ZOOLOGICA

DEPARTMENT OF ZOOLOGY

BARASAT GOVERNMENT COLLEGE

ZOOLOGICA

Department of Zoology

BARASAT GOVERNMENT COLLEGE

ANNUAL MAGAZINE 2020-2021

Editorial Board

Designer

Ankita Mondal

ankitamondal152@gmail.com

+91 87778 57187

Prologue

College magazine is the platform, where students, members of faculty, staff members showcase their creativity and thoughts. Every year students publish wall magazine, but due to prevailing COVID -19 pandemic there is an urgent need to change its mode of presentation from conventional wall magazine to electronic version. This volume is a diverse and wonderful concoction of story of novel discoveries, interesting facts or nitty-gritty of various fields of zoology, various alarming global issues, etc, hopefully will be useful to readers from various disciplines. The differences of the authors experiences are reflected in our pages. Our undergraduate & postgraduate (Alumnui & Present) students have actively participated in this event. Hope this academic aspiration/venture will motivate our students to enhance their knowledge and upgrade their writing skills as well as thinking ability. We would also like to update the community as a whole with our activities. I am also grateful to the reviewers for rendering their honorary services as well as valuable time to evaluate the articles. Their cooperation is highly solicited also in future for the betterment of the magazine. The wholehearted support of all my colleagues are gratefully acknowledged. Thanks are due to the contributors to the magazine who have made the upcoming online publication possible. I wish you all, the zoology community of Barasat Government College, the best for this endeavour.

Dr. Sumana Saha

Head, Post Graduate Department of Zoology

Contents

A Tribute to Sir Ronald Ross, the Fly Man & His Landmark Discoveries on Transmission of Malaria

Dr. Jayati Ghosh, Associate Professor, PG Dept. of Zoology, Barasat Govt. College

We all know that malaria is caused by infection with Genus *Plasmodium*, a protozoan parasite which is transmitted by female *Anopheles* mosquitoes. But many of us are not aware that Surgeon-Major Ronald Ross working at the Presidency General Hospital (Now called SSKM Hospital), Kolkata is credited with the first successful demonstration of the transmission of malaria parasite in birds. For this work he was awarded the Nobel Prize for Physiology and Medicine in 1902.

Ross- Early life and education

Ronal Ross was born in Almora (Uttar Pradesh) in the year 1857. His father Campbell Claye Grant Ross was a Scottish officer in the Indian army and he had immense influence in the life of his elder son. He wished that Ross should join Indian Medical Service (IMS) as it was a well paid job at that time. But Ross had no early predilection towards medicine. Rather he loved natural history studies and music. He was a multifaceted personality. He had passion for poetry, mathematics and art and wanted to become an artist. However, to fulfill father's wishes he enrolled in Medical School at St. Bartholomew's hospital in London at the age of eight. After that he attended medical school in England.

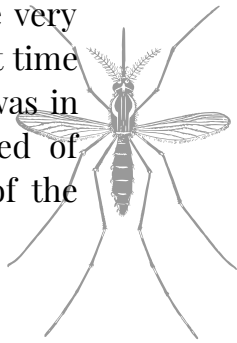
In the year 1881, Ross joined the Indian Medical Service. Initially, he started his career in the Madras infantry and later worked in many places like Burma, Mysore and Andaman islands. Charles Louis Alphonse Laveran, a French physician in the year 1880 while working in the military hospital found numerous pigmented bodies in the blood of a malaria patient and concluded that the cause of malaria is a protozoan. He found such pigmented bodies in 148 out of 192 patients.

Figure 1. Sir Ronald Ross

Figure 2. Sir Patrick Manson, a true mentor of Ronald Ross

Image Source: London School of Hygiene and Tropical Medicine

Initially Ross was ignorant of Laveran's work and he believed that malaria is caused due to some form of poisoning in the digestive system. In 1892, Ronald Ross became very interested in Laveran's discovery of the protozoan causing malaria. Malaria at that time was a menace. Each year more than a million people died in India. While Ross was in Madras he treated many malaria patients seriously. But he was not convinced of Laveran's idea. He collected blood of malaria patients to see crescent stages of the parasite but did not succeed.



Patrick Manson and Ronald Ross: beginning of a scientific friendship

In March, 1894, Ross went to London and met Sir Patrick Manson who later became his mentor. Ronald Ross had discussions on malaria with Manson, the father of tropical medicine. Manson showed him the parasites of human malaria discovered by Laveran in a stained slide and compared with a healthy blood. In 1878 Manson had already identified *Culex* mosquitoes as the intermediate host for filarial parasites in human. So, he gave the idea to Ross that malaria might also be mosquito-borne. This meeting changed the life of Ross.

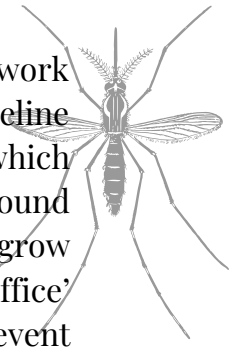
Patrick Manson was impressed by the Ross' interest of the subject and so he kept Ross focused in his work. He always encouraged and supported the work of Ross. Manson's idea changed the mind of Ross and he decided to prove the role of mosquito in malaria transmission in countries like India where malaria is endemic. The two men were in two different countries but there was continuous exchange of thoughts of scientific ideas. About 173 letters were exchanged between them. There was a lot of frustration and disappointment faced by Ross in this hard task but to make the quest a success Manson continued to offer him support by his letter giving advice and guidance.

Early research and failure

His work started at Secunderabad. Collection of blood from malaria patients and feeding that to mosquitoes and raising them in laboratory was a difficult task. After dissecting the stomach of mosquitoes, Ross found some flagellated forms but those forms suddenly disappeared in subsequent days of development. His tireless observations under microscope continued to find out the unknown enemy.

At that time it was believed that malaria infection spreads through drinking water contaminated by mosquito or its larvae. Even Manson believed that idea. Ross had done many experiments to disprove it. Ross wrote to Manson in 1896 that the concept of mosquito water does not transmit malaria but rather mosquito biting may be the reason for the transmission. On this new idea his new search began but it did not work. Unfortunately, Ross worked on wrong mosquito species *Culex* and *Stegomyia* which are not the vectors of *Plasmodium*. Failing in this effort he became frustrated and depressed. In the next year, he was posted for a short period in Ooty where one day his attention was drawn to a different mosquito species. It was dappled winged *Anopheles* and Ross decided to work on this species.

The great discovery



In 1897 he again came back to Secunderabad and was desperate to start his new work with a new hope that the problem will be solved. His assistant brought some Anopheline mosquitoes and those were raised and fed again. Ross dissected two of which immediately and two the following day. He was exhausted but on his surprise he found very delicate rounded, unusual cell (oocyst) in the gut of these mosquitoes which grow bigger in subsequent days. The day and night extreme hard work in the 'hot little office' made his eyes stressed, he became fatigued. Even he had to stop ceiling fan to prevent blowing of the mosquitoes from the working desk. But final success removed all exhaustion. Ross named 20th August day as 'Mosquito Day', the day in which his research over the past two years had finally rewarded him with the breakthrough he desperately looked for.

Figure 3. Nobel Laureate Sir Ronald Ross, Mrs. Ross, Mahomed Bux and two other assistants at Cunningham's laboratory (Now Ronald Ross Laboratory) of IPGMER and SSKM Hospital, 1898

But before he could unravel the complete life cycle from insect to humans next month he received telegraphic instruction from Government to be posted at Bombay. He could not work on human malaria as very little malaria cases were reported here. Ross was transferred to Calcutta on 29th January, 1898 and was able to study malaria in caged birds. He showed that *Culex* mosquitoes could transmit *Plasmodium relictum* directly from infected to healthy birds. Later Italian scientist Grassi completed the life cycle

study by experimentally transmitting the malaria parasite from mosquito to human in 1898.

Nobel prize

Ronald Ross' work was interrupted several times. He got no support from the administrative end; rather frequent interference was always there. His determination and zeal to carry out the experiments despite of all odds is inspiration for entire budding scientists of the world. He paid his own expenses throughout the research journey and IMS did not cooperate or appreciate. Even they ordered Ross to abandon the malaria work and gave him new posting in Assam. Broken heart Ross resigned from the IMS and left India on 1899 to join Liverpool School of Tropical Medicine. The discovery of Ronald Ross was announced by Manson at a meeting of the British Medical Association in Edinburgh and Ross was awarded the Nobel Prize in Medicine in 1902.

He was a novelist and a great poet. He expressed his joy, victory, excitement and disappointments through poems. Ross wrote the following poem in the night of 20th August, 1897:

This day relenting God
Hath placed within my hand
A wondrous thing, and God
Be praised. At this command,
Seeking His secret deeds
With tears and toiling breath,
I find thy cunning seeds,
Oh million-murdering Death.

You can find a small, unimpressive Ronald Ross memorial located on AJC Bose Road on the Northern wall of SSKM hospital built on 1927. Ronald Ross and G. Macdonald developed a mathematical model of mosquito-borne pathogen transmission. Today 89 years after his death it seems very relevant to explore his idea on disease epidemiology and mosquito control as enough has not been done on this matter.

Figure 4A. Ross's Diary and Notes of Researches on Malaria

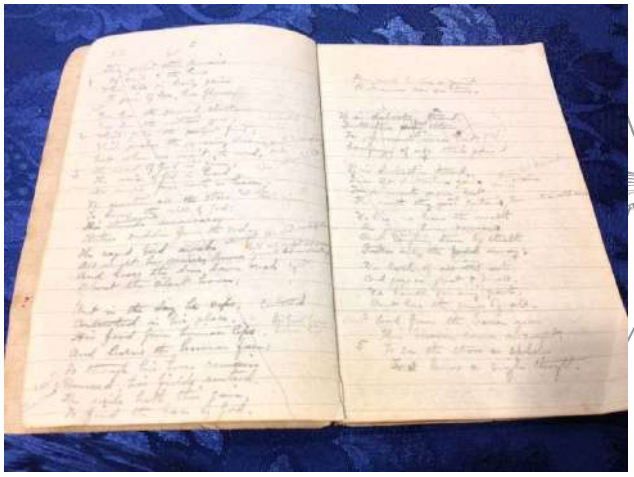


Figure 4B. Early drafts of poems from 'Lyra Modulata'

Figure 4C. Sir Ronald Ross

References

1. Harrison, G. 1978. Mosquitoes, Malaria and Man: A History of the Hostilities Since 1880. EP Dutton, New York. 314 pp.
2. Jay V.2000, "Sir Patrick Manson, Father of Tropical Medicine. A Portrait in History," Arch. of Pathol. and Lab. Med. 124: 1594-595.
3. Ross, R. 1923. Memoirs: with a Full Account of the Great Malaria Problem and its Solution. John Murray, London. 547 pp.
4. "Ross and the Discovery that Mosquitoes Transmit Malaria Parasites".2010 Centers for Disease Control and Prevention.
5. Ross, R. 1911. Some quantitative studies in epidemiology. Nature 87: 466–467.

Image Source: London School of Hygiene and Tropical Medicine

Worst Wildlife Disasters in Modern Times

Dr. Sumana Saha, Associate Professor & Head, PG Dept. of Zoology, Barasat Govt. College

Global warming is already influencing fire seasons round the world. Increment of dry and hot days is the cause of extension of wild fire seasons. An extended fire season is predicted to end in more frequent and severe fires. The bushfires raging across Australia (popularly called Black summer fires) have had a devastating impact on the country's unique flora and fauna, with some estimates putting the death rate at

Red dots show locations of fires detected in Australia the week ending Nov. 25, 2019. The brown area shows the range of the koala (Courtesy : NASA, IUCN)

nearly 500 million animals in one state alone, and experts believe it could take decades for wildlife to recover. The major crisis has focused attention on change of climate, which scientists utter due to a prolonged and more intense bushfire season. Record-breaking rising temperature and months of severe drought have fuelled as well as swelled a series of massive bushfires across Australia. A University of Sydney study estimates that over 480 million animals are killed in precisely the state of New South Wales since September 2019 to Mid January, 2020. 143 million mammals are affected within 2019-20 blazes, one amongst the 'worst wildlife disasters in modern times'. Koala (Phascolarctos cinereus) populations are wounded severely particularly because they live in trees, feed only on certain types of eucalyptus and can't move quick enough from the front of the flames. More than 61,000 koalas were likely in the path of the Australian bushfires of late 2019 and early 2020, in keeping with a significant assessment of the ecological toll of the "black summer" blazes. Millions of reptiles, birds and frogs also lived in habitats inside the blaze, which covered 12.6m hectares – a locality almost the scale of England. Among the 143 million mammals affected were mostly the marsupials like wombats, kangaroos, wallabies, possums and bats, native mice and rats. About 5.5 million threatened marsupials (bettongs, bandicoots, quokkas and potoroos) were also affected. Whether or not resident animals were not killed outright by fires and managed to escape, they surely have experienced higher subsequent risk of death as a result of

Burnt baby kangaroo shows extent of devastation

Rescued kangaroo from the fire ash

injuries or there upon stress and lack of key resources. There was death of many of thousands of fishes after bushfire ash and dirt washed into rivers (WWF-Australia reported). Mortality caused by direct exposure to flames, smoke inhalation, heat and

Eucalyptus trees - mountain ash (*Eucalyptus regnans*) depend on fire for their life cycle – habitat of koala

Forest caught by bushfire – Koalas too

Injured koala

Burned koala carried to the rescue centre

sediment run-off, fire interacts with other stressors, intensifying threats to the persistence of threatened species and ecosystem. We have glimpsed the headlines: "Australia is burning," "Australia is ablaze," even, "Australia is committing climate suicide". We have seen the photos in daily leading newspapers & google news: a fire tornado, evacuated townsfolk sheltering on a beach, kangaroos leaping for their lives, flames turning forests incandescent, cockatoos dropping dead out of scorching skies and specially half burned & dead bodies of koalas. Social media are awash with images and videos of local people stumbling upon burned and thirsty koalas placed in laundry baskets, munching on leaves indoors and koala (kangaroos also) with bandaged paws.

Most of the burned & dehydrated and starved koalas have received treatment at the Port Macquarie Koala Hospital, located about 250 miles north of Sydney in one in every of the foremost fire-affected zones. Doctors have actively treated koalas rescued by the Australian volunteers. In Australia, the koala bear, the flagship species is an iconic animal. Koalas have specific physical characteristics that make them appealing to humans, especially their baby-like, cuddly look. Primarily as a result of habitat

Adult koala (*Phascolarctos cinereus*)

Mother koala carrying a baby (joey) on its back

destruction and deforestation, the koalas are already considered vulnerable by IUCN. But the fires are so devastating that koalas may well be reclassified as endangered within the state, possibly extinct unless circumstances threatening their survival and reproduction improve. Conservationists have raced to put in water stations for surviving koalas stricken with dehydration. The stubborn animals typically depend

Water being fed to the injured koala

Koala rescued from bushfire by the volunteers

Koala scorched in fire

Fire burned koala rescued

Rescuer race to save koala in distress

on eucalyptus leaves for much of their water consumption, but the fires have destroyed swaths of their habitat and food source. Koalas eat as much as 200 to 500 grams of leaves per day and even reject leaves that do not contain enough water. Hotter and drier weather brought on by global climate change which has exacerbated the fires and have also severely damaged eucalyptus, driving koalas to look for artificial water

Water being fed to the burned koala

Burned koala rescued by volunteers from bushfire

Injured koala hospitalised

supplies in Gunnedah, the "koala capital of the world" in New South Wales west of Port Macquarie. Conservationists have reverberated the alarm over the fire's impact on the sensitive species. They typically breed once a year— making each death a major event. Additionally, koalas are slow-moving animals, thus limiting their ability to flee fast-moving fires, and *Eucalyptus* trees ignite rapidly, allowing them to be destroyed unless prompt fire-fighting actions are deployed. Interestingly, *Eucalyptus spp.* are typically

Injured koala brought in the hospital for treatment

An injured koala at the Kangaroo Island Wildlife Park, Australia

After recovery koalas released into the wild again

killed by fire, then regenerate from surviving seeds in the aftermath. Australia has many trees that are to complete their entire life cycle from germination through to reproductively mature adult before the subsequent major bushfire passes through. Conservationists fear that the number of individual koala deaths may end in a dramatic reduction in the genetic diversity found within regional koala populations. This curtailment of genetic inequality could further weaker the species, making animals that survive the fires more prone to *Chlamydia* (a bacterial infection which makes the females infertile) and other harmful infections, which are often fatal. Thus, the koala is under great duress. Without an immediate halt to the changes led to by climate change, the viability of the koala may not be safeguarded. Australia encompasses a moral and ecological responsibility to save lots of the animals, because the overwhelming majority of those affected existed no where else on Earth. The fatal impact of the months-long Australian bushfires on wildlife was unprecedented. There is some hope, however, as experts believe scorched forests can recover in time, and light has emerged from the darkness as decimated populations of koalas, kangaroos and other badly affected species is also ready to return back into the wild.

Photo Courtesy: Google

Weblinks

1. http://www.hindustantimes.com Australian bushfires could destroy all koala habitat : Conservationists, Nov. 25, 2019.
2. http://www.nationalgeographic.co.uk No, Koalas aren't 'functionally extinct'–yet. Nov. 26, 2019.
3. http://www.bbc.com/news/50986293 Australia fires : How do we know how many animals have died? BBC News, Jan. 4, 2020.
4. http://www.bbc.com/Australia fires : A visual guide to the bushfire crisis. BBC News. Jan. 31, 2020.
5. http://www.theguardian.com 'Devastating' : more than 61,000 Koalas among 3 billion animals affected by bushfire Dec. 6, 2020.
6. http://www.wwf.org.auWWF : 60,000 koalas impacted by bushfire crisis, Dec. 7, 2020

Covid-19 & Antimicrobial Resistance: Dual Threat to Global Health

Smt. Indrani Banerjee, SACT II, PG Dept. of Zoology, Barasat Govt. College

The outbreak of coronavirus disease 2019 (COVID-19) was caused by the SARS-CoV-2 virus and was reported a pandemic by the World Health Organization (WHO) on 11 March 2020 and has changed the world. Antimicrobial resistance (AMR), a similarly cross-sectoral challenge which has received increased international attention since 2015 (WHO, 2015), had already been named a priority for global public health for the year 2020 (World Health Organization, 2020). Increased use of antibiotic causes the emergence of antimicrobial resistance (AMR). This is a major global health challenge. Simultaneous increasement of antimicrobials during the covid-19 period attains concern of community.

Impact of COVID-19 on AMR

Three main components: emergence-, transmission-, and population-level infection burden indicate the evolution of AMR in population. The emergence and dissemination of AMR can be caused by selective pressures on microbial populations within humans, animals, or in the environment. Subject to the 'drug and bug' of concern, such selective pressures facilitate the acquisition of resistance mechanisms such as point mutation or horizontal transfer of genes which encodes the resistance to one or different antibiotics. The transmission of these emerged antimicrobial-resistant organisms (AROs) between humans, animals were prevented or enabled by environmental conditions and behaviors. Therefore AROs cause the burden of illnesses. These illnesses will then depend upon the number and nature of infections, and the availability, effectiveness, and safety of alternative treatments.

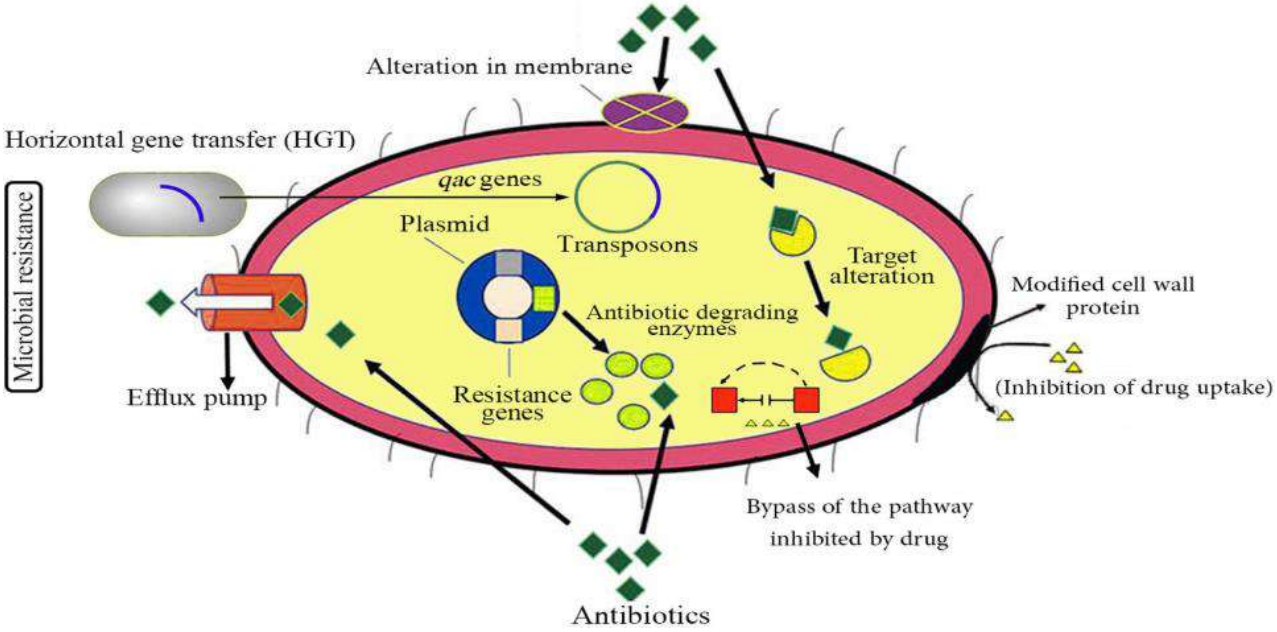


Figure 1. Shows various antibiotic resistance mechanism in bacteria

Inadvertent use of antimicrobial substances for long time to prevent secondary infections caused due to bacteria may lead to other post covid complications like antimicrobial intolerance, absorption and side effect related problems. In addition, with that prolonged application of steroids to reduce inflammation like Methylprednisolone may invite other flora (fungus) which are untreatable with antibiotics, hepatotoxic antifungal used for their control and multiplication. Overall public health is affected with this dilemmic situation. The use of antimicrobials have direct effect on SARS-CoV-2. This may lead to the emergence of resistance in co-infecting or co-colonising pathogens('bystander selection'). The antimalarial drug chloroquine has been used to treat COVID-19 but chloroquine remains the drug of choice for malaria (WHO,2015). But when it uses for the treatment of COVID-19, it may encourage chloroquine resistance emergence. Some reports were published on death of COVID-19 cases who experienced further bacterial co-infections. In these patients and in particular upon hospitalization, the conditions could be gradually deteriorated due to nosocomial infections by multidrug-resistant (MDR) microorganisms. The World Health Organization (WHO) warned against the increased use of antibiotics during the pandemic with the statement: "The COVID19 pandemic has led to an increased use of antibiotics, which ultimately will lead to higher bacterial resistance rates that will impact the burden of disease and deaths during the pandemic and beyond". So, antibiotics might be considered as a prophylactic measure among the community. Misuse of life saving antimicrobials during the pre and post covid situations may adversely affects the LMICs due to over the counter selling.

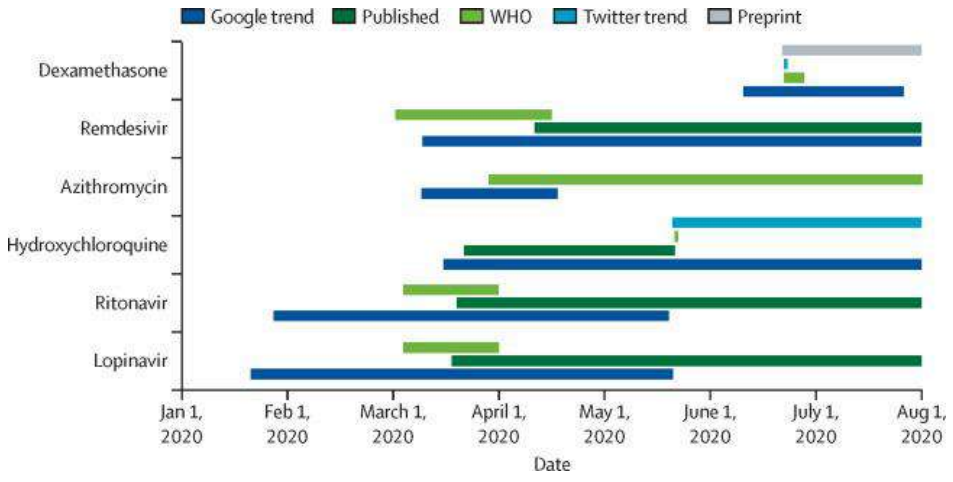


Figure 2. Use of multiple COVID-19 drugs in practice

The scenario of post- COVID might be associated with a rise in AMR in human and animals due to increased stress on antibiotic dependent healthcare systems to fight against secondary bacterial infections. Interruptions of antibiotic stewardship programs in hospitals and communities, prescription with antibiotics for COVID patients misdiagnosed with bacterial bronchitis, over prescription in telehealth consultations, and easy accessibility of medicines from online pharmacy are just a few key factors related with AMR identified during the pandemic. Improvement of the immune system

with a rise in animal based protein diet was promoted by governments and non-governmental organizations throughout the world during the pandemic. It will further increase the demand for animal protein, which may enhance the growth promotional use of antimicrobials in IFAPs. To overcome these problems, Govt also takes some interventions and group these interventions into three dimensions (antimicrobial use, infection prevention, and health system changes) in order to highlight the ways in which various dimensions of change in response to COVID-19 which can affect the emergence, transmission, and burden of AMR.

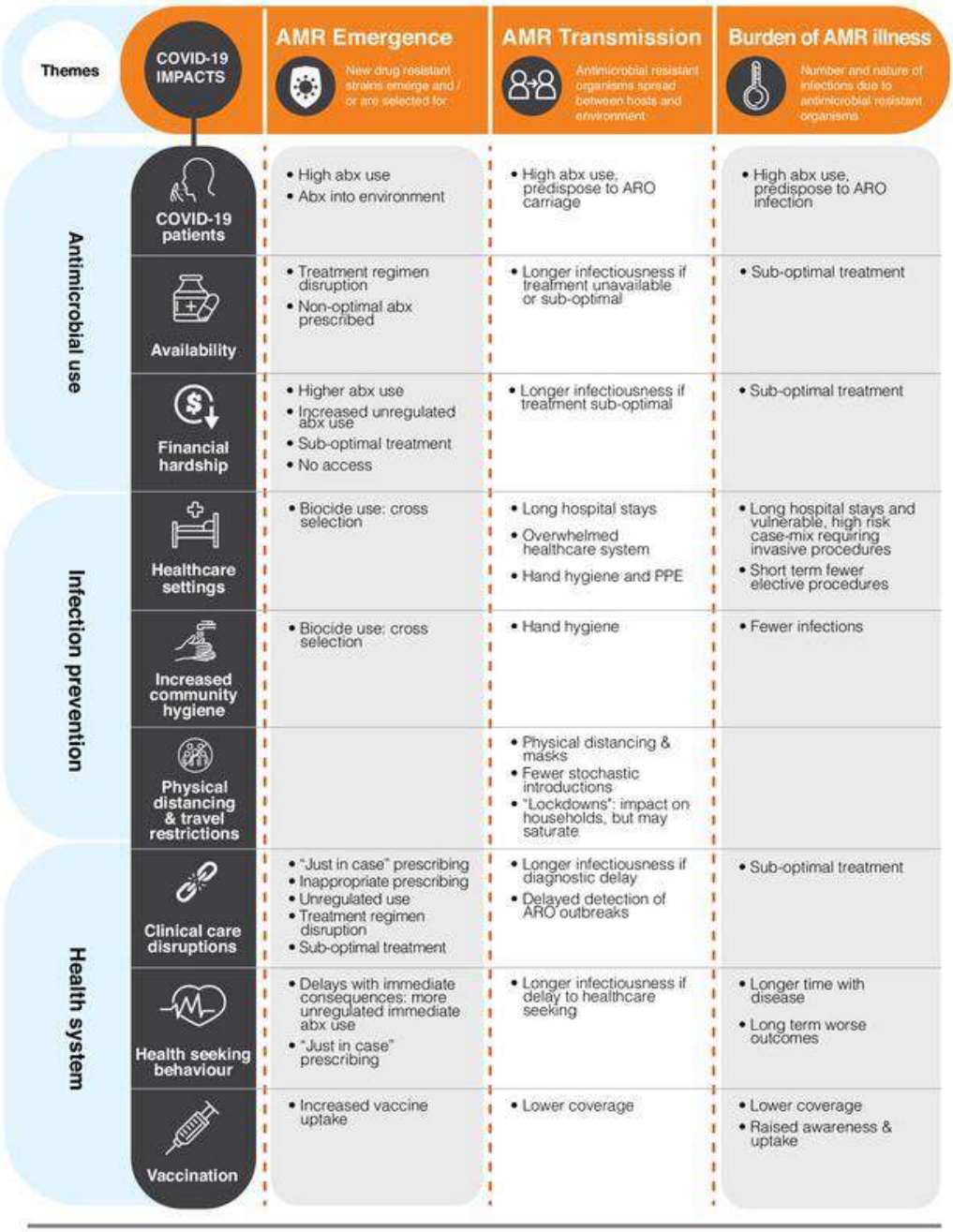


Figure 3. The interactions between the dimensions of change brought on by the coronavirus disease 2019 (COVID-19) pandemic (rows) and the key components in the evolution of antimicrobial resistance (AMR, columns)

Therefore, we must be vigilant and cautious that the fight against COVID-19 does not invite another significant threat to humankind.

References

1. Davies J Davies D, (2010) Origins and evolution of antibiotic resistance Microbiology and Molecular Biology Reviews 74:417–433.
2. Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., et al. (2020a). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 395:10223.
3. WHO (2020a) Country progress in the implementation of the global action plan on antimicrobial resistance: who, FAO and OIE global tripartite database WHO; World Health Organization. Accessed February 9, 2021.

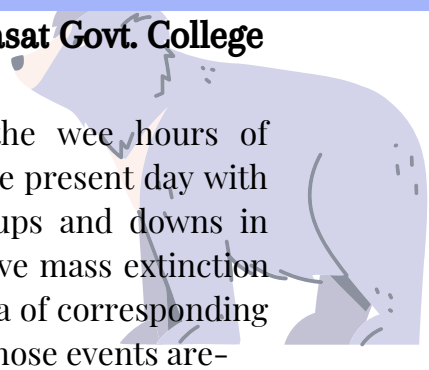
_ভাবনা_

আশুতোষ দাস, প্রাক্তন ল্যাবরেটরি অ্যাসিস্ট্যান্ট, প্রাণীবিদ্যা বিভাগ, বারাসাত সরকারি মহাবিদ্যালয়।

শৈশবেতে দারিদ্র আর প্রাচুর্যের অভাব
লেখাপড়ায় ফাঁকি দিয়ে নবাবী স্বভাব।
কৈশোরের বড়ই মজা স্কুলগন্ডী ছেড়ে
মেলামেশা অবাধ হল কলেজেরই ক্লোরে।
কোনটা ছেড়ে কোন বিষয়টা অনার্স নিয়ে ভাবি
উঁকি মারে প্রাণীবিদ্যার ভেসে ওঠে ছবি।
কোথায় পড়ি? কি যে করি, ভেবে পাইনা দিশা
বারাসাতে সরকারি কলেজ পেলাম শেষ ভরসা।
ধীরে ধীরে প্রবেশ করে দেখি বিশাল কান্ড
ক্লাসরুম আর ল্যাবরেটরীর নিয়ম ভাঙার দন্ড।
স্যার-ম্যাডামদের ভালবাসায় হলাম সবাই মুগ্ধ
থিয়োরি আর প্র্যাকটিক্যালেই মগজ হল শুদ্ধ।
সিলেবাসের নিয়ম মেনে জঙ্গলেতে গেলাম
বাঘ, ভাল্লুক, চিতা, ময়ূর কত প্রানী দেখলাম।
শেষের বছর দিচ্ছে উঁকি মনের মাঝে এসে
ভগ্ন হৃদয় প্রহর গুনি চোখ মুছে হেসে।
কৃতী বন্ধু বান্ধব সব কলেজ পড়া শেষে
ছিটকে গেলাম কে যে কোথায় দেশ হতে বিদেশে
মনে পড়ে তোমার কথা কখনো কি জানতাম
ইশারাতে দিলে সাড়া মণিকোঠায় রাখতাম।
অঝোর ধারায় বৃষ্টি ঝরে জানলা দিয়ে দেখি
ভাবছি বসে সেদিন গুলোর রঙীন মাথামাখি।

Holocene Extinction - The Nemesis at Vicinity

Tamoghna Roy, Ex Student (2016-18), PG Dept. of Zoology, Barasat Govt. College



Planet earth is teeming with life for billions of years. From the wee hours of evolutionary lineage, when life appeared as single cellular form to the present day with myriads of complex multicellular forms, there have been ample ups and downs in climatic condition which set the fate of life. Erstwhile, there were five mass extinction events which took place and wiped out majority of the flora and fauna of corresponding time but after each, new forms of life emerged and thrived till now. Those events are-

End-Ordovician (443 million years ago) -

Ice age caused sea level to decrease by 100m, wiping out 60-70% of all species which were prominently ocean dwellers.

Late Devonian (360 million years ago) -

Climate change again killed 70% of species.

Permian-Triassic (250 million years ago) -

95% of species perished, including giant insects – caused by severe volcanic eruptions in Siberia that resulted in prolonged global warming.

Triassic-Jurassic (200 million years ago) -

75% of all species gone extinct due to humongous volcanic eruption.

Cretaceous-Tertiary (65 million years ago) -

Giant asteroid impact on Mexico, just after large volcanic eruptions in what is now India saw the end of the dinosaurs and ammonites.

Now again another mass extinction event is hanging over as sword of Damocles which is Holocene extinction named after current Holocene geological epoch. The bitter truth is the causes of this event are not entirely natural factors but mankind's acts which triggered the climate change too early in following ways-

1. Expansive distribution that humans had throughout the planet 100,000 years ago

and how hunting killed the large mammals of the Pleistocene.

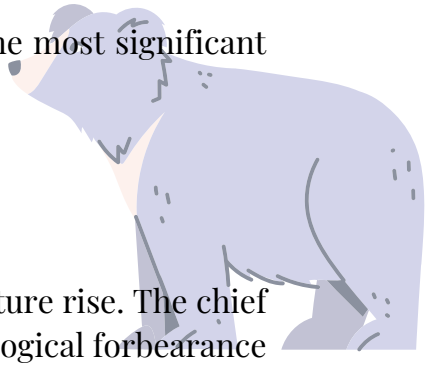
2. The development of agriculture 10,000 years ago

and how its global expansion notably decreased the biodiversity of many regions, which were deforested for monoculture plantations.

3. The industrial revolution, and consequently, global warming,

which can finish off a great number of species, including ours.

All of the above reasons are catalysing climate change which plays the most significant role in mass extinction event by impacting following natural factors-



(a) Abiotic factors

(i) Temperature (physiological tolerances)

Many effects of anthropogenic climate change are caused by temperature rise. The chief factor causing extinction is temperatures that rise beyond the physiological forbearance of corresponding species. It may be most significant in motionless organisms and those with limited thermoregulatory capability, and in regions and time periods in which temperature rise is highest. The effects of temperature may also be indirect, but still related to physiological tolerances. For example, in spiny lizards (*Sceloporus*), local extinctions likely to occur because higher temperatures restrict surface activity during the spring breeding season to a daily time window that is overly shorter. Similarly, increased air temperatures may both decrease activity period and increase energy maintenance costs, leading organisms to kick the bucket from fast rather than from overheating. In aquatic organisms, raised water temperatures may lead to increased metabolic demand for oxygen while decreasing the dissolved oxygen of the water. Variability in temperature may also be a crucial imminent reason of extinction, including both extreme events and large differences over the course of a year. In temperate and polar latitudes, a mismatch between photoperiod cues and temperature may be important, with fixed photoperiod responses leading to activity patterns that are inappropriate for the changed climate. Both reduced and raised thermal situation could raise mortality and lead to population extinction.

(ii) Precipitation (physiological tolerances)

Decreasing precipitation may lead directly to water scarcity, local extinction for local terrestrial species, and loss of habitat for freshwater species or life stages.
There may also be coordinated impacts between heat and drought. Change of precipitation may be more crucial to some species than thermal variation, sometimes leading to range shifts in the direction opposite to those predicted by rising temperatures.

(iii) Other abiotic factors

Other abiotic, non-climatic factors may catalyse extinctions that are ultimately caused by climate change. For example, climate change can increase wildfire, and these wildfires may be imminent reason of extinction (e.g. in South African plants). Similarly, rise in temperature leads to melting polar ice caps and rising sea levels, which may extirpate habitats along shorelines and alter the salinity of freshwater habitats.

(b) Biotic factors

(i) Harmful impacts on useful organisms

Climate change may lead to local extinction of a corresponding species by eliminating any species upon which it depends. E.g. prey for predators, hosts for parasites and specialized herbivores, species that create necessary microhabitats and species that are essential for reproduction of plants (e.g. pollinators).

(ii) Sanguine impacts on harmful species

Alternately; climate change may cause extinction through sanguine effects on species that have negative interactions with a focal species, including competitors, predators and pathogens. Rising temperatures may also benefit invasive species, exacerbating their negative effects on native flora and fauna.

(iii) Temporal mismatch between interacting species

Climate change may also create incongruence between the activity times of interacting species. These phenological mismatches may take place when interacting species respond to altered environmental cues (e.g. temperature versus photoperiod for winter fall) that are not directly triggered by climate change.
Today, species extinction rates are hundreds or thousands of times faster than the "normal" or "previous" rates prevailing in the last tens of millions of years. The recent United Nations report on biodiversity and ecosystem estimates that a quarter of all species face extinction, many within a few decades. When a species becomes extinct, a wide range of characteristics is lost for good, from genes and interactions to phenotypes and behaviours. Umpteen evidence demonstrating the decline of the biodiversity of our planet can be found in the Red List of Threatened Species from the International Union for Conservation of Nature (IUCN). In its 2017 edition, this list now includes a number of 87,967 species, of which 25,062 are on the verge of extinction. Another study also analysed 29,400 species of terrestrial vertebrates and found which of these are on the brink of extinction because they have fewer than 1,000 individuals. Out of the studied species, they concluded that over 515 of them are near extinction, and that the current loss of species has been occurring since the 1800s. Most of these 515 species are from South America (30%), followed by Oceania (21 %), Asia (21%) and Africa (16%) among others.

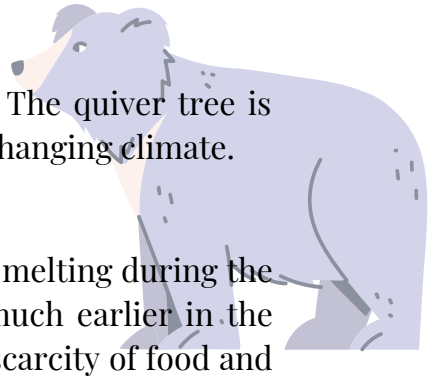
Climate change is wreaking havoc on species adapted to specialized niche that can be seen from the example of these following few species which are pushed to the brink of extinction in recent time-

1. Orange-spotted filefish (*Oxymonacanthus longirostris*)

The filefish lives in coral reef habitats, on which it is totally dependent, and which themselves are on decline due to climate change. In addition, the orange-spotted filefish is highly sensitive to warm water: The animal went extinct in Japan during a period of

raised ocean temperatures in 1988.

2. Quiver tree (*Aloe dichotoma*)



This tree is endemic to the arid west of South Africa and Namibia. The quiver tree is unable of growing and disperses quickly enough to cope with a fast-changing climate.

3. Polar bear

The Arctic sea ice sheet on which the animals forage is progressively melting during the summer. Sea ice is forming later in the winter and disappearing much earlier in the spring. Due to all these effects of global warming, there's a growing scarcity of food and habitat for this large predatory species which is leading to its extinction.

4. Adélie penguin

These Antarctic birds usually feed on tiny crustaceans known as krill. Krill dwell on the undersides of ice sheets, where they find refuge and algae for feeding. But as Antarctic sea ice is melting, krill populations are declining—meaning that the penguins have to migrate farther to find food. Spending a lot more energy to forage makes penguins less successful at breeding and raising young.

5. North Atlantic cod

Overfishing has historically caused numbers of this fish to decline, but its populations usually rise back. Not so off the north-eastern coast of North America, where populations have not recovered since declining in the 1990s. This may be caused due to changing ocean currents and the influx of cold Arctic waters.

6. Coral

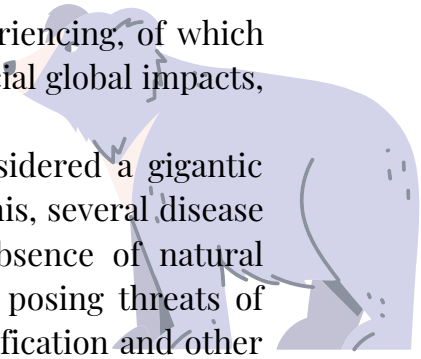
The rise in temperature and the acidification of water are triggering coral reefs to bleach to a greater extent across the globe.

And in case of complete extinction, only the year 2019 saw extinction of handful species such as- Sumatran rhinoceros, Chinese paddlefish, Yangtze giant soft shell turtle, Spix Macaw, Catarina pupfish, Indochinese tiger etc. Apart from these numerous other species such as Yangtze river dolphin, the northern white rhinoceros, bramble cay melomes to name a few have gone extinct in just last few decades alone due to impact of anthropogenic influence on climate.

Conclusion

The Holocene extinction event which is knocking at the door due to anthropogenic induced climate change is clearly a severe threat to the human civilization itself. For example, many of the species endangered or at the brink of extinction are being slaughtered by the legal and illegal wildlife trade, which poses a major threat for human health and well-being. It is also a major cause of population and species extinctions, and is eroding the ecosystem that we require to survive.

The coronavirus disease 2019 (Covid-19) pandemic that we are experiencing, of which we still do not fully understand the likely economic, political, and social global impacts, is probably linked to wildlife trade.



It is imperative that wildlife trade for human consumption is considered a gigantic threat to both human health and wildlife conservation. Apart from this, several disease causing microbial agents are on the rise in population in the absence of natural containment and also mutating into more lethal strains which are posing threats of more horrific pandemics. Global warming, sea level rise, ocean acidification and other climate change impacts such as tropical cyclones are affecting coastal areas and coastal countries. The survival of many societies, and of the biological support systems of the planet, is on peril.

To avert all these disastrous consequences, more importance should be given to sustainable developments. The international political response to the climate change initiated at the Rio Earth Summit in 1992, where the 'Rio Convention' included the adoption of the UN Framework on Climate Change (UNFCCC). In December 2015, the 21st Session of the Conference of the Parties (COP21/CMP1) which was convened in Paris, France, and adopted the Paris Agreement, a universal agreement which aims at keeping a global temperature rise for this century well below 2 degrees Celsius, with the goal of driving efforts to limit the temperature rise to 1.5 degrees Celsius above pre-industrial levels.

All the developmental works across the globe should be done following this perimeter. On another hand, conservation of flora and fauna should be continued meticulously and any kind of unscientific construction or alteration of landscapes should be put to an end. To implement these actions, apart from measurements, Governments should focus on public awareness. Lastly, the ancient Sanskrit phrase," vasudhaiva kutumbakam "meaning "the world is one family" from Maha Upanishad should become common perception to make the "pale blue dot" more habitable for life to thrive.

Weblinks

1. https://www.bbvaopenmind.com/en/science/bioscience/
2.https://www.theguardian.com/environment/2017/jul/10/earths-sixth-mass-extinction-event-already-underway-scientists-warn
3. https://www.pnas.org/content/117/24/13596
4. https://sustainabledevelopment.un.org/topics/climatechange
5. https://www.nationalgeographic.com/
6. https://www.scientificamerican.com/
7. https://royalsocietypublishing.org/

A Great Paleoanthropological Fraud: Dawson's Dawn Man

Koustav Bhattacharjee, Ex Student (2017-19), PG Dept. of Zoology, Barasat Govt. College

Introduction

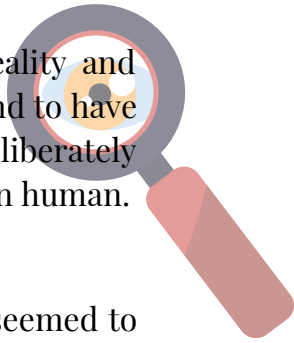
Scientific discovery on every aspect brings a new hopes and aspirations to the society, people get informed by some sort of unknown information or even rediscovered form of some old concept. But all the discoveries are not great, it seems promising on that particular time but the real truth might be something else just like in the case of discovery in Pilt Down man.

The pilt down man discovery was a palaeoanthropological fraud in which bone fragments were presented as the fossilized of a previously unknown early human. It was basically a hoax skeleton; the skeleton which is not the intact one or natural rather artificially made skeleton.

Discovery

- In 1912, Charles Dawson claimed that he had discovered the "**missing link**" between ape and man in the form of " Pilt Down man".
- In February 1912, Dawson contacted Arthur Smith Woodward, who was the Keeper of Geology at the Natural History Museum and Dawson told him about his discovery. Smith Woodward then reconstructed the skull fragments and hypothesised that they belonged to a human ancestor from exactly 500,000 years ago.
- The discovery was announced at a Geological Society meeting and was given the name as *Eoanthropusdawsoni* ("Dawson's dawn-man") on the honour of Dawson's name.

About forgery



In 1953 the great scientific discovery of once upon a time hit the harsh reality and transformed into a great scientific fraud or skeletal forgery forever. It was found to have consisted of the altered mandible and some teeth of an orang-utan deliberately combined with the cranium of a fully developed, though small-brained, modern human.

The Piltdown hoax is prominent for two reasons

- The attention it generated around the subject of human evolution which seemed to be more attractive at that time because the study regarding human evolution was not gained the ground.
- The length of time, 41 years, that was a long time to eclipse the real truth under the covers and make a complete different story on it before revealing the truth till 1953.

The main forgers

The identity of the Piltdown forger remained unknown initially, but suspects have included **Dawson, Pierre Teilhard de Chardin, Arthur Keith, Martin A. C. Hinton, Horace de Vere Cole** and **Arthur Conan Doyleat** that time but the ultimate truth revealed at 1953.

Legacy and influence

- Discovery of Pilt down man influenced the early discoveries of human evolution like:-
- The discovery of Taung child by Raymond Dart from African region at 1924 which was the 6 years old child's skull of *Australopithecus africanus* which was originally serves as the "missing link" of ape and human and the reconstruction of human evolution was confused for decades.

In November 2003, the **Natural History Museum in London** held an exhibition to mark the 50th anniversary of the exposure of the fraud regarding pilt down man forgery.

So if we arrange the total incidents related with the Pilt down man and his discovery the it would be looking like as per timeline:-

- **1912 June**

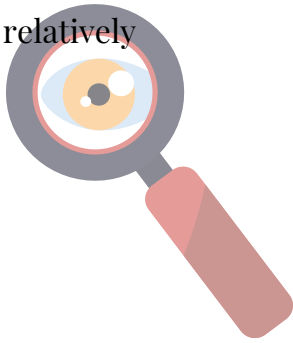
After contracting with Arthur Edwards; Dawson, Woodward, and Teilhard de Chardin form digging team, different parts of skull had discovered from that particular place of Pilt down.

- **1925**

Edmond reports Piltdown geology error. Report ignored.

- **1949**

With the basis of Fluorine content test it establishes that Piltdown Man was relatively recent.



- **1953**

Weiner, Le Gros Clark, and Oakley expose the hoax.

- **2003**

Full nature of Charles Dawson's career in fakes is exposed.

- **2016**

Study reveals method of Dawson's forgery.

References

1. "The Natural History Museum Annual Review 2003/2004".Archived from the original on 5 November 2005.Retrieved 17 November 2007.
2. Caroll, Robert Todd (1996). "Piltdown Hoax". Archived from the original on 13 November 2007.Retrieved 29 August 2007.
3. Harter, Richard (1997). "Creationist Arguments: Piltdown Man". Archived from the original on 20 August 2007.Retrieved 29 August 2007.

Down Syndrome: A Synergic Association of Immune Complexities & Autoimmunity

Susraba Chatterjee, Ex Student (2017-19), PG Dept. of Zoology, Barasat Govt. College

'Down Syndrome': A name that is not only regarded as one of the most common chromosomal anomalies but also it's a milestone that reflects the benevolent nature of human society from 6000 years ago. The recent archeological data published in 'Nature' informs the oldest confirmed case of DS(Down Syndrome) baby who was buried almost 5,500 years ago found from Poulbrone, Ireland. DS is a genetic disorder due to the presence of an extra copy of chromosome 21. It is evident that mainly 3 reasons may be responsible for DS includes: a) nondisjunction of sister chromatids in first meiotic division b) Robertsonian Translocation c) Reciprocal Translocation. The presence of this HSA21 leads to altered immune regulation, autoimmunity, heart disease, endocrine disorder, neurological issues and phenotypic variability. In this article I will discuss the immune impairment associated with DS.

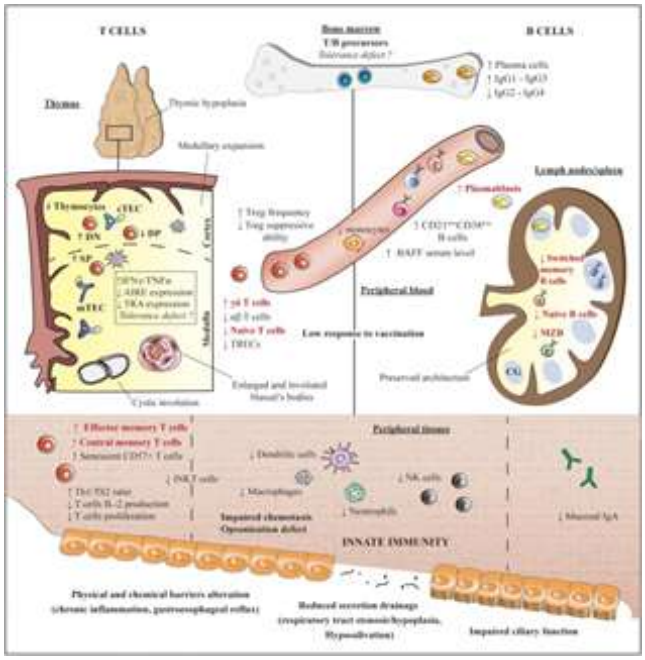
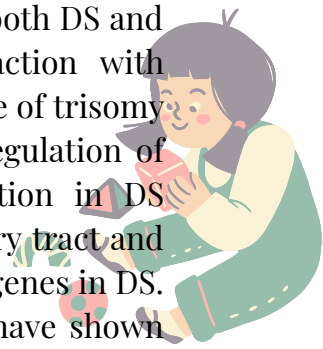


Figure: Immune dysregulations and autoimmunity in DS. [From: Dieudonne Y et al., 2020]

Apparently, the presence of extra HSA21 gene is not only associated with overexpression of different genes but also down regulation of some. This dynamic expression level can alter DNA-protein interplay, alter DNA position and disrupt whole genome networks. Previous study noted that many immune systems associated genes are located on HSA21 (human chromosome 21) that could lead to altered cellular and humoral immune function. Overexpression of 4 interferon receptors (IFNAR1, IFNAR2, GR2, LI10RB) genes and pro-inflammatory cytokine genes (IL-6, IL-10, TNF, IL-26) on chromosome 21 lead to 'cytokine storm'. Thymus is a primary lymphoid organ and T cell maturation place associated with thymic T cell selection to eliminate auto reactive T cells. Autoimmune regulator protein (AIRE) is a key component of thymic selection and

coded from HSA21. Structurally abnormal thymus with smaller size and increased medullary Hassall's corpuscle is an evident complication of DS. Lowered expression of AIRE genes in DS is a reason for defective negative T cell selection. This loss of function of AIRE and its related genes (TOP2a, NUP93) can generate autoimmunity and defective Treg cell generation. Chemotactic activity of neutrophil is impeded due to down regulation of the CD11b receptor on its membrane in DS. Elevated level of NK cells with its hyperactive signaling to interferon may be a reason for immune deregulation. Reduced numbers of CD4+(TH) and CD8+(TC) cells, impaired development of memory T cell, reduced TCR excision cycle ultimately altered T cell normal activity. Tc cells stimulate a high level of IL-17A expression that creates a network with IFN signaling to induce inflammation and autoimmunity. Numbers of switched memory B cells are decreased in adult DS patients. So, inappropriate antibody response, altered antibody titer value, impaired immunization and increased susceptibility towards a pathogen are observed in the DS. Increased probability of B lymphocyte apoptosis in its germinal centre is one of the main reason for Lymphopenia in DS. Lowered IgA, IgG2, IgG4, IgM and elevated level of IgG1, IgG3 mediated Hypergammaglobubinaemia also noticeable after 5 years of age in DS. Normally numbers of CD3+ γδ T cells are found to be lowered in blood but in case of DS γδ T cells significantly increased. Elevated expression of Inflammasome mediated IL-1 β is reported in DS children. Hypocomplementemia or reduced complement factors (C1QA, C3, C6) is evident in DS. TLR mediated pro inflammatory signaling, Activation induced cytidinedeaminase mediated (AICD) immunoglobulin class switching are altered in DS. Micro RNA mediated gene expression has an impact for autoimmunity development. Micro RNAs (miR-99a, miR 155, miR125b-2) are overexpressed in trisomy 21 and act as molecular sponge to down regulate innate immune genes. Most of these immune deregulations emulate developing autoimmune disorders-Type 1 diabetes mellitus (T1DM), Hypothyroidism, Celiac disease, Alopecia, Vitiligo, and Idiopathic Arthritis. In this article I will discuss some of the most prevalent autoimmune disease-T1DM, Hypothyroidism. 5.7% of DS children compared to 0.28% normal children population exhibit presence of Autoantibody against β islets, Insulin (IAA), Zinc Transporter 8, glutamate decarboxylase. Elevated expression of UBASH3A gene on HSA21 leads to down regulation of NF-Kβ mediated innate immunity and self tolerance. Replication of β cells during early childhood is dependent on the Nuclear factor of activated T cell (NFAT) translocation inside the nucleus. NFAT expression is promoted by calcineurin phosphatase and NFAT kinase. Down syndrome critical region (DSCR) code for inhibitors of calcineurin phosphatase and ultimately β cell replication is hampered. Thyroid dysfunction in DS is the most common endocrine abnormality. In DS patients. Maturation of Hypothalamo-Hypophyseal axis is delayed that hampers TRH (Thyrotropin releasing hormone)-TSH (thyroid stimulating hormone)-TH (thyroid hormone) cycle. Presence of anti thyroid peroxidase (TPO) antibody, reduced TSH activity, altered TSH secretion, abnormal functionalities of Thyroid hormone(TH), toxic effect of interferon (IFN) on Thyroxine (T_4) gene could lead to thyroiditis. This is a striking discovery found in this covid 19 pandemic that the DS persons are more

susceptible to the covid virus majorly because of the impairment in their immune system. 'Cytokine Storm' is one of the deadliest reasons that is common in both DS and COVID 19. Coronavirus entry is dependent on spike protein(S) interaction with angiotensin converting enzyme (ACE2) receptors of host cells. TMPRSS2 gene of trisomy 21 activates S protein and promotes virus entry. In recent study, down regulation of NUP62, NOP210 nucleoporins are reported to enhance viral incorporation in DS patients. Coronavirus can disrupt tight junctions to enter into the respiratory tract and this procedure is intensified by down regulation of 2 tight junction forming genes in DS. Despite such disadvantages there have been studies which show that DS have shown protective approach against coronavirus by elevating antiviral protein genes to inhibit viral entry and genome release. DS shows elevated expression of EIF2AK2 gene and combination of this gene with PPP1CA (serine/threonine-protein phosphatase PP1 catalytic subunit) down regulation is a magnificent mechanism to block viral protein synthesis.



At last from these review studies we may develop some future therapeutic approaches to regulate immune response by designing some microRNAs that can block and target some key factors of hyperactive immune signaling. In the case of coronavirus entry, already designing of blocking agents against the coronavirus entry receptor gene is proposed as a fruitful treatment option.

Finally there is hope that further research in this field could result in opening up the 'black boxes' of immune impairment among DS individuals to offer them a better life.

References

1. Butler AE, Sacks W, Rizza RA, Butler PC. Down Syndrome-Associated Diabetes Is Not Due To a Congenital Deficiency in β Cells. J Endocr Soc. 2017 ;1(1):39-45.
2. Ferrari M, Stagi S. Autoimmunity and Genetic Syndromes: A Focus on Down Syndrome. Genes (Basel). 2021;12(2):268.
3. Hüls A, Costa ACS, Dierssen M, Baksh RA, Bargagna S, Baumer NT, Brandão AC, Carfi A, Carmona-Iragui M, Chicoine BA, Ghosh S, Lakhanpaul M, Manso C, Mayer MA, Ortega MDC, de Asua DR, Rebillat AS, Russell LA, Sgandurra G, Valentini D, Sherman SL, Strydom A; T21RS COVID-19 Initiative. Medical vulnerability of individuals with Down syndrome to severe COVID-19-data from the Trisomy 21 Research Society and the UK ISARIC4C survey. EClinical Medicine. 2021 ;33:100769.
4. Moreau M, Benhaddou S, Dard R, Tolu S, Hamzé R, Vialard F, Movassat J, Janel N. Metabolic Diseases and Down Syndrome: How Are They Linked Together? Biomedicines. 2021 Feb 22;9(2):221.
5. Pepe G, Corica D, De Sanctis L, Salerno M, Faienza MF, Tessaris D, Tuli G, Scala I, Penta L, Alibrandi A, Pajno GB, Aversa T, Wasniewska M; Thyroid Study Group of the Italian Society of Pediatric Endocrinology and Diabetology (ISPED). Prospective evaluation of autoimmune and non-autoimmune subclinical hypothyroidism in Down syndrome children. Eur J Endocrinol. 2020 ;182(4):385-392.

Navegaon & Tadoba National Park: An Unforgettable College Excursion

Arghya Biswas, Ex Student (2017-19), PG Dept. of Zoology, Barasat Govt. College

Two years ago, we returned from our annual college excursion trip to Navegaon and Tadoba. The enchanting forest provided a mix of diverse geographical attributes from mountains to small lakes amidst the forest. In general, Navegaon used to be a small village in the Chandrapur region of Maharashtra and is now part of Nagpur whereas Tadoba, named after 'Taru" God of local tribesman is now one of the hotspots especially for sighting tigers. Navegaon gate leads way through the buffer zone to the core area of Tadoba National Park. While visiting Tadoba's core area in the Chandrapur district of Maharashtra pretty much guarantees tiger sightings. Both parks have many man-made watering holes that, in that dry countryside, have become an oasis for animals; since these watering holes are visible from the path, there are opportunities for excellent animal sightings. We had a lot of samplings work at both places. A great number of insects were also collected by my friends. We were a team of about 40 people including teachers.

The hit of the fresh air around us was equally enchanting and delightful. The trees seemed greener. There were stars visible in the night sky that would never be the same again from Kolkata. The atmosphere around us was warm and soothing. The mild breeze of spring and ecstasy to explore the vast nature kept us on our nerves.

In early morning safaris, the jungle was beginning to wake up and the birds were chirping. We were moving ahead to the core region of the forest via the Navegaon gate, trailing through the buffer zone. The forest scape appears very welcoming from the distance as one is approaching it. About several kilometers, after crossing the second gate, the forest path takes a bend and joins the main path that goes towards Tadoba Lake. During these safaris, we were divided into small groups which gave us more coverage and access to our findings.

We saw a diverse range of wildlife—from tigers, leopards, sloth bears, wild dogs, and many species of deer. Above our heads, a profusion of birds enchanted us—the rollers and doves, the gorgeous racket-tailed drongos the brilliantly plumaged parakeet, golden orioles darting around like streaks on a Van Gogh painting. The water birds dotted the fringe of the lake like a pearl necklace.

On the last day of the Tadoba trip, we finally got to see a tiger. It came close by and stopped in front of us on our right side. She was finding a spot in between the vehicles for him to cross. Gypsys exactly behind us was following us with equal space to make way for them to pass. This time our heart was pounding as she came so close distance of our vehicle–not more than 5 feet–and walked by our side for 2 mins. She is an enormous wild tiger and we observed her powerful muscles from a very close distance as he walked further. When she stared at us, at that moment, I leaned back and turned my head towards the driver to avoid direct eye contact with this tiger. It was beyond imagination and I don't find any words to describe that feeling. There were tumultuous

tides of emotion running inside us. We also found some fresh carcass, that has been left by the tiger. While returning we came across a bear. At distance from us, we saw it crossing the sides of the jungle and getting busy scraping food from the floor of this vast multitude of greenery.

Tadoba in itself is a small reserve forest. Therefore, the tigers here are accustomed to people who come here as wildlife enthusiast or families enjoying vacation here. Luckily, the authorities have only opened 20% of the park to tourist traffic; hence it's just the tigers whose territories fall in these areas. An interesting side-note, from Navegaon gate towards Tadoba is an inspiration and the setting for Rudyard Kipling's 'The Jungle Book'.

We also had a great time together as friends, made memories that will last a lifetime before each of us get busy in our lives back in the city and get caught up in the cob-web of monotonous career making and settlement. At the most, we can never be thankful enough for our teachers and college authorities without whom this trip would not have been a success. I shall be forever in debt to them for giving me some of the best unforgettable moments in life.

Our short trip made us realize Life in the forest is beautiful, living one day at a time, making memories that will last a lifetime. The greater knowledge that we acquired was truly priceless.

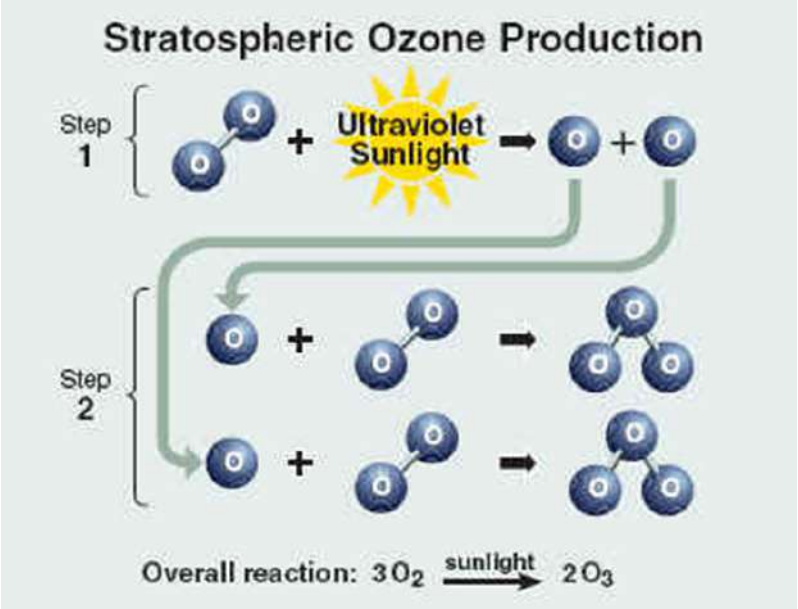
Atmospheric Ozone: A Friend or Foe?

Anwesha Das, Ex Student (2018-20), PG Dept. of Zoology, Barasat Govt. College

Ozone (O_3) is a colourless gas. It is made up of three oxygen atoms. Ozone in atmosphere is found in both Stratosphere (2nd layer of atmosphere) and in Troposphere (lowest layer below stratosphere). It is a powerful oxidizing agent. It readily reacts with other chemicals and makes many toxic oxides.

Ozone (O_3) layer in stratosphere

Ozone forms an ozone layer or Ozone Shield in lower part of the Stratosphere 15-30 km above Earth's surface. Stratosphere has the highest concentration of O_3 (10 ppm) than other parts of atmosphere (0.3 ppm). O_3 is formed when UV light strikes an oxygen molecule to form 2 oxygen atoms. Each atom then combines with another oxygen molecule to form ozone.



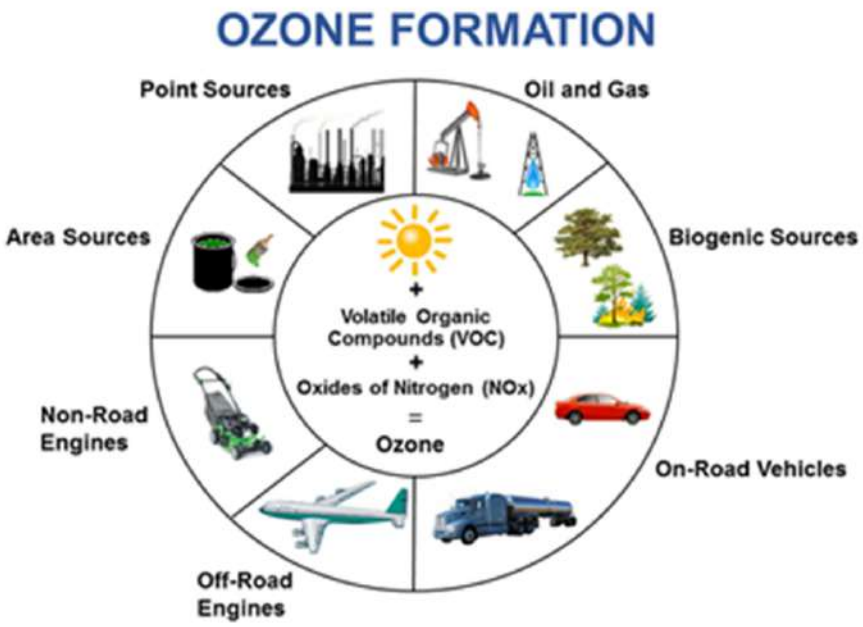
Importance of stratospheric ozone shield

Ozone is unstable, but it is long-lived in Stratosphere. It absorbs 97-99% of ultraviolet radiation [UVB and part of UVC: λ 310-200 nm; max absorption 250 nm] coming from the sun which is very harmful for all forms of life on Earth. Thus, ozone shield in the Stratosphere protects the ecosystem and our lives by preventing diseases such as cataract, skin ailments and cancer. (Subedi, T., 2017).

Tropospheric or ground-level ozone

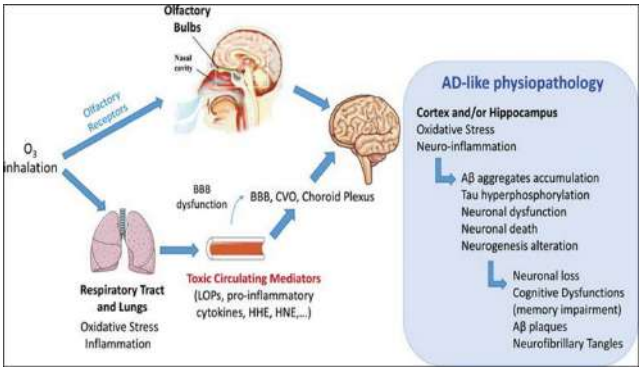
Ground-level ozone is mainly produced by human activities by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOCs) such as xylene in presence of sunlight. Therefore, ozone is a secondary air pollutant. Ground-level

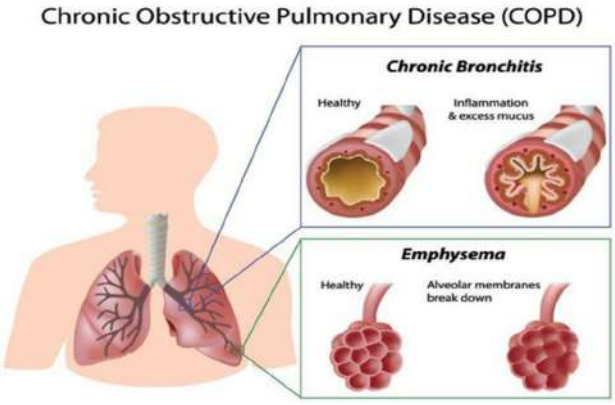
ozone increases in urban areas during daytime and reaches its peak at noon or early afternoon.



Health hazards caused by tropospheric ozone

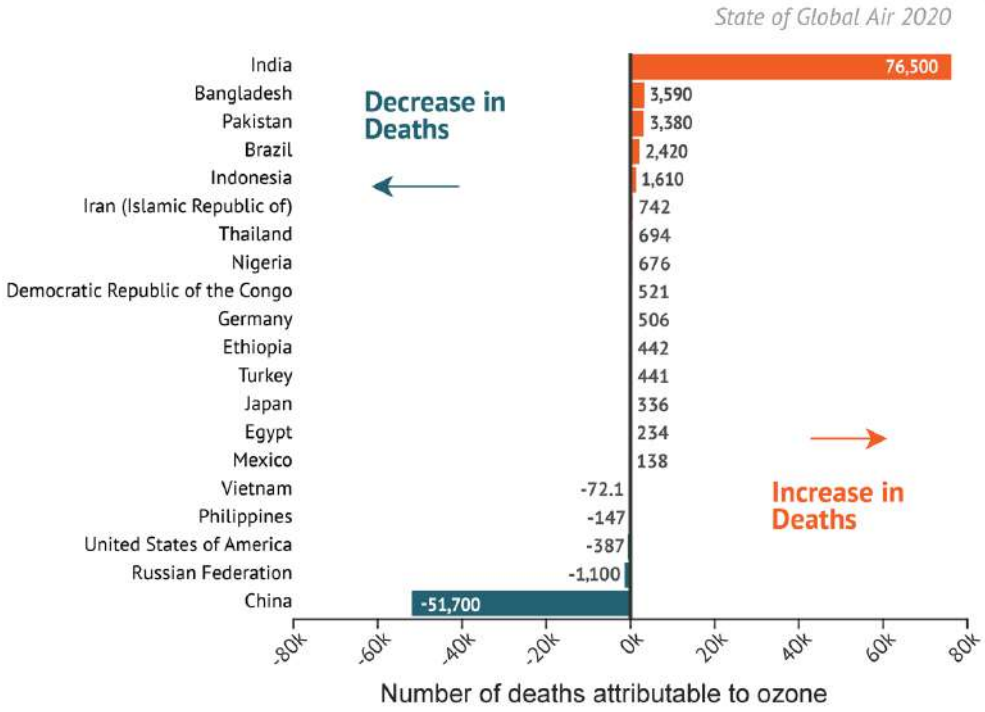
- Due to its toxic nature ozone causes lung injury, reduction in lung function and develop chronic obstructive pulmonary disease (COPD) which is combination of two diseases- Chronic bronchitis (inflammation, mucus hyper-production and blockade of air tubes) and emphysema (destruction of alveolar walls).
- Ozone impairs short-term and long-term memory, disturbs sleep-wake cycle. It produces oxidative stress via generation of ROS in the lungs and the ROS can reach the CNS through the bloodstream, causing neural damage and development of Alzheimer's disease (AD) (Croze and Zimmer, 2018).





Mortality due to ozone exposure

Because of its serious effects on human health, ozone is also associated with premature deaths, particularly among vulnerable populations and even more particularly among those with respiratory and heart problems. More vulnerable are children with developing lungs, older adults with lower immunity.



Conclusion

Ozone present in the stratosphere absorbs UV-ray and protects us from adverse effects of this ray and reduces global warming. So, we have to be more conscious about the destruction of this layer and formation of ozone hole. But tropospheric ozone produced by vehicular emission causes different types of health hazards. So, we should reduce the precursor sources of ground level ozone. From this review we can conclude that when ozone is present in **stratosphere** it acts as '**friend**' of human being as well as other animals but **tropospheric ozone** is actually '**foe**' for us causing different health hazards.

References

1. Croze ML, Zimmer L. Ozone Atmospheric Pollution and Alzheimer's Disease: From Epidemiological Facts to Molecular Mechanisms. J Alzheimers Disease 62, 503-522,2018.
2. Health Effects Institute. 2020. State of Global Air 2020. Special Report, Boston, MA: Health Effects Institute.
3. Subedi, T. Ozone: A Pollutant and a Protector Gas. Janapriya Journal of Interdisciplinary Studies, 5:124-132,2017.

Cobra Genome Secrets Found Way to Better Anti-Venom

Avirup Ghosh, Ex Student (2018-20), PG Dept. of Zoology, Barasat Govt. College

Snakes are misunderstood and sometimes maligned, primarily out of ignorance about their true nature and position in the natural world. Snakes are the most specialized group of reptiles. They are ectothermic, elongated, limbless, carnivorous, amniote vertebrates covered in overlapping scales. Diverse species of poisonous and non-poisonous snakes are found all over the world. Varieties of snakes are found in India also and their length varies from 6 mm to 10 mm, while weight ranges between few grams to several kilograms. Snakes are occupied in various habitats like deserts, forests, marshy, swampy places, lakes, streams and rivers of inauspicious terrains.

Snakes bite either for prey capture or for self-defense. Not every snake bite is created equal. There are two different types of snake bites, dry bites (occur when a snake doesn't release any venom with its bite and these are mostly seen with non-venomous snakes) and venomous bites (These are much more dangerous when a snake transmits venom during a bite). Snake bites are especially common in poor communities, often in rural areas. People with specific jobs are also more at risk, including agricultural workers, herders, fishermen and hunters.

The evolutionary history of snake venom may be a matter of debate. Venom originated among Toxicofera nearly 170 million years ago, then diversified into the wide range of taxa. The original toxicoferan venom was a very simple set of proteins that were assembled in a pair of glands. In due course, this set of proteins diversified in the various lineages of toxicoferans, including Serpentes, Anguimorpha, and Iguania. Later several snake lineages lost the ability to produce venom, often due to a change in diet.

Charles Lucien Bonaparte, son of Lucien Bonaparte, younger brother of Napoleon Bonaparte, was the first to establish the proteinaceous nature of snake venom in 1843.

Figure 1. Charles Lucien Bonaparte

Snake venoms are composite mixture of pharmacologically active proteins and polypeptides. They play a vital role in incapacitating and immobilizing, as well as in digesting prey. It is a clear, transparent, pale yellow or straw-coloured fluid having a specific gravity of 1.03-1.07.

The pH value of the venom ranges from 5.5 to 6.8 in different species. It is protein in nature containing many enzymes, viz. Hyaluronidase, L-Arginine hydrolases, Proteinase, Transaminase, L-Amino acid oxidase, Phospholipase -A, B and C, Phosphodiesterase, Cholinesterase, Ribonuclease, Deoxyribonuclease, Alkaline phosphatase, Acid phosphatase, Exopeptidases etc. The composition of venom extends from species to species. It is wrecked by coagulating agents like $KMnO_4$, $AgNO_3$ and alcohol and strong alkalies like NaOH and KOH etc. The venom also contains few metals like zinc (Zn), sulphur (S), copper (Cu).

Figure 2. Snake

Venom

The poison apparatus consists of a pair of poison glands, their ducts, fangs and associated muscles.

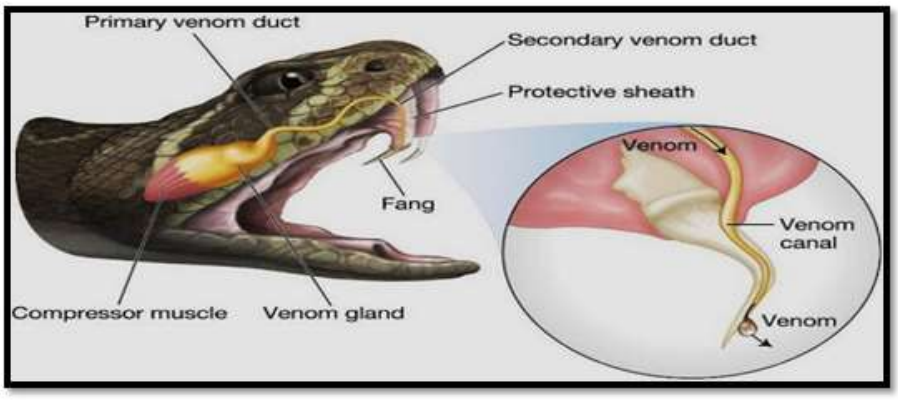


Figure 3. Venom gland and venom duct

In poisonous snakes a few maxillary teeth are modified to act as poisonous teeth or fangs. The fangs are conical, curved, sharply pointed with enlarged maxillary teeth which regenerate when lost. These are with an intake aperture and a discharge aperture basally and sub-terminally respectively. Different types of fangs are also found in the snake world. They are (i) Proteroglypha: Fangs are small, relatively non-movable and situated at the front of the maxillary bone. Fangs of cobras, kraits, mambas (Fam. Elapidae) and sea snakes (Fam. Hydrophidae) are included in this category; (ii) Solenoglypha: Fangs are long, hollowed and situated at the rear end of the maxillary bone. They are vertically movable in which the fangs are folded against the roof of the mouth when the jaws are closed. Fangs are pierced by venom canals, thus acting as hypodermic syringe; (iii) Opisthoglypha: Fangs with open groove on the posterior surface, situated at the posterior extremity of the maxillary bone. The fangs are either one or two in number with few smaller teeth in front, eg. vine snake (*Ahaetulaa nasutus*), common cat snake (*Boiga trigonata*), flying snake (*Chrysopelea ornata*).

Figure 4. Fangs of snake

Snakes are dangerous because of their venom. Venom is actually highly-modified saliva that is made up of 90 percent proteins and 20 percent enzymes. Most of those enzymes are harmless to humans and are generally not dangerous when ingested. Snake venom is classified into 3 groups as per the nature of action on tissues of human beings.

a. Neurotoxic venom

The venom effects mainly on nervous system. Ultimately the respiration halts due to failure of nervous system and death occurs. This type of venom is found in cobras, kraits, mambas and coral snakes. Other species are Taipan (*Oxyuranus scullatus*). Tiger snake (*Notechis scutatus*), Death adder (*Acanthophis antarcticus*) and Tropical rattlesnake (*Crotalus dwissus*).

Figure 5. Coral snake

b. Haemo-toxic venom

The venom acts on blood vascular system. Damage is observed in the blood vessels lining causing hemorrhages. RBC is destroyed causing haemolysis. Clotting of blood occurs in vipers and rattlesnakes. This attacks the cardiovascular system, circulatory system, and muscle tissues, thus directly resulting in coronary failure. The C*rotalus atrox*, notoriously known as the western diamondback rattlesnake, uses this deadly venom to make its prey more pliable.

Figure 6. Rattle snake

c. Myotoxic venom

The venom effects on muscles. This venom is found in sea snakes like *Bothrops moojeni*, commonly referred to as the Brazilian lancehead snake. It is known to cause muscular necrosis. Its symptoms are a dry throat, thirst, thickened-tongue sensation, muscular spasms, and convulsions. The other symptoms are stiffness of the jaw, neck, trunk, and limbs, along with severe pain in movement.

Figure 7. Sea snake

d. Cytotoxic venom

Cytotoxic venom is usually composed of several digestive enzymes and spreading factors, which end in local and systemic injury. Clinical effects progressing from pain and edema to ecchymosis (bleeds under the skin) and bullae (watery blisters) most commonly predominate. Haematological abnormalities including benign defibrination with or without thrombocytopenia (increased bleeding and decreased clotting) may result, but severe generalized bleeding is not common.

Figure 8. *Bitis arietans*

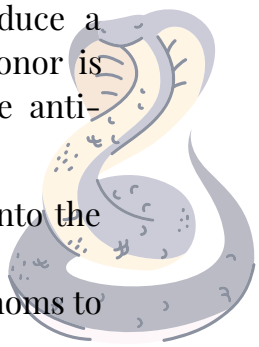
The anti-snake venom is the specific antidote for venomous snake bites. The only available treatment against snake bites is the use of anti-venom. The first anti-venom was developed by Albert Calmette against the Indian cobra (*Naja naja*). Anti-venom is produced by immunizing mammals such as horse, goat, rabbit with particular snake venom and the specific immunoglobins are isolated from the blood. The subject animal will undergo an immune reaction to the venom, producing antibodies against the venom's active molecule which may then be harvested from the animal's blood and used to treat envenomation.

Figure 9. Albert Calmette

Anti-venom is classified into two types: (i) Monovalent anti-venom when they are effective against a given species venom, (ii) Polyvalent when they are effective against a range of species. Snake anti-venom is a medication made up of antibodies used to treat snake bites by venomous snakes. It is a type of antivenom. They are on the World Health Organization's List of Essential Medicines, the foremost important medications needed in a basic health system.

Figure 10. Anti-venom

Anti-venom is usually produced employing a donor animal, like a horse or sheep which is hyperimmunized with non-lethal doses of one or more venoms to produce a neutralizing antibody response. At particular intervals, the blood from the donor is collected and neutralizing antibodies are purified from the blood to produce anti-venom.



1. A mixture of venoms from different species of venomous snakes is injected into the body of horse or goat or sheep.
2. The donor has high level of immunity with non-lethal doses of one or more venoms to produce a neutralizing antibody response.
3. The blood with antibodies is collected.
4. Neutralizing antibodies are purified from the blood to produce anti-venom.

Snake venoms are used for treatment of various diseases like epilepsy, asthma, arthritis, chronic nervous and muscular pain, neuritis, neuralgia, migraine and pain for cancer. Russell viper's venom can be used as homeostatic agent. To stop the internal bleeding venom's dilution are often used. In homeopathy rattlesnakes venom is employed to cure various diseases like lumbago, sciatica, coccygodynia, laryngitis, pleurisy and insomnia, etc.

Venom samples from the puff adder (*Bitis arietans*) milked daily for a period of 5 days, were investigated with regard to electrophoretic patterns and protein concentration (Willemse et al. 1979). Snakes are often milked consistent with a daily schedule, depending on the species. The gap between milking varies among producers and ranges from every 2 or 3 weeks to every 3 months. For very deadly species, the use of short-acting general anesthesia or moderate cooling (15°C) during milking can be considered (e.g. inhaled sevofluorane or sevoflurane, halothane or even carbon dioxide) because it reduces the risk of accidents both to the snake and to the snake-handler. For the venom collection, the snake's head is grasped between index finger and thumb, just behind the angle of the jaw, while the snake's body is held between the trunk and the arm of the snake handler. By applying little pressure, the snake's jaws are forced open, the fangs exposed. The fangs are pushed through a plastic/parafilm membrane hooked over the lip of a glass container, and venom is squeezed out. Any venom sample contaminated with blood should be eliminated. After extraction of venom the fangs are carefully withdrawn from the collection container, while preventing damage to the mouth and dentition and avoiding the snake's impaling itself with its own fangs. During milking, the wearing of protective clothing and a mask and vinyl gloves are suggested to stop any accidents or infections.

Figure 11. Milking process of snake venom

An international team, comprising several Indian researchers, recently reported high-quality sequencing of Indian cobra genome, unlocking the key code of its 'venome-ome' that carries 139 genes, out of which 19 are linked to venom-specific toxins (Source : Deccan Herald, 2021). The finding may help save thousands of lives in future because it exposes the doors to make better quality anti-venoms in the laboratory using recombinant DNA technology. Since 1896, anti-venom remains the quality treatment for snakebites though they trigger serious adverse responses and their ability to neutralise the venom is poorly understood. The genetic sequencing, on the other hand, could lead to the development of a safe and effective humanized anti-venom, the scientists reported in Nature Genetics. These 19 toxins using synthetic human antibodies should lead to safe and effective anti-venom for treating Indian Cobra bites. Currently, anti-venom is produced by immunizing horses with extracted snake venom and extracting the antibodies subsequently. Developed overflow 100 years ago, the process is laborious and suffers from lack of consistency resulting in varying efficacy and side effects. Using the genome and gene expression data from 14 different cobra tissues, the authors found that 19 toxin genes are expressed exclusively within the venom gland and verified the presence of protein for 16 of those genes by using mass spectrometry. They also performed comparisons with the prairie rattler and identified 15 toxin gene families unique to the Indian cobra. Venom is primarily used by snakes to conquer their prey. But it's also an upscale source of drug-like molecules. The Indian cobra genome is not any exception and it codes for toxin molecules which will block pain, reduce blood pressure and stop blood clotting, the scientists have shown. Scientists now plan to make the gene-maps of other three common poisonous snakes of India besides deadly African snakes (black mamba, carpet viper and spitting cobras) instead to make a large catalogue of venom toxins for developing a safe and universal anti-venom for snakebite victims all over India, Africa and other neighbouring countries.

In India anti-snake venom serum is prepared at the Haffkine Institute, Bombay and Central Research Institute, Kasauli, Himachal Pradesh. There anti-venom is prepared by immunizing horses. A mixture of venom of four common poisonous snakes (Cobra, *Naja*

naja: Common Krait, *Bungarus caeruleus*; Russel's viper, *Vipera russelli* and Saw scaled viper, *Echis carinatus*) is injected into horse's body and increases its doses gradually. When the horse acquires a particular level of immunity, the plasma is collected by drawing blood from the body. After collection, 10 ml doses are packed. Anti-venom of Banded krait, King cobra and Sea snake is not produced in India. Anti-venom of Banded Krait and King cobra is available at the Queen Saovabha Institute, Bangkok, Thailand. The anti-venom of *Enhydrina schistosa* is available in Japan and Australia.

Figure 12. Haffkine institute, Bombay

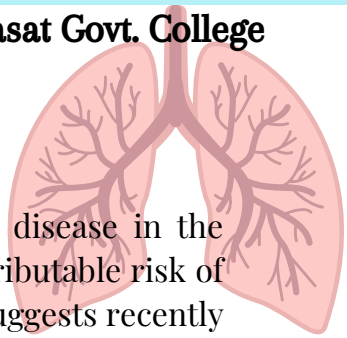
Snakebites are very common in the rural population of India. There is need to educate the general public about the preventive measures of snake bite, advantages of early hospital referral and treatment. Snake venom is the stuff of nightmares for few, the light at the end of the tunnel for others. It is a killer also a saviour.

References

1. Gutierrez, J.M., Williams, D., Fan, H.W., Warrell, D.A. (2010). Snakebite envenoming from a global perspective: the need of an integrated approach. Toxicon 56, 1223-1235.
2. Kang TS, Georgieva D, Genov N. et al (2011). Enzymatic toxins from snake venom: structural characterization and mechanism of catalysis. FEBS J, 278, 4544-4576.
3. Kemparaju K, Girish KS (2006). Snake venom hyaluronidases: a therapeutic target. Cell Biochem Function, 24, 7-12.
4. Willemse, G.T, Hattingh, J., Karlsson, R. M., Levy, S. and Parker, C. (1979). Changes in composition and protein concentration of puff adder (*Bitis arietans*) venom due to frequent milking. Toxicon 17, 37-42.

Occupational Asthma

Koustuv Chakraborty, Ex Student (2018-20), PG Dept. of Zoology, Barasat Govt. College



Introduction

Occupational asthma is the most frequent form of occupational lung disease in the developed countries as well as developing countries. The population attributable risk of asthma due to occupational exposures is considerable. Different study suggests recently the mechanisms by which many agents cause occupational asthma is limited, especially for low molecular- weight sensitizers and irritants. Early diagnosis, avoiding the exposure to the responsible agent, and early use of inhaled steroids may play important roles in the prevention of long-term persistence of asthma. Persistent occupational asthma is often related with substantial disability and consequent impacts on lifestyle. Prevention of new cases is the best way to reducing the burden of asthma attributable to occupational exposures.

What is occupational asthma?

Occupational asthma refers to asthma induced by exposure in the working environment to airborne dusts, vapours, or fumes, with or without pre-existing asthma. After confirming the presence of asthma, diagnosis hinges on obtaining a detailed and accurate occupational and environmental history and documenting a temporal association of symptoms or signs with workplace exposure.

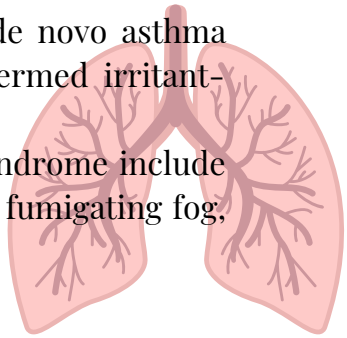
Types of occupational asthma

Sensitizer-induced occupational asthma

Occupational asthma from sensitizers presents with a latent period of exposure. After sensitization, respiratory pathway reactions develop from levels of exposure to the sensitizing agent that were tolerated before sensitization. The mechanism causing OA from some sensitizers has usually an IgE mediated immunological basis. But there are no mechanism at least no mechanism has been demonstrated for some suspected sensitizers (eg, colophony). OA sensitizers are classified on the basis of their molecular weight. High-molecular weight (HMW) sensitizers are usually>10 kd. HMW agents typically cause occupational asthma by IgE antibody-mediated mechanisms. Low molecular-weight (LMW) sensitizers often act as haptens in that they can only induce an adaptive immune response and be recognized as antigens after combining with self-proteins to form immunogenic conjugates after inhalation. Some LMW agents may cause IgE mediated sensitization (Leung and Ledford; 2002).

Irritant-induced OA

It was previously not considered as a form of occupational asthma, de novo asthma caused by exposure to inhaled irritants at work now is commonly termed irritant-induced OA.
Examples of agents reported to cause Reactive Airways Dysfunction Syndrome include chlorine gas, hydrochloric acid, anhydrous ammonia, hydrogen sulfide, fumigating fog, heated acids, and smoke by inhalation (Dhala A; 2005).



Causing sensitizers of OA (HMW)

Animal & insect derived	
Bird proteins (feathers, serum)	Bird breeders
Crustaceans: snow crab, prawn	Seafood processors
Eggs (chicken)	Food processors
Insects	Beekeepers, farmers, granary workers, silk processing, dockworkers
Mammalian proteins in hair, dander, urine	Research labs, veterinarians, breeders, pet shop workers
Pharmaceutical enzymes, eg, pancrease	Pharmaceutical industry, health care workers
Bacteria & fungal derived	
Bacillus subtilis–derived enzymes	Detergent formulators
Penicilliumcaseii	Cheese workers
Thermophilic molds	Mushroom workers
Plant-derived	
Henna dye	Beauticians
Latex, natural rubber	Health care workers
Plant enzymes (papain, bromelain)	Food, pharmaceutical industries
Psyllium	Laxative manufacture, nursing
Wheat flour	Bakers

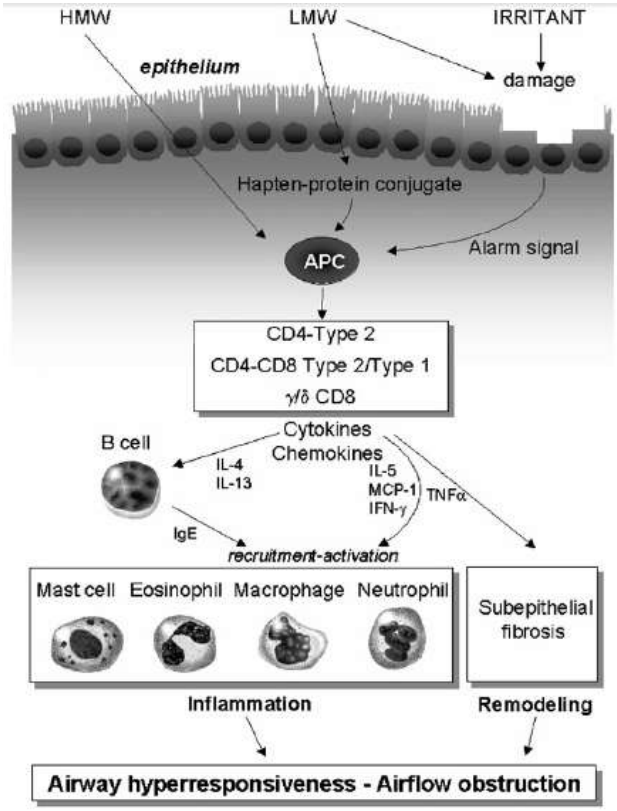
Source: Leung & Ledford; 2011

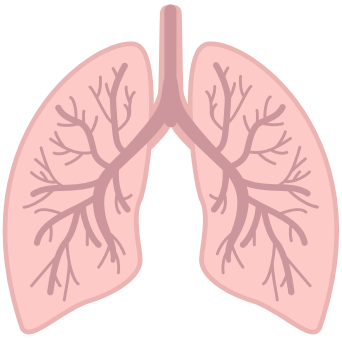
Causing sensitizers of OA (LMW)

Persulfates (in hair bleaching solutions)	Persulfates (in hair bleaching solutions)
Metals and metal salts	
Chromium	Miners and cement, electroplating and tanning workers
Cobalt	Metal workers and diamond polishers
Nickel sulfate	Metal plating
Platinum	Alloy makers
Organic chemicals	
Acid anhydrides (prototype: trimellitic anhydride)	Plastics industry, dye, insecticide makers, organic chemical manufacture (used in epoxy resin)
Ethylenediamine	Shellac/lacquer industry workers
Polyisocyanates (prototype: toluene diisocyanate)	Polyurethane, foam coatings, adhesives production, and end-use settings (eg, spray painters, foam workers)
Wood dusts (red cedar, oak, mahogany, redwood, iroko)	Foresters, woodworkers and furniture makers

Source: Leung & Ledford; 2011

Pathophysiology





Questionaire for occupatioal environmental history for suspected work-related asthma

1. Have you ever been transferred from a job because of a health reason? If yes, provide details.
2. When did you start your current job?
3. What is your current job description? Provide details.
4. What is your current work area? Provide details regarding job, exposure to all substances encountered in the work area, and description of job processes. This might require requesting the employer for access to material safety data sheets.
5. What is your current work shift?
6. What percentage of time during the day is spent in the work area?

Dao and Bernstein; 2018

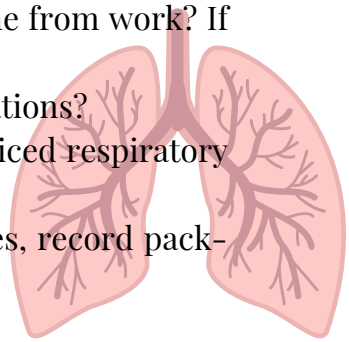
Questionaire for occupatioal respiratory history for suspected work-related asthma

- While at your current job, have you had wheezing, cough, chest tightness, or shortness of breath?
- If you answered yes, do these symptoms occur immediately after coming to work?
- If you answered yes, do these symptoms begin hours after coming to work?

Image Source: Mapp et al; 2005

If so, how many hours?

- If you answered yes, do these symptoms continue after coming home from work? If so, within how many hours and how long do these last?
- If you answered yes, do the symptoms decrease on weekends or vacations?
- How long were you working at your current job before you first noticed respiratory symptoms?
- Are you a current smoker, former smoker, or current smoker? If yes, record pack-years.



Diagnosis

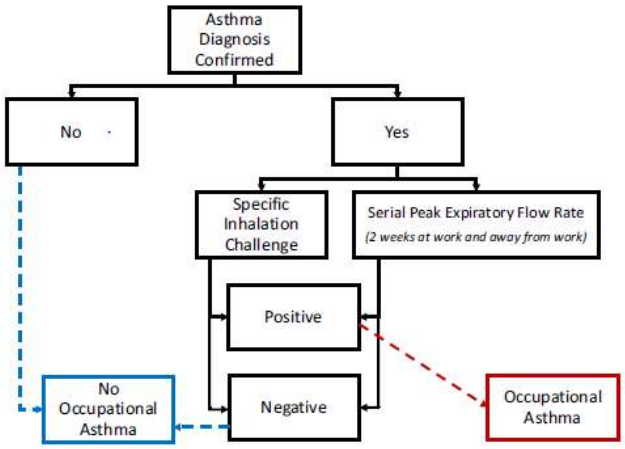


Figure 1. Stepwise approach to evaluating the worker with work-related lower respiratory symptoms. Asthma is confirmed by reversibility in forced expiratory volume in 1 second (FEV_1) or with methacholine testing. If asthma is present, then occupational asthma (OA) is confirmed by a positive specific inhalation challenge (if available) or serial monitoring of peak expiratory flow rate for 2 weeks at work and 2 weeks away from work.[6]

Prevention

Primary prevention

Complete elimination of the sensitising agent is a secure way of preventing exposure, but this is difficult to achieve. A more practical approach may be reduction in exposure and implementation of measures to limit the number of subjects exposed. However, there is as yet no evidence that reliably allows the setting of clear-cut no-effect threshold levels. Control of other known determinants should also be considered, such as atopy and smoking. Education, labeling and warning systems, environmental monitoring and management programs are important determinants indirectly related to primary prevention, as they are a prerequisite to implementation of the above controls.

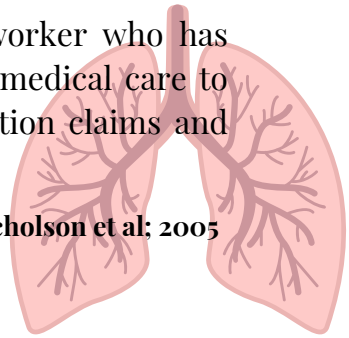
Secondary prevention

Secondary prevention is usually executed through regular medical surveillance of employees, and is aimed at the early detection of sensitisation and occupational rhinitis/ asthma. Respiratory questionnaires are generally used in surveillance programs, although these are neither standardised nor validated. Sensitisation can be detected by means of skin prick tests or testing for serum specific IgE antibody.

Image Source: Brooks SM & Bernstein IL; 2011

Tertiary prevention & compensation

This form of prevention aims to minimise the consequences for a worker who has already developed OA. The key to tertiary prevention is thus offering medical care to affected workers as well as assisting patients with relevant compensation claims and rehabilitation.



Nicholson et al; 2005

Future scope of research

1. The relationship between exposure to a sensitizing agent (allergen, chemical), atopic status, and the development of asthma: Research should focus on the dose-response relationship of allergen exposure, on the measurement of allergen exposure, and on possible interactions (smoking, endotoxin, particulates, pollutants) (**MJ et al;2003**).
2. The role of HLA class II molecules in the development of occupational sensitization and asthma, particularly to low-molecular-weight agents: Whether genetic susceptibility is a risk factor is an important issue, because it was shown that the *DQB1*0501* allele is involved in asthma induced by low-molecular-weight sensitizers such as organic acid anhydrides the same allele is relevant for asthma induced by isocyanates and plicatic acid (protective role) suggesting various affinities of chemical sensitizers for the corresponding specific class II molecules (**Horne et al; 2005**)
3. The role of airway inflammation and remodeling in causing chronic asthma, bronchial obstruction, and airway hyperresponsiveness: Research should focus on understanding the cellular and molecular events leading to airway remodeling, and on the development and validation of noninvasive markers of matrix turnover.
4. The mechanisms of irritant-induced asthma and factors other than exposure those are relevant to this type of OA: Research should focus on prospective cohort studies of individuals with possible exposure to high or repeated low levels of irritants, using accurate definitions of the population baseline characteristics (**Choi et al; 2004**).

References

1. Choi, J., Nahm, D., Kim, S., Kim, Y., Suh, C., Park, H. and Ahn, S. (2004). Increased levels of IgG to cytokeratin 19 in sera of patients with toluene diisocyanate-induced asthma. Annals of Allergy, Asthma & Immunology, 93(3), pp.293-298.
2. Leung, D. and Szefler, S. (2011). The Editors' Choice. Journal of Allergy and Clinical Immunology, 128(5), pp.946-947.
3. Meredith, S., Taylor, V. and McDonald, J. (1991). Occupational respiratory disease in the United Kingdom 1989: a report to the British Thoracic Society and the Society of Occupational Medicine by the SWORD project group. Occupational and Environmental Medicine, 48(5), pp.292-298.

Nature & Natural Healing Due to Pandemic

Ankita Mondal, 4th Semester (2019-21), PG Dept. of Zoology, Barasat Govt. College

In December 2019, a novel coronavirus was identified as the pathogen causing, mild or severe type of respiratory infectious disease known as Covid-19 (Coronavirus Disease). The first case of this disease appeared in the Wuhan city of Hubei in China. In January 2020, the World Health Organization confirmed human-to-human transformation through respiratory droplets. As this is a very contagious disease gradually the epidemic turns into a pandemic and now in more than 200 countries are suffering from this outbreak. On the 11th of March, 2020 Covid-19 was declared a pandemic by the WHO. Later the Coronavirus Study Group (CSG) of the International Committee on Taxonomy of Viruses (ICTV) named this virus SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2). The name was given due to its genetic relationship to the previous SARS-CoV that causes an outbreak of the disease in 2002-2003. Now, physical distancing, wearing masks, hand washing with soap-water and sanitizer with a minimum of 70% alcohol is a must to save ourselves from this disease.

But this disease has some mesmerizing effects on our environment. Nowadays, after the sunset, I can hear sounds I haven't heard in years such as the chorus of chirping crickets, serenading frogs, and screeching owls. According to WHO (2016), air quality is very essential for people's health but 91% of the world population lives in places where poor air quality exceeds the permissible limits. Due to lockdown, there is very little or almost no vehicle on the roads. For this, the sound of the traffic is replaced with the chirping of birds and tinkling of wind chimes and especially there is a drastic decrease in the concentration of nitrogen dioxide (NO_2) and Particulate Matter that have a diameter of fewer than 2.5 μm which is extremely dangerous as it can lodge deep into the lungs and pass into other organs and the bloodstream, causing serious health risks. NO_2 is a highly reactive pollutant and is produced from the combustion of fossil fuels. Traffic pollution is considered as the major source of this. NO_2 has highly lethal effects on human health (bronchial hyperresponsiveness, cellular inflammation, and some respiratory problems) for both short-term and long-term exposure. Air pollution is a global problem. The changes in transport activities and lower oil demand have a significant impact on the environmental quality. NASA (National Aeronautics and Space Administration) and ESA (European Space Agency) announced fresh pieces of evidence which suggest that environmental quality has improved greatly and the emission of NO_2 reduced up to 30%. In India, especially in New Delhi, there is a 50% reduction in air pollution observed. NASA suggested that in India the reduction of air pollution is low for the first time in the past 20 years. Besides this carbon emission was reduced drastically. Aerosol is one of the important pollutants identified by national and international agencies which is associated with mobility and mortality. NASA's Terra and Aqua satellites had measured the size distribution and the optical depth of ambient aerosol over the globe on an hourly basis that showed a huge decrease in the concentration level

of AOD (Aerosol Optical Depth) just after a week of reduction of human activities. Climate experts suggested that greenhouse gas (GHG) emissions drop to proportions never had been seen before since World War II. The air is so clear that one can now see the Himalayas more than 120 miles away which occurs for the first time in 30 years. The ozone layer slowly starts repairing and the rate of the melting of the Arctic ice has reduced for the first time in the last 50 years. This is a sign of a solution towards the greatest environmental issue global warming.

Due to halt in public and transport activities, noise levels had dramatically decreased significantly in most countries. The noise pollution is so low that seismologists investigating earthquakes in London, Brussels and Los Angeles reported that the ambient noise levels are so low that they are now better able to detect even smaller seismic events in these cities. The non-responsible activity of people had caused many beaches in the world to become highly polluted. The decrease in the number of tourists on the beaches due to lockdown had caused a remarkable change in the appearance of many beaches in the world such as Acapulco (Mexico), Barcelona (Spain), and Salinas (Ecuador) had crystal clear clean water. With each passing day, the rivers are visibly purer and clean, and the once-endangered flora and fauna are now coming back to life. In India, it is estimated that every day, almost 40 million liters of wastewater enters rivers and other water bodies. The river holy Ganga of India became a dump yard for untreated sewage and industrial waste but during lockdown water quality of Ganga improved extraordinarily with a 79% increase in DO values. Within 10 days of lockdown, signs of improvement in water quality have started. The water of Ganga at Haridwar and Rishikesh was suggested fit for drinking due to a 50% decrease in sewage and industrial effluents. The pollutants' concentration in Vembanad Lake, the longest lake in India, decreased by an average of 16% compared to the values of the previous year. Water pollution in San Francisco Bay in California has reduced notably due to the reduction in traffic. The toxic particles emitted by cars, fall into the surrounding waters, inlets, and on the coast for miles. The overabundance of nitrogen and other chemicals and nutrients in the water can cause excessive algae growth which causes consumption of oxygen, leaving the waterbody without oxygen to support life.

We have been extremely cruel to nature, but the lockdown brings a great change. Actually, Coronavirus comes as Earth's vaccine. We, humans, are the virus who destroy the Mother Nature in all possible ways. Covid-19 is a human tragedy but we should consider Covid-19 as a "Blessing in Disguise", where pollution is reducing and nature is reclaiming itself. If you could leave nature on its own, it survives and comes back to its own life but levels will go back up as soon as we reopen the economy because most of the people are not going to learn anything from this devastating pandemic. This type of positive impact on the environment may be temporary but governments and every individual should learn from this lockdown on how to reduce pollution on a long term basis because pollution is going to come back in a much worse form if we ignore the investment required for cleaning our air, water, and land. We need to understand that a

growing economy needs to respect the carrying capacity of nature. By ignoring that we have already made our cities unlivable with excessive pollution, which makes us further vulnerable to Covid-19 like pandemics. We are standing on the threshold of various environmental issues. We must have to learn about sustainable development because nature does not need humans but we need nature to survive. Let's use this time to plan on what we should do and will definitely do after things normalize. Not all of us are revolutionaries and not all changes are possible at a broad level. What is possible is that a small bit from all of us, a drop in the ocean but nevertheless a contribution to the whole. Always we have to remember that small steps bring great changes. We take everything from Mother Nature and now it is the time to take care of her.

Weblinks

1. https://indianexpress.com/article/opinion/world-environment-day-covid-pandemic-6450766/
2. https://moderndiplomacy.eu/2020/04/07/covid-19-lockdown-and-migratory-birds-international-perspective/
3. https://www.cbc.ca/news/science/pandemics-biodiversity-covid-19-1.5528063
4. https://www.india.com/festivals-events/world-environment-day-2020-positive-impact-of-covid-19-lockdown-on-environment-4047703/
5. https://www.livescience.com/leatherback-sea-turtle-babies-thrive-covid-19-pandemic.html
6. https://www.thehindu.com/sci-tech/energy-and-environment/covid-19-lockdown-like-interventions-may-help-combat-air-pollution-in-india-say-scientists/article31746151.ece
7. https://www.thehindu.com/sci-tech/energy-and-environment/covid-19-lockdown-not-all-news-of-urban-wildlife-spotting-is-factual/article31228052.ece
8. https://www.thehindubusinessline.com/opinion/columns/the-effect-of-covid-19-on-indias-air-quality/article31564038.ece
9. https://www.weforum.org/agenda/2020/03/covid-19-climate-change/
10. https://www.weforum.org/agenda/2020/05/covid-19-coronavirus-pandemic-nature-environment-green-stimulus-biodiversity/

G-quadruplexes: The Four Stranded DNA is the New Weapon Against Cancer

Arup Chanda, 4th Semester (2019-21), PG Dept. of Zoology, Barasat Govt. College

What is G-Quadruplex?

Guanine-rich DNA sequences can fold into four-stranded, noncanonical secondary structures called G-quadruplexes (G4s). Previously G4s were considered as a special structure of DNA but in recent times some researches prove that it has an effective role in transcription, replication, genome stability and epigenetic regulation. Thus, G4 plays a crucial role in the field of cancer biology. In a G4 structure, four Guanines are connected by Hoogsteen hydrogen bond where each of the four Guanine acts as an acceptor as well as a donor for two hydrogen bonds.

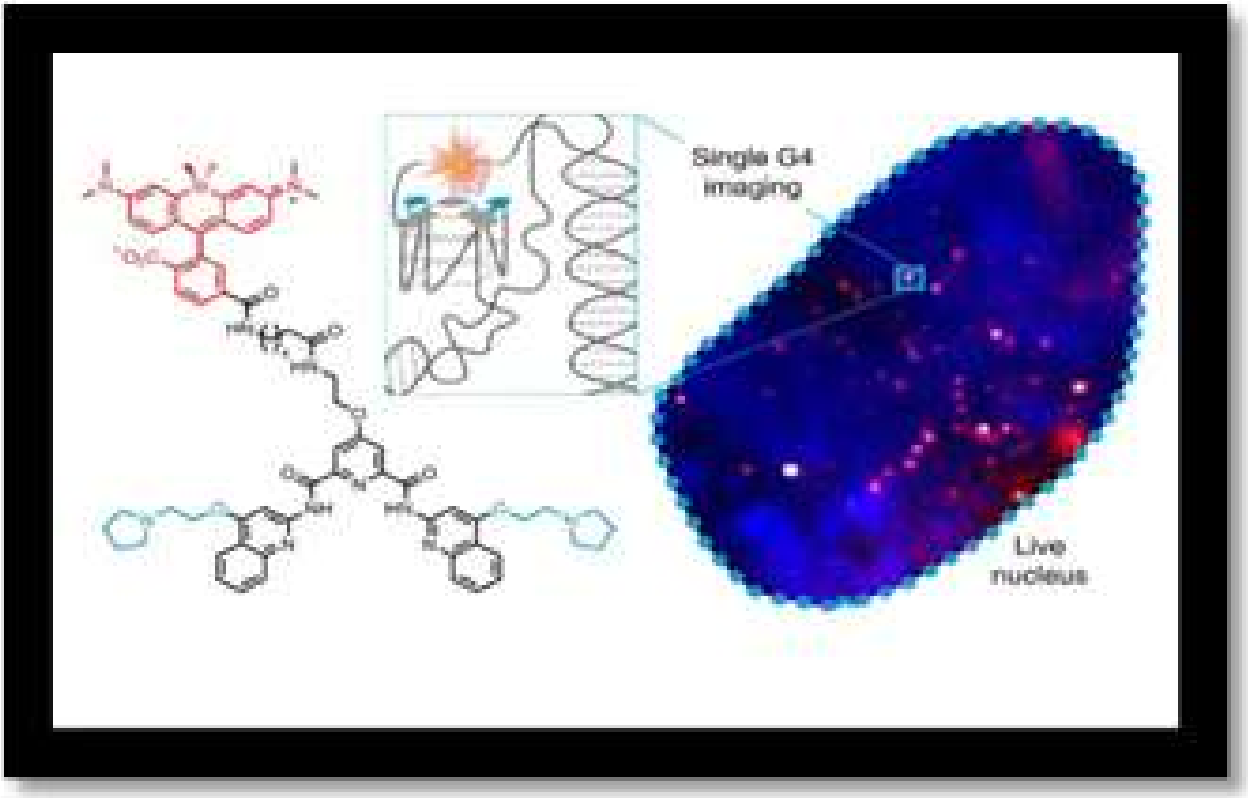


Figure 1. G-Quadruplexes

G4 motifs are not randomly distributed throughout the genome, but are enriched in certain regions (e.g. promoters, telomeres, transcription factor binding sites).

There are three classes of G4-interacting proteins: G4 binding, G4 stabilizing and G4 unwinding proteins (e.g. helicases: BLM, WRN, BRIP1/FAN. There is strong evidence that the deletion or mutation of those protein(eg.PIF1) coding genes leads to change in G4s formation results in changes of biochemical pathways like transcription and also increase in genome instability. So it suggests that alteration within some G4 interacting helicases leads to the proceedings of cancer progression and tumorigenesis although

there is no proof that can support the link of tumorigenesis and mutations of G4 interacting helicases related to G4 formation.

Increased level of G4 expression was seen in stomach and liver tissue of immortal HeCaT cells compared to the normal or healthy cells. Different lines of research work demonstrated that changes in G4 formation/stability can alter telomerase activity, transcription efficiency (inhibit or promote) stall DNA replication and induce genome instability.

G4-Ligands:

G4 ligands are the chemical molecules or proteins that can modulate G4 structure formation. G4 ligands that modulate G4 structure formation or stabilize G4 structures were developed with the idea that G4 formation can be used as an anti-tumor treatment strategy by blocking cellular replication or expression of oncogenes. These ligands have different binding surface, cell permeability and distinct specificity. Most of them, including **MM41**, **Telomestatin**, **BRACO19**, **TMPyP4**, **RHPS4**, and **PDS** preferentially bind G4 structures over duplex DNA.

Mechanism of G-Quadruplexes:

G4 formation/stabilization was supported by G4 ligands and there are three different therapeutic strategies discovered till now:

First, formation/stabilization of G4 structure at telomere results in inhibition of Telomerase:

Treatment of cancer cells with the G4 ligands **Telomestatin** or **2, 6-diamidoanthraquinone** derivatives leads to telomerase inhibition, whereas the G4 ligand RHPS4 resulted in telomere dysfunction by disrupting the telomere protecting shelterin complex.

A great approach is to use specific G4 ligands which can acts as photosensitizer in Photodynamic Therapy (PDT). Photosensitizers specifically target tumors and cause an increased ROS production after photoirradiation, which results in a cytotoxic effect for the tumor cells. **Porphyrins** are well known photosensitizer used in PDT. Specific porphyrin derivates have been developed to target telomeric G4 (**TMPipEOPP, ZnP1**).

TMPipEOPP binds to the Telomeric G4 sites and after photoinduction the ligand bound sites are cleaved which leads to cell death by increasing the ROS level. **ZnP1** creates a singlet oxygen after photoinduction which drives cleavage leads to increase in ROS production and cell death.

Second, G4 formation can affect expression of oncogenes:

The MYC gene encodes for the transcription factor MYC, which is upregulated in 70% of all cancers and drives oncogenesis by altering cell proliferation, metabolism, and immune evasion. We can block the expression of MYC gene by inducing G4 structure formation at MYC gene promoter.

Third, under certain conditions G4 structures can result in genome instability:
G4 misregulation means G4 formation in cell at wrong time and wrong place leads to alteration in replication and recombination event as well as DNA damage.

Treatment with G4 ligands (e.g. **PDS**) leads to enhanced DNA double strand breaks, replication pauses, micronuclei formation and telomere maintenance problems. BRCA1, BRCA2, Rad51 deficient cells show slow growth, fragile telomeres, DNA double strand breaks and checkpoint activation when treated with **PDS**. When functional DNA repair machinery is absent, stabilization by **PDS** enhances genome instability leads to checkpoint activation that can further cause G2/M cell-cycle arrest and cell death.

G4 ligand **20A** can cause G4 mediated upregulation of proteins coding genes where those gene products involved in autophagy and apoptosis thus proving that **20A** has an anti-tumorigenic affect.

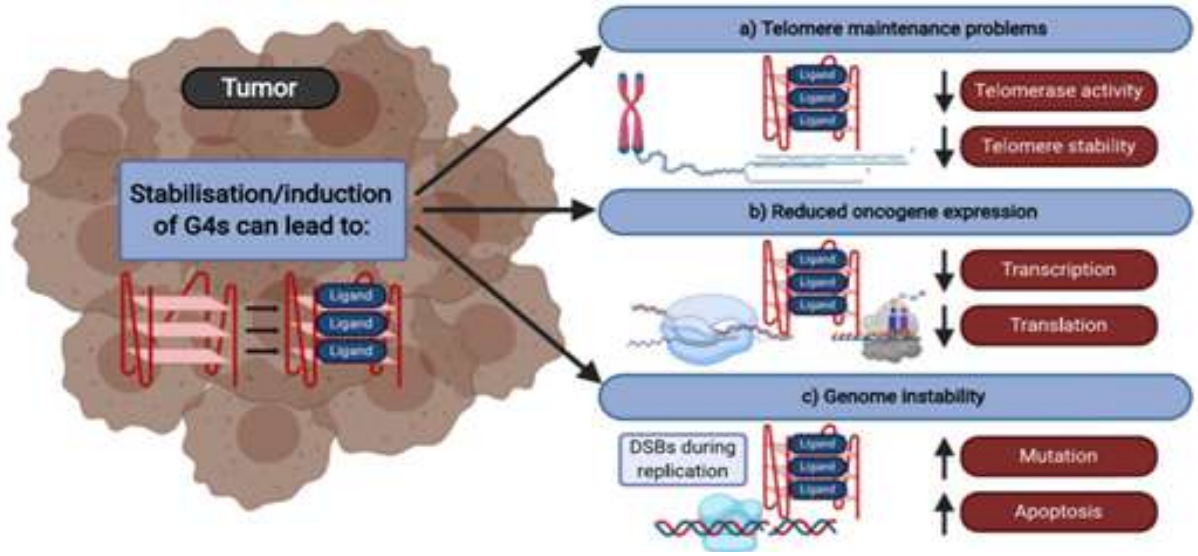


Figure 2. Mechanism of G-Quadruplexes

Application in cancer treatment:

- **In melanoma:**

  G4 ligand **RHPS4** can inhibit the growth of cancer cells of several different melanoma cell lines. Melanoma cells treated with the **imidazole-benzothiazole** conjugate **IZTZ-1** show reduced cell growth. Both ligands target MYC and lead to a reduction of MYC protein expression (up to 80%) after G4 stabilization. Prostate and melanoma cell lines treated with either **RHPS4** or **BRACO19** for 3-21 days can cause telomere uncapping which leads to end to end fusion of chromosomal ends.

- **In pancreatic cancer:**

  RAS genes (KRAS, NRAS and HRAS) represent the most frequently mutated oncogenes in human cancer including pancreatic cancer. The expression of all three RAS genes can be reduced by G4 formation. G4 stabilization at the KRAS gene

promoter can silence the KRAS expression by blocking transcriptional activity.

- **In leukemia:**

  Cells from Acute Myeloid Leukemia (AML) patients when treated with G4 stabilizer **Telomestatin** leads to apoptosis and telomere shortening.
  Similarly, telomere shortening and senescence were observed with the G4 ligand **SYUIQ-5** in K562 and HL-69 leukemia cells, because of changes in the expression of telomerase (TERT) and TERF2.

Conclusion

Here I present and discus the relevance of G4 structure formation and stabilization as a therapeutic approach to treat cancer cells based on the recent research data.

Weblinks

1. https://www.nature.com/articles/s41557-020-0506-4
2. https://www.google.com/amp/s/www.livescience.com/amp/quadruple-helix-DNA.html
3. https://www.cell.com/trends/chemistry/fulltext/S2589-5974(19)30174-1
4. https://molecular-cancer.biomedcentral.com/articles/10.1186/s12943-021-01328-4
5. https://www.google.com/amp/s/www.newscientist.com/article/2249390-quadruple-stranded-dna-seen-in-healthy-human-cells-for-the-first-time/amp/

Some Captivating Animals

Paulami Ghosh, 4th Semester (2019-21), PG Dept. of Zoology, Barasat Govt. College

Angora Rabbit

This is an elder form of domestic rabbit which were found only in the Turkey but now available in many countries. We know that sheep, goat, yak, alpaca provide us wool but interestingly this rabbit provides us wool, the long fur coated it, and also it is the non-allergic type of wool.

Elephant Bird

The elephant bird is considered as the world largest bird ever found which is three times larger than ostrich. The weight was approximately 450 kg and had approximately 12 feet in height. They were last seen at about 1200 AD at the Madagaskar island and became extinct due to human activities such as this birds were being the main source of food for the locals until they diminished entirely.

Dumbo Octopus

We can imagine the film “Dumbo", where the elephant calf can fly with the help of specialized ear. Here also the octopus can swim with the ear. This ear is mainly a fin, appears from the mantle just above eye, and its arms are also short in length. For those special features the dumbo octopus can swim as well as escape very soon as they reside the pelagic region of the ocean.

Firefly - A Lightning Bug

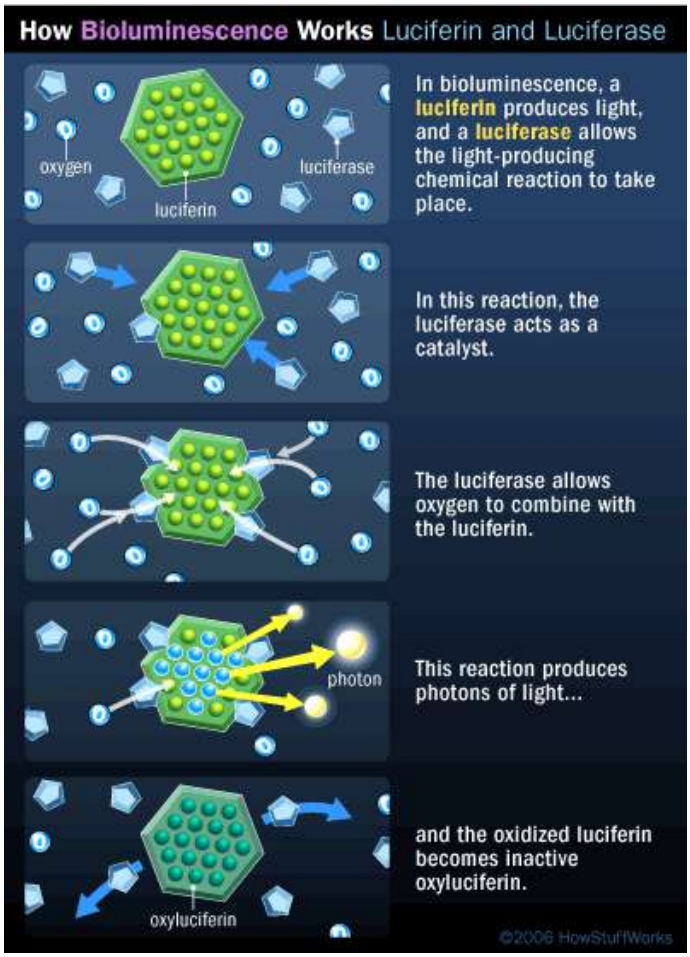
Anushka Sengupta, 2nd Semester (2020-22), PG Dept. of Zoology, Barasat Govt. College

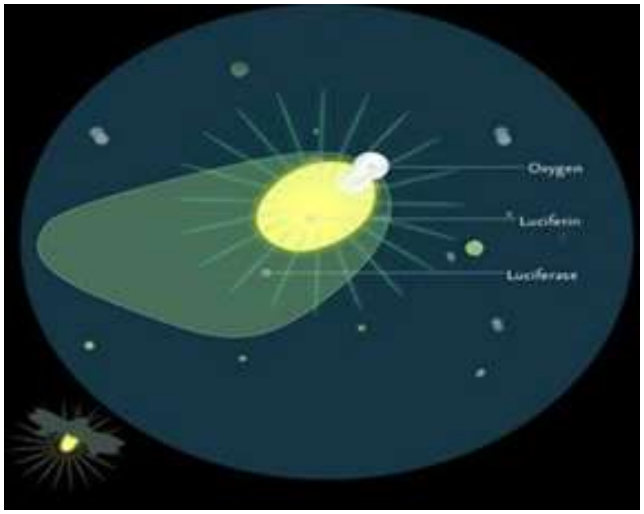
Firefly, Firefly ; wow, how are you glow!
Under your body ; you light up below!
Firefly, firefly ; wow, how you Shine!
At night in the dark ; I can see you just fine!
-MeishGoldish

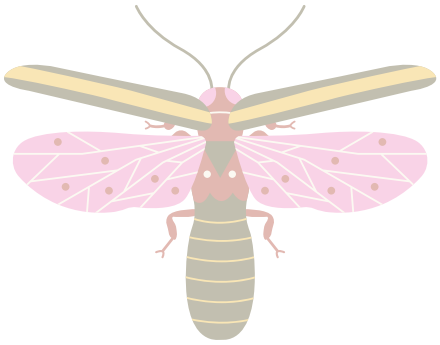
Fireflies are the most amazing creation of nature which can produce and EMIT different natural light like yellow, green and even orange sometimes. Such light is called "Cold light", it is the result of some biochemical reactions taking place in their transparent abdomen is known as bioluminescence.

Cold light: Heat generation by firefly is a chemical reaction which is common event, but these energy consuming reaction produce less than 20% heat or sometimes no heat is generated by this process. (Wavelength- 510 to 670 nm). Usually, generation of light produces a lot of heat along with light, but here light is produced with heat, hence it is known as "cold light".

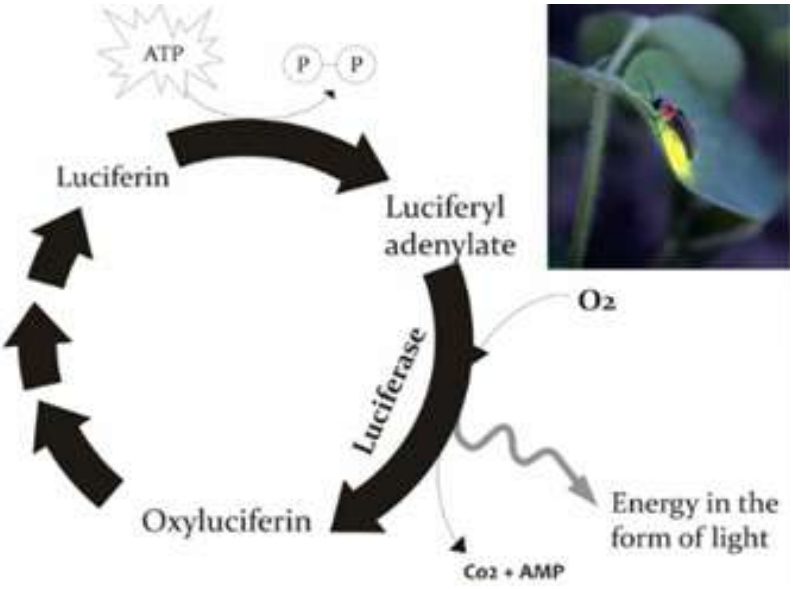
Bioluminescence reaction:



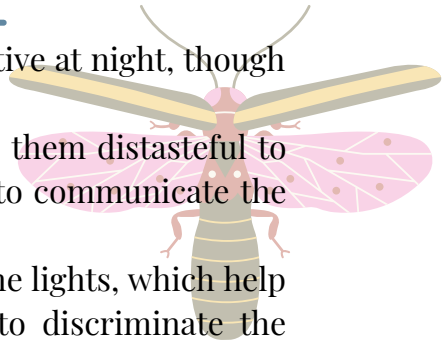




We can find Fireflies always in fresh healthy and pollution free environment which is warm and full of humidity where light is limited (like forest Paints beneath the trees riverside).



There are various reasons for lighting up of the Fireflies :



- The larvae of the fireflies produce short glows, which remain active at night, though many species are subterranean or semi-aquatic.
- The fireflies are able to produce a defensive steroids that make them distasteful to the predators. The larvae use the short glow as warning lights to communicate the unpalatability.
- The adult fireflies have species specific unique flash pattern of the lights, which help them to identify other members of their species as well as to discriminate the members of opposite sex.
- Based on several studies, it has been observed that female fireflies choose mates, which is determined by specific flash pattern.
- It has been observed in two Fireflies species that the higher male flash rate with increasing flash intensity are more attractive to females.

Significance of bioluminescence:

- It helps in polarizing behaviour of Firefly hot there cold light they can easily find their prey.
- For reproduction or for identification of mate partner-attracting by their light
- Community identification can easily identify their own community by the light
- Self-defense can easily defend or protect themselves from any predators, confusion appears.

Communication

- This cold light helps in communication of Fireflies speaks at same time.
- In Fireflies communication plays a role in regulation of bioluminescence. They can turn on the genes for light production only at high cell densities, using extracellular lunch secreted molecules.

Attracting mates and preys

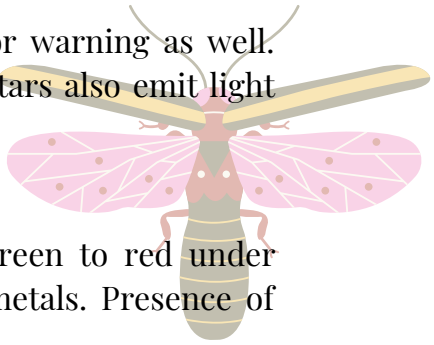
- It eats mite, snail, sludge - which keeps our environment healthy.
- Fireflies use this property to attract mates. Sometimes females emit periodic flash of light from their abdomen to attract males in the mating season, on the other hand sometimes flying males emit signals to which the female respond.
- Dinoflagellates use bioluminescence for defense against predators, as they shine when they detect a predator.

Camouflage

- Bacterial bioluminescence is used for camouflage by counter illumination.
- Photoreceptors control the illumination to match the brightness with the background in some animals, having separate light organs.
- In firefly squid, *Watasenia scintillating* is responsible for this.

Warning light

- Bioluminescence is widely used for warning. *Millipedes* glow for warning as well. Some marine organisms like scale worms, jellyfish and brittle stars also emit light for the same.



Bioindicator or indicator species

- The luciferase of firefly bioluminescence shifts from yellow-green to red under acidic pH, at high temperatures or in the presence of heavy metals. Presence of Fireflies indicate the environment is pollution free.

Fireflies help human beings to find a path in dark forest.

Fireflies are now highly threatened species among 2000 species only 7 to 8 are found in India.

Birds, spiders, frogs eat Fireflies.

Fireflies usually do not bite because they lack pincers they do not attacks they do not carry any disease they are not poisonous they cannot even fly very fast.

When predator attacks they start reflex bleeding - produce drops of blood filled with nasty Chemicals that is poisonous to lizard and birds (not for human).

Causes of declined habitat / population:

The numbers of firefly flies are gradually declining throughout the world. The basic factors for this decreasing number of Fireflies are,

a) Light pollution.
b) Use of pesticides
c) Loss of Habitat.

Fireflies are disappearing. While the exact reason is still unknown, three main factors are suspected: Loss of Habitat, toxicants (which tend to linger in aquatic environments where fireflies start their lives) and light pollution.

The decline in firefly population density has ecological and conservation implications. Based on literature and local environmental conditions, pesticides are believed to affect the firefly population and climate change could also be a factor.

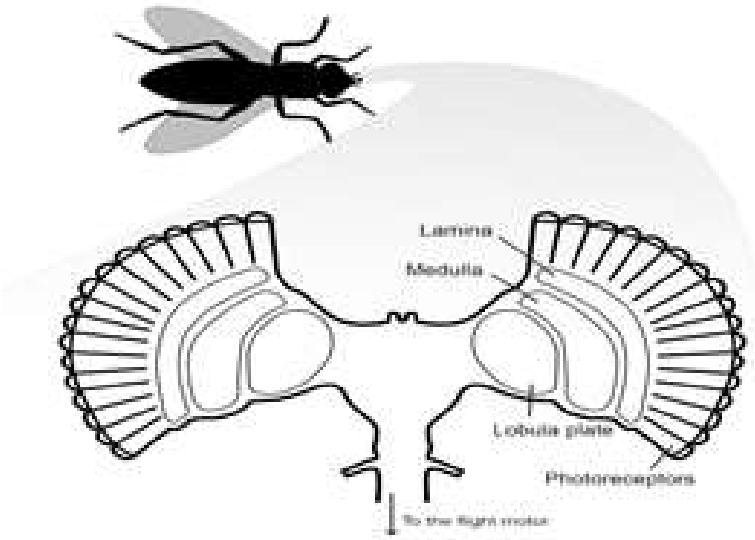
Weblinks

1. https://www.nationalgeographic.org/encyclopedia/bioluminescence/
2. https://www.reed.edu/biology/courses/BIO342/2012_syllabus/2012_WEBSITES/Agan Barrett-5.Website/Mechanism.html
3. https://www.scientificamerican.com/article/how-and-why-do-fireflies/

The Visual System of *Drosophila melanogaster*

Avijit Karmakar, 2nd Semester (2020-22), PG Dept. of Zoology, Barasat Govt. College

The visual system of animals helps to perceive their surrounding environment. The fruit fly ***Drosophila melanogaster*** belongs to the invertebrates and constitutes an important model organism for this group. The adult *Drosophila* visual system contains about 150,000 neurons and glia cells. The *Drosophila* detected the visual information by their retina and visual processing occurs in the optic lobes. The optic lobes are the main regions where neuronal computations extract important features from the visual world, such as shape, motion, color, e-vector orientation of polarized light, which are then transmitted to the central brain (CB).



1. The compound eye

The adult Drosophila compound eye is made of about 800 independent unit eyes called ommatidia. Each ommatidium composed of 8 photoreceptor cells (R1 – R8), that differ in the rhodopsin. The photoreceptor cells R1-R6 receive information about the motion. R1-R6 cells express rhodopsin Rh1, which responds to a broad spectrum of visible light. The R7 and R8 cells helps in colour vision. R7 cell expresses the UV-sensitive rhodopsin Rh3 or Rh4 and R8 cell expresses Rh5 or Rh6.

2. Optic lobe

The optic lobes are composed of following parts. They are:- **lamina, medulla, and the lobula complex** which is further subdivided into the **lobula and the lobula plate**. Two major types of neurons are found within the optic lobes: **1. Interneurons** whose cell bodies and projections remain within the optic lobe, and **2. Projection** neurons, which connect the optic lobe to the CB(central brain).

2.1 Lamina

The lamina is organized into radially distinct regions, called **cartridges**. The curvature of the compound eye causes the outer photoreceptor cells R1 - R6 to know information about different spatial locations. To increase sensitivity, the photoreceptor cells R1 - R6 from different, neighbouring ommatidia are guided to an equivalent one cartridge within the lamina. This allows to maintain retinotopy. This process is called **neural superposition**. R7 and R8 cells do not share the problem of retinotopy, because they are situated in the centre of the ommatidium. The photoreceptor cells R1-R6 ends in the lamina and associate to the lamina neurons by formation of synapses. These lamina neurons transmit the information into the medulla. R7 and R8 do not form synapses in the lamina and enter into the medulla.

2.2 Medulla

The medulla consists of 10 distinct layers M1 – M10 and is radially divided into columns. R7 projects specifically into the layer M6 and R8 projects into the layer M3. The lamina neurons also exhibit stereotypic connection patterns. Lamina neurons, as well as the photoreceptor cells R7 and R8 form synapses to neurons that guide the visual information out of the medulla into the lobula and lobula plate. By passing of the information through the lamina, medulla, lobula and lobula plate, the information is computed and allows visual perception of the environment.

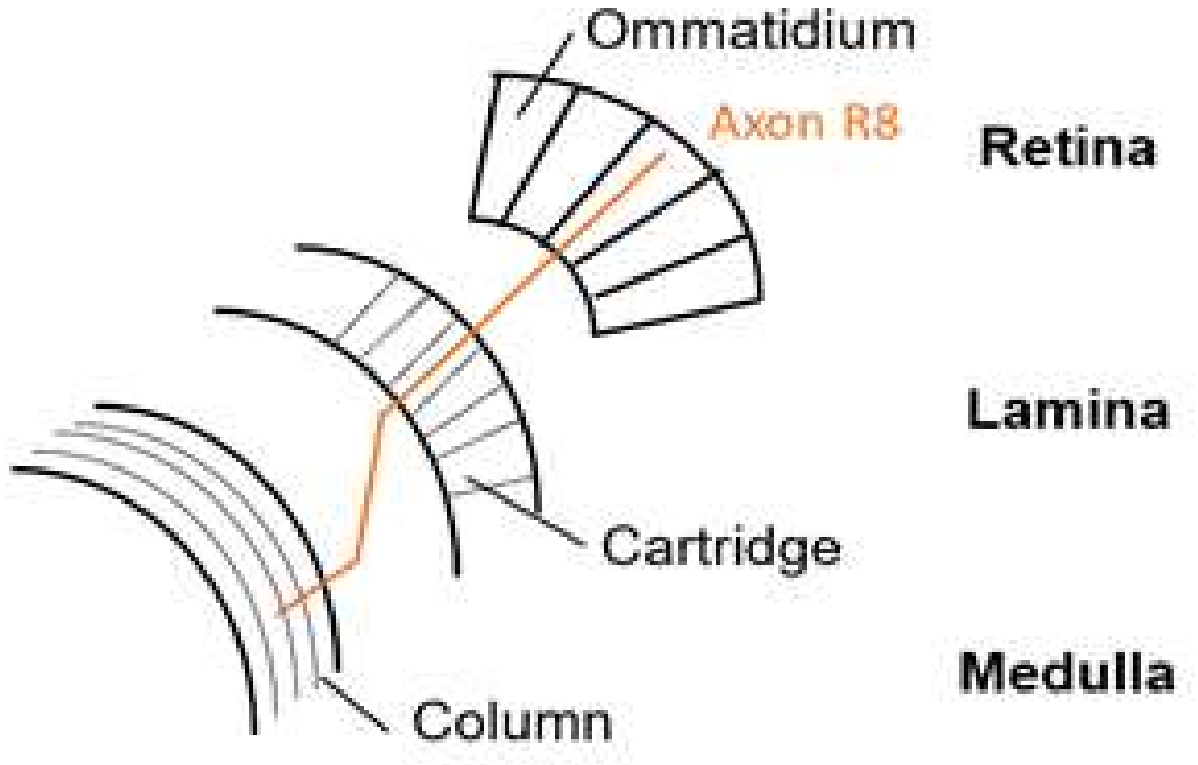


Figure: Schematic Drawing of Retina, Lamina and Medulla in the fly visual system

2.3 Lobula complex: the lobula

The lobula can be differentiated into 6 layers arranged perpendicularly to the columnar structures. This layer formation occurs due to the columnar inputs of the medulla neurons. Almost all lobula cells are projection neurons whose cell bodies are located between the central brain and the lobula Complex. Interestingly, despite the cell bodies varying distance to the lobula, their projections all merge at the neck of the lobula to form a one fiber tract connecting the lobula to the central brain. Lobula neurons are two types: 1. **Columnar neurons (LC)** that receive visual input from 8–9 ommatidia, reminiscent of multicolumnar neurons in the medulla; 2. **Tangential or treelike neurons (LT)** that receive input from very large visual fields, almost like medulla tangential neurons.

2.4 Lobula complex: the lobula plate

The lobula plate neuropil can be differentiated into four layers containing dendrites. Two types of lobula plate interneurons are observed, called **T4** and **T5**. Each neurons can be further subdivided into four subclasses. The T4 neuron can be divided into:- **T4a, T4b, T4c, T4d** and T5 neuron can be divided into:- **T5a, T5b, T5c, T5d**. Their cell bodies are all located adjacent to the lobula plate neuropil, beneath medulla rim cell bodies. Two other classes of interneurons can be identified. They are:- **1. Translobula-plate neurons (Tlp)** and **2. Y cells**. They have pre-synaptic input in the lobula plate and post-synaptic output in the lobula. Both have their cell bodies nearby to those of T4 and T5 cells.

The **Lobula Plate Tangential Cells (LPTCs)** are projection neurons. LPTCs are sensitive to visual motion during a direction-selective manner. They receive their inputs from the T4 and T5 neurons and send direction-selective visual information to the ventrolateral neuropils of the Central brain.

3. Visual Centers in the Central brain

The central brain mainly consists of Ventrolateral neuropils. **The Ventrolateral neuropils (VLNPs, also called optic glomeruli)** are located right beneath the optic lobes. VLNPs can be considered the most important part in visual processing after the optic lobes. There are 14 different types of lobula projection neurons project to distinct target regions within the VLNPs. The visual function is performed by each optic glomerulus.

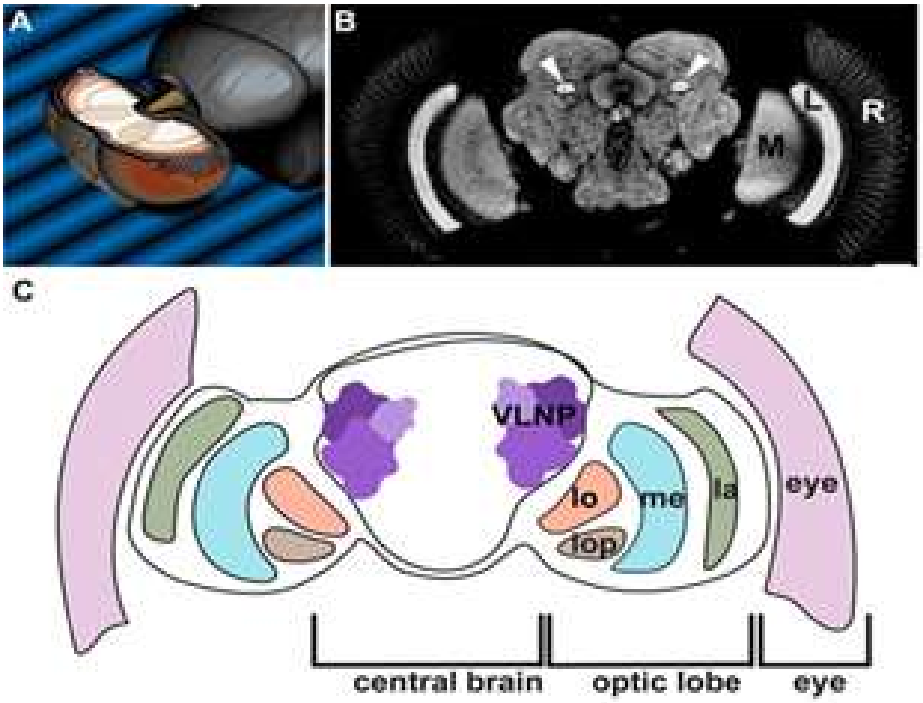


Figure: The visual system of *Drosophila melanogaster*

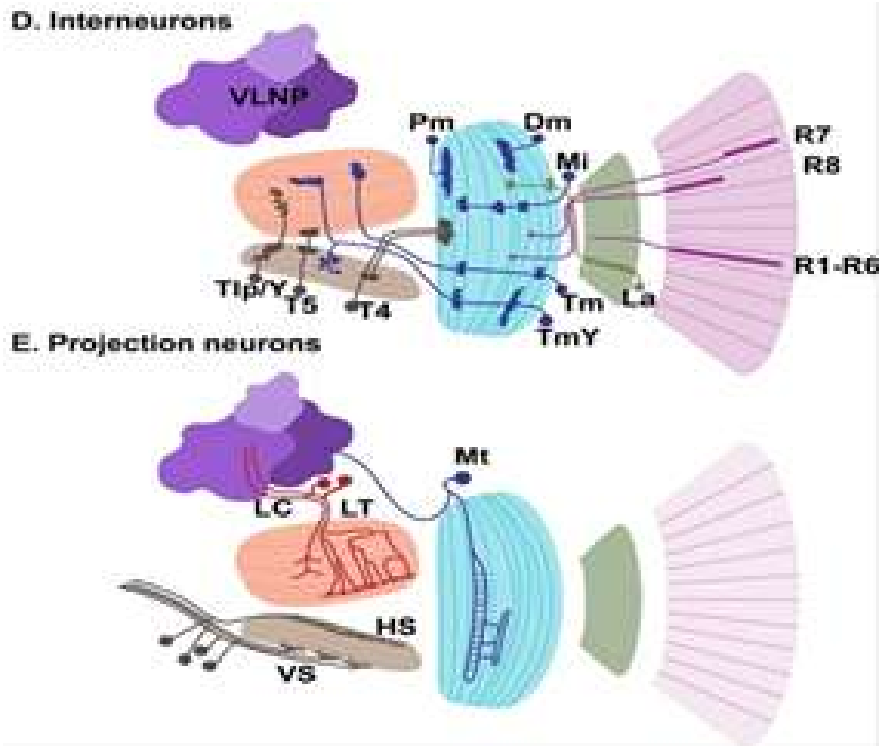


Figure: Neurons that helps in vision

References

1. Apitz H, Salecker I. A challenge of numbers and diversity: neurogenesis in the *Drosophila* optic lobe. J Neurogenet. 2014;28(3–4):233–249.
2. Bausenwein B, Dittrich AP, Fischbach KF. The optic lobe of *Drosophila melanogaster*. II. Sorting of retinotopic pathways in the medulla. Cell Tissue Res. 1992;267(1):17–28.

Preservation of Barasingha: Biggest Achievement of Kanha National Park

Arghya Kamal Das, 2nd Semester (2020-22), PG Dept. of Zoology, Barasat Govt. College

Figure 1. A group of deer in beautiful foggy morning at Kanha National Park

Last October, 2019, I visited Kanha National Park, one of the best managed and largest national parks not just in Madhya Pradesh but perhaps in the whole India. It covers an area about **2000 sq. kms**. (917 sq. kms. Core zone) which mainly have four zones- **Kisli, Kanha, Mukki** and **Sarhi**. It is the habitation of large variety of vegetations and sustain a large population of Spotted Deer, Sambar, Barasingha, Gaur and their predators such as Tigers, Leopards, Wild dogs, Foxes etc.

During my visit at Kanha, I came to know about **Barasingha, 'the pride of Kanha National Park'**. They are locally named as Barasingha because of their **12 beautiful antlers**. Antlers of these animals are extension of their bones. When antlers of a young deer emerge, they are usually covered in a layer of 'felt', which has blood vessels in it. When this felt dries, young males remove it. They get rid of the felt by rubbing against tree bark. Kanha National Park's biggest achievement has been the preservation of Barasingha (Hard ground Swamp Deer, Rucervus duvaucelii.) from near extinction. They became just **66** in **1970**, but today they are more than **800** due to endless efforts of Kanha National Park. Their existence is now only limited to Kanha National Park in all over the world.

During those beautiful days at Kanha, unfortunately I can not observe tiger, but I am very lucky that I have spotted Barasingha, "The Jewel of Kanha".

Figure 2. A male Barasingha in water body

©Arghya Kamal Das

Barasingha is the **state animal of Madhya Pradesh**. Three subspecies of swamp deer are found in the Indian subcontinent. These are the **Western Swamp Deer (found in Nepal)**, **Southern Swamp Deer (found in Central India)**, and **Eastern Swamp Deer (found in Kaziranga and Dudhwa National Parks)**. Among them, the Southern Swamp Deer have hard hooves and are adapted to hard ground, while the other two species are found in swampy areas.

Figure 3. A female Barasingha in grassland

©Arghya Kamal Das

Reasons for declining the number of Barasingha

The main reasons for decreasing the number of Barasingha are heavy hunting, habitat loss.

Year	Numbers of Barasingha
1953	551
1967	66
2015	450
2020	800

(Source: an article published in the kanha-national-park.com on 6th March,2020)

Primarily, it was assumed that, brucellosis, a contagious disease which causes abortion, can be a major reason for declining the number of Barasingha. Later it was found that, if *Brucella* bacteria is present in the grassland of Kanha it should affect all herbivores, not just Barasingha.

"**The main cause of declination was the loss of suitable grassland habitat and fawning ground, not the disease**" told by Claude Martin (head of world wildlife fund international), 1970.

Initiatives taken for preservation

At the meeting of state wildlife advisory board held in Kanha, Dr. M.K. Ranjitsinh proposed "**The main objective of management of Kanha is to save the Barasingha, everything else is subsidiary**".

Figure 4. The pride of Kanha, Barasingha in waterbody

©Arghya Kamal Das

The first measure taken was to stop baiting of tigers at Schaller Hide, the only spot between Shravan Tal and Kanha village which held permanent water, where Barasingha were always found. The tigers were translocated from the spot to save the Barasingha, and it worked. From 16 Barasingha killed by tigers in 1968, it droped to just 1 in 1969.

A large stockade was built and a small group of Barasingha was kept there to breed and survive. This idea is also worked. These Barasingha was multiplied in stockade and they were subsequently translocated in some areas of Kanha.

Some meadows (Sonph and Raunda) are occupied by villages and also the Maikal range, boundary of Mandla District, adjacent to Mukki range was also occupied by forest villages. Those villages were translocated to other places for increasing the meadows of Barasingha. This helps a lot for increasing the number of Barasingha.

Some translocation efforts

As the Swamp deer population is going towards extinction, conservationists are trying to translocate them in other habitats.

In early **2000s**, some Swamp deer were being translocated to **Bandhavgarh National Park**, which was largely a failure.

In March, **2019**, four Swamp deer died due to stress when they were being translocated from one zone to another zone in **Satpura Tiger Reserve**. But their numbers have gradually increased since 2016, when they were introduced in the park for the first time. **33** Swamp deer translocated in **2016**, another **13** in February, **2020**, now their number is increased to **80**.

Figure 5. Wonderful grassland of Kanha

©Arghya Kamal Das

Finally it is a great pleasure that Kanha National Park is successful in the preservation of Barasingha "**The Jewel of Kanha**". Beside the government, the local people helped a lot in this conservation effort.

Worst Locust Attack in India Amidst Covid Pandemic

Ritom Mondal, 2nd Semester (2020-22), PG Dept. of Zoology, Barasat Govt. College

Introduction

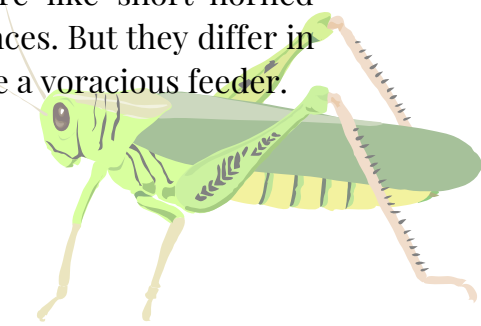
Locust attack has been a great challenge for India since 19th century. It invades India between July and October. Rajasthan, Punjab, Haryana and Madhya Pradesh are the major under threat States. Almost every year they enter the western area of the country, that is Rajasthan. As the name suggests, desert locusts make their base at the dry, arid desert area of Rajasthan and breed there as they need a huge bare area which is abundant in the desert. Then for hatching and development of the offsprings called 'hopper' (i.e., the stage between nymph and winged adult), they need green vegetation, hence move to the central parts of India like Haryana, Delhi, Uttar Pradesh, Chhattisgarh and parts of Punjab even to the eastern portion of India. Recently in the years 2020-2021, locust attack was reported from10 districts of Rajasthan, Madhya Pradesh, Punjab, Gujrat, Uttar Pradesh, Maharashtra, Chhattisgarh and Bihar. During May-June2020, the Government of Rajasthan reported crop damage due to locust attack in 2235 hectares in Bikaner, 140 hectares in Hanumagarh and 1027 hectares in Sri Ganganagar. During 2019-20, locust attack was reported in few districts of Rajasthan and Gujarat. Rajasthan Government has reported that a total area of 1,79,584 hectares of 8 districts of the state was affected by locust attack during 2019-20. The Gujarat State Government has reported that crop loss due to locust attack was observed in a total area of 19,313 hectares of 2 districts of the state during the year 2019-20.

What is locust?

Locusts are herbivorous insects of phylum Arthropoda, class Insecta, order Orthoptera, suborder Caelifera and family Acrididae (Grasshopper). It is the most serious, ancient,

Image Source: WWW.BBC.Com

migratory agricultural pest in the world because of their ability to form swarms of millions and destroy a lot of crops in their pathway. They are like short-horned Grasshopper, increase greatly in numbers and migrate long distances. But they differ in morphology and behaviour from a simple grasshopper. Locusts are a voracious feeder.

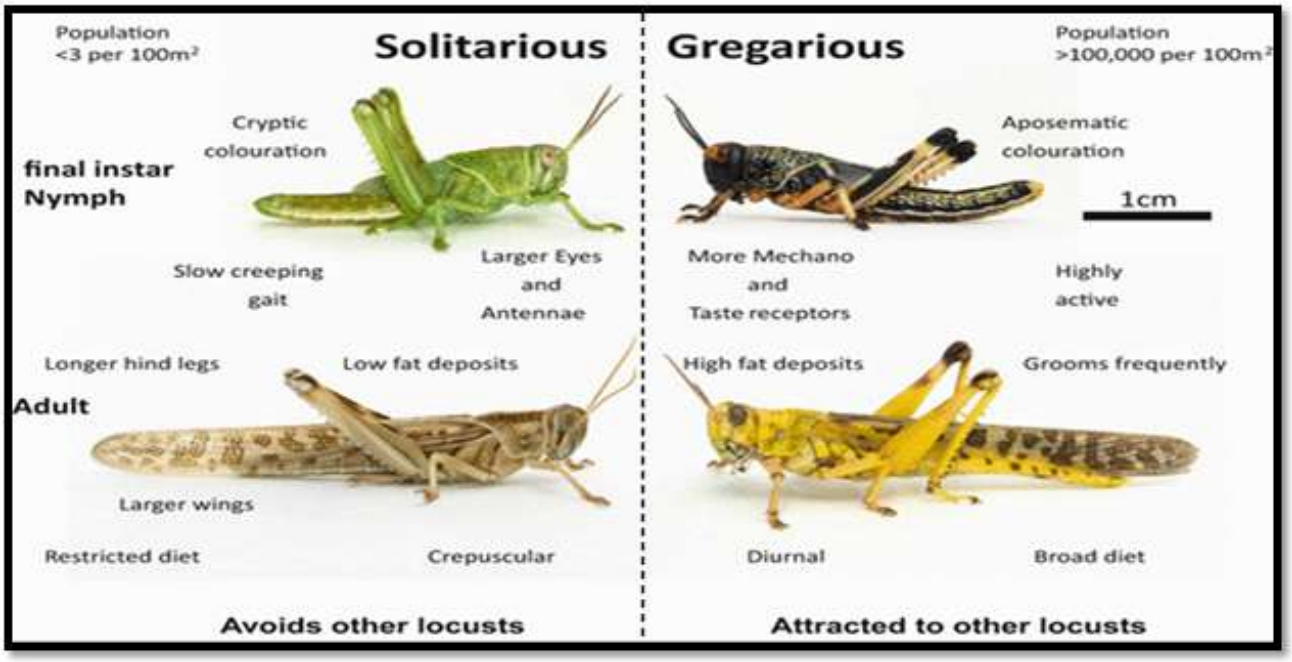


Generally, four species of locust hard found in India,that are-

1. Desert locust (*Schistocerca gragaria*) .
2. Migratory locust (*Locusta migratoria*).
3. Bombay locust (*Patanga succinta*).
4. Tree locust (*Anachridium melanorhodon*).

Among them, Desert locusts are the most destructive in nature.

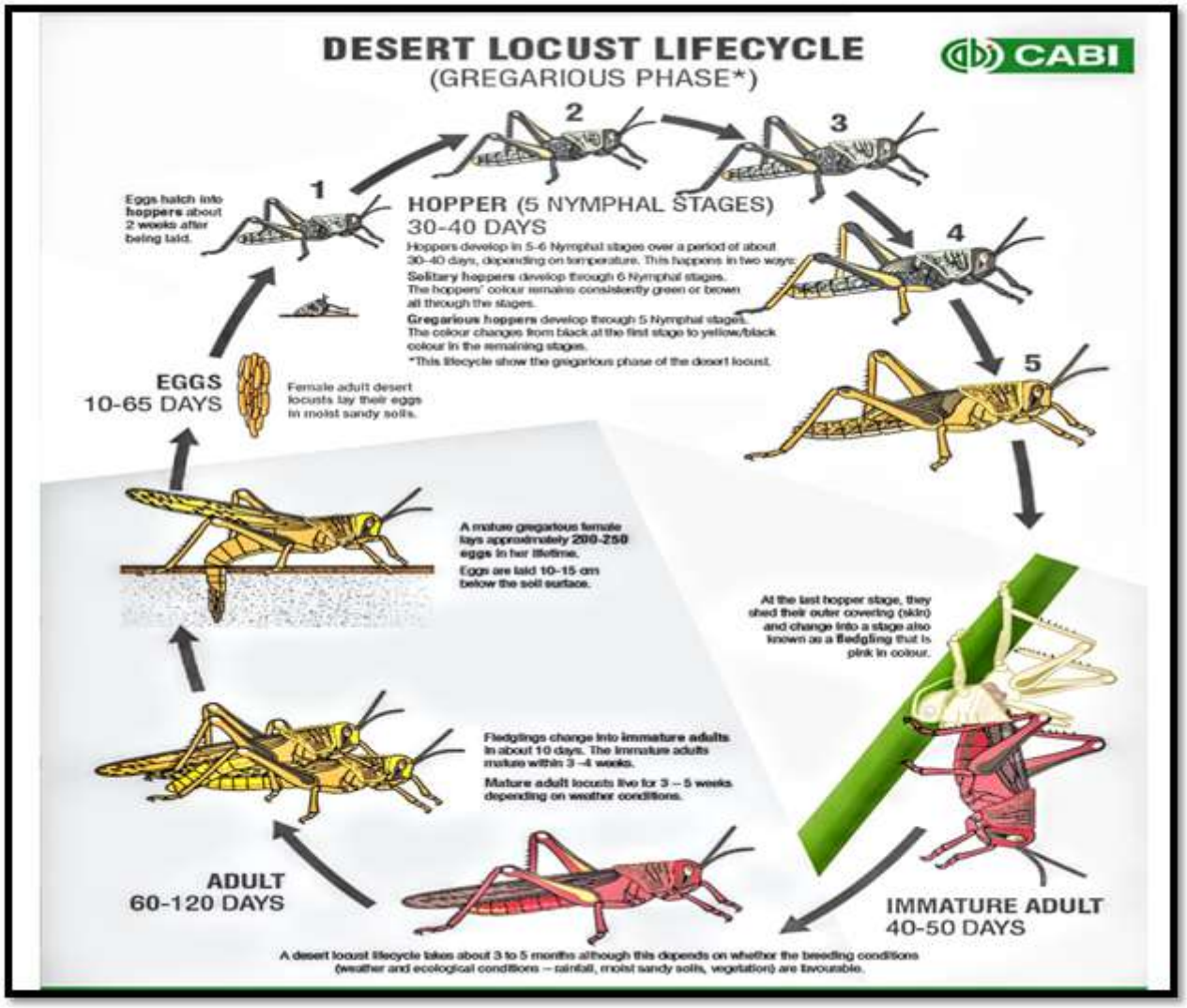
Morphological characters



A plague species of locust, i.e., Desert locust, has two phases in their life, Solitary and Gregarious, differs by colouration, form, physiology and behaviour. Solitary nymphs are generally green for camouflage with the surrounding. On the other hand, Gregarias nymph posses a patterned appearance consisting of black and yellow or orange colouration. Adult solitary ones have short wings, longer legs and narrower pronotum or dorsal sclerite. Gregarian phase has a saddle-shaped pronotum, broader shoulders andlonger wings. In the solitary phase, locust exhibit sexual dimorphism with females (50-60mm long)being larger than males(40-50mm long). This dimorphismdisappearsin the gregarious phase.

Image Source: WWW.idc.icrisat.org

Life cycle

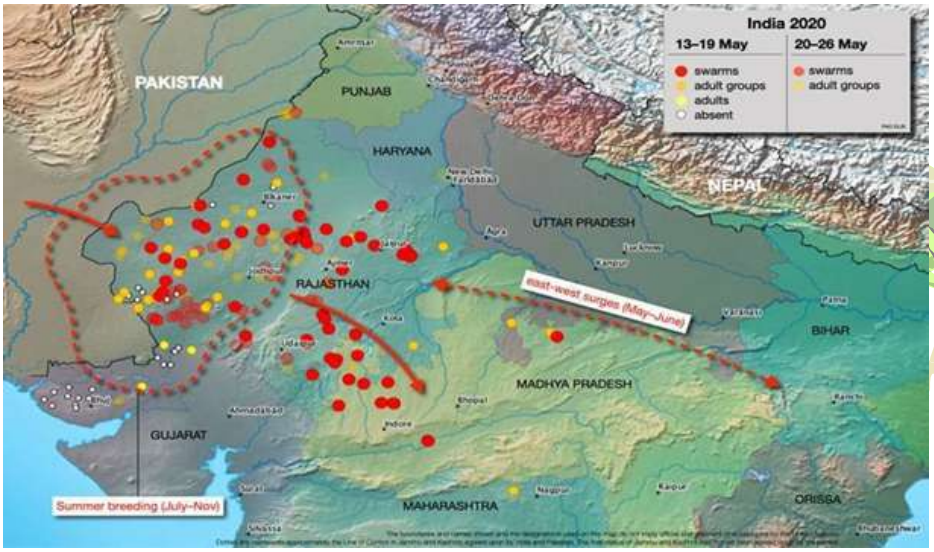


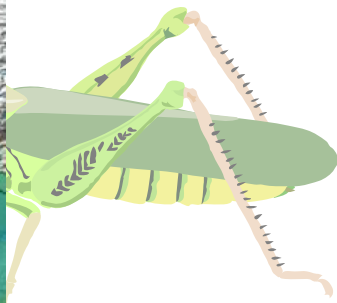
There are three stages in the life cycle of desert locusts i.e., egg, hopper and adult. Their breeding occurs in the rainy season and lays eggs in the damp soil. Breeding areas are so much restricted and do not extend as much as during the plague. In the moist soil, completes its development through 10 to 70 days and hatching occurs (for development wet environment is necessary).The offsprings are wingless and are commonly called hoppers. They go through several moults of development, sheds skin 5 to 6 times becoming adults with fully grown wings. These newly formed adult migrates in search of a new breeding area and food.

Pathway of migration

Desert locusts typically live in the Arabian Peninsula and in the dry arid regions of Africa. They used to move into the east African–Ethiopia, Kenya, Eritrea. With wind currents from the Sahara desert in North Africa. Then migrate long distance to the Arabian Peninsula and Iran. From there move to India enrouted Pakistan.

Image Source: WWW.aatf-africa.org





There is a specific reason for invading India. July to October is the breeding time for locust. They breed during the rainy season in African deserts in large numbers, but it remains very dry and resource-scarce condition there. Whereas it is the monsoon time in India, hence a great time for the development of crops and vegetation, a perfect source of food and that's too in a large quantity. Not limited to this , India has witnessed heavy rainfall and cyclones, a trend of climate change. It causes a suitable condition for the plants to grow, making heaven for such herbivorous insects. They prefer wet condition because eggs remain dormant in dry condition, which revokes in wet rainy condition. Locusts have pheromone communication that informs them of wind patterns as it determines rainfall.

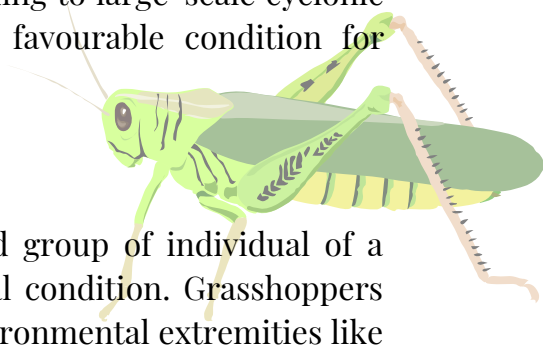
Connection between the climate change and locust plague

After the huge breeding upsurge of locust in Africa, the main target is India. There are some reasons behind it related to climate change. According to Roxy Mathew Koll, climate scientist at the Indian Institute of Tropical Meteorology, the heavy rainfall is due to unusually warm waters in the western Indian Ocean. The warm water caused by raising temperature due to global warming leading to climate change, i.e., a phenomenon called "Indian Ocean Dipole" with warmer water to its west, and cooler water to its east. Warmer water rises from the ocean, which is full of moisture, which means precipitation. The greater and stronger the dipole the stronger the rainfall and cyclones.

Moreover, for two consecutive years 2019 and 2020, locust attack has been reported early in the month of May, which is very unusual. The main reason behind it is increased pre-monsoon rains in India. The heavy pre-monsoon rains caused by the Western Disturbances (WD), which are low pressure systems that originate in the Mediterranean sea or the mid-west Atlantic Ocean, move eastwards. Western Disturbances is a prominent lead of long-term climate change. Every year during December to March-April, an average of 4-6 WDs per month reaches inducing locust plague. Scientists said that increased western disturbances have a polar connection and

Image Source: WWW.Downtoearth.org.in

be linked to a phenomenon called 'Polar Vortex'. It is a low pressure system of extremely cold swirling air in the north and south poles leading to large-scale cyclonic activity over India. All these factors collectively make a favourable condition for uncontrolled locust breeding and spreading.



What makes the locust swarm?

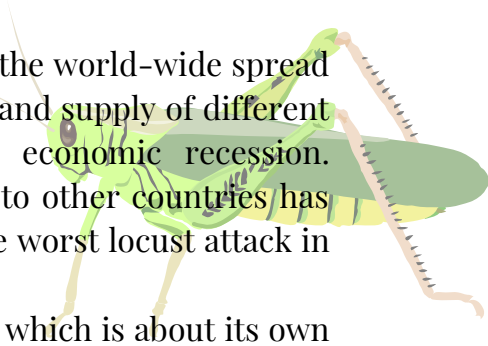
In ecology, swarming means the formation of a huge-sized group of individual of a particular species in response to a particular environmental condition. Grasshoppers are generally solitary in nature they don't make a group. Environmental extremities like lack of food, draught, etc. lead to hunger, as a result, their behaviour changes drastically. They start to gather in large groups called 'swarm', foraging for food over large distances. This phase of life is called "Gregarious Phase". The phenomenon of such change is known as "Polyphenism". During this phase, prominent coordination in their movements and feeding behaviour can be observed. The grasshoppers of this phase can be called the 'locust'.

Locust may form a swarm of different sizes –

- **Small pockets** – Limited to a smaller area like 1 sq. Km. called 'outbreaks'.
- **Large groups** - It is confined to a particular geographical area called 'Upsurge'.
- **Mega groups** - It spreads over a very large area, maybe of the size of the whole country called 'Plague'. Aggregate of millions of locusts.

When the locust insect is obtain for a group forming strategy, comes together in a few to a large number like 10 together and constantly touches each other. Because of this sudden crowding they start touching and rubbing hind limbs of each other, which leads to the release of a special hormone called 'Serotonin' in their CNS shifting them to the Gragarious phase. This hormone signals them to assemble in a large number called Swarm. This hormone is known as happy hormone, which is also functionable in humans. Now they become destructive with developed musculature for travelling large distances and also with polyphagous nature.

Threats from locust attack



- Food insecurity is the biggest problem of our country due to the world-wide spread of covid-19 and nation-wise lockdown. The chain of demand and supply of different food products has already been disrupted, resulting in economic recession. Currently, the export of food resources between states and to other countries has been out of order. Amidst this covid pandemic India faces the worst locust attack in 30 years.
- A desert locust can consume food of amount 2 gram in a day, which is about its own body weight. According to the UN, Food and agricultural organisation (FAO), a locust swarm of 1 sq. Km can consume food amount equals that of 35,000 people in a single day. It is estimated that a large swarm of the size of Paris can consume same amount of food in a day as half the population of France consumes.
- Not only feeding, but they can also travel huge distances in search of food and a breeding area. Each single locust can fly over 150 km in a single day simply gliding over the wind currents. According to some research, a swarm is traced to have flown a distance over 5,000km, from West Africa to the Caribbean in just 10 days in 1988.
- A good size of locust Swarm may contain about 40 to 80 million of insect per sq. km, and they forage covering such a huge area feeding over hectares of agricultural crops and other plants. They eat almost everything green before them. It is large enough of the amount of the whole season Rabi crop of a country.
- They also pose rapid multiplication capabilities. A female locust can lay eggs at least three times in their lifetime (live about 3 to 5 months) at intervals of 6-11 days. Estimating, a population is capable of multiplying about 20 folds in just 3 months.
- In smaller poor countries of Africa, locust attack is so devastating that often leads plague and food scarcity with a major loss in Agricultural economy.
- Locust can damage crops by devouring all parts of plant and also by their sheer weight when they settle down in mass.
- Locust plague also poses a threat to livestocks as they convert the vegetation into a graveyard, not leaving any edible ones.
- It is too pathetic condition for the livelihood of rural areas mostly dependent upon agricultural practices.

Prevention & mitigation

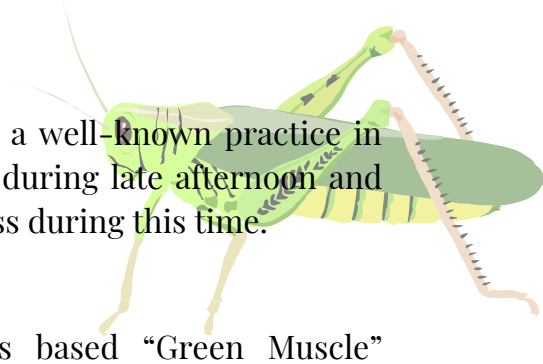
1. Harvesting time

Harvesting time can be manipulated; the crops can beharvested well before the swarming time.

2. Pesticides

'Organophosphates', Carbamate containing solutions can be applied in a small

concentration by aerial spraying using drones or jets, and Knapsack- hand-held spraying method.



3. High pitch sounds

Locust are rippled by loud noises, their swarm breaks. It is a well-known practice in rural India; people used to beat metallic objects or utensils during late afternoon and evening, usually locusts rest over trees and soil surface in mass during this time.

4. Biopesticides

Newly developed microbial biopesticides such as fungus based "Green Muscle" application is very much effective in controlling locust.

5. Natural predators

The introduction of natural predators such as wasps is very effective in keeping them away from agricultural fields. Wasps belonging to the genus '*Scelio*', parasitizes locust eggs. Various species of flies, i.e., "Sarcophid blowflies" are common enemies, capable of killing and reducing the fertility of locust.

6. Use of Hopper dozers

It consists of wheeled screens that causes locusts to fall into troughs containing water and kerosene.

7. Trapping eggs

Digging trenches (2'×2') in front of the advancing swarm to trap their eggs and nymphs of adult themselves. Locusts' eggs can also be destroyed by ploughing and harrowing in the breeding ground.

8. Insecticide

Insecticides like 'Pyrethroids', Insect growth regulators (IGR), neem extract application is also effective.

9. Fungus

FAO has recommended the use of the fungus *Metarhiziumanisopliae*, it can kill locusts by growing inside their bodies.

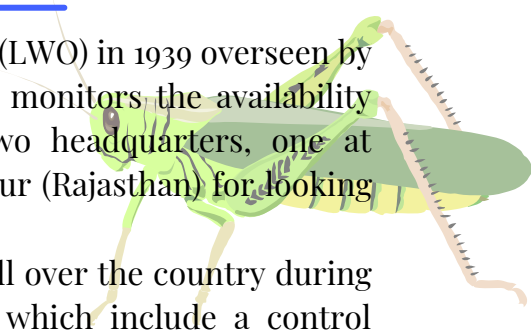
10. Ducks

A duck can eat 200 locusts per day, introduction of ducks in large numbers may be an effective measure to control over swarms.

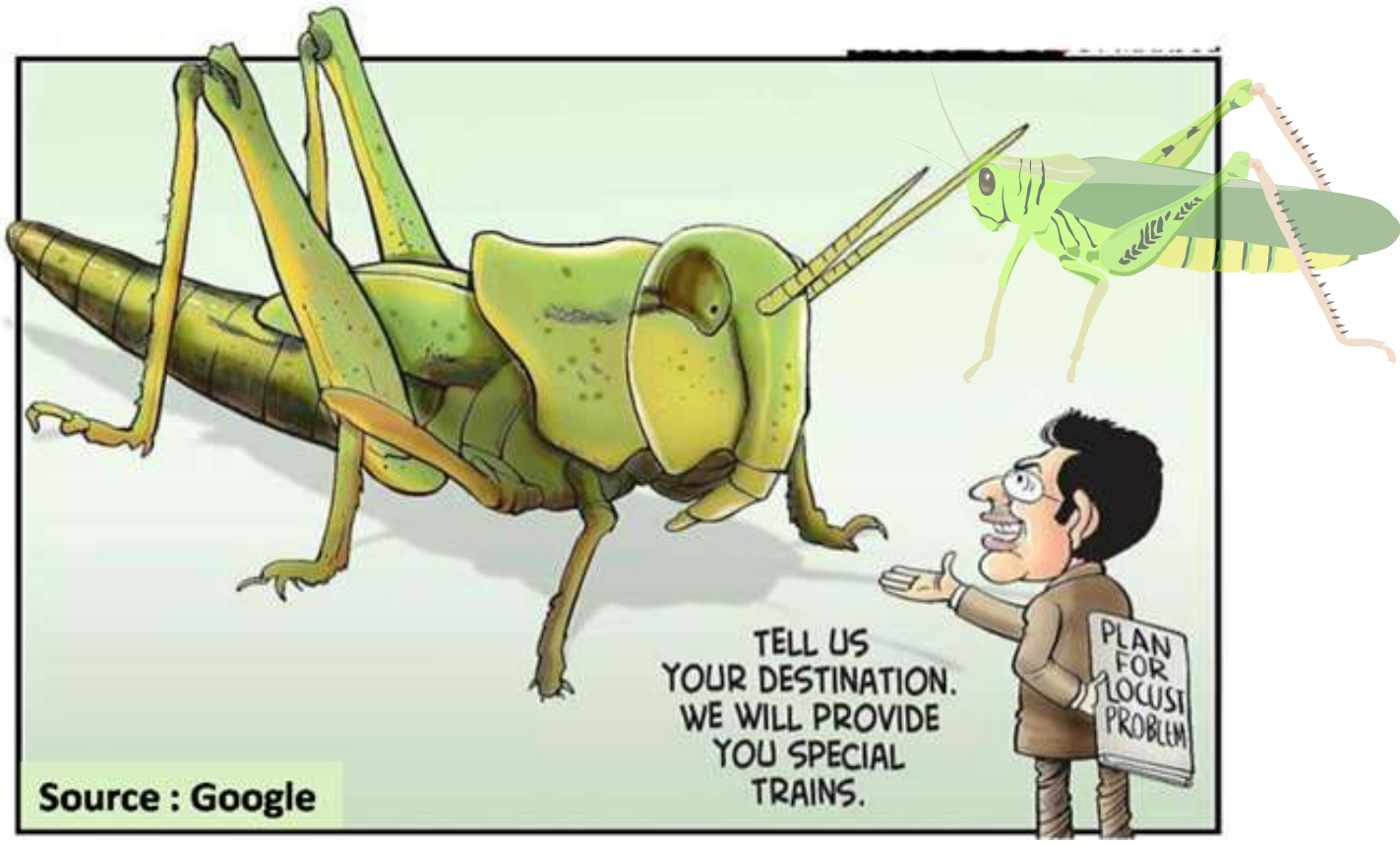
11. IPM

Integrated pest management or IPM is a very modern and effective way nowadays to check locust plague.

Measures taken by Indian government to fight locust attack



- India formed a "Locust warning and control organisation" (LWO) in 1939 overseen by the "Indian Council of Agricultural Research". The LWO monitors the availability and movements of locust over desert areas. It has two headquarters, one at Faridabad for administration works and another at Jodhpur (Rajasthan) for looking over the desert area .
- The Locust warning Organisation (LWO) becomes active all over the country during the locust plague and follows some contingency plans which include a control strategy to impart a early warning, reduce the frequency, duration and intensity of the plague.
- During the 2019-20 attack period, India witnessed a massive locust attack, control operations were employed and successfully controlled a total of 4,03,488-hectare areas, from May 21, 2019 till February 17, 2020 over the whole country by the Locust circle office (LCO) in association with the District Administration and State Agricultural Department.
- The Government has placed an order for buying 60 spraying machines from UK-based company 'Micron'.
- Firms are set up for flying drones for aerial spraying of insecticides for effective control over tall trees and inaccessible areas.
- Currently there are 89 fire brigades, 120 survey vehicles with spray equipment and 810 tractor mounted sprayers under full action over the attack prone states for effective control.
- Temporary control camps are set up well before the attack seasons in Ajmer, Chittorgarh, Dausa, in Rajasthan; Mandsaur, Ujjain, Shivpuri in Madhya Pradesh; and Jhansi in Uttar Pradesh to monitor the arrival.
- Different locust control offices in the country have advanced 21 Micronair and 26 Ulvamast spray machines for spraying pesticides.
- The pesticide Melathion 96-percent ULV is used in Desert Locust control in India. A buffer of 5,000 litres minimum is maintained at different LCOs from where pesticide can be mobilised for immediate requirement.
- India had an agreement in 2014 with Hindustan Insecticides Limited (HIL). This corporation uses to keep ready stocks of Melathion 96-percent technical reserve. Upon receiving demand from the Directorate of Olant protection, quarantine and storage, it will supply the desired quantity of the pesticide to the LCOs within 7-10 days.
- According to FAO, not only India but the whole world is facing the worst locust infestations in decades leading to starvation of millions of people especially in Africa, so the FAO and UN had made an appeal for $70 million in funds to help fight.



References

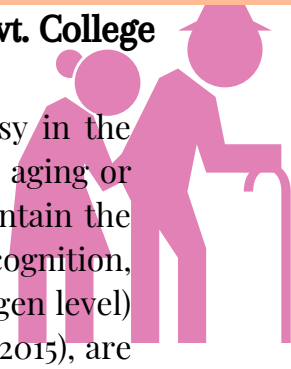
1. Sword GA, Lecoq M, Simpson SJ. Phase polyphenism and preventative locust management. J Insect Physiol. 2010;56(8):949-57.
2. Topaz CM, D'Orsogna MR, Edelstein-Keshet L, Bernoff AJ. Locust dynamics: behavioral phase change and swarming. PLoS Comput Biol. 2012;8(8):e1002642.

Weblinks

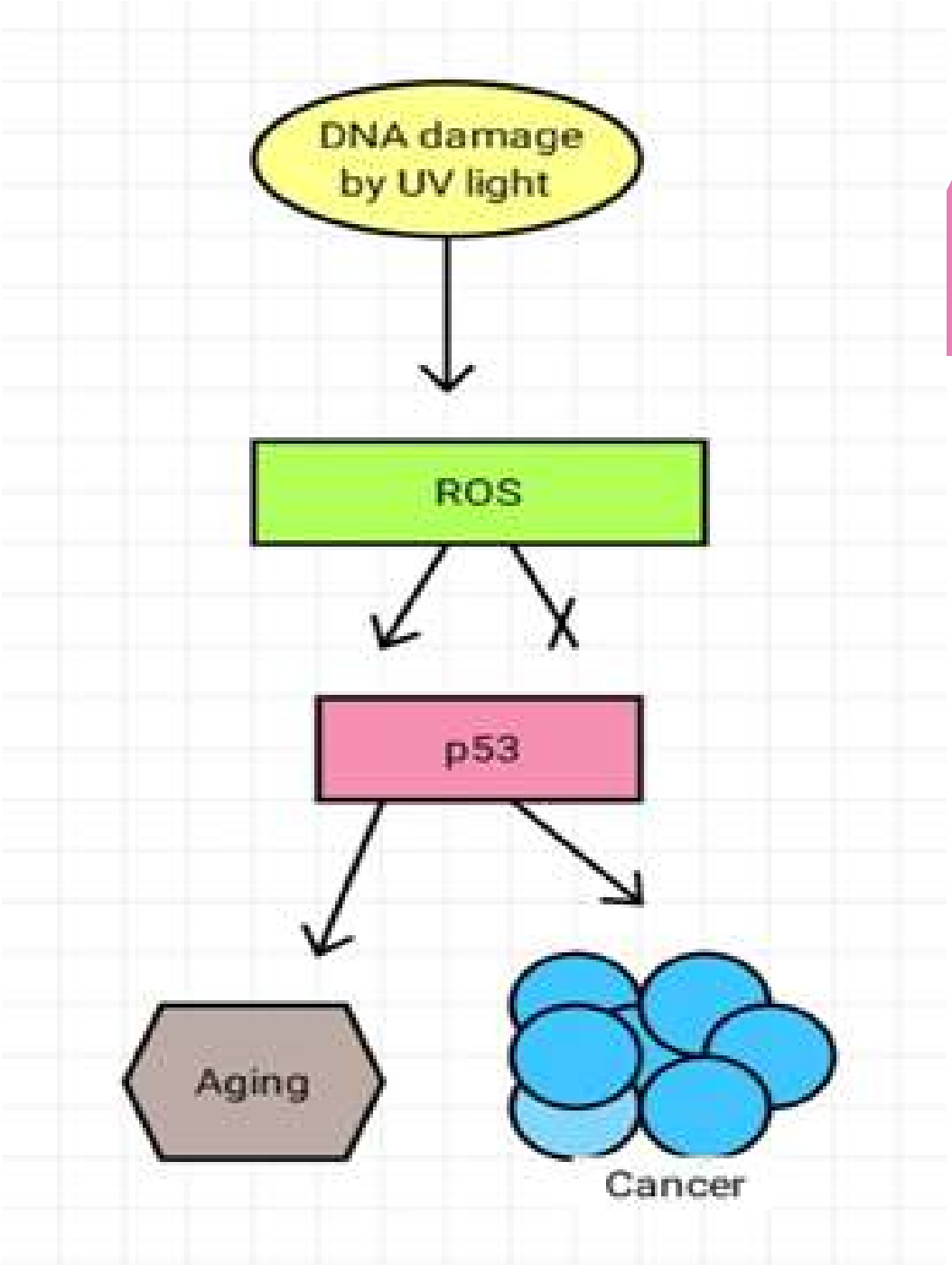
1. https://www.bbc.com/news/world-asia-india-52804981
2. https://indianexpress.com/article/explained/explained-why-we-have-a-desert-locust-problem-this-year-6431837/

Aging & Its Relatives

Arpita Samanta, 2nd Semester (2020-22), PG Dept. of Zoology, Barasat Govt. College



Nowadays Aging is a very common term in our daily life. Despite being busy in the scheduled life, people are too much worried about this term “aging”. Actually aging or senescence is a programmed deterioration of physiological function that maintain the homeostasis. There so many factors like chronic stress (Lavretsky H, 2012), cognition, hormonal disbalance (mainly high glucocorticoid and declining adrenal androgen level) and accumulation of damage in DNA (Sergiev PV, Dontsova OA, Berezkin GV., 2015), are responsible for this deterioration. In replicative senescence telomeres become spoiled after each cell division but telomerase plays important role in regeneration of telomere, resulting cellular longevity. Telomere remains bound by a multiprotien complex, known as shelterin, the main function of which is to prevent the access of DNA repair proteins to the telomeres. Telomere uncapping can also results from deficiencies in shelterin components. Various loss of function models for shelterin are characterized by rapid decline of regenerative capacity of tissue and accelerated aging. In humans, recent analyses have supported that there is a strong relationship between short telomere and mortality risk, particularly at younger age (Boone Kamp et al., 2013). But cells can choose only single fate between apoptosis and senescence. So, anti-apoptotic signaling induces the senescent, pro-inflammatory phenotype during aging process. In case of DNA damage, caused by UV light or oxidative stress (elevation of free radical or ROS), activation of p53 results aging. But the deficiency in p53 network, increased activity in nuclear factor kappa B (NF-kB), changes in molecular chaperons, microRNA and epigenetic regulation, which are related to aging, resist the apoptotic cell death. Studies show that those molecules involved in apoptosis signaling in mammals, have been found in *Caenorhabditis elegans* and *Drosophila melanogaster* to regulate aging. Some studies also show that biological aging has a relationship with cancer. In that case actually entropy production rate is calculated in normal individuals and carcinogenic patients. It is observed that the entropy production rate decays gradually with age in normal individuals, while in metastatic carcinoma patients the rate of entropy production also diminish with age but in carcinogenic patients the entropy production rate is much higher than healthy organisms. This higher robustness can be interpreted in terms of cancer. So, the entropy production per unit time could be considered as physical marker of biological age and a predictor of longevity. But research works on the thought about cross communication between apoptotic cell death and aging in mammalian system are on proceed. Finding out this relationship will a great success about aging related effect on cancer.



References

1. Boone Kamp et al., 2013 JJ Boone Kamp, MJP Simons, L Hemerik.- Aging cell, (2013) - Wiley Online Library.
2. Lavretsky H, Newhouse PA. "Stress, inflammation, and aging". Am J Geriatr Psychiatry (2012) 20: 729-33.
3. Sergiev PV, Dontsova OA, Berezkin GV. "Theories of aging: an ever evolving field". Acta Naturae (2015) 7:9-18.
4. Weinert BT, Timiras PS. "Invited review: theories of aging". J Appl Physiol. (2003) 95:1706-16.

Mutations of SARS-CoV-2, Causing the Emergence of Current Variants of Concern (VOC) Worldwide

Bidisha Ray, Ex Student (2017-2020), UG Dept. of Zoology, Barasat Govt. College

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causative agent of coronavirus disease 2019 (COVID-19) has many variants which have caused this global pandemic. Continuous mutations in the viral spike glycoprotein are causing the emergence of different variants worldwide. Viral mutations and new emerging variants can be tracked through gene sequencing.

The SARS-CoV-2 virus mutates over time, which causes a change in the genetic sequence of the virus (the first genetic sequence of the previously identified virus predominant in the population). Thus a new variant (genetic variant) has some key mutations that differentiate it from the previous one. Some mutations can make the new variant more transmissible, virulent or some can make it weaker compared with the previous virus.

A variant with increased binding affinity with ACE2 receptors, increased transmissibility, increased virulence, more severe disease symptoms, significant reduction in effectiveness of treatments, medicines or vaccines, is called the Variant of Concern.

Current VOCs include the lineages represented in the picture below.

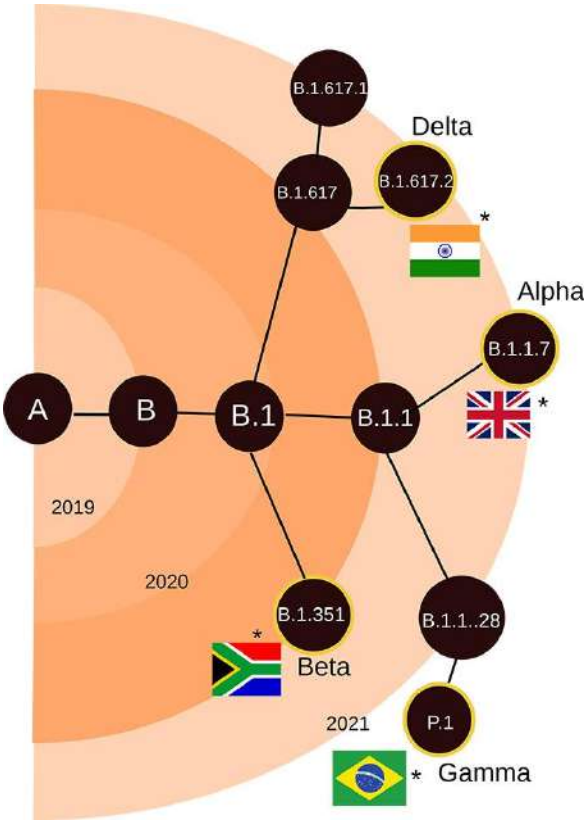


Figure 1. Selected lineages of SARS-CoV-2, VOCs are highlighted with yellow circle

There were initially 3 main systems for the nomenclature of SARS-CoV-2, namely the **Pango lineage**, **GISAID clade** and **Nextstrain clade** for scientific uses. Besides this, every variant was commonly named based on their geographical origin. To reduce this discrimination of place and make it more user-friendly WHO announced a new naming system of SARS-CoV-2 variants. They used Greek alphabets for this new nomenclature. For example, the first variant detected in the UK (UK variant) was named B.1.1.7 after Pango lineage, GR/501Y.V1 after GISAID clade, 20I (V1) after Nextstrain clade, and finally **Alpha variant** after WHO labeling. Like this the other variants like the South Africa variant, Brazil variant, India Variant are termed as **Beta**, **Gamma** and **Delta** variants respectively.

B.1.1.7 strain (Alpha variant)

The first variant with a large number of mutations, first found in the United Kingdom, September 2020, initially named VOC 202012/01- variant of concern December 2020. This B.1.1.7 variant is also known as GR/501Y.V1 (GISAID clade). WHO labeled this newest variant of concern as the **Alpha variant**. This B.1.1.7 variant has a total of **17 amino acid changes causing 23 mutations**.

The B.1.1.7 strain includes the following key mutations:

- N501Y
- P681H
- H69-V70 and Y144/145 deletions

SARS-CoV-2 binds with the ACE2 receptors in our body by its **spike glycoprotein**. This spike protein has two subunits, the first of which is the receptor-binding domain (RBD) . This alpha variant (B.1.1.7 lineage) carries a mutation on the RBD, in which tyrosine replaces an asparagine at position 501 and that's why the mutation is termed N501Y. The strain often shows a deletion of amino acids 69 and 70 i.e. histidine and valine respectively (mutation H69-V70), which causes the conformational change of spike protein.

At position 681, a mutation which replaces proline amino acid for histidine is prominent in B.1.1.7. This is a mutation to open reading frame 8 (ORF 8), whose function is not fully understood.

This UK strain was initially responsible for the first wave of COVID-19 in India.

B.1.351 strain (Beta variant)

This B.1.351 lineage also carries the N501Y mutation. This B.1.351 strain, also known as GH/501Y.V2 or the **Beta variant** by WHO. This Beta SARS-CoV-2 variant was first detected in South Africa, October 2020 and has since been found in more than 48 other countries, causing concern globally.

The B.1.351 strain includes the following key mutations:

- N501Y
- K417N
- E484K

Again at position 501 proline replaces asparagine (mutation N501Y). Another prominent mutation occurs at position 417 which replaces lysine for asparagine (mutation K417N). Additionally, at position 484, lysine replaces glutamic acid, causing the mutation E484K.

This new South African variant is believed to be about 50% more transmissible as compared to the previously detected variants in South Africa.

P.1 strain (Gamma variant)

The P.1 lineage of SARS-CoV-2, also known as GR/501Y.V3, or the **Gamma** SARS-CoV-2 variant by WHO. This variant was first detected in Japan on 6th January, 2020. The National Institute of Infectious Diseases, Japan, described this to have arrived there from Brazil. This variant has been traced back to Manaus, Brazil, and therefore is termed the Brazil variant.

The strain is less deadly but more transmissible than the previous strain of SARS-CoV-2.

The P.1 strain includes the following key mutations:

- N501Y
- K417T
- E484K

The P.1 lineage is closely related to the B.1.1.248 lineage and carries 12 mutations in the spike glycoprotein. The N501Y and the E484K mutations are the same as in the Beta variant, that's why it is a close relative of the B.1.351 strain or the beta variant. An additional mutation occurs at position 417 which replaces lysine for threonine.

B.1.617 strain (Kappa and Delta variants)

The B.1.617 strain also known as the “double mutant virus” first detected in India, December 2020. The term "double mutant" is quite misleading as it carries about 15 mutations in spike glycoprotein. But particular two mutations, causing concern globally include :

- E484Q
- L452R

The first mutation occurs at position 484, where glutamine replaces glutamic acid (mutation E484Q). In the second mutation, at position 452 leucine is replaced with arginine (mutation L452R).

This variant has spread rapidly across India and is more transmissible than the previous strains.

Three different subtypes of this Indian variant have been detected namely B.1.617.1, B.1.617.2, and the B.1.617.3 variants. The second subtype i.e. the **B.1.617.2** variant or the **Delta variant** (G/478K.V1)is more dominant in India (because of its growth rate advantage) compared to the first subtype i.e. the B.1.617.1 or **Kappa variant**. This Delta variant was responsible for the 2nd wave of covid-19 in India.

Recently the newest variant has been found, the **Delta plus** variant also known as **AY.1**, is more transmissible than the original Delta variant. It interacts more easily with lung cells' ACE2 receptors and affects our lung more than the other strains. According to the health ministry, India, the Delta plus variant was first detected in India in April 2020. Till date, approximately 51 cases of this Delta plus strain have been detected across the country (Maharashtra, Kerala and other 12 states), with Maharashtra again reporting most of the cases of this new variant. ICMR has already declared this strain as a new variant of concern, and the probable variant responsible for the upcoming 3rd wave of covid-19 in India. If now we ignore this alarming signal, it could be dangerous!

Variant of concern (in tabular form)

WHO naming	Lineage with additional mutations	Country (first detected)	Spike glycoprotein mutations	Year, month (first detected)	Impact on transmissibility (evidence)	Impact on immunity (evidence)
Alpha	B.1.1.7	United kingdom	N501Y, D614G, P681H	September 2020	Yes	No
	B.1.1.7 + E484K	United kingdom	E484K, N501Y, D614G, P681H	December 2020	Yes	Neutralisation
Beta	B.1.351	South africa	N501Y, K417N, E484K, D614G, A701V	September 2020	Yes	Escape

Contd.

Gamma	P.1	Brazil	K417T, N501Y, E484K, D614G, H655Y	December 2020	Yes	Neutralisation
Delta	B.1.617.2	India	L452R, D614G, T478K, P681R	December 2020	Yes	Escape

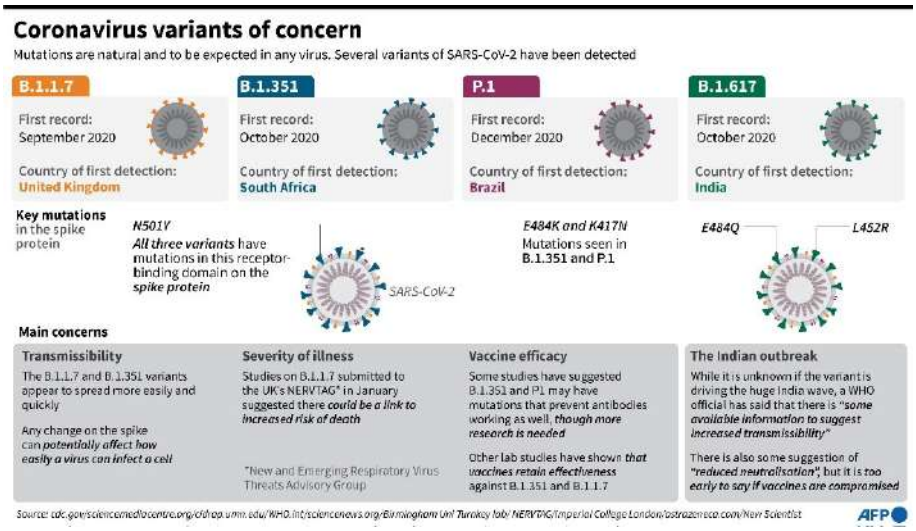


Figure 2. Coronavirus variant of concern diagrammatic representation

References

1. Carmen Elena Gómez, Beatriz Perdiguero, and Mariano Esteban; Emerging SARS-CoV-2 Variants and Impact in Global Vaccination Programs against SARS-CoV-2/COVID-19, Published online 2021 Mar 11. doi: 10.3390/vaccines9030243.
2. Understanding variants of SARS-CoV-2 Talha Burki Published: February 06, 2021. DOI:https://doi.org/10.1016/S0140-6736(21)00298-1.
3. Figure 1: Picture credit: Observer Research Foundation. "Tracking SARS-COV-2 Variants of Concern," ORF Special Report No. 144, June 2021 by CHITRA PATTABIRAMAN].

Weblinks

1. https://www.ecdc.europa.eu/en/covid-19/variants-concern
2. https://www.cdc.gov/coronavirus/2019-ncov/variants/variant-info.html
3. https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/
4. https://www.orfonline.org/research/tracking-sars-cov-2-variants-of-concern/?amp

Liposome : A Space Shuttle to the Multiverse of Diseases

Rebanta Roy, Ex Student (2017-2020), UG Dept. of Zoology, Barasat Govt. College

We are all aware of the fact, that the human population has increased substantially over the past few centuries. Each century has experienced record growth of population, what we biologists call as an Exponential Rise. As on par with this, the spectrum of diseases has also increased by many folds during this rise. Along with this man has explored many preventive and curable methods to tackle them. Our understanding till date, gives us the clue that of the greatest discoveries made by mankind, vector mediated drug delivery stands apart as a pillar of success. Vector mediated drug delivery for someones basic understanding can be classified into viral mediated and non viral mediated. Viral mediated drug delivery or gene delivery is being progressively done using adenoviral vectors, dead or attenuated, the same which are being used to design various vaccines. The virus is tagged with specific surface molecules whose receptors are present on the target cells. As the viral particle binds to the receptor on the target cell, it releases its contents after being engulfed by endocytosis. The non viral mediated vector delivery has developed in the last few decades. We've already seen gene gum, microinjection and magnetoinfection in case of the non viral vector mediated drug delivery. Here the naked DNA for gene transfer or the material for drug delivery is administered directly via physical or chemical process or via various vesicles, as we will be discussing here. Liposome mediated drug delivery is one of the progressive inventions, the history of drug delivery has witnessed. Liposome, a spherical vesicle, which is composed of nothing but a phospholipid bilayer, creating a middle core. Both anionic and cationic liposome models are in use these days. Liposomes have substantially reduced the toxicity produced by the viral vector mediated drug delivery mechanisms. Drugs like Amphotericin B, quite commonly used to cure fungal diseases, integrates between the hydrophobic tails of the liposomal phospholipid bilayers. On the other hand Pegylated Liposomal Doxorubicin, is used to treat varieties of carcinogenic damages. Pegylation, i.e. use of polyethylene glycol tags to the liposome, gives it a chance to escape the mononuclear phagocytic system, which would otherwise identify and destroy the system compacted within the liposome. Here the Liposomal coat reduces the toxicity of Doxorubicin and prevents it from affecting cells other than the cancer cells. The liposomes are thus like space shuttles reaching the niche of the cancer cells. Their small size increases their specificity to identify the cancer cells. Again they are also used against neuronal damages, chronic inflammation and even to treat bacterial induced sores. The extensive research to draw insight into the molecular mechanisms are still on progress, and thus the Universal character of liposomes needs a change as they are potent to be reach the Multiverse of the Diseases.

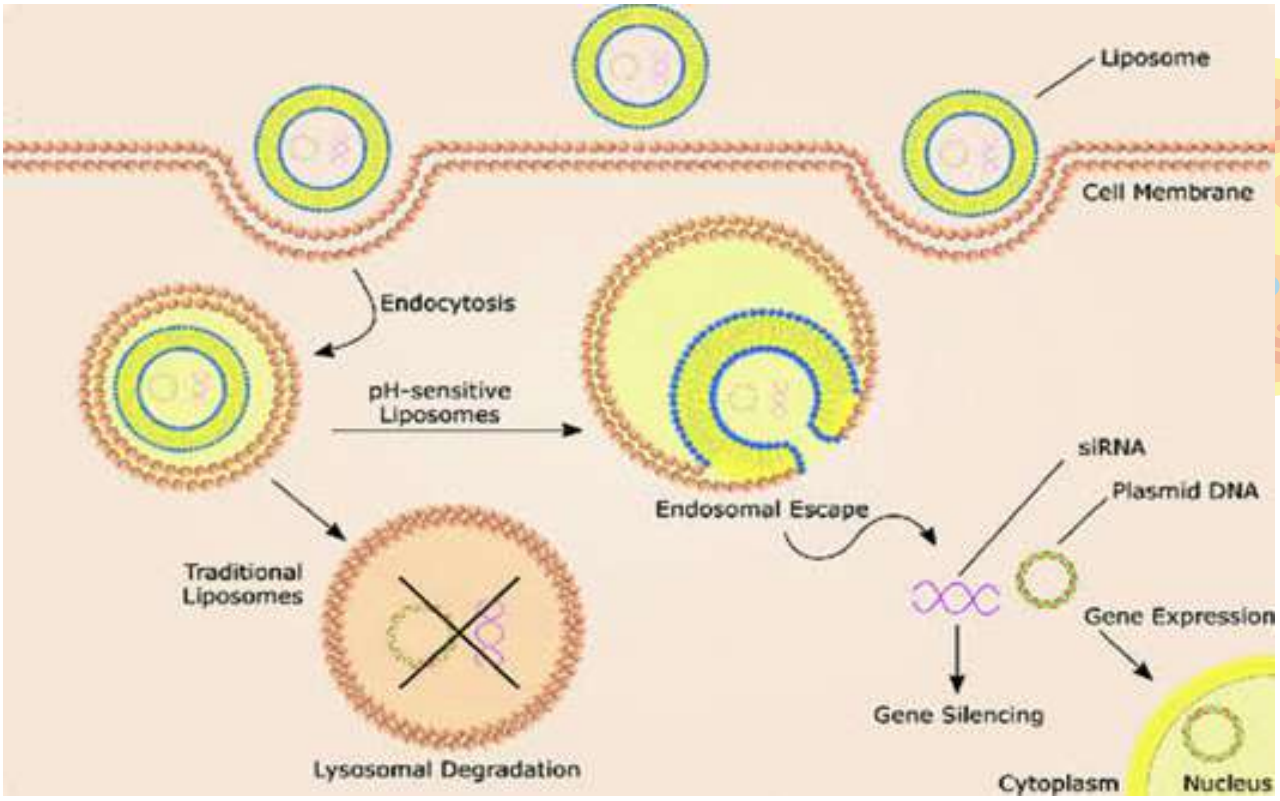


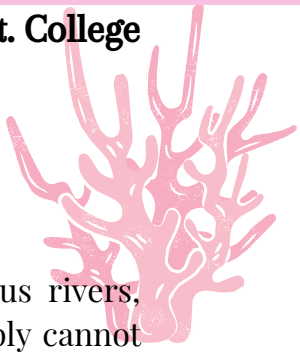
Figure: Mode of action of a pH sensitive liposome. *Ref: Liposomes - Based Nanoparticles for Cancer Therapy and Bioimaging, Jamal et al., Nanooncology, p 51-87 (2018).* The figure shows the importance of pH in liposomal entry, the infection or the entry route of a liposome into a cell, via endocytosis, the difference between a pH sensitive liposome and a general liposome has been described over here, it is easier for a pH sensitive liposome to release its contents out of a cell as the endosomal pH is slightly acidic to acidic, and thus the materials for gene silencing like siRNA or the plasmid DNA, as shown above can exit the endosome and can enter the nucleus for its effects. So a pH sensitive liposome is more efficient.

References

1. Moen, M. D., Lyseng-Williamson, K. A., & Scott, L. J. (2009). Liposomal Amphotericin B: A Review of its use as empirical therapy in febrile Neutropenia and in the treatment of invasive fungal infections. Drugs, 69(3), 361–392.
2. Nisini, R., Poerio, N., Mariotti, S., De Santis, F., & Fraziano, M. (2018). The Multirole of Liposomes in Therapy and Prevention of Infectious Diseases. Frontiers in immunology, 9, 155.
3. Yuan, Z., Zhang, Y., Cao, D. et al. (2021). Pegylated liposomal doxorubicin in patients with epithelial ovarian cancer. J Ovarian Res 14, 12.

Biorock Technology in India to Reform Coral Reefs

Meghna Das, 2nd Semester (2020-23), UG Dept. of Zoology, Barasat Govt. College



"LETS' MAKE THE CORALS COLOURFUL"

Introduction

Think about this if water is the blood of our plant flowing through venous rivers, streams, and into our oceans, what does that make coral? Our heart we simply cannot survive without our heart, there we must heal and protect our coral reefs now. Coral reefs are one of the world's most beautiful creatures, but they are also the foundation of marine life; without those most of the sea's most exotic species will not survive. Coral reefs are under assault. These reefs are being destroyed by human exploitation. They are over-fished, bombed, and poisoned. They are smoothed by sediment and choked by algae growing on nutrient rich sewage and fertilizer runoff. They are damaged by irresponsible tourism and are being severely stressed by the warming of the world's oceans (Global Warming). Each of these pressures is bad enough in itself but together they are making the condition worst for the corals.

The Zoological Survey of India (ZSI) with help from Gujarat's Forest Department, had been attempting for several years to build a structure that can restore coral reefs using BIOROCK or MINERAL ACCRETION TECHNOLOGY. A biorock structure was first installed in the Gulf of Kachch one nautical mile from the Mithapur Coast on 19th January 2020.

What is coral reef?

A coral reef is an underwater ecosystem that is nothing but corals that are building corals. Colonies of coral polyps which are held together by calcium carbonate form the coral reefs. Coral belongs to the Class of Anthozoa in the Animal Phylum of Cnidaria, which includes sea anemones and jellyfish. Corals are made up of genetically similar organisms called Polyps. Coral polyps do not photosynthesis but have a symbiotic relationship with microscopic algae of the genus symbiodinium, commonly referred to as zooxanthellae. By mutual relationship, coral reefs grow much faster in clear water, which needs more sunlight. The varieties of pigments present in different species of zooxanthellae gives their brown or golden-brown appearance.

Degradation of corals

Currently, it has been observed that Global Warming and other anthropogenic disturbance in the zooxanthellae algae that live in association with coral polyps. There are buildups of various poisonous products that poison the zooxanthellae algae. For saving its own life, the coral spits out the zooxanthellae. Without the zooxanthellae, the corals slowly starve to death not being able to either make or get food. This is called Coral Bleaching.

- **Anthropogenic pressure**

  Almost three-quarters of the world's coral reefs are deteriorating as a consequence of environmental degradation. Much of this is anthropogenic pressure such as coastal urban development, pollution and, nutrient enrichment; resource use pressure such as mining and overfishing and management activities.

- **Global Warming**

  Climate change is another challenge faced by the coral reef ecosystem. Increasing sea temperature and ocean acidification, are likely to result in loss of ecosystem function, Coral bleaching, mortality and reduced ability to develop reef structure.

- **Sedimentation**

  Deforestation, Mining, or Farming upstream and logging in forests of tropical areas result in the formation of a huge quantity of sediment and soil depositing into sea bed and onto coral reefs. This dirt, sand, or slit can make the water cloudy or muddy, smothering the coral which then can't get enough light to survive.

- **Water pollution and trash dumping**

  Slash-and-Burn agriculture and the use of fertilizers are the cause of an increased nutrient flow into reef water. Human sewage that is continuously flowing in ocean water leads to the rapid growth of algae which chokes coral polyps, preventing their supply of oxygen and light.

Restoration by biorock process

BIOROCK is a substance formed by electro-accumulation of minerals dissolved in seawater on steel structure that is installed into the seabed and is connected to a power source, in this case the Solar Panel that float on water surface. This process was discovered by WOLF HILBERTZ in 1976 to provide alternative construction materials for the growth of the coral reefs. Wolf Hilbertz and Tom Goreau of the Global Coral Reef Alliance later developed its demarcated usage for reef restoration.

Process of biorock formation

This technology particularly works by allowing a less amount of electrical current to pass through electrodes installed in the water. When a positively charged anode and negatively charged cathode are installed on the seabed, with an electric discharge flowing between them, calcium ions combine with carbonate ions and adhere to the negatively charged structure (cathode). This results in calcium carbonate formation ($CaCO_3$). Coral larvae get themselves stick to the $CaCO_3$ and grow on them quickly.
Electrified reefs can be placed using the significant process which provides a substance on which corals can flourish, being very similar to that of the original or natural reef. The constructional element of the reef can be low-cost rebar metal on which the rock will form. This structure can be created locally. Power is supplied between this positively charged metal structure (the cathode) and a negatively charged anode. Coral also get benefited from the electrified and oxygenated reef environment that forms surrounding the positively charged cathode. The higher the level of dissolved oxygen the more makes it highly attractive to marine organisms, particularly finfish. Biorock projects not only use conventional electric power but can also be powered by a wide range of windmills, photovoltaic solar panels, and tidal current generators. This enables the fact that it can be installed in areas where conventional electric power is unavailable.

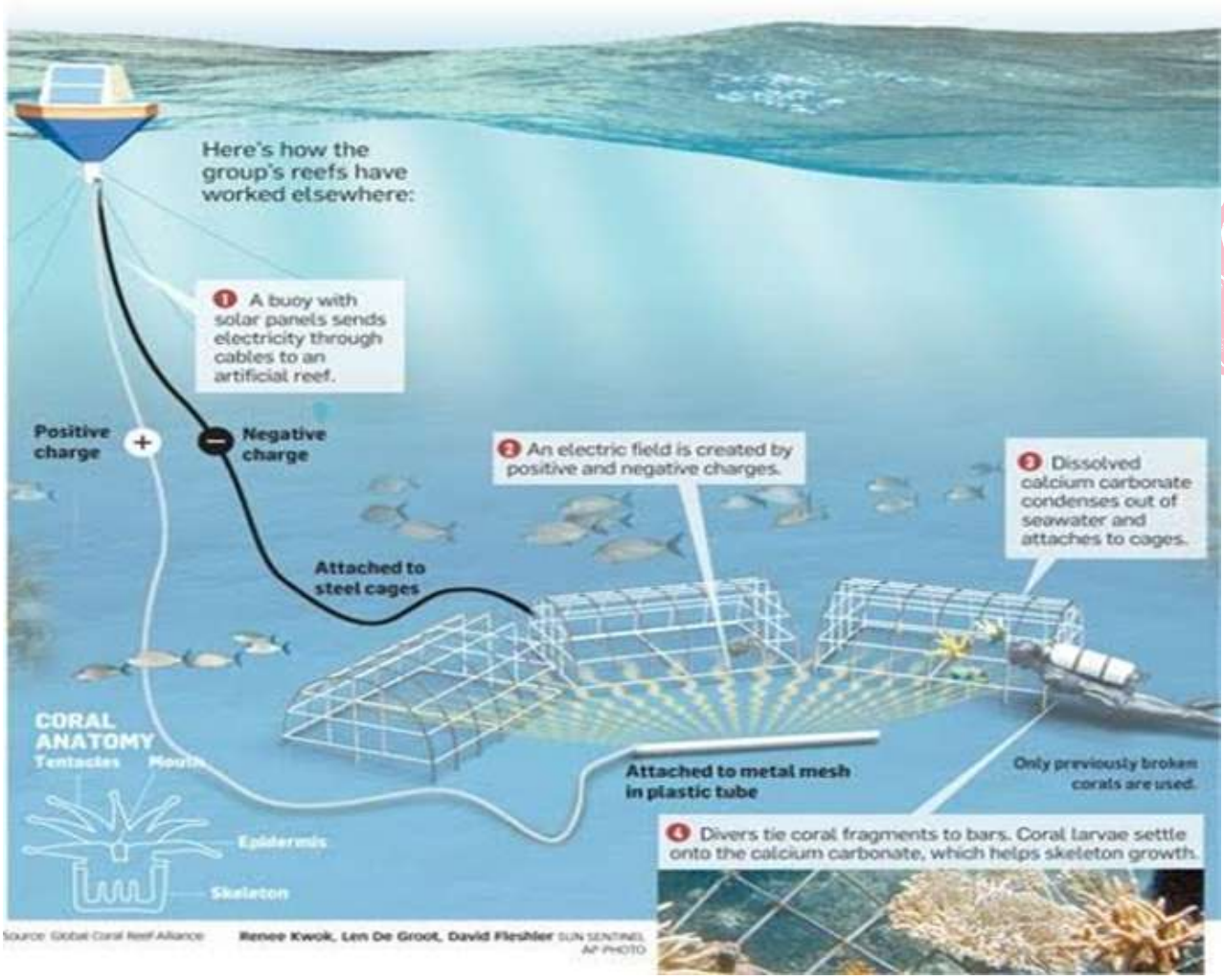


Figure: The process of biorock formation

References

1. THE BIOROCK BOOK, unit-16, by RICHARD JAMES BREEN, 2019, Bartlett School of Architecture.
2. Innovative Methods of Marine Ecosystem Restoration, 1st Edition, by Thomas J. Goreau and Robert Kent Trench, 2013, CRP Press.
3. Bibliography And Checklist of CORALS AND CORAL REEF ASSOCIATED ORGANISMS Of India.

Bizarre Animal Defense Mechanisms

Basusri Dandapat, 2nd Semester (2020-2023), UG Dept. of Zoology, Barasat Govt. College

We all live in a huge world which is the abode of a wide range of species, including both animals and plants. Millions of species interacting every time, it is possible that at this very moment a flower is blooming, a lion has just came back to its cub, a bird is in middle of its flight, a butterfly just coming out of its pupa with beautiful wings and many more incidents take place in the environment and these define the beauty of our nature. In this kind of arrangement we all at certain point of time, in our lives have implemented certain strategies unknowingly or knowingly to separate ourselves from unpleasant events, actions or thoughts most of the time to protect ourselves from a threat. These are known as defense mechanisms.
Let's discuss about some of the animals having some strange but amazing defense mechanisms that will make us bewildered.

Texas horned lizards - *Phrynosoma cornutum*

Lizard that shoot blood from its eyes

The Texas horned lizards' primary defense is sharp spines and horns, which makes it a scary creature. If it does not work it squirts a well aimed stream of blood out of its eye which can go as far as 5 feet and is mixed with a foul tasting chemical to ward off predators. This happens as the two constricting muscles lining the major vein around eye contracts and cut off blood flow back to the heart, but flows in head. As the pressure builds up, the thin sinus membranes rupture resulting in a jet stream of blood that can shoot from the eye socket, a process known as auto- hemorrhaging.

Hairy frog - *Trichobatrachus robustus*

Frog that break their own finger bones to use as claws

Lets know about the hairy frog of Central Africa which has a compelling ability to crack its own toe bones and push them through their skin to form sharp claws, a great action to ward off attackers. The claws of *T. robustus* found on the hind feet only are nestled inside a mass of connective tissue. A chunk of collagen forms a bone at the claw's sharp point and a small piece of bone at the tip of frog's toe. At other end the claw is attached to muscle. It is believed when the frog is attacked, it contracts this muscle, which pulls

the claw downwards and the sharp point breaks away from the bony tip and cuts through toe pad, emerging on other side.

Termites - *Neocapritermes taracua*

Frog that break their own finger bones to use as claws

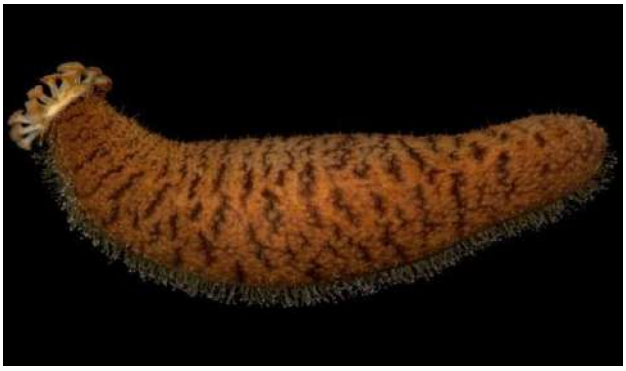
A deadly mission is observed in one of the species of termites. They sends older workers on suicide missions to defend their whole colony. The termites are equipped with explosive backpacks. Throughout their lifetime the termites produce toxic blue crystals using a pair of glands in the abdomen and store them in external pouch. When they are under attack, the poisonous blue crystals they have amassed react with salivary gland secretion to create a toxic explosion. When an enemy takes a bite, the explosive backpack ruptures, covering surrounding foes in deadly, paralyzing venom that also kills the workers in the process. The old ones have the largest accumulation of the toxic crystals. So, they are the first to response against attacks.

Sea cucumber - *Holothuroidea*

Sea cucumber push their internal organs out of their anus

Sea cucumber utilizes a unique defense mechanism to get rid of the predators. They have a mechanism called self-evisceration in which they eject their intestines and other organs out of their anus. When the predators attack them, they push out the internal organs, the long intestines distract, entangle and even harm the enemy as in some sea

cucumber species the intestines are poisonous. Predators are fooled or they think the sea cucumber to be dead and the organs keep them busy while the sea cucumber leaves the scene. The sea cucumber remains unharmed as they can regenerate lost body parts if necessary.



Boxer crabs - *Lybia edmonsoni*

Crabs that use deadly pom-poms

Boxer crabs prove to be clever. They pick up and carry around a tiny sea anemone in each claw. When disturbed, they wave the anemones in order to warn and wave off the predators. In case the predator (gobies and other small fish) attacks, the powerful stink of the anemone help the boxer crab. In this the anemones benefit by becoming mobile and they get access to more foods. The boxer crabs can also use corals or sponges instead. The pincers of the boxer crab are so small that they are of little use in defense but are well adapted to their role in holding anemones. As they use their pincers to hold, they have adapted to use its second pair of legs to rip off small pieces from chunks and move it.

Hagfish - *Myxine*

Hagfish expel slime to choke predators

Hagfish can even escape predators like shark by the slime it releases. The hagfish emit a unique slime from their pores that has mucin bonded with protein which when mixed

with seawater to become almost three orders of magnitude more dilute than typical mucous secretion and forms a gelatinous goo. They use it to either trap predators or to suffocate them by clogging their gills. They have large battery of slime glands which large volume of slime when hagfish is provoked or stressed. The predators that come to bite it spit it out immediately. They remain uninjured and oblivious to the fact that somebody tried to bite it. The potential effectiveness of this strategy is demonstrated by the fact that hagfishes are known to die if left in their own slime.

These are some examples of different animals having bizarre and unique ways to protect their own selves. There is existence of various such species in the whole world. In order to avoid the loss of these incredible creatures we need to be careful and responsible while dealing with our nature. A dreadful debacle on our environment can result from any sort of disturbance to its balance.

References

1. "The Most Disgusting Defense Mechanisms In Nature" Jessica Hullinger, Mental_Floss.
2. "12 Bizzare Defense Mechanisms Found On Nature" by Jaymi Heimbuch.

Weblinks

1. https://images.app.goo.gl/ViP1jTPrg95v6b448
2. https://images.app.goo.gl/tqiefff1u6CJg29B8
3. https://images.app.goo.gl/X3Mu3XPUDemBcJxv5
4. https://images.app.goo.gl/mR8pYJAuApXv3sSY9
5. https://images.app.goo.gl/jiL44LeVjSbNLyXR6
6. https://images.app.goo.gl/RZh6Et8gyg9nhR3D6

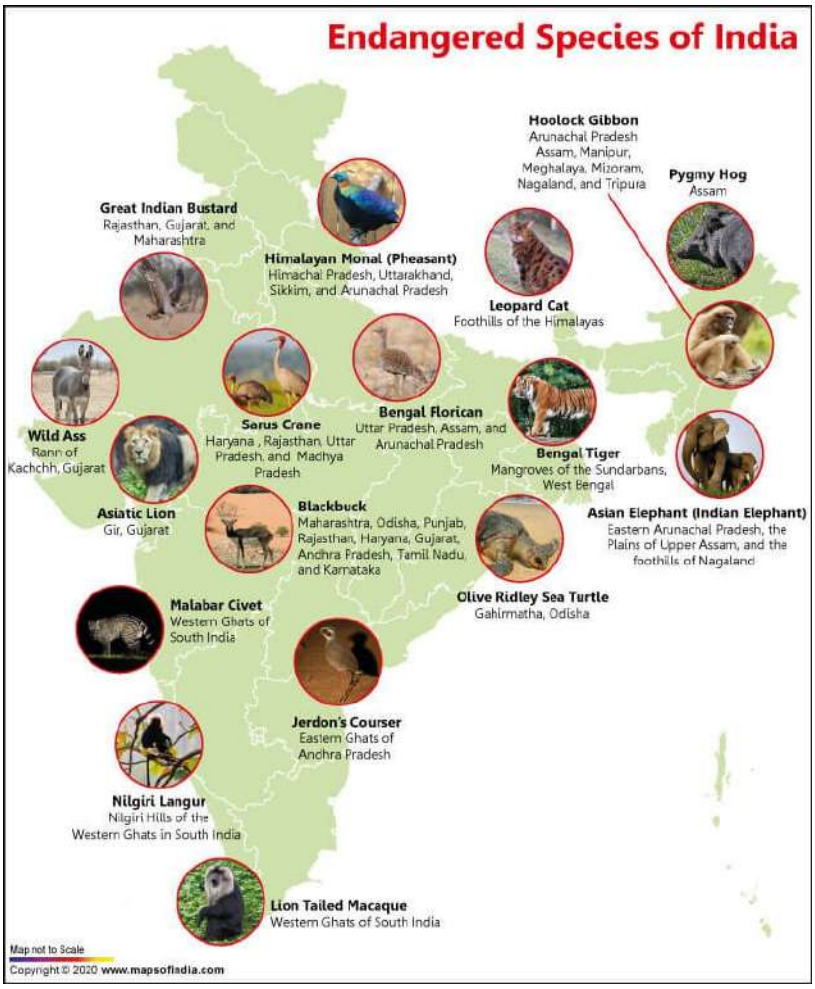
Endemic Faunal Species of India

Puja Upadhyay, 2nd Semester (2020-2023), UG Dept. of Zoology, Barasat Govt. College

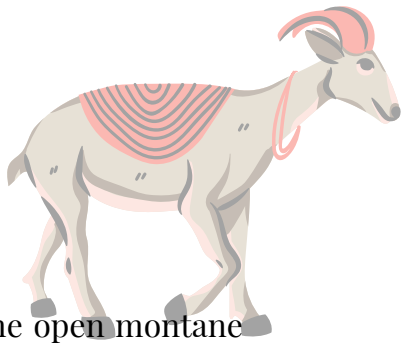
"Security is mostly a superstition; it does not exist in nature. Life is either a daring adventure or nothing at all".

–Helen Keller

The paraphrased quotation of Helen Keller, the American writer, and social activist, aptly reflects in true sense and spirit the concept of species – endemism in nature. Endemism is the phenomenon of confinement of species or groups of animals or plants to a particular area beyond which their existence is not found. Species can be endemic to a large or a very small area of the world. Endemic species are confined to certain areas because they are highly adapted to that particular area. Because of their habitat particularity and inability to move into new habitats, some endemic species are at high risk of destruction when a new disease strikes, or if any invasive species enters its region and becomes a competitor. So, endemic species are often endangered, so it is important to save the species. Almost 60% of the endemic species in India are found in the **Himalayas**, and the **Western Ghats**. Endemic species are mainly concentrated in the regions of **North-East India**, **North-West Himalayas**, **Western Ghats**, and **Andaman-Nicobar islands**.



Some endemic faunal species, found in India



Nilgiritragus hylocrius

Common name

Nilgiri tahr. It is a wild sheep species.

Distribution

It is endemic to the Nilgiri Hills of the Western Ghats. It is found in the open montane grassland habitat in **Tamil Nadu** and **Kerela**. In the **Eravikulam National Park** estimated 700-800 Nilgiri Tahr lives.

Status

It is an **endangered** species also. Nilgiri tahr is the only mountain ungulate **amongst 12 other species of ungulates in India**.

Figure 1. Nilgiri tahr

Nasikabatrachus sahyadrensis

Common name

Purple frog.

Distribution

It is found in the rainforest of the **Western Ghats** in India. These unique frogs spend most of its life underground. They are also known as the **pig-nose frogs**.

Status

It is listed as **endangered** species by the IUCN because of its habitat destruction.

Figure 2. Purple frog

Cervus elaphus

Common name

Kashmir stag. It is also known as Hangul and is the state animal of Jammu and Kashmir.

Distribution

It is the only species of elk native to India. It is endemic to the dense riverside forests of **Dachigam National Park**, Kashmir valley of Jammu and, Kashmir and Chamba in Himachal Pradesh.

Status

The IUCN's Red List has classified it as c**ritically endangered**.

Figure 3. Hangul

Macaca silenus

Common name

Lion–tailed macaque. It ranks among the rarest and most threatened monkey.

Distribution

It is endemic to the **Western Ghats** of South India. The lion-tailed macaque is protected in the **Shendurney Wildlife Sanctuary**, which is situated in **Kollam** district of **Kerala**.

Status

It is a highly **endangered** species endemic to India.

Figure 4. Tailed macaque

Rucervus eldii eldii

Common name

Sangai deer. It is also known as brow-antlered deer.

Distribution

It is found only in **Keibul Lamjao National Park of Manipur**, it is the only floating park in the world. This Park is a marshy wetland located in the southern parts of **Loktak Lake**.

Status

It is also an **endangered** species found only in the Indian state of Manipur.

Figure 5. Sangai deer

Sholicola major

Common name

Commonly known as **Nilgiri Blue Robin**, **Nilgiri shortwing** / **white-bellied shortwing**, **Nilgiri sholakili**, or **rufous-bellied shortwing**.

Distribution

This species is endemic to the shoal forests of the higher hills of southern India, mostly north of the **Palghat Gap**. They are also found in the **Nilgiris**, the Bababudan Hills and the Brahmagiris.

Status

This birds are also **endangered** species found in India.

Figure 6. Nilgiri blue robin

Poecilotheria metallica

Common name

Peacock parachute spider or **Gooty Tarantula**. It is also known as the **Gooty sapphire ornamental**, it is an Old-World species of tarantula.

Distribution

Its known habitat is in the **Eastern Ghats**, in degraded forests near **Nandyal in Andhra Pradesh**. Recently it is sighted for the first time beyond the Eastern Ghats in the **Pakkamalai Reserve Forest** near Gingee in Villupuram district, Tamil Nadu.

Status

IUCN enlisted Gooty Tarantula as **critically endangered** species.

Figure 7. Gooty sapphire ornamental

Viverra civettina

Common name

Malabar large-spotted civet, also known as the **Malabar civet.**

Distribution

·It is a viverrid endemic to the **Western Ghats** of India. It is also found in the Malabar Coast from the latitude of Honnavar to Kanyakumari.

Status

·It is listed as **critically endangered** on the IUCN Red list as the population is estimated to number fewer than 250 mature individuals. They were highly threatened by habitat destruction and hunting outside protected areas.

Figure 8. Malabar civet

Ahaetulla perroteti

Common name

Commonly known as the **bronze headed vine snake**, **Perrotet's vine snake** or the **Western Ghats bronze back**.

Distribution

This is a species of mildly venomous, rear-fanged snake in the family Colubridae and is **endemic** to the **Western Ghats** in South India.

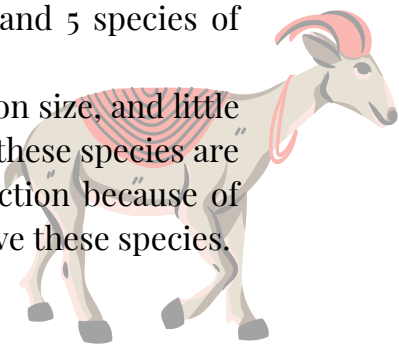
Status

It is listed as **endangered** species by the IUCN.

Figure 9. Bronze headed vine snake

Apart from these animals, the Indian subcontinent is home to 25 species of Deer, 15 species of monkeys, 15 species of the cat family, 6 species of Bears, and 5 species of Canid.

The endemic species have a narrow geographical range, small population size, and little genetic variability thus they are more vulnerable to extinction. Most of these species are becoming endangered because of human interference, habitat destruction because of urban growth and other causes. So, it is very much important to conserve these species.



References

1. Endemic Animals of India (Vertebrates), Edited by-K. Venkataraman, A. Chattopadhyay, K.A. Subramanian. (Published: May 2013), ZOOLOGICAL SURVEY OF INDIA.
2. Endemic Species, Editors: Carmelo Maria Musarella, Eusebio Cano Carmona, Ana Cano Ortiz. (Published in December, 2019).

Image Source: pinterest.com

Awareness Regarding Taeniasis & Cysticercosis in Human

Anushka Ghosh, 2nd Semester (2020-2023), UG Dept. of Zoology, Barasat Govt. College

Introduction

Both taeniasis and cysticercosis are mainly human diseases, causes due to the intake of raw, improperly cooked, infected pork. The parasite responsible for taeniasis is *Taenia solium*, commonly known as **PORK TAPEWORM** and the cysticercoses larvae, larval stage of *Taenia solium*, is responsible for cysticercosis. It is more prevalent in tropical and subtropical regions where pork is available and eaten by man. The WORLD HEALTH ORGANIZATION (WHO), has designated this disease as one of the 17 neglected tropical diseases (NTDs), affecting the poorest people in the world. An estimated 2.5 million people are infected with *Taenia solium* and there are 50,000 deaths annually due to neurocysticercosis, it is a cysticercosis infection inthe central nervous system.

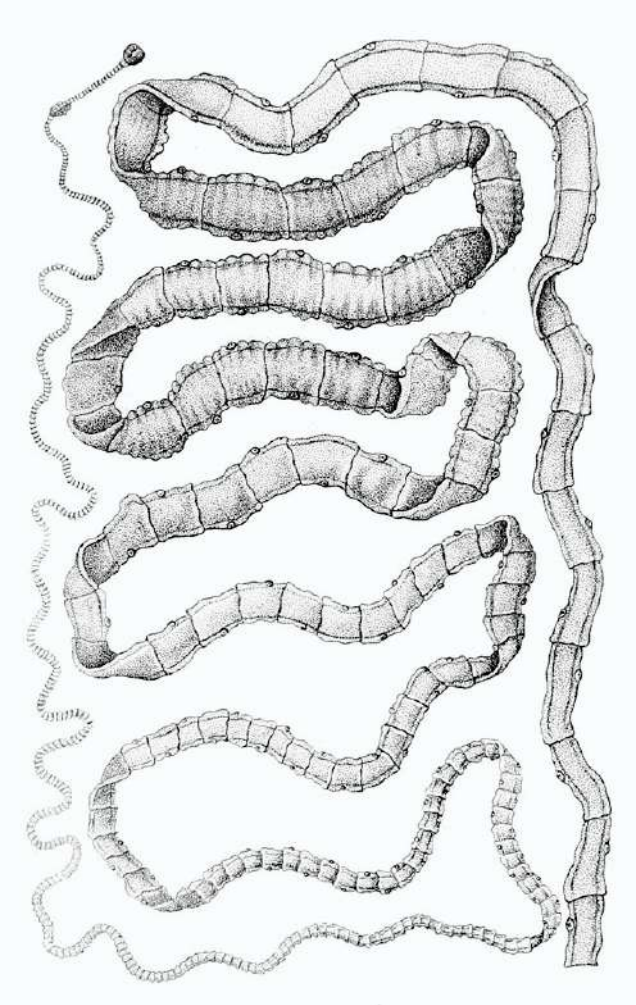


Figure 1. ***Taenia solium***

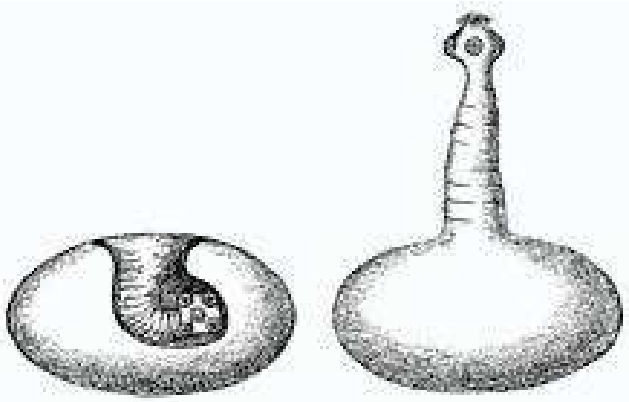


Figure 2. ***Cysticercus cellulosae*** **(Cysticercas larvae)**

How does it enter into human body?

Infected pig is the main vector of this disease. If a person eats improperly cooked, raw flesh of *Taenia* infected pig (measly pork), then it enters into the human body.

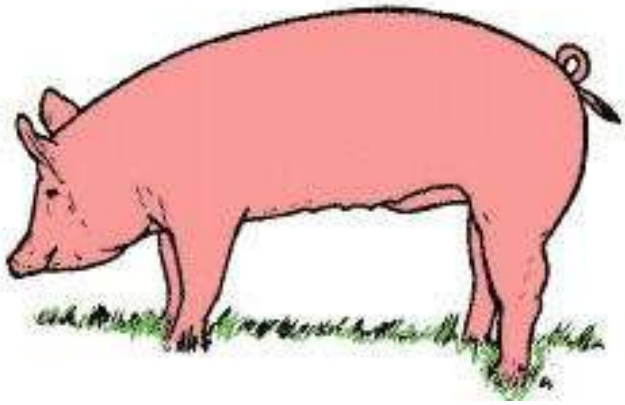


Figure 3. The main vector

Figure 4. Measly pork

Life cycle of *Taenia solium*

Taenia solium, completes its life cycle within two host bodies. Human serves as definitive host, as adult worm completes its sexual stages within human. On the other hand, pig is intermediate host where larval stages, especially cysticercas larva dwells within it. It starts when pig eats human feces which is filled with eggs of Taenia, within the pig body, it converts into cysticercas larvae stage and when this infected flesh is eaten by man, then it enters into human body and become mature into adult, then it starts infection, penetrates the intestinal wall by its hooks and spines and dissolves tissues by its secretion of tissue dissolving ferment by the help of penetration gland. Then it reproduces and produces numerous eggs, which releases through fecal matter to outside. When another pig eats these feces, the cycle starts again as same. Here a diagram represents how does the parasite complete life cycle, it is very helpful to understand –

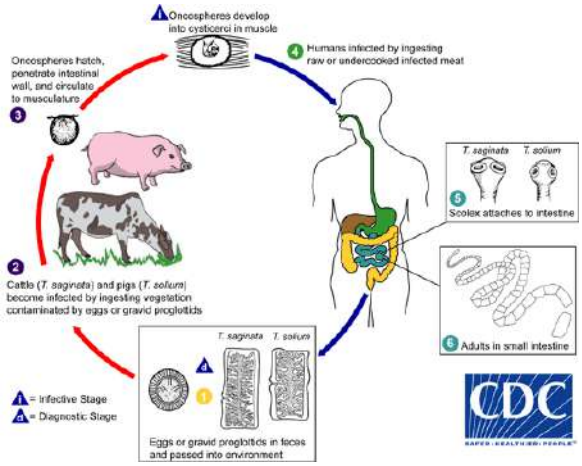


Figure 5. Life cycle of *Taenia*

In some cases, autoinfection causes in man due to unhealthy habits, improper sanitation, poor or non-hygienic adaptation and also intake of contaminated food. Then the eggs of *Taenia* instead of releasing to outside through stool, it re-enters into the body through the mouth and often travels to the central nervous system (CNS), the muscles or the eye, and they develop into cysticerci. The presence of cysticercas larva in these locations of the body leads to the pathogenesis of cysticercosis (neurocysticercosis in the CNS).

Here we are providing the diagram of both taeniasis and cysticercosis representing the migration and infection.

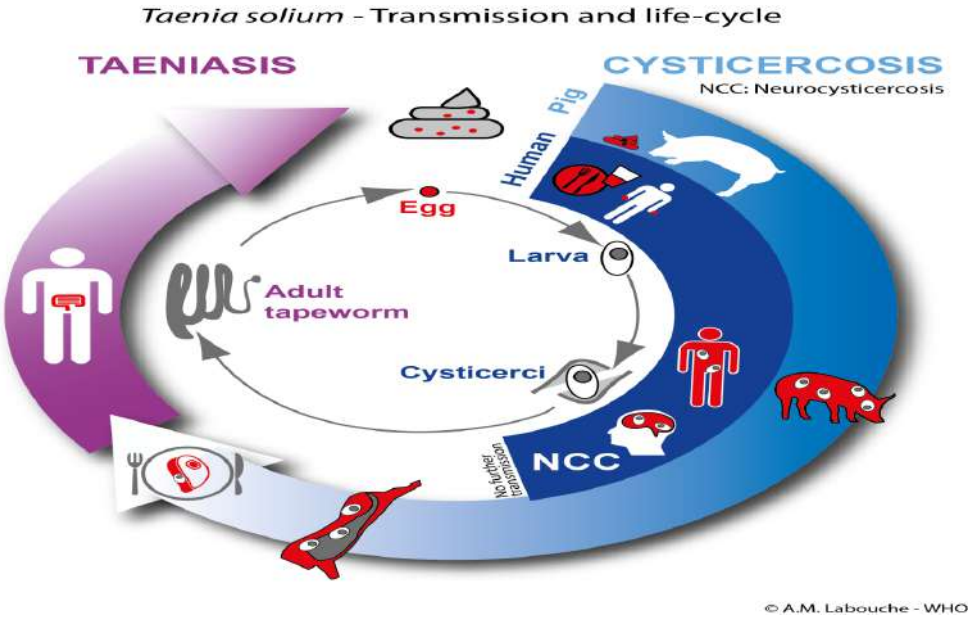


Figure 6. Transmission of *Taenia solium*

Symptoms and pathogenicity

Taeniasis

Intestinal infection caused by *Taenia solium* called taeniasis is quite asymptomatic. Only in severe cases, these symptoms occur –

1. Intestinal irritation.
2. Anemia
3. Indigestion
4. Loss of appetite.

In symptomatic cases, a wide spectrum of symptoms may be expressed, it is included –

1. Headaches
2. Dizziness
3. Occasional seizers
4. Dementia or hypertension also occurs in severe cases due to perturbation of the normal circulation of cerebrospinal fluid (CSF).

Cysticercosis

It is more serious than taeniasis because it occurs due to the full development and migration of cysticercas larvae into the body of host. The larvae start migrating into many organs, especially infects the central nervous system. Cysticercosis in the brain can lead to –

- **Epilepsy**

It is one of the most common clinical signs in patients with neurocysticercosis (NCC). According to WHO, epilepsy is one of the most common chronic neurological diseases, and people with epilepsy frequently suffer from stigmatization and discrimination. According to the Resolution WHA 68.20 Of 2015, WHO urges the Member States to support the establishment and implementation of strategies for the management of epilepsy, and promote actions to prevent the causes of epilepsy.

- **Neurocysticercosis**

It is associated with a variety of signs and symptoms depending on the number, size, stage, and location of the pathological changes as well as the immune response of the host and the parasite's genotype, but it can be clinically asymptomatic also. It may include chronic headaches, dementia, seizures (epilepsy if they are recurrent), hydrocephalus, meningitis, blindness, and symptoms caused by lesions occupying spaces of the central nervous system.

- It may cause death for severe infection.

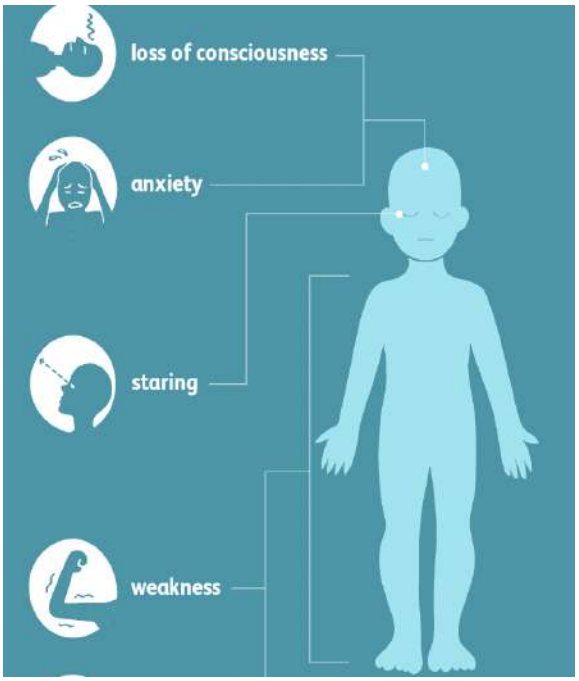


Figure 7. Symptoms of epilepsy

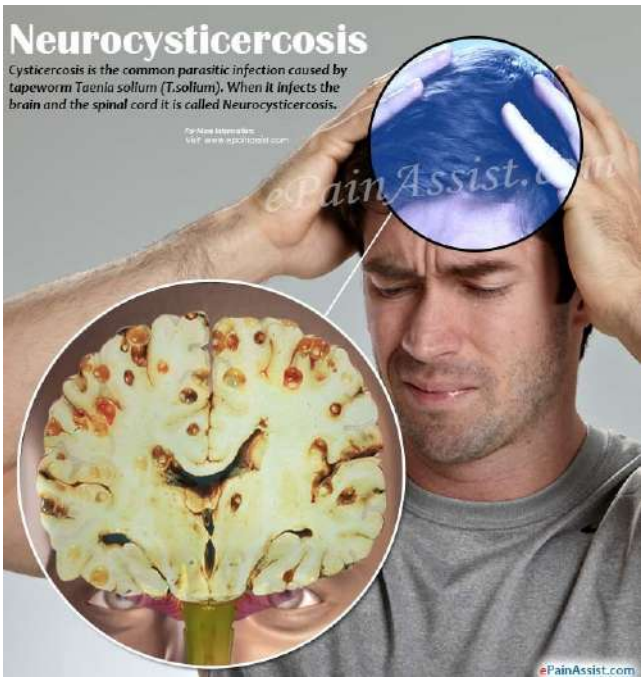


Figure 8. Neurocysticercosis

Neurocysticercosis is estimated to cause 30% of all epilepsy cases in *T. solium* endemic countries.

Diagnosis

For the diagnosis of both taeniasis and cysticercosis, the following steps should be taken -

- Stool analysis
- Blood sample test
- Physical exam
- Test of cerebrospinal fluid (CSF) sample
- ELISA (Enzyme-linked immunosorbent assay)
- X-ray, CT scan, MRI like radiological tests can also be used to detect disease.

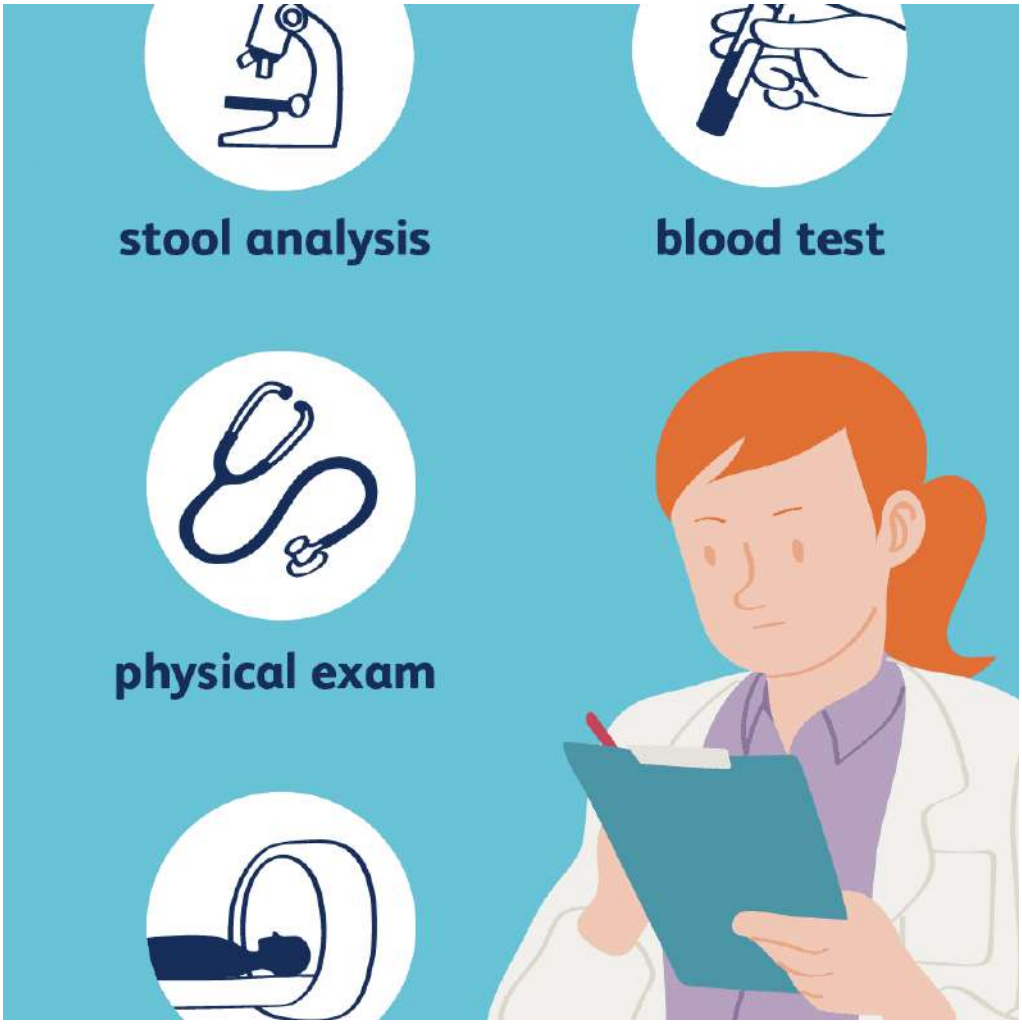


Figure 9. Diagnosis

Treatment

Praziquantel (**Biltricide**). (PZQ) should be taken 5 – 10 mg/kg for treatment. Taeniasis is typically treated with medications prescribed by doctors. Medications for the treatment of taeniasis also include albendazole (Albenza). Both are anti-helminthics drugs, they kill parasitic worms and their eggs.

Figure 10. Reason behind taeniasis and cysticercosis

Figure 11. Praziquantel

Figure 12. Albendazole

Conclusion

For all types of parasite infection, self-sanitation and self-awareness are very important to prevent it. Especially, people with having no idea of proper sanitation need to know. People should cook or boil properly before eating. CYSTICERCOSIS is serious one than taeniasis because it mainly infects the CNS, that's why in severe cases it may cause death. For small negligence, it may show a large impact on health which is dangerous. WHO is one of the most popular organizations, has been working for this program. Moreover, health is wealth, we have to take care of it.

Figure 13. The close relation of human and pig population

Reference

1. Zoology For Degree Students, author-Dr. V.K. Agarwal, 2017, 1st edition.

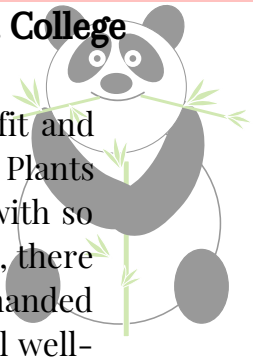
Weblinks

1. https://www.who.int/news-room/fact-sheets/detail/taeniasis-cysticercosis
2. https://www.cdc.gov/parasites/taeniasis/index.html

Image Source: pinterest.com

The Legal Provision for Wildlife Protection in India

Priya Debnath, 2nd Semester (2020-2023), UG Dept. of Zoology, Barasat Govt. College



We all now know how important it is to protect the environment for our benefit and other creatures, including humans, are deeply involved with the environment. Plants and other living things have the same right to live on this earth as we do. But with so much to understand, what can we do? Sometimes, amid a thousand engagements, there is nothing to be done for the environment. But those in whose hands we have handed over the responsibility of our society to our country are looking at environmental well-being. As responsible citizens, we need to know the answer to the question of how much of the money we give to the government as tax is spent on environmental development or not at all.

Role and mandate of the ministry

The Ministry of Environment and Forest and Climate Change (MoEF&CC) is the nodal organization in the Central Government for directing the execution of India's current circumstance and backwoods strategies and projects identifying with the protection of the country's regular assets including lakes and streams, its biodiversity, woods, and natural life, guaranteeing the government assistance of creatures and counteraction and decrease of contamination. While carrying out these strategies and projects, the Ministry is directed by the rule of reasonable turn of events. The Ministry is also the nodal agency for the United Nations Climate Program (UNEP), South Asia Co-employable Environment Program (SACEP), International Canter for Integrated Mountain Development (ICIMOD), and the United Nations Conference on Environment and Development (UNCED). The Ministry likewise arranges with multilateral bodies like the Commission on Sustainable Development (CSD), Global Environment Facility (GEF), and provincial bodies like Economic and Social Council for Asia and Pacific (ESCAP) and South Asian Association for Regional Cooperation (SAARC) on an issue relating to climate. The broad objectives of the Ministry are:

- Protection and review of vegetation, fauna, woods, and untamed life
- Prevention and control of pollution
- Afforestation, and regeneration of degraded areas

These destinations are all around upheld by a bunch of administrative and administrative measures, focused on the safeguarding, preservation, and assurance of the climate. Other than the authoritative measures, a National Conservation Strategy and Policy Statement on Environment and Development, 1992, National Forest Policy, 1988, a Policy Statement on Abatement of Pollution, 1992 and a Public Environment Policy, 2006 additionally guide the Ministry's work.

Figure 1. World environment day 2018

The ministry of environment, forest, and climate change claims to do these things

- Environment and Ecology, remembering climate for seaside waters, in mangroves and coral reefs yet barring marine climate on the high oceans.
- Environment Research and Development, instruction, preparing, data and, mindfulness. Bio-diversity Conservation including that of Lakes and Wetlands.
- Conservation, development, management and abatement of pollution of rivers excluding the river Ganga and its tributaries.
- National River Conservation Directorate.
- Wildlife conservation, preservation, protection planning, research, education, training, and awareness including Project Tiger and Project Elephant.
- All matters relating to Forest and Forest Administration in the Union territories.20. Indian Forest Service.
- Wildlife Preservation and protection of wild birds and animals.
- Fundamental and applied research and training including higher education in forestry.
- Padmaja Naidu Himalayan Zoological Park.
- National Assistance to Forestry Development Schemes.
- Indian Plywood Industries Research and Training Institute, Bangalore.
- Afforestation and Eco-Development which shall include National Afforestation, and Eco-Development Board.
- Bio-fuel plantations in forests, wastelands and environmental issues concerning biofuels.
- Desert and Desertification.
- Forest Survey of India.
- Indian Institute of Bio-diversity, Itanagar.
- Central Pollution Control Board.
- Wildlife Institute of India and Indian Board for Wildlife.
- Indian Institute of Forest Management.
- Central Zoo Authority including National Zoo Park.

- Indian Council of Forestry Research & Education.
- Andaman and Nicobar Islands Forest and Plantation Development Corporation Limited.
- Prevention of cruelty to animals.
- Matters relating to pounds and cattle trespass.
- Gaushalas and Gaussians.
- Climate change and all other matters related thereto.
- The Prevention of Cruelty to Animals Act, 1960 (59 of 1960).
- The National Green Tribunal Act, 1995 (27 of 1995).
- The Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974).
- The Water (Prevention and Control of Pollution) Cess Act, 1977 (36 of 1977).
- The Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981).
- The Indian Forest Act, 1927 (16 of 1927). 48. Indian Forest (Amendment) Act, 2017
- The Wildlife (Protection) Act, 1972 (53 of 1972)
- The Forest (Conservation) Act, 1980 (69 of 1980).
- The Environment (Protection) Act, 1986 (29 of 1986).
- The Public Liability Insurance Act, 1991 (6 of 1991).

Figure 2. ***Ailuropoda melanoleuca***

Figure 3. ***Tigris tigris***

The Ministry of Environment, Forest, and Climate Change will be answerable for by and large approach according to woods, aside from all issues, including enactment, identifying with the privileges of timberland harping Schedule Tribes on woodland lands.

Figure 4. Mamata Banerjee, CM, West Bengal, launches wildlife safari in North Bengal at Bengal Safari Park

National biodiversity plan admits India has failed to conserve biodiversity

- The union ministry of environment and forest (MOEF) says India's vast gene pool in agriculture and livestock has been widely ignored, creating a food security risk in the country.
- Measure to conserve its rich biodiversity have not been sufficient. Despite numerous laws set up (untamed life assurance act, 1972, Forest (preservation Act, 2002) the report concedes that there is the absence of a successful requirement of the laws to ensure biodiversity.
- Much of India's forestland has been given away for industrial and infrastructure activities. Since the sanctioning of the woodland (protection) Act 1980, around 15,000 ventures including 1.14 million hectares of backwoods have official leeway.
- Over 40 percent of India's forests face different levels of degradation. The arrangement faults homegrown interest for lumber, fuel-wood and touching for the emergency. About 80 percent of the faces heavy grazing While fire affect 50 percent of the forest cover.
- India presently has only 12 assortments of food, which give 80% of the food energy. Changing lifestyles have affected the variety, taste and nutritional value of food.
- Agrarian biodiversity has been declining in India with more number of harvests being industrially developed. The number of varieties grown under different agriculture systems has also fallen. Over 300,000 samples of indigenous plants kept in the national gene bank have gone out of cultivation.

- About 90 percent of India's traditional herbs are being traded India's share in the global complementary medicine market valued at us $62 billion is only 0.3 percent, out of which 70% comes from the fare of crude materials.
- Grasslands, rivers, wetlands, and coastal and marine ecosystems are under threat causing widespread damage in support for various species.
- Field species like the Great Indian Bustard are in danger.
- With just 180 lefts across the world, the gharial (*Gavialis gangesticus*), a riverine species, is in the critically endangered category of the Red List of the conservation of Nature and Natural Resources (IUCN).
- Egyptian vulture (*Neophron percnopterus*), is in IUCN's imperiled classification Bengal Florican (*Houbaropsis bengalensis*) is also in the critically endangered category.
- Despite biodiversity concerns, genetically modified crops like Bt cotton have got official approval for commercial use down to earth 70 percent of the country's land area has been surveyed and around 46,000 species of animal have been described. Nearly 50 percent of the aquatic plants of the world are recorded in India.
- An overabundance to be recorded. The absence of specialists is influencing recognizable proof source Draft National Biodiversity Action plan, Ministry of Environment and Forests, Government of India, August 2007, IUCN Red List of undermined Species, 2007.

Reference

1. The information has been collected from WWF magazine archive, Explore wild India magazine and "Study and practise of wildlife laws in India "published by Natraj publishers (1 January 2010).

Image Source: pinterest.com

Tiger Conservation in India

Tista Das, 2nd Semester (2020-2023), UG Dept. of Zoology, Barasat Govt. College

Tiger (*Panthera tigris*) has been an inherent part of the life and legend of mankind. The tiger has been feared and revered, hunted and worshiped; it has found its way into folklore and lullabies, books of worship, popular fiction and innumerable stories of heroism, bravery and adventure.

In a recent situation, the tiger is an endangered species and has found its way to Red Data Book. The tiger populations have been reduced from 40,000 to 1,827 in 1972, mainly due to hunting, habitat loss due to deforestation and taming the rivers for human needs.

Considering the first decrease of tiger population, a special task force was set up in 1970 by the Indian Board for Wildlife to prepare an action plan to conserve the population of the tiger in country. As a result, on 1st April, 1973, Project Tiger was launched.

Cause of decreasing the number of tigers

a) Hunting, poaching and illegal trade

For over thousands of years, tigers have been hunted as a status symbol, home decorative items and for use in traditional Asian medicines. Hunting for sport probably caused the greatest decline in tiger population until the 1930s. In the early 1990, trade in tiger bone for traditional Asian medicine threatened to drive tigers to extinction in the wild. Poaching is the largest immediate ultimatum to the remaining tiger population.

b) Conflict with humans

As tigers continue to lose their habitat and prey species, naturally they are increasingly coming into conflict with humans as they attack domestic animals- and sometimes people. In reprisal, tigers are often killed by angry villagers.

Objectives of project tiger

- To make sure the maintenance of a viable population of tigers in India for scientific, economic, cultural and ecological values.
- To conserve, for all times, places of biological importance as a national heritage for the utility, education 017 sq. km.

Principles of tiger reserves

In 1973-1974, 9 tiger reserves were established –found in 9 different states and covering an entire area of 13,017 sq. km.

- Elimination of all forms of human exploitation and disturbance from the core and rationalization of such activities in the buffer.
- Limitation of habitat management to repair the damage done by men to restore the ecosystem as close to its natural functioning as possible.
- Restoring facts about habitat and wild animals and carefully monitoring changes in flora and fauna.

Conservation of tiger requires the following knowledge

- The natural dwelling of tiger and its eating habit.
- About the breeding habit and breeding season of tigers.
- Its relation with other animals.
- The number of tigers present at any given time, reasons for their diminishing or increasing.
- Places of drinking water and its arrangement.
- Places of cover and shelter of tigers.
- Enactment of the laws for their protection.

Levels of conservation

- **Level 1**

The population of the tigers in any reserve is to be surveyed from time to time. The reasons for either their increase or decrease to be noted. In case of a decrease, the reasons are to be located and appropriate measures are to be undertaken.
If they experience severe diseases then it should be identified and instant treatments are to be made. If the decline in number is due to poaching then constant attention is to be maintained to prevent the occurrence of poaching.

- **Level 2**

The food of the tiger consists of deer, sambar, wild boar etc as it is a carnivore. Care should be taken to keep the food animals in sufficient numbers so that the tiger need not come out of the forest for food and get killed by hunters.

- **Level 3**

It is necessary to know about the breeding time of the tigers and the number of litters born. The litter should be secured from all kinds of danger including diseases. The diseased litter of tigers should be imprisoned and treated and later released into their natural habitat.

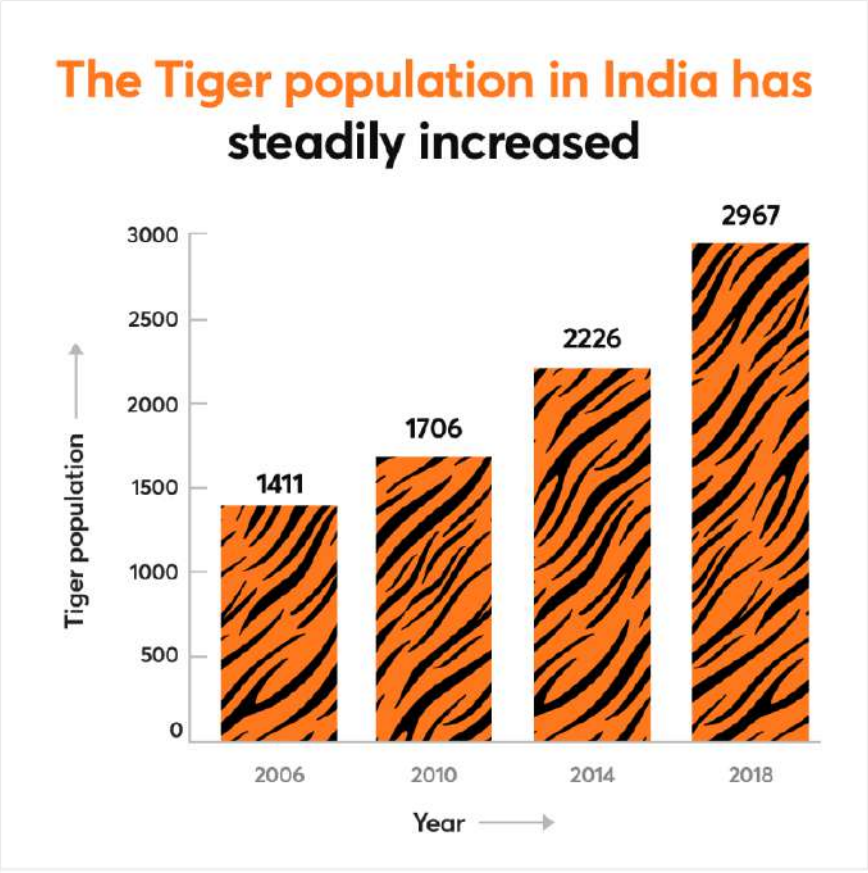


Figure: Graph of showing the increased numbers (2006-2018)

Tiger reserves of India

Name of Tiger Reserves	Year of Declaration
Bandipur (Karnataka)	1973
Corbett (Uttarakhand)	1973
Kanha (Madhya Pradesh)	1973
Manas (Assam)	1973
Melghat (Maharashtra)	1973
Palamau (Bihar)	1973
Ranathambore (Rajasthan)	1973
Simlipal (Orissa)	1973
Sunderbans (West Bengal)	1973
Periyar (Kerala)	1982
Sariska (Rajasthan)	1982
Buxa (West Bengal)	1983
Indravati (Madhya Pradesh)	1983
Nagarjunasagar Shrishailam (Andhra Pradesh)	1983
Namdapha (Arunachal Pradesh)	1983
Dudhwa (Uttar Pradesh)	1987
Kalakad - Mundathuari (Tamil Nadu)	1988
Valmiki (Bihar)	1990

Contd.

Pench (Madhya Pradesh)	1992
Bandhavgarh (Madhya Pradesh)	1993

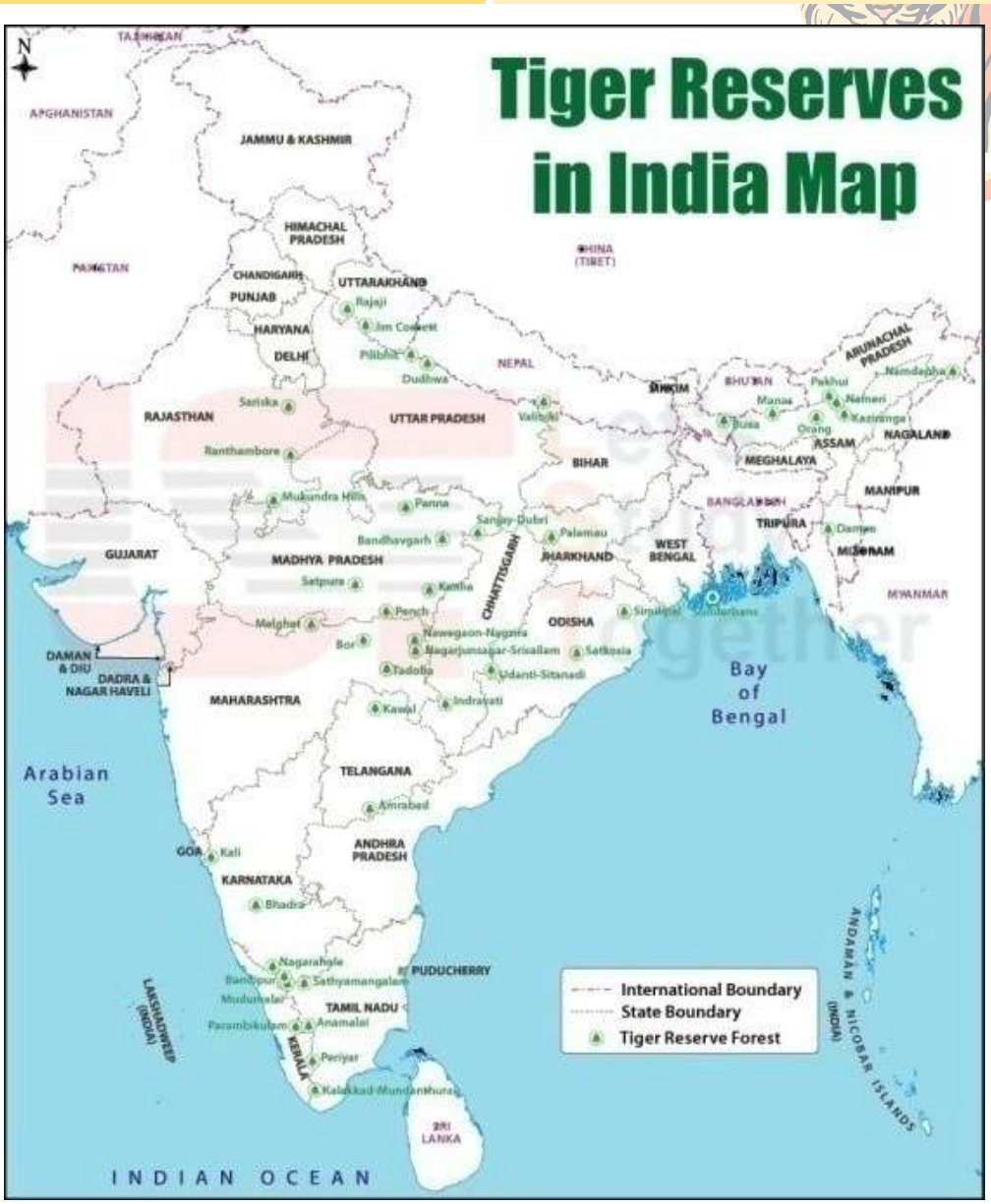


Figure: Tiger Reserves in Indian Map

Reference

1. V. K. Agarwal Zoology (for degree students)(1st edition 2017).

Weblinks

1. www.wwfindia.org
2. www.conservationindia.org/articles/conservation-at-crossroads-an-interview-with-dr-ullas-karnath

Image Source: pinterest.com

Photography

The spectacular Kenya experiences

Alluring sunset in Amboseli National Park !

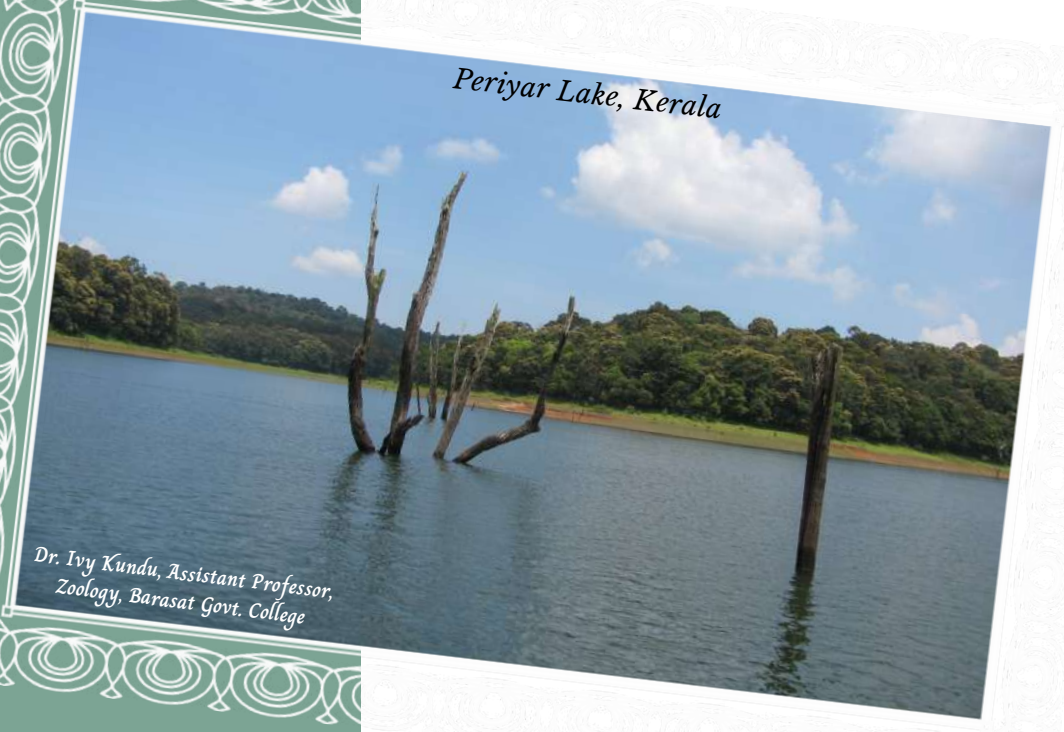
Save Cheetahs for posterity (Masai Mara)

Vibrant Colour the power (Masai Mara)

Dancing star of Lake Bogoria

Photography by Dr. Sumana Saha


Study nature, love nature, stay close to nature. It will never fail you.
Wildlife is something which man cannot construct
How can we expect wild animals to survive if
we give them nowhere in the wild to live?
Dr. Somaditya Dey, Assistant Professor, Zoology, Barasat Govt. College


Periyar Lake, Kerala
Dr. Ivy Kundu, Assistant Professor, Zoology, Barasat Govt. College

Paintings & Sketches

Trishani Das
M.Sc. Semester-IV

Michael Changjit Pal
M.Sc. Semester-IV

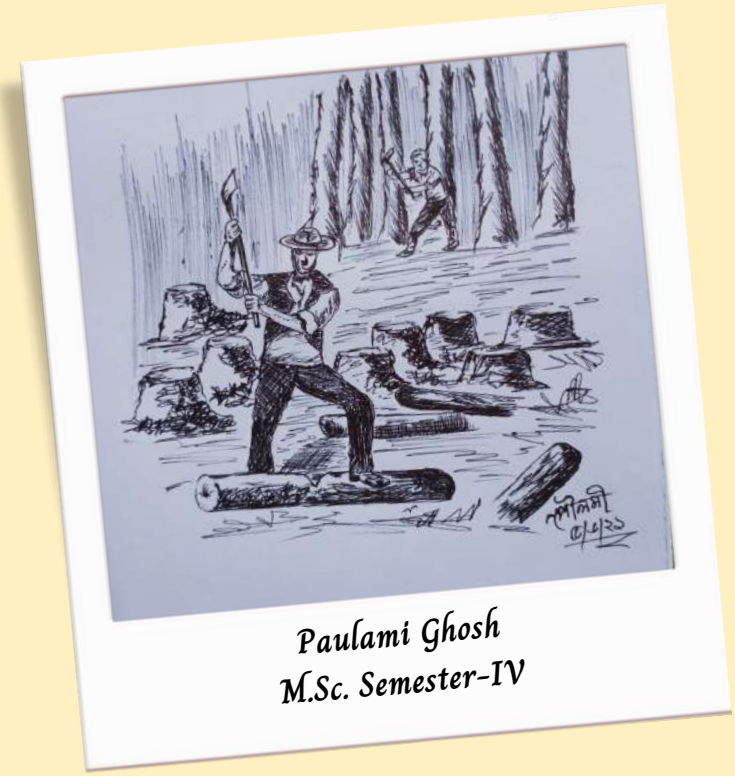
Titas Dasgupta
M.Sc. Semester-IV

Trishani Das
M.Sc. Semester-IV

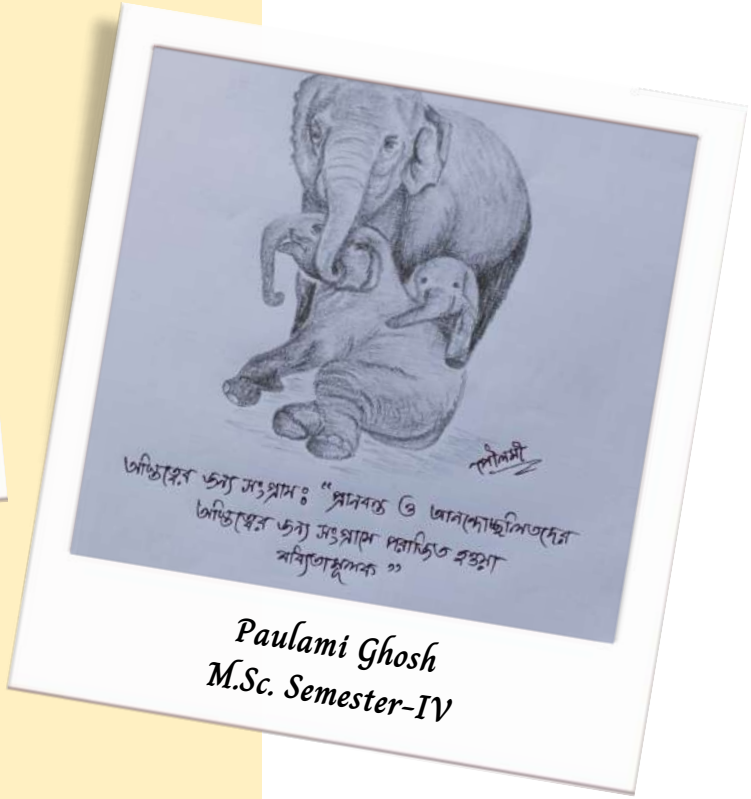
Michael Changjit Pal
M.Sc. Semester-IV

Michael Changjit Pal
M.Sc. Semester-IV

Trishani Das
M.Sc. Semester-IV



Paulami Ghosh
M.Sc. Semester-IV



Paulami Ghosh
M.Sc. Semester-IV

Piyali Banerjee
M.Sc. Semester-IV

Paulami Ghosh
M.Sc. Semester-IV

Arpita Samanta
M.Sc. Semester-II

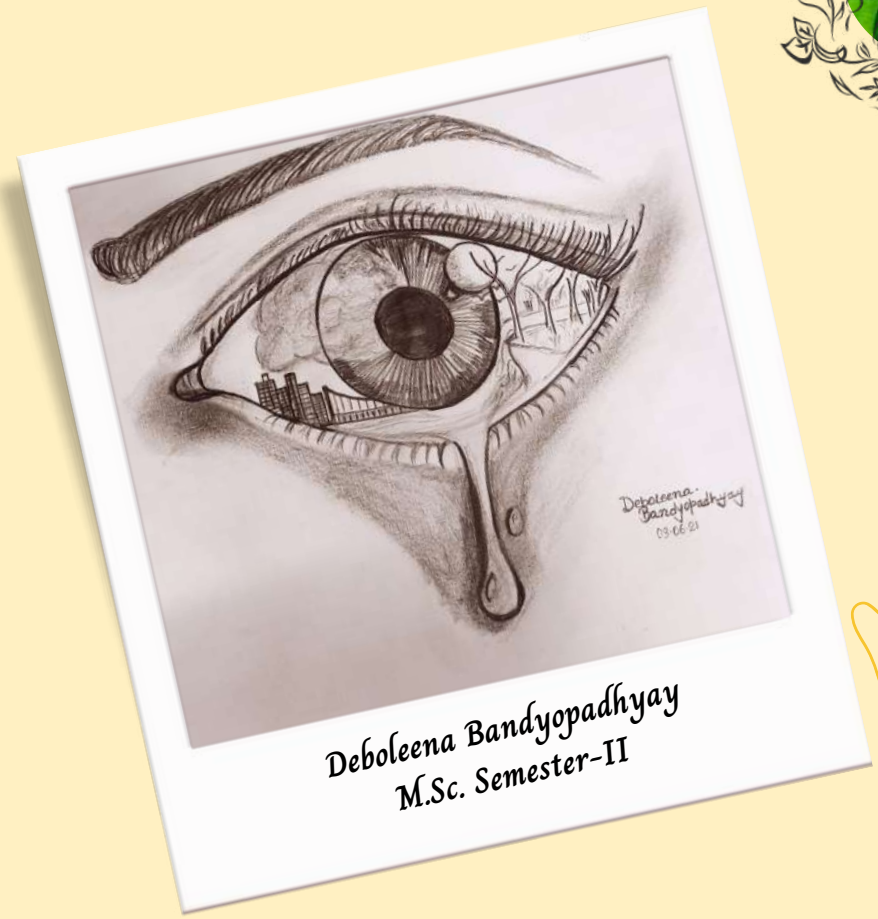
Arpita Samanta
M.Sc. Semester-II

Nandana Sen
B.Sc. Semester-II

Piyali Banerjee
M.Sc. Semester-IV

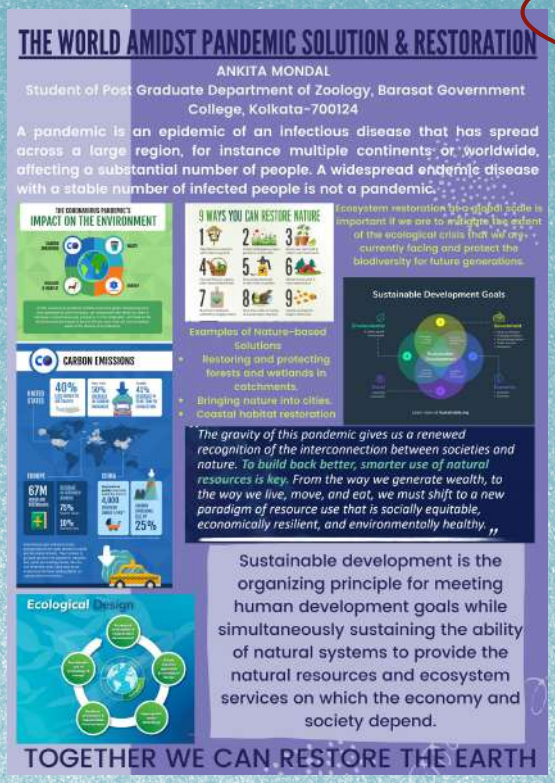
Pritam Chakraborty
M.Sc. Semester-II

Deboleena Bandyopadhyay
M.Sc. Semester-II

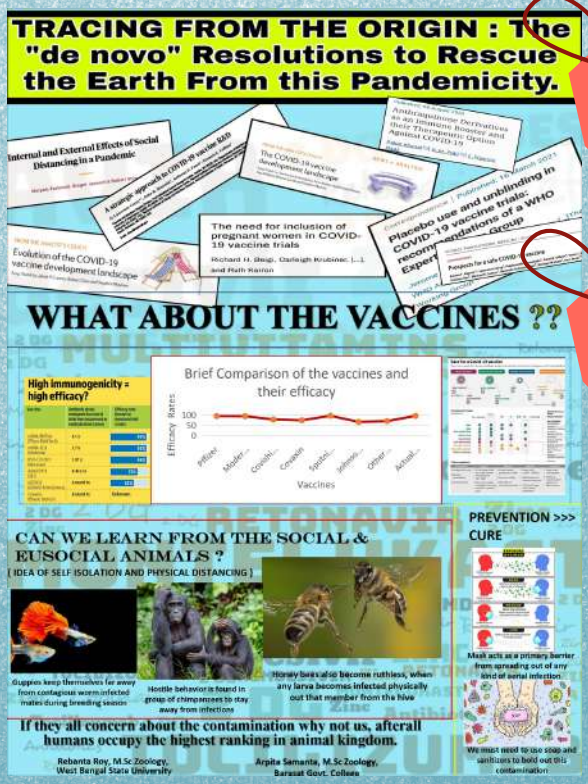


Deboleena Bandyopadhyay
M.Sc. Semester-II

Award Winning Posters

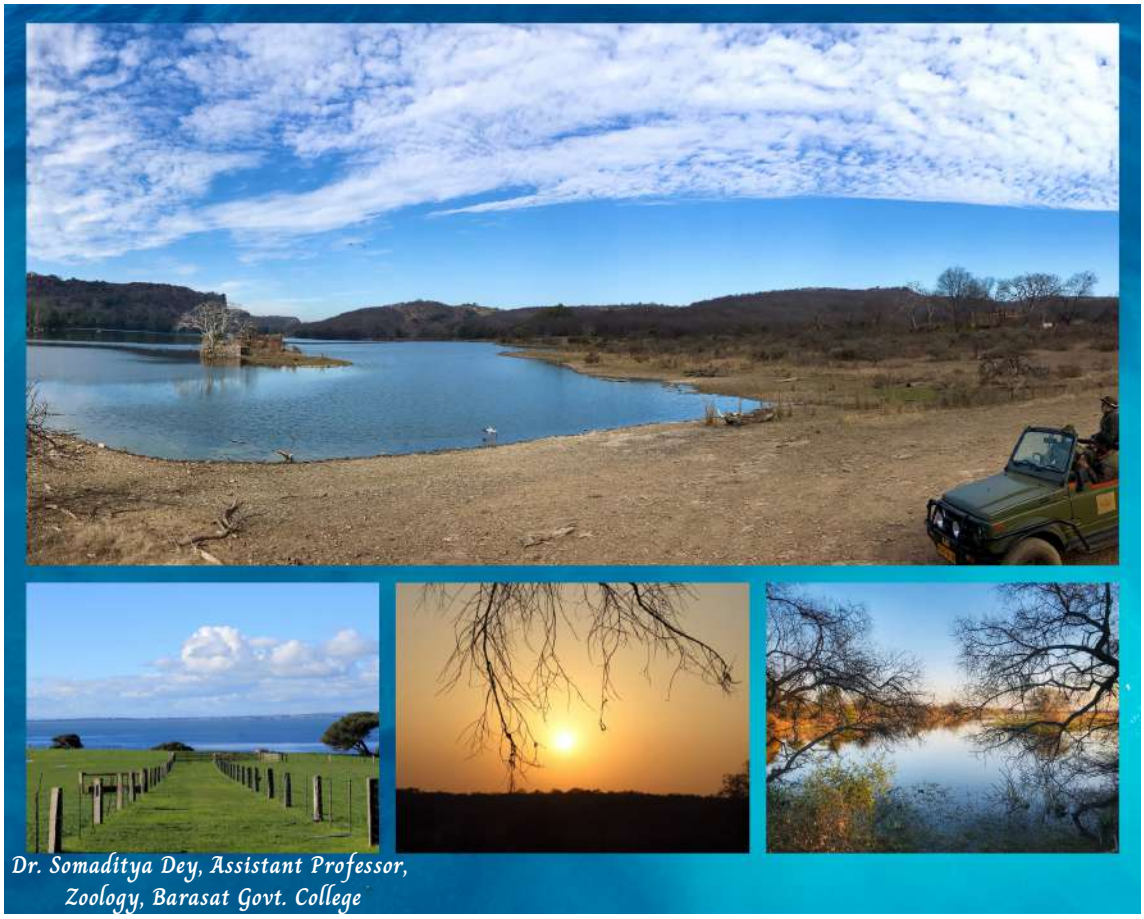


Ankita Mondal
M.Sc. Semester-IV



Rebanta Roy
B.Sc. Ex-Student

Arpita Samanta
M.Sc. Semester-II



Dr. Somaditya Dey, Assistant Professor,
Zoology, Barasat Govt. College

PRESERVE AND CHERISH THE PALE BLUE DOT, THE ONLY HOME WE'VE EVER KNOWN

Published by: Department of Zoology, September, 2021

Barasat Government College
bgc.ac.in