

	DNA & RNA	Live Attenuated	Subunit	Inactivated	Viral vector
How it functions	Target the viral proteins by regulating the immunity system	Weakened the viral activity of the actual virus	Subunit vaccine is consisting the piece of virus surface, it target immunity system	Inactivation of whole virus by applied heat or chemicals & use as an inactivated vaccine	The virus used as vector system to deliver viral genes; stimulate the immunity
Advantages	The concept easy to design	The stimulation of the immunity response & robust it	It's well established, more affective, focuses targeted responses	It may safe and easy to develop	The virus-mediated delivery system is more effective
Disadvantages	Not applied before & currently no evidence is available	The concept been used earlier, may be safe by compromised immunity system	The substrate or catalysts are required to stimulate the strong response	Inactivated vaccines cause serious health issues. It may not as effective as a live virus	The selection of appropriate virus safe & host immune response may cause less effective
Existing example	None	Mumps Measles Chickenpox	Hepatitis B HPV Pertussis	Polio	Ebola
Group testing approaches for COVID-19	Moderna (RNA) Inovio (DNA)	Indian Immunologicals Ltd Cadogenix	Adapt Vac Novavax	Sinopharma Sinovac	CanSino Biologics Oxford University & AstraZeneca Johnson & Johnson

Reproductive Ratio (R0)

It tells the **average number of people who will catch the disease from one contagious person.**

Product of three numbers:

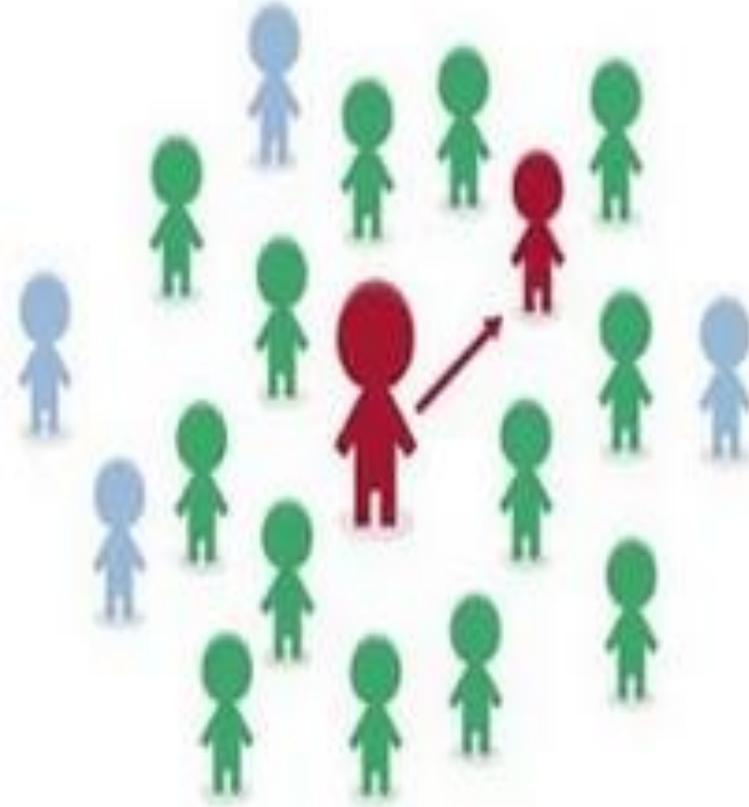
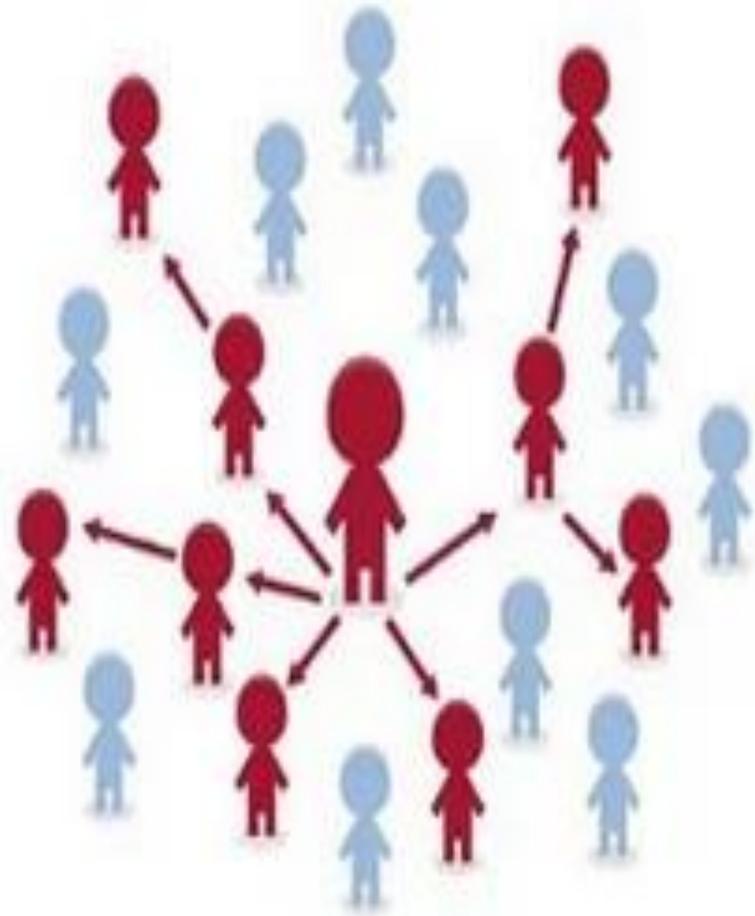
- The number of **days an infected person remains infectious** (that is, can infect others).
- The number of **susceptible persons available** to infect.
- The **chance that a susceptible person** gets infected

Herd immunity

Occurs when a high percentage of the community is immune to a disease (**through vaccination and/or prior illness**), making the spread of this disease from person to person unlikely.

For a highly infectious virus like SARS-CoV-2 [the virus that causes COVID-19], the minimal level to reach herd immunity – where we'd expect newly infected people to pass the virus to less than one additional person – is thought to be about 70% of the population





No herd immunity

Herd immunity achieved

● Susceptible ● Infected ● Immune → Disease transmission

Breakthrough Infections

- A 'breakthrough infection' refers to the **virus being able to penetrate the protective barrier of antibodies**. Breakthrough infections are infections following two doses of vaccine.
- **Natural immunity** following a virus infection stays robust and lasts longer. People infected with the 2002 Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) have been shown to **have strong immunity for up to three years**.
- A vaccine effectiveness study undertaken in Israel has shown that **natural infection confers stronger immunity against the SARS CoV2 virus than even full vaccination**.
- While it is a fact of **evolution that viruses would mutate to be able to avoid antibodies**, and vaccines, therefore, would have to keep being upgraded, it seems that the moment appears to have come too soon.



Case fatality rate (CFR)

- Deaths due to COVID-19 in India remain a contentious topic of debate.
- **The World Health Organization (WHO) recently analysed that the actual pandemic toll of the country is four million, a claim that the Union health ministry has denied based on the “validity and accuracy” of the modelling exercise used.**

Recent study

- It looked at the case fatality rate (CFR) – total recorded deaths as a share of total recorded cases – in India between March 2020 and April 2022 to gauge how the death rate has changed with widespread primary vaccine coverage and emerging variants of concern.

- The findings revealed that **India has an erratic CFR that increases in congruence with a surge in cases, typically triggered by a new variant of concern.**
- Cases are on the rise in some parts of the country, following a deluge of cases triggered by omicron in December 2021 and January 2022.
- **The current CFR is actually higher than what it was in January 2021** and the months thereafter, when the vaccination drive had just begun.
- **India's CFR is among the highest in the world (1.89 per cent),** according to an analysis by Shahid Jameel, virologist and former head of the Indian SARS-CoV-2 Genomics Consortium (INSACOG).
- **The United States has a CFR of 1.5 per cent, France and Italy 0.12 per cent each, South Africa 0.5 per cent** and Germany below 0.1 per cent (approaching the CFR for flu).

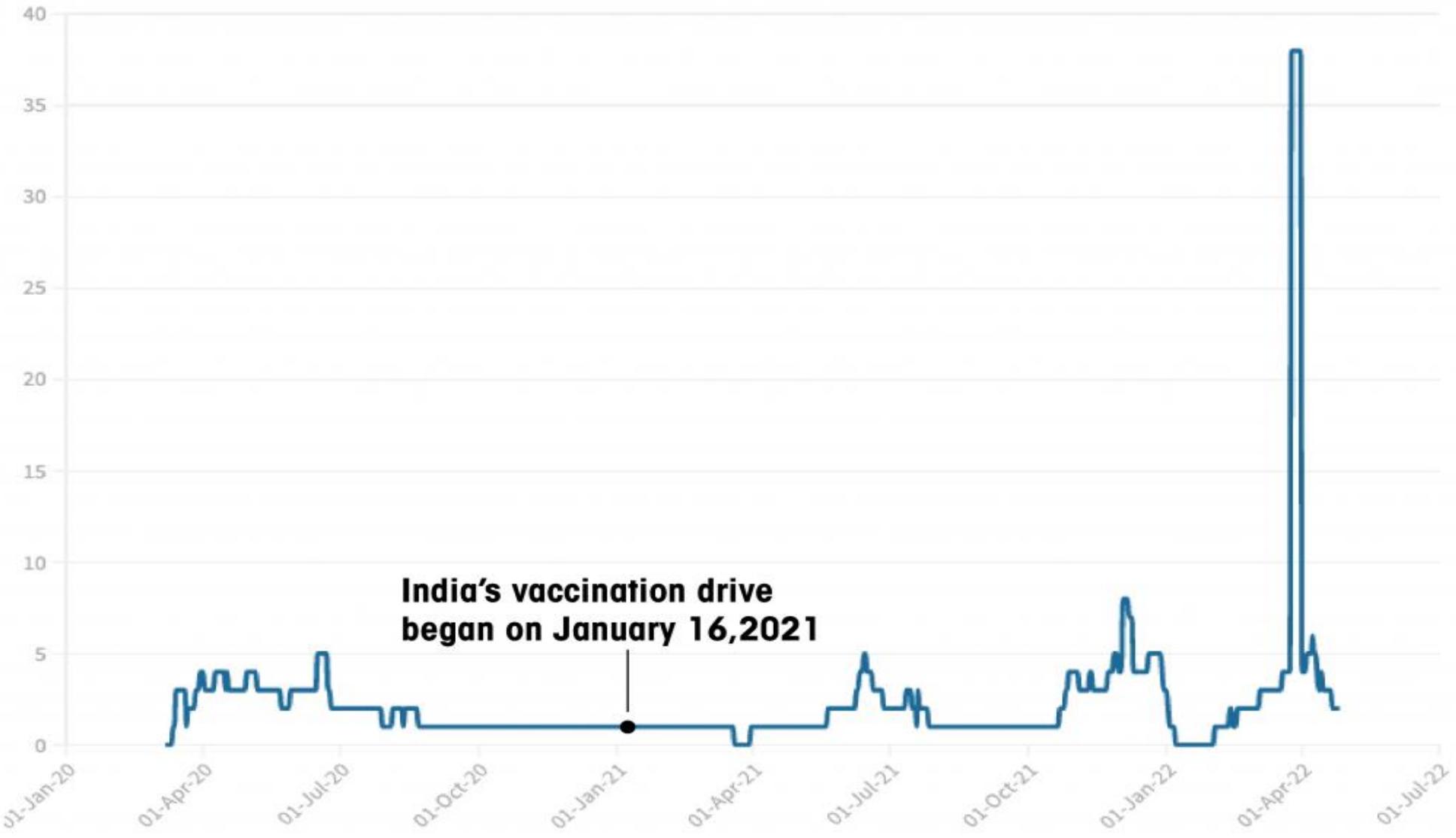
What explains this?

- There are myriad reasons for India's high CFR, **but an ineffective vaccine isn't one of them.**
- **"Deaths do not escape detection as much as cases do. If somebody has an infection but is not getting tested, they are not in the system.**
- The 1,000-2,000 daily cases being reported in India currently is a gross underestimation. **If the denominator increases, the CFR will automatically come down.**

- A major difficulty about interpreting CFR is that the denominator — the number of cases — is by and large the number of virus test-positive samples. This is subject to change based on several variables, including how many tests are being done, whether all tests are being reported and who exactly is getting tested.

- For example, if testing becomes less widespread, and if the people being tested are mostly people who are moderately or severely ill, then the CFR will appear to be high. That would be simply a statistical accident, and not an indication that the infection is more lethal.

CFR



Colour blindness

- The Supreme Court has directed the Film and Television Institute of India (FTII) **not to exclude candidates suffering from colour blindness** from its courses on film making and editing and asked it to make changes to its curriculum instead.

What is colour blindness?

- Colour blindness, also known as colour deficiency, is the inability to see colours in the normal way.
- Colour blind individuals often cannot distinguish between certain colours – usually greens and reds, and sometimes blues as well.
- Two types of cells in the retina detect light – the “rods”, which distinguish between light and dark, and the “cones” that detect colour.
- There are three types of cones that see colour – red, green, and blue – and our brains use the information from these cells to perceive colour.
- Colour blindness can be the result of the absence of one or more of these cone cells, or their failure to work properly. In a situation where all three cone cells are present but one of them is malfunctioning, mild colour blindness may occur.
- Colour blindness may be of different kinds and degrees. Mildly colour blind people often see all colours properly only when the light is good; there are others who cannot tell one colour apart from the another no matter how good the light is.
- In the most severe kind of colour blindness, vision is black-and-white, that is, everything appears as a shade of grey. This is not very common.



What causes colour blindness

- Most colour blind people are **born with the condition** (congenital colour blindness), but some can develop it later in life. Congenital colour vision deficiencies are usually passed on genetically.
- A problem with colour vision that arises later in life could be the result of disease, trauma, or ingested toxins. If colour blindness arises out of **disease**, one eye may be affected differently from the other, and the difficulty could worsen over time.
- Medical conditions that may increase the risk of getting colour blindness include glaucoma, diabetes, Alzheimer's, Parkinson's, alcoholism, leukaemia, and sickle-cell anaemia.

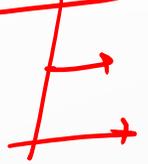
Who is at risk?

- **Men suffer from a higher incidence of colour blindness than women.** Around the world, every tenth male is estimated to have some form of colour deficiency. Men of Northern European descent are considered to be especially vulnerable.

What you can or cannot do

- Colour blindness **impairs in some ways the ability to do certain kinds of jobs, such as being a pilot or joining the armed forces.** However, whether you can or cannot do these jobs often depends on the severity of the colour blindness, and the rules in place in different jurisdictions.
- **In June 2020, India's Ministry of Road Transport and Highways amended the Central Motor Vehicles Rules 1989 to enable citizens with mild to medium colour blindness to obtain a driver's licence.** The decision was taken after the Ministry received representations that colour blind citizens are not able to get a driver's licence because restrictions specified in the requirements in the declaration about physical fitness (Form I) or the Medical certificate (Form IA) make it difficult, a government release said.
- The release noted that medical experts had recommended that mild to medium colour blind citizens should be allowed to drive, and that restrictions should be put only on the severely colour blind citizens.

Retina

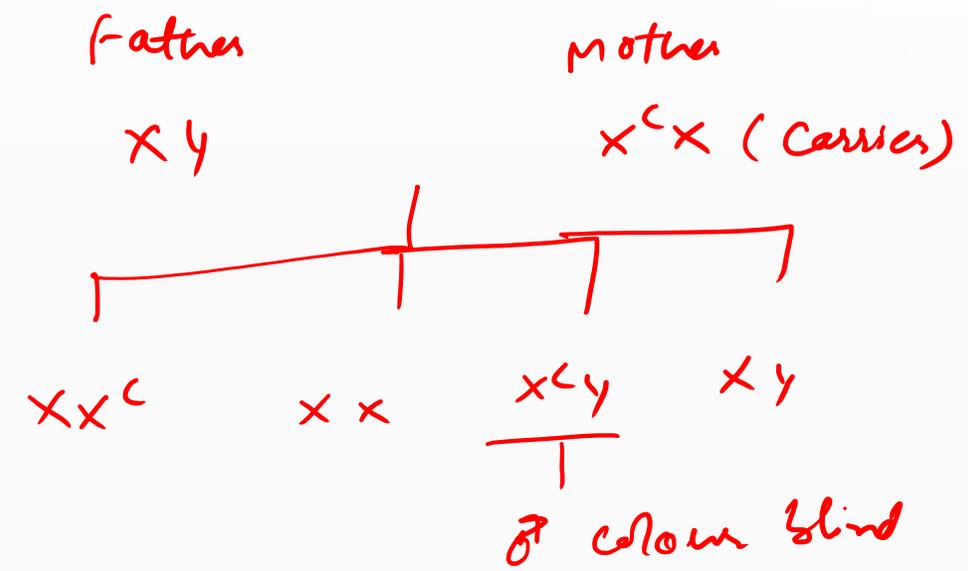
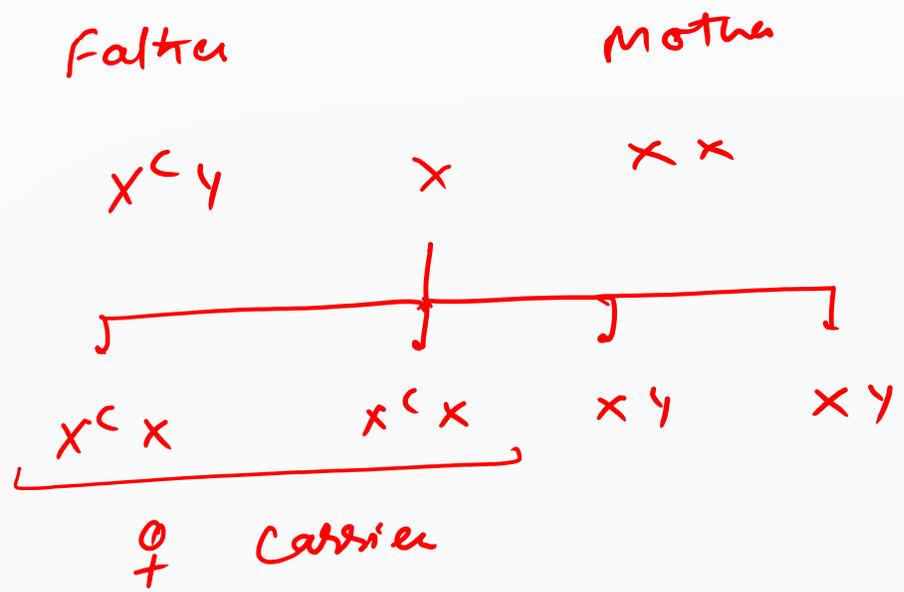


Rod cell → night vision

Cone cell → daylight / color discrimination



Red / Green C.B → on x chrom



Men > women

Blue / yellow — effect ♂ = ♀
 (R) — non sex chrom



Reclassify 'Toxic 3 Os'

US activists, politicians demand FDA reclassify 'Toxic 3 Os' used in sunscreen

- They urged that these chemicals be shifted to “**Not Generally Recognized as Safe & Effective**” (GRASE Category II).
- They also called for the **removal of products that contained these chemicals from the marketplace.**

Toxic 3 Os

- **Oxybenzone, octinoxate and octocrylene** are active ingredients present in more than two-thirds of all sunscreens.
- They pose a threat to **public health, marine life and coral reefs**

Reclassify 'Toxic 3 Os' (DTE)

- **Octocrylene in sun protection** products degrades into **benzophenone, a carcinogen** that can also interfere with key hormones and reproductive organs.
- Oxybenzone is particularly **toxic to corals at concentrations as low as a few parts per trillion** – the equivalent of three drops in an Olympic-size swimming pool may be enough to severely **damage or kill coral**.

Physical
Sunscreen

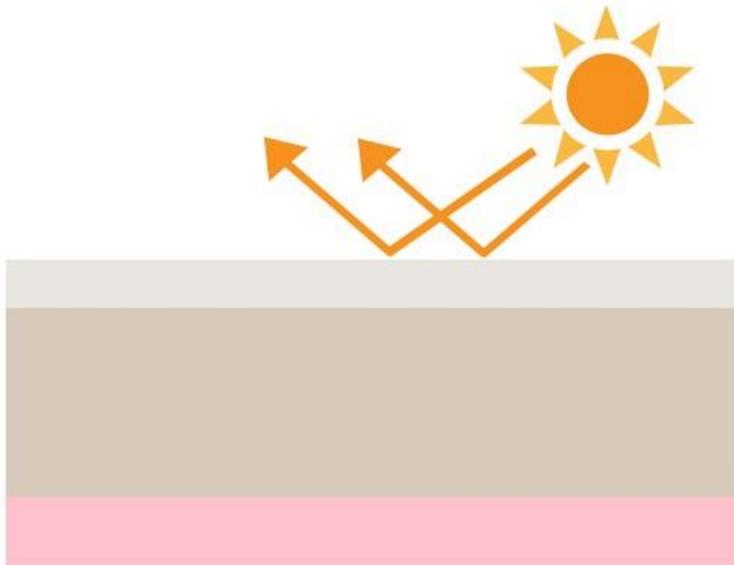


Chemical
Sunscreen

What's the Difference?

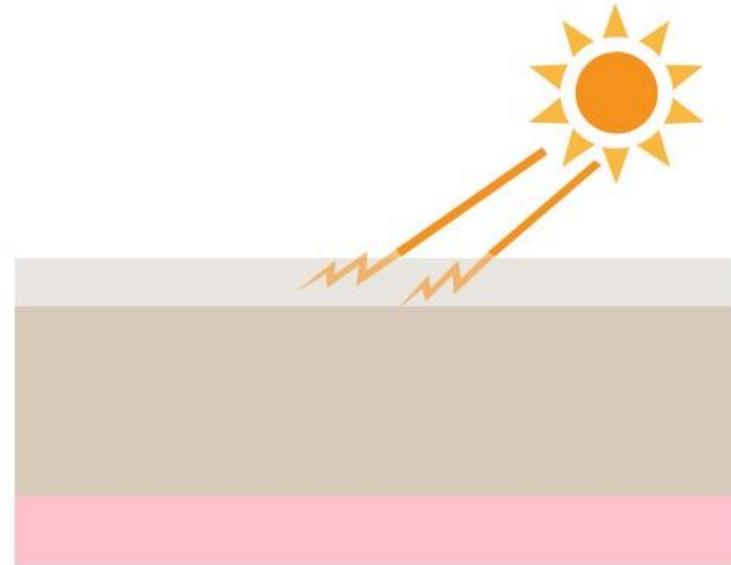
Physical Sunscreens

Physical sunscreens prevent UV rays from hitting the skin at all.



Chemical Sunscreens

Chemical sunscreens turn UV rays into non-damaging wavelengths of light or heat.



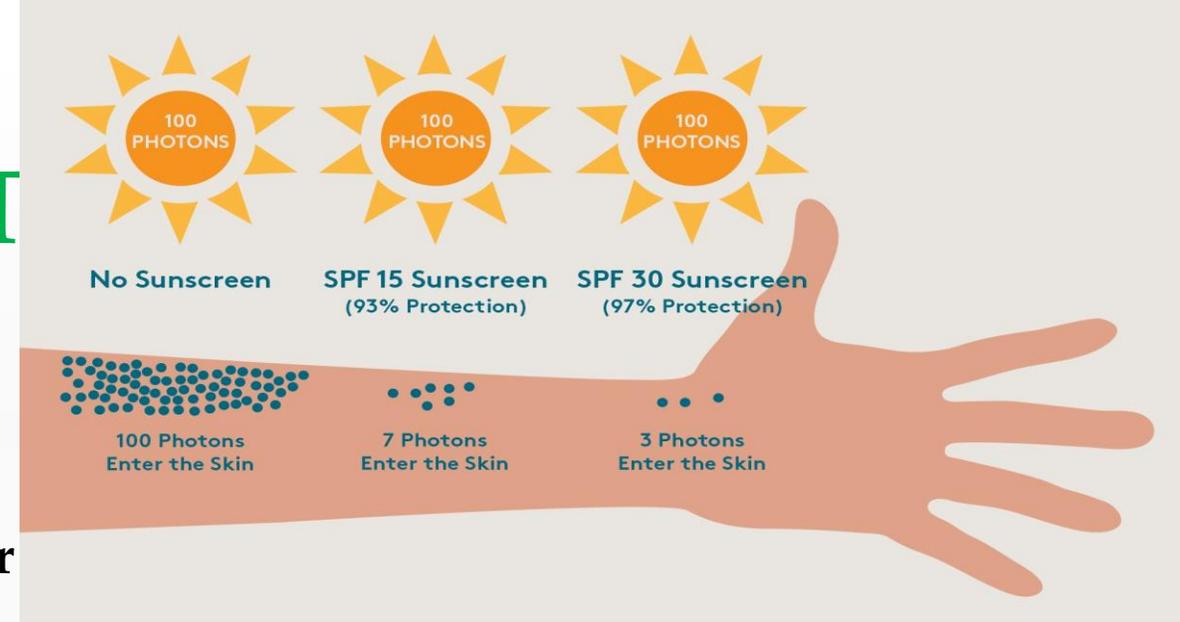
Reclassify 'Toxic 3 Os' (DT

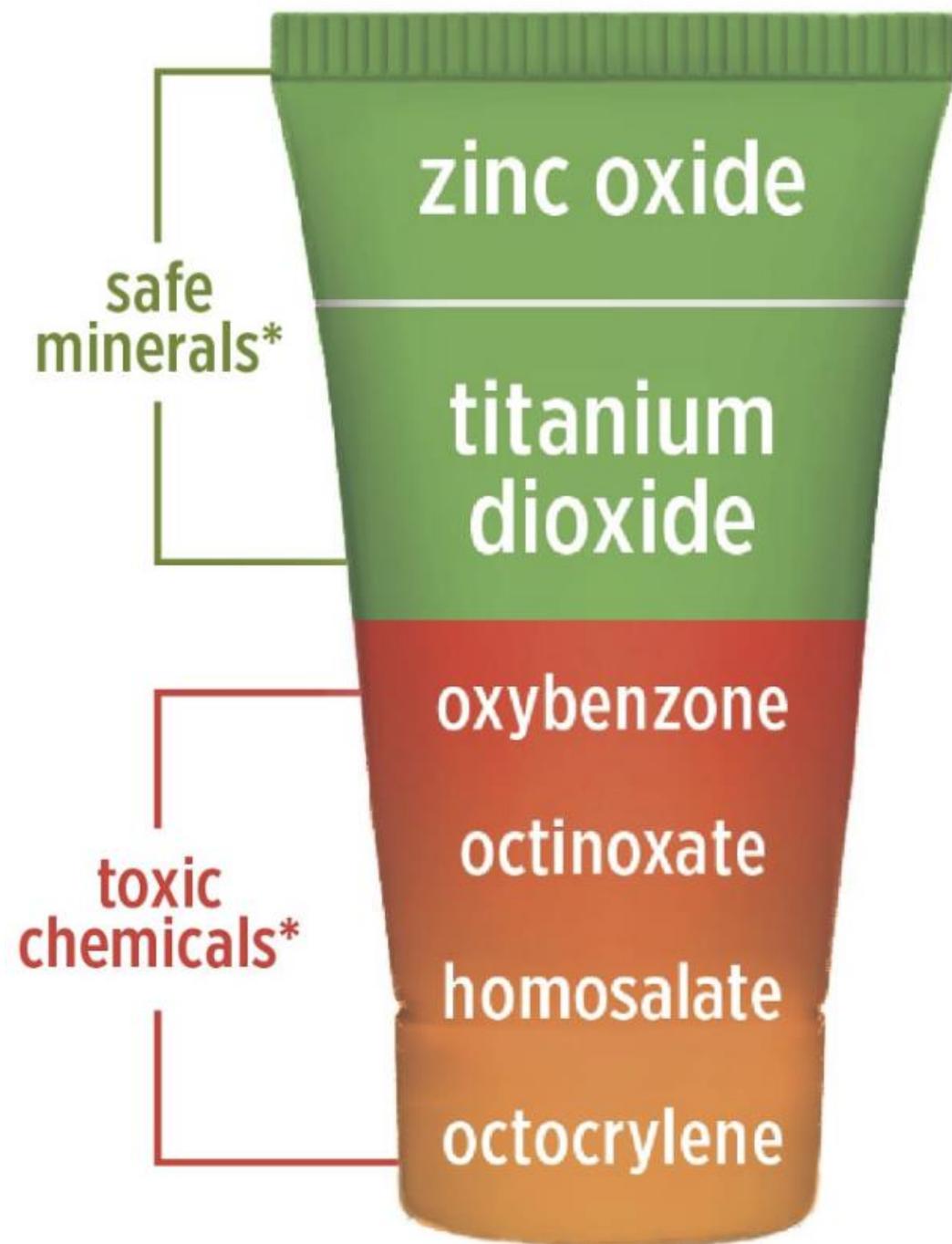
Physical sunscreen

- Also called “**mineral**” **sunscreen**, contains inorganic physical UV filters that **reflect, scatter and block the sun’s rays** before they penetrate the skin
- Eg either Titanium Dioxide and/or Zinc Oxide

Chemical sunscreen

- This type of sunblock contains organic (carbon-based) active ingredients **designed to absorb UV radiation upon contact.**
- Eg Octinoxate , Octocrylene , Oxybenzone





say **YES** to minerals

Natural minerals reflect UV to protect from burning and aging rays. They rub in sheer and are immediately effective. Because minerals aren't absorbed, they are safe and gentle on sensitive skin, and just as gentle on the planet!

say **NO** to chemicals

Chemical sunscreens disperse UV rays through the body and need 20 minutes to become effective. They're absorbed into the skin and the bloodstream, where they've been linked to health issues from allergies to infertility. They've even been tied to the destruction of the coral reefs.

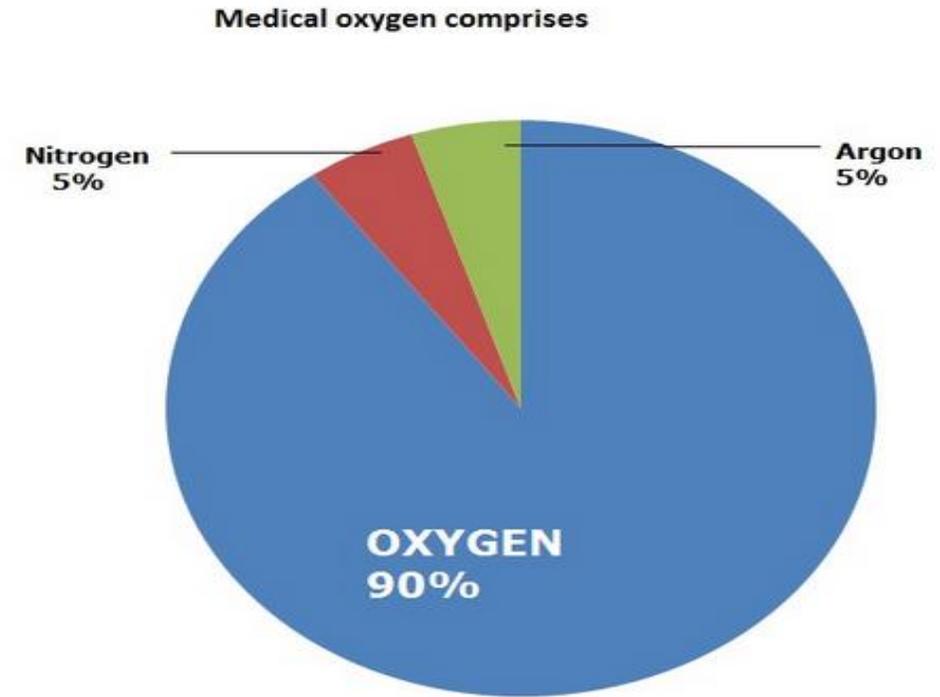
***SUNSCREEN TOXICITY RATINGS - FROM EWG.ORG/SKINDEEP**

Peter Pan Syndrome (PPS)	
Context	<ul style="list-style-type: none"> • A special court in Mumbai has granted bail to a 23-year-old accused of sexually assaulting a minor. • The accused had told the court he suffered from Peter Pan Syndrome
PPS	<ul style="list-style-type: none"> • The term first appeared in 1983, in a book authored by Dr Dan Kiley titled 'Peter Pan Syndrome: Men Who Have Never Grown Up'. • He described it as a "social-psychological phenomenon". • WHO does not recognise Peter Pan Syndrome as a health disorder
Symptom	<ul style="list-style-type: none"> • No clearly-defined symptoms • People with the body of an adult but the mind of a child • Can affect both sexes, but it appears more often among men
Wendy syndrome	<ul style="list-style-type: none"> • Psychologist Dan Kiley describe it as women who act like mothers with their partners or people close to them.

Medical oxygen

Medical oxygen

- Medical oxygen comprises of minimum **90% oxygen with 5% nitrogen and 5% argon.**
- Mostly, oxygen concentrators or **oxygen plants** contain 90-95% O₂ with traces of nitrogen and argon.



Medical oxygen

Methods

- There are different ways of making oxygen but all the techniques **eliminate nitrogen, moisture, hydrocarbons and CO₂ are removed leaving behind only oxygen.**

Medical oxygen

Pressure swing adsorption

- is a process that separates single gases from a gas mixture
- Eg-separate oxygen (O₂) and nitrogen (N₂) from air.
- The **adsorption process is based on gas molecules binding to an adsorbent material.**
- The **adsorbent bed is specially selected depending on the gas to be absorbed.**

Medical oxygen

Cryogenic air separation

- Largely used in the **making of oxygen plants.**
- It functions by **liquefaction of the atmospheric air in the air separation unit of the plant.**
- Whatever technique is used it must meet the rules and regulations of Indian and European Pharmaceuticals standards.

Medical oxygen

How to maintain purity of Oxygen ?

- It is imperative that **purity and the recommended composition** of oxygen for medical oxygen must be maintained.
- It is therefore very necessary for compressors and molecular to be **cleaned** so that medical oxygen remains without impurities.
- **Oxygen tanks** used for storing oxygen for medical purposes must be **properly cleaned** to ensure there are no contaminants.
- And oxygen cylinders should also be **properly vacuumed** before filling them with oxygen.
-

Medical oxygen

Medical oxygen Vs Industrial Oxygen

Medical Oxygen

- Medical oxygen is **high purity oxygen** that is used for medical treatments and is developed for use in the human body.
- Medical oxygen cylinders contain a high purity of oxygen gas; **no other types of gases are allowed in the cylinder to prevent contamination.**
- There are additional requirements and rules for medical oxygen, including **requiring a person to have a prescription to order medical oxygen.**
-

Medical oxygen

Industrial Oxygen

- Industrial oxygen is focused on uses in industrial plants including **combustion, oxidation, cutting and chemical reactions**.
- The industrial oxygen **purity levels are not appropriate for human use** and there could be impurities from dirty equipment or industrial storage that could make people ill

Medical oxygen

Who controls the supply of medical grade oxygen?

Empowered group

- The supply of medical oxygen is currently being allocated **centrally and monitored by the empowered group, EG II**, headed by the **secretary** in the department for promotion of industry and internal trade (**DPIIT**).
- The EG II has **members nominated from all the states**, along with **representatives from all major oxygen manufactures**, All India Industrial Gases Manufacturers' Association (**AIIGMA**), Petroleum and Explosives Safety Organisation (**PESO**), the Ministry of **Road Transport**, and the **Indian Railways**.
- It was constituted in March 2020.

Medical oxygen

Issue

- Most large plants producing medical oxygen are concentrated in **Eastern and Western India**.
- The **densely populated areas of north and central India have limited capacities** and therefore **logistics becomes an issue** for supply of the commodity in some regions.
- States of **Bihar, UP, MP and Rajasthan**, despite their huge population, have very **limited medical oxygen producing capacities**.

Medical oxygen

- The **Health Ministry** has repeatedly **warned against oxygen wastage and unnecessary use.**
- Industrial experts have raised concerns over possible **leakages in hospital pipelines** that supply oxygen.
- Last year, an **expert committee under the Health Ministry** fixed oxygen supply to **40 litres in intensive care units and 15 litres in normal wards per patient per minute.**
- It has advised monitoring of patients on oxygen support daily, and that **only those with oxygen saturation levels below 94%** be put on oxygen support.

AMLEX

To increase the life of **medical oxygen cylinders** three fold, the **Indian Institute of Technology, Ropar** has developed a first-of-its-kind Oxygen Rationing Device – AMLEX

AMLEX

- It supplies a required volume of oxygen to the patient during inhalation and **trips when the patient exhales CO₂**.
- This process **saves oxygen** which otherwise unnecessarily get wasted.
- The device can operate on both **portable power supply (battery) as well as line supply (220V-50Hz)**
- AMLEX can be **easily connected between oxygen supply line and the mask worn by the patient.**
- It **uses a sensor** which senses and successfully detects inhalation and exhalation of the user in any environmental condition



AMLEX

Significance

- So far, **during exhalation**, the oxygen in the oxygen cylinder/pipe is pushed out along with the exhaled CO₂ by the user.
- This leads to **wastage of a large volume of oxygen** in long run.
- In addition to this, a **large volume of oxygen escapes from the openings** of the mask to the environment in the resting period (between inhalation and exhalation) due to continuous flow of life saving gas in the mask.
- This technology helps to save oxygen

Omicron is less severe

Nomenclature:

- The WHO has decided to name the variants **after the letters of the Greek alphabet**, to avoid the **countries that first detected them being stigmatised**.
- WHO selected the name Omicron, **instead of Nu or Xi**, the two letters between Mu and Omicron. This is because:
 - Xi happens to be a popular **surname in China** (avoiding 'causing offence to any cultural, social, national, regional, professional or ethnic groups).
 - Nu could have been confused with the **word 'new**

Omicron is less severe

The WHO currently lists **5 variants of concern**:

- **Omicron (B.1.1.529)**, identified in southern Africa in November 2021
- **Delta (B.1.617.2)**, which emerged in India in late 2020 and spread around the world
- **Gamma (P.1)**, which emerged in Brazil in late 2020
- **Beta (B.1.351)**, which emerged in South Africa in early 2020
- **Alpha (B.1.1.7)**, which merged in Britain in late 2020.

Greek alphabet list

Upper Case Letter	Lower Case Letter	Greek Letter Name	English Equivalent
A	α	Alpha	a
B	β	Beta	b
Γ	γ	Gamma	g
Δ	δ	Delta	d
E	ε	Epsilon	e
Z	ζ	Zeta	z
H	η	Eta	h
Θ	θ	Theta	th
I	ι	Iota	i
K	κ	Kappa	k

Upper Case Letter	Lower Case Letter	Greek Letter Name	English Equivalent
Λ	λ	Lambda	l
M	μ	Mu	m
N	ν	Nu	n
Ξ	ξ	Xi	x
O	ο	Omicron	o
Π	π	Pi	p

Covid-19 variants tracked by WHO

The World Health Organization is currently tracking seven variants, five of which are classified of concern

VARIANTS OF CONCERN

Meet the characteristics of a variant of interest and have at least one of these consequences:

- increase in transmissibility
- increase in virulence
- decrease in effectiveness of public health measures/vaccines

α

β

γ

δ

\omicron

ALPHA

B.1.1.7

BETA

B.1.351

GAMMA

P.1

DELTA

B.1.617.2

OMICRON

B.1.1.529

Earliest recorded samples

Sept 2020

May 2020

Nov 2020

Oct 2020

Nov 2021

United Kingdom

South Africa

Brazil

India

Multiple countries

Date of designation

Dec 18, 2020

Jan 11, 2021

May 11, 2021*

Nov 26, 2021

Dec 18, 2020

VARIANTS OF INTEREST

λ

μ

Cause significant community transmission or multiple clusters in several countries, emerging risk to global public health

LAMBDA

C.37

MU

B.1.621

Dec 2020

Jan 2021

Peru

Colombia

June 14, 2021

Aug 30, 2021



AFP

Sources: WHO, AFP image/handout, US Food and Drug Administration *monitored from April 4, 2021 as variant of interest

Comparing variants of concern

Like all viruses, the SARS-CoV-2 coronavirus **has been evolving since it first emerged in late 2019**. The WHO has identified four variants of concern and four variants of interest:

Variants of concern

Earliest documented sample:



Alpha

United Kingdom
September, 2020

Reported in: 173 countries



Beta

South Africa
May, 2020

Reported in: 122 countries



Gamma

Brazil
November, 2020

Reported in: 74 countries



Delta

India
October, 2020

Reported in: 104 countries

Variants of interest

Earliest documented sample:

Eta

Multiple countries
December, 2020

Iota

United States
November, 2020

Kappa

India
October, 2020

Lambda

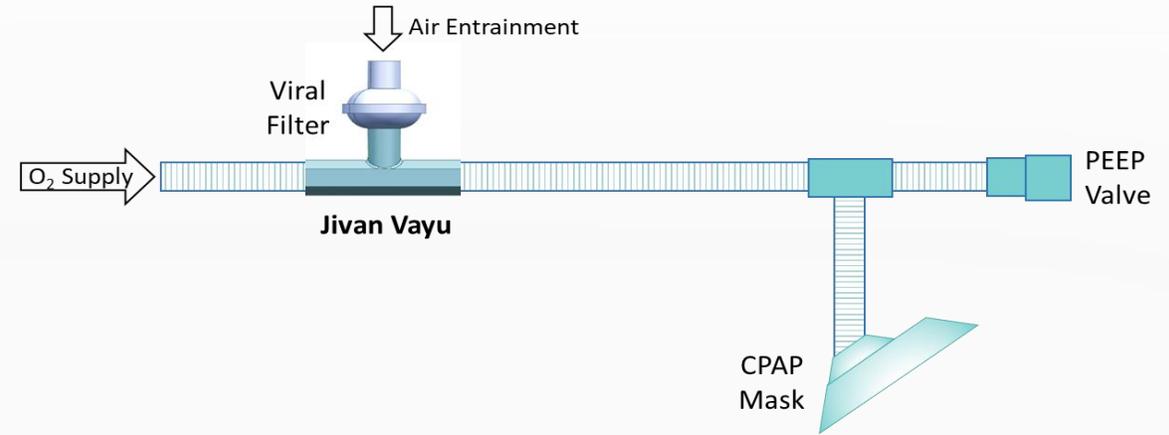
Peru
December, 2020



<p>Variant of Interest</p>	<ul style="list-style-type: none"> • The genetic changes involved are predicted or known to affect transmissibility, disease severity, or immune escape. • An acknowledgement of the fact that the variant has caused significant community transmission • These variants are monitored because they can lead to an increase in positive cases
<p>Variant of Concern</p>	<ul style="list-style-type: none"> • There is evidence of an increase in transmissibility, more severe disease (e.g., increased hospitalizations or deaths), significant reduction in neutralization by antibodies generated during previous infection or vaccination • Previously effective treatments may not work, and diagnostic tests might fail to detect the VOCs.
<p>Variants of High Consequence (VOHC)</p>	<ul style="list-style-type: none"> • This type of variant has the same characteristics as the VOCs. • In addition, there is unquestionable proof that treatment and other efforts to treat and contain the disease are ineffective. • Vaccine efficacy against VOHC is very low, and those impacted by these variants are more likely to require hospitalization.

Jivan Vayu

- It is nation's first power-free CPAP device 'Jivan Vayu', developed by IIT Ropar.
- Continuous positive airway pressure therapy (CPAP) uses a machine to help a person who has obstructive sleep apnea (OSA) breathe more easily during sleep.
- A CPAP machine increases air pressure in your throat so that your airway doesn't collapse when you breathe in.
- Jivan Vayu has an inbuilt viral filter at air entrainment end, with viral efficacy of 99.99 per cent. This filter ensures that air does not bring in any pathogens from environment



Omisure

- Omisure – India’s first home-grown testing kit – can **differentiate the omicron strain of the novel coronavirus from the delta, alpha** and the other variants in under four hours.
- It is an **omicron detecting RT-PCR kit** developed by the Mumbai-based Tata Medical and Diagnostics Ltd (TATA MD) in partnership with the Indian Council of Medical Research (ICMR).
- The kit recently received **approval from the Drugs Controller General of India.**
- Globally, all other test kits for omicron are either made for gene dropout or mutation-specific detection. Omisure is the first test kit combining both

How does Omisure work?

- This new kit can identify the Omicron variant **by targeting two regions of the S or the spike gene**. This gene codes for the spike protein, which helps the novel coronavirus enter and infect human cells.
- **The S, the Enveloped (E), and Nucleocapsid (N) genes are some of the targets of conventional RT-PCR tests**. When it detects these genes, a patient sample is labelled positive.
- As omicron bears **heavy mutations in the S gene**, the RT-PCR can sometimes miss it.
- The absence of **S gene likely indicates omicron's presence**. This is called **S gene dropout or S gene target failure** – and is one of the targets of Omisure.
- This kit also depends on a second target: **S gene mutation amplification, which detects mutations explicitly in the S gene**.

How does Omisure compare with gene sequencing?

- **Gene sequencing** reads the order of nucleotides, which are the building blocks of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
- Despite being considered the gold standard, sequencing has a few limitations. It is **slow, expensive and complicated**.
- It is a **multi-step process**. It begins with extracting the virus' RNA from patient samples, converting it into DNA, amplifying or multiplying it through RT-PCR before finally **sending it for gene sequencing**.
- Identifying variants through gene sequencing can take as many as **three days**.
- **Omisure**, on the other hand, will do test the Omicron variant in **four hours**

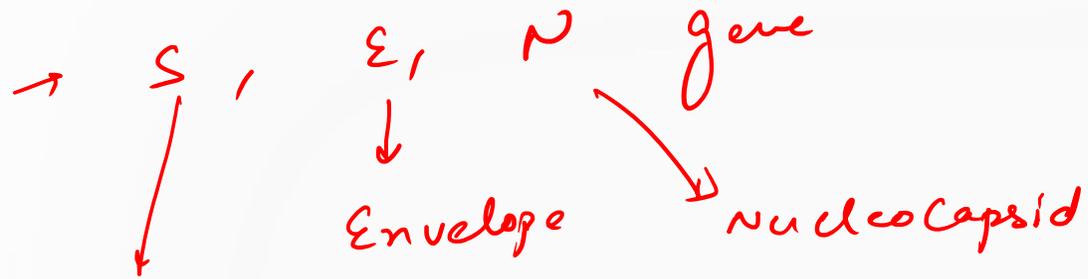
How does Omisure compare with gene sequencing?

- Gene sequencing is also complicated and expensive. It has to be done in batches of 24, 96 or 384. Testing 384 samples on one sequencing chip “costs around Rs 10,000 per sample. The cost is higher when the number of samples is lower
- A single kit of **Omisure** will reportedly cost Rs 250 for the laboratory.

How accurate is this new kit?

- ICMR's evaluation showed that the kit picked up all sequence samples with **100 per cent accuracy**.
- The Pune-based National Institute of Virology has independently validated the kit

RNA \longrightarrow DNA \longrightarrow copies . . .



omicron

\rightarrow Mutator \rightarrow RT-PCR - miss

\rightarrow Absence of S gene \rightarrow omicron

\downarrow
S gene target failure / S gene dropout

SGTF strategy

- Researchers are pitching for genome sequencing of positive samples using RT-PCR kits that employ 'S' Gene Target Failure (SGTF) strategy to detect the variant.
- For example, 'S' Gene, ORF, 'N' gene, RdRp, 'E' gene etc are viral genes that are targeted to detect COVID-19 virus, and multiple genes make up the genetic structure of SARS-Co V-2.
- In case of Omicron variant, the 'S' gene is not getting detected in Thermofisher's Taq Path RT-PCR test due to mutation in the gene, while other gene targets such as ORF gene and N gene are getting detected, he said.
- "The occurrence is called as '**S' Gene Target Failure (SGTF) positive** cases. Such samples can be presumptively reported as Omicron positive and can be sent for fast-track genome sequencing for confirmation

SGTF strategy

- The SGTF strategy focuses on taking those positive samples in which the RT-PCR test result shows **'S' Gene negative result, but ORF and N gene are positive.**
- The SGTF strategy will work as a kind of early detection at RT-PCR stage, and will help in screening COVID-19 positive samples of Omicron variant

UV-C technology

Union Minister of State for Science and Technology has said that **Ultraviolet-C or UV-C Disinfection Technology will be installed in Parliament** for the “mitigation of airborne transmission of SARS-COV-2

UV-C technology

- The UV-C air duct disinfection system was developed by **CSIR-CSIO** (Central Scientific Instruments Organisation)
- The system is designed **to fit into any existing air-ducts** and the virucidal dosages using UV-C intensity and residence time can be optimised according to the existing space.
- The **virus is deactivated** in any aerosol particles by the calibrated levels of UV-C light.
- It can be used in **auditoriums, malls, educational Institutions, AC buses, and in railways.**

UV-C technology

What is UV?

- Ultraviolet (UV) is a type of light or radiation naturally emitted by the Sun. It covers a **wavelength range of 100-400 nm**.
- The human visible light ranges from 380–700 nm.
- UV is divided into three bands: **UV-C (100-280 nm), UV-B (280-315 nm) and UV-A (315-400 nm)**.

UV-C technology

UV-A/B/C

- **UV-A and UV-B rays from the Sun** are transmitted through our atmosphere and all **UV-C is filtered by the ozone layer.**
- **UV-A rays** can penetrate the middle layer of your skin or the dermis and can cause aging of skin cells and indirect damage to cells' DNA
- **UV-B rays** can only reach the outer layer of our skin or epidermis and can cause sunburns and are also associated with skin cancer.
- **UV-C radiation from man-made sources** has been known to cause **skin burns and eye injuries.**

UV-C technology

Can UV-C kill coronavirus ?

- **UV-C radiation** (wavelength around 254 nm) has been **used for decades to disinfect the air** in hospitals, laboratories, and also in water treatment.
- But these conventional germicidal treatments are done in unoccupied rooms as they can **cause health problems**.
- A **paper published in June 2020** in Scientific Reports noted that UV-C radiation can **destroy the outer protein coating of the SARS-Coronavirus**

UV-C technology

Harmful effects

- Researchers from the **Indian Institute of Technology-Kanpur**, who developed a portable disinfectant device that used **UV-C radiation** (222-254 nm), noted that the device was specifically **developed to disinfect non-living things**.
- UV-C radiation used in this device **could be harmful to the skin and eyes of the living beings**, therefore the operator of the device must use spectacles with UV-C radiation protection and use this device safely
- It can take **hours to get sunburn from UV-B**, but with **UV-C it takes seconds**

UV-C technology

Not harmful

- The release from our **Ministry of Science and Technology** does not state the wavelength or duration used, but mentioned that the **product was tested for more than 99% disinfection.**
- Few studies have shown that **far-UVC light (207-222 nm)** does not **harm mammalian skin.**
- Far-UVC light has a very limited range and **cannot penetrate through the outer dead-cell layer of human skin** or the tear layer in the eye, so it's not a human health hazard.
- But because **viruses and bacteria are much smaller than human cells,** **far-UVC light can reach their DNA and kill them**



Why do we care about atmospheric ozone?

400 nm

UV-A
Long wave

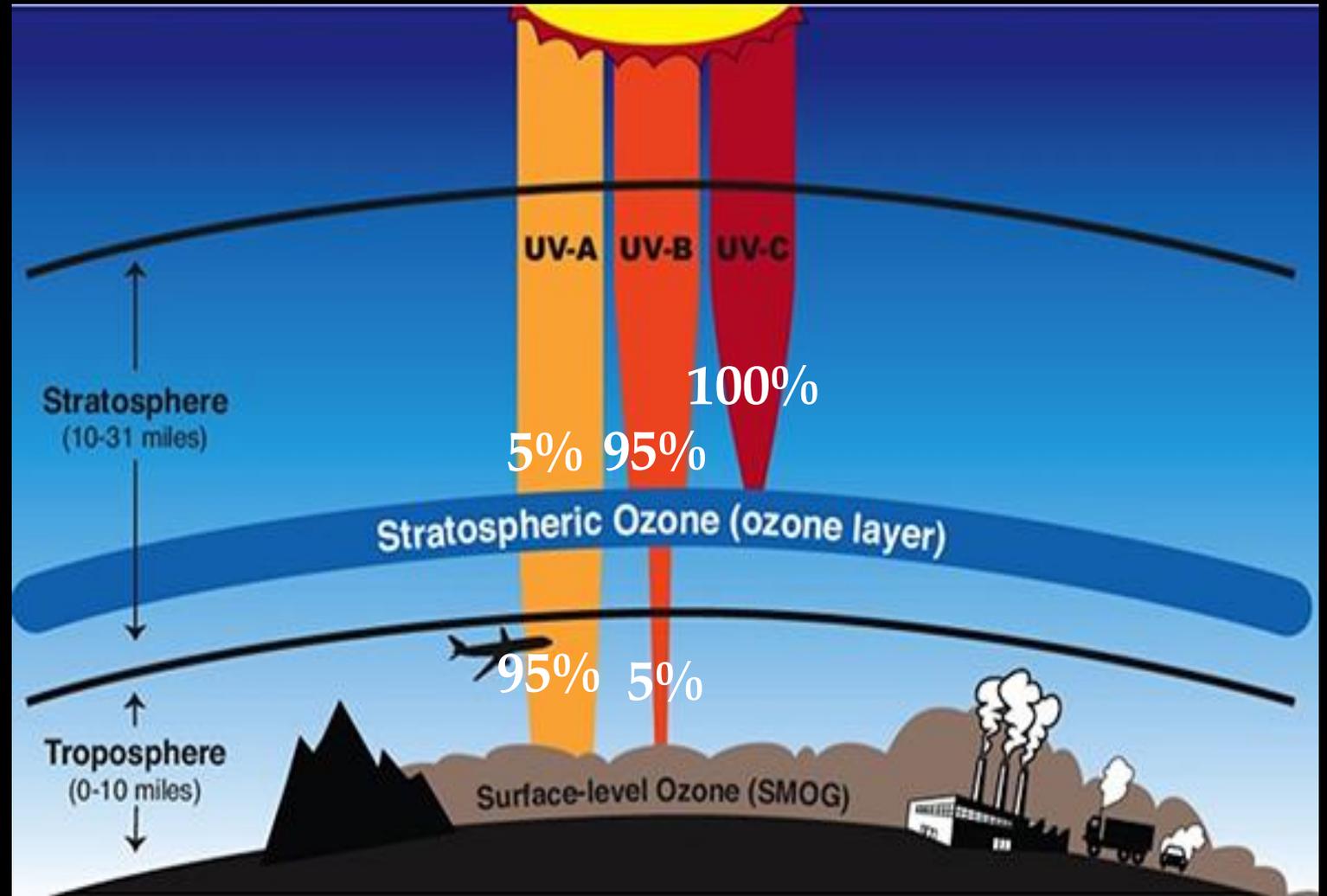
315 nm

UV-B
Small wave

280 nm

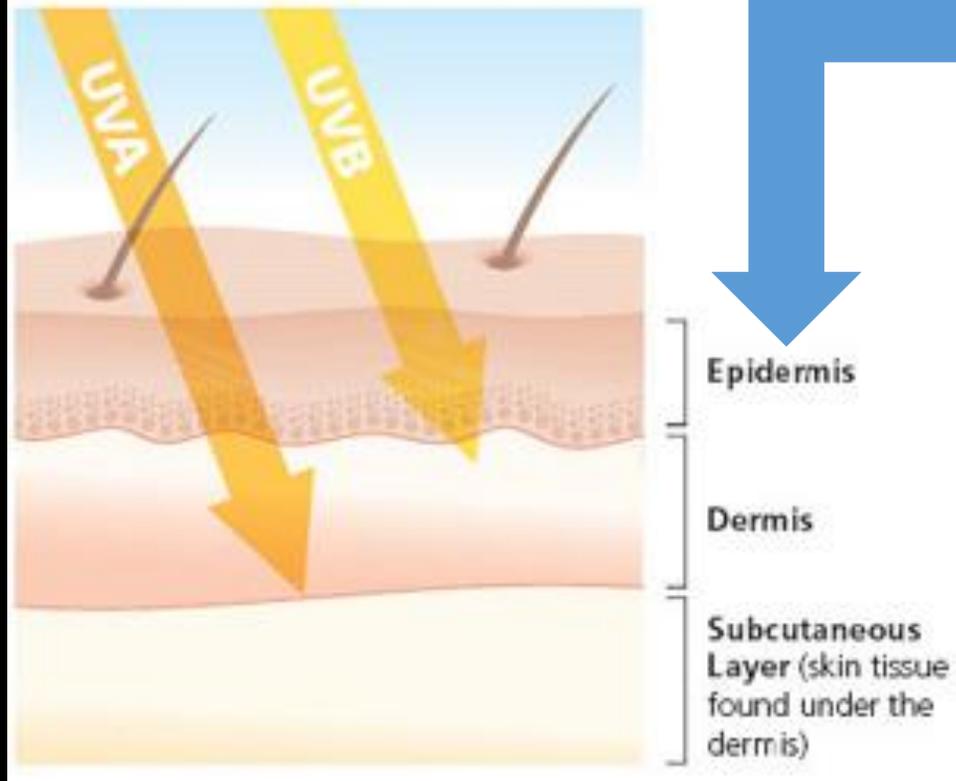
UV-C
Shortwave

200 nm



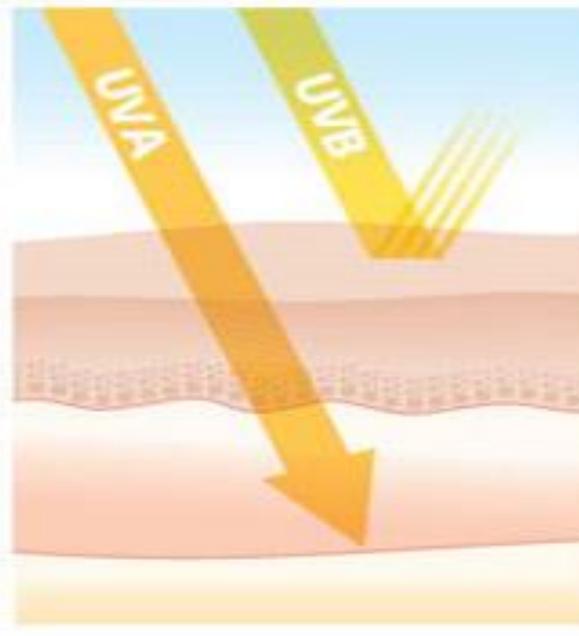
UV-A or UV-B which is more dangerous?

UV Radiation and the Skin

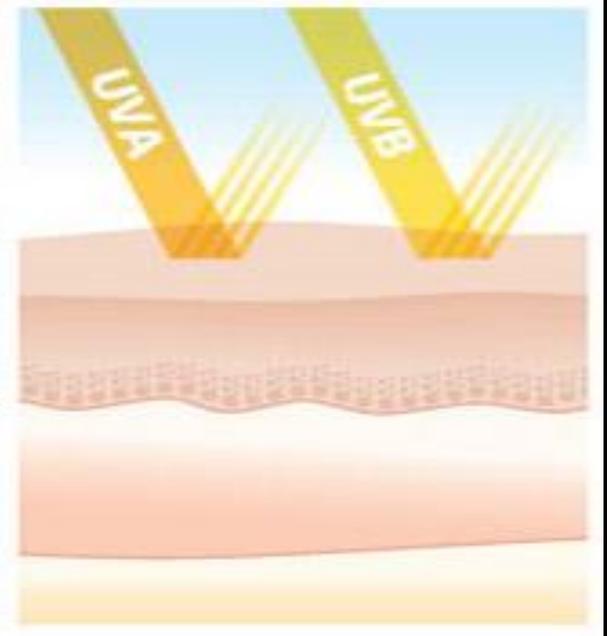


Max Skin Cancer

UVB-Screening Sunscreen



Broad-Spectrum Sunscreen



Germicidal -UV C



- Air disinfection
- Water disinfection
- Waste water treatment
- Aquarium and Pond
- Food and Beverage

Process

Destroy DNA

Sterile

Can't reproduce

Havana Syndrome

- Some of the 1,000 US diplomats and intelligence officers hit by a mysterious illness known as **Havana Syndrome** could have been targeted by electromagnetic energy pulses, according to a report
- The problem has been labeled the "Havana Syndrome," because the first cases **affected personnel in 2016 at the U.S. Embassy in Cuba**
- They experienced some **odd physical sensations** and heard **peculiar sounds**, after which they **started feeling sick**
- The **US** had even **accused Cuba** of carrying out **sonic attacks**. But Cuba denied the accusations of the sonic attacks and refused awareness of any such illness or syndrome.
- The symptoms of the syndrome include **Nausea, Severe headaches, Fatigue, Dizziness, Sleep problems, Hearing loss**

Havana Syndrome

Microwave Weapons

- Microwave weapons are supposed to be a type of direct energy weapons, which aim highly focused **energy in the form of sonic, laser, or microwaves, at a target.**
- It uses a focussed beam of high-frequency electromagnetic radiation to **heat the water in a human target's skin**, causing pain and discomfort.

Which countries have these microwave weapons

- According to a report, **China** had first put on display its “microwave weapon”, called **Poly WB-1**, at an air show in 2014.
- The United States has also developed a prototype microwave-style weapon, which it calls the “**Active Denial System**”.

Havana Syndrome

India

- Recently, the Defence Research and Development Organisation (DRDO) has announced its plans to develop (DEWs) using high-energy lasers and microwaves.

Concerns

- Concerns have been raised on whether they can damage the eyes, or have a carcinogenic impact in the long term.
- It is not clear yet how China intends to use such a weapon, and whether it can kill or cause lasting damage to human targets.

Pain without injury

The 'Active Denial System' deters attackers by sending a non-lethal millimeter-wave of electromagnetic energy, causing a burning sensation.

Wave Penetrates the skin to 1/64 of an inch, causing a feeling similar to being on fire



Two-second burst can heat skin to 130° F

98.6° F Normal

122° F People pull away reflexively

130° F

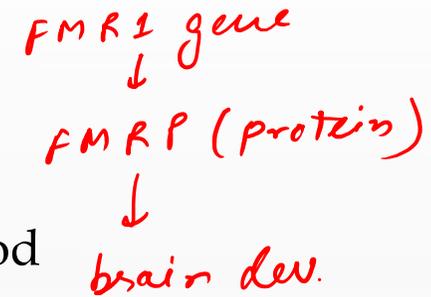


Antenna focuses the invisible energy

Note: Drawing is schematic

Transmitter Produces 95 GHz frequency waves

Fragile X syndrome(FXS)- (TH)



In 2017, a man in Delhi, affected by autism, underwent his first DNA blood test at the age of 40. He tested positive for **Fragile X Syndrome (FXS)**.

Fragile X Syndrome (Martin-Bell syndrome or Marker X syndrome)

- Fragile X syndrome (FXS) is a genetic disorder.
- **Cause** : FXS is caused by changes in a gene that scientists called *FMR1* gene when it was first discovered.
- The *FMR1* gene usually makes a protein called FMRP. FMRP is needed for brain development. People who have FXS do not make this protein.
- It affects **both males and females**. However, females often have milder symptoms than males
- **The syndrome is the leading inherited cause of autism** in 4% of the population worldwide.
- It is largely undetected in India

Fragile X syndrome(FXS)- (TH)

Signs and Symptoms

- Developmental delays (not sitting, walking, or talking at the same time as other children the same age);
- Learning disabilities (trouble learning new skills)

Mosquitoes To Combat Dengue

- Recently, **Researchers in Indonesia** have found a way to fight disease-bearing mosquitoes by breeding a species of insect which carries **Wolbachia bacteria**.
- Wolbachia is a common bacterium that **occurs naturally in 60% of insect species**, including some mosquitoes, fruit flies, moths, dragonflies, and butterflies.
- It is **not found in dengue-carrying Aedes aegypti mosquitoes**, the primary species responsible for transmitting human viruses such as Zika, dengue, chikungunya, and yellow fever.

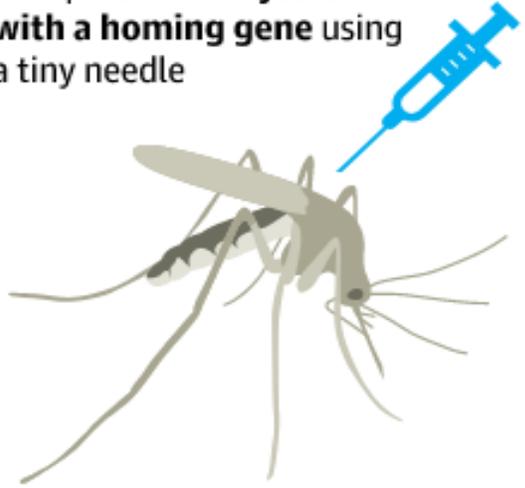
Mosquitoes To Combat Dengue

- The lab-bred mosquitoes with **Wolbachia** will mate with mosquitoes **with dengue**, which will produce Wolbachia mosquitoes ('good' mosquitoes).
- Wolbachia bacteria in the mosquitoes **prevent viruses like dengue from growing inside them.**
- Wolbachia method helps to **protect communities from mosquito-borne diseases like Zika, dengue, chikungunya, and yellow fever** and does so without posing a risk to natural ecosystems or human health.

Mosquitoes To Combat Dengue

- The dengue vaccine **CYD-TDV** or **Dengvaxia** was approved by the **US Food & Drug Administration in 2019**, the first dengue vaccine to get the regulatory nod in the US. Dengvaxia is basically a live, attenuated dengue virus that has to be administered in people of ages 9 to 16 who have laboratory-confirmed previous dengue infection and who live in endemic areas.

1 Mosquitoes are **injected with a homing gene** using a tiny needle



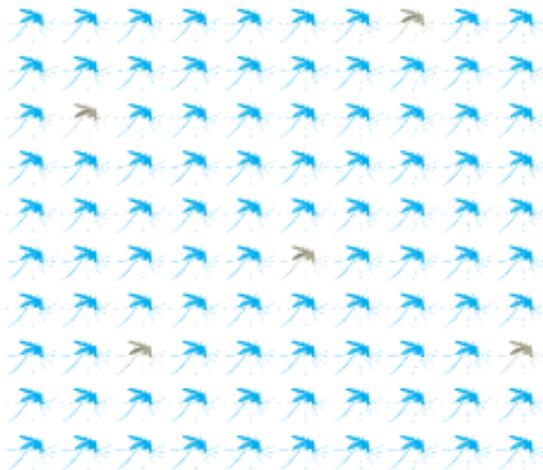
2 The gene locks on to a sequence in the **X chromosome**



3 That part of the X chromosome is **'shredded'**



4 This favours unaffected sperm-bearing Y chromosomes, meaning their **offspring become 95% male**



GM mosquitoes - 2 type gene

- Self limiting
↓
Prevent ♀ offspring from surviving adulthood
- Fluorescent marker gene
↓
glows
↓
To identify GM mass in wild.

1-890-3043



Mosquitoes without *Wolbachia* transmit Zika and dengue



Mosquitoes with *Wolbachia* block transmission of Zika and dengue

Control strategy 1:

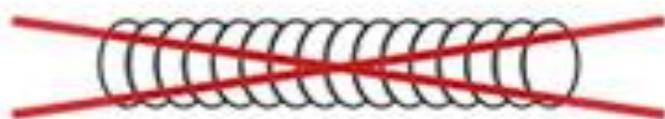
Directly insert incompatibility genes into male mosquito genome



Released male with incompatibility genes



Wild female



Resulting eggs do not hatch, which crashes the local population

Control strategy 2:

Insert extra incompatibility genes into *Wolbachia*



Released male with extra incompatibility genes



Wild female



Local population crashes