

DRUG AWARENESS / FORENSIC DRUG CHEMISTRY

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Forensic Science

- It is application of science to find the truth and help in matters of law. A science which has legal implications.



Forensic Scientist

- A person, who with his scientific knowledge, educational background, training and experience analyses evidence and interprets the results for legal purposes.

Drug

- A chemical substance which can change living processes in an organism
- Has physiological action on living things.

Forensic drug chemistry

- Examination of all controlled substances , abused drugs and narcotics and cannabis and related products.
- Poisons and toxins which may have legal



Applications

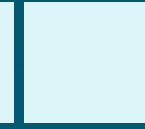
- Examination of illegal substances and poisons

Analysis of plant materials and related products.

- Analysis of contraband materials.

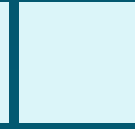
Standards followed

- ASCLD LAB / INTERNATIONAL
- (American Society of Crime Laboratory Directors/ LAB ACCREDITATION BOARD)
- SWGDRUG
- Scientific working group on drug analysis
International forensic science laboratories



Requirements of test

- To establish a fact at least two tests are required.
- A preliminary test.
- A confirmative test.



Preliminary tests

- Color tests.
- UV, VIS Spectrophotometric methods.
- TLC
- GC.
- HPLC.
- Crystal tests.
- Polarimetry.
- Any other test which analyst deems fit but is recognized by scientific community.

Confirmatory tests

- GC-MS
- FTIR
- GC-IR
- NMR
- Ms-MS ICP-MS, NAA ,XRD and XRF etc
- Any test which elucidates the structure of the substance.

Drug Chemistry

- Analyze suspected samples for the presence of controlled substances and Cannabis
- Work with plant material, powders, tablets, and capsules, syringes etc.
- Instrumentation is the main form of analysis



Drug

- **Proper use** - a substance used in the diagnosis, treatment or prevention of a disease or as a component of medication
- **Abuse** - a chemical , such as a narcotic, that affects the Central Nervous System, causing change in behavior and often addiction
- **Drug Misuse** - Using a substance the way it is not intended to be used

What are Narcotics ?

- Strictly speaking a Narcotic is a substance which is CNS depressant that has a numbing effect.
- Some experts use the term as Opiates. Narcotics and Opiates are interchangeable terms.
- OPIATES : They are derived from opium poppy *PAPVER Somniferum*. The term also applies to the compounds which are pharmacologically similar or closely related structurally to morphine.
- They are CNS depressants and also addictive
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Continued

- Some important Narcotics are:
- Opium
- Morphine
- Codeine
- Hydrocodone
- Oxycodone
- Acetyl codeine
- 6-monoacetylmorphine
- Heroin
- At least there are 24 alkaloids in opium

The main alkaloids in opium

	Minimum	Avg %	Max
▪ Morphine	3.1	11.4	19.2
▪ Codeine	0.7	3.5	6.6
▪ Thebaine	0.2	3.1	10.6
▪ Papaverine	< 0.1	3.2	9.0
▪ Noscapine	1.4	8.1	15.8

Opioids

- These are mostly synthetic opiates , most important are given below
- Fentanyl 200 times more potent than morphine
- Alpha methyl fentanyl twice as potent as Fentanyl
- Levorphanol
- Nor Levorphanol
- Dihydrocodeinone (Dicodid)
- Dihydromorphinone (Dilaudid)
- Ethylmorphine
- Methyldihydromorphinone(Metopon)
- Benzylmorphine hydrochloride (Peronine)
- Numorphan hydrochloride and many more

Source determination

- It is fair approximation but not absolute
- Opium from Thailand and Myanmar has lowest content of Papaverine
- Opium from Pakistan and Afghanistan tend to have highest content of Noscapine
- Opium from Iran has highest content of Thebaine
- Opium obtained in America has lowest Thebaine and highest Papaverine content
- The agronomic and climatic differences could account for the contents found in the opium

History

- illegal drugs started out as legal drugs. Most current drugs with medicinal purposes.
 - Why did people “invent” drugs?
- FOR MEDICAL PURPOSE/FOR MONEY or TO KILL
- MOST DRUGS were EXTRACTED FROM PLANTS BUT ALSO SYNTHESIZED

Categories of Drugs

- Stimulants
- Depressants
- Inhalants
- Hallucinogens

Stimulants

- Drugs which stimulate CNS.
- Most widely known stimulant is, Caffeine an ingredient of coffee, tea, cola and other beverages.
- Other stimulants are, Cocaine, Amphetamines, Methylphenidate, Phenmetrazine Ephedrine Pseudoephedrine and other closely related compounds.



Continued

The stimulants produce excitation, increased activity, and sleeplessness for extended period of time.

- Effects include----Dilated pupils, Increased heart rate ,and blood pressure, Increased body temperature, Bruxism, Anxiety, Restlessness, Talkativeness, Body tremors and runny nose.

Depressants/Hypnotics

- These drugs depress the CNS.
- Prescribed in small doses to reduce restlessness, anxiety, and emotional tension and to induce sleep and treat epilepsy.
- Commonly used are----barbiturates, Glutethamide and Meprobamate and **benzodiazepines**.
- Abuse can cause : slurring of speech, staggering, loss of balance, faulty judgment, quick temper and quarrelsome disposition.
- Drunkenness without alcohol may be due to use of the above depressants.
- Most abundantly used depressant is alcohol.

Some important depressants are

- Diazepam (valium)
 - Temazepam (Restoril)
 - Alprazolam (Xanax)
 - Flunitrazepam (Rohypnol)
 - Bromazepam (Lexomil)
 - Brotizolam (Lendormin)
 - Oxazepam (Serax)
- Triazolam (Halcion)
Tetrazeepam (Megavix)
Midazolam (Hypnovel)
Hundreds of them are in use

Continued

- Allobarbitol
- Barbitol
- Butobarbitol
- Methyi phenobarbitol
- Secobutabarbitol
- Secobarbitol
- AND MANY MORE

Amobarbitol
Butabital
Cyclobarbitol
Pentobarbitol
Phenobarbitol
Secbutabarbitol



AS Investigative tools

- Some of these sedatives/ hypnotics are used as investigative tool on tough guys.
- Amobarbital and Amobarbital sodium when in combination with other agents make a person feel in heaven or burning in hell used with bright light.
- Aprobarbital also is used to get the truth out of culprit
- Sodium thiopental weakens the resolve of the subject and he follows the command and recalls memories

Continued

- Succinylcholine (Anectine) A strong muscle relaxant causes suffocation and other effects the subject feels he is drowning
- MDMA when given it creates trust between the subject and the interrogator. The subject wants very close association
- Butabarbital weaken the will power and the subject follows the command
- They are also in thousands

Hallucinogens

- Are the drugs which distort or intensify the user's sense of perception and lessens his ability to discriminate between fact and fantasy. The user may speak of seeing sound and hearing colors. One is seeing illusions his eyes will be wide open and will be very sensitive to light.
- Commonly used are: Marijuana, Heroin, PCP, Psilocin, psilocybin, LSD, DMT (found in the seeds of certain plants in West Indies and South America), DET, MDMA and MDA.

Inhalants

- These are the drugs which are inhaled to get high.
- These are mostly gums and glues and liquids. and can also be powders.
- Generally work as stimulants and hallucinogens.

Some inhalants

- Xylene
 - Toluene
 - Household sprays
 - Petroleum
 - Petroleum ether
 - Ether
 - Acetone
- Rubber glue
Markers
Cigarette lighter fluid
Nail polish remover
paint thinners
Varnish
Spirit etc.

Cocaine a Powerful Stimulant

- Produced from coca plants in Western south America primarily in Colombia, Peru and Bolivia
- Four varieties of coca plant used to produce cocaine.
 - 1-Erythroxyllum coca
 - 2-Erythroxyllum Ipadu
 - 3-Erythroxyllum Novogratens
 - 4-Erythroxyllum Truxillense.
- South American Production of cocaine around 600 million pounds per year.

Metabolites of Cocaine

- Ecgonine and O-benzoylecgonine are main metabolites of cocaine.
- Result of esterase enzyme activity.
- Liver N-dimethylase enzymes convert cocaine to norcocaine.
- Norcocaine gets converted to O-benzoylnorecgonine and finally to norecgonine.

Illegal cocaine

- It is estimated that around one million people are involved in the illegal production of cocaine.
- Americans spend around one billion dollars every year for the illegal purchase of cocaine.

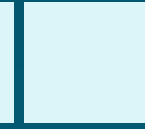
Field of Cocaine plants



- Used for thousands of years in the Peruvian jungles
- Used as a local anesthetic in surgery
- Even put in Coca Cola!



▪ Cocaine Bricks



Effects of Cocaine Use

- As a stimulant Cocaine...
 - Increases heart rate & blood pressure
 - Paranoia
 - Hyperactivity
 - Aggression
 - Disorientation
 - Panic
 - Potential DEATH

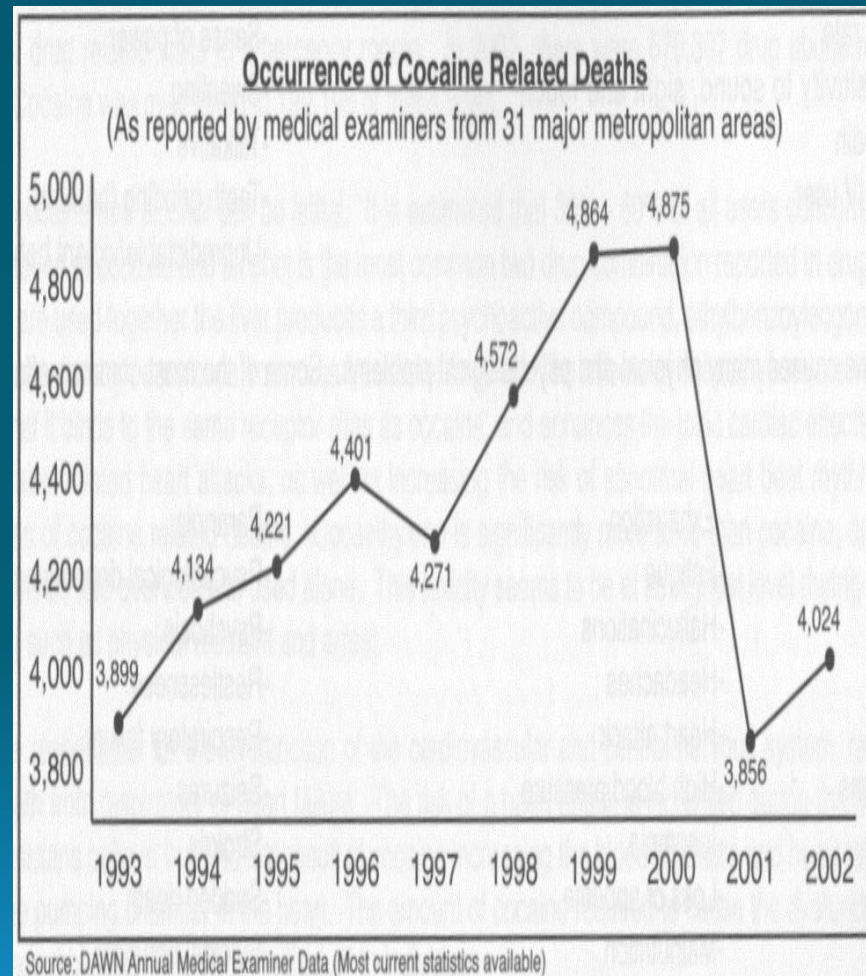
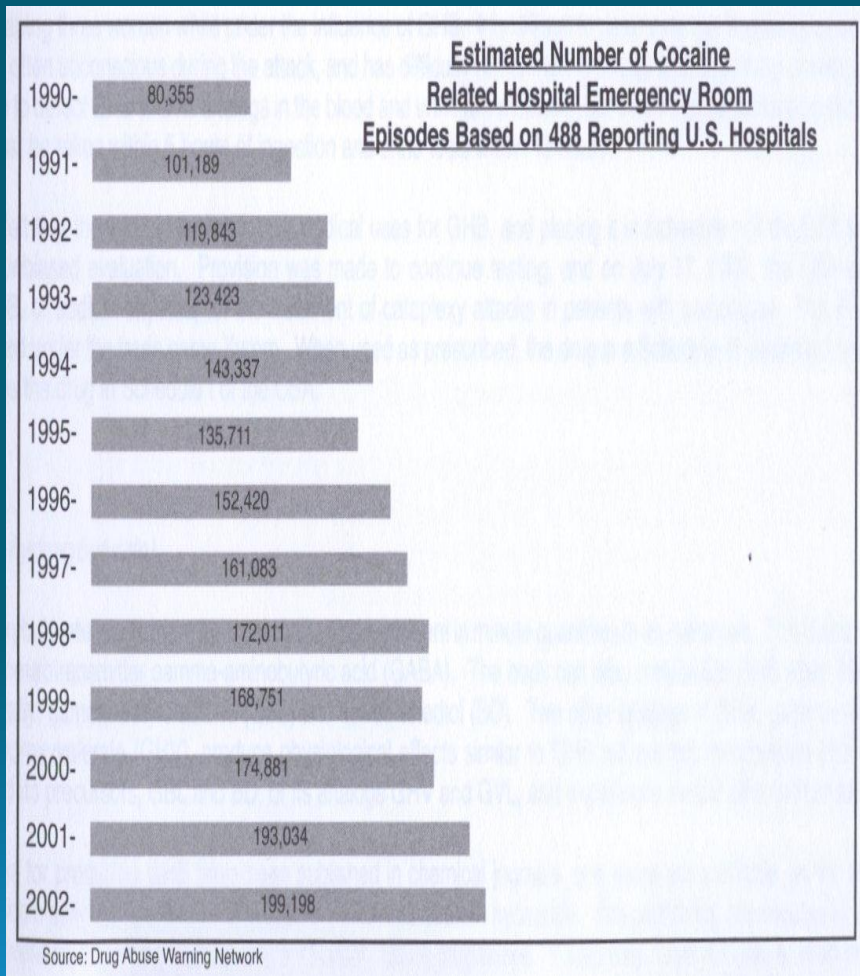
Mechanism of action

- In normal doses it increases production of dopamine and noradrenaline but only in higher doses it increases serotonin.
- This increase is due to the fact that cocaine blocks the reuptake of these 3 neurotransmitters.
- Noradrenaline shoot up makes total peripheral resistance greater elevating arterial blood pressure.

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- This vasoconstriction decreases skin heat loss contributing to hyperthermia.
- Local anesthetic effects also interfere with myocardial conduction, leading to cardiac arrhythmias and convulsions.
- Excessive doses are fatal due to arrhythmias and respiratory depression.

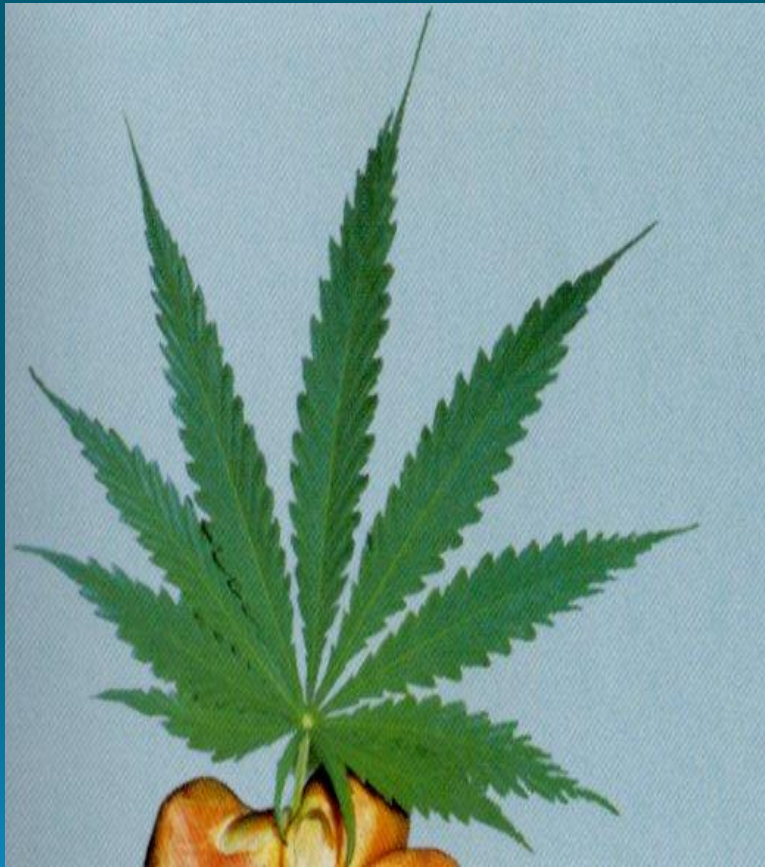
Cocaine Hospital Visits & Related Deaths



Amphetamine

- Interferes with normal reuptake of Dopamine and Nor epinephrine.
- Displaces them from their presynaptic nerve endings causing an increased release of neurotransmitters
- This increase in Dopamine and Norepinephrine causes a massive stimulation of CNS including the pleasure response portion of brain called Nucleus Accubens
- Eventually the excess supply of released neurotransmitters is depleted and the user experiences deep depression, fatigue, sleeplessness. headaches and low energy.
- Mostly the amphetamines work this way

Hallucinogen: Marijuana

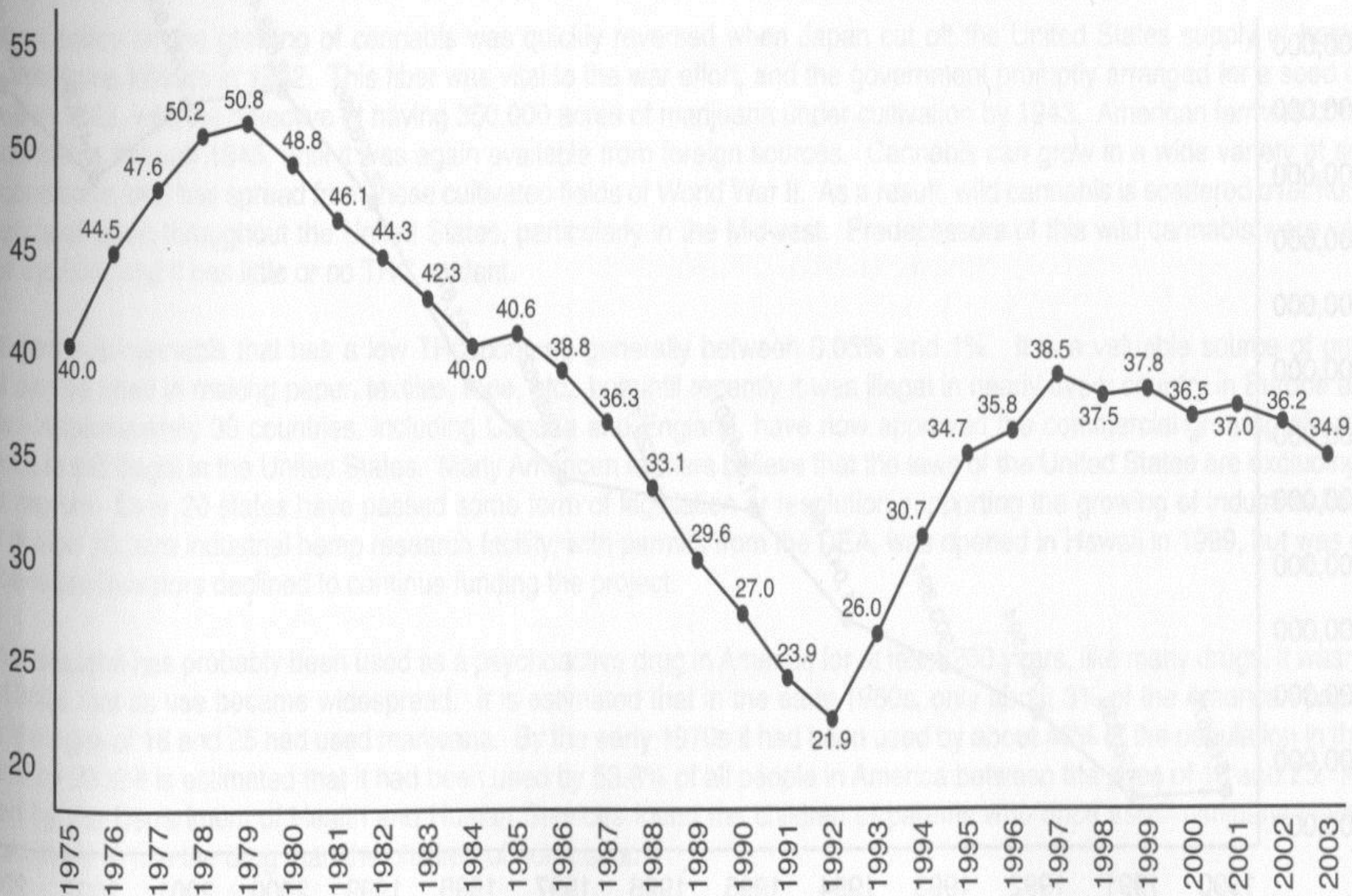


- Originally used to make fiber for rope and clothing
- Seeds were sources of food and oil
- Not native to North America
- The active ingredient is Delta-9 Tetrahydrocannabinol.

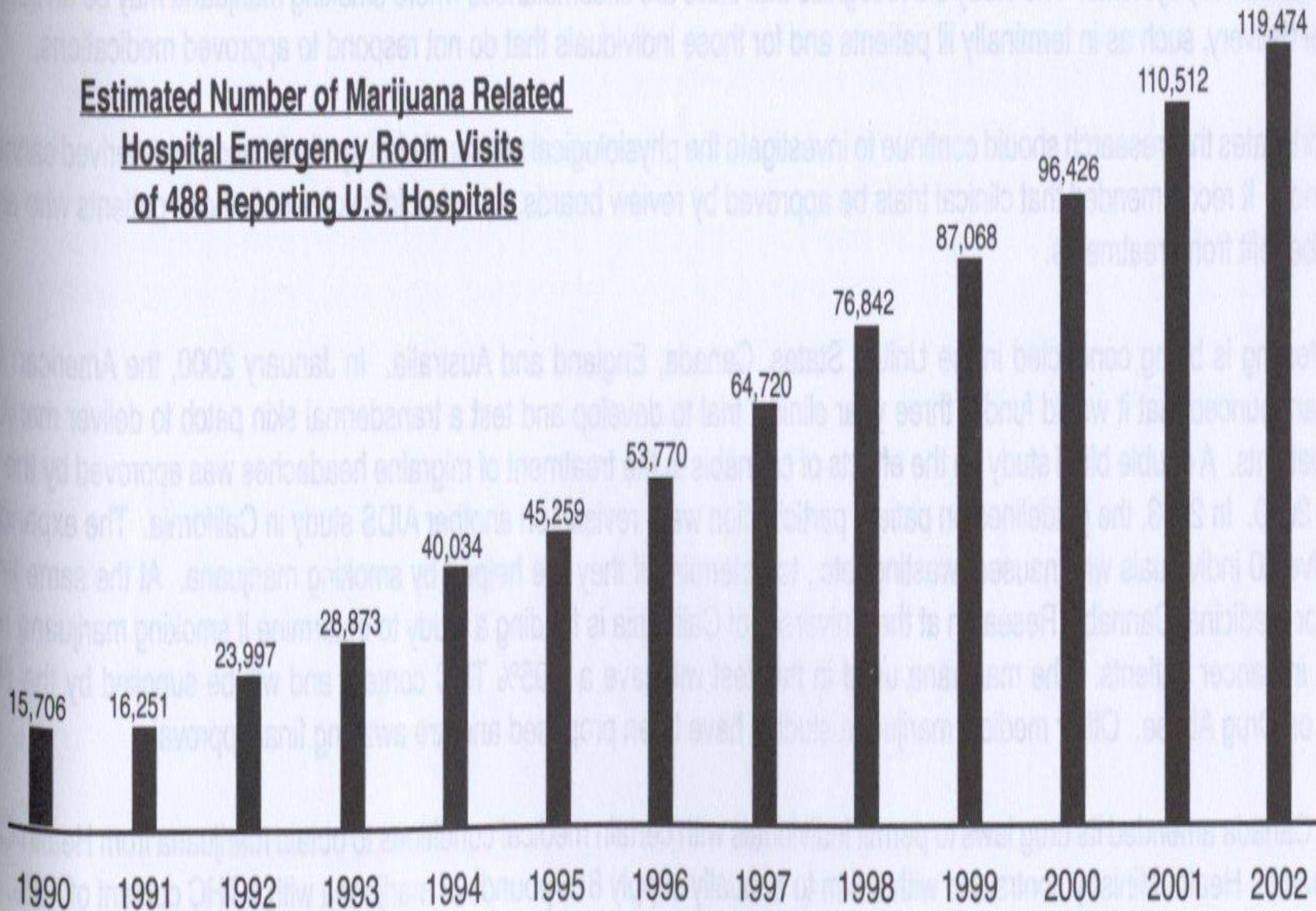
Marijuana: Effects of a Hallucinogen

- Accelerated heart rate
- Anxiety and panic
- Rapid mood changes
- Hallucinations
- Redness of eyes
- Short term memory loss

Percent of High School Seniors Who Have Used Marijuana in the Last 12 Months



**Estimated Number of Marijuana Related
Hospital Emergency Room Visits
of 488 Reporting U.S. Hospitals**



Mechanism of action

- THC is lipophilic, very easily dissolving through plasmatic membranes.
- Hetrogeneously distributing through out the brain.
- THC seems to stimulate phospholipase A2 increasing the production of arachdonic acid, diacylglycerol and inositol triphosphate.
- It is thought to be a neuromodulaltor substance which acts via a receptor located in the cellular membrane.

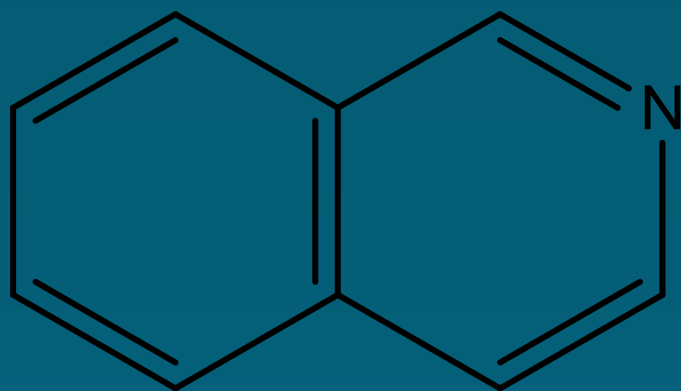
Depressant: Alcohol

- Legal for adults over 21
- 3rd leading cause of death in the United States is drunk driving
- Socially addictive
- Is a poison
- Excessive drinking leads to liver disease

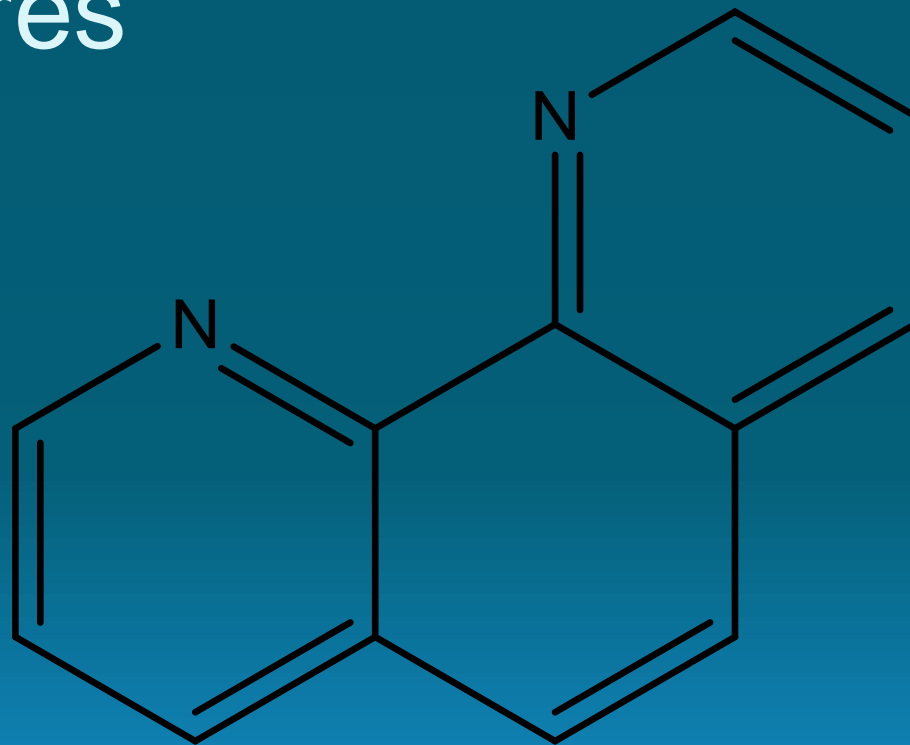
Heroin

- Produced from opium which is obtained from poppy pods.
- Around 25 alkaloids are extracted from opium.
- The main ones are: Morphine, Codeine, Thebaine and papaverine.
- Can be classified into two groups.
- Phenanthrene alkaloids(morphine ,codeine) and Isoquinoline alkaloids (Tebeine , Papaverine)

Structures



isoquinoline



1-10 phenanthroline

Metabolites

- The main metabolite is morphine.
- Blood and urine samples are taken.
- Usually 0.3 mg/liter when lethal.

Mechanism of action

- Enters blood stream and reaches the brain.
- Very rapidly gets converted into morphine.
- It activates the pleasure and pain centers of the brain by working on Delta, Kappa and mu receptors.
- Large amounts of dopamine are produced within the nucleus accumbens

Effects

- Heroin modifies the action of dopamine thereby causing lot of euphoria.
- Hallucinations.
- Acts on brain's respiratory center thereby reducing the heart rate.
- Excessive doses can shut down the respiratory system and death occurs.
- HIV Infection.

Other dangerous drugs

- GHB
- GBL
- 1,4 Butane diol
- MDA
- MDMA
- Rohypnol.
- Similar effects but very potent.

Toxicity levels of some drugs

- Heroin lethal dose = 0.3 mg/L or 50 mg once.
- Effective dose = 8.0 mg
- Cocaine lethal dose = 5.0 mg/L or 1200 mg once.
- LSD lethal = 4.8 µg/L 100 mg once.
- Marijuana > 15 g. once.

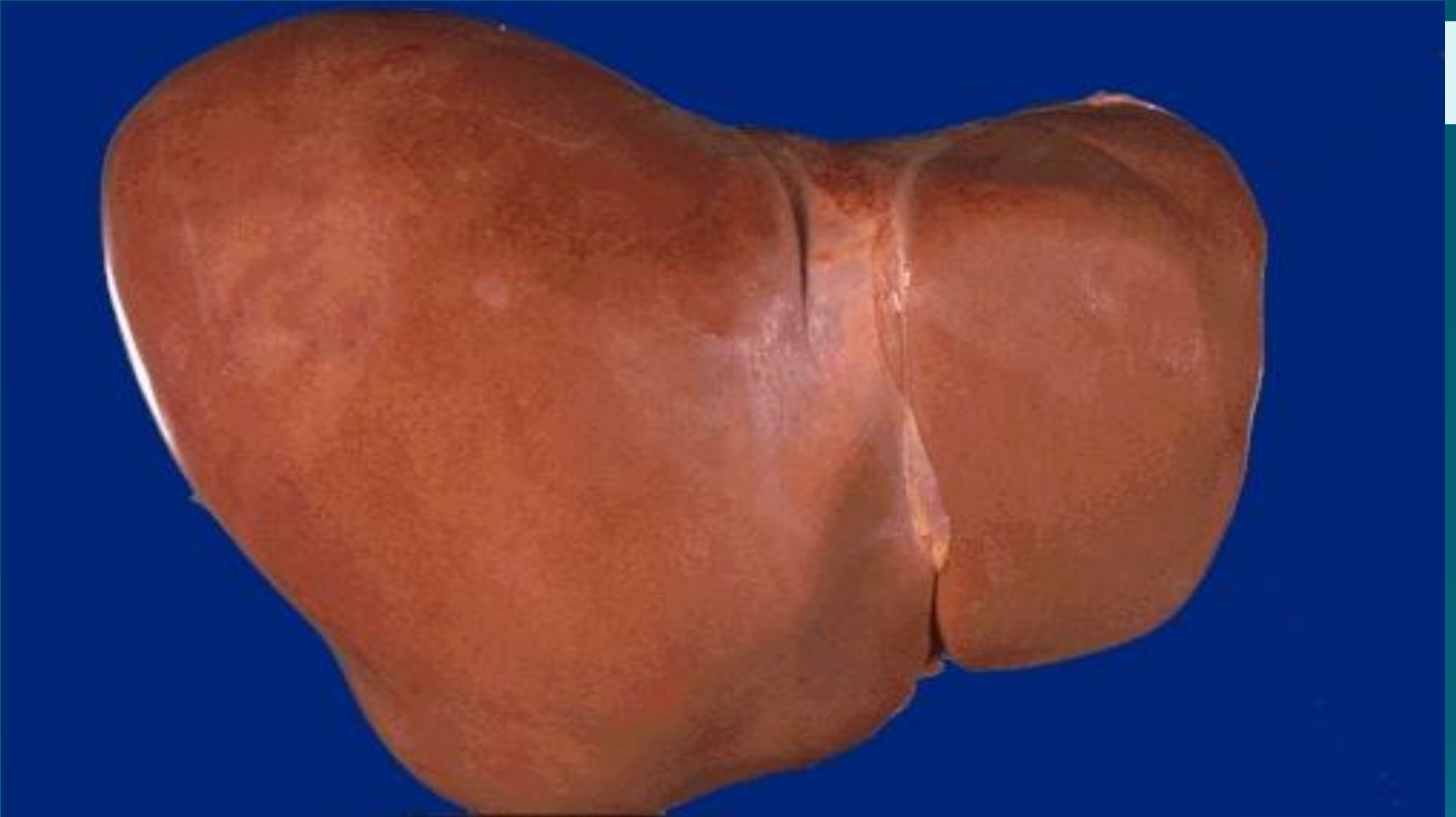
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- MDMA lethal=3.0 mg/L or 2.0 g once.
- Methamphetamine lethal=2.0
?.or>150 mg once.
- Alcohol lethal=3.6mg/L or 330 g once.
- GHB lethal=300mg/L or 16 g once

- Data taken from Society for Study of
Addiction 2004.

ALCOHOL EFFECTS

- Depressant
- Loss of judgment
- Loss of fine motor skills
- Loss of inhibition
- Loss of coordination
- Depressant in high dose
- Stimulant in small dose



Healthy Liver



▪ Alcoholic Liver

Tobacco use

- Cigarettes
 - Chewing tobacco
 - Pipes
 - Cigars
- Nicotine is the active ingredient
 - HIGH PHYSICAL ADDICTION
 - Body craves nicotine

Initial Use of Tobacco

- May cause adrenaline rush or “high” but...
- Positive effects disappear quickly and you are then **ADDICTED!**
- Your body recognizes the harmful effects
 - Coughing is body's way of telling you 'no'

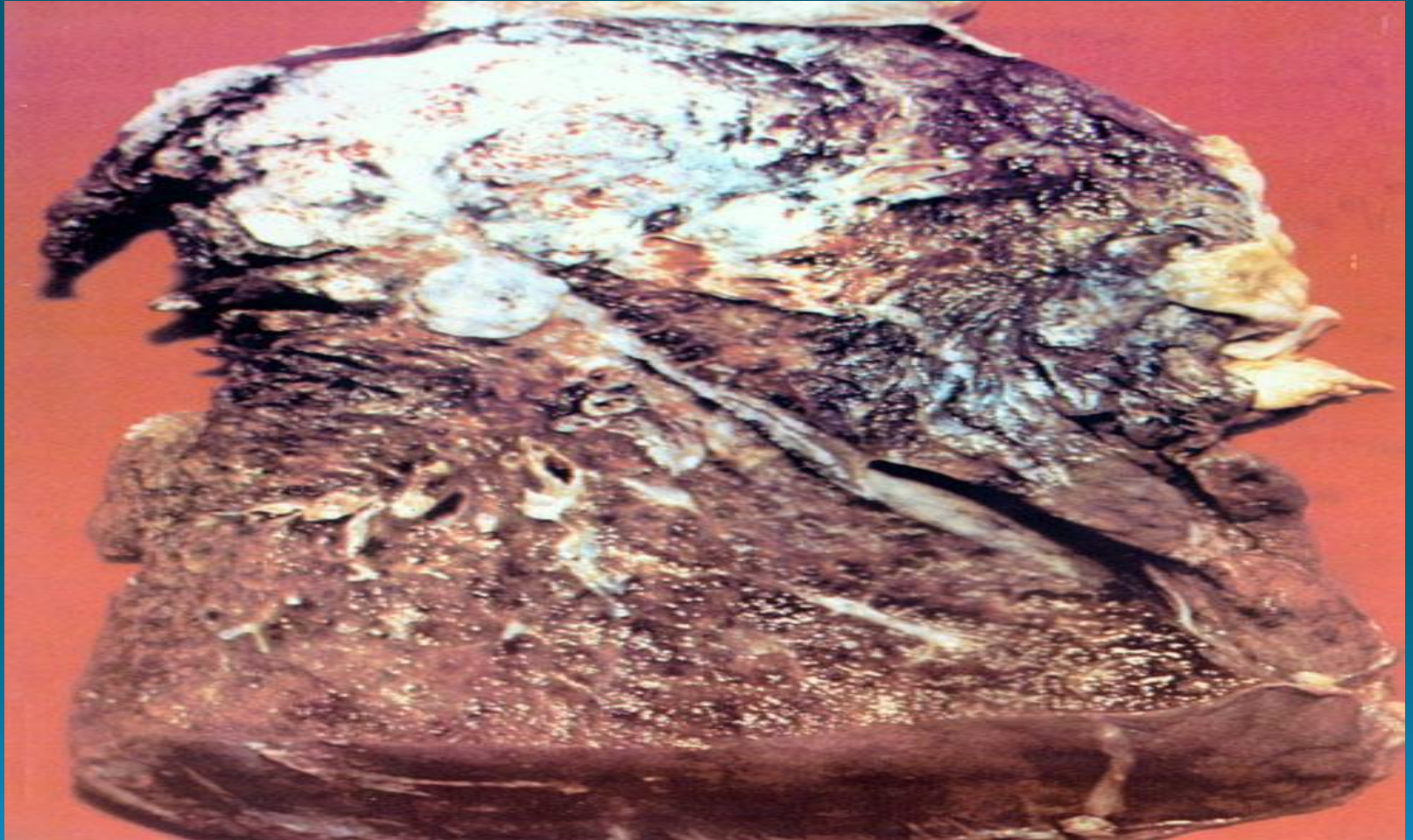
Tobacco Use Effects

- Heart and lung disease (#1 cause of death)
- Increases risk of cancer (#2 cause of death)
- Stains teeth
- Bad breath
- Stinky clothing, rooms, & car
- Harmful second hand smoke

Healthy Lung



Smoker's Lung



Tobacco—Doesn't Pay!

- \$5.00 per cigarette pack
- \$5 x 1 pack per day x 7 days
a week =

\$35 per week

- \$35 x 52 weeks a year =
\$1820

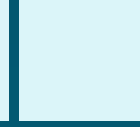
SMOKING A RISKY GAME

- FOR EACH SMOKED CIGARETTE YOU LOOSE 11 MINUTES OF YOUR LIFE.
- If you smoke 20 cigarettes a day , in a year you loose ca.2 months of your life.
- If you have to live for 70 years while smoking you loose ca. 11.5 years of your life.
- BMJ 313,907-8 ,1996.

The Message

- The best choice you can make is to stay clear of drugs

They do not pay but kill 😊



Any Questions?