invisible
- Stupid
- Ugly
- Poor
- Fragile
- Conspicuous

Sobriety & Euphoria

Excitement

Drunkenness



Stupor

Effects of Alcohol- short term & long term Signs & symptoms

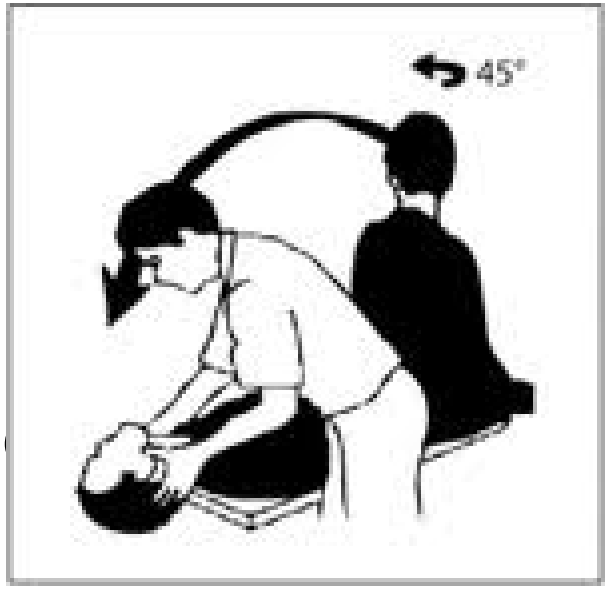
- CNS- orientation, Memory, Gait, Coordination, special séances-
  - Speech,
  - Eye changes – Nystagmus, Pupillary Changes, double vision, tunnel vision
  - Wernike’ s encephalopathy, Kosocoff syndrome
- Cardiovascular Effects- pulse, BP, heart, alcoholic cardiac myopathy
- Metabolic Effects- hypoglycemia
- GIT- Gastritis, GI Bleeding, alcoholic cirrhosis

Nystagmus

- eye is easiest to examine to detect the effects of alc
- Alcohol can cause nystagmus through at least two mechanisms.
  - on the vestibular system causing positional alcohol nystagmus (PAN) i.e. when patient is lying supine with the head turned to either the left or right) (Behrens,1978).
  - on ocular movements via neural mechanisms by inhibiting smooth pursuits causing impaired ability to maintain eccentric gaze-i.e. Horizontal gaze nystagmus (HGN)

(Aschan, Acta Otolaryngol. 1958)

Positional Alcohol Nystagmus



- Positional alcohol nystagmus occurs in two sta
- PAN I
  - is associated with acute elevation of blood alcohol, tending to occur approx 30 minutes after alcohol ingestion.
  - nystagmus is in the direction toward which the head is turned.
- PAN II
  - occurs at approx 5–6 hours after drinking
  - Nystagmus in the opposite direction to that seen in PAN I.

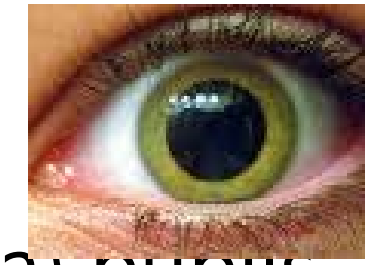
Horizontal gaze nystagmus

- HGN is a jerky eye movement noted when gaze is directed to one side.
- HGN is in the direction of gaze, and intensified at a more eccentric gaze position
- HGN can be seen in normal individuals at extreme lateral gaze
- *HGN when detected at lesser deviations, it is considered pathological.*
- *An angle of onset of 40° or less from the midline is a sensitive indicator of a blood alcohol level in excess of 100 mg/100 ml (Belton H 1987)*

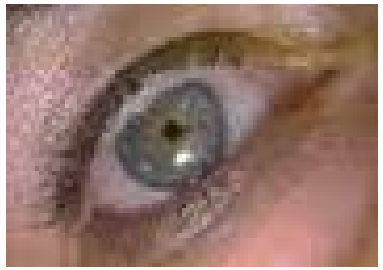
Eye changes

Pupillary Changes

- Early stages pupils are dilated

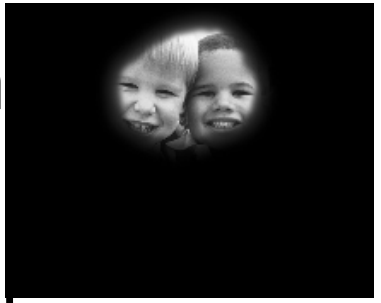


- Late stage (coma) pupils are pinpoint



vision

- Double vision
  - (BAL 200mg/100m
- Tunnel vision
- Night vision impaired (pupils to adapting)
- Contrast sensitivity (reduced)



Speech

- Speech production is a complex motor activity.
- Requires a high degree of coordination
- A sensitive index of alcohol intoxication
- Early stages of alcohol intoxication results talkativeness
- Slurring of speech : 100 mg/100 mL.

Cardio vascular effects

- Moderate doses leads slight increase in blood pressure and pulse rate (rapid bounding pulse due to increase catecholamine)
- higher doses of alcohol cause depression
- Due to combination of central effects and direct depression of the myocardium

Metabolic effects

- Severe Hypoglycemia because of inhibition of gluconeogenesis.
- Alcohol induced hypoglycemia within 6–36 hours of heavy drinking
- typically seen : undernourished individuals or one who has not eaten for the previous 24 hours.

Death From Alcohol Poisoning

Alcohol intoxication may result in death

- respiratory failure
- circulatory failure
- result of aspiration of stomach contents in the absence of a gag reflex.

blood alcohol above 500 mg/100 mL are “probably fatal”

Lower level of blood alcohol may result death when there are other therapeutic and non therapeutic drugs

Diagnosis of Intoxication

- Alcohol intoxication and drunkenness are often used interchangeably.
- behavioral changes associated with drunkenness are seen when they believe they have consumed alcohol but actually have not
- Therefore drunkenness means the behavioral aspect that is resulted after consumption of alcohol

Intoxication with alcohol

Behavioural and physical abnormalities seen when the quantity of alcohol the person consumes exceeds the individual's tolerance for alcohol. (drinking too much too fast)

Diagnostic Criteria for Alcohol Intoxication—DSM-IV

- Recent ingestion of alcohol
- Clinically significant maladaptive behavioral or psychological changes (e.g. inappropriate sexual or aggressive behavior, mood lability, impaired judgment, impaired social or occupational functioning) that developed during, or shortly after, alcohol ingestion.
- One (or more) of the following signs, developing during, or shortly after, alcohol use:
  - slurred speech
  - unsteady gait
  - impairment in attention or memory
  - incoordination
  - nystagmus
  - stupor or coma
- The symptoms are not due to a general medical condition and are not better accounted for by another mental disorder.

DSM-IV, *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed.

Pathological States Simulating Alcohol Intoxication

- Severe head injuries
- Metabolic disorders (hypoglycemia, hyperglycemia, uremia, hyperthyroidism)
- Neurological conditions associated with dysarthria, ataxia, tremor, drowsiness (Multiple sclerosis, intracranial tumors, Parkinson’ s disease, epilepsy, acute vertigo)
- The effects of drugs, either prescribed or illicit (insulin, barbiturates, benzodiazepines, cocaine)
- Psychiatric disorders (e.g., hypomania, general paresis)
- High fever
- Carbon monoxide

Alcohol Dependence & Withdrawal

- *Diagnosis of alcohol dependence (criminality is associated)*
- *Uncomplicated Alcohol Withdrawal*
  - Nausea and vomiting.
  - Malaise and weakness.
  - Autonomic hyperactivity (raised blood pressure and tachycardia).
  - Anxiety, depressed mood, and irritability.
  - Transient hallucinations and illusions.
  - Headache and insomnia.

- *Alcohol Withdrawal Delirium (72-96hrs after drink)*
  - impaired attention and memory, disorganized thinking, disorientation,
  - reduced level of consciousness,
  - perceptual disturbances, visual hallucinations, tactile or auditory hallucination, and agitation.
  - Withdrawal seizures
  - Cardiac arrythmia
  - Metabolic disorders - Wernicke' s encephalopathy & Korsakoff' s psychosis

Medical opinion of a person referred for medico-legal purpose with a history of consumption of alcohol /drunkenness

- Whether a person has consumed alcohol/ under the influence of alcohol /intoxicated with alcohol
- Whether there are other associated conditions including injuries
- Whether the person taken to custody is fit to detain (there is existing threat to life, eg withdrawal status, or other conditions)

Summary

- Alcohol is associated with criminal behaviors, accidents and death.
- Liquors contain alcohol i.e. ethanol (C_2H_5OH)
- Different liquors/ beverage contain different % of alcohol varying from 4%- 60%
- Rate of alcohol absorption is > elimination.
- 5-10% excreted unchanged in breath, urine, and sweat.

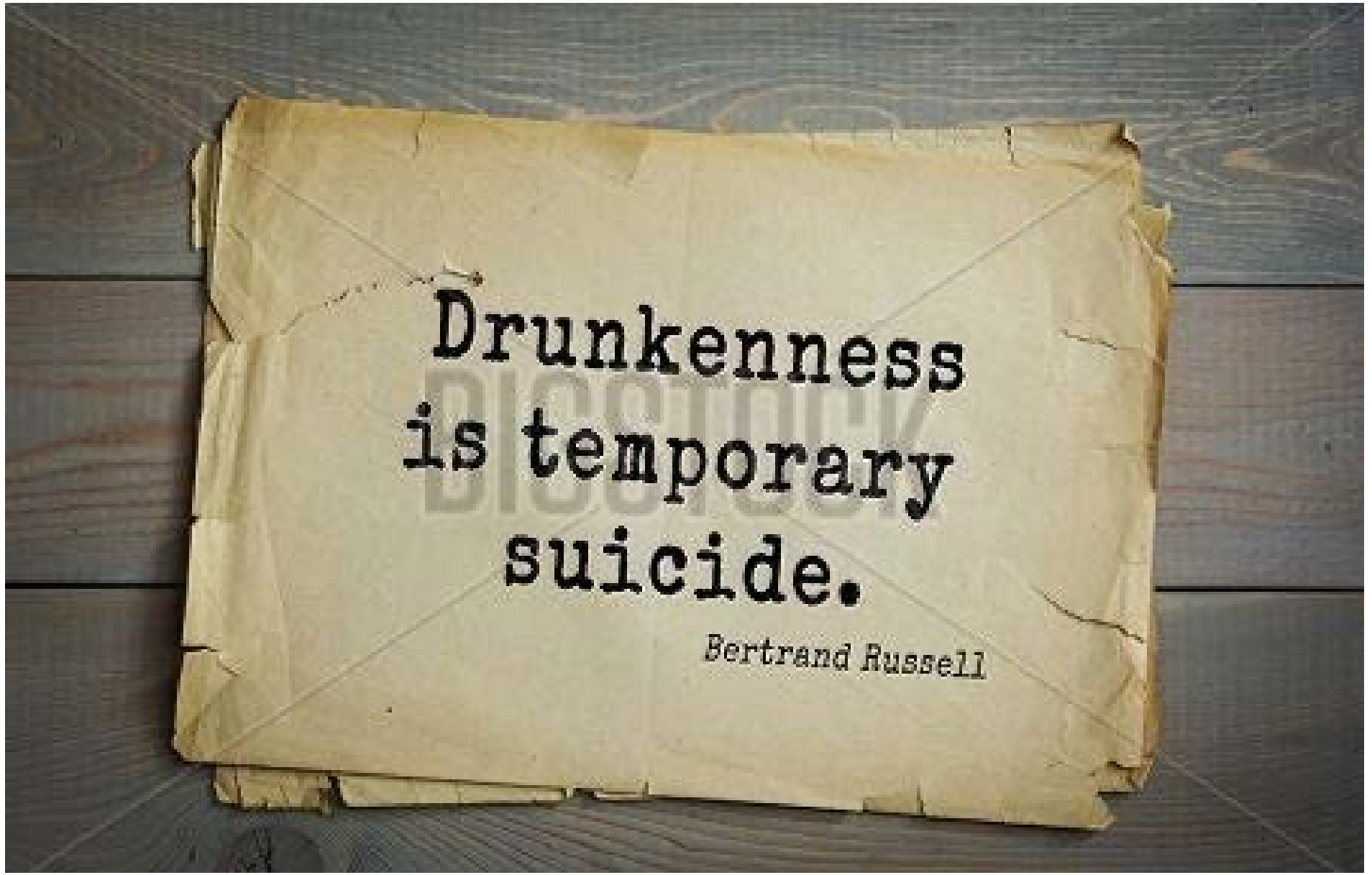
Increasing blood alcohol levels in the body produce different in the behavior stages

- euphoria, excitement, drunkenness, stupor, coma and death

- Effects of alcohol in body is important to diagnose intoxication especially those in CNS & eye.
- Diagnosis of alcohol intoxication include recent ingestion of alcohol, maladaptive behavior, one or more of CNS depressant sings and exclusion of illnesses that mimic those signs
- Death from alcohol poisoning occur above 300mg/100ml of blood
- Knowledge on alcohol effect and withdrawal is important in recommendation of fitness for detention

Recommended reading

- Clinical forensic Medicine – A physician’ s guide 3rd Edition by Margaret M Stark
- Simpson's Forensic Medicine
- Lecture notes in Forensic Medicine- Dr. L.B.L de Alwis
- Clinical Forensic Medicine eds W.D.S. MacLay



Thank you

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