Sunscreens

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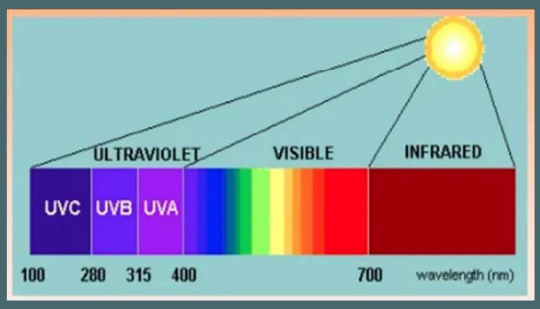
WHY USE SUN-SCREEN

- Too much unprotected sun exposure leads to:
  - Premature skin ageing
  - Sun-burn
  - Skin-Cancer

Sunlight reaching the surface of the earth's contains:

- Visible rays
- Ultravoilet rays
- Infrared rays

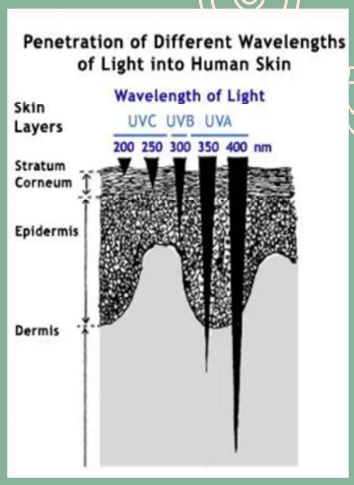
UV rays particularly wavelength below 320nm are responsible for most of the therapeutic as well as well as noxious effects that we attribute to sunlight



Skin Damage

The UV spectrum is broken into 3 parts :

- Very High Energy (UVC) - Very high energy radiation (UVC) is currently blocked by the ozone layer.
- High Energy (UVB) - High energy radiation (UVB) does the more immediate damage.
- Low Energy (UVA) - Lower energy radiation (UVA) can penetrate deeper into the skin leading to long term damage.



Radiation Type	Characteristics Wavelength	Effects on Human Skin	Visible to Human Eye?
UVC	~200-290 nm (Short-wave UV)	DNA Damage	No
UVB	~290-320 nm (Mid-range UV)	Sunburn DNA Damage Skin Cancer	No
UBA	~320-400 nm (Long-wave UV)	Tanning Skin Aging DNA Damage Skin Cancer	No
Vis	~400-800 nm	None Currently Known	Yes
IR	~800-120000 nm	Heat Sensation	No

Introduction

- Sunscreen absorbs or reflects some of the sun's ultraviolet (UV) radiation on the skin exposed to sunlight.
- Sunscreens are mixture of UV filters.
- It contains organic chemical compounds(helps in absorption of UV light) or inorganic particulates(which reflects, scatter and absorbs UV light.)

Classifications

Physical

Opaque formulations containing:

- Titanium dioxide
- Talc Kaolin
- Zinc oxide
- Ferric chloride
- Icthyol, red petrolatum.

Mechanism : scatters or reflects UV radiation due to large particle size.

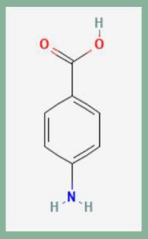
Chemical

Formulations containing one or more:

- PABA, PABA esters
- Benzophenones
- Cinnamates
- Salicylates
- Digalloyl Trioleate
- Anthranilates

Mechanism : absorbs UV radiation.

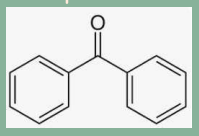
Sunscreen Agents



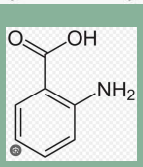
- PABA (Para-aminobenzoic acid)
  - Very effective in the UVB range (200-300 nm).
  - Most effective in conc. of 5% in 70% ethanol.
  - Maximum benefit when applied 60 minutes prior to exposure (to ensure binding to stratum corneum).
  - Contact dermatitis can develop.
  - May stain clothing.

- PABA Esters (Padimate A, Padimate O, Glyceryl PABA)
  - Also very effective in UVB range (280-320 nm).
  - Most effective i conc. 2.5-8% in 65% alcohol.
  - May penetrate less effectively than PABA.
  - Similar application and adverse effect.
  - Less staining.

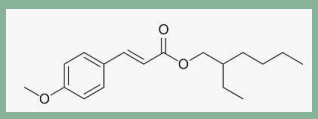
- Benzophenones (oxybenzone, dioxybenzone, sulisobenzone)
  - Slightly less effective than PABA.
  - Absorbs from 250-400 nm spectrum (i.e, UVA & UVB).
  - Combined with PABA or PABA ester improves penetration and is superior to either agent used alone (200-400 nm wavelength coverage).
  - Contact dermatitis is rare.
  - May stain clothing.

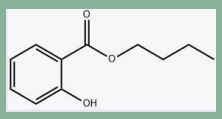


- Anthranilates
  - Minimally effective, absorbs UVA spectrum 250-322 nm.
  - Usually combined with UVB agent to broaden spectrum.



- Cinnamates and Salicylates
  - Minimally effective, absorbs UVB spectrum.
  - Generally used in combination with one of the above.





IDEAL SUN-SCREEN CHARACTERS

- Absorb light preferentially over the range of 280 - 320mμ.
- Resistance to water
- Be stable to heat, light and perspiration.
- Preferably odorless, if mild odor: accepted by user.
- Be non-toxic, non-irritant, non- sensitizing
- Capable of retaining sunscreening property for several hours.
- Stable under condition of use.
- Non- stain
- Not be rapidly absorbed.
- Be neutral.
- Be rapidly soluble in suitable vehicles.

Humans need protection from-

- UVA(315-400 nm) - It does minor damage such as tanning and wrinkles and can also trigger DNA damage that can lead to skin cancer.

- UVB(280-315 nm) – Can damage the DNA in epidermis and also sunburn.

Our earth receives 90% UVA and 10% UVB from sun.

Sunscreen Components

1. **Active Ingredients (10-30%)**

- **It contains compounds that filter the sun rays.**
- **In mineral sunscreen (physical sunscreen) the reflected light is responsible for white cast and the absorbed light gets radiated as heat.**

- **Organic sunscreen (chemical sunscreen) works by absorbing and dissipating the energy of photons.**

2. Formulation stabilizers(50-60%)

Solvents,preservatives, thickening agents and emulsifiers

It helps the active ingredients stay in solution.

Preservatives,such as phenoxyethanol and tocopherol acetate,keep the ingredients away from having a shorter shelf life.

3. Sensory Enhancers (13-33%)

Moisturizing ingredients, fragnances,and emollients.

Responsible for how the product feels or smells.

Things that can affect the way it feels on the skin.

4. Added Extras (2%)

- Extra ingredients that companies add. For example, Aloe, which attracts moisture.

Some extras that companies say can protect against pollution.

Sunscreen Deciding Factors

1. Sun Protection Factor(SPF)

- The SPF of a sunscreen product determines how efficiently it absorbs or reflects some of the sun's ultraviolet (UV) radiation on the skin exposed to sunlight.
- Higher is the SPF number greater is the protection.

$$\text{SPF} = \frac{\text{MED (with sunscreen)}}{\text{MED (without sunscreen)}}$$

MED: Minimal erythematous dose = amount of UV radiation needed for an individual to just start to redden

Ex.: A person who burns in 0.5 hr would develop erythema in 2h with SPF 4 sunscreen (0.5 x4)

SPF is measured for UVB and not UVA


SPF SELECTION GUIDE
Skin Tone
Hours Outdoors
Very Fair
Never tans, always burns
Fair
Tans slowly, burns easily
Light
Usually burns first
Medium
Burns minimally
Dark
Rarely burns
1
SPF 30
SPF 15
SPF 15
SPF 8-14
SPF 8-14
2
SPF 30
SPF 30
SPF 30
SPF 15
SPF 8-14
3
SPF 50+
SPF 50+
SPF 30
SPF 15
SPF 15
4
SPF 50-100
SPF 50+
SPF 30
SPF 30
SPF 15

2. Boot Star

- This method is used to describe the ratio of UVA to UVB protection offered by sunscreen creams.
- The boot method uses a spectrophotometer to measure absorption of UVA vs UVB.

3. Photostability

Ability of sunscreen product to retain its efficacy upon exposure to UV radiation.
A photo-unstable product could leave users at risk of uncontrolled exposure to UVB as well as UVA.

4. Other Tests

1. PHYSICO-CHEMICAL AND MICROBIAL TESTS.
2. Total Fatty Substance (TFS), Heavy Metals and Microbial Contents.
3. THE GENERAL TESTS-Packaging(such as type and quality of packaging material, recyclability information etc.) and Marking(such as name and type of cream, recognized trademark etc.)

TOOTH WHITENING

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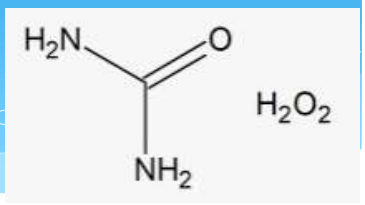
What is Tooth Whitening?

* Chemical process using oxidizing agents that work on tooth surface to penetrate enamel and dentine resulting in a change of colour to brighten the teeth.

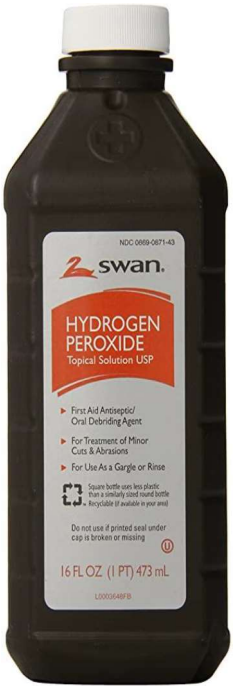
What are the causes of tooth discolouration?

* Tooth color = combination of optical properties of enamel, dentine and pulp.
* Important to identify aetiology (cause) for effective treatment
* **Extrinsic** – superficial accumulation and adherence
  * Tobacco, coffee, tea, red wine, medications (CHX, iron supplements, tannin)
  * Brown, black, green coloration
* **Intrinsic**
  * Trauma to developing tooth.
  * Loss of vitality, remnant blood pigments infiltrating dentinal tubules
  * Iatrogenic origin – amalgam, residual GP from RCT
  * Discolouration from ageing process may be considered intrinsic – more secondary dentine formation and thinning of enamel layer.

What are the most common dental bleaching agents?



* Carbamide peroxide ($CH_6N_2O_3$)
  * Most home bleaching kits, breaking down into a solution of hydrogen peroxide and urea
  * Active hydrogen peroxide is calculated as 1/3 of concentration of Carbamide peroxide
  * Eg 10% Carbamide peroxide = 3.6% hydrogen peroxide
* Hydrogen peroxide(H2O2)
  * Most bleaching agents contain this in some form
  * Breaks down into reactive free radicals that penetrate the tooth and oxidise the pigment molecules (resulting in smaller molecules with reduced colour reflectance)



Conditions under which bleaching is contraindicated?

- **Medical**
  - **Undergoing radiation/chemotherapy for melanoma, photosensitive drugs**
  - **Pregnant/breastfeeding women – no supported proof of any harmful side effects however advised to postpone**
  - **G-6P dehydrogenase deficiency**
- **Age → Under 18 years of age**
- **Allergy → Previous allergy to bleaching or any ingredients**
- **Dental**
  - **Quality of enamel – inappropriate if surface/thickness is compromised → Cavities, micro-cracks, thinned enamel**
  - **Periodontal disease**
  - **Hypersensitivity**
- **Patients Habits → Heavy smoking habit – rapid recurrence of discolouration**

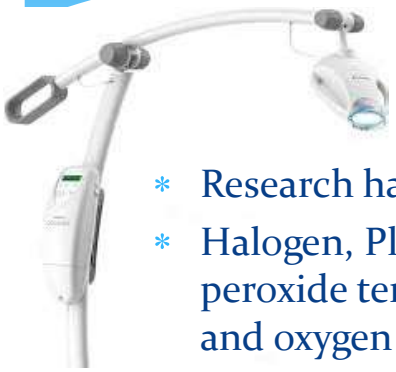
What are the main factors for success of bleaching?

* Initial colour of teeth
  * Yellow or orange intrinsic discolouration responds best
  * Bluish/grey discolouration more difficult
* Patient's responsiveness
  * Compliance
  * Oral hygiene
  * Smoking habits
  * Avoiding substances that can stain teeth
    * Coffee, tea, cola, mustard, ketchup, red wine, soy sauce, beetroot
* Bleach concentration
  * Concentration and length of time in contact with tooth surface

Is bleaching harmful to enamel?

* Enamel undergoes a reduction in micro-hardness
* Dissolution of calcium phosphate of enamel
* Calcium lost in 12 hours of bleaching = soft drink/juice for a few minutes.
* Termination of bleaching process – re-calcification occurs
* Whether or not the re-calcified enamel is of the same quality originally deposited into the enamel matrix remains uncertain

Does the use of light sources enhance the whitening process?



* Research has shown two contradictory opinions.
* Halogen, Plasma arc, LED, UV light source may increase the hydrogen peroxide temperature, accelerating the reaction and formation of hydroxyl and oxygen free radicals.
* Temperature rise of 10°C increase the speed of hydrogen peroxide decomposition by 2.2 times
* Incorporated colour pigments in the bleach promote maximum absorption of light and subsequent conversion to heat.
* But this temperature rise by the use of light acts just like a catalyst for the bleaching process and won't work if hydrogen peroxide is not used.
* So, we can conclude that the use of light source is not necessary for the whitening process.

Why do some patients experience sensitivity?

* Tooth sensitivity is a common dental problem that involves discomfort or pain in teeth when encountering certain substances and temperatures.
* Tooth whiteners and toothpastes with peroxide-based bleaching solutions can cause sensitive teeth.
* Too many acid-rich foods and drinks could erode the enamel, and expose the tender layer beneath, called dentine. This can be one of the reasons for sensitive teeth.
* Treatments :-
  * Doctor prescribed NSAIDs can be used
  * Desensitiser application including toothpaste (KNO_3 e.g. Sensodyne Pronamel)– seals dentine tubule orifice, preventing movement of fluid and hence, decrease the discomfort. Also, discontinuing the ongoing treatment of bleaching might help.

What is the average time of treatment?

* Weekly visit to dentist is necessary to observe any initial bleaching results
* 2-5 weeks is required for desired results
* Usually 8 syringes of 1.2ml of medication is used for normal treatment.
* For more severe discolouration, time and quantity may require to be doubled.

When can we stop the bleaching treatment and how often can it be repeated?

* Saturation point
  * When only hydrophilic colourless structures remain
  * Clinically – when the patient visits two successive times with no colour change
* Patient must understand that bleaching isn't permanent treatment
  * Periodic re-bleaching required
  * Teeth will return to pre-bleaching colour in 3-4 years
  * Suggested one in-office bleaching or 3 week at home session per year.

SNAKE VENOM

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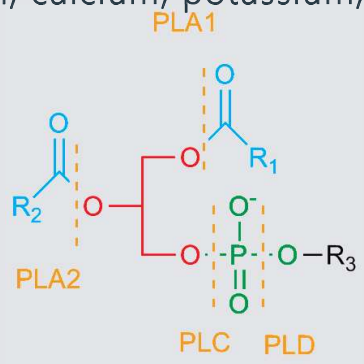
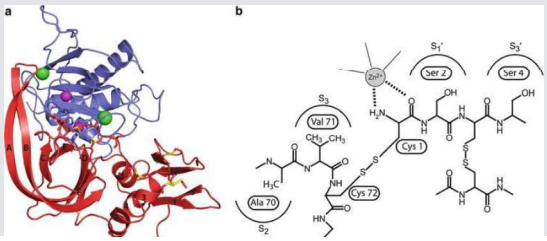
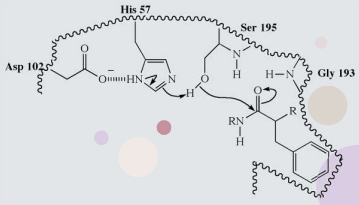
Contents

Compounds present in snake venom

- Snake venoms are complex mixtures of enzymes and proteins of various sizes, amines, lipids, nucleosides, and carbohydrates. Venoms also contain various metal ions that are presumed to act as cofactors and include sodium, calcium, potassium, magnesium, and zinc.
- Common enzymes present in Venom
  - Phospholipase A2s (PLA2s)
  - Serine proteinases
  - Metalloproteinases
  - Acetylcholinesterase (AChEs)
  - l-amino acid oxidases







Types of Venom:

- Hemotoxic Venom

1. RBC or other tissue
2. Hemolysis, disrupts blood clotting
3. Tissue Damage is permanent

- Myotoxic Venom

1. Muscle tissues or kidney
2. Paralysis, loss of muscle contraction

- Neurotoxic Venom

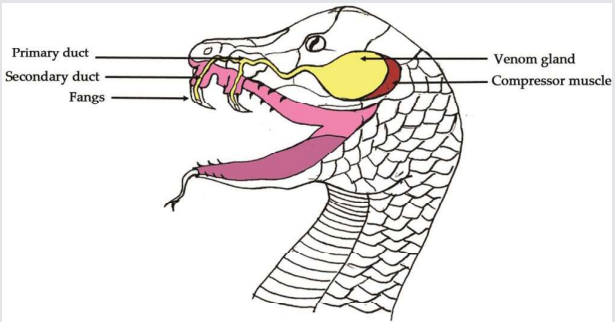
1. Nervous system, respiration
2. Vomiting, droopy eyelids etc.

- Cytotoxic Venom

1. Destroys and attacks the living cells of all sorts
2. Bleeding, swelling etc.

- Hemorrhagic Envenoming

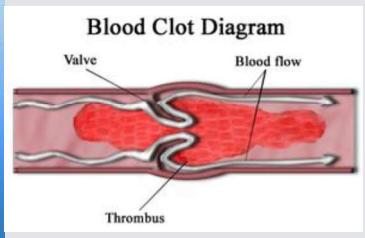
1. Bleeding in multiple organs



Let's concentrate on 2 major types now:

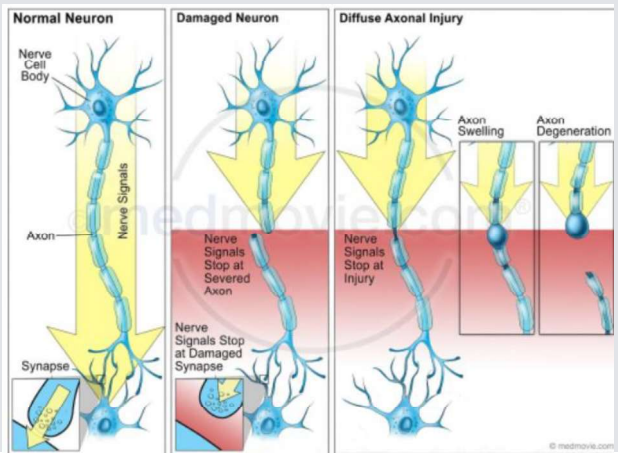
Hemotoxic Venom

- It goes for the bloodstream. It can trigger lots of tiny blood clots and then when the venom punches holes in blood vessels causing them to leak, there is nothing left to stem the flow and the patient bleeds to death.



Neurotoxic Venom

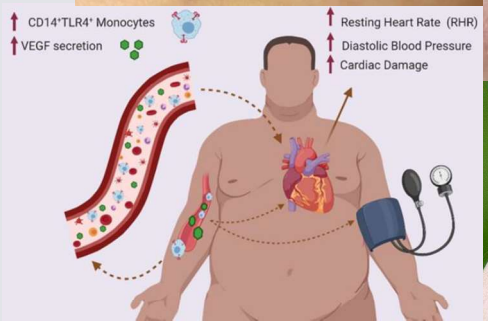
- It tends to act more quickly, attacking the nervous system and stopping nerve signals getting through to the muscles.



What happens when a venomous snake bites a person?

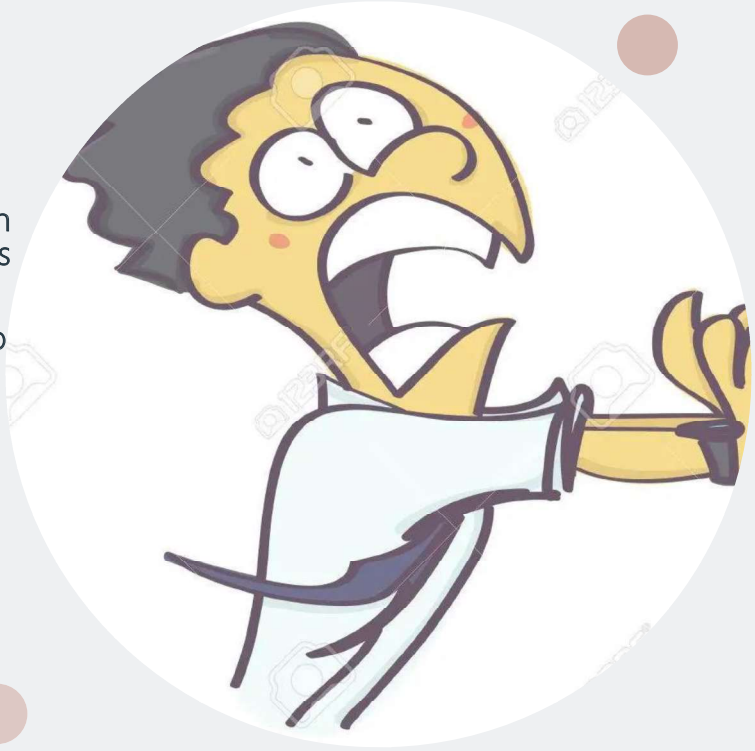
The typical symptoms of a venomous snake bite include:

- swelling and pain around the bite area
- redness and bruising around the bite
- elevated heart rate
- difficulty breathing
- dizziness
- Headache and blurred vision
- Nausea and Vomiting



What to do when a snake bites

- Keep the bitten person still and calm. This can slow down the spread of venom if the snake is venomous.
- Apply first aid if you cannot get the person to the hospital right away.
  - Lay or sit the person down with the bite below the level of the heart.
  - Tell him/her to stay calm and still.
  - Wash the wound with warm soapy water immediately.
  - Cover the bite with a clean, dry dressing.



Antivenom

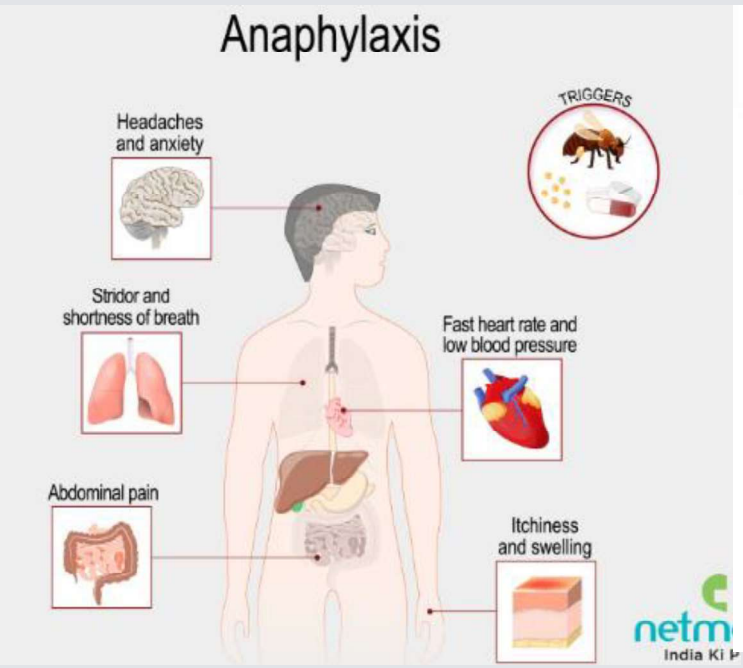
- Antivenoms act by binding to and neutralizing venoms.
- Antivenoms are purified antibodies against venoms or venom components. Antivenoms are produced from antibodies made by animals to injected venoms. Antivenom is the only definitive treatment for effective bites by venomous snakes.
- Antivenom, also known as antivenin, venom antiserum, and antivenom immunoglobulin, is a specific treatment for envenomation. It is composed of antibodies and used to treat certain venomous bites and stings.

Side effects of Antivenom

Anaphylactic reactions such as difficulty in breathing, reddening of skin, swelling of eyes and face, fever.

Pyrogen reaction probably due to the action of high concentrations of non-immunoglobulin proteins.

Inflammation of joints, Enlargement of lymph gland.

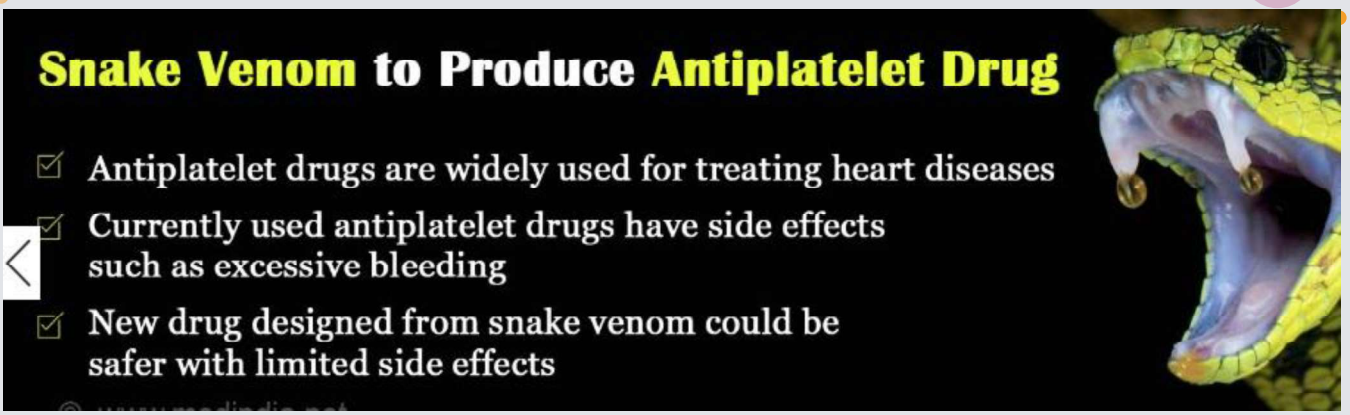


Pyrogens

- Pyrogens - fever inducing organic substances
- Responsible for many febrile reaction
- These are Endotoxin.
  - Having nature
    - Endogenous (inside body)
    - Exogenous (outside body)
  - Exogenous pyrogens –
    - mainly lipopolysaccharides
    - bacterial origin, but not necessary

Uses of snake venom

- Snake venom contains several neurotoxic, cardiotoxic, cytotoxic, nerve growth factor, lectins, disintrigrins, haemorrhagins and many other different enzymes.
- These proteins not only inflict death to animals ar humans but can also be used for the treatment c thrombosis, arthritis, cancer and many other diseases.
- Currently, animal venom components are being used as valuable and powerful pharmacologically research tools. Venom derived-drugs have been produced by the pharmaceutical industry as Captopril, Aggrastat, and Eptifibatide, all designed based on snake venom components



Why are snakes used in rave party?

According to a study by the 'National Institutes Of Health' on 'Snake Venom Use As A Substitute For Opioids', spiny-tailed lizards' burnt lizard carcasses, toxic honey, Spanish flies and cantharides are also used for doping purposes at rave parties as per the study by the Indian Journal of Physiology and Pharmacology. 19 Mar 2024