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... the scientific information

Volume-05, No.-01 (2023)

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

*info*SCIENCE

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Principal's Message and Editor's Words





I am extremely pleased to present the 1st issue of 5th volume of science magazine… *info*SCIENCE. This issue is incorporated with various informative scientific and research articles, reviews on different aspects and concepts of science and technology. I am sure that, readers will definitely get benefitted from it.

It gives me immense pleasure to pronounce that, publishing the *info*SCIENCE is one of our best practices. On this occasion, I congratulate the board of editors of *info*SCIENCE, for their committed work and tireless efforts in bringing out this publication of *info*SCIENCE.

Dr. Vijay D. Nanoty
Principal, Shri R.L.T. College of Science, Akola

The board of editors is proud exuberant to present the 1st issue of 5th volume of science magazine… *info*SCIENCE of Shri R.L.T. College of Science, Akola incorporated with various scientific and research articles of varied ideas that are influential in the field of science and technology with substantially advance scientific understanding.

The aim of publishing the *info*SCIENCE is to help the readers and contributors make sense of the world of science and technology. Its focus is on publishing the scientific and research articles, reviews with matter of interest to teachers, researchers, students and other who concerned with the wide implications of science and technology.

The board of editors is sincerely thankful to our patrons, honorable executive members of the Berar General Education Society, Akola and the principal, advisors and authors for extending their support to this scientific project and contributing valuable articles for publication in *info*SCIENCE. Editorial board feels that everyone needs to contribute spontaneously in making the *info*SCIENCE more readable and informative.

Prof. Dr. Sushil M. Nagrale, **Prof. Dr. Pradip P. Deohate**
Dr. (Mrs.) Anjali A. Sangole and **Dr. Vinod D. Deotale**, Editors, *info*SCIENCE

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The Berar General Education Society's
NAAC Reaccredited 'A' Grade with CGPA 3.18

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

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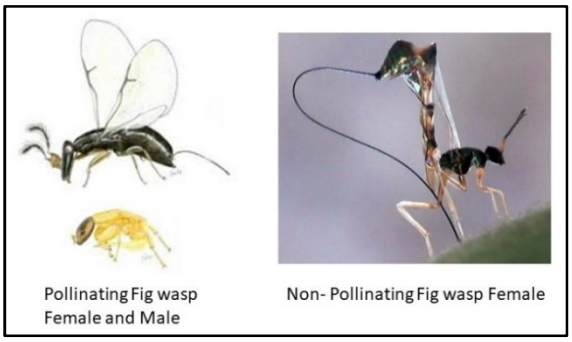
Insect World - Fig Wasp (Order - Hymenoptera, Family - Agaonidae)

Prof. Dr. Sushil M. Nagrale
Department of Zoology, Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Fig wasp belongs to family Agaonidae is considered as a specified insect of host plant Fig. Figs and wasps have become so profound that neither organism can exist without the other. The female is a normal insect, while the males are mostly wingless. The non-pollinating wasps have developed impressive morphological adaptations in order to oviposit eggs inside the fig but from the outside: an extremely long ovipositor. The pollinating wasps are part of an obligate nursery pollination mutualism with the fig tree, while the non-pollinating wasps feed off the plant without benefiting it.

The fig wasp (Family - Agaonidae, Order - Hymenoptera), also called fig insect, any of about 900 species of tiny wasps responsible for pollinating the world's 900 species of figs. Fig wasps are wasps of the superfamily Chalcidoidea which spend their larval stage inside figs. Most are pollinators but others simply feed off the plant. The non-pollinators belong to several groups within the superfamily Chalcidoidea, while the pollinators are in the family Agaonidae. Pollinating fig wasps are gall-makers and the remaining types either make their own galls or use the galls of other fig wasps. The parasitoids are considered as non-pollinating fig-wasp.



Pollinating Fig wasp Female and Male

Non- Pollinating Fig wasp Female

Each species of wasp pollinates only one species of fig, and each fig species has its own wasp species to pollinate it. This extraordinary diversity of co-evolution between figs and wasps has become so profound that neither organism can exist without the other.

Aristotle recorded in his book "History of Animals" that the fruits of the wild fig (the caprifig) contain psenes (fig wasps). These wasps begin life as grubs (larvae) and the adult psen splits its "skin" (pupa) and flies out of the fig to find and enter a cultivated fig, saving it from dropping. He believed that the psen was generated spontaneously. He did not recognize that the fig was reproducing sexually and that the psen was assisting in that process.

Fig taxonomy

The fig wasps are a polyphyletic group, including several unrelated lineages whose similarities are based upon their shared association with figs. Thus, the number of genera in the family is in flux. The family Agaonidae has been recently updated to include all the pollinating fig wasps and the subfamily Sycophaginae. Remaining taxa such as Epichrysomallinae, Sycoecinae, Otitesellinae, and Sycoryctinae should be included in the Pteromalidae.

Among the Agaonidae, the female is a normal insect, while the males are mostly wingless. The males' only tasks are to mate with the females while still within the fig syconium (inverted flower) and to chew a hole for the females to escape from the fig interior. This is the reverse of Strepsiptera and the bagworm, where the male is a normal insect and the female never leaves the host. The non-pollinating wasps have developed impressive morphological adaptations in order to oviposit eggs inside the fig but from the outside: an extremely long ovipositor.

Host of fig wasp

Most figs (more than 600 species) have syconia that contain three types of flowers - male, short female, and long female. Female fig wasps can reach the ovaries of short female flowers with their ovipositors, but not long female flowers. Thus, the short female flowers grow wasps, and the long flowers only seeds. It is believed that ripe figs are not full of dead wasps and the "crunchy bits" in the fruit are only seeds. The fig actually produces an enzyme called ficain (also known as ficin) which digests the dead wasps and the fig absorbs the nutrients to create the ripe fruits and seeds. Several commercial and ornamental varieties of the fig are parthenocarpic and do not require pollination to produce (sterile) fruits. These varieties need not be visited by fig wasps to bear fruit.

Life cycle of fig wasp

The life cycle of the fig wasp is closely intertwined with that of the fig tree it inhabits. The wasps that inhabit a particular tree can be divided into two groups; pollinating and non-pollinating. The pollinating wasps are part of an obligate nursery pollination mutualism with the fig tree, while the non-pollinating wasps feed off the plant without benefiting it. The life cycles of the two groups, however, are very similar.

Though the lives of individual species differ, a typical pollinating fig wasp life cycle is as follows.

A fertilized mature female pollinator wasp enters the immature "fruit" (known as a syconium) through a small natural opening (the ostiole) and deposits her eggs in the cavity.

Forcing her way through the ostiole, she often loses her wings and most of her antennae to facilitate her passage through the ostiole. The underside of the female's head is covered with short spines that provide purchase on the walls of ostiole.

In depositing her eggs, the female also deposits pollen she picked up from her original host fig. This pollinates some of the female flowers on the inside surface of the fig and allows them to mature.

After the female wasp lays her eggs and follows through with pollination, she dies. After pollination, there are several species of non-pollinating wasps that deposit their eggs before the figs harden. These wasps act as parasites to either the fig or possibly the pollinating wasps. As the fig develops, the wasp eggs hatch and develop into larvae.

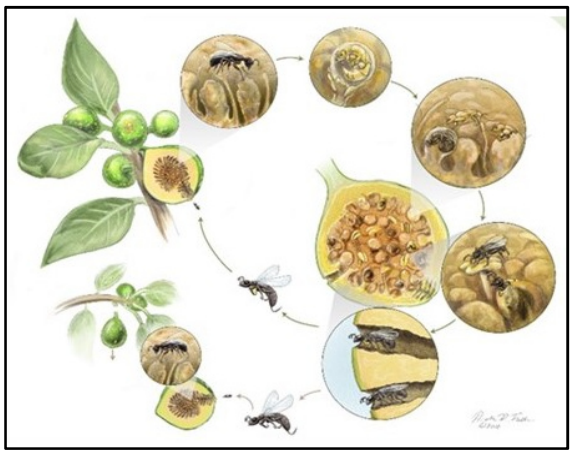
After going through the pupal stage, the mature male’s first act is to mate with a female, before the female hatches.

Wasps mature from eggs deposited inside the flowering structure of the fig,

called syconium, which looks very much like a fruit. Inside the completely enclosed syconium are the individual flowers themselves. When a wasp egg is deposited in one of the flowers, that flower develops a gall-like structure instead of a seed. The blind, wingless male wasps emerge from the galls and search out one or more galls containing a female. On finding female, he chews a hole in the gall and mates with her before she has even hatched.

In many cases, the male then digs an escape tunnel for female. The male then dies, having spent its entire life within fig.

The female emerges later from her gall and proceeds toward the escape tunnel or eye of the fig (the part opposite the stem end), because she must deposit her eggs in a second fig. In departing, she passes by many male flowers and emerges covered with pollen. During her brief adult life (as short as two days), she flies into the forest to fertilize another fig and deposit another generation of fig wasps.



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Biodiesel - A Cleaner Burning Renewable Alternative to Diesel

Prof. Dr. Pradip P. Deohate
Department of Chemistry, Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Biodiesel is a cleaner burning renewable alternative to diesel fuel made from biological sources like vegetable oils, animal fats and greases through a chemical process. Biodiesel offer carbon neutral cycle. Concerns over environment, global warming, energy security, use of agro products brought the biodiesel to the forefront. In India, biodiesel is exclusively prepared from non-edible feedstock like jatropha, karanja, neem, mahua, algae or waste cooking oil. Biodiesel i.e. soybean oil methyl ester (SOME) and rapeseed oil methyl ester (ROME) are most common biodiesel blend. In Asia, palm oil methyl ester (POME) is most common biodiesel blend. Biodiesel is non-toxic and biodegradable. It has lower greenhouse gas emissions than diesel. Biodegradability is 95% at end of 28 days. Sulphur content, lubricity, flash point, cetane number etc. are better than the petro-diesel. It reduces carbondioxide exhaust emissions by upto 80%, produces 100% less sulphurdioxide than petro-diesel, reduces exhaust smoke i.e. particulates emissions by up to 75%. It reduces classic diesel engine "knocking" noise. It can be used in its pure form with certain engine modifications.

Biodiesel is made from biological sources like vegetable oils, animal fats and greases through a chemical process. It is a cleaner burning renewable alternative to diesel fuel. Modern biodiesel is made through trans-esterification by converting vegetable oils into fatty acid alkyl esters i.e. fatty acid methyl esters (FAME) or fatty acid ethyl esters (FAEE). Biodiesel offer carbon neutral cycle. Concerns over environment, global warming, energy security, use of agro products brought the biodiesel to the forefront. Biodiesel i.e. soybean oil methyl ester (SOME) and rapeseed oil methyl ester (ROME) are most common biodiesel blend. In Asia, palm oil methyl ester (POME) is most common biodiesel blend. In India, biodiesel is exclusively prepared from non-edible feedstock like jatropha, karanja, neem, mahua, algae or waste cooking oil.

Biodiesel is an alternative fuel for diesel engines that is produced by chemically reacting a vegetable oil or animal fat with an alcohol such as methanol. The reaction requires a catalyst, usually a strong base, such as sodium or potassium hydroxide, and produces new chemical compounds called methyl esters. It is these esters that have come to be known as biodiesel.

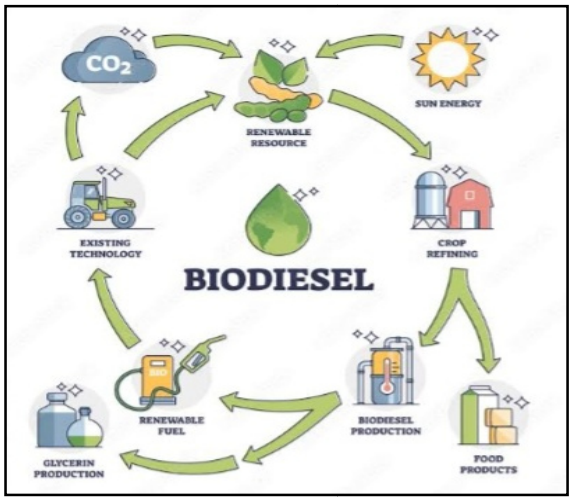
Why biodiesel ?

- Renewable source produced from the vegetable seeds.
- Energy security because of the less dependence on oil imports.
- Non-toxic and biodegradable.
- Lower greenhouse gas emissions than diesel.
- Lower exhaust emissions from engines.
- Reduces carbondioxide exhaust emissions by upto 80%.

- Produces 100% less sulphurdioxide than petro-diesel.
- Reduces exhaust smoke i.e. particulates emissions by up to 75%.
- Biodegradability is 95% at end of 28 days.
- Sulphur content, lubricity, flash point, cetane number etc. are better than the petro-diesel.
- Much less dangerous to put in a vehicles fuel tank as the flash point of biodiesel is 150^{0}C as opposed to petroleum diesel which is at 70^{0}C.
- Degrades about 4 times faster than petroleum diesel.
- Provides the significant lubricity improvement over petroleum diesel.
- Reduces the classic diesel engine "knocking" noise.
- Does not require any changes to the existing storage infrastructure.
- Can be mixed in with existing diesel to create mixtures like B10 or B20 blend.
- Fantastic lubricity additive even at blend levels as low as 1%.
- A diesel engine vehicle does not need to be modified to use biodiesel.
- Can be used in its pure form with certain engine modifications.
- Decreases dependence on fossil fuels which could be abruptly interrupted by terrorism, war, political action, economic action i.e. price rises.

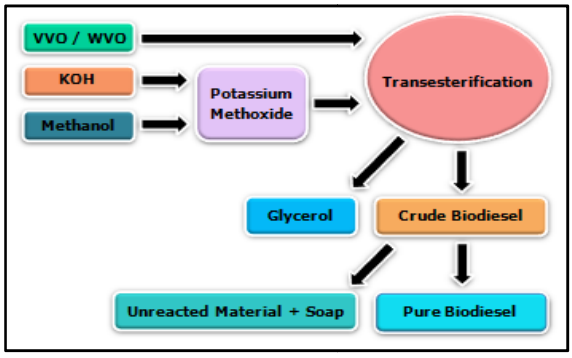
How biodiesel is made ?

Bio-diesel is produced through a process known as trans-esterification. The trans-esterification process involves mixing at room temperature methanol with NaOH, then mixing vigorously with vegetable oil and letting the glycerol settle (about 15% of the biodiesel mix). The supernatant is biodiesel and contains a mixture of methylated fatty acids and methanol, catalyst remaining dissolved in glycerol fraction. Biodiesel fuel can be made from new or used vegetable oils and the animal fats, which are nontoxic, biodegradable, renewable resources.



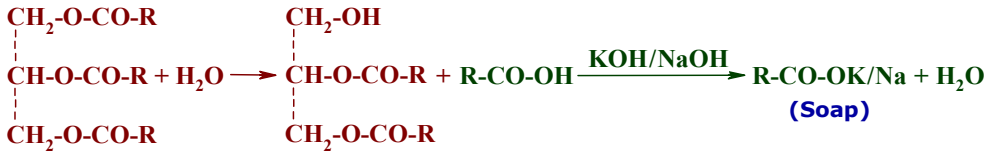
How biodiesel is prepared in laboratory ?

Heat 100 gm of virgin vegetable oil (VVO) to 60^{0}C. Separately, prepare the potassium methoxide by stirring 1 gm of KOH with 20 ml of methanol. Transfer it to preheated VVO and stir it for 1 hour maintaining temperature at 60^{0}C. Allow two layers of above reaction mixture to separate in separating funnel for about 15 minute. Discard lower layer of glycerol. Wash upper layer of crude virgin vegetable oil biodiesel (VVOBD) with distilled water by swirling for about 1 minute to dissolve unwanted methanol, traces of glycerol, KOH and soap. Again allow two layers to separate for 30 minute. Discard lower layer and transfer upper layer of pure VVOBD in bottle. Extend this method and synthesize waste vegetable oil biodiesel (WVOBD) from waste vegetable oil (WVO) by adding additional KOH as per the predetermined FFA value.



Vegetable oil is a triglyceride molecule. During trans-esterification, fatty acids of triglyceride molecule are cleaved and attach to alkyl group of alcohol to form fatty acid alkyl esters in presence of catalyst KOH/NaOH. WVO is more acidic. Its trans-esterification required the more catalyst. While frying the food in hot oil, some water present in it reacts with triglyceride molecule to form free fatty acid (FFA), which consumes some of the KOH/NaOH to form soap.

Scheme-1



Scheme-2

Biodiesel and the environment

Emissions reductions using biodiesel is -

- 73% life cycle carbondioxide
- 100% sulphuroxide (acid rain)
- 51% methane
- 67% unburned hydrocarbons
- 48% carbonmonoxide
- 47% in particulate matter
- 80% in polycyclic aromatic hydrocarbons

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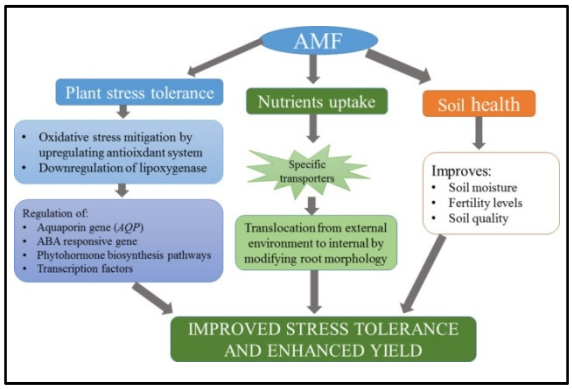
Role of Arbuscular Mycorrhizal Fungi in Plant Growth Regulation, Implications in Abiotic Stress Tolerance

Dr. Pramod M. Khadse
Department of Botany, Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Arbuscular mycorrhizal fungi (AMF) facilitate host plants to grow vigorously under stressful conditions by mediating a series of complex communication events between the plant and the fungus leading to enhanced photosynthetic rate and other gas exchange-related traits, as well as increased water uptake. Bio-fertilizers are a mixture of naturally occurring substances that are used to improve soil fertility. Plant tolerance to drought could be primarily due to a large volume of soil explored by roots and extra-radical hyphae of the fungi.

Arbuscular mycorrhizal fungi (AMF) facilitate host plants to grow vigorously under stressful conditions by mediating a series of complex communication events between the plant and the fungus leading to enhanced photosynthetic rate and other gas exchange-related traits, as well as increased water uptake. Numerous reports describe improved resistance to a variety of stresses including drought, salinity, herbivory, temperature, metals, and diseases due to fungal symbiosis. Nearly 90% of plant species including flowering plants, bryophytes, and ferns can develop interdependent connections with AMF. AMF form vesicles, arbuscules and hyphae in roots and also spores and hyphae in the rhizosphere. Formation of hyphal network by the AMF with plant roots significantly enhances the access of roots to a large soil surface area, causing improvement in plant growth. AMF improve plant nutrition by increasing the availability as well as translocation of various nutrients. AMF improve the quality of soil by influencing its structure and texture, and hence plant health. Fungal hyphae can expedite the decomposition process of soil organic matter. Furthermore, mycorrhizal fungi may affect atmospheric CO_2 fixation by host plants, by increasing "sink effect" and movement of photo-assimilates from the aerial parts to the roots. Keeping in view the importance of AMF and the research advancements related to their applications in agriculture, present review focuses on the role of AMF as bio-fertilizers in the regulation of plant growth and development with improved nutrient uptake under stressful environments and the level to which AMF can enhance plant grow.



AMF as a bio-fertilizer

Bio-fertilizers are the mixtures of naturally occurring substances that are used to improve soil fertility. These fertilizers are very useful for soil health as well as for plant growth and development. Different research studies conducted on AMF during the past two decades have highlighted their countless benefits on soil health and crop productivity. Therefore, it is widely believed that AMF could be considered as a replacement of inorganic fertilizers in the near future, because mycorrhizal application can effectively reduce the quantitative use of chemical fertilizer input especially of phosphorus. Continuous use of inorganic fertilizers, herbicides, and fungicides has caused

various problems to soil, plants, and human health, through their damaging impact on the quality of food products, soil health, and air and water systems. It is believed that AMF can possibly lower down the use of chemical fertilizers up to 50% for best agricultural production, but this estimate depends on type of plant species and the prevalent stressful regimes.

It is evident that inoculation of AMF can enhance the concentration of various macro-nutrients and micro-nutrients significantly, which leads to increased photosynthetic production and hence increased biomass accumulation. AMF have the capability to boost the uptake of inorganic nutrients in almost all plants, specifically of phosphate. AMF are also very effective in helping plants to take up nutrients from the nutrient-deficient soils. Apart from the macronutrients, AMF association has been reported to increase the phyto availability of micronutrients like zinc and copper. AMF improve the surface absorbing capability of host roots. Experimental trials on tomato plants inoculated with AMF have shown increased leaf area and nitrogen, potassium, calcium and phosphorus contents, reflecting enhanced plant growth. AMF develop symbiosis with roots to obtain essential nutrients from the host plant and consequently provide mineral nutrients in return, for example, N, P, K, Ca, Zn and S. Thus, AMF provide nutritional support to the plants even under inappropriate conditions inside the root cells. AMF produce fungal structures like arbuscules, which assist in exchange of inorganic minerals and the compounds of carbon and phosphorus, ultimately imparting a considerable vigor to host the plants. Therefore, they can significantly boost the phosphorus concentration in both root and shoot systems. Under phosphorus limited conditions, the mycorrhizal association improves phosphorus supply to infected roots of host plants. For example, Pi uptake rate was markedly improved in the AMF colonized maize plants. Increased photosynthetic activities and other leaf functions are directly related to improved growth frequency of AMF inoculation that is directly linked to the uptake of N, P and carbon, which move towards roots and promote the development of tubers. It has been observed that AMF maintain P and N uptake ultimately helping in plant development at higher and lower P levels under different irrigation regimes. For example, mycorrhizal symbiosis positively increased the concentrations of N, P and Fe in *Pelargonium graveolens* L. under drought stress. It was reported improved levels of P, Ca, and K in *Euonymus japonica* under salinity stress due to instant fungus attachment. In another study, the AMF inoculated *Pistachio* plants exhibited high levels of P, K, Zn and Mn under drought stress. In addition, AMF inoculation improved P, N contents in *Chrysanthemum morifolium* plant tissues and increased seedling weight by improving water content and intercellular CO_2, P and N contents in *Leymus chinensis*.

AMF and abiotic stresses

Drought - Drought stress affects plant life in many ways. For example, shortage of water to roots reduces rate of transpiration as well as induces oxidative stress. Drought stress imparts deleterious effects on plant growth by affecting enzyme activity, ion uptake and nutrient assimilation. However, there is a strong evidence of drought stress alleviation by AMF in different crops such as wheat, barley, maize, soybean, onion and strawberry. Plant tolerance to drought could be primarily due to a large volume of soil explored by roots and the extra-radical hyphae of the fungi.

Such a symbiotic association is believed to regulate the variety of physio-biochemical processes in plants such as increased osmotic adjustment, stomatal regulation by controlling ABA metabolism,

enhanced accumulation of proline or increased glutathione level. Symbiotic relationship of various plants with AMF may ultimately improve root size and efficiency, leaf area index and biomass under the instant conditions of drought. Moreover, AMF and their interaction with the host plant are helpful in supporting plants against severe environmental conditions. The AMF symbiosis also results in enhanced gas exchange, leaf water relations, stomatal conductance and transpiration rate. AMF can facilitate the ABA responses that regulate stomatal conductance and other related physiological processes. Recently, have demonstrated AMF mediated enhancement in growth and the photosynthesis in C_3 (*Leymus chinensis*) and C_4 (*Hemarthria altissima*) plant species through the up-regulation of antioxidant system.

Salinity - It is widely known that the soil salinization is an increasing environmental problem posing a severe threat to global food security. Salinity stress is known to suppress growth of plants by affecting the vegetative development and net assimilation rate resulting in reduced yield productivity. It also promotes the excessive generation of reactive oxygen species. Attempts are being made to explore potential means of achieving enhanced crop production under salt affected soils. One such potential means is the judicious use of AMF for mitigating the salinity induced adverse effects on plants. Several research studies have reported the efficiency of AMF to impart growth and yield enhancement in plants under salinity stress. It was reported that AMF enhanced growth rate, leaf water potential and water use efficiency of the *Antirrhinum majus* plants. Recently, reported the beneficial effects of AMF symbiosis on physiological parameters such as photosynthetic rate, stomatal conductance and leaf water relations under saline regimes. AMF significantly alleviated the deleterious effects on photosynthesis under salinity stress. Mycorrhizal inoculation markedly improved the photosynthetic rate and other gas exchange traits, the chlorophyll content and the water use efficiency in *Ocimumbasilicum* L. in saline conditions. The AMF inoculated *Allium sativum* plants showed improved growth traits including leaf area index, and fresh and dry biomass under saline conditions. Recently, reported considerable enhancement in fresh and dry weights, and N concentration of shoot and root due to mycorrhizal inoculation under moderate saline conditions.

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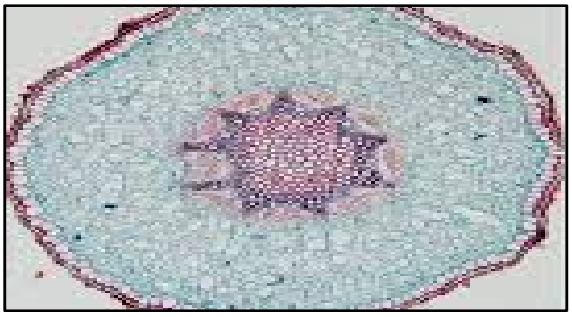
Plant Anatomy - At the Heart of Plant Science

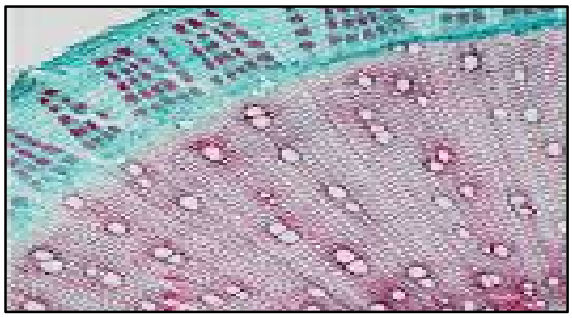
Dr. Anjali A. Sangole
Department of Botany, Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Anatomy is a branch of natural science that deals with the structural organization of living things. Plant anatomy or Phytotomy is the general term for the study of the internal structure of plants. Originally it included plant morphology, the description of the physical form and external structure of plants, but since the mid-20th century plant anatomy has been considered a separate field referring only to internal plant structure. Plant anatomy is the study of the shape, structure, and size of plants.

Anatomy is one of the oldest disciplines of plant science and there is a huge amount of accumulated knowledge. At the same time, anatomy is highly important as a linking medium between several key branches of modern plant science. As in all experimental sciences, research in plant anatomy depends on the laboratory methods that can be used to study cell structure and function. Many important advances in understanding cells have directly followed the development of new methods that have opened novel avenues of investigation.

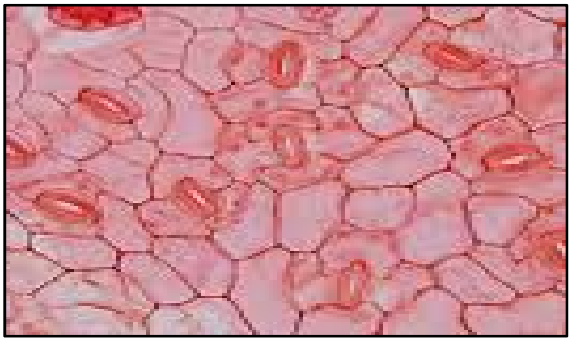


An appreciation of the experimental tools available to cell biologist is thus critical to understanding both the current status and future directions of this rapidly moving area of science. The elements of the plant cell are the membrane and the protoplast. The protoplast includes the cytoplasm, the nucleus, the plastids, the mitochondria, and other organelles. Plant anatomy or Phytotomy is the general term for the study of the internal structure of plants. Originally it included plant morphology, the description of the physical form and external structure of plants, but since the mid-20th century plant anatomy has been considered a separate field referring only to internal plant structure. Plant anatomy is the study of the shape, structure, and size of plants. As a part of botany (the study of plants), plant anatomy focuses on the structural or body parts and systems that make up a plant. A typical plant body consists of three major vegetative organs - the root, stem, and the leaf, as well as a set of reproductive parts that include flowers, fruits, and seeds.



Anatomy, the branch of biology concerned with the study of the structure of organisms and their parts. Anatomy is a branch of natural science that deals with the structural organization of living things. It is an old science, having its beginnings in prehistoric times. Anatomy is inherently tied to developmental biology, embryology, comparative anatomy, evolutionary biology and phylogeny, as these are the processes by which anatomy is generated, both over immediate and the long-term timescales. Anatomy and physiology, which study the structure and function of organisms and their parts respectively, make a natural pair of related disciplines and are often studied

together. Human anatomy is one of the essential basic sciences that are applied in the medicine.



As a living thing, all of a plant's parts are made up of cells. Although plant cells have a flexible membrane like animal cells, a plant cell also has a strong wall made of cellulose that gives it a rigid shape. Unlike animal cells, plant cells also have chloroplasts that capture the Sun's light energy and convert it into food for itself. Like any complex living thing, a plant organizes a group of specialized cells into what are called tissues that perform a specific function. For example, plants therefore have epidermal tissue that forms a protective layer on its surface. They also have parenchyma tissue usually used to store energy. The "veins" or pipelines of a plant are made up of vascular tissues that distribute water, minerals, and nutrients throughout the plant. Combined tissues form organs that play an even more complex role.

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Recycling of Waste Silk

Dr. Rashmi P. Joshi (Sawalkar)
Department of Zoology, Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Sericulture is an agro-based industry in a developing country like India. The sericulture waste products are used in many industries by recycling it. In addition to the production of silk, this industry can produce a number of by-products from mulberry and silkworm wastes. The major waste generated during silkworm cocoon reeling and doubling can be recycled and produce the spun silk fabrics. Spun silk is made of thread spun from the short silk filaments left over from classic silk production, so in a way it's actually made of waste silk.

Silk is the product of sericulture. Sericulture is one of the important agro based industry, in which silkworms are reared (cultured) to yield the silk. Silk waste includes all kinds of raw silk which may be unwindable and therefore unsuited to the throwing process. Silk throwing is the industrial process wherein silk that has been reeled into skeins, is cleaned, receives a twist and is wound onto bobbins. The yarn is now twisted together with threads, in a process known as doubling. It is hard to swallow, that this silk throwing can be used in the entire process of reeling, throwing and doubling. Before the introduction of machinery applicable to the spinning of silk waste, the refuse from cocoon reeling, and also from silk winding, which is now used in producing spun silk fabrics. This silk waste was destroyed as being useless but, sometimes this could be hand-combed and spun by means of the distaff (is a tool used in spinning) and spinning wheel, a method which is still practiced by some of the peasantry in India and other countries in Asia.

Sources

The supply of waste silk is drawn from the following sources.

- The silkworm, when commencing to spin, emits a dull, lusterless and uneven thread with which it suspends itself from the twigs and leaves of the tree upon which it has been feeding, or the straws provided for it by attendants in the worm rearing establishments - this first thread is unreelable and moreover, is often mixed with straw, leaves and twigs.
- The outside layers of the true cocoon are too coarse and uneven for reeling and as the worm completes its task of spinning, the thread becomes finer and weaker, so both the extreme outside and inside layers are put aside as waste.
- Pierced cocoons, that is, those from which the moth of the silkworm has emerged-and damaged cocoons.
- During the process of reeling from the cocoon the silk often breaks and both in finding a true and reliable thread, and in joining the ends, there is unavoidable waste.
- The raw silk skeins are often re-reeled and in this process the part has to be discarded - this being known to the trade as gum waste. Same term gum waste is applied to waste made in the various processes of silk throwing, but manufacturers using threads known technically as organizes and trams call the surplus manufacturer's waste.

Processing

A silk throwster receives the silk in skein form, the thread of which consists of a number of silk fibers wound together to make a certain diameter or size, the separate fiber having actually been spun by the worm. The silk waste spinner receives the silk in quite a different form - merely the raw material, packed in bales of various sizes and weights, the contents being a much tangled mass of all lengths of fiber mixed with much foreign matter, such as ends of straws, twigs, leaves, worms and chrysalis. It is the spinner's business to straighten out these fibers, with the aid of machinery, and then to so join them that they become a thread, known as spun silk.

All silk produced by the worm is composed of two substances - fibroin, the true thread and sericin, which is a hard, gummy coating of the fibroin. Before the silk can be manipulated by machinery to any advantage, the gum coating must be removed by dissolving and washing it away. Where the method used in achieving this operation is through fermentation, the product is called schappe. The former, schapping, is the French, Italian and Swiss method, from which the silk when finished is neither so bright nor so good in colour as the discharged silk, but it is very clean and level, and for some purposes essential, as, for instance, in velvet manufacture.

The products obtained in recycling process, whether become raw materials that can be processed further and turned into the whitened or carbonized silk or combed / carded yarn. These are used as semi-finished products to be spun. They can be used in carded yarn spinning, combed wool spinning, cotton spinning i.e. in the production of yarns blended with other natural and/or synthetic and artificial fibers. Such threads can also be made into 100% silk yarns.

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The Spectrum of Lightning and Display Devices and their Biological Impacts on Human Health

Dr. Shailesh R. Jaiswal and **Ms. Prerna P. Ghuikar**
Department of Physics, Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Dr. Pankaj A. Nagpure
Department of Physics, Shri Shivaji Science College, Amravati, 444 602, INDIA

This study reports the spectrum of different natural and commercial light sources and their drawbacks. This study also put light on the biological effects of lighting devices on human health. Identify the emission spectra of various lighting and display devises using USB650-UV-VI-SPI mini portable spectrometer with 'Spectra Suite Ocean Optic' computer software. Put forth new eco-friendly and health-friendly alternatives for lighting and display technology such as mercury-free fluorescent lamps (MFFLs) and organic LEDs.

Humans are exclusive animals on the planet that produces lighting using external sources. In olden eras, the sun light is one of the natural sources of light in day time but at night, lighting was obtained by burning dry vegetation. Progressively open fires were replaced by candles, fuel lamps and natural gas. In 1880, Thomas Edison invented an electric light appropriate for commercialization and today electric lighting predominates and our cities are covered in light well into the night. Over time due to the large development in lighting technology, it possible for lighting to be providing at lesser price to more numbers of individuals.

The commercial incandescent lamp which was developed by Edison's, operates by heating a tungsten filament to emit light. But in the incandescent lamp most of the energy is loss in to heat i.e., energy emitted in the infrared, outside the range of human vision. Over time electric lighting types expanded, a process driven by demand for cost efficiency, large area lighting, visual attractions and the preference for high colour renderings that are similar to daylight[1].

However, over time incandescent lamps were replaced by the gas discharge lamps (e.g., fluorescent, high-pressure sodium and metal halide). Gas discharge lamps are a light source that generates light by sending an electrical discharge through an ionized gas, plasma. Some lamps convert ultraviolet radiation (emitted photons of characteristics energy from gas discharge/ionized gas) to visible light with the help of phosphor coating on the inside of the lamp's glass surface. Such type of lamps is called low-pressure gas discharge lamps. The classic fluorescent lamp and compact fluorescent lamp (CFL) are the best examples of Low-pressure gas discharge lamps.

Fluorescent lamps are inexpensive, have a long life, have good luminous efficacy, and very good CRI but it contains mercury. All fluorescent lamps contaminate the environment with mercury when broken or disposed of after use. Because of their shapes and the structure of the materials, the collection and recycling of the lamps do not apply to every situation. Apart from that, it contains ambient temperature affects switch-on and output, and need auxiliary ballast and starter or electronic ballast. These are the major disadvantages of fluorescent lighting[2].

Now a days, there is replacement of fluorescent lamps with environmentally benign light sources such as light-emitting diodes (LEDs). Use of LEDs seems to be most environmentally benign way of lightning. A

characteristic method to produce "white" light from LEDs is to combine a blue LED (peak wavelength ~ 460 nm) with phosphor coating to produce a broad spectrum in the green-yellow-red range. The manufacturer is able adjust the balance between these two components to produce a range of correlated-colour temperatures (CCTs) for "white" LEDs[1].

But W-LED still suffers from a poor colour rendering index (CRI)[2] and a comparatively low luminous intensity (especially when a good CRI is attempted). Secondly it is found that most of the new commercial LED light bulbs emit a high proportion of the blue region reaching up to 35% of total emitted light. Therefore, the biggest disadvantage of LED is the suppression of melatonin in humans due to blue light. From the literature survey, it is reported that blue light from light-emitting diodes elicits a dose-dependent suppression of melatonin in humans[3]. The figure 1 shows the history of lighting technologies which have been adopted by the human being.

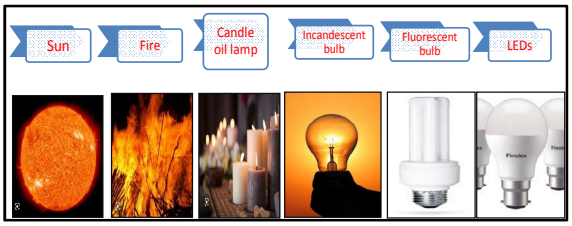

Figure 1 : History of lighting technology[4]

In this report, we investigate the emission spectrums of different light sources (lighting and display devices) and also study their biological effects on human health. For that we adopted directed method of reading, in which we identify the spectra of various lighting and display devises using USB650-UV-VI-SPI mini portable spectrometer with 'Spectra Suite Ocean Optic' computer software. Compare all the emission spectra (other sources of light, lighting and display devices) with daylight (Sun) spectra. Also put idea of forth new eco-friendly and health-friendly alternatives for the lighting and display technology such as the mercury-free fluorescent lamps (MFFLs) and organic LEDs.

Emission spectra of various lighting and display devises were acquired using USB650-UV-VI-SPI mini portable spectrometer with 'Spectra Suite Ocean Optic' computer software. It has a wavelength range of 200-850 nm, and utilizes a detector with 650 active pixels; that's 650 data points in one full spectrum, or one data point per nanometer. The spectrometer is a low-cost, small-footprint lab spectrometer that's ideal as a general purpose instrument for budget-conscious teaching and research labs. The innovativeness of this spectrometer is to directly measure the emission spectrum of any natural and artificial light sources. No need to collect the samples/phosphors of the devices for monitoring the spectra. Diagrammatic representation of the system is shown in the figure 2.

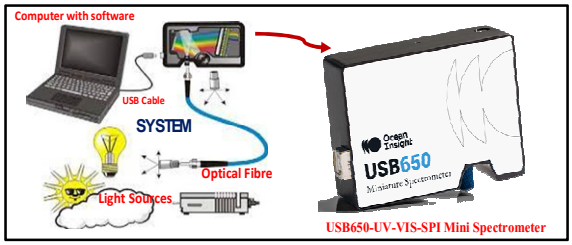

Figure 2 : Complete system with USB650-UV-VI-SPI mini portable spectrometer[5]

Spectral power distribution (SPD) of the lighting sources

Sun light spectrum - Spectra were acquired from direct sunlight. The emission spectra of sun having all types of wavelengths start with violet and blue colors, with a wavelength of 380 nanometers. It spans the range of visible light colors, including green, yellow and orange and ends at the bottom with red colors with a wavelength of 750 nm as shown in figure 3(a).

Fire or candle - Spectra were acquired from direct burning of fire or candle. The spectra have a flattened appearance, with the short wavelength and an upward swing

in emission from 550 to 700 nm as shown in figure 3(b).

Incandescent lamps - Spectra were acquired from incandescent lamp. The emission spectra of incandescent lamps have blackbody shapes. It is a thermal radiator that emits a continuous spectrum of light extending from about 380 nm to 780 nm as shown in figure 3(c).

Fluorescent lamps - Spectra were acquired from fluorescent lamp. The fluorescent lamp is a low-pressure gas discharge lamp that generates light predominately by phosphors excited by UV emissions. The fluorescent lamp spectra show broad band spectra with consist of a set of sharp emission lines at wavelength of 408, 436, 544, 574 and 611 nm as shown in figure 3(d). The red emissions are quite low.

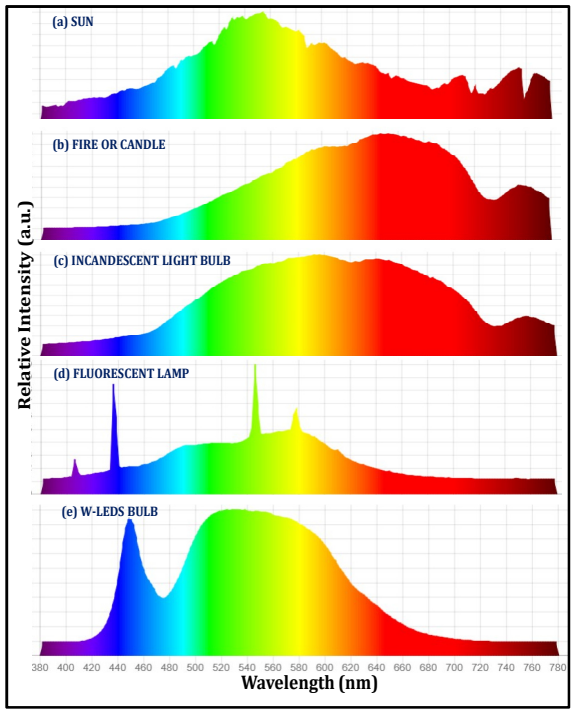

Figure 3 : Spectral characteristics of different light sources

Light emitting diodes (LED) - Spectra were acquired from LED lamps. These are solid state light sources that generate light by electroluminescence, moving electrons from a high energy state to a lower energy state on a semi-conductor substrate. The figure 3(e) shows two spectra from white LED bulb containing the primary emission at 420-460 nm and the phosphor induced secondary emission in the green to red. Second emission peak in W-LED spectrum is induced by a phosphor coating on LED which absorbs a portion of blue emission and reradiates at longer wavelengths.

Discrimination of lighting types

We compare the spectrum of various light sources such as sun light, fire, or candle, incandesce blub, fluorescent tube and LED as shown in the figure 4.

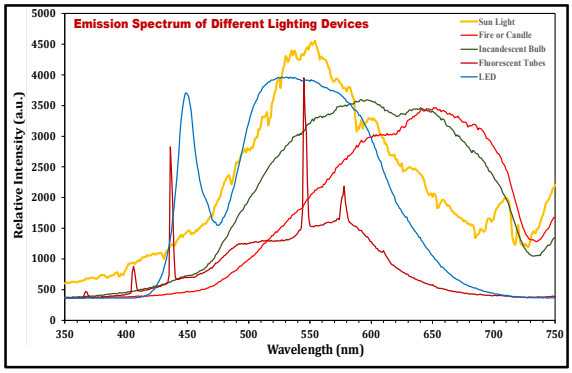

Figure 4 : Comparison of emission spectrum of different light sources

From the graph results in figure 4, the emission of blue light spectra is more in LED. The blue spectrum element of W-LED spectrum accounts for a larger amount, thus creating the blue light problem. In most of the countries LED widely used both indoors (lighting and display devices) and outdoors (streetlight, automobile headlights etc.). Figure 5 shows emission spectrum of different flat LED display (Cell Phones/Laptops Screen/TVs Screen).

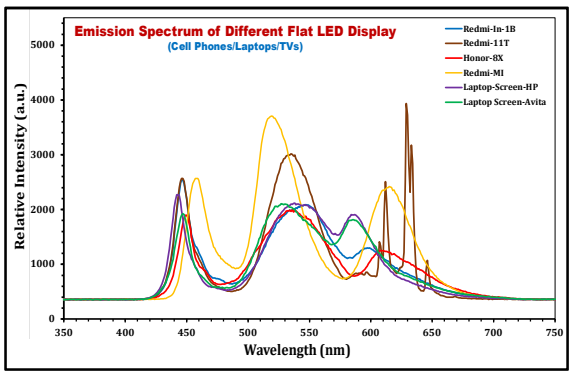

Figure 5 : Emission spectrum of different flat LED display/ screen

Many reports said that exposure to an intense and powerful (LED) light is 'photo-toxic' and can lead to irreversible loss of retinal cells and diminished sharpness of vision[6]. From literature survey, it is reported, blue light from light-emitting diodes elicits a dose-dependent suppression of melatonin in humans[3].

Conclusion

In fact, artificial lighting is an integral part of our everyday life. We spend an average of 10-12 hours under these lights. It was observed that as compared to the emission spectrum of other light sources, LED emits blue light most so it causes melatonin suppression due to which sleeping pills can occur. Also, white LEDs still suffer from a poor colour rendering index (CRI) due to comparatively low luminous intensity. It is, therefore, important that LED lights need the photobiological safety standards prescribed internationally. In fluorescent lamps, low-pressure mercury vapour is used and this mercury caused an adverse effect on human health. It is concluded that this lighting technology may have two alternatives, one is mercury-free fluorescent lamps in which we can use Xe discharge rather than Hg and other may be organic LED in which we can suppress the blue colour. The future will show if this developing technology will take market shares in the lighting field. We hope that their use will favour the design of new eco-friendly and health-friendly lighting technologies.

Acknowledgement

One of the authors is very thankful to the Department of Physics, Shri Shivaji Science College, Amravati for providing the facilities of mini spectrometer. Authors thank all those who helped in this work.

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Biodiesel Production from Waste Cooking Oil using Calcium Oxide (CaO) Nano-Catalyst

Ms. Aakanksha S. Dongare
M.Sc.-II (Chemistry), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

All over the world, fuel sources like petroleum, coal and natural gas based on fossil fuel are predominant sources of energy for a long time. The increasing demand of energy in the industrialized world and the domestic sector are causing environmental pollution problems because of widespread use of fossil fuels. In most of the developing countries waste cooking oil is simply dumped into the environment which causes serious environmental, social, economic and health problems to the society. Biodiesel production from waste cooking oil is environment friendly as it recycles waste cooking oil and gives renewable energy with lower pollution. In some recent years, heterogeneous catalysts have attracted great attention for their use in biodiesel production because these can be easily separated from the product, reused and are eco-friendly. Calcium oxide nanoparticles have a more basicity, non-corrosive and can be prepared with a low cost. Unlike other heterogeneous nano catalysts CaO nano-catalyst can be prepared without much effort and it only needs preparation and activation by calcination of the prepared catalyst.

In this century, the energy sources accessibility is the major challenge that is facing the mankind. There is continuous growth in the energy demand because of increasing population and the prosperity. Predominantly, human civilization depends on the utilization of energy and it plays a major role in the socio-economic progress. For the economic development of every country, energy is an important factor. Every sector of the economy such as agriculture, industry, transport and other commercial as well as domestic sectors needs energy.

All over the world, the fuel sources like petroleum, coal and natural gas that are based on fossil fuel are predominant sources of energy for a long time. About 81.1% of the world's energy requirement is supplied through petrochemical sources like coal, oil and natural gas. The other sources like nuclear, hydro, biofuels and various renewable energy systems account for only 18.9%.

The increasing demand of energy in the industrialized world and the domestic sector are causing environmental pollution problems because of widespread use of fossil fuels. Combustion of fossil fuels has number of public health risks as well as environmental issues that extend to the universal and potentially irreversible consequences on global warming. Due to this, the concerns related to environmental impacts are increased and triggered the search of other energy sources. The wind power, hydro power, solar energy, biomass, biofuels are the typical forms of renewable energy. The contribution of these resources is very much important because of economic and environmental impact. Biodiesel is one of the solutions to this problem. Biodiesel is an alternative to fuel diesel derived from the triglycerides of vegetable oils or animal fats. It can be produce from various vegetable oils using different types of catalysts.

In most of the developing countries waste cooking oil is simply dumped into the environment which causes serious environmental, social, economic and health problems to the society. Improper or poor waste cooking oil disposal into water bodies increases the level of organic pollutants in the water which significantly lowers the water quality and consequently affects the life of fish stocks, other aquatic living things and surrounding community.

Biodiesel production from waste cooking oil is environment friendly as it

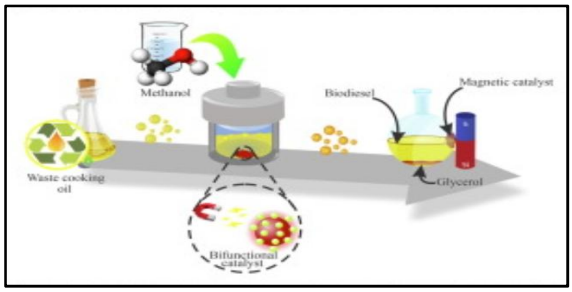
recycles waste cooking oil and gives renewable energy with lower pollution. It replaces some amount of petrochemical oil import and also lowers the cost of waste management. Biodiesel production from waste cooking oil has three solutions that are economic, environmental and waste management. In some recent years, heterogeneous catalysts have attracted great attention for their use in biodiesel production. The need for development of heterogeneous catalysts has increased because of the fact that homogeneous catalysts used for biodiesel production has some drawbacks that includes washing of products with water to remove catalyst from the products which results in waste water generation and loss of biodiesel as a result of washing, the use of intensive biodiesel separation protocol, the corrosive nature of the catalysts and impossibility of catalyst reuse. However, heterogeneous catalysts can be easily separated from the product, these can be reused and these are eco-friendly. Calcium oxide nanoparticles have a more basicity, non-corrosive and can be prepared with a low cost. These have lower solubility and easy to handle than homogenous catalysts. In addition, heterogeneous catalysts are being safe to the ecosystem and so it is an interesting choice for a catalyst. The production of biodiesel from waste cooking oil feedstock can be increased using the nanoparticles of calcium oxide (CaO).

CaO nano-catalyst synthesis

CaO nano-catalyst can be prepared by mixing 11.81 g of calcium nitrate [$Ca(NO_3)_2.4H_2O$] in 25 ml ethylene glycol solution and adding 2.10 g of sodium hydroxide with vigorous stirring for about 15 minutes. Keep this solution for about 5 hours at static state and wash with distilled water followed by vacuum drying. Finally, after calcination at 500^{0}C the CaO nano-particles of different sizes are obtained.

Waste cooking oil sample preparation

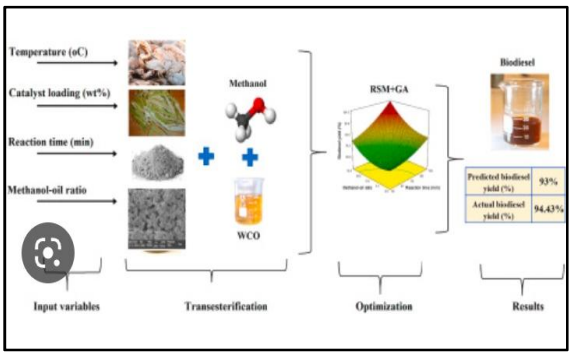
Collect the waste cooking oil which is used for food frying from restaurants or street fast food sellers. Allow to settle it for about 5 days at room temperature and pressure. Filter it by using the sieves of 100 nm hole size to remove any suspended food particles, inorganic residues and heat at 110 °C to remove the water.



Biodiesel production

Biodiesel can be produced from triglycerides in presence of alcohol through trans-esterification reaction by using the nano-sized calcium oxide nano-catalysts. Trans-esterification reaction can be carried out in a flask by placing it on a hot plate equipped with a controlled magnetic stirrer and temperature sensor. Waste cooking oil is pre-heated to the required temperature. The calculated amount of methanol to oil ratio is poured into the reaction flask and the CaO nano-catalyst is added in a range between 0.5 to 5% by weight with respect to mass of the waste cooking oil. Then the formed reaction mixture is mixed for 10 minutes, 100 ml of waste cooking oil is added and temperature of the mixture is set from 30 to 70^{0}C, 5^{0}C interval. Trans-esterification is done under continuous stirring of the reaction mixture for a desired duration. After the completion of reaction, the mixture is transfer into a separating funnel and allows standing overnight. Three phases are formed because of the solid catalyst and glycerol is denser than the biodiesel. The biodiesel is separated and heated above the boiling point of methanol (64.7^{0}C) to remove excess unreacted methanol. Suspended

solid catalysts are removed by settling it for two to three days.



Unlike other heterogeneous nano catalysts CaO nano-catalyst can be prepared without much effort and it only needs preparation and activation by calcination of the prepared catalyst. It is not expensive, environment friendly, easy to handle, low solubility in organic solvents with high basicity and reusability.

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Sensor Based Gas Leakage Detector System Catalyst

Ms. Samiksha S. Dongare
M.Sc.-II (Chemistry), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

The gas leakage is a serious problem and it is observed in various places like residences, industries and vehicles like CNG buses, cars etc. Due to the gas leakage, dangerous accidents occur. LPG is highly inflammable and can burn even at some distance from the source of leakage. An odorant like ethane thiol is added to LPG, so that leaks can be detected easily by most people. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. A gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage. An MQ-6 semiconductor sensor can be used to detect LPG gas leakage. Sensitive material of the MQ-6 gas sensor is SnO_2, which has lower conductivity in clean air.

Now a day's gas leakage is a serious problem and it is observed in various places like residences, industries and vehicles like CNG buses, cars etc. It is observed that due to the gas leakage, dangerous accidents occur.

The LPG or propane is a most flammable mixture of hydrocarbon gases used as fuel in homes, hostels, industries, automobiles, vehicles etc. because of its desirable properties that includes high calorific value, less smoke, less soot and meager harm to the environment. LPG is highly inflammable and can burn even at some distance from the source of leakage. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. These gases can catch fire easily. In homes, LPG is used mainly for cooking purposes and when a leakage occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and the threat to human lives and properties has been growing in recent years. The risks of explosion, fire, suffocation are based on their physical properties like toxicity, flammability etc. In recent years, number of deaths due to the explosion of gas cylinders has been increasing. The Bhopal gas tragedy is an example of accidents because of gas leakage. The reason for such explosions is because of the use of substandard cylinders, old valves, no regular checking of gas cylinders, worn out regulators and a lack of awareness of handling gas cylinders. So, the gas leakage should be detected and controlled to protect people from danger. An odorant like ethane thiol is added to LPG, so that leaks can be detected easily by most people. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. A gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage.

An MQ-6 semiconductor sensor can be used to detect LPG gas leakage. Sensitive material of the MQ-6 gas sensor is SnO_2, which has lower conductivity in clean air. When the target combustible gas exists, the sensor conductivity increases along with the rising gas concentration. The MQ-6 gas sensor has a high sensitivity to propane, butane, LPG and response to natural gas. The sensor could be used to detect different combustible gases, especially methane. It has a low cost and is suitable for different applications. An MQ-6 can detect gas concentrations anywhere from 200 to 10,000 ppm. The sensor's output is an analog resistance. The system is based on the Arduino UNO-R3 and MQ-6 gas sensor detects gas in the atmosphere, it gives digital output 1 and if gas is not

detected the sensor gives digital output 0. Arduino receives the sensor output as digital input. If the sensor output is high, then the buzzer starts tuning along with the LCD that shows “Gas detected: Yes”. If the sensor output is low then the buzzer is not tuning and the LCD shows “Gas detected: No”. The buzzer has number of switches or sensors connected to control unit that determines which button was pushed or whether preset time has lapsed and usually illuminates a light on the appreciate button or control panel and sounds a warning in the form of a continuous beeping sound.

The sensor based automatic gas leakage detector is a low-cost, low power, light weight, portable, safe, user friendly, efficient, multi featured and simple.

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Wolbachia Bacteria's Genetic Manipulation for Curbing Human Diseases

Ms. Aarti A. Nakat
B.Sc.-III (Batch-B2), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Wolbachia **are the common intracellular, gram negative bacteria that are found in arthropods and nematodes. The** ***Wolbachia pipientis*** **was first described nearly a century ago as a Rickettsia-like organism in the gonads of various insects. These endosymbionts are transmitted vertically through host eggs and alter host biology in diverse ways, including reproductive manipulations, such as feminization, parthenogenesis, male killing and sperm-egg incompatibility.** ***Wolbachia*** **can be used for curbing human diseases by population replacement strategy, incompatible insect technique, genetic manipulation etc.**

The *Wolbachia pipientis* was first described nearly a century ago as a Rickettsia-like organism in the gonads of various insects including culex mosquitoes. These are gram-negative bacterial symbionts, which are transmitted vertically through maternal lineage. Estimated to be present in up to 66% of insect species, the *Wolbachia* are probably most abundant endosymbionts on earth.

Wolbachia phenotypes

A. Cytoplasmic incompatibility (CI) - Most common *Wolbachia* induced reproductive phenotype in arthropods (mosquitoes) is CI. It is of two types i.e. Unidirectional CI and Bidirectional CI. In Unidirectional CI, when there is cross between an infected male and uninfected female, the embryo does not survive. In Bidirectional CI, when male and female mosquitoes harbouring reciprocally, incompatible *Wolbachia* strains cross it, results in embryonic death.

B. Male killing - It is a form of reproductive parasitism in which *Wolbachia* selectively kill the developing, infected male, resulting in female based sex ratios in mosquitoes. WO-mediated killing gene expression is responsible for the male embryo death.

C. Parthenogenesis - *Wolbachia* infected females produce all female offspring from their unfertilised eggs instead of males.

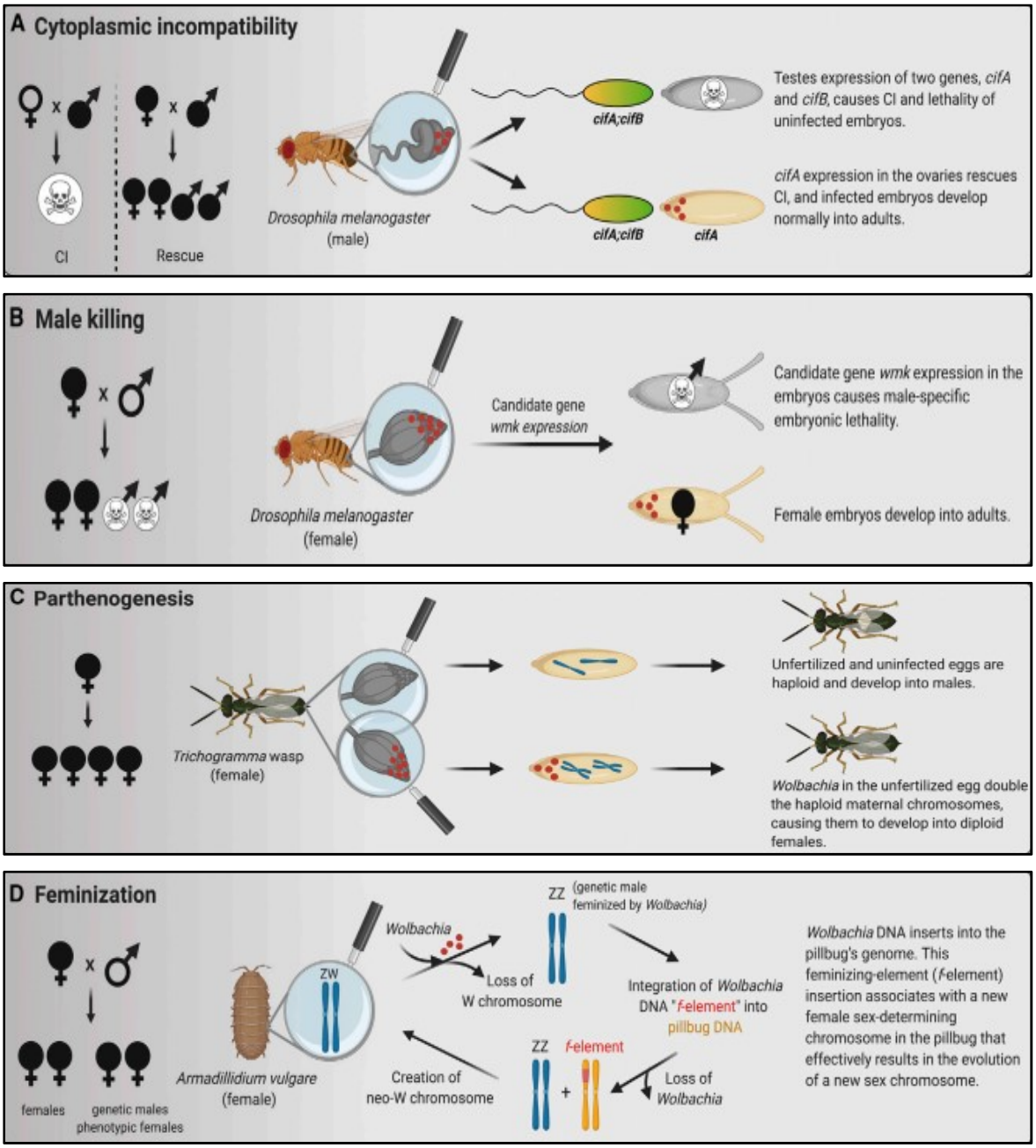
D. Feminization - In this modification, genetic males morphologically develope into females.

E. Pathogen Resistance - In mosquitoes, *Wolbachia* can limit replication of virus in various somatic tissues such as midgut and salivary glands, making them less capable of transmitting infection to humans. *Wolbachia* also form resistance against bacteria, filarial nematodes and malaria parasite *Plasmodium*, providing a broad range of pathogen protection. At cellular and molecular levels, *Wolbachia* can induce viral blocking by inhibiting viral binding, entry into the cell and RNA replication in early stages. Such blocking reduces production of virus progenies and thus limits transmission.

Applications of *Wolbachia* for curbing human diseases

A. Population replacement strategy - The population replacement strategy commences with release of both male and female mosquitoes where CI-inducing *Wolbachia* spread throughout uninfected target populations, thus replacing the native species with pathogen-resistant, *Wolbachia*-infected mosquitoes that are no longer capable of transmitting disease.

B. Incompatible insect technique - The incompatible insect technique entails release of CI-causing *Wolbachia* infected male mosquitoes that do not produce viable embryos after mating with wild type uninfected females, thus reducing the total number of disease transmitting mosquitoes in natural populations.



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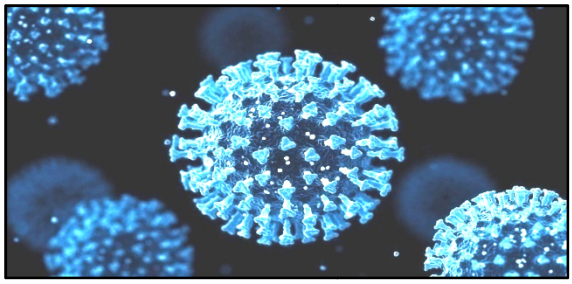
Molecular Archeology of Ancient DNA and Modern Virology

Ms. Sakshi R. Mishra
B.Sc.-II (Batch-B3), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Viruses are the smallest living organisms composed of only one nucleic acid either DNA or RNA ranging from 20 nm to 300 nm in size. The evolution of human-virus associations is usually reconstructed from contemporary patterns of genomic diversity. An intriguing, though still rarely implemented, alternative is to search for the genetic material of viruses in archeological and medical archive specimens to document evolution as it happened. Viruses are responsible for number of human diseases, ranging from the common cold to the highly fatal rabies or AIDS. They may be sporadic like mumps, infectious like hepatitis, epidemic like dengue fever or pandemic like influenza and the recent corona virus.

Viruses do not fall strictly into the category of unicellular microorganism as they do not possess cellular organization. They are the smallest living organisms barring prions and are composed of only one nucleic acid either DNA or RNA. They have ultramicroscopic structure with sizes ranging from 20 nm to 300 nm. Some of their defining characters are -

- They do not have cellular organization.
- They contain only one type of nucleic acid, either DNA or RNA, but never both.
- They are obligate intracellular parasites.
- They lack the enzymes necessary for protein and nucleic acid synthesis and are dependent for replication on the synthetic machinery of host cells.
- They multiply by complex process and are not by binary fission.
- They are generally unaffected by antibacterial antibiotics.



The main differences between viruses and other microorganisms are as presented below in the table.

Microorganisms	Organized Cell	Growth in Artificial Media	Binary Fission	DNA / RNA	Ribosomes	Antibiotics Sensitivity	Interferon Sensitivity
Viruses	–	–	–	–	–	–	+
Bacteria	+	+	+	+	+	+	–
Mycoplasma	+	+	+	+	+	+	–
Rickettsia	+	+	+	++	+	+	–
Chlamydia	+	–	+	+	+	+	+

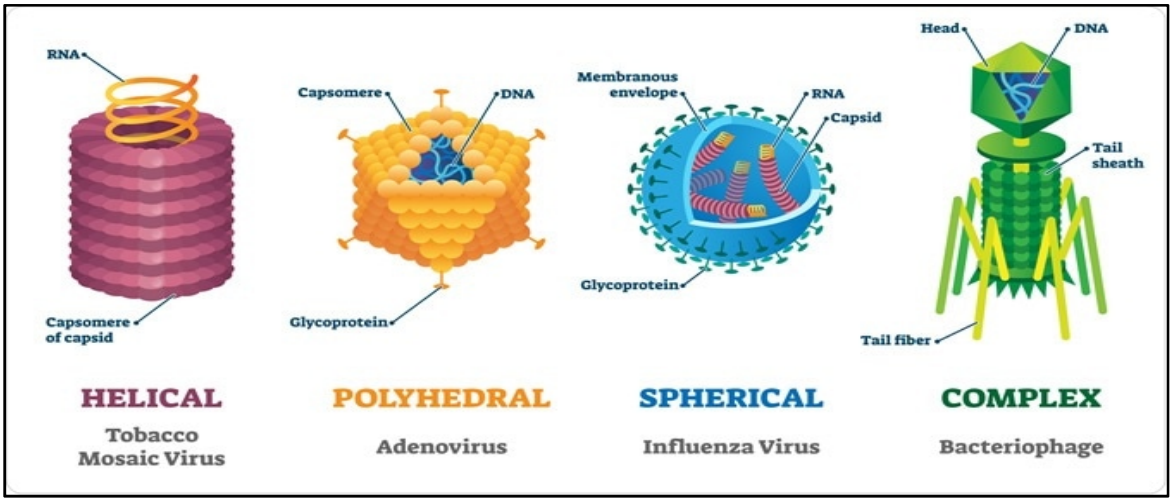
Viruses are responsible for large number of human diseases, ranging from the common cold to the highly fatal rabies or AIDS. They may be sporadic like mumps, infectious like hepatitis, epidemic like dengue fever or pandemic like influenza and the recent corona virus. They may be geographically localized (arbovirus diseases) or may occur worldwide (like influenza). They have been associated syndromes (e.g. diabetes with Coxsackievirus B).

Size

The extracellular infectious virus particle is called as virion. Viruses are much smaller than bacteria - too small to be seen under the light microscope (hence called as ultra-microscopic) and only seen under the electron microscope. Some large viruses,

such as poxvirus, can be seen under light microscope when suitably stained. Viruses vary widely in size. The largest (poxvirus) measures about 300 nm and is as large as smallest bacteria (mycoplasma). The smallest viruses (e.g. parvovirus) measures about 20 nm. The electron microscopy is used to estimate the size of virus particles.

Structure



Capsid

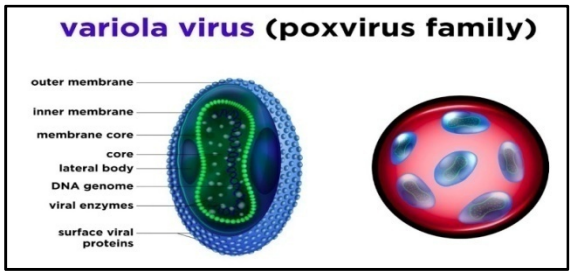
The virion consists essentially of a nucleic acid surrounded by a protein coat, the capsid. The capsid with the enclosed nucleic acid is known as the nucleocapsid. The capsid is composed of a large number of capsomers which form its morphological units. Capsids are polypeptide molecules arranged symmetrically to form an impenetrable shell around the nucleic acid core. One of the main functions of capsid is to introduce the viral genome into the host cells by adsorbing readily to cell surfaces.

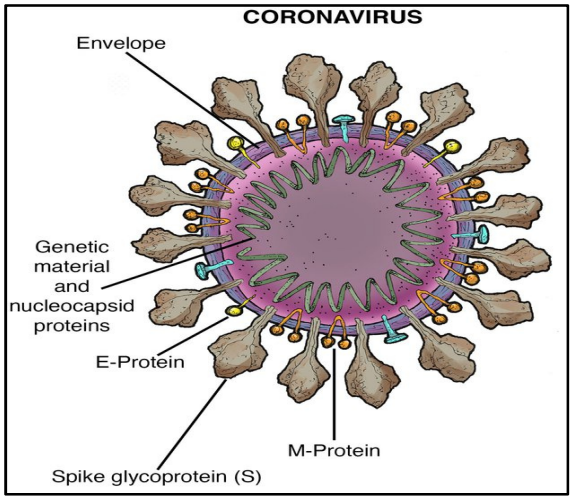
Three kinds of symmetry are seen in the capsid.

1. Icosahedral (cubical) - An icosahedron is a polygon with 12 vertices or corners and 20 facets or sides. Each facet is in the shape of an equilateral triangle. Two types of capsomers constitute the icosahedral capsid - the pentagonal capsomers at the vertices (pentons) and the hexagonal capsomers making up the facets (hexons). There are always 12 pentons but number of hexons varies with the virus group.

2. Helical in nucleocapsids with helical symmetry - The capsomers and the nucleic acid are wound together to form a helical or spiral tube. In some like the tobacco mosaic virus, the tube may be rigid; in animal viruses, the tubular nucleocapsid is pliable and may be coiled on itself. Not all viruses show the typical icosahedral or helical symmetry.

3. Complex - Some viruses like poxvirus, exhibit complex symmetry.





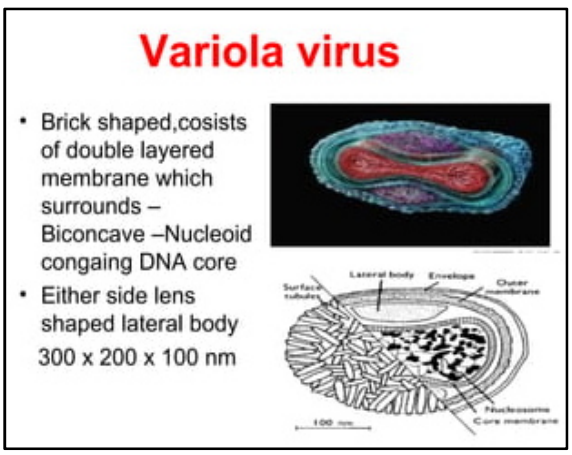
Envelope

Virions may be the enveloped or non-enveloped (naked). The envelope or outer covering is derived from the host cell membrane when the progeny virus is released by budding. The envelope is made of lipoprotein the lipid is largely of host cell origin while the protein is virus-coded. Protein subunits may be seen as projecting spikes on the surface of the envelope. These structures are called peplomeres *(from peplos, meaning 'envelope')*. A virus may have more than one type of peplomer. The influenza virus carries two kinds of peplomers - the hemagglutinin, which is a triangular spike and the neuraminidase, which is a mushroom-shaped structure.

Envelopes confer the chemical, antigenic and biological properties of viruses. Enveloped viruses are susceptible to the action of lipid solvents like ether, chloroform and bile salts. Specific neutralization of virus infectively depends on antibodies to the surface antigens. Biological properties such as attachment to the host cell surface or hemagglutination depends on the envelope.

Shape

Shape varies among different groups of viruses. Viruses are roughly spherical. Some are irregular and pleomorphic. The rabies virus is bullet-shaped, Ebola virus and hepatitis viruses, filamentous and poxviruses, brick-shaped, tobacco mosaic virus is rod-shaped.



Viral components

Viruses contain only one type of nucleic acid, either single or double stranded DNA or RNA. In this respect, viruses are unique, for nowhere else in nature is genetic information solely carried by RNA. Viral nucleic acids may be extracted by treatment with detergents or phenols. An extracted picornavirus and papovavirus nucleic acid is infectious to host cells.

Protein - Viruses also contain proteins which make up the capsid. Viral protein, besides protecting the nucleic acid also determines antigenic specificity of virus.

Lipids - Enveloped viruses contain lipids derived from the host cell membrane.

Other - Some viruses also contain small amounts of carbohydrates. Most viruses do not possess any enzymes for the synthesis of viral components or for energy production; some have other enzymes, for examples, neuraminidase in the influenza virus. Retroviruses have a unique enzyme, RNA dependent DNA polymerase or 'transcriptase' which can transcribe RNA into DNA.

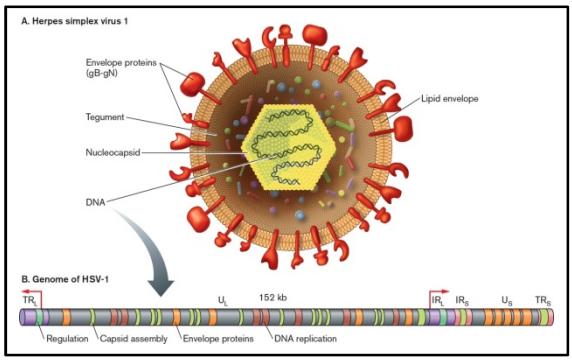
Molecular archeology of human virus

Bearing in mind the characteristics of a DNA or RNA, here are the evidence from virology that may inform predictions about when the genetic material of viruses may be detectable in ancient remains. Viruses represent an extremely diverse group of organisms that only share a small set of features that may influence the relative detectability of their genomic material in comparison to the detectability of their host's genomic material. At minimum, virus particles consist of a nucleic acid genome surrounded by a layer of proteins, the capsid. It is theoretically conceivable that similar to the protective properties of the thick wall of some bacteria (e.g. Mycobacterium leprae), capsids might have a protective effect on viral genomes.

While such protection might improve the detectability of viral genomes in ancient samples, a much less favorable characteristic is that viral genomes are generally extremely small when compared to their host. The human cytomegalovirus (Human betaherpesvirus 5) and the human corona virus OC43 (Betacoronavirus-1) represent the human infecting viruses with the largest DNA and RNA genomes (235 kb dsDNA genome for the former and 30 kb RNA + genome for the latter) but these are still much smaller than smallest genome found in human-infecting bacterium (Mycoplasma genitalium, 580 kb) or, of course, the human (diploid) genome (6 gb). Accordingly, it is predicted that viral genetic material will be the most diluted component of the diverse metagenomic material extracted from ancient specimens. Although this can be partially compensated by high replication levels (see below) and the ability to sequence deeply, shotgun sequencing of metagenomes from healthy and diseased patients suggest that this dilution will almost always be extreme. For example, RNA sequencing of blood from patients infected with Lassa virus (LASV) that causes hemorrhagic fevers and can reach high viremia, revealed that median fraction of LASV reads was 0.0003%.

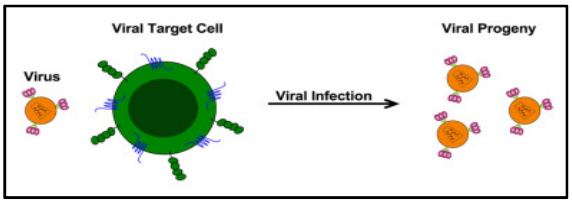
Viruses are polyphyletic and have considerably diversified during their complex evolution, arguably making them the most diverse biological entities on Earth. Aspects of this diversity are likely to influence the relative detectability of the genetic material of different groups of viruses. Contrary to cells that universally use double stranded DNA as genetic material (whether eukaryotic, bacterial or archeal), viruses have explored all DNA and RNA based options to build up their genomes, and those equipped with a reverse transcriptase even exist as proviruses integrated to their host cell genomes. If DNA is more stable than RNA and double stranded molecules are more stable than single stranded ones, the ability to recover ancient viral genetic material should partially reflect the nature of their genomes (and therefore be predicted by the famous Baltimore classification).

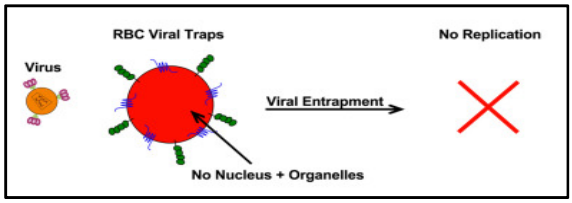
Viruses have also evolved varied interactions with their hosts. Some viruses establish transient infections causing acute diseases (e.g. respiratory viruses), while others can persist in their hosts and cause chronic or latent infections (e.g. herpes viruses). Often, this results in distinct dynamics of infection at the population level, with the former circulating in an epidemic manner, which is usually not true of the latter. This in turn means that, in a given population, viruses causing acute diseases will only reach high prevalence over short period of time. In contrast, many viruses causing persistent infections are found at a stable, relatively high prevalence, e.g. two-thirds and one-tenth of adults worldwide are infected with herpes simplex virus type 1 and 2, respectively. Such viruses might be more easily detected from the relatively small sample, sets typical of a DNA studies.

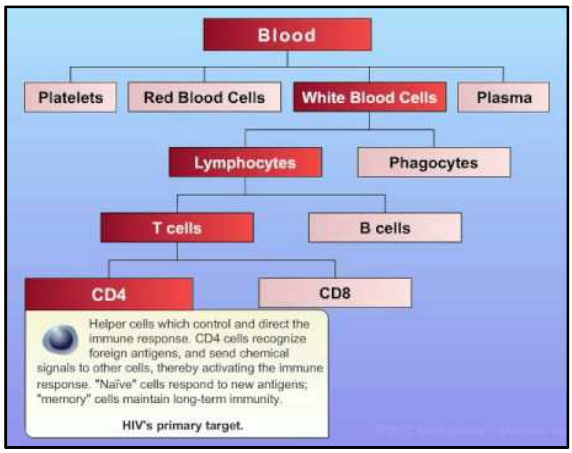


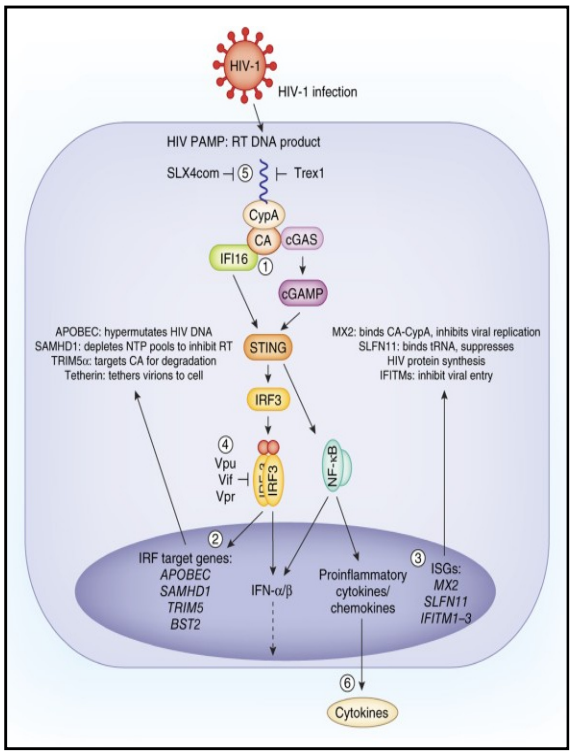
Tissue tropism and replicative activity will also influence the relative detectability of particular viruses. Specific viruses may preferentially replicate in particular tissues, and if they are preserved, these tissues may be more likely to allow for viral detection. The typical (but by no way unique; see below) substrate of a DNA analyses is the bone and this tissue is not very frequently targeted by viruses (but parvovirus B19 which targets red

blood cell progenitors in the bone marrow). Yet, all bones are vascularized and many viruses can be detected in the blood stream of their hosts. Therefore, this particular tissue is already likely amenable to the detection of many viruses. There is a huge variability in the level of replication across viruses, including those sharing similar tropism. For example, hematotropic viruses cover a range that goes from nearly no replication (e.g. human T-cell leukemia viruses which integrate into their host cell genomes and then almost only expand clonally with it to intense replication leading to extremely high viremia). Such differences in viremia across viruses will likely have important effects on their relative detectability in ancient materials. These factors are not independent of one another. For example, only DNA viruses have evolved genomes larger than 30 kb. Similarly, viruses that establish persistent infections (and therefore often reach a high prevalence in a population) tend to exhibit low replication levels. This suggests that guessing which viruses can be detected by means of archeovirology will be a very uncertain game. Expectations are that the best strategy to address the question of the feasibility of the detection of specific viruses in ancient remains will always be to give it a try. To date, this has only been done in earnest for a few human-infecting viruses. They will help us to better delineate shape of archeovirology as it has recently developed.









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The Plastic Eaters - Strains of Bacteria

Ms. Juvairiya Sadiya Nasir Khan
B.Sc.-III (Batch-B3), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

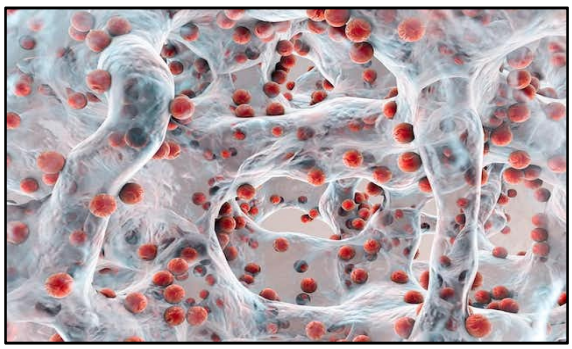
Plastic pollution leads to severe impact on marine ecosystems and can affect human health. Scientists recently discovered a strain of bacteria that can literally eat the plastic used to make bottles and have now improved it to make it work faster. Scientists from Japan tested different bacteria from a bottle recycling plant and found that *Ideonellasakaiensis* 201-F6 could digest the plastic used to make single use drinks bottles, polyethylene terephthalate (PET). It works by secreting an enzyme, a type of protein that can speed up chemical reactions, known as PETase. This splits certain chemical bonds i.e. esters in PET, leaving smaller molecules that the bacteria can absorb, using the carbon in them as a food source. Researchers at the University of Portsmouth have re-engineered PETase to create an enzyme "cocktail" that they say can digest plastic up to six times faster than normal. The scientists combine PETase with another plastic eating enzyme called MHETase to form one super enzyme.

Plastic eating bacteria could help to one day tackle some of the 14 million tons of plastic that is offloaded into our oceans every year. Plastic pollution leads to severe impact on marine ecosystems and can affect human health. According to the International Union for Conservation of Nature (IUCN), once plastic enters ocean it can suffocate and entangle the animals.

Microplastics are also ingested by many marine species that are both preyed upon by other species and that we catch for food. As per the IUCN, once microplastics ingested, it can leach the toxic contaminants that have collected on their surface into the body of the organism that has consumed it.

Those toxins can accumulate and transfer up the food chain from marine life into humans, whenever we eat something that has been taken from the sea. On land, the majority of plastic ends up either building up in landfills or burnt into incinerators, which releases toxic fumes. As per the BBC, just 16% of all plastic produced is recycled to make new plastic.

The plastic bottles we throw away today will be around for hundreds of years. It's one of the key reasons why the mounting plastic pollution problem, which is having a deadly effect on marine life, is so serious.

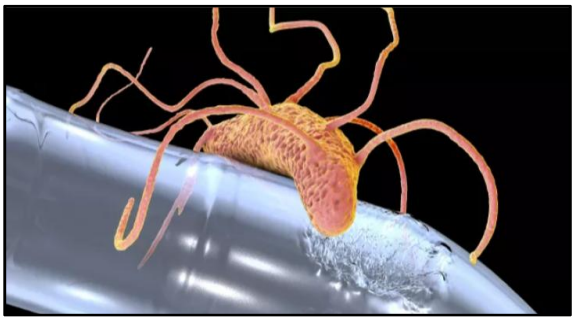


Scientists recently discovered a strain of bacteria that can literally eat the plastic used to make bottles and have now improved it to make it work faster. The effects are modest, it's not a complete solution to plastic pollution, but it does show how bacteria could help create more environmentally friendly recycling.

Plastics are complex polymers, meaning they are long, repeating chains of molecules that don't dissolve in water. The strength of these chains makes plastic very durable and means it takes a very long time to decompose naturally. If they could be broken down into their smaller, soluble chemical units, then these building blocks could be harvested and recycled to form new plastics in a closed loop system.

The scientists from Japan tested different bacteria from a bottle recycling plant and found that *Ideonellasakaiensis* 201-F6 could digest plastic used to make single use drinks bottles, polyethylene

terephthalate (PET). It works by secreting an enzyme, a type of protein that can speed up chemical reactions, known as PETase. This splits certain chemical bonds i.e. esters in PET, leaving smaller molecules that the bacteria can absorb, using the carbon in them as a food source.



Although other bacterial enzymes were already known to slowly digest PET, the new enzyme had apparently evolved specifically for this job. This suggests it might be faster and more efficient and so have the potential for use in bio-recycling.

Herein, the part of the PETase protein, that performs the chemical digestion is physically tailored to bind to PET surfaces and works at 30°C, making it suitable for recycling in bio-reactors. It is also observed that, by subtly changing the enzyme's chemical properties, so it interacted with PET differently, can work more quickly than the natural PETase.

Using enzymes from bacteria in the bio-reactors to break down plastic for recycling is still easier. The physical properties of plastics make them very difficult for enzymes to interact with.

The PET used in drinks bottles has a semi-crystalline structure, which means the plastic molecules are tightly packed and difficult for the enzyme to get to. The latest study shows that the enhanced enzyme probably worked well because the part of the molecule that is involved in the reaction is very accessible, making it easy for the enzyme to attack even the buried PET molecules.

Following the discovery of plastic eating bacteria, many genetic scientists have experimented with the bacterial species *Ideonellasakaiensis* to improve its efficiency. One such research venture has been to genetically engineer bacteria that are more efficient at enzyme production like the *E. coli* and turn them into the PETase factories.

Although the discovery offers hope in fight against mounting plastic, scientists caution that we are still years away from widespread commercial use. Similarly, PETase only decomposes PET plastic. There are six other plastic types that we are still unable to degrade using enzymes.

Researchers at the University of Portsmouth have re-engineered PETase to create an enzyme "cocktail" that they say can digest plastic up to six times faster than normal. The scientists combine PETase with another plastic eating enzyme called MHETase to form one super enzyme (Proceedings of the National Academy of Sciences, United States of America).

The combined PETase-MHETase enzyme was created with a synchrotron, a type of particle accelerator that uses x-rays 10 billion times brighter than the sun, according to the University of Portsmouth. It enabled researchers to see the individual atoms of each enzyme and draw their molecular blueprints.

Scientists then stitched their DNA together to form a super enzyme. This enzyme can also break down Polyethylene furanoate (PEF), a sugar-based bioplastic.

Researchers at the University of Edinburgh have been using *E. coli* bacteria to convert plastic into vanillin, the primary component of vanilla bean extract. As the global demand for vanillin exceeded and 85% of it is made from chemicals taken from fossil fuels, using plastic could be an eco-friendly alternative situation.

After degrading PET plastic into its basic monomers, researchers took the process one step further and converted one of those monomers, terephthalic acid into vanillin through a series of chemical reactions. The resulting vanillin is believed to be fit for human consumption, though some further investigation is needed.

Modest improvements

The improvements to PETase activity were not dramatic and we are nowhere near a solution to our plastic crisis. But it helps us understand how this promising enzyme breaks down PET and hints at how we could make it work faster by manipulating its active parts.

It is relatively unusual to be able to engineer enzymes to work better than they have evolved through nature. Perhaps this achievement reflects the fact that the bacteria that use PETase are only recently evolved to survive on this man-made plastic. This could give scientists an exciting opportunity to overtake evolution by engineering optimised forms of PETase.

There is one worry, though. While any modified bacteria used in bioreactors are likely to be highly controlled, the fact that it evolved to degrade and consume plastic in the first place suggests this material we rely on so heavily may not be as durable as we thought.

If more bacteria began eating plastic in the wild then products and structures designed to last many years could come under threat. The plastics industry would face the serious challenge of preventing its products becoming contaminated with hungry micro-organisms.

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The Climate Change and Human Role

Ms. Rutuja S. Badhe
B.Sc.-III (Batch-B5), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

The climate change is becoming the major issue. Climate change is basically the change in climate by some reason or human cause like burning fossil fuels, deforestation, industrialization etc. The greenhouse gas effect, global warming also changes the climatic conditions naturally but cause indirectly by humans. The natural causes such as effect of El-Nino, La-Nina and ozone layer depletion are also the reasons. To save the planet earth, its solution is very much important.

Climate is the weather conditions of particular region from year and year. Some regions are known by their weather which changes with time but the definite weather which that place have is the climate. This is static in terms of temperature, rain and drought. For example, India is known for monsoon as have monsoon type of climate. The five major types of climate are tropical, dry, temperate, cold and polar.

Climate change

Climate change is the change in static weather type of some region. It is long term shift in temperature and weather patterns in any particular region. Change in seasons, rainy days, drought occurrence, flood, desertification are some causes because of which there is change in climate. It adversely affects the living being and can cause harm in future. For the sustainable development we have to look after this issue.

There are so many reasons for climate change, some cause by the human being like burning of fossil fuels, deforestation, industrialization etc. and it gives rise to natural calamities such as green house effect, global warming. Also change in sun's energy and volcanic eruption are the reasons of climate change.

Major reasons for climate change

- **Burning of fossil fuels -** Fossil fuels are made from the remaining dead material of decompose plants and animals. These contain gases like hydrogen and carbon. By burning this we can produce energy, coal, oil and natural gas. When these fossil fuels are burned they emit gases which are harmful for human being as well as for the environment. These are the gases like carbondioxide, nitrogen, CFC's. It causes air pollution which affects our health and generates toxic emission.

The gases emit from cars and trucks are also the harmful gases. Large industrial operation, also the gases emit from ships, airplanes plays an important role in greenhouse effect and climate change.

The gases carbondioxide, nitrogen are the major gases which traps the replicating heat of earth's surface in atmosphere and lead to increase in temperature of earth surface. This is nothing but the greenhouse gas effect, which causes global warming and drives to climate change.

- **Greenhouse gases and global warming** - The gases that emit out from the industries or burning fossil fuels such as carbondioxide, nitrogen, methane, CFC's are the examples of greenhouse gases. Some of the UV rays that come to earth's surface are get absorbed by the surface and some get reflected back out of atmosphere. But because of greenhouse gases present in atmosphere that reflecting rays get trapped in atmosphere and 30% to 40% comes back to earth which causes heating of earth surfaces and increases the temperature of earth. It is global warming which definitely lead to climate change**.**

Possible solution on fossil fuel burning

Fossil fuel burning is carried out for producing energy or electricity, which is necessity of daily life. So we cannot stop or cut out this activity but can reduce this by following things.

At macro level -

- Using hydroelectric plant i.e. generating energy through water harvesting
- By using renewable energy
- Increasing energy efficiency
- Reducing emission by making annual plan and setting targets for burning
- Minimizing the use of fossil fuels in industries with some government laws

At micro level -

- Reducing use of vehicles
- Less use of electricity
- Switching off the electric equipments like fan, light etc. after use
- Limited use of air conditioner
- Using new models of equipments like heater, refrigerator, AC with less energy requirement

Climate change due to deforestation

In different causes, deforestation is the one reason. People cut down trees, clean the forest cover for their purposes like making furniture, for doing agriculture and also involve in conversion of forest to land, farm or urban use and industries.

As the tress are cut down from forest, the capacity of carbon holding by trees get reduce and the carbon get back to atmosphere, which causes the global warming definitely leads to climate change. Also, as the forest cuts down the water holding capacity of soil is reduced and erosion occurs, because of which flood water does not get absorbed and there is reduction in ground water level. The solutions for this are tree plantation, control on illegal cuttings in forest regions, 3R's - reduce, recycle, reuse product coming from forest, sustainable forest management, awareness on importance of forest, controlling forest fires.

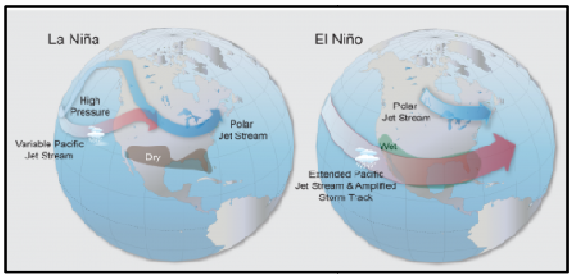
Urbanization and industrialization

As India is a developing country, urbanization and industrialization are the two fast growing sectors. Urbanization leads to industrialization as the demand of goods and infrastructure increases.

Growing Industries lead to emission of greenhouse gases from industries, so this is reason of climate change. Urbanization means increase in urban areas, increase in vehicles using fossil fuels like oil, petrol, and diesel which causes greenhouse effect and leads to climate change. The solutions are building sustainable cities, population control, source control, recycling, industry site selection, rebuilding habitats and forestation, rebuilding old buildings with more flats.

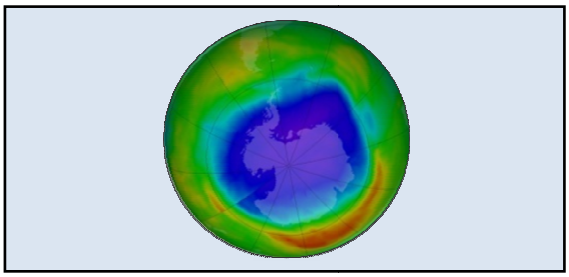
El-Nino and La-Nina

These are the deflections in Pacific Ocean. This effect makes changes in temperature of Pacific Ocean. In El-Nino, water of pacific becomes warm whereas in La-Nina water becomes cold. Due these deflections the winds blowing on ocean get reverse or there directions changes, therefore the nearby continent get change in there climate. As wind changes rains occurs or rain does not occur at all.



Ozone layer depletion

The gases coming from industries are the green house gases which make harmful effect on ozone layer; it is like the blanket of earth which protects us from UV radiation. It affects the human and also animals and trees. It stops the growth of trees which leads to change in climate.



We can change the things which are in our hand to make a sustainable development and leave this earth as beautiful as it is today for next generation.

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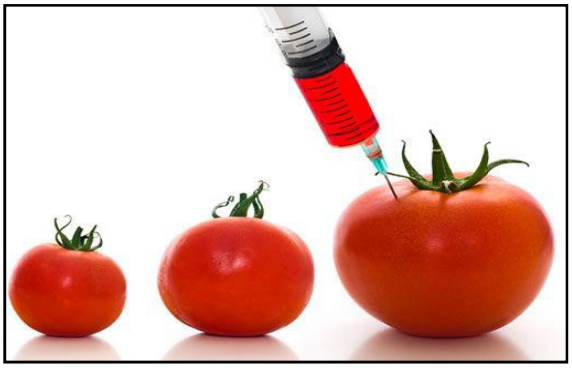
Genetically Modified Food

Ms. Chaitali M. Lanjudkar
B.Sc.-II (Batch-B2), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

The genetically modified foods are foods produced from organisms that have had changes introduced into their DNA using the methods of genetic engineering as opposed to traditional cross breeding. According to World Health Organization (WHO), "foods produced from or using GM organisms are often referred to as GM foods". Advantages of genetically modified foods are food supplies become predictable, nutritional content can be improved, genetically modified foods are easier to transport whereas disadvantages are genetically modified organism crops may cause antibiotic resistance, some genetically modified foods may present a carcinogen exposure risk, farmers growing genetically modified foods have a greater legal liability. Some examples of genetically modified foods in use are golden rice, potato, tomato etc.

A genetically modified food is made with a genetically modified organism (GMO) or living thing. A GMO is an animal, plant or microorganism. The genetically modified foods are foods produced from organisms that have had changes introduced into their DNA using the methods of genetic engineering as opposed to traditional cross breeding. In the US, Department of Agriculture (USDA) and Food and Drug Administration (FDA) favour the use of term genetic engineering over genetic modification as being more precise. USDA defines genetic modification to include "genetic engineering or other more traditional methods". According to World Health Organization (WHO), "foods produced from or using GM organisms are often referred to as GM foods".



Advantages of genetically modified foods

1. Food supplies become predictable - When crop yields become predictable, then the food supply becomes predictable at the same time. This gives us the ability to reduce the presence of food deserts around the world, providing a greater population with a well-rounded nutritional opportunity that may not have existed in the past.

2. Nutritional content can be improved - Genetic modifications do more than add pest resistance or weather resistance to GMO crops. The nutritional content of the crops can be altered as well, providing a denser nutritional profile than what previous generations were able to enjoy. This means people in the future could gain the same nutrition from lower levels of food consumption. The UN Food and Agricultural Organization (FAO) notes that rice, genetically modified to produce high levels of Vitamin A, have helped to reduce global vitamin deficiencies.

3. Genetically modified foods are easier to transport - Because GMO crops have a prolonged shelf life, it is easier to transport them greater distances. This improvement makes it possible to take excess food products from one community and deliver it to another that may be experiencing a food shortage. GMO foods give us the opportunity to limit food waste, especially in the developing world, so that hunger can be reduced and potentially eliminated.

Disadvantages of genetically modified foods

1. GMO crops may cause antibiotic resistance - Iowa State University research

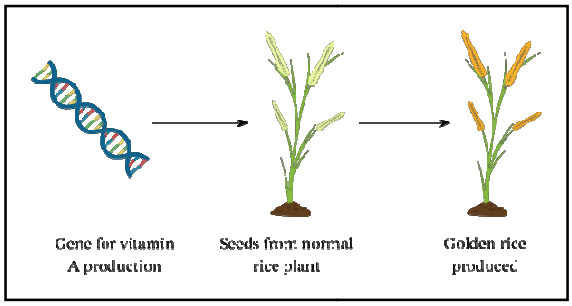
shows that, when crops are modified to include antibiotics and other items that kill germs and pests, it reduces the effectiveness of an antibiotic or other medication when it is needed in the traditional sense. Because the foods contain trace amounts of the antibiotic when consumed, any organisms that would be affected by a prescription antibiotic have built an immunity to it, which can cause an illness to be more difficult to cure.

2. Some genetically modified foods may present a carcinogen exposure risk - A paper that has been twice-published, but retracted once as well showed that crops tolerant to commercial pesticides greatly increased the risk of cancer development in rats. The information from this research study, though limited, has been widely circulated and creates the impression that all GMO foods are potentially hazardous.

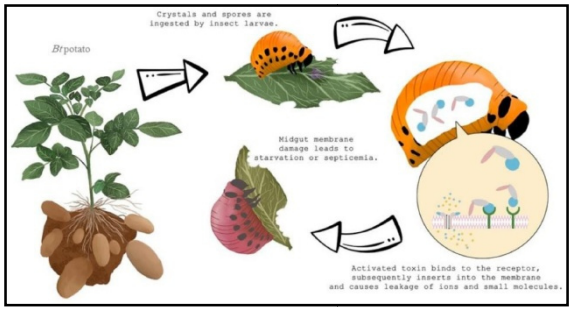
3. Farmers growing genetically modified foods have a greater legal liability - Crops that are genetically modified will create the seeds that are genetically modified. The cross-pollination is possible between GMO crops and non-GMO crops as well, even when specified farming practices are followed. Because many of the crops and the seeds that produce GMO crops are patented, farmers that aren't even involved in growing these foods are subjected to a higher level of legal liability. Farmers that do grow GMO crops could also face liabilities for letting seeds go to other fields or allowing cross-pollination to occur.

Genetically modified foods

1. Golden rice - Golden rice is developed through genetic engineering. While ordinary rice does produce beta carotene, it is not found in the grain. Thus, scientists used genetic engineering to add the compound to the grain - a minor tweak that improved the grain's nutritive value. The beta carotene in golden rice, which was made possible by the addition of two new enzymes, is identical to the beta carotene found in green leafy and yellow coloured vegetables, orange coloured fruits and even in many vitamin supplements and food ingredients. Like ordinary rice, golden rice does not require any special cultivation practices and generally has the same yield and agronomic performance. While vitamin A can be obtained from food products and supplements, challenges regarding their availability, accessibility and affordability make it difficult to address the problem of vitamin A deficiency (VAD).

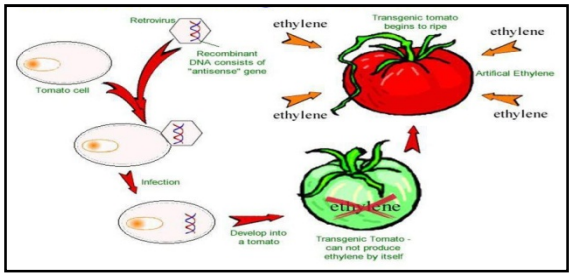


2. Potato - A genetically modified potato is a potato that has had its genes modified, using the genetic engineering. Goals of modification include introducing pest resistance, tweaking the amounts of certain chemicals produced by the plant and to prevent browning or bruising of the tubers. Varieties modified to produce large amounts of starches may be approved for industrial use only, not for food.



3. Tomato - A genetically modified tomato, or transgenic tomato, is a tomato that has had its genes modified, using genetic engineering. The first trial genetically modified food was a tomato engineered to have a longer shelf life, which was on the market briefly beginning on May 21, 1994.

The first direct consumption tomato was approved in Japan in 2021. Primary work is focused on developing tomatoes with new traits like increased resistance to pests or environmental stresses. Other projects aim to enrich tomatoes with substances that may offer health benefits or be more nutritious. As well as aiming to produce novel crops, scientists produce genetically modified tomatoes to understand function of genes naturally present in tomatoes.



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The Story of "White Death" … Tuberculosis

Ms. Mrunmayee V. Galphade
B.Sc.-II (Batch-B2), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

With the successful experiment of isolation and inoculation of infectious agent on guinea pigs, Koch discovered that, tuberculosis is not a hereditary disease, as it was assumed in those days, but an infectious disease caused by microorganism named as *Mycobacterium tuberculosis*. This discovery was the milestone, as isolation of an infectious agent has led to the pathway of creation of a vaccine. TB is caused by *Mycobacterium tuberculosis* complex, which can affect any part of the body with the lungs being the most common organ involved as the portal of entry of this pathogen into our body is respiratory tract itself. It is transferred from person to person by aerosol produced by coughing, the source being an active case of tuberculosis. Drugs like rifampicin (R) and pyrazinamide (Z) etc. are given for treatment of tuberculosis. Chemotherapy has revolutionized the management of tuberculosis.

'And the plains of Panipat were not fatal to the Maratha Empire than the early end of this excellent Prince'. These are the remarkable words by Sir Grant Duff, the author of seven volumes of 'The history of Marahatas' about the 'Excellent Prince' of Maratha Empire Madhavrao Peshwa-I. Even a cursory look into the history of Maratha power, we will find that, this king has ruled just for 12 years after ascending the throne at the age of 16; as he died at the age of 27 due to a lethal and incurable disease at that time. The great warrior, whose enemy is praising him using words like 'his death was more fatal than the plains of Panipat'. How did he die? What was that lethal infection which literally has changed the golden Indian history?

The answer for this question is 'Tuberculosis'. Yes, so friends now we can imagine what were the dangerous consequences of this disease and how important it was to find actual cause and remedy for this disease. This great work has been done by the father of Bacteriology 'Sir Robert Koch' in the year 1882.

With the successful experiment of isolation and inoculation of infectious agent on guinea pigs, Koch discovered that, tuberculosis is not a hereditary disease, as it was assumed in those days, but an infectious disease caused by microorganism named as *Mycobacterium tuberculosis.* This discovery was the milestone, as isolation of an infectious agent has led to the pathway of creation of a vaccine.

Koch himself in the year 1990 declared in front of the International Medical Congress in Berlin, 'I have found remedy for tuberculosis' This news has created a huge sensation in the society. It was the discovery of 'tuberculin'. Koch was not completely wrong because when he performed the experiment on the guinea pigs using the mixture of glycerin and bacteria it was observed that the mixture is killing the cancerous tissues. The injection of tuberculin has created severe immune response which is known due to the hyper sensitivity, known as 'Koch phenomena'. After the successful trials on guinea pigs it was time to make human trials as tuberculosis was the subject of concern for each and every individual of the society

that is the patients as well as the healthy ones. Crowd was uncontrollable in front of Berlin research institute for the vaccine.

Soon the human trials were started. Koch's announcement was the ray of hope for many patients and their families who were suffering from tuberculosis. However the results were disastrous, the remedy was nothing but the tragedy. After the injection of tuberculin into humans, about 1061 patients were diagnosed with tuberculosis of internal organs and 708 patients were diagnosed with the tuberculosis of external tissues. Hence, tuberculin was Koch's greatest failure. But we know that 'every cloud has a silver lining'; likewise tuberculin was not a complete failure. The hypersensitivity, Koch phenomenon, shown by the tuberculin (formation of lesions at the site of inoculation) led it to use for diagnostic test.

Later, Albert Calmette, a French physician and bacteriologist and his assistant and later colleague, Camillie Gue'in, a veterinarian, were working at the Institute Pasteur de Lille, France in 1908 observed that glycerin-bile-potato mixture grew bacilli that was less virulent and changed the course of their research to see if repeated sculpturing would produce a strain that was attenuated enough to be considered for use as a vaccine. BCG vas isolated after sculpturing 239 times during 13 years from virulent strain on glycerin potato medium. In year 1921 BCG was first used by humans.

So this was the brief history of tuberculosis also known as white death. But the story is not finished yet. Even though vaccines are available today, many people get infected by tuberculosis every year. Hence, the diagnosis and treatment is matter of concern.

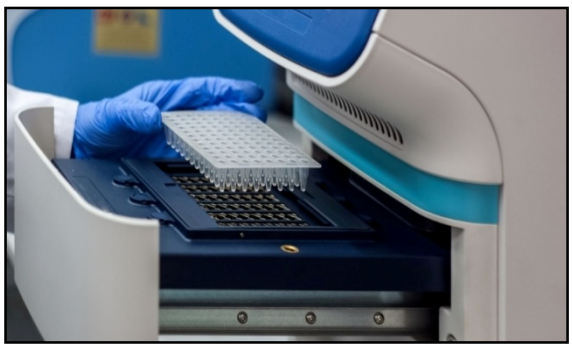
Source of infection

Before discussing about the diagnosis and treatment area let's look into the roots of this infection. As mentioned earlier, TB is caused by *Mycobacterium tuberculosis* complex, which can affect any part of the body with the lungs being the most common organ involved as the portal of entry of this pathogen into our body is respiratory tract itself. It is transferred from person to person by aerosol produced by coughing, the source being an active case of tuberculosis.

Diagnosis

Laboratorial methods of detecting TB are quite lengthy and inaccurate process. As *Mycobacterium* takes near about 24 hours to divide. Hence new techniques have been introduced for the early and accurate diagnosis of TB, like -

- **Molecular methods** - Nucleic acid amplification methods by polymerase chain reaction (PCR) and Lipase chain reaction (LCR).
  - ✓ Transcription - mediated amplification
  - ✓ RFLP and IS fingerprinting
  - ✓ Line probe assay (LPA)



- **Typing methods** - These are used to geographically define the roots of

transmission and dissemination in the environment and the source of infection in humans and animals.

- ✓ Molecular typing
- ✓ IS6110 Restriction Fragment Length Polymorphism (RFLP) typing
- ✓ Spoligo typing (spacer oligo typing)
- ✓ Insertion-sequence-based typing of non-tuberculous mycobacteria (IS-based typing of NTM

- **Immuno diagnosis**

- ✓ Tuberculin test
- ✓ Gamma interferon assays.

Treatment

Anti-tuberculosis drugs are given like rifampicin (R) and pyrazinamide (Z) etc. Chemotherapy has revolutionized the management of tuberculosis.

Developments in science and technology have been proved to be the boon for medical industry and health care sectors. Today due to availability of vaccines and modern equipments used in diagnosis as well as for treatments, the death date has been certainly decreased. Even if these medications are available we must remember that, 'Precaution is always better than cure'. We are Madhavrao for our own empire, for our own family whose death can be fatal to them than any other disaster in the world.

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Medicinal Plants and Herbs

Ms. Vaishnavi R. Mohod
M.Sc.-II (Botany), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Medicinal plants include different types of plants that used in herbalism i.e. "herbology" or "herbal medicine". Plants have been used for medicinal purposes long before prehistoric period. Among ancient civilizations, India has been known to be rich repository of medicinal plants. The forest in India is the principal repository of large number of medicinal and aromatic plants, which are largely collected as raw materials for manufacture of drugs and perfumery products. About 8,000 herbal remedies have been codified in AYUSH systems in INDIA. Treatment with medicinal plants is considered very safe as there is no or minimal side effects. The golden fact is that, use of herbal treatments is independent of any age groups and the sexes. Apart from the medicinal uses, plants and herbs are also used in natural dye, pest control, food, perfume, tea and so on. These herbal products are today the symbol of safety in contrast to the synthetic drugs that are regarded unsafe to human being and environment.

The term "medicinal plant" includes various types of plants used in herbalism i.e. "herbology" or "herbal medicine". It is the use of plants for medicinal purposes, and the study of such uses.

The word "herb" has been derived from the Latin word "herba" and an old French word "herbe". Now a day, herb refers to any part of the plant like fruit, seed, stem, bark, flower, leaf, stigma or a root, as well as a non-woody plant. Earlier, the term "herb" was only applied to the non-woody plants, including those that come from trees and shrubs. These medicinal plants are also used as food, flavonoid, medicine or perfume and also in certain spiritual activities.

Plants have been used for medicinal purposes long before prehistoric period. Ancient Unani manuscripts Egyptian papyrus and Chinese writings described the use of herbs. Evidence exist that Unani Hakims, Indian Vaids and European and Mediterranean cultures were using herbs for over 4000 years as medicine. Indigenous cultures such as Rome, Egypt, Iran, Africa and America used herbs in their healing rituals, while other developed traditional medical systems such as Ayurveda and Chinese Medicine in which herbal therapies were used systematically. Traditional systems of medicine continue to be widely practiced on many accounts. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several synthetic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments. Among ancient civilizations, India has been known to be rich repository of medicinal plants. The forest in India is the principal repository of large number of medicinal and aromatic plants, which are largely collected as raw materials for manufacture of drugs and perfumery products. About 8,000 herbal remedies have been codified in AYUSH systems in INDIA. Ayurveda, Unani, Siddha and Folk (tribal) medicines

are the major systems of indigenous medicines. Among these systems, Ayurveda and Unani Medicine are most developed and widely practiced in India. Recently, World Health Organization (WHO) estimated that 80% of people worldwide rely on herbal medicines for some aspect of their primary health care needs. According to WHO, around 21,000 plant species have the potential for being used as medicinal plants as per data available over three-quarters of the world population relies mainly on plants and plant extracts for their health care needs. More than 30% of the entire plant species, at one time or other was used for medicinal purposes. It has been estimated, that in developed countries such as United States, plant drugs constitute as much as 25% of the total drugs, while in fast developing countries such as India and China, the contribution is as much as 80%. Thus, the economic importance of medicinal plants is much more to countries such as India than to rest of the world. These countries provide two third of the plants used in modern system of medicine and the health care system of rural population depend on indigenous systems of medicine.

Treatment with medicinal plants is considered very safe as there is no or minimal side effects. These remedies are in sync with nature, which is the biggest advantage. The golden fact is that, use of herbal treatments is independent of any age groups and the sexes. The ancient scholars only believed that herbs are only solutions to cure a number of health related problems and diseases. They conducted thorough study about the same, experimented to arrive at accurate conclusions about the efficacy of different herbs that have medicinal value. Most of the drugs, thus formulated, are free of side effects or reactions. This is the reason why herbal treatment is growing in popularity across the globe. These herbs that have medicinal quality provide rational means for the treatment of many internal diseases, which are otherwise considered difficult to cure.

Medicinal plants such as Aloe, Tulsi, Neem, Turmeric and Ginger cure several common ailments. These are considered as home remedies in many parts of the country. It is known fact that lots of consumers are using Basil (Tulsi) for making medicines, black tea, in pooja and other activities in their day to day life.

In several parts of the world many herbs are used to honour their kings showing it as a symbol of luck. Now, after finding the role of herbs in medicine, lots of consumers started the plantation of tulsi and other medicinal plants in their home gardens. Medicinal plants are considered as rich resources of ingredients which can be used in drug development either pharmacopoeial, non-pharmacopoeial or synthetic drugs. A part from that, these plants play a critical role in the development of human cultures around the whole world. Moreover, some plants are considered as important source of nutrition and as a result of that they are recommended for their therapeutic values. Some of these plants include ginger, green tea, walnuts, aloe, pepper and turmeric

etc. Some plants and their derivatives are considered as important source for active ingredients which are used in aspirin and toothpaste etc.

Apart from the medicinal uses, herbs are also used in natural dye, pest control, food, perfume, tea and so on. In many countries different kinds of medicinal plants/ herbs are used to keep ants, flies, mice and flee away from homes and offices. Now a day, medicinal herbs are important sources for pharmaceutical manufacturing.

Recipes for the treatment of common ailments such as diarrhoea, constipation, hypertension, low sperm count, dysentery and weak penile erection, piles, coated tongue, menstrual disorders, bronchial asthma, leucorrhoea and fevers are given by the traditional medicine practitioners very effectively.

Importance of some herbs with their medicinal value

- Herbs such as black pepper, cinnamon, myrrh, aloe, sandalwood, ginseng, red clover, burdock, bayberry, and safflower are used to heal wounds, sores and boils.
- Basil, Fennel, Chives, Cilantro, Apple Mint, Thyme, Golden Oregano, Variegated Lemon Balm, Rosemary, Variegated Sage are some important medicinal herbs and can be planted in kitchen garden. These herbs are easy to grow, look good, taste and smell amazing and many of them are magnets for bees and butterflies.
- Many herbs are used as blood purifiers to alter or change a long-standing condition by eliminating the metabolic toxins. These are also known as 'blood cleansers'. Certain herbs improve the immunity of the person, thereby reducing conditions such as fever.
- To reduce fever and the production of heat caused by the condition, certain antipyretic herbs such as Chirayta, black pepper, sandal wood and safflower are recommended by traditional Indian medicine practitioners.
- Sandalwood and Cinnamon are great astringents apart from being aromatic. Sandalwood is especially used in arresting the discharge of blood, mucus etc.
- Some herbs are used to neutralize the acid produced by the stomach. Herbs such as marshmallow root and leaf serve as antacids. Healthy gastric acid needed for proper digestion is retained by such herbs.
- Indian sages were known to have remedies from plants which act against poisons from animals and snake bites.
- Herbs like Cardamom and Coriander are renowned for their appetizing qualities. Other aromatic herbs such as peppermint, cloves and turmeric add a pleasant aroma to the food, thereby increasing the taste of the meal.
- Some herbs like aloe, sandalwood, turmeric, sheetrajhindi and kharekhasak are commonly used as antiseptic and are very high in their medicinal values.
- Ginger and cloves are used in certain cough syrups. They are known for their expectorant property, which promotes the thinning and ejection of mucus from the lungs, trachea and bronchi. Eucalyptus, Cardamom, Wild cherry and cloves are also expectorants.
- Herbs such as Chamomile, Calamus, Ajwain, Basil, Cardamom, Chrysanthemum, Coriander, Fennel, Peppermint and Spearmint, Cinnamon, Ginger and Turmeric are helpful in promoting good blood circulation. Therefore, they are used as cardiac stimulants.

• Certain medicinal herbs have disinfectant property, which destroys disease causing germs. They also inhibit the growth of pathogenic microbes that cause communicable diseases.

• Herbal medicine practitioners recommend calmative herbs, which provide a soothing effect to the body. They are often used as sedatives.

• Certain aromatic plants such as Aloe, Golden seal, Barberry and Chirayata are used as mild tonics. The bitter taste of such plants reduces toxins in blood. They are helpful in destroying infection as well.

• Certain herbs are used as stimulants to increase the activity of a system or an organ, for example herbs like Cayenne (Lal Mirch, Myrrh, Camphor and Guggul).

• A wide variety of herbs including Giloe, Golden seal, Aloe and Barberry are used as tonics. They can also be nutritive and rejuvenate a healthy as well as diseased individual.

• Honey, turmeric, marshmallow and liquorice can effectively treata fresh cut and wound. They are termed as vulnerary herbs.

Conclusion

As our lifestyle is now getting the techno-savvy, we are moving away from nature, while we cannot escape from nature because we are part of nature. As herbs are natural products they are free from side effects, they are comparatively safe, eco-friendly and locally available. Traditionally there are lots of herbs used for the ailments related to different seasons. There is a need to promote them to save the human lives.

These herbal products are today the symbol of safety in contrast to the synthetic drugs that are regarded unsafe to human being and environment. Although herbs had been priced for their medicinal, flavouring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for a while. However, the blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security. It's time to promote them globally.

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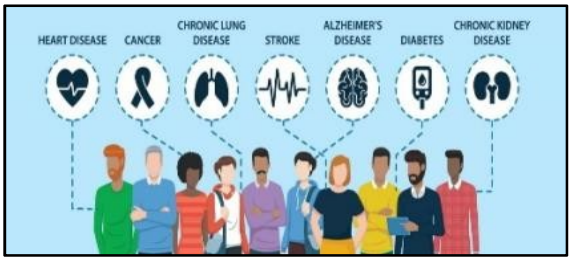
Prion - New Fatal Infectious for Mankind

Ms. Naziya Bano Mohd. Arif
B.Sc.-II (Batch-B3), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

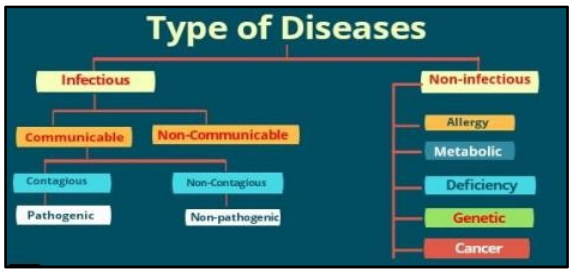
Disease is an abnormal functioning of body which makes unable to perform particular function and show illness. There are so many diseases. Some diseases are transfer from animal to human whereas some from human to animal. Prion is infectious protein with devoid of genetic material. It affect on CNS. This disease shows symptom like fatigue in muscle. This disease is not curable. Some drugs slow down the growth of infection but after some time death is confirmed.

A condition of a person, animal, plant in which its body is harmed because an organ or that body part become unable to work, so body show sickness or illness characterized by specific sign or symptoms. It is called as disease. The study of disease is called pathology. Humans, animals and plants are all susceptible to the disease. It disturbs the function of normal functioning of one type of organism. Disease can affect people not only physically but also mentally. A person living with disease can change affected person's perspective on life.



Types of disease

There are four main types of disease i.e. infectious disease, deficiency disease, hereditary disease and physiological disease. But disease can be classified as the communicable and the non-communicable. The disease can be transfer from pathogens like bactria, virus, fungi, protozoa, worm and even infectious protein called prion. Deficiency disease is caused by lack of particular mineral or vitamin in the diet. Hereditary disease is a disorder caused by mutation in gene and that are transfer from one generation to another. Hereditary disease includes genetic and non-genetic hereditary disorders. The physiological disease is caused by the malfunction of organ in the body which causes illness characterized by specific sign or symptoms.

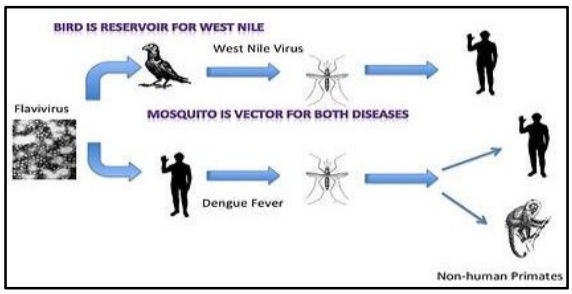


Vector of disease

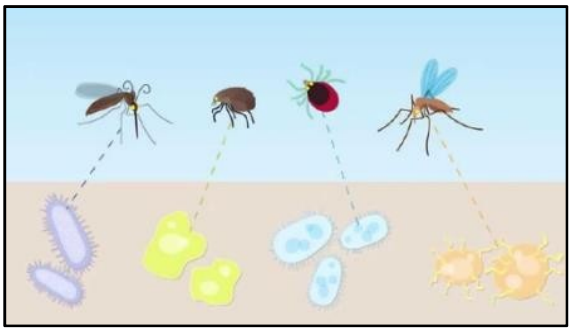
Vector is a living organism that can transmit an infectious agent from infected animal to a human or another animal. Vectors are invertebrate's arthropods like mosquito, ticks, flies, fleas and lice's, mosquito etc. Vector are of two types i.e. biological vector and mechanical vector.

Biological vector - It is that vector which may carry pathogen that can multiply within their bodies and be delivered to new hosts usually by biting. Example are mosquitoes, ticks etc.

Mechanical vector - It is that vector which transmits disease by transporting causative agent from contaminated food and water through physical contact. Examples are flies, west virus etc.

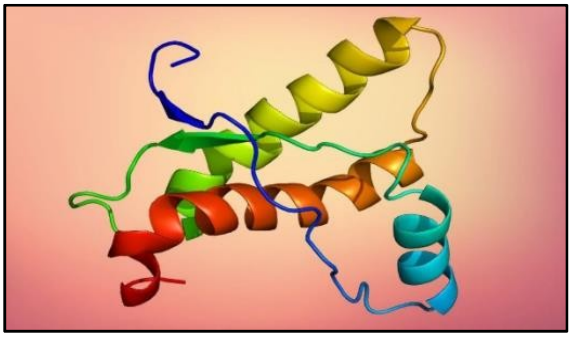


The disease transferred by vector is called vector borne disease. The disease transmitted from animal to human is called zoonotic disease. Examples are plague, west virus. Generally disease transmitted from animal to human is very rare. But if happened, then it is very dangerous.



Prion

Prion is cause of group of wide range of neuro degenerative disease. Prion is the infectious protein which devoid of nucleic acid. Prion disease may genetic, infectious disease sporadic disorders. This disease involve in modification of Prion protein that is PrP. Prion are transmissible particle which have only protein devoid of genetic material. It is made up of modified protein which is PrPsc. Normal protein PrPc is converted into PrPsc during the process in which it acquire beta sheet content.



Structure of prion

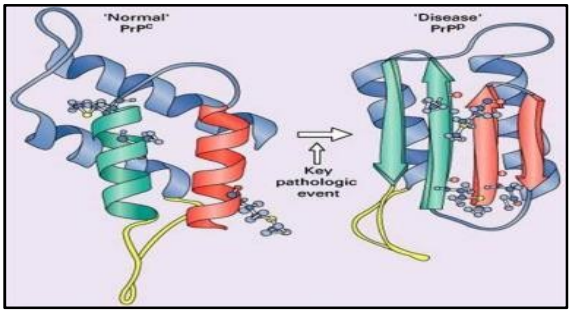
On earth, there are many viruses and prion are present. But 450 billion years ago, there was no life on earth. We know that how evolution takes place and how life formed. During this evolution, many viruses and prion would have formed. At the time of evolution, fluctuation of temperature and seasonal changes take place due which new viruses would have formed. Many of the living organisms that were present at that time have had these new viruses. After the natural calamities, those living organisms like plant and animals get buried in land. Because of this those viruses also get buried in the land. After million year deforestation, soil erosion, pollution takes place and then this buried viruses and prion get exposure in the environment. Global Warming is the main problem for earth. Due to this global warming, there is acid rain, increase in temperature and ice of Himalaya's is melting. Many scientists have told new viruses are hidden in the ice of the Himalayas and it is very dangerous for all living organism.

Medical history

In 1982 Stanley Prusiner isolate an infectious agent protein that called prion. This prion can be transferred to normal protein and leads to illness. It has ability to self propagate and transmit its conformation to other proteins. The functions of these normal prion proteins are still not completely understood. The abnormal folding of the prion proteins leads to brain damage and the characteristic signs and symptoms of the disease. Prion diseases are usually rapidly progressive and always fatal. Prion aggregates are stable and this structural stability means that prion is resistant to denaturation by chemical and physical agents. They cannot be destroyed by ordinary disinfection or cooking. This makes disposal and containment of these particles difficult and the risk of iatrogenic spread through medical instruments a growing concern.

This structural transition is profound changes in physicochemical properties of PrP. The amino acid sequence of PrPsc corresponds to that encoded by PrP gene of mammalian host in it. Last replicated transgenic studies explain that PrPsc act as

template upon which PrPc refold into a PrPsc molecules through the process facilitated by another protein. More than 20 mutation of PrP gene are known to cause human prion disease.



Slow virus term was coined by Bjorn Sigurdsson in 1954, when he was working on the viruses' scrapie and visna of sheep. After 5 more years, William Hadlow saw the disease kuru, it is similar to scrapie and he told, it caused by slow virus. CJD, kuru, and scrapie now referred as prion disease.

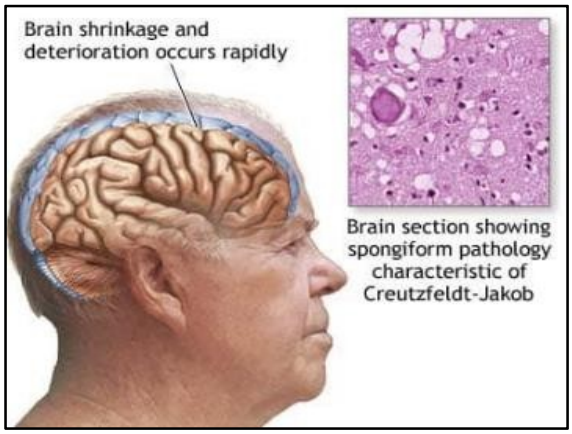
Symptoms

- Hallucination
- Difficulty in speaking
- Fatigue
- Rapidly developing dementia
- Difficulty in walking

Fatal disease for human

Most human affected with prion disease present with rapidly progressive dementia but some manifest cerebellar ataxia. After the prion disease, the brain of patient shows spongiform degeneration and astrocytic gliosis under microscope. In human prion disease, abnormal form of prion proteins aggregates in brain. Prion protein polymorphism play important role in pathogenesis of these disease by enhancing the amyloidogenic properties of protein. The human prion disease can present as sporadic, genetic or infections disorders. How prion causing disease arrived in patient with sporadic forms is unknown but hypothesis include the transmission of prion from human or animals somatic mutation of the PrP and spontaneous conversion of PrPc into PrPsc. CJD cases suggest that genetic factor might influence pathogenesis.

Prion is causative agent of several transmissible and fatal neurodegenerative diseases in human and other animals. Creutzfeldt Jakob disease (CDJ) is most dangerous prion disease. In this disease abnormal iso form of cellular glycoprotein is known as the prion protein. This disease very rare in human but in future there are very high chances that this disease infect the man. Because of pollution, global warming, prion get modified themselves.



Treatment

The risk of prion is increasing day by day but there is no medicine for prion disease, because it is not curable. There are some drugs given by doctor to prion disease patients to slow down the propagation of disease in the body. After month or year the patient will die. We know that, the normal protein PrPc is converted into PrPsc, so the structure of PrPc is bind with drug or modified the action of X protein which might function as molecular chaperone. It is effective as drug, that drug bind PrPc at protein X binding site which may prevent scrapie and CJD. Research is in progress, but can't say whether this treatment will work or not.

Prevention

- CJD Patient don't donate organ or tissue
- Sterilization of medical equipment
- Feeding of cows may help to prevent the spread of prion disease

Present status

At present, the transmission of this disease is very low in human. After study, researchers found the prion nucleation seed that enhances their ability to appear and resist curing. The significant progress in our understanding of this infectious agent, many fundamental questions relating to the nature of the prion, including the mechanism of replication and the molecular events underlying brain damage, remain unanswered.

Future aspect

The cure for prion diseases in humans will likely involve a combination of therapies. It involve gene editing to create disease resistant prion gene alleles, a drug that inhibits apoptosis, a small molecule that stabilizes PrPc and regular injections of heterologous prion proteins that bind and clear nascent PrPsc.

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Animal Adaptation

Mr. Sourabh K. Gaikwad
B.Sc.-III (Batch-B2), Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, 444 001, INDIA

Animals are the eukaryotes and are multicellular organisms which are the parts of environment. So to survive well, they have to fight for their needs and carry out several activities in their day to day life. These needs and activities are condition dependent means their needs changes according to their surrounding and availability of sources such as food, water, shelter, temperature, sunlight, soil etc. Different types of organism have different types of requirement to survive, so according to their habitat and necessity they achieve some changes in them physically, mentally, biologically (on cellular level) which makes their life easy and which helps them to survive.

The physical or the behavioral achievement or adjustment of animals to help themselves to survive and adapt themselves according to the environmental condition is called as animal adaptation. Adaptations are of following types -

- Body part adaptation (webbed feet, sharp claws, wings, hooves)
- Body covering adaptation (striped and spotted fur, feathers, scales)
- Behavioral adaptation (instincts, hibernation, migration)

However, animals adapts multiple features in them not ranging it upto a single type of adaptation, having mixture of the types given above.

Animal adaptation depends on the factors animals going to face which are temperature, availability of food, water etc., out of which the most affecting factor is climate. As climate is the main element of environment, most of the environmental activities depends on it such as growth of plants, quality of water, spread of disease, quality of air, temperature etc. Plant growth is affected in such a way that, types of plants has types of requirement to grow like some plants grows in only humid condition (fern, lily, spider plant etc.) and some plants which only grow in low humidity (ponytail palm, jade plant etc.) because of which the herbivores which feeds on high humidity plant have to change its food when the humidity gets low due to the effect of Climate. In desert there is scarcity of water and there is almost no covers from sunlight due to the less growth of plants and tree which can give shade, so according to that condition 'Ship of the Desert' means "Camel" has adapted himself in such a way that camel can store the water in their blood stream hence they drink large amount of water (about 20 gallons) and can go for long period of time without the uptake of water. Also they have large foot so that their legs do not sink in sand and their weight gets evenly distributed giving them stability. Several herbivorous animals go carnivorous in spring as most of the plants dies in that time of season.

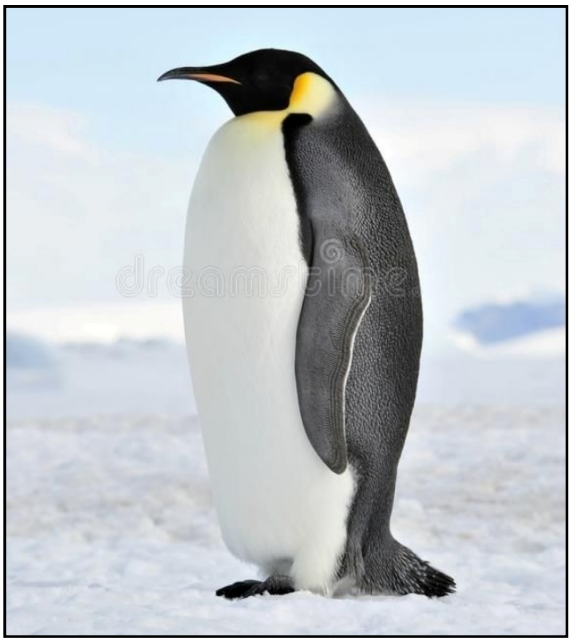
Some animals have different kinds of skin and patterns on them which helps them a lot in their day to day life as it blends them in that environment which protects them from their predators and in some cases these patterns and skins shows them dangerous to other animals, showing themselves as dominating animal. Crocodile is the best example of this adaptation as their scales protects them from other creatures and blends them in the bottom

of the river, adding in they have their nostrils and eyeballs on their head so they can keep 95% of their body submerged in the water body while hunting for their prey which makes them a stealthy predator. Another example is rattlesnake which has ability to make a sound which says "be careful, I also have venom, so stay away" and it also have scales and patterns on them which makes them hard to notice when they are still and blends them in the surrounding.

"Sloth" has adapted a life on tree in such a way that they barely come to the ground. They have three toes with three long claws which make them hang on the tree. They have long arms which also a beneficial factor for them by which they can climb a tree. They spent their more than 95% of life on tree as the tree gives them a perfect shelter and place to hide from predators. The Slowness and Laziness they have which is a behavioral adaptation save their energy and increases their life span and in addition they stay unseen by predators. Chameleon is also an interesting creature as it changes the skin colour according to the surrounding which makes them stay hidden from their predators and also their unique eyeballs which rotate in 360^0 giving them perfect eyesight to detect the danger around them and they have nice feet and tail which makes them an excellent climber.

Other characters of the animal adaptation are their flesh and presence of fur on them which helps them maintaining their body temperature. Polar bears are one of the examples of this adaptation

which is a body covering adaptation. As the temperature at polar region is very low i.e. about -34^{0}C during average winter, the fur on the polar bear helps them to stay warm in low temperature and they also have thick layer fat which maintains the body temperature even if they gets wet. They have learned to swim in icy water as their favorite food 'seal' stays in and under the water, so they are excellent swimmers. An additional feature of them is that their fur is of white colour and hence blending them in surrounding which keeps them unseen by their predators.



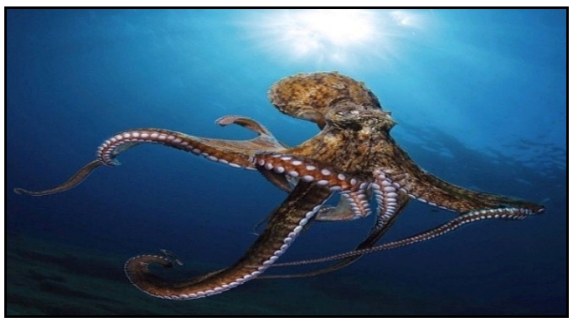
There are certain other creatures which has taken body part adaptation, of which the best example is penguin as penguin are the species of bird and most birds do not swim but penguin are the unique birds who can swim as they have their majority of food inside the water, so they have flippers which play an important role in swimming and hunting their favorite food they also have wings through which they can glide in water.

Giraffe also comes in this type because they have a long neck which makes it easy to reach the leaf on long trees as they are herbivores and also can go without water for long period as they consume most of the water from the dew present on leaf they eat.

Racoons are adapted to survive in any condition as they can feed on anything. They are said as urban wild animal as they have found in dust bin and trash searching for food, they are nocturnal as they have fine eyes which gives them a nice sight and hunting in night saves them from their predators and keep them in cover. Taking about nocturnal creatures, the owl is an amazing bird which is very active in darks and they hunt for their food in night, they can hunt their food without watching by

sound only, they can rotate their head in 270^0 giving a wide range of sight and their body colour also favors them in hiding and keeps them unnoticed, putting all these features together makes them a efficient predators.

Going in aquatic life there are several examples of physical adaptation such as octopus, they are like chameleon but chameleon can only change the colour according to the environment but the octopus itself becomes the part of the environment, they can change their colour but they can also adapt the texture of the material such as rock, they can change their as rock and also takes the texture of it, this feature of them are primary defense, it keeps them hidden in such environment saving themselves by predators and in some cases by humans also.



All these adaptation are achieved by the animals through evolutions and have taken hundreds of year and generations, by small changes and all the adaptations are also modifying as the generations are going on and our upcoming generation will get to see all the changes that are going to happen in these animal and their adaptations.

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Chandrayaan-3 ... India is on the Moon

Chandrayaan-3 is the third Indian lunar exploration mission under Chandrayaan programme of the Indian Space Research Organisation (ISRO). Chandrayaan-3 was launched on 14th July 2023. The spacecraft entered lunar orbit on 5th August 2023 and the lander softly touched down in the lunar south pole region on 23rd August 2023 at 06.04 pm, making India the fourth country to successfully land on the Moon and the first to do so near the lunar south pole. Chandrayaan-3 comprises three main components; a propulsion module, a lander named “Vikram” and a rover named “Pragyan”. The propulsion module carried the lander and the rover configuration to lunar orbit in preparation for a powered descent by the lander.

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Printed and published by Principal, Shri R.L.T. College of Science, Civil Lines, Akola-444001, Maharashtra, India.
