

# Info**SCIENCE**

Volume-03, No.-01 (2021)

*... the science information*



Shri R.L.T. College of Science, Akola

## Message from the Hon'ble President ...



On the occasion of publication of 1<sup>st</sup> issue of 3<sup>rd</sup> volume of science magazine... *infoSCIENCE*, I am very much happy and proud to greet you through this message. Shri R.L.T. College of Science, Akola is ceaselessly catering to the academic needs of students' right from its inception. It has left no stone unturned to provide opportunities to students and teachers through different activities. The achievements of many of them have been recognized at various national and international levels that have brought not only personal recognitions, but also fame and glory to the institute. I am confident that, this magazine will prove to be the excellent platform to researchers, teachers and students to present their scientific ideas and research output.

At this juncture, I congratulate the editors of *infoSCIENCE* for their dedicated work and tireless efforts in bringing out this publication.

**Adv. Motisingh G. Mohta**

President, The Berar General Education Society, Akola

## Principal's Message ...



I feel very much happy and delighted to present the 1<sup>st</sup> issue of 3<sup>rd</sup> volume of science magazine... *infoSCIENCE* to all the stakeholders of Shri R.L.T. College of Science, Akola. The aim of publication of *infoSCIENCE* is to provide the common platform to researchers, teachers and students to share their innovative scientific ideas and research plan in the field of science and technology. This issue is enriched with various scientific and research articles of varied ideas and diverse views. These articles will definitely help the readers and contributors to update their scientific knowledge.

On this occasion, I congratulate the board of editors of *infoSCIENCE*, for its sincere work even during the COVID-19 pandemic, that has resulted in the publication of this issue. I hope these determined efforts of our, will go a long way.

**Dr. Vijay D. Nanoty**

Principal, Shri R.L.T. College of Science, Akola

## Editorial ...

The board of editors is proud exuberant to present the 1<sup>st</sup> issue of 3<sup>rd</sup> volume of science magazine... *infoSCIENCE* of Shri R.L.T. College of Science, Akola incorporated with various scientific and research articles in the field of science and technology. The editorial board cordially thanks the patrons, honorable executive members of the Berar General Education Society, Akola and the principal, advisors and authors for extending their kind support to this scientific project.

**Dr. Sushil M. Nagrale, Dr. Pradip P. Deohate**

**Dr. (Mrs.) Anjali A. Sangole and Dr. Vinod D. Deotale ... Editors, *infoSCIENCE***

# InfoSCIENCE

Volume-03, No.-01 (2021)

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**Shri R.L.T. College of Science, Akola**

## Contents

### Research / Scientific Articles

1. Recycling of Sericultural - Pupae Waste 01  
**Dr. Rashmi P. Joshi (Sawalkar)**
2. Introduction and Importance of Medicinal Plants and Herbs 03  
**Dr. Anjali A. Sangole**
3. Nanoplastics - Blood-Brain Barrier, Threatens to Human Health 05  
**Dr. Poonam T. Agrawal**
4. Processed Food and Health 07  
**Dr. Vinod D. Deotale**
5. Insect World - Diversity of Wasp 09  
**Dr. Sushil M. Nagrale**
6. Chemical Weapons - The Toxic Chemical Compounds 11  
**Dr. Pradip P. Deohate**
7. Plants Use as Ethno Medicine 14  
**Ms. Shiwani G. Gangamwar**
8. Biodiesel - Eco-Friendly, Biodegradable and Renewable Biofuel 16  
**Ms. Juvairiya Sadiya Nasir Khan**
9. Transgenic Bt Cotton 20  
**Ms. Laxmi S. Mhasaye**
10. Higgs Boson - Really a God Particle? 22  
**Ms. Varada V. Bhusari**
11. Li-Fi - The Future of Data Transfer 24  
**Mr. Rohit S. Wadkar**
12. What is Bone Marrow? How it Saves Life? 26  
**Ms. Samiksha S. Dongare**
13. Mathematical Model for Covid-19 Epidemic 30  
**Ms. Rohini M. Wankhade**
14. Metabolism 32  
**Ms. Disha A. Shah**
15. The New Fish Hiranyakeshi - Jewellery in the Mountains of Sahyadri (Western Ghats) of Maharashtra 34  
**Ms. Dnyaneshwari N. Polkat**
16. Reuse of Cooking Oil - Not a Healthy Choice 36  
**Ms. Prachi D. Dalu**
17. Forget 98.6<sup>o</sup>F, Humans are Cooling Off - It's Time to Redefine Normal Body Temperature 38  
**Mr. Nikhil V. Sharma**

## Recycling of Sericultural - Pupae Waste

**Dr. Rashmi P. Joshi (Sawalkar)**

Department of Zoology, Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

**In silk production, the spent pupae are produced in large quantities and are a major by-product. For 1 kg of raw silk, 8 kg of wet pupae or 2 kg of dry pupae is produced. Spent silkworm pupae are a waste material often discarded in the open environment or used as fertilizer. In recycling, waste materials are changed to new products so as to prevent the waste of potentially useful materials.**

### What is recycling?

Recycling is a process to change materials (waste) into new products to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from land filling) by reducing the need for 'conventional' waste disposal and lower greenhouse gas emissions. Materials to be recycled are brought to a collection center or picked up from the curbside, then sorted, cleaned and reprocessed into new materials bound for manufacturing.

### Use of silkworm pupae waste

When the silkworm enters the pupal phase, it builds a protective cocoon made of raw silk. At the end of pupation, the pupa releases an enzyme that creates a hole in the cocoon and the moth emerges. In order to produce silk, the pupae are killed by boiling, drying or soaking in sodium hydroxide solution, before they produce the enzyme. The spent pupae are produced in large quantities and are a major by-product of silk production. For 1 kg of raw silk, 8 kg of wet pupae (2 kg of dry pupae) is produced.



Spent silkworm pupae are a waste material often discarded in the open environment or used as fertilizer. It can be extracted to yield valuable oil used in industrial products such as paints, varnishes, pharmaceuticals, soaps, candles, plastic and bio-fuels. The extracted meal is sometimes used for the production of chitin, the long-chain polymer of N-acetyl glucosamine which is the main component of the exoskeleton. Silkworm pupae have long been part of human food in Asian silk-producing countries, and are considered as a delicacy in regions of China, Japan, Thailand and India, among others. Due to its high protein content, silkworm pupae meal has been found suitable as a livestock feed, notably in monogastric species (poultry, pigs and fish), but also in ruminants.

Fresh spent silkworm pupae spoils rapidly due to its high water content and spent pupae are generally sun-dried and ground. The degradation of mulberry-fed silkworm pupae produces a foul smell that has been attributed to the presence in mulberry leaves of compounds that might

be sequestered by silkworms, including essential oils, flavonoids, and terpenoids. This bad odour has been linked to palatability issues. Defatted silkworm pupae meal is less perishable and has higher protein content than non-defatted meal. Ensiling also increases the shelf life of silkworm pupae meal and good quality silage has been obtained when ensiling with molasses, propionic acid or curd. Spent silkworm pupae should be ground to assure more uniform mixing in rations.

Spent silkworm pupae are a fresh, highly degradable product. In silk production areas, the disposal of large quantities of pupae can cause serious environmental problems. The utilization of this resource for feed and food or for the production of valuable biological substances such as chitin, protein, oil and fatty acids ( $\alpha$ -linolenic acid) is a way to reduce the environmental impact of silk production.

Silkworm pupae meal is a protein-rich feed ingredient with a high nutritional value. Its crude protein content ranges from 50% DM to more than 80% DM (for defatted meal. Defatting is a practice used by dieters to reduce the fat and caloric content of a meal). The lysine (6-7% of the protein) and methionine (2-3% of the

protein) content are particularly high. However, the true protein (calculated as the sum of amino acids) in silkworms was found to correspond to only 73% of the crude protein content, which was explained by the presence of chitin, since this component includes nitrogen. On the other hand the chitin content of pupae meal is relatively low, about 3-4% DM. The presence of chitin and insoluble protein may also explain the presence of fibre and values of 6-12% DM of ADF have been reported). Non-defatted pupae meal is rich in fat, typically in the 20-40% DM range. Defatted meal contains less than 10% DM of oil. Silkworm oil contains a high percentage of polyunsaturated fatty acids, notably linolenic acid (18:3), with reported values ranging from 11 to 45% of the total fatty acids. Compared to other animal by-products, silkworm pupae meal is relatively poor in minerals (3-10% DM).

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## Introduction and Importance of Medicinal Plants and Herbs

**Dr. Anjali A. Sangole**

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For over 4000 years, Unani Hakims, Indian Vaidis and European and Mediterranean cultures were using herbs as medicine. In traditional medical systems herbal therapies were used systematically. Medicinal plants are considered as rich resources of ingredients which can be used in drug development and synthesis. In India, global population depends on medicinal plants as their first source of therapeutics. The importance of some medicinal plants i.e. aloe vera, mint, fenugreek, fennel, coriander, ginger, garlic, spinach, bael, neem, dalchini, tulsi, ananas, haldi, nagarmotha, nirgudi, aswagandha, cumin, cardamom, tejpatta, sarpagandha, arjun and babool are discussed here.

Plants have been used for medicinal purposes long before prehistoric period. Evidence exist that Unani Hakims, Indian Vaidis and European and Mediterranean cultures were using herbs for over 4000 years as medicine. Traditional medical systems such as Unani, Ayurveda medicine are those in which herbal therapies were used systematically. The term of medicinal plants include a various types of plants used in herbalism and some of these plants have a medicinal activities. These medicinal plants are considered as rich resources of ingredients, which can be used in drug development and synthesis. Besides that these plants play a critical role in the development of human cultures around the whole world. The plants also characterize by their ability to prevent the appearance of some diseases. This will help to reduce the use of the chemical remedies which will be used when the disease is already present i.e., reduce the side effect of synthetic treatment. The importance of some medicinal plants is as given herewith.



**Aloe Vera** - It has an amazing property of water retention in its leaves that helps in certain conditions such as constipation, acne and poor body immunity.

**Mint** - It keeps the digestive system running, boost immunity. It also helps in keeping the mosquitoes away.

**Fenugreek** - It maintains the body cholesterol level and also purifies blood. It is very beneficial for joint and diabetes.

**Fennel** - It treats cough, improves eyesight and cure acidity from the stomach. It also helps for digestion.

**Coriander** - It is rich with antioxidants and purifies the body from harmful toxins. It also helps in treating acne.

**Ginger** - It plays a vital role in digestion and also helps in controlling blood pressure. It also helps during menstruation.

**Garlic** - It plays a vital role in strengthening our immune system and also fights against the cancer.

**Spinach** - Spinach has riboflavin, beta carotene and luteine which improve cardiovascular and nervous system.

**Bael** - It play an important role in dysentery and diabetes, sunstrokes and anti-Cancer.

**Neem** - It can be used for eye disorders, bloody nose, intestinal worms and leprosy.

**Dalchini** - It play an important role as antibacterial and antiseptic.

**Tulsi** - It play a vital role in indigestion, heart diseases and respiratory diseases.

**Ananas** - It play an important role in sore throat, diabetes, heart disease and obesity.

**Haldi** - The rhizomes are used in sprains, bruises and internal injuries.

**Nagarmotha** - The tubers are used in urinary and heart troubles.

**Nirgudi** - The extract of the leaves is used in body pain and in skin diseases.

**Aswagandha** - It acts as an anti-stress and adaptogenic herb. The regular use of ashwagandha improves stress tolerance thereby enhancing the mental capabilities.

**Cumin** - Help in improving digestion, boosting memory, prevent cancer cells from multiplying and help to reduce pain with its anti-inflammatory properties.

**Cardamom** - It is beneficial for overall digestive system, respiratory system, kidneys, blood, heart and skin.

**Tejpatta** - It helps to manage blood glucose levels by enhancing insulin secretion due to its antioxidant and anti-inflammatory activity.

**Sarpagandha** - It is used for blood pressure.

**Arjun** - Fresh juice of arjun leaves is a cure for earache, cure blood pressure problems and heart diseases.

**Babool** - It is used as a tonic and a cure for eye sores and a medicine for cough.

### Conclusion

In India, global population depends on medicinal plants as their first source of therapeutics. The uses of herbal drugs in home are an old practice for rural area.

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## Nanoplastics - Blood-Brain Barrier, Threatens to Human Health

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Trillions of pieces of plastic, many of which will last for thousands of years, are floating in the oceans, potentially damaging human health, killing birds and fish, and even adding to global warming. One of the biggest problems with these tiny plastic pieces is that they can be ingested by marine organisms and slowly work their way up the food chain, ending up causing health problems for humans. When plastic pieces are smaller than about 0.1 micrometres in size, they are known as nanoplastics and can be tiny enough to enter the bloodstream and even cross the blood-brain barrier.

From bottles and shopping bags to micro-beads in cosmetics and the tiny shreds that rub off the soles of our shoes as we walk, vast amounts of plastics find their way into rivers, lakes and the sea. Trillions of pieces of plastic, many of which will last for thousands of years, are floating in the oceans, potentially damaging human health, killing birds and fish, and even adding to global warming.



Scientists estimate that more than 5 trillion plastic particles are floating in oceans around the world - an amount that has accumulated since global mass production of plastics started in the 1950s.

So far, we know that the ocean is absorbing carbon dioxide, but what if the large-scale influx of new micro-materials impacts the most critical layer in this exchange, modifying the capacity of the ocean to act as a carbon dioxide sink?

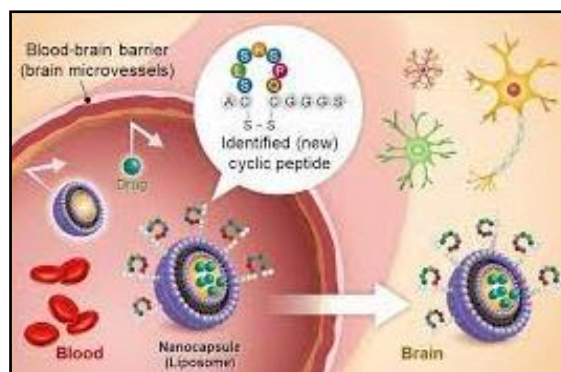
Microplastics can include items such as nurdles - small plastic pellets used in manufacturing plastic products or fragments of larger pieces of plastic waste,

as well as synthetic fibres from clothing and cosmetic micro-beads.

The researchers are examining the interactions between microplastics, bacteria and algae and how microbes colonise plastics in the surface micro layer. It's a vital question as this is the layer that acts as the interface between the water and the atmosphere.

One of the biggest problems with these tiny plastic pieces is that they can be ingested by marine organisms and slowly work their way up the food chain, ending up causing health problems for humans.

When plastic pieces are smaller than about 0.1 micrometres in size, they are known as nanoplastics and can be tiny enough to enter the bloodstream and even cross the blood-brain barrier. These can cause different problems as they move through the body, such as inflammation, or even tumours, when the immune system goes into overdrive.



“Normally an immune system cell can attack a foreign particle, such as a

bacterium and remove it. But plastic is so persistent that it is able to resist attack by our enzymes”, said Dr Leslie, Co-ordinator of the CleanSea project which has been funded by the EU to study micro and nanoplastics in the marine environment and take steps to address this problem.

In the system, in which we live it is very hard for consumers not to create

microplastics emissions, just by walking in shoes with synthetic soles we contribute to the problem. So that is something that needs to be addressed at the design phase.

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## Processed Food and Health

**Dr. Vinod D. Deotale**

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**Processed food is a modified food that has a series of mechanical or chemical operations performed on it to change or preserve it. It contains additives, flavorings, emulsifiers and stabilizers. Notably, processed food includes packaged breads, breakfast cereals, biscuits, pastries, buns, cakes, industrial chips and french fries, soft and fruit drinks or packed juices, packaged pre-prepared meals and reconstituted meat products. Most of the processed food contains higher amounts of unhealthy fat, sugar, salt and also lack fiber and protein. If a large part of a person's diet consists of processed food, they can suffer from lack of important vitamins and minerals. For most of us, it's not realistic to avoid all processed foods, but it is important to note that large quantities may be harmful to our health. It may leads to weight gain and high blood sugar, which ultimately increases the risk of heart attack and stroke.**

Processed food is any food that has been altered in some way during preparation. A processed food is modified item that has a series of mechanical or chemical operations performed on it to change or preserve it. It contains additives, flavorings, emulsifiers and stabilizers.

Food processing can be as basic as freezing, canning, baking, and drying. The food is then assembled into ready-to-eat hyper palatable food called 'Cosmetic food'. Refined or processed sugar, however, lacks these accompanying vital nutrients and is found in most processed foods, even those that are not considered sweet like ready-to-eat soups and ketchup. Notably, processed food includes packaged breads, breakfast cereals, biscuits, pastries, buns, cakes, industrial chips and french fries, soft and fruit drinks or packed juices, packaged pre-prepared meals and reconstituted meat products.

As per the doctor, processed foods are harmful because they contain higher amounts of unhealthy fat, sugar and salt. The extra calories - termed 'empty' calories because they lack nutritional value - consumed in the form of fat and sugar, from processed food, leads to weight gain and high blood sugar. Excess sodium that comes from salt, in this type of food raises blood pressure and causes water retention. Furthermore, most processed foods also

lack fiber and protein, which are necessary for satiety or the feeling of being full after a meal. These processed foods contain little to no vitamins and minerals. If a large part of a person's diet consists of processed foods, they can suffer from lack of important vitamins and minerals. The combination of high blood sugar and blood pressure with obesity increases the risk of heart diseases and cancer.



A study from Brazil showed that preschool children who consumed excess ultra processed food had increased waist circumference by the time they entered primary school. Two large European studies have studied the link between consumption of processed foods and health. One study found that, people who consumed even 10% more processed food had increased risk of heart attacks and strokes. In addition to the poor nutritional quality of the food, substances formed from additives during the production, processing and storage as well as contact of food with the packaging have unknown

effects. In India, consumption of packaged food is on the rise paralleling an increase in overweight and obese children and adults. (The Indian Express, 7<sup>th</sup> April, 2020).



For most of us, it's not realistic to avoid all processed foods. Soft drinks, jams, ketchup, tinned fruits and potato chips, all these taste delicious and are convenient, but it is important to note that they are

examples of processed foods and large quantities may be harmful to your health.

Food processing sector is one of the largest sectors in India in terms of production, growth, consumption, and export. India's food processing sector covers fruit and vegetables; spices; meat and poultry; milk and milk products, alcoholic beverages, fisheries, plantation, grain processing and other consumer product groups like confectionery, chocolates and cocoa products soya-based products, mineral water, high protein foods etc.

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## Insect World - Diversity of Wasp

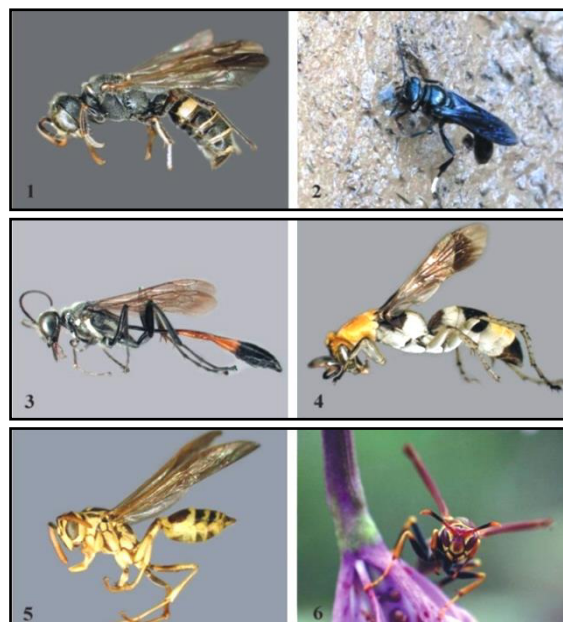
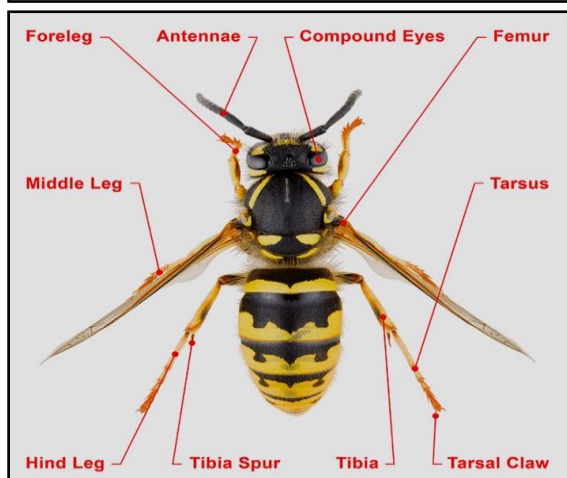
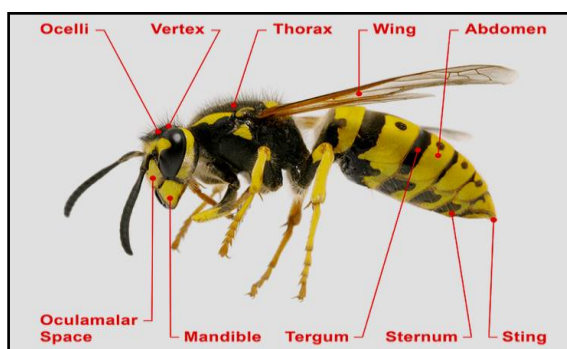
**Dr. Sushil M. Nagrale**

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A wasp is neither a bee nor an ant. Any insect of the narrow-waisted suborder Apocrita of the order Hymenoptera is wasp. Wasps are first appeared in the fossil record in the Jurassic. The largest social wasp is the Asian giant hornet at upto 5 centimeters in length, whereas the smallest are solitary chalcid wasps including smallest insects, with a body length of only 0.139 mm and smallest flying insect, only 0.15 mm long. Different types of wasps include social wasp, solitary wasp, predatory wasp, pollinator wasp etc.

A wasp is any insect of the narrow waisted suborder Apocrita of the order Hymenoptera which is neither a bee nor an ant. The most commonly known wasps, like yellow jackets and hornets are in the family Vespidae and are eusocial, living together in a nest with an egg-laying queen and non-reproducing workers. However, majority of wasp species are solitary with each adult female living and breeding independently. Females typically have an ovipositor for laying eggs in or near a larvae food source.

and diverse group of insects with tens of thousands of described species. Wasps have spread to all parts of the world except for the polar regions.



The largest social wasp is the Asian giant hornet at upto 5 centimeters in length. The smallest wasps are solitary chalcid wasps in the family Mymaridae, including the world's smallest known insect, with a body length of only 0.139 mm and the smallest known flying insect, only 0.15 mm long. There are estimated to be 100,000 species of Ichneumonoid wasp in the families Braconidae and Ichneumonidae. These are almost exclusively parasitoids, mostly utilizing other insects as hosts.

### Diversity

Wasps first appeared in the fossil record in the Jurassic. They are a successful

Many wasp species are parasitoids. Female wasp deposit eggs on or in a host arthropod on which the larvae then feed.

Some larvae start off as parasitoids, but convert at a later stage to consuming the plant tissues that their host is feeding on. In other species, the eggs are laid directly into plant tissues and form galls, which protect the developing larvae from predators but not necessarily from other parasitic wasps. In some species, the larvae are predatory themselves; the wasp eggs are deposited in clusters of eggs laid by other insects and these are then consumed by the developing wasp larvae.

### Social Wasp

Family Vespidae contains social species. All species of social wasps construct their nests using some form of plant fiber (mostly wood pulp) as the primary material, though this can be supplemented with mud, plant secretions (e.g., resin) and secretions from the wasps themselves. Multiple fibrous brood cells are constructed, arranged in a honeycombed pattern and often surrounded by a larger protective envelope. Wood fibers are gathered from weathered wood, softened by chewing and mixing with saliva.



### Solitary wasp

The vast majority of wasp species are solitary insects. The adult female forages alone and builds a nest for the benefit of her own offspring. Some solitary wasps nest in small groups alongside others of their species, but each is involved in caring for its own offspring. There are some species of solitary wasp that build communal nests. Each insect having its own cell and providing food for its own offspring, but these wasps does not adopt division of labour and complex behavioural patterns adopted by eusocial species.



### Predatory wasp

Predatory wasp species normally paralyze their prey by stinging it and then either lay their eggs on it or leaving it in the place.



Some time they carry it back to their nest where an egg may be laid on the prey item and the nest sealed. Several smaller prey items may be deposited to feed a single developing larva. Apart from providing food for their offspring, no further maternal care is given. Members of the family Chrysididae, the cuckoo wasps, are kleptoparasites and lay their eggs in the nests of unrelated host species.

### Pollinator wasp

The Agaonidae (fig wasps) are the only pollinators of nearly 1000 species of figs and thus are crucial to the survival of their host plants. Since the wasps are equally dependent on their fig trees for survival, the coevolved relationship is fully mutualistic.

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## Chemical Weapons - The Toxic Chemical Compounds

**Dr. Pradip P. Deohate**

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**Chemical weapon is any of the several toxic chemical compounds or agents that are intended to kill, injure or incapacitate enemy personnel. For the first time, chemical weapons were used in world war-I. Just like the nuclear and biological weapons, chemical weapons are the weapons of mass destruction. Several types of chemical agents were developed into chemical weapons after the world war-I. These are choking agents, blister agents, blood agents, nerve agents, incapacitants, riot-control agents, herbicides etc. Chemical weapons are delivered via aerosols, mortars, artillery shells, missile warheads, mines or aerial bombs. In most of the chemical weapons all the ingredients are premixed but in binary weapons, ingredients are mixed in flight while the weapon is being delivered.**

Any of the several toxic chemical compounds or agents that are intended to kill, injure or incapacitate enemy personnel is chemical weapon. In world war-I, the chemical weapons were used for the first time and since then employed for number of times.



Just like the nuclear and biological weapons, chemical weapons are the weapons of mass destruction. Under the Chemical Weapons Convention (CWC) of 1993, the use of chemical weapons in war is prohibited. The development, production, acquisition, stockpiling and the transfer of chemical weapons are totally banned. The aim of the CWC is to completely eliminate most of these chemical weapons, but unfortunately not all the countries have abandoned their chemical warfare capabilities. Some countries have pursued chemical weapons programmes as deterrents to being attacked by enemies that have either stronger conventional forces or their own weapons of mass destruction and some have used chemical

weapons to threaten especially vulnerable foes outside and even inside their self borders. Some of the individuals and militant organizations have acquired chemical weapons so as to attack their enemies and secure their own boundaries through terror.

### Types of chemical weapons

Chemical weapons are the chemical agents in gaseous, liquid or solid state, which are employed due to their direct toxic effects on humans, animals as well as plants. These chemicals inflict damage when absorbed through the skin, inhaled or ingested in food or drinking material. When chemical agents are placed into artillery shells, land mines, aerial bombs, missile warheads, mortar shells, grenades, spray tanks or any other type of delivering the agents to designated targets, they become weapons.



All the toxic substances can't be suitable for preparing the chemical weapons or to be used as chemical weapons, only few of them can be used as

chemical warfare agents. The highly toxic compounds but not too difficult to handle can be of most utility. Also the substances to be used as chemical weapons must be able to withstand the heat produced when placed in a bursting shell, bomb, mine or warhead. In order to be most effective, it must be resistant to atmospheric oxygen and water.

Several types of chemical agents were developed into chemical weapons after the world war-I. These are choking agents, blister agents, blood agents, nerve agents, incapacitants, riot-control agents, herbicides etc.

### **Choking agents**

The choking agents are chlorine, phosgene, diphosgene, chloropicrin, ethyldichlorarsine and perfluoroisoboxylene. These are the chemicals which deliver as gas clouds to the target area. Through the inhalation of vapour of these chemicals, individuals become casualties. Toxic agent attacks on the immune system causing fluids to build up in the lungs, which damages the lungs and results in death. Once an individual is exposed to vapour of such chemical agent, its effect may be immediate or it may take few hours.



### **Blister agents**

The blister agent used is sulphur mustard, commonly called as mustard gas. When a person is attacked and exposed to blister agent like sulphur mustard, casualties are inflicted. This chemical weapon is delivered in either liquid or gaseous state. It burns the skin, eyes, windpipe, lungs etc., may be immediate or after

several hours depending on the level of exposure. The modern blister agents are sulphur and nitrogen mustard, phosgene oxime, phenyl dichlorarsine, lewisite etc.



### **Blood agents**

The hydrogen cyanide or cyanogen chloride are the blood agents designed to be delivered to the targeted area in vapour form. When these chemicals are inhaled, they restrict the transfer of oxygen to the cells, resulting in the body to asphyxiate. The enzyme that is necessary for aerobic metabolism gets blocked because of these chemicals. Cyanogen inhibits the proper utilization of oxygen within the blood cells and damages the heart.

### **Nerve agents**

The nerve agents affect the transmission of impulses through the nervous system. A single drop of these agents on the skin or if inhaled into the lungs can shut down the brain centres controlling the respiration and other parts of body like muscles, heart and diaphragm become paralyzed. Poisoning by nerve agents causes intense sweating, filling of the bronchial passages with mucus, dimming of vision, uncontrollable vomiting and defecation, convulsions and finally paralysis and respiratory failure. Death results from asphyxia, generally within a few minutes of respiratory exposure or within hours if exposure was through a liquid nerve agent on the skin. Tabun (GA), sarin (GB) and soman (GD) are the extremely high toxic organophosphorus compounds used as the nerve agents. These all were invented in Germany. VX is



the most famous deadliest V-series (V is for venom) nerve agent developed by chemists at a British government facility.

### Incapacitants

The hallucinogenic drug compounds 3-quinuclidinyl benzilate (BZ), lysergic acid diethylamide (LSD), mescaline and methaqualone can be used to incapacitate, disorient or paralyze opponents. These chemical weapons are designed not to kill but to cause permanent injury. BZ or LSD attack the nervous system and derange the mental processes of a victim like hallucinations or psychotic thinking. Other incapacitants may cause victims to sleep or to be slow to respond.

### Riot-control agents

Tear gas and vomiting agents are produced to control riots and unruly crowds. The chloroacetophenone (CN), chloropicrin (PS), dibenz-(b,f)-(1,4)-oxazepine (CR), and *o*-chlorobenzylidene malononitrile (CS) are most commonly used tear gases. The principal component of the aerosol agent CN chiefly affects the eyes. PS and CS are the stronger irritants that can burn the skin, eyes, and respiratory tract. Such riot-control agents cannot be used in warfare but are allowed for domestic police enforcement.



### Herbicides

Herbicides can be used to destroy enemy's crops and foliage cover. Chemicals picloram, 2,4-dichlorophenoxy acetic acid and dimethyl arsenic acid are the herbicides that act as chemical weapons.



### Properties of chemical weapons

The characterization of chemical weapons is done by their physical properties like persistency, lethality, mode of action on the human body and physical state when being delivered i.e. solid, liquid or gaseous.

Chemical agents have different levels of persistency. Some of them evaporate very fast, in minutes or hours. Sarin is a lethal but non-persistent nerve agent whereas VX can persist for days or weeks in lethal form. Some chemical agents are highly lethal. The nerve agents like sarin, tabun, soman and VX can kill immediately. Chemical agents such as tear gas only act as irritants or incapacitants. The poison gases like chlorine and hydrogen cyanide enter the victim's lungs during inhalation whereas nerve agent droplets enter through the skin into the bloodstream and nervous system. There are some other chemicals that can be mixed with food in order to poison it. Chemical weapons may be delivered via aerosols, mortars, artillery shells, missile warheads, mines or aerial bombs. Most of these have all the ingredients premixed. In newer chemical arms commonly the binary weapons, ingredients are mixed in flight while the weapon is being delivered. These binary chemical weapons are safe and easy to handle and store.

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## Plants Use as Ethno Medicine

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Various parts of plants are used as ethno medicine. It can be root, leaves, fruits, barks, seeds etc. These are either taken raw or grinded to use with water, milk or honey in prescribed doses for a definite period. Some of common ailments that are cured using ethno medicine are fever, cough, dysentery, toothache, indigestion, bleeding from wounds, helminthic parasites.

Tribes are settled in valleys and forests which abound in plants of herbs, shrub and tree nature. Various parts of plants are used as ethno medicine. It can be root, leaves, fruits, barks, seeds etc. These are either taken raw (tender leaves) or grinded to use with water, milk or honey in prescribed doses for a definite period.

Some of common ailments that are cured using ethno medicine are fever, cough, dysentery, toothache, indigestion, bleeding from wounds, helminthic parasites.

Some plant medicines used by us are also by many tribes such as use of neem plant (*Azadirachta indica*) in various infections, use of *Solanum nirgrum* by Kuki tribe, use of Tulsi (*Ocimum sanctum*) by Dimasa and other tribe to treat a variety of ailments are few examples.

There are two main disturbing aspects in the overall scenario; one concern the lack of interest in survey and documentation of these biodiversities which are scattered throughout our country. In recent times, however, there has been some attempt to fill this void and National Institute of Science Communication and Information Resources (NISCAIR) organized a seminar in 2001 at Guwahati (Assam) to assess these ethnic biodiversities particularly of North-East India. Similar efforts are needed in other parts of country. The second aspect is gradual destruction of these herbal medicines which are being destroyed by different agents knowingly or unknowingly. There is an urgent need to conserve such

biodiversities, lest they are lost forever.

**Khasi tribe** - These are inhabitants of Khasi hills of Meghalaya.

1. Cuts and wounds - Goat weed (*Ageratum*)
2. Toothache - Bat thri (*Solanum*)
3. Multidisease - Pa Theng (*Potentilla*)
4. Cough and Asthma - Pine needles kept below the pillows.



**Mizo tribe** - These uses many types of ethno medicines.

1. Inflammatory glands - Roots of certain plants. e.g. Tubal
2. Snake bite - Crush juice of roots of Hrudum (*Butea*) and Gangmula (*Sonchus*).
3. Jaundice - Extract of Khankiah (*Callicarpa*)





**Monpas and Sherdukpens** - These are isolated from civilized world and are in possession of knowledge.

1. Tuberculosis- Rhizome of Australia (*Acorus*)
2. Leprosy - Whole world of Clematis
3. Bone fracture - Shang Shun Sheng (*Gaultheria*)
4. Asthma - Swetaria (whole plant)
5. Cancer - Seeds of Blagar Sheng (*Viburnum*)
6. BP - Roots of menang (*Girardinia*)



**Kuki and Dimasa tribe of Assam** - They uses following ethno medicines.

1. Fever - Bark of *Alstonia* (Rongmei, Kuki)
2. Malaria - Leaves of *Azadirachta* (Dimasa)
3. Stomach Problems - Leaves of *Centella*
4. Bleeding - Leaves of *Mikania*



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## Biodiesel - Eco-Friendly, Biodegradable and Renewable Biofuel

**Ms. Juvairiya Sadiya Nasir Khan**

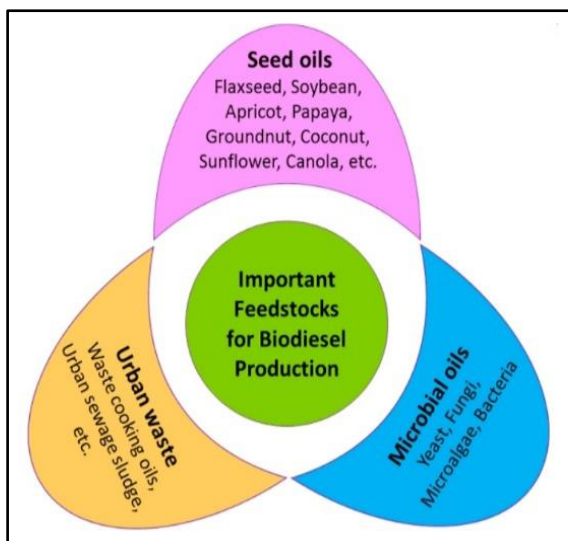
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**Biodiesel is prepared by adding methoxide in hot oil having the temperature about 60°C. We can use any type of edible oil, vegetable oil, coconut oil, wood oil, leaf oil, seed oil, animal fats, bio-waste products or oil extracted from plant containing fatty acids. Rudolph Diesel himself developed biodiesel in 1890. ASTM defines biodiesel as a mixture of long-chain mono-alkyl esters of fatty acids obtained from renewable resources, to be used in diesel engines.**

Biodiesel is a type of Biofuel prepared chemically by adding methoxide (which is prepared by mixing methanol and sodium carbonate) in hot oil having the temperature about 60°C. For the preparation we can use any type of edible oil, vegetable oil, coconut oil, wood oil, leaf oil, seed oil, animal fats, bio-waste products or any other oil extracted from plant containing fatty acids.



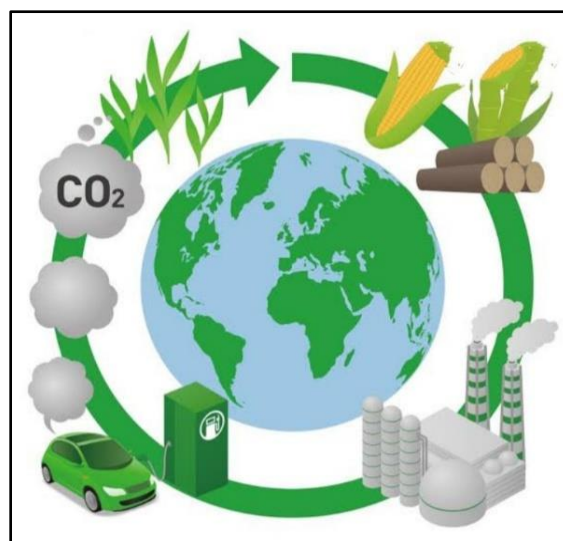
Rudolph Diesel himself developed biodiesel in 1890. At that time pure vegetable oils were used in diesel engines, as geo-extracted diesel was not available.



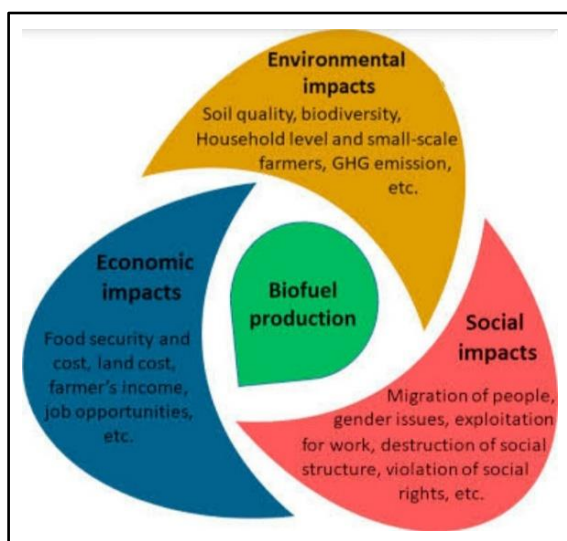
American Society for Testing and Materials (ASTM) defines biodiesel as a mixture of long-chain mono-alkyl esters of fatty acids obtained from renewable resources, to be used in diesel engines.

### Advantages

- ✓ It is an eco-friendly fuel because it is biodegradable, complete CO<sub>2</sub> cycle. It has no sulphur, no aromatic compounds and has inbuilt oxygen. It is non-toxic, burns fully and renewable.
- ✓ It is non toxic and biodegradable, so there is no harm for biological system and living animals.
- ✓ It is renewable, so we can make how much we want.
- ✓ It has in built oxygen content and complete CO<sub>2</sub> cycle, so there is no requirement to use extra oxygen. Because of this the quantity of oxygen in the environment not decreases and the CO<sub>2</sub> will consume by the plants or the lithotrophic animals.



- ✓ It is safe and easy to handle and store for about six months.
- ✓ It has no aromatic compounds and no sulphur, so there is no chance of acid rain.
- ✓ Increases the life of engine.
- ✓ No requirement for modifications in engine.
- ✓ Reduce foreign oil dependence.
- ✓ It burns fully, so lowers the emissions and lower the global warming.
- ✓ The flash point of biodiesel is higher than 100°C, so it is considerably less dangerous as compared to kerosene (flash point - 38 to 72°C) and diesel (flash point - 52 to 96°C).
- ✓ Biodiesel contains no hazardous materials, so generally regarded as safe.
- ✓ Users in environmentally sensitive areas such as wetlands, marine environments, and national parks have taken advantage of this property by replacing toxic petroleum diesel with biodiesel.
- ✓ There are many positive environmental, social and economic impacts on agriculture productivity, water, biodiversity, livelihood, food price, food security, cost of government support, trade, viability, competitiveness in industries, poor households, soil quality etc.



### Disadvantages and harms

- ✓ If we not take the prevention at the time of preparation then the chemicals can harm our body like; methanol can harm

our skin and sodium carbonate can cause blindness of our eyes.

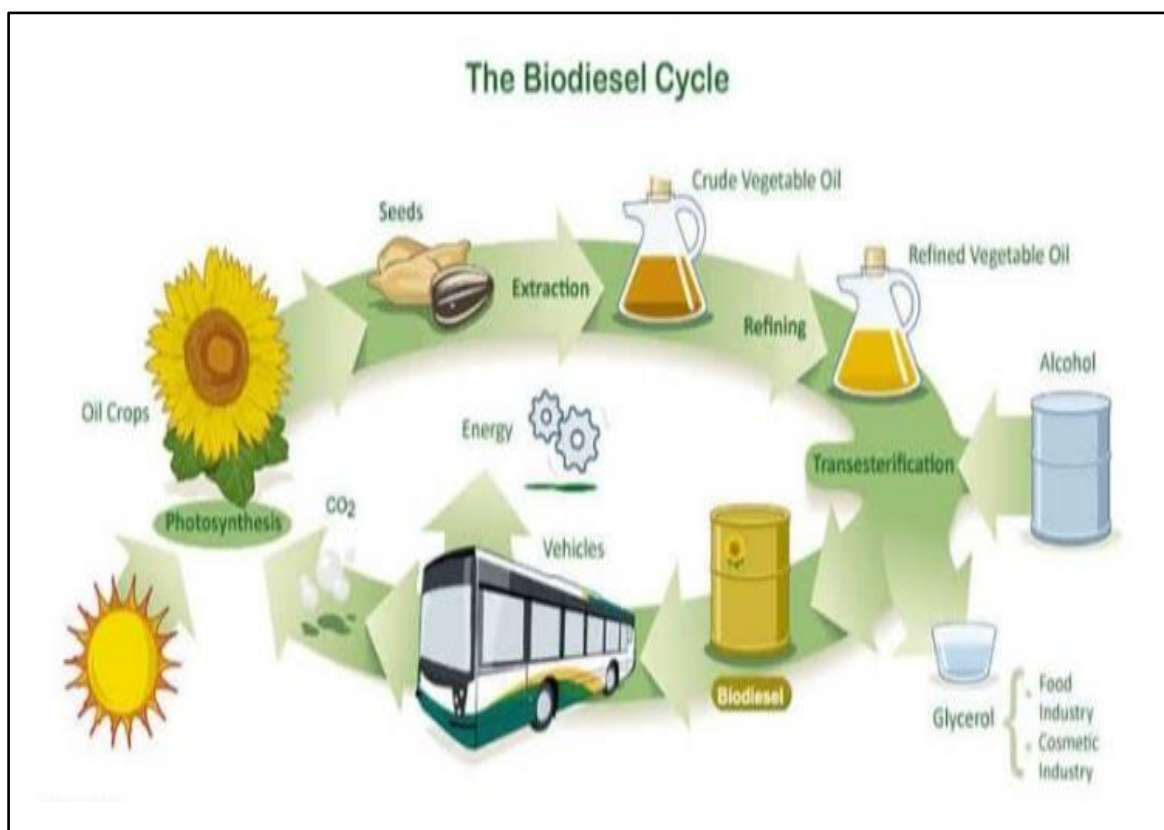
- ✓ It has higher freezing point than diesel fuel. This may be inconvenient in cold climate.
- ✓ It is less stable than diesel fuel and therefore long-term storage (more than six months) of biodiesel is not recommended for better results.
- ✓ Due to the lower calorific value of biodiesel the consumption is slightly higher.
- ✓ Nitrous oxide (NOx) emissions about 10% higher than diesel fuel.
- ✓ It dissolves the deposits of sediments and other contaminants from diesel fuel in storage tanks and fuel lines, which then are flushed away by the biofuel into the engine, where they can cause problems in the valves and injection systems. Inconsequence, the cleaning of tanks prior to filling with biodiesel is recommended.
- ✓ May degrade plastic and natural rubber gaskets and hoses when used in pure form, in which case replacement with teflon components is recommended.
- ✓ The use of water to produce more crops can put pressure on local water resources. The area where there is water scarcity, production of crops to be used in the making of biofuels is not a wise idea.
- ✓ Biodiesel cleans dirt from the engine. This proves to be an advantage of biofuels, but the problem is that this dirt gets collected in the fuel filter and clogs it.
- ✓ While the usage of biodiesel increases the efficiency of an engine, it can also considerably damage the rubber houses of some engines.
- ✓ Biodiesel gels in cold weather, but the temperature that it will gel depends on the oil or fat that was used to make it.

### How to prepare biodiesel?

- We require three main components -

  1. Oil
  2. Caustic soda (NaOH)
  3. Methanol.

- First of all we have to make methoxide by mixing the caustic soda and methanol.
- Then to heat the oil till the temperature of oil becomes 60°C.
- In this hot oil now we have to add the methoxide so as to get impure biodiesel.
- At last filter, wash and dry it to get the pure biodiesel.



### Difference between diesel and biodiesel

- ✓ Diesel is a natural geo-extracted fossils fuel while the biodiesel is a type of biofuel which is prepared by chemical methods by using bio-products having the fatty acids.
- ✓ Diesel can't burn fully whereas the biodiesel burns fully.
- ✓ Diesel emits large number of green house gases while biodiesel has no sulphur, don't emit the aromatic compounds and completes the CO<sub>2</sub> cycle.
- ✓ Nitrous oxide (NO<sub>x</sub>) emissions of biodiesel are about 10% higher than diesel.
- ✓ The flash point of biodiesel is higher than 100°C, so it is considerably less dangerous as compared to kerosene (flash point - 38 to 72°C) and the diesel (flash point - 52 to 96°C).
- ✓ Biodiesel is a renewable but diesel is not a renewable.

- ✓ Diesel increases the environmental pollution but biodiesel decreases it by completing the CO<sub>2</sub> cycle.
- ✓ By the use of biodiesel there is a chance of clogging in engine but not by diesel.
- ✓ There is no chance of acid rain if we use the biodiesel but the chance is more if we use diesel.
- ✓ Biodiesel is degradable but diesel is not.



BIOFUEL VERSUS FOSSIL FUEL	
Biofuel is a fuel produced from living matter	Fossil fuel is a naturally occurring fuel formed from geological processes
Obtained from renewable sources	Obtained mainly from non-renewable sources
Provides a low amount of energy per unit biomass	Provides a high amount of energy per unit mass
Causes less pollution than fossil fuels	Play a major role in environmental pollution
Emits a low amount of unfavorable gases when burnt	Emits a high amount of unfavorable gases when burnt
Can be produced from safer methods	Obtained from unsafe methods such as drilling and milling

Fuel Property	Diesel	Biodiesel
	ASTM D975	ASTM D6751
Lower Heating Value, BTU/gal	129,050	118,170
Kinematic Viscosity @ 40 <sup>o</sup> C., cSt	1.3-4.1	4.0-6.0
Specific Gravity @ 60 <sup>o</sup> C., g/cm <sup>3</sup>	0.85	0.88
Carbon, wt %	87	77
Hydrogen, wt %	13	123
Oxygen, by dif. Wt %	0	11
Sulfur, ppm	500	0
Boiling Point, <sup>o</sup> C	180 to 340	315 to 350
Flash Point, <sup>o</sup> C	60 to 80	100 to 170
Cloud Point, <sup>o</sup> C	~15 to 5	~3 to 12
Pour Point, <sup>o</sup> C	~35 to ~15	~15 to 10
Cetane Number	40-50	48-65
Lubricity (HFRR), μm	300-600	<300

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## Transgenic Bt Cotton

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**Bt cotton refers to transgenic cotton which contains endotoxin protein inducing gene from soil bacterium bacillus thuringiensus. In cotton, the first transgenic plant was developed in 1987. The transgenic cotton is of two types - Bollgard and Roundup ready cotton. The former confers resistance to bollworms and the latter is resistant to herbicides. The introduction of Bt cotton has provided growers with a new tool for managing bollworm in cotton. Numerous benefits of this technology accrue to the grower, the global cotton industry and society on many levels - economic, environmental and social.**

A genotype or individual which is developed by the technique of genetic engineering is referred to as transgenic. In other words, genetically engineered organisms are called transgenics. A transgenic may be a plant, an animal or a microbe. Transgenic plant contain foreign gene or genetically modified gene of the same species. The foreign gene may be from a distantly related species, closely related species and unrelated species or from micro-organisms such as fungi, bacteria and viruses.



Bt cotton refers to transgenic cotton which contains endotoxin protein inducing gene from soil bacterium bacillus thuringiensus. The first transgenic plant was developed in 1983 in tobacco whereas in cotton, the first transgenic plant was developed in 1987. Later on the research work on development of transgenics was intensified all over the globe and several transgenic plants were developed. The transgenic cotton is of two types - Bollgard and Roundup ready cotton. The former confers resistance to bollworms and the latter is resistant to herbicides.



### Benefits of Bt cotton

The introduction of Bt cotton has provided growers with a new tool for managing bollworm in cotton. Numerous benefits of this technology accrue to the grower, the global cotton industry and society on many levels - economic, environmental and social. These benefits such as reduced pesticide use, improved crop management effectiveness, reduced production cost, improved yield and profitability, reduction in farming risks and improvement, opportunity to grow cotton in areas of severe pest infestation. Indirect significant benefits of the technology include, improved population of beneficial insects and wildlife in cotton field, reduced pesticide run off, air pollution and waste from the use of insecticides, improved farm worker and neighbour safety, reduction in labour costs and time, reduction in fossil fuel use and improved soil quality. The most significant benefit of Bt cotton to date has been the reduction in insecticidal usage for the control of certain bollworms.



### Major advantages of Bt cotton

- The Bt cotton has inbuilt genetic resistance to bollworms and is very effective in controlling the yield losses caused by bollworms to a considerable extent.
- Use of Bt cotton reduces the use of pesticides, resulting in reducing the cost of cultivation.
- It results in improvement of yield levels and also improves margin of profit to the farmer.
- It provides opportunities to grow cotton in areas of severe bollworm.
- It promotes eco-friendly cultivation of cotton and allows multiplication of beneficial insects i.e. parasites and predators of bollworm.
- It also reduces environmental pollution and risk of health hazards associated with the use of insecticides, because in Bt cotton insecticides are rarely used. An average reduction of 3-6 sprays per crop season has been reported in Bt varieties as compared to non-Bt varieties.



### Effects of Bt cotton on the health of animals, poultry, human and environment

- The feeding of Bt cotton seed to animal has not been reported to have any adverse effect.
- The seed of Bt cotton and its cake do

not have any adverse effect on digestion of animals. Moreover, no allergic or toxic effect of use of Bt cotton seed and meal has been reported.

- The oil extracted from the seed of Bt cotton has not been found to have any adverse effect on human health.
- No adverse effect of Bt cotton has been reported on non-target beneficial insects so far.
- The possibilities of cross pollination of Bt cotton to other species of gossypium are nil to negligible.
- No adverse effects of Bt cotton on the environment has been reported by any of the countries where Bt cotton is commercially cultivated.

### Basic research in India

In India, the basis of research on Bt transgenic cotton is being carried out at the following research institutes / centres.

- National Botanical Research Institute (NBRI), Lucknow.
- National Research Centre on Plant Biotechnology (NRCPB), New Delhi.
- International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi.
- Central Institute for Cotton Research (CICR), Nagpur.
- National Chemical Laboratory (NCL), Pune.
- Bhabha Atomic Research Centre (BARC), Mumbai.
- University of Agricultural Sciences (UAS), Dharwad.

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## Higgs Boson - Really a God Particle ?

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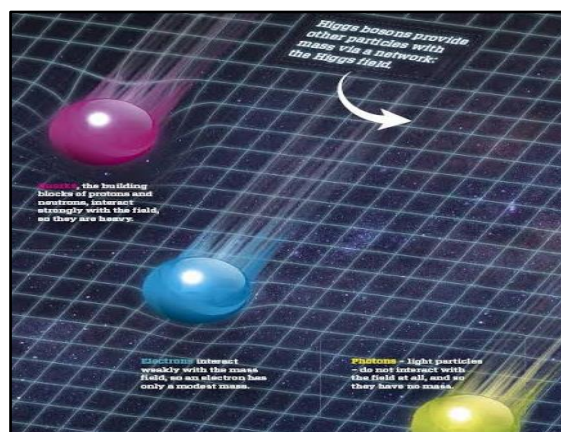
The Higgs boson is one of the fundamental particle which is game changer in particle physics. It proves how particles gain mass. It is called God particle because particles get mass due to Higgs field. The physicist Peter Higgs gave the theory which predicted presence of Higgs field and Higgs boson. The theory says that "there exists a field called Higgs field, which is present everywhere in universe like other fields and where energy is supplied to this field, Higgs boson are formed".

The concept of Higgs boson started from mass. Any object travelling with speed of light has zero mass. This means every object which does not travel with speed of light have some mass. In universe, every object has its own mass. But the question arises that from where these particles are getting mass? Quark and lepton are building blocks of any constituent elements. As quark and lepton are not made up of anything, they should have no mass. But we know that quark, lepton, electron have their own mass. So from where these particles get mass? and then why photons are mass less?

In decade of 1960, scientists made an equation on the behaviour of elementary theory of particle which was supposed to help in understanding these particles more clearly. But the equation increased the confusions of scientists. When they assumed that all elementary particles are mass less, they solved the equation very easily. But as scientists knew that elementary particle are not mass less. After using mass of particle in equation it became more complex. Scientists were unable to find reason behind this.

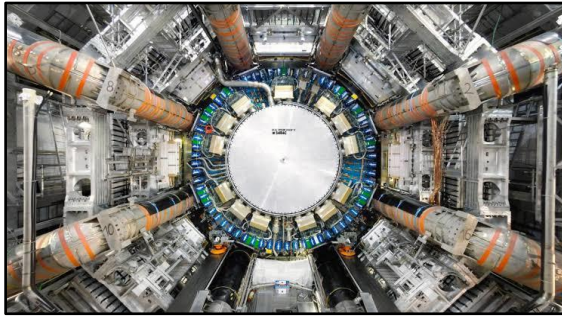
Then physicist Peter Higgs gave the theory which predicted presence of Higgs field and Higgs boson. The theory says that "there exists a field called Higgs field, which is present everywhere in universe like other fields and where energy is supplied to this field, Higgs boson are formed". He believed that all particles are mass less. But Higgs field provides mass to every particle.

**Higgs mechanism** - All particles are mass less, until they enter the Higgs field. After entering in this field, some particles have more interaction with Higgs field and some have less interaction. The particles which interact more with Higgs field gain more mass and particle which interact less will have less mass. As photon does not interact with Higgs field, they are mass less.



When Peter Higgs published this theory, it was rejected by many scientists as they didn't believe that invisible field can provide mass to particles. But later on after deep study the theory was accepted and scientists started to find the way to prove this theory experimentally and created *Large Hadron Collider*. As Higgs field is not visible it was difficult to find presence of Higgs particle. If we make collision of charged particles in small space, it will create some sensation in Higgs field. This sensation will produce Higgs boson particle which can be seen and detected also. Physicist used this idea in *Large Hadron Collider*, but they didn't get any conclusion. After many trials in 2012 CERN

announced that they have detected the Higgs boson.



**Image : Large Hadron Collider**

The inventions of Higgs field is very important because -

- It is much different than any other field. Many fields are present like electric, gravitational, magnetic etc. but effects of these fields are not same everywhere. But Higgs field is only field which shows same effect everywhere in universe.
- Higgs boson shows us very different from of matter. Such forms were limited only in mathematical equations before invention of Higgs boson.

- For any particle except its mass and charge; spin is only thing which do not change. But Higgs boson is particle which does not have any spin.

### **Why Higgs boson is called God particle?**

It is called God particle because particles get mass due to Higgs field. The absence of Higgs field will left all particles mass less and we know that mass less particle travel with speed of light. So if there is no Higgs field all particles will travel with the speed of light. There will be no formation of atoms, molecules, matter and anything. It means there is no existence of world in absence of Higgs field. So Higgs boson is known as God particle.

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## Li-Fi - The Future of Data Transfer

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Li-Fi is a wireless optical networking technology that uses LEDs for data transmission. It is a type of wireless connection that can be up to 100 times faster than Wi-Fi. Its transmission speeds can go over 100 Gbps, 14 times faster than the world's fastest Wi-Fi. It's been predicted that Li-Fi would be released to the general public in early 2022. Large mobile companies, such as Apple, are also starting to suggest that their future devices will be Li-Fi capable. Li-Fi is considered to be future of the internet.



### What exactly is Li-Fi?

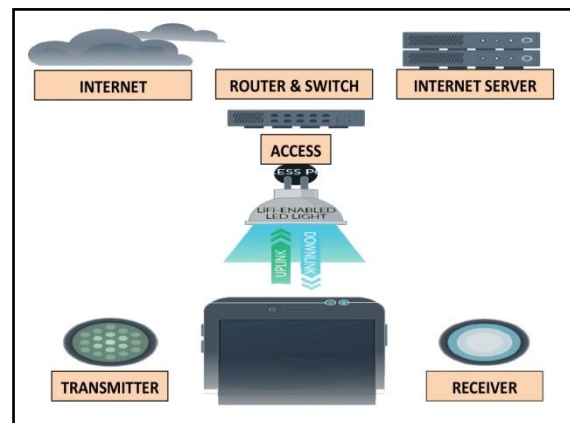
Wi-Fi runs our life, and now-a-days its use has gone to an extreme level that we cannot live without it, to an extent. No matter where you are in the world, you have probably experienced the internet connectivity problems at one point or another.

Now here's Li-Fi, a type of wireless connection that can be up to 100 times faster than Wi-Fi. Just imagine a world where you can connect to high-speed internet by just flicking on your light switch. Li-Fi is a wireless optical networking technology that uses LEDs for data transmission. In simpler terms, Li-Fi is considered to be as a light based Wi-Fi which uses light instead of radio waves to transmit information. Using light to transmit data allows Li-Fi to deliver a couple of advantages such as working in the areas susceptible to electromagnetic interference like hospitals, aircraft cabins and working across the higher bandwidth while offering higher transmission speeds. The Li-Fi technology is currently being developed by numerous organizations around the world.

### How does Li-Fi works?

Li-Fi is a visible light communications system transmitting wireless internet communications at very high speeds. The technology makes a LED light bulb emit pulses of light that are undetectable to the

human eye and within those emitted pulses; data can travel to and from receivers. Then, the receivers collect information and interpret the transmitted data. This is conceptually just similar to that of decoding Morse code but in a much faster rate, millions times a second. Li-Fi transmission speeds can go over 100 Gbps, 14 times faster than WiGig, also known as the world's fastest Wi-Fi.



### Advantages of Li-Fi over Wi-Fi

- Less interference can pass through salty sea water, works in dense region.
- Used in airlines, undersea explorations, operation theatres in the hospitals, office and home premises for data transfer and internet browsing.
- Coverage is about 10 meters.
- Works in High density environments.
- Li-Fi transmits data using light sources so, does not have any interference issues similar to radio frequency waves.
- With Li-Fi, light is blocked by the walls and hence will provide more secure data transfer.

### What does Li-Fi means to everyone?

Using Li-Fi is really not that different from using Wi-Fi; except that it would be very fast. At a city scale, street lamps could provide data to pedestrians, vehicles, and all sorts of infrastructure components that might be in need of data.

### Why Li-Fi is important?

Consumption of wireless data increases by 60% every year. That means that the radio- frequency space is slowly becoming saturated which can lead to phenomenon called a spectrum crunch. Spectrum crunch refers to the potential lack of sufficient wireless frequency spectrum needed to support a growing number of consumer devices. Eventually, Wi-Fi will not be able to keep up with the demand of data.

### How close are we using to Li-Fi?

It's been predicted that Li-Fi would be released to the general public in early 2022. A grocery store in France is currently using Li-Fi to track the locations of their customers throughout the store and is then able to offer coupons and

incentives. Large mobile companies, such as Apple, are also starting to suggest that their future devices will be Li-Fi capable.



### The future of Li-Fi

Right now, Li-Fi cannot fully replace Wi-Fi as a connectivity source; however, there are several Li-Fi companies that are working hard on developing Li-Fi products and marketing Li-Fi as the primary wireless technology. The demand for fast internet access is increasing day by day and light fidelity could be the technology to meet this demand.

*Li-Fi is considered to be future of the internet. That future is looking bright and I hope that we will be using it soon.*

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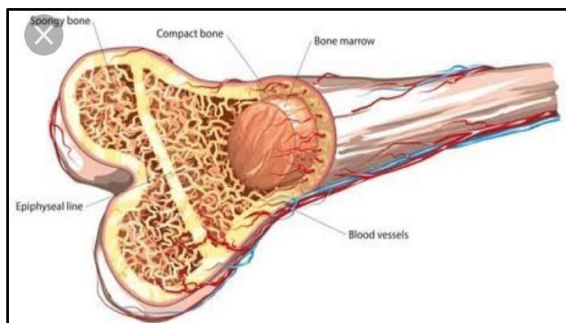
## What is Bone Marrow? How it Saves Life?

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Bone marrow serves as the primary site of new blood cell production i.e. haematopoiesis. It is the soft, highly vascular and flexible connective tissue. There are two types of bone marrow tissue - red marrow and yellow marrow. During birth to early adolescence, most of the bone marrow is red marrow whereas within age, the red marrow is replaced with yellow. The bone marrow structure consists of hematopoietic tissue islands and adipose cells covered by vascular sinuses interspersed within a meshwork of trabecular bone. It is composed of cellular as well as non-cellular components and structurally divided into two regions i.e. vascular and non-vascular regions. Every year numbers of people have an illness such as leukaemia or lymphoma. For some of them, bone marrow transplant may be the only treatment option. Donation could save a life and that's a nice feeling.

Bone marrow is the soft, highly vascular and flexible connective tissue present in bone cavities. It serves as the primary site of new blood cell production i.e. haematopoiesis. In adult humans, bone marrow is primarily located in the ribs, vertebrae, sternum and bones of pelvis.



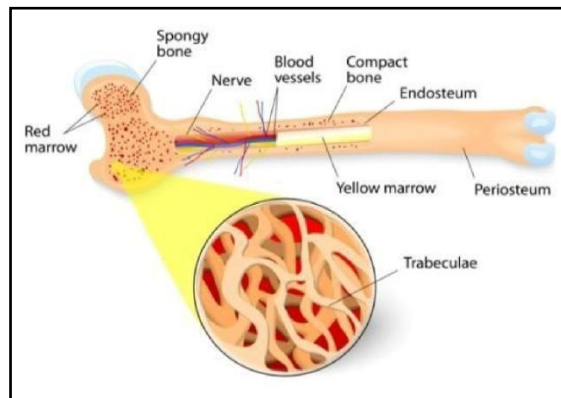
Most of the cells involved in the immune system are produced from a common hematopoietic stem cell (HSC). The HSC are found in fetal liver, fetal spleen, neonate and adult bone marrow. Bone marrow is the primary source of pluripotent stem cells which give rise to all hematopoietic cells including lymphocytes.

As a part of the lymphatic system, it is the major organ for B cell maturation and gives rise to precursor cells of the thymic lymphocytes. The thymus and the bone marrow are primarily lymphoid organs, as T and B cells must first undergo maturation in these organs / tissues before migration to secondary lymphoid tissues, such as spleen, lymph nodes and mucosa associated lymphoid tissues (MALT).

Beginning from the last months of fetal development when bone marrow becomes dominant site of haematopoiesis (blood cell formation), the great majority of cells involved in mammalian immunity is derived from precursors in bone marrow.

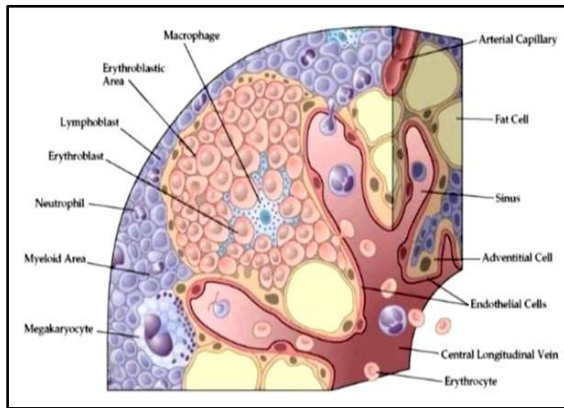
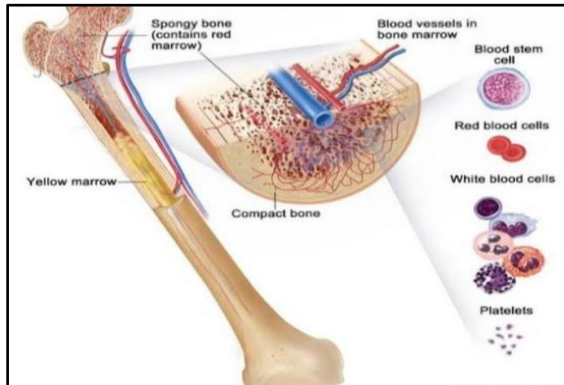
### Types of bone marrow

There are two types of bone marrow tissue - red marrow and yellow marrow. During birth to early adolescence, most of the bone marrow is red marrow whereas within age, the red marrow is replaced with yellow.



In adults, red marrow is confined mostly to skeletal system bones which serve for producing blood cells and help in removing old cells from circulation. They contain hematopoietic stem cells that produce two other types of stem cell - myeloid stem cell and lymphoid stem cell. These cells developed into red blood cells, white blood cells or platelets. Yellow marrow observed in sponge bones and in

shafts of long bones. It is non-vascular and consists primarily of fat cells. It is composed of hematopoietic tissues which become inactive.

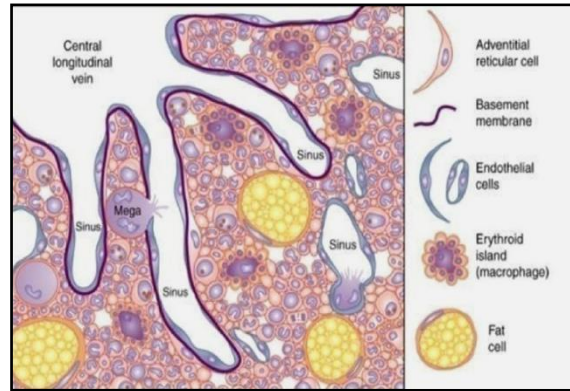


### Structure of bone marrow

The bone marrow structure consists of hematopoietic tissue islands and adipose cells covered by vascular sinuses interspersed within a meshwork of trabecular bone. It is composed of cellular as well as non-cellular components and structurally divided into two regions i.e. vascular and non-vascular regions.

The non-vascular section of bone marrow is composed of hematopoietic cells of various lineages and maturity packed between fat cells, thin bands of bony tissue (trabeculae), collagen fibres, fibroblasts and dendritic cells, where haematopoiesis occurs.

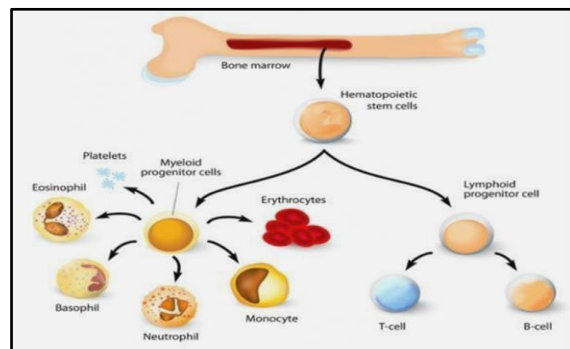
The vascular section contains blood vessels which supply the bone with nutrients and transport blood stem cells and form the mature blood cells away into circulation.



Ultra-structural studies show hematopoietic cell clusters around the vascular sinuses where they matured, before they eventually are discharged into the blood. Lymphocytes are found surrounding the small radial arteries whereas most immature myeloid precursors are found deep in the parenchyma.

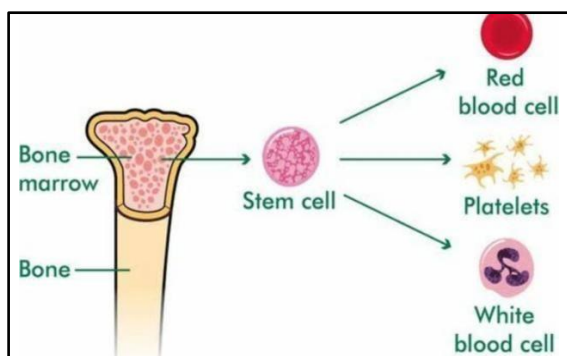
### Function of bone marrow

The bone marrow gives rise to all of the lymphoid cells that migrate to thymus and mature into T cells as well as to the major population of conventional B cells. The B cells mature in the bone marrow and undergo selection for non-self before making their way to the peripheral lymphoid tissues. As the bone marrow constitutes of hematopoietic cells derived from multi stem cells, they not only give rise to all of the lymphoid cells found in lymphoid tissue but also to all of the cells found in blood. The platelets, which are crucial for blood clotting process, are formed from bone marrow just like other blood cells. Yellow marrow is actively involved in lipid storage.



## Overview

The bone marrow transplant is a type of stem cell transplant in which stem cells are collected from bone marrow and after being removed from the donor, they are transplanted into the recipient. The procedure takes place in a hospital or outpatient facility. Doctors can use general anaesthesia, so that the person will be asleep during the surgery and won't feel any pain. Alternatively they can use local anaesthesia, where person will be awake but won't feel anything. The surgeon inserts needles into the hip bone to draw the marrow out. The incisions are tiny, won't need stitches. This procedure takes one to two hours. The bone marrow will then be processed for the recipient or can be preserved and frozen for later used. Mostly the same day donors can go home.



## Benefits of bone marrow donation

Every year numbers of people have an illness such as leukaemia or lymphoma. For some of them, bone marrow transplant may be only treatment option. Donation could save a life and that's a nice feeling.

## Requirement to be a donor

Any person having the age between 18 to 60 years can register to be a donor. People between 18 to 44 years tend to produce more and higher quality cells than older individuals. Mostly doctors choose the donors in 18 to 44 years of age.

The some conditions that prevent you from being a donor are autoimmune diseases which affect the whole body, bleeding problem, certain heart conditions,

HIV and AIDS. The other conditions that decide eligibility on a case-by-case basis are addiction, diabetes, hepatitis, certain mental health issues and very early cancer that didn't require either chemotherapy or the radiation.

With prior consent, one should need to provide a tissue sample. It is taken by swabbing inside of your cheek. Donor will need to give additional blood tests and have a physical examination. Total time commitment for the donation process about 4 to 6 weeks.

## Risks in bone marrow donation

The most serious risks are of anaesthesia. General anaesthesia is usually safe and most people come through without any type of problems. But some people may have a bad reaction, particularly when there is a serious underlying condition or the procedure is extensive. The People who for into those categories may have an increased risk for postoperative confusion, pneumonia, stroke and heart attack.

Harvesting of bone marrow doesn't normally cause major problems. Very few donors have serious complications from anaesthesia or damage to bone, nerve or muscle. Donor only loses a small amount of bone marrow, so it won't weaken immune system, body will replace it in about six to seven weeks.

## Potential side effects

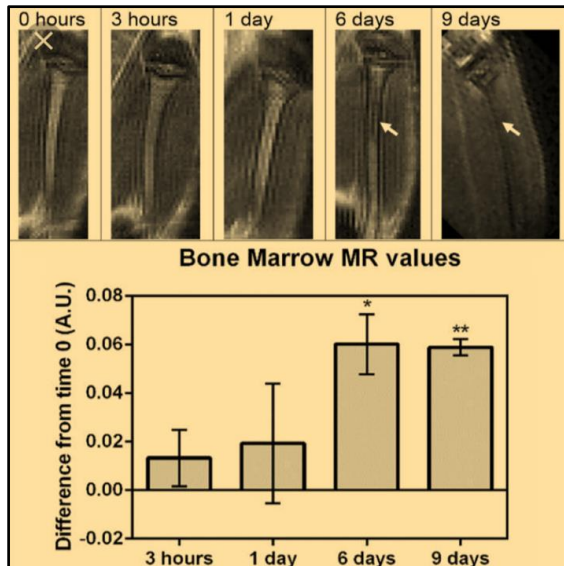
Some potential side effects from general anaesthesia are sore throat due to the breathing tube, mild nausea and vomiting. The regional anaesthesia may cause headache and a temporary drop in blood pressure.

The side effects of bone marrow donation include bruising at the incision site, soreness and stiffness where marrow was harvested, achiness or pain in the hip or back and trouble walking for few days due to pain or stiffness



### Recovery time line

Right after the surgery, donor will be moved to a recovery room and monitored for several hours. Most donors can go home the same day, but some need to stay overnight.



Recovery time varies from person to person. You might be able to resume your usual activities within a few days. It could also take up to a month to feel like your old self.

### Number of times you can donate bone marrow

As body can replace lost bone marrow, one can donate it many times. But in case of bone marrow just because registered as a donor, it doesn't mean donor will get a match with a recipient finding. Multiple potential matches are rare. According to the Asian American donor programme, the odds of one unrelated match are between 1 in 100 and 1 in a million.

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## Mathematical Model for Covid-19 Epidemic

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**The corona virus infection continues to spread all over the world. For reducing the corona virus infection we can use the mathematical model to present the dynamical behaviour of Covid-19 when it enter a community and investigate under which condition it will be wiped out or continued.**

The mathematical model is a description of the workings of the real world employing mathematical equations, formulas and symbols. Mathematical model are commonly used fields like medicine, agriculture, management, social science etc. To forecast disease, outbreaks, avoid or cure illness, mathematical model has been used in health sector. There are many mathematical model used to explain disease processes.

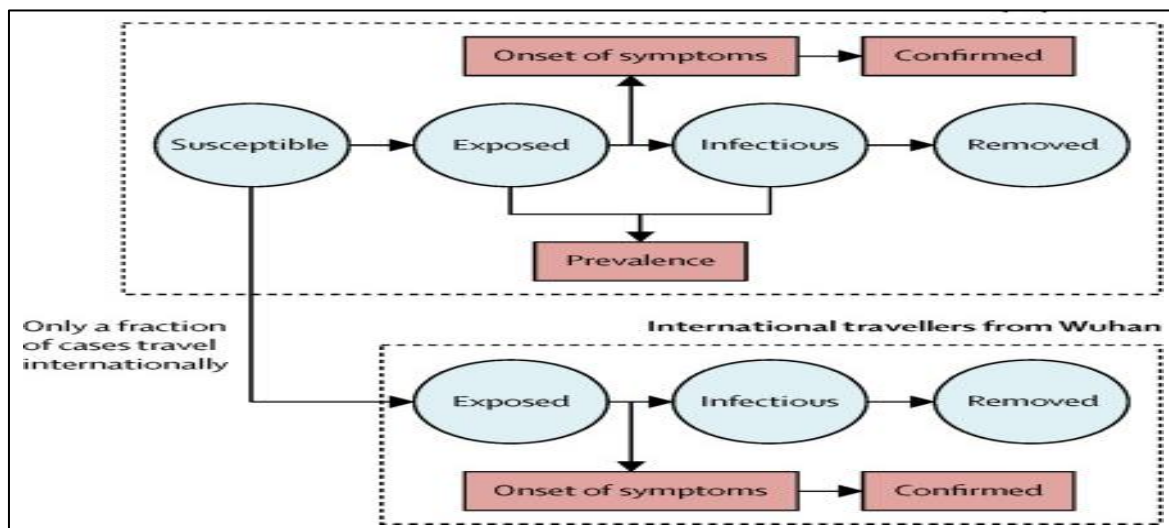
In Covid-19 epidemic, the high rate of infection spread and the significant number of deaths occurred. To control the spreading and to reduce the death rate, researchers are using and formulating mathematical models as a technique in gaining insight into the mode of spread of epidemic, prevention and control of epidemic.

The literature survey of mathematical epidemiology reveals that, mathematical model can be used to get an idea about how individuals are exposed

and infected with the disease and their possible recovery.

The mathematical analysis can be done by using ordinary differential equation and fractional differential equation. In a set of differential equations, epidemiological data regarding the evolution of Covid-19 infection in a reduced set of regions and basic information on the characteristic of the Covid-19 infection can be used to accurately recreate one set of Covid-19. The model can be adapted to closely follow the evolution of Covid-19 in densely populated areas by simply adjusting related to population density and aggressiveness of the response from a society to epidemic.

The differential operator in fractional calculus are non-integers for fractional order which have memory features and are useful in demonstrating many natural phenomenon and facts having non-local dynamic behaviour.



The human to human contact is the main cause to spread Covid-19. If we control the contact rate, the control of Covid-19 epidemic is possible.

The total population can be divided into five compartments i.e. susceptible, exposed, infected, isolated and recovered and out of these five compartments, only three compartments i.e. susceptible (S), infected (I) and recovered (R) can be considered. This compartmental model is known as SIR model. The susceptible population includes the exposed population and infected population. Infected population does not show symptoms but they are disease carriers and infect other individuals. Hence they must send to isolated compartments. The population which has been infected and recovered is to be added into the recovered compartment to know whether

they will infect again or not.

By using the approach of basic reproductive, the local stability and global stability of model can be discussed. It can show the impact of interaction of infected people to susceptible population. The non standard finite difference scheme and Runge-Kutta fourth order method can be used for numerical solution.

### **Conclusion**

The mathematical model can be important for the health practitioners and the world to understand and predict infected individuals for health concern arrangement of the citizen and to control its spread rate with restricted supply.

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## Metabolism

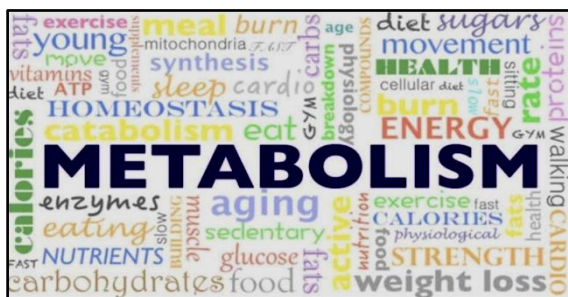
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**Metabolism** refers to the countless chemical processes, going on continuously inside the body, that allow life and normal functioning. Basal metabolic rate (BMR), energy used during physical activity, hormonal disorders are some of the important factors that influence our body's metabolic rate. Factors affecting our BMR includes body size, amount of lean muscle tissue, amount of body fat, crash dieting, starving or fasting, age, growth, amount of physical activity, drugs, dietary deficiencies etc.

Metabolism refers to the countless chemical processes, going on continuously inside the body, that allow life and normal functioning.

The amount of energy, measured in kilojoules (kJ), that your body burns at any given time is affected by your metabolism. Your metabolic rate is influenced by many factors, including age, gender, muscle to fat ratio, amount of physical activity and hormone function.



Your body's metabolic rate (or total energy expenditure) can be divided into three components, which are -

**Basal metabolic rate (BMR)** - Even at rest, the body needs energy (kilojoules) to keep all its systems functioning correctly (such as breathing, keeping the heart beating to circulate blood, growing and repairing cells and adjusting hormone levels). The body's BMR accounts for the largest amount of energy expended daily (50 - 80 % of your daily energy use).

**Energy used during physical activity** - This is the energy used by physical movement and it varies the most depending on how much energy you use each day. Physical activity includes planned exercise.

**Factors affecting our BMR** - BMR is influenced by multiple factors working in combination. It includes -

- ✓ **Body size** - Larger adult bodies have more metabolizing tissue and larger BMR.
- ✓ **Amount of lean muscle tissue** - Muscle burns kilojoules rapidly.
- ✓ **Amount of body fat** - Fat cells are sluggish and burn far fewer kilojoules than most other tissues and organs of the body.
- ✓ **Crash dieting, starving or fasting** - Eating too few kilojoules encourages the body to slow the metabolism to conserve energy. BMR can drop by up to 15 per cent and if lean muscle tissue is also lost, this further reduces BMR.
- ✓ **Age** - Metabolism slows with age due to loss of muscle tissue, but also due to hormonal and neurological changes.
- ✓ **Growth** - Infants and children have higher energy demands per unit of body weight due to the energy demands of growth and the extra energy needed to maintain their body temperature.
- ✓ **Amount of physical activity** - Hard working muscles need plenty of energy to burn. Regular exercise increases muscle mass and teaches the body to burn kilojoules at faster rate, even when at rest.



✓ **Drugs** - Like caffeine or nicotine, can increase the BMR.

✓ **Dietary deficiencies** - For example, a diet low in iodine reduces thyroid function and slows the metabolism.

**Hormonal disorders of metabolism** - Hormones help to regulate our metabolism. Some of the more common hormonal disorders affect the thyroid. This gland secretes hormones to regulate many metabolic processes, including energy expenditure (the rate at which kilojoules are burned). Thyroid disorders include -

**Hypothyroidism (underactive thyroid)** - The metabolism slows because the thyroid

gland does not release enough hormones. A common cause is autoimmune condition Hashimoto's disease. Some symptoms of hypothyroidism include unusual weight gain, lethargy, depression and constipation.

✓ **Hyperthyroidism (overactive thyroid)** - The gland releases larger quantities of hormones than necessary and speeds the metabolism. The most common cause of this condition is Graves' disease. Some of the symptoms of hyperthyroidism include the increased appetite, weight loss, nervousness and diarrhoea.

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## The New Fish Hiranyakeshi - Jewellery in the Mountains of Sahyadri (Western Ghats) of Maharashtra

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**Schistura Hiranyakeshi**, a new species of loach is described from Hiranyakeshi river, Amboli, Sindhudurg district of Maharashtra. It is unique among congeners from peninsular, north-eastern, and central India. Hiranyakeshi is a small and colourful fish that lives in water and streams in an abundance of oxygen and is endemic to this area. The fish was named as Schistura Hiranyakeshi after the river Hiranyakeshi. According to studies, the species has a golden beige body colour with a crimson sheen and golden yellow bars on their elongated body along with a unique colour pattern.

The western ghats of India, together with Sri Lanka, is considered as one of the major biodiversity hotspot of the world. About 320 species of freshwater fishes under 11 orders, 35 families and 112 genera are known from the western ghats, out of which 66% are endemic to this zoogeographical region. This rich diversity of these fishes is under threat due to several anthropogenic stressors. About 47% of the endemic fishes in this region are under threatened and near threatened categories.

The river Hiranyakeshi is one such river that originates in the western ghats of southern Maharashtra. The Hiranyakeshi river originates at about 840 meter near Amboli, in Sindhudurg district of Maharashtra state in India. It is surrounded by tropical evergreen and moist deciduous forest in upstream and agricultural lands.

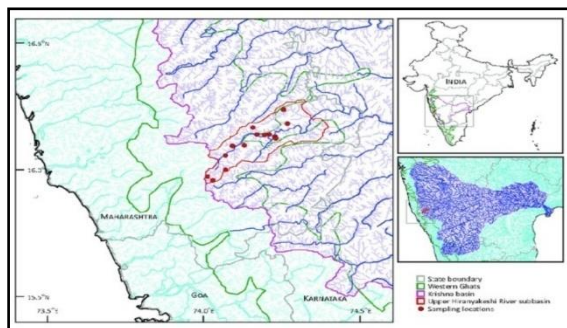


Image : Locations along the river Hiranyakeshi

The freshwater fish fauna of Hiranyakeshi river, a tributary of the Krishna river system, originating in the western ghats of Maharashtra, was under

studies for the periods of 3 years. The freshwater fish species are discovered from them. At least 11 species are in the threatened and near threatened categories of the IUCN red list and the river Hiranyakeshi holds a good population of most of these species.

**Schistura Hiranyakeshi** - It is a new species of loach described from river Hiranyakeshi, Amboli, Sindhudurg district, Maharashtra. It is unique among congeners from peninsular, north-eastern and central India.



Hiranyakeshi is a small and colourful fish that lives in water and streams in an abundance of oxygen and is endemic to this area. The fish was named as Schistura Hiranyakeshi after the river Hiranyakeshi which originates in the Sindhudurg district. The fish have not any official scientific name. Hiranyakeshi in Sanskrit means golden hair which also symbolises the golden yellow fin colour on the fish. This is one of the prettiest loaches ever discovered from India. Endemic to its type locality the Schistura Hiranyakeshi has a very limited distribution and appears to be rare and restricted only to the upper

streams and ponds of the ancient Shiva temple in Sindhudurg district at Amboli, a recognised hotspot for multiple discoveries.

According to studies, the species has a golden beige body colour with a crimson sheen and golden yellow bars on their elongated body along with a unique colour pattern. They are around 37.8 mm long. There are 64 species of Schistura in India, with most of them described from the north-east region, while only 14 were described from peninsular India.

It is a significant discovery. The northern parts of the western ghats, including parts of Goa and Maharashtra, are poorly as compared to their southern counter parts in Karnataka and Kerala, where major studies have been focussed. There have always been speculations that the north-western ghats freshwater system has rich biodiversity. Now this is an evidence to show the presence of strikingly beautiful space, have previously escaped the eyes of researchers.

The species of fish Schistura Hiranyakeshi endemic to Amboli was recorded for the first time in the western ghats in the local temple pond. Schistura is a genus of fish in the stone loach family Nemacheilidae native to the streams and rivers of the southern and eastern Asia.

Some of these species are troglotic. This is the freshwater fish species because species that spend most of their life in either freshwater inland areas or brackish estuaries are known as freshwater fish species (lives in water and streams in an abundance of oxygen).

#### **Classification**

Kindom : Animalia  
Phylum : Chordata  
Class : Actinopterygii  
Order : Cypriniformes  
Family : Nemacheilidae  
Genus : Schistura

Earlier, the state government has declared an area at Amboli in western ghats in Sindhudurg district as biodiversity heritage site. The decision to declare the habitat of these freshwater species as the biodiversity heritage site is taken because it is rare species and due to fishing activities, it might have faced extinction. It was important to conserve the species.

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## Reuse of Cooking Oil - Not a Healthy Choice

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When oil is heated for frying many physical and chemical changes takes place due to the frying temperature and when food is fried in heated oil, the water, steam and oxygen initiates the chemical reaction in frying oil. Water, a weak nucleophile attacks the ester linkage of triacylglycerol and produce glycerol, monoacylglycerol, diacylglycerol and free fatty acids. Every time we reuse the oil, it gets more and more destabilized until it decomposes. More the free fatty acid concentration, more unstable the oil become. Instability leads to oxidation of the oil and makes it rancid. If the oil becomes rancid it loses vitamins and can also form toxic compounds. Consuming such oil won't show any quick illness but it will show adverse effects slowly and gradually.

India is the nation of food diversity. The elements and taste of food change after every few miles. But the key elements remain the same. One of them is cooking oil. Oil is such an important aspect in cooking that one cannot replace it completely. If one tries to replace the cooking oil with substitute such as ghee, butter, mayonnaise etc. then difference between the smoking point, water content (in butter and mayonnaise) cannot be neglected. Fried stuffs are major components in Indian diet. Mostly one cannot utilize the full amount of oil taken for frying in single use. Very first thought that come to one's mind is to store the leftover oil and then reuse it. But is it a healthy choice? May be yes. What if one overuse the recycled oil? What are the health effects of reusing cooking oil let's see in detail.



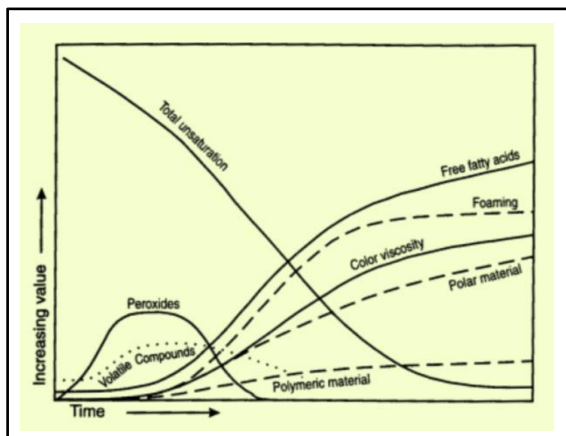
Cooking oil consists of three classes, saturated fats, monounsaturated fats and polyunsaturated fats. If the concentration of saturated fats increase than the amount of monounsaturated and polyunsaturated

fats then the composition becomes harmful. This is because unsaturated fats are considered as good fats and saturated fats are considered as bad fats. Saturated fat intake increases heart diseases risk factors including LDL cholesterol, which is considered as bad cholesterol. Unsaturated fats provide health benefits like improved cholesterol level, reduce inflammation and stabilize heart rhythms. The number of LDL particles is directly proportional to the risk of heart diseases.

When oil is heated for frying many physical and chemical changes takes place due to the frying temperature and when food is fried in heated oil, the water, steam and oxygen initiates the chemical reaction in frying oil. Water, a weak nucleophile attacks the ester linkage of triacylglycerol and produce glycerol, monoacylglycerol, diacylglycerol and free fatty acids. Every time we reuse the oil, it gets more and more destabilized until it decomposes. More the free fatty acid concentration, more unstable the oil become. Instability leads to oxidation of the oil and makes it rancid. If the oil becomes rancid it loses vitamins and can also form toxic compounds. Consuming such oil won't show any quick illness but it will show adverse effects slowly and gradually.

The given figure shows us about the change in texture and composition of the oil. These changes are given with respect to the number of times oil is heated or time.





When oil is fresh and not heated even once, its composition is mostly unsaturated fatty acids and saturated fatty acid. But this composition doesn't remain constant as the oil is heated again and again. Significant differences are observed in the constituents of oil. In the initial heating no major difference is seen in the concentration of unsaturated fatty acid. After some more heating time gradual increase and then lowering down is noted in the amount of peroxides and volatile compounds. Peroxide value is commonly used to determine the rancidity of the sample oil subject to oxidation. In general fresh oil have peroxide value of >10 meq/kg while the peroxide values in the 30-40 meq/kg range are generally associated with rancid taste. After some more heating, the concentration of free fatty acid is increased up to significant level. Besides this foam formation is also observed. Degradation and contamination in cooking oil causes foam formation or foaming. When the cooking oil is used again and again some amount of polar materials are formed. Polar materials are

the by-products formed during the breakdown of free fatty acids, monoglycerides, diglycerides and some oxidation products like aldehydes and ketones. When a significant amount of polar compounds is accumulated in cooking oil, it can create toxicity in the oil, which is associated with many diseases like hypertension, atherosclerosis, Alzheimer's disease, liver diseases etc. Due to the heating many chemical changes occur in cooking oil. When the oil is chemically transformed, compounds commonly known as polymeric materials (polyesters, polyamides, polyester amides and polyurethanes) are formed from the linear dysfunctional monomers. Along with the rise in various compounds, the level of unsaturated fatty acids is observed as continuously decreasing until it is totally degraded.

### Conclusion

When the oil is fresh its composition is totally healthy for our body, but when it is reused several times, many changes occur in its composition. New components such as free fatty acids, foam, polar material, etc. are formed. Some of the compounds cause toxicity in the oil. Consuming such oil can cause slow growing several health issues.

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## Forget 98.6°F, Humans are Cooling Off - It's Time to Redefine Normal Body Temperature

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The normal body temperature of humans is 98.6°F. Since our childhood, we all are aware of this and studied but it's time to redefine normal body temperature. If anyone says that 98.6°F is not the right temperature, it would seem crazy, but it's fact. The studies show that normal body temperature of humans is falling over time. During the nearly 160 years covered by the analysis, the average oral temperature gradually fell by 1.1°F and something closer to 97.5°F be more accurate.

Carl Wunderlich, German physician measured axillary (armpit) temperature in the mid 1800's, from about 25000 people and observed that the average body temperature was 98.6°F (37°C) and since ever we have believed that.



Over the course of day, body temperature varies, it tends to be higher latter. It varies among the individuals, women and younger ones have higher body temperature than men and older ones. Studies suggest that normal body temperature may be falling over time to well below the commonly accepted 98.6°F. In different 20 studies from 1935 to 1999 it was observed that the average oral temperature was 97.5°F. In 2017, study of more than 35000 peoples showed the similar type of results.

Number of researchers analyzed temperature recording from different three periods of time over 160 years.

1859 to 1940 - A mix of armpit and oral temperatures of nearly 24000 veterans of the civil war were measured.

1971 to 1975 - Oral temperatures of more than 15000 people from a large population

study of NHNES (National Health and Nutrition Examination Survey) were studied and analyzed.

2007 to 2017 - Oral temperatures of more than 15000 people in research project of STRIDE (Stanford Translational Research Integrated Database Environment) were evaluated and reviewed.

In nearly 160 years of study it was found that, the average oral temperature gradually fell by 1.1°F. These observations held up even after accounting for age, sex, body size and time of day.

Why would the average body temperature be falling? There are two key possibilities.

- **Low metabolic rate** - Body temperature is one of the biggest determinants of our metabolic rate. Our body expends energy just keeping things going and that generates the heat. In modern times, the low metabolic rate could be due to higher body mass or better medical treatments and preventive measures as well as overall good health.



- **Low rate of infection / inflammation** - In Wunderlich's days tuberculosis, syphilis, chronic gum diseases and the other

inflammatory conditions that can raised body temperature were common and treatment were limited.

The body temperature and changes over time matter very much. The body temperature is vital to health and that is why it is among the vital signs along with blood pressure, heart rate and breathing rate routinely checked by our doctor. These measures are absolutely critical when evaluating someone who may be sick, because significant abnormalities can indicate major, even life threatening illness.

In human body, thousands of chemical reactions occur simultaneously and continuously, which requires a rather narrow range of temperature. Human body does not tolerate wide fluctuations in temperature very well. Sever hypothermia

or hyperthermia may cause permanent damage in organ or results in death. Because of this body has an elaborated thermoregulation system which maintains the body temperature close to ideal most of the time. The metabolic rate, infection and inflammation in the body, all influence human health and longevity.

### **Conclusion**

We will need to rely on additional research that tells us about the importance of these findings. Meanwhile it's probably time to abandon the assumption that 98.6<sup>0</sup>F is a normal body temperature. Something closer to the 97.5<sup>0</sup>F be more accurate.

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## COVID-19 Vaccination in India

In India, the COVID-19 vaccination drive is going on using the two SARS-CoV-2 vaccines i.e. Covaxin and Covishield approved by the Government of India. Both of these vaccines are made in India. Here is the information about, how these two vaccines vary from each other as far as the formulation and other details are concern.

- Covaxin has been developed by Bharat Biotech International Ltd., Hyderabad in association with ICMR - Indian Council of Medical Research, New Delhi and NIV - National Institute of Virology, Pune.
- Covishield has been developed by the University of Oxford and AstraZeneca Ltd. and is being manufactured by the Serum Institute of India Pvt. Ltd., Pune.
- Covaxin is an inactivated vaccine, which has been prepared on a tried and tested platform of dead viruses. This vaccine is developed using Whole-Virion Inactivated Vero Cell derived platform technology. It contain dead, inactivated viruses, which cannot infect a person but still can instruct the immune system to prepare a defence mechanism against the active virus. Numbers of vaccines for diseases like Polio, Rabies etc. are made using the same technology.
- Covishield has been prepared by a totally different technology, using the viral vector platform. A chimpanzee adenovirus called ChAdOx1 is the vector that has been modified to enable the COVID-19 spike protein into the human cells. Basically, this cold virus is incapable of infecting the receiver but it can very well teach the immune system to prepare a mechanism against such viruses. The same technology was used to prepare vaccines for virus like Ebola.
- There is no difference between Covaxin and Covishield in terms of dosage. Both of them follow a two-dose regimen, administered 28 days apart. Both of these are intramuscular vaccines injected preferably into the deltoid muscle that is accessible in the upper arm.
- Both Covishield and Covaxin can be stored at 2-8<sup>o</sup>C i.e. at household refrigerator temperature. It makes both the vaccines most suited for India, as most of the vaccines are kept at the same range of temperature. It also makes their transportation and storage easier for all parts of country.
- Both Covaxin and Covishield have shown more than satisfactory results ever since the inoculation started in India. By the Drugs Controller General of India, these vaccines have been approved for restricted use in emergency situation in individuals 18 years of age and above.

**References** - <https://www.bharatbiotech.com/covaxin.html>, [https://www.seruminstitute.com/product\\_covishield.php](https://www.seruminstitute.com/product_covishield.php)  
<https://pharmeasy.in/blog/covaxin-vs-covishield-a-detailed-comparison>

**Disclaimer** - Information given herewith is only for academic use. It is not intended to be a substitute for medical purpose.

## Photo Gallery



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