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As per decision of Council meeting held on May 3, 2014, Presidential Addresses will not be printed henceforth in Everyman's Science as they are already printed in the above mentioned book.

EDITORIAL**EDUCATION FOR NEXT GENERATION****PROLOGUE**

The National Knowledge Commission (NKC), the Scientific Advisory Committee to Prime Minister (SAC-PM) and several countrywide educational survey reports have emphatically indicated the urgent need of reforms in education sector. The New Education Policy of India is about to be announced. Strengthening old educational institutions, opening new educational institutions, seeking public-private partnership in education sector, redesigning the academic curricula to promote entrepreneurship oriented education, flagging of moral/value education, increasing Gross Enrollment Ratio (GER) etc. are envisaged and envisioned remedial measures.

t-EDUCATION VERSUS e-EDUCATION

Traditional education system (t-education) requires physical presence of student, teacher, school etc. at a given place at any given moment of time. It entails a minimum definite infrastructural setup in terms of man-power (teacher etc.) and physical facilities (building, library etc.) at each and every location identified for this purpose (school and/or college). Obviously, a huge budget is required to provide these facilities on per capita basis. On the other hand, electronic education system (e-education) requires minimum infrastructure and can address large mass simultaneously. The initial phase in this direction was to adopt audio-visual system in t-education. The overhead projector and slide projector were

next to come. Finally, computer based projectors are widespread. All these projectors are basically add-ons to t-education system operational at any given location.

The next generation education system will dwell upon the use of satellite communication system (EDUSAT etc.) in addressing countrywide classrooms. It provides facility of education that requires less number of resource persons and addresses large number of learners at significantly reduced budget when compared to t-education system. Internet based e-education system is bringing revolution and is a paradigm shift from t-education. Countrywide classrooms, Webinars, Podcasts, Web based discussion portals etc. need to be widely promoted.

MINDS-ON VERSUS HANDS-ON EDUCATION

The real world needs ready to deliver stuff. In general, present education system is mostly addressing theoretical/conceptual aspects (dominant classroom component i.e. Minds-on) while many of the academic programs need dominant laboratory/workshop/field study components (Hands-on). The incongruent relation between Minds-on and Hands-on components leads to students who are unable to adjust in the real world. Though there are good examples like Mathematics (dominant Minds-on component) and Computer Science (dominant Hands-on component) where Indian students are considered to be excellent, however, this is not true in the case of science

and engineering students (as very few institutes have adequate hands-on facility). It has led to concept of finish schools that may not be required if adequate emphasis is given to education system where Minds-on synchronizes with Hands-on.

RURAL VERSUS URBAN EDUCATION

We must understand that rural India is quite different from urban/semi urban India. This difference is momentous and is visible at all levels including life style, food habit, local dialect, local eco-surroundings etc. It translates that we need to have different education system for rural and urban India. Unfortunately, we are yet to consider education system that would take care of local language, culture, resources, heritage etc. along with scheduling according to local harvesting season, local festival etc.

There are numerous schools/colleges located in rural/semi urban areas where majority of students come from farming background. Due to obvious reasons these students are unable to attend classes during sowing/harvesting season. The institutions located at rural areas should consider Rabi/Kharif vacation rather than summer/winter vacation. These institutions should aim at imparting education to students such that they are able to understand their local level heritage, environment and natural resources as per calendar scheduled according their local need. It would strengthen the local level livelihood generation including unwanted migration of rural population. A quantum increase in GER and decrease in drop-outs may be achieved by rescheduling the calendar and timing according to local requirements.

NEW VERSUS OLD INSTITUTIONS

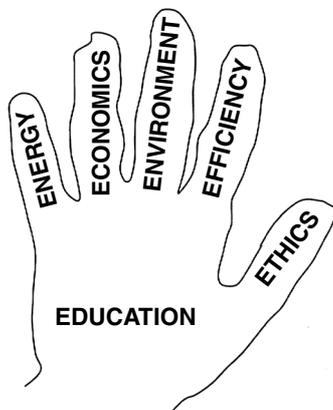
The Education Facility Index takes into account education at all levels. Even a cursory

look of statistics of developed countries would suggest that number of academic institution per unit population is much higher than their developing or underdeveloped counterparts. Education is foremost requirement for sustainability and, for peace of man and environment. India strongly needs large number of new Universities and colleges to move from developing to developed status. The new Universities/colleges may be goal specific based on the regional requirements. To explain in simple words, new institutions should not necessarily always compete with already established institutions, rather considering local and regional needs, more and more of them should focus on educating people not only for job market but for appropriate entrepreneurship also. At the same time, already established institutions should focus on innovative education and research based on national and global requirements.

EPILOGUE

In addition to maintaining quantity, quality and delivery of educational contents, the best result of education is possible through sharing of resources and networking of institutions. High quality teaching/learning materials accessible through internet and networking of library resources are essentials step in this direction. Sharing of laboratory facilities amongst network members is highly desirable. Team research (inter/intra institutional) needs to be effectively encouraged. Rescheduling of academic calendar according to local needs will significantly increase the GER. The role and goal of new institutions should be defined according to regional and local needs. India is home for large number of rural students. The system should encourage such schools/colleges with extraordinary flexibility in terms of academic contents and time scheduling.

Private-public partnership is must to achieve the goal of 100% literacy.



The next generation education may be illustrated by palm as education and the five fingers as its outputs. The 'thumb' will reflect 'ethics'; like thumb impression, education will have impression of 'value' (inbuilt value based education system). The 'index finger' will

represent 'efficiency'; education will impart efficiency, capacity and intelligence that will be unquestionable. The 'middle finger' will represent 'environment'; the education will impart enough weight to natural resources and eco systems. The 'ring finger' will represent 'economics'; the education will marry inclusive development and will impart knowledge about local/regional/global development. The 'little finger' will represent 'energy'; education will provide strength of intellect, experience, innovation, network.

(Note - The views expressed are exclusively of author and do not represent view of his organization)

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Council of Science & Technology, Bhopal

*Reading makes a full man, meditation a profound man,
 discourse a clear man.*

—Benjamim Franklin

STRESS OF MULIEBRITY

Vanita Kamat

This is an article written with the view to create awareness among people about stress women face in today's world. Author has made an effort to present the current information regarding the causes, effects and preventive measures of stress in brief. Despite growing awareness about the stress, anxiety and various psychological disorders in our society, special efforts are needed to be taken for making women mentally and physically fit. We still have long way to go in our understanding about stress management in women. It is hoped that the information brought together in this article would be found useful.

INTRODUCTION

In the womb itself when female foetus is conceived, the stress and life of woman, puts hands together. Mostly her birth is regarded unwelcome in almost all parts of society by one or the other person in the relations or by parents themselves. Woman's life various phases from childhood, adolescence, adulthood to her last breathe in the world is full of stresses.

The word 'Stress' was previously used in physics to refer the internal force exerted on material body leading to strain. Walter Bradford Cannon, American Physiologist in 1926, coined the term 'Flight or Fight' to describe animal's response to threats as bodily changes in fear, hunger, pain and rage. He, for the first time discovered the 'stress response' as 'flight or fight response' or 'Allostasis with urgency' i.e. response of a body to the problem for physical survival of the individual animal. The term 'Stress' was

first used in 'biological context' by Hans Selye in 1936 as 'Non specific response of the body to any demand for change'¹.

Stress is a reaction of body to the short lived situation like missing the bus or long lasting one like dealing relationship problem, spouse's death etc. It becomes dangerous when it interferes with the person's ability to live normal life for an extended period when person is not able to concentrate, irritated which can further damage the physical wellbeing.

Though stress is a feeling when one is faced with challenges. To a limited extent it can be good as makes a person alert, gives the burst of energy and motivates to deal with the stressor. But feeling stressed for longer time can take toll on mental and physical well being.

COMMON CAUSES OF STRESS IN WOMEN

Stress happens when women feel they don't have capacity to manage the demands of their lives. It's a continual feeling. Stress can be short lived or long lasting. Few stressful events in women's life can be²:

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1. Marriage
2. Pregnancy
3. Divorce
4. Death of spouse
5. Death of close family members
6. Marital separation
7. Relationship breakups
8. Losing the job
9. Personal illness or Injury
10. Commuting to work
11. Job responsibilities
12. Keeping home clean
13. Getting less time to spend with family members
14. Glass ceiling treatment i.e. experiencing gender inequality for being women despite having qualifications or achievements etc.

SYMPTOMS OF BEING STRESSED OUT / COMMON SIGNS OF STRESS

1. Headache
2. Lack of energy
3. Lack of concentration
4. Poor self esteem
5. Short temper
6. Stomach upset
7. Back pain
8. Not eating too much or eating too much
9. Feeling of no control over situation
10. Forgetfulness etc.

Above mentioned symptoms may be of depression or anxiety, which can be caused by long term stress².

CURRENT STATUS OF KNOWLEDGE

'Stress does affect the health' :

The body responds to stress by releasing the stress hormone. When brain perceives the stress, hypothalamus releases Corticotripin Releasing Hormone (CRF), which triggers the release of Adrenocorticotropin Hormone (ACTH). ACTH travels through the bloodstream and it stimulates adrenal glands to release Cortisol and Epinephrine into the bloodstream. Cortisol and Epinephrine are the hormones which help to provide the energy to produce emergency energy and support 'Flight or Fight Response'. As long as the brain perceives the stress, it continues to produce CRF. The body's stress response ends when the brain relaxes, allowing hormone level to return to normal⁸.

Happenings that trigger stress response do not last longer. But when long term a problem creates stress, above mentioned 'stress response system' is activated over too long period of time. This can lead to many psychological disorders. It reduces overall immune response and thus succumbs the body to various illness and some forms of cancers⁹.

LONG TERM STRESS CAN LEAD TO VARIETY OF HEALTH PROBLEMS IN WOMEN

1. Mental health disorders like depression, anxiety, insomnia
2. Eating disorders, obesity, nausea, ulcers and other gastrointestinal problems,
3. Fatigue, depersonalization, panic disorders
4. High Blood Pressure, heart arrhythmias, diabetes, chest pain, head aches.

5. Menstrual and other hormonal imbalances.

‘Do women react to stress differently than men?’:

Many surveys suggest women experience more physical symptoms of stress than men. But Women tend to be friendly, taking care of those close to them but also draws support from their family and friends. Men are most likely to have flight or fight response. They cope by escaping into relaxing activity or other distraction².

A study in rats has revealed a gender difference in brain's stress response that sheds light on women's proneness to mood and anxiety disorders. Corticotropin Releasing Factor (CRF) which acts as both hormone and neuro transmitter plays key role in response to stressor. In response to the stressor, CRF binds to the receptor on the cells in 'Locus coeruleus' alarm centre in the brain. After stress, CRF receptors remain exposed on neuronal membrane of female rat, allow CRF to persist in its effect making them more stressful. In male rats, there is internalization of many hormone's receptor in neuronal membrane and thus males are more resilient in compared to female rats³.

‘Sandwiched Generation’ :

This term refers to the women who care for their children at home as well as parents in addition to their usual job obligation. Many surveys conducted suggest such women are less likely to be happy than others. Problems related to money, lack of time, health problems are leading sources of stress along with the concern for elderly relative's health. Such women are more likely to be depressed and worried about not having enough time for other family members as well as more trouble managing stress⁷.

‘Stress and Abdominal Weight gain in Women’ :

In animal studies, stress induced cortisol secretion has been shown to increase central fat. In various researches it has been found that high Waist to Hip Ratio (WHR) displayed heightened Cortisol to repeated laboratory stressors⁴.

Cortisol is named 'stress hormone' as its secretion raises during physical or psychological stressful events. Some studies in women have shown that, stress and elevated cortisol levels leads to fat deposition in abdominal area rather than hips. Studies have shown that women have tendency to react to stress with high levels of cortisol have been shown to have tendency to eat more under stressful conditions than women who secrete less cortisol in similar such events⁵. Thus such women become more prone to cardiovascular diseases in course of time.

‘How to handle the stress?’ :

Every woman has to handle her own stress. Experts suggest few steps that can help to handle stress in a positive way^{2, 10} :

1. Improving the attitude :

- (a) **Being flexible** : One can let go things or meet people half way. It is seen sometime its not worth arguing and thus one can avoid stressful situations. Trying to cope up with existing circumstances is very important.
- (b) **Getting organized** : Women should make 'To do list' and figure out what is most important and prioritize the things to do.
- (c) **Setting limits** : A day has 24 hours only. In that workable hours are limited. Women needs to set limit for themselves and others. They should not be afraid

of 'saying No' to request for their time and energy. Women should understand their limitation and capacities, accept them and in that accordance should set goals.

- (d) **Problem solvers** : Women should try to be problem solvers . They should list the problems that can be solved now and which are beyond control for the moment.

2. Relax :

- (a) **Taking deep breaths** : it helps to relax the muscles .
- (b) **Stretch** : It relaxes muscles and make a person feel less tense.
- (c) **Massage the tense muscles** : Massaging the neck and upper back .
- (d) **Hobbies etc** : Taking out time to do things one wants e.g. listening to music, reading a book , going for a movie etc.
- (e) **Being joyful** : Entertaining , hilarious attitude helps a person to be socially acceptable.

3. Self Care :

- (a) **Get enough sleep** : 7-9 hours of sleep is must for body to feel rested.
- (b) **Right food habits** : Having fruits, vegetables, beans and whole grains. Avoiding alcohol, caffeine, high carbohydrate snack food, junk or fast foods.
- (c) **Exercise** : Getting physical activity helps body to relax and improve the immune response, routine exercise like walking, swimming, cycling etc.
- (d) **Meditation** : Practicing yoga, and various breathing techniques in meditation helps to relax and rejuvenate.

4. Connect with others :

- (a) **Share the stress** : Talking out about the problem to the near ones can help to feel better. Also there is possibility that solutions can be suggested.
- (b) **Friendships** : One should try to cherish friendships, get together helps to reconnect.
- (c) **Getting help from professionals if needed** : If one can no longer cope, counseling can help to deal with the stress. Doctors can also suggest some antidepressants and other medications.

CONCLUSION

Its said the way we live decides the way we suffer. From existence of our civilization, stress has been the important factor in human evolution. But as no thought, no problem , no circumstances are forever lasting ; nor is the element of stress. So we need to understand our stressors and then learn to deal with them as its well said 'We must learn to let go. Release the stress. We were never in control anyway'.

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POSSIBLE REASONS OF VULTURE MORTALITY AND THEIR REMEDIAL MEASURES WITH SPECIAL REFERENCE TO INDIAN CONTEXT

Biswaranjan Paital and Shailazar Tripathy

Vultures rapidly consume the carcasses which act as host for various diseases that spread to livestock. Despite high ecological significance of vultures, research on their biology and pathophysiology is still wanting. As a result, their population is severely declining or locally extinct not only in India but also in the globe. It indicates the emergency to revive their population both by laboratory and field interventions. This article is an attempt to string together the possible causes and remedies against their disappearance from the ecosystem with special reference to Indian context.

INTRODUCTION

An ecosystem is stabilized with different trophic levels without which it is pushed to an unbalanced state. Trouble to any of the trophic organism such as producers, consumers or scavengers, eventually not only leads to the disappearance of the food chain but also it makes disorder in the existing food web. It is not worthy to mention here that scavengers occupy an imperative level in a food chain without which eco-maintenance of dead carcasses is either stopped or delayed. It leads to several ecological disturbances. Specifically, it is believed that their absence can lead to a remarkable crisis in terrestrial ecosystem¹. The vultures, an excellent scavenger of dead bodies, are critically tagged in the endangered lists². It is noteworthy to mention here that, they feed mostly on the carcasses of

animals. They do not kill animals but by consuming the dead animals, they keep the environment clean. In the absence of any alternative mode of disposal of animal's carcasses, they continue to be disposed off openly. It leads to increased risk of rabies and live stock born diseases like anthrax. Therefore, the scavenging habit of vultures prevents spreading to dangerous diseases such as rabies and anthrax, which could play havoc to the wildlife, live stock and human being as well.

The ecotones which were occupied with important scavengers like vultures are now found to be in numerous troubles. Specific studies highlighted more about the persisting problems related to the causes and consequences of vulture extinction from particular regions³⁻⁶. The Indian white-backed (*Gyps bengalensis*) and long-billed (*Gyps indicus*) vultures were the most abundant vulture species of India before more than a decade ago. Unfortunately, they are now on

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the verge of extinction. In Indian sub-continent, the problem was scientifically documented by the Bombay Natural History Society (BNHS). In 1999, data published from a study by BNHS at Keoladeo National Park (KNP), a world heritage site, showed around 96% decline in the Indian white-backed vulture population and around 97% decline in the long-billed vulture population between 1985 and 1999³. In 2000, nation-wide surveys showed similar decline of vulture population throughout India. Afterwards, such cases have been noticed with *Gyps* spp. population in neighbouring countries such as in Nepal and Pakistan^{3, 5}.

The right time of the task to discuss about the causes and remedial measures against vulture destruction has gone back to many decades back. Now, the problem must be taken seriously to put forward specific scientific and social strategies in order to revive their population. In the above context, a different look has given in the present article with an aim to string together the cause and possible remedial measures against the rapid decline of vulture populations with special reference of India.

POSSIBLE CAUSES OF VULTURE MORTALITY AND THE REMEDIAL MEASURES

Several laboratory and field intervention have been made to list the possible causes of vulture mortality. However, the outcome are not sufficient to stop or to delay the processes of their declining population.

ENVIRONMENTAL FORCES

Biotic and abiotic environmental factors such as extreme heat or cold, chemical pollution in air and water, heavy cyclone, loss of habitat, loss of forest canopy, imbalanced food chain

etc. are always detrimental factor for the disappearance of a species from the world. Such factors many times are enhanced by human activities into many folds of its actual level which becomes threat to the inhabiting species. Environmental factors such as chemical pollution and heavy cyclone were found to have important role on the declining vulture population in India.

Air and Water pollution

Vultures are usually colonial in nature (live in groups) and by drinking polluted water containing either or both pathogenic organisms and organic or inorganic poisons, might caused disappearance of the vultures patch wise. For example, presence of a novel *Mycoplasma* species (*Mycoplasma vulturii*) in tissues of oriental white-backed vulture (*Gyps bengalensis*) at Changa Manga forest plantation area of Pakistan is proposed to be a water born pathogenic contamination responsible for their population decline¹². Pathogens of malaria can grow better in water lodging polluted area. Though malaria is not a water born disease, pathogens causing malaria could be a cause for death of the wild population of the Indian white-backed vulture (*Gyps bengalensis*). Persistently several organochlorine pesticide residues (p, p'-DDE, p, p'-DDT, HCH, Dieldrin etc.) detected in tissues and eggs of white-backed vulture, *Gyps bengalensis* from different locations in India such as at Delhi and Mudumali. Indian white-backed *Gyps bengalensis* and long-billed *Gyps indicus* vulture populations were also noticed to be affected with dropped neck posture followed by death due to pesticide contamination in their tissues. The above results could be due to drinking of contaminated water and very less probability

is due to biomagnifications of the selected chemical through the food chain in vultures. Therefore, water pollution could be a major cause for declining vulture population. Despite lack of experimental records, it can be presumed that huge air pollution could drive vulture species to change their habitat and this process could be very rapid since the species is arboreal (e.g. birds including vultures) one. As a consequence to adapt with a new habitat or the old polluted habitat with many unwanted factors may become fatal to the vulture life for their extinction. Scientific investigations are anticipated to find out the role of specific air pollutant on vulture physiology and mortality.

The common human attitudes at individual level and community level like proper use of chemicals, toxins in agriculture, industry etc. and disposal and treatment of industrial (especially from chimneys) and individual (especially from vehicles) by products must be taken care of as remedial measures.

Environmental Extremities

Vultures are arboreal in nature and usually found to live in colonies patch wise. Environmental conditions like high rainfall, high or low temperature, cyclone may be responsible to affect their arboreal life. Irregular and unexpected weather conditions including high or low rainfall and temperature is virtually due to loss of balanced ecosystem in general and loss of green forest in particular. Loss of green canopy always leads to disturb biogeochemical cycles. Finally, disturbances in biogeochemical cycles such as water and carbon dioxide cycles directly influence rainfall and temperature, nitrogen cycle influence canopy growth and development. It leads to rise in environmental temperature. It is noted

that neck-drooping posture followed by mortality in oriental white-backed vultures (*Gyps bengalensis*) is correlated with failure in its body thermoregulation with respect to environmental temperature. During 1990, a severe cyclone was found to reduce the vulture population to almost extinct locally at Guntur of Andhra Pradesh, India. The remaining few vultures again were drastically reduced there due to hunting of the vultures for meat by the Bandola (Banda) people in the districts of Guntur and Prakasham, Andhra Pradesh. Similarly, record of vulture population was nil in the coastal belt (especially that of Jagatingpur district and few places of Kendrapara and Puri district) of Odisha, India after the super cyclone blown over the region during 1999.

Such extremities may not be stopped by human beings but may be minimized by applying new techniques of science and of course by enhancing the plantation in large scales.

NESTING AND RESTING PLACE

Vultures usually colonize in large trees. Invading human beings into wild animal habitat and cutting large trees for various purposes leads to destroy the habitats of vultures. Consequently, it pushes the inhabiting animals to be displaced by migration. Such a case has already been distinctly reported². Shedding down large trees which is preferably and specifically used for nesting purpose by vultures, has the enough reason to be a real problem for their disappearance. According to the records of Regional Museum of Natural History, Bhubaneswar, the slender billed Vultures (*Gyps tenuirostris*) were found to prefer to make their nest on large trees such as banyan,

mango, bullet wood etc. at the coastal belt of Jagatsingpur district of Odisha during 1992. After the declination of the above tree populations, the inhabiting vulture population declined severely. It indicates that when the trees are chopped off, the vultures lose their home. Although, the concept of vulture restaurants already has been started in few locations in India, it is still to be expanded to various parts of the country. It may serve as a beneficial and safe way to provide vultures with food and resting place help them live longer.

NUTRITIONAL PROBLEM

Food availability

Dead bodies are the only important source of food for vultures. The way of disposal of the dead bodies of animals at the contemporary time such as throwing into rivers, buried down into the soil obviously leads to food scarcity in vultures. So, after a normal death, the dead bodies of animals may be disposed openly far away from the human community especially nearer to habitats of vultures for their consumption. With a specific strategy with follow up action for proper disposal of dead bodies openly can lead to get rid of any bad consequences including pollution.

Infection by contaminated food

Vultures are found to feed in groups¹. It creates an augmented chance of community destruction after feeding the contaminated foods. Dead bodies with pathogenic or poisonous threats must be properly disposed to avoid consumption of the same by vultures. Diclophenac contamination in vultures from dead bodies of cattle was a bright example. Severe pathologic conditions such as peptic ulceration, gastrointestinal bleeding,

hepatotoxicity, renal papillary necrosis, and renal failure were the major cause in death of vultures in diclophenac contaminations⁴. Involvement of drugs such as carprofen, flunixin, phenylbutazone and ibuprofen as the cause of death of vultures and other avian scavengers have also been reported⁷. Many farmers spray cattle carcasses with the pesticide such as organo-chlorine and organo-phosphorous to prevent them from spreading foul odour. This pesticide infested carcass eaten by the vulture has reported to be a cause of their death. Instances are there of death of hundreds of vultures in this way⁸. Like wise, in parallel to diclophenac or other contaminations, many other unknown natural and man made threatening factors may be the causes of toxicity to vultures and other scavenger birds⁷. There factors must be investigated with priority in order to conserve the vulture species in India or world wide^{9, 10}.

Food poisoning

Food poisoning may contribute a lot for the death of vultures patch wise. It may be due to natural causes like toxic fungal or bacterial growth on dead bodies or man made disposal of contaminated dead bodies. A search of such case may have fruitful results toward vulture recovery plan.

BREEDING PROBLEM

The declining population is always revived either by slowing down the death rate or by high natality (reproduction) rate followed by enhanced survivability rate. If there is problem with the former case then the decreased mortality (death) rate may not be sufficient enough for revival of the species. In this regard, study in nature on the life cycle and breeding problem may be thus identified to take care of vulture death⁹.

Induced breeding

Induced breeding (reproduction in captive condition) of vultures is suggested if natural natality rate is insufficient. Although world wide including in India, such measures have been taken care of but the output has yet to be increased. In India, a captive care centre has been constructed at Birshikargha Wildlife Sanctuary, Pinjore. Such centers are yet to be increased in number in several parts of the country³.

Incubation

Unnecessary consumption and damage of eggs and predation of juvenile vultures in nature may be collected from nature for *in vitro* incubation. Baby vultures may be released into nature after they acquire enough offence and defence capacity to survive in nature.

Captivity plan for pathological susceptibility

Diseased or susceptible vultures to death may be identified and should be kept under special supervisions. It is believed that morbid vultures exhibit signs of illness (neck drooping syndrome) for approximately 30 days prior to death. Therefore, further investigations on this bird can be performed easily to investigate the causes of morbidity and mortality. Analysis of the infected birds for possible pathogenic infections may be helpful to have a complete picture on their pathophysiology which yet has to be fully explored. The infected birds may be released after their fully recovery. Vulture Care Centre at Pinjore, District Panchkhla, Haryana is an example of such step.

EPIDEMIC AND ENDEMIC DISEASES

Any endemic (native disease) or epidemic (disease from other geographic place) disease

must be taken care of to find the remedial measures against the identified disease. Instances of vultures suffering from malaria and infected with Mycoplasma have been noticed⁸. Thus other epidemic and endemic bird diseases may be the reason why vultures are dying in the wild due to pathogenic attacks. It needs careful field interventions on their physiology at large scale in different parts of the world.

ELECTROCUTION

Electrocution is a probable cause discussed by⁸. A specific study indicates that a vulture out of any disorder has died with high voltage electric wires. The logic of increased risks of electrocution has been contributed to the larger size and larger wing span of vultures. Some other species that are threatened due to electrocution are great Indian bustard, Saras crane and some species of eagles. But still a concrete report has to be produced to believe this point for a strong cause of vulture deaths. However, since vultures prefer their nesting on larger trees, natural lightening may be responsible for their high mortality rate in wild. On the other hand, due to the large size of vultures, their menace to air craft in India has already been discussed¹¹.

CONCLUDING REMARK

If a species is under consideration with a possibility of extinction, then investigation on its health problems relating to its life cycle and pathogenesis (disease caused by other microorganisms) must be identified. Accordingly, possible measures can be taken. India is ahead of taking steps for such plan for recovery of vultures. Indian Vulture Disease Investigation Centre is serving over the past new years. BNHS and the Poultry Diagnostic

Research Centre (PDRC) have been actively collaborating on vulture disease investigations.

Vultures are the important scavengers of the ecosystem so their revival in the earth is very much essential. Following steps may be taken for their population recovery in the earth.

1. Vigorous research on the species biology and pathology.
2. Proper funding for the research programs on their nesting ecology, roosting sites, breeding success and feeding ecology.
3. Research lab establishment and human awareness in and around the vulture community to report the proper about problematic vultures.
4. General awareness of disposal of dead bodies in favor of vultures after ensuring that wild animals that had natural death and were free from contagious diseases by made available to the vultures. The awareness program either about dead body disposal or against diclophenace contamination to revive vulture population must includes but should not be limited to forest field staff, livestock owners, villagers, school children and teachers on a periodic basis.
5. Proper health and nutritional care of vultures both in captive and in nature if possible.
6. In captive breeding, rearing etc of the species.
7. Identifying natural and artificial hazards and their remedial measures.
8. Last but not the least, it can be planned to produce a genetically programmed

vulture race by manipulating their genetic material to survive against hazardous conditions especially against pathogenic infections. It is here to mention that carcasses, the preferred foods of vultures are usually infected with many pathogenic microorganisms and pathogenic infection in vulture tissues has already been detected¹². On the other hand, if we can genetically program any other species (goat for more meat, birds for more egg and meat, avian for more milk, fishes for more flesh production etc.) then why not a resistant vulture species to make them fit to survive against several pathophysiological conditions. This logic is in order to produce a fantastic scavenger which not only will be beneficial to human but also to many other species of earth by maintaining the food chain. However, the post consequence issues such as environmental impact to genetically modified vultures, their interaction with other species etc. should be seriously considered before initiating such programs.

ACKNOWLEDGEMENTS

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UNDERSTANDING URBANIZATION VS. SUSTAINABLE DEVELOPMENT

Rita Gupta¹, Nidhi Gupta² and Neelam Gupta³

Today, urbanization in India has increased faster than expected. Land has become the medium of “enabling environment” for infrastructure provisions in growing cities and urban planning emerges out of series of crisis and social responses to them. In the present article we try to discuss that nothing is as important as sustainable development is in today's era of urbanization and growth.

An important aspect often forgotten in planning of types is our environment. Planners aim to understand analyze and influence the variety of forces, social economic, cultural, legal, political, ecological, and technological aesthetic and so forth shaping the built environment. Urbanization has been accompanied by disruption & sometimes destruction of fragile ecosystem including water bodies such as surface water bodies & ground water tables decline, the green cover with its accompanying life support system is adversely affected.

With increasing population and growing pollution we cannot ignore the ill effects of planning on the environment. Humans have been using land and its resources for centuries in a pursuit of their better lives. The way humans have used land and exploited its resources over time is a serious problem as it has altered land cover and impacted the

functioning of the ecosystem. Environmental problems associated with urban planning can be broadly classified under two categories namely Strategic Planning, & Urban Management. The environmental problem associated with urban growth in management include urban sprawl, damage due to construction activities (in planned versus unplanned settlement), threats to cultural heritage in inadequacies in the provision of basic environmental amenities in the urban areas (underground drainage waste water treatment facilities & solid waste disposal sites).

It is a well known fact that city is not a problem, it is a solution and present day uncontrolled urbanization may lead to deterioration in the environment and reduction in the quality of life. Cities are probably the most complex things that human beings have ever created. They are the wellsprings of culture, technology, wealth and power. People have a love hate relationship with cities. We are born between our needs for community and privacy and the conflicting attractions of

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urban and rural life. Urban planning can be defined as the design and regulation of the uses of space that focus on the physical form economic functions and social impacts of the urban environment. and on the location of different activities within it. The urban problems are not all of recent making. In India the urban situation had become serious because of the large increase in population since 1921. The United Nation estimates that 4.9 billion inhabitants out of 8.1 billion will be living in cities by 2030. The urban drift is continuing unabated. Rapid urbanization has resulted in depletion of water table and there is a gap between supply and demand. And in some cases water quality is also compromised with degradation of land & water environment. More emphasis should be laid on the planning of residential & commercial areas.

In a more general sense, urbanization is the concentration of population due to the process of movement & redistribution (i.e. the spatial location & relocation of human population, resources and industries in a land space)

Basically humans have been using land and its resources for centuries in pursuit of their better lives. The way human have used land and exploited its resources overtime is a serious problem as it has attended land cover and impacted the functioning of the ecosystem. With the advent of agriculture, modern technology and the rise of capitalist mode of economy, the exploitation of land and its resources has increased dramatically. In the last few decades, land use practices (agriculture, mining, logging, housing, recreation etc) have become so intensive & predominant that we can see their impacts in form of uncontrolled development, deteriorating environmental quality, loss of prime agriculture

lands and wildlife habitats everywhere on the earth. Such impacts have reduced the local capacity of lands to support both ecosystem and human enterprise at global scale. Therefore, the effect of land use change is no longer a local environmental problem but a global one.

To address such a problem of global scale detailed information on existing land use pattern and sound knowledge about changes in land use through time is important for legislator's planners and state & local governmental officials.

Cities are growing faster all over the world, it require more land and resources to support the growth. This leads to change in land use, causing environmental problems such as air & water pollution, loss of open space and biodiversity, heat island effects and so on.

Global human population is growing and rural to urban migration is increasing, the urbanization trend will continue to happen at least for another few decades. This continuation of urbanization pattern will increase land and resource consumption and exacerbate the environmental problems, which have already posed threats to our earth. So planner, government, planning agencies and others should acknowledge these problems, immediately and put environment perspective into land use planning and decision making process effectively & promptly.

So we can define urbanization as a major driven of land use change which causes environmental problems. There are unlimited no of urbanization induced environmental problems of many scales i.e. issue of air & water quality at the local scale and issue of global warming & climate change at the global scale.

Land use refers to the way human beings employ and exploit land cover for several purpose such as farming, mining, housing, logging on recreation. Therefore land use change is the exploitation of land cover through it's conversion and/or modification overtime primarily to serve human needs.

The process of urbanization results in a dense settlement called an urban area. The conglomeration of urban areas including cities & their suburbs liked economically & socially constitutes a system called metropolitan area and this definition left out one of the major linkage of the system i.e. ecological linkage.

Hence the urban area is a result of capitalism which promotes diffusion of habituate and activities based on economic functioning and administrative activities.

Ecosystem provides services to living organism including human's ecosystem. Services are the conditions and processes which are driven by solar energy and generated by a complex of natural biogeochemical cycles such C, N, S etc and life cycle such as bacteria, trees, etc.

So for a healthy population more emphasis on planning should be given due importance to environmental & sustainable development, uncontrolled urbanization and growing population. There presume essential challenges for the water management in urbanized regions of the emerging and development countries. The reciprocal impact of urban development & ground water represents one of the most important aspects of growing, cities. The interaction between urban development & ground water many be explained in the relation with the land use pattern and stage of city evolution on affecting the quantity & guilty of ground water. Previous studies of the effect of

the fast growing cities on groundwater have concluded that urbanized area changes ground water recharge on cycle with modification to the existing recharge and introduction of the new sources. Discharging of new sources of recharge in urbanized area causes extensive but essentially diffuse ground water contamination i.e. fluctuation on ground water level and impacts on engineering structure.

Urbanization reduces infiltration to ground water due to the impermeabilization of the catchment by paved areas, building and roads. The sources and pathway's for ground water recharge in urban areas are more numerous & complex than in rural environment. The increase of ground water recharge in urbanized area is closed related to these main sources i.e. rain water, waste water and main leakage from water supply networks.

Fast growing cities with an inadequate waste water system have potentially major effects on increasing ground water recharge than cities with sewerage system. So it can also be concluded that almost all urbanization processes can potentially increase the rate of infiltration to groundwater. With population migrating to urban settlements in search of improved economic levels, the first pressure is on housing leading to the high land cost or prevailing high rent in urban areas thus leading to illegal occupancy of vacant / public land through huts which over a period of time develops into a slum. Such a housing doesn't have any basic amenity like light, water, toilet facilities & consequently, affects environment in the immediate surroundings.

Absence of provision of water in sewage system by the state (due to illegal nature of these sites & constructions) forces people to draw uses of ground water & use of soak pits

for toilet activities, thus affecting the environment. It has been observed that the users of revenue are not the fresh migrants to urban areas but people who have stayed in urban areas & have saved certain amount of money & want to improve their living conditions.

The effect of urbanization on the quality of recharge is commonly poor, especially if waste water is an important component. There exists deficiency in the provision of basic urban infrastructure in terms of underground drainage & waste water collection & treatment which pose severe environmental & health problems. These problems can be linked to the lack of planning in new residential layouts in urban areas that has led to human settlements without sewerage system.

So, in the years to come for sustainable development, cities should be well managed, clean & dynamic serving its citizen. We have to embark on a hard and difficult journey to fulfill this vision that must be achieved during the lifetime of the present generation for the benefit of its own and next. The environment impacts of the problems associated with urban planning & growth are listed below:

- Ground water contamination due to soak pits & improper drainage system near open wells.
- Decrease in ground water recharge due to increasing surface run off due paved areas.
- Polluting surface water bodies like tanks by the letting sewage into the lakes.
- Health problems due to uncollected garbage strewn around.
- Health problems due to crowding families in one room or two room houses.
- Increase in temperature due to radiation from buildings & paved roads (heat islands) & inadequate tree cover to counter this rise in temperature. Air circulation is also reduced due to the dense residential development & loss of vegetation / tree cover.

Finally a better and well managed city is home of healthy people & good health has a positive, sizable and statistically significant effect on aggregate output. Nothing is as important as, sustainable development is in today's era of urbanization & growth. The need of the hour is sustainable development. Sustainable development refers to :

1. Utilizing the present resources keeping in mind the future needs of the society, so as not to exhaust the resources.
2. It should not disturb the ecological cycle and hence preserve the environment.

Urban Planning in India includes (but is not confined to) the following -

- Town planning
- Regulation of land use for residential and commercial purposes
- Construction of buildings
- planning for economic development
- planning for social development
- Construction of roads
- Constructions of bridges
- Water supply for domestic use, industrial and commercial purposes
- Public health care management
- Sewerage, sanitation and solid waste management
- Proper fire services

- Urban forestation and maintenance
- Protection of environment through sustainable development
- Promotion of ecological balance and maintenance
- Safeguarding the interests of weaker sections of society
- Offering proper infrastructural help to the handicapped and mentally retarded population of the society
- Organized slum improvement
- Phased removal or alleviation of urban poverty
- Increased provision of basic urban facilities like public urinals, subways, footpaths, parks, gardens, and playgrounds
- Increased public amenities including street lighting, parking lots, bus-stop and public conveyances
- Continual promotion of cultural, educational and aesthetic aspects of the environment
- Increased number of burials grounds, cremation grounds and electric crematoria
- Proper regulation of slaughter houses and tanneries
- Absolute prevention of / zero tolerance of cruelty to animals

- Proper maintenance of population statistics, including registration of births and deaths records.

From the above discussion it is clear that proper planning of urbanization is necessary for sustainable development and new environmental planning is moving towards a more sustainable future. A good environmental sense has been one of the fundamental features of India's ancient philosophy. The earth was called 'mother earth' and water, air and sun were considered to be Gods. Major rivers like the Ganga & the Yamuna were also treated as mothers. The environmental concerns were integrated into various religious and social customs in such a manner that these were automatically taken care of by the people.

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COMPARATIVE STUDY OF VARIOUS DEPOSITION TECHNIQUES FOR SYNTHESIS OF SOLID THIN FILMS

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Solid films of thickness less than 1 micron are commonly called as thin films. In recent years, thin films have attracted much interest because of their varied application such as semi conducting devices, photovoltaic, optoelectronic devices, radiation detectors, laser materials, thermoelectric devices, solar energy converters. The reliable thin films have huge demand in microelectronic, optoelectronic and photovoltaic industries. The demand and supply ratio doesn't fulfill either quality or economics behind film synthesis. The article discusses precisely various techniques for development of thin films to enhance basic and applied research in thin films so that quality and economics both will be controlled.

INTRODUCTION

Thin films are two dimensional solids. In these solids the third dimension is negligibly smaller than the two dimensions. To fulfill the urgent needs of the technology, understanding of thin films has made tremendous advances in last decade¹.

Thin solid films were probably first obtained by electrolysis in 1838. However, Bunsen and Grove obtained metal films in 1852 by means of chemical reaction. Faraday obtained metal films in 1857 by thermal evaporation of metallic

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elements. The usefulness of optical properties of metal films, and the scientific curiosity about the behavior of two dimensional solid have been responsible for the major interest in the study of the science and technology of thin films. Thus thin films can be obtained from various deposition techniques. Improper selection of deposition technique causes varied and irreproducible results on the films².

This article discusses various deposition techniques for developing thin films in order to optimize the desired film characteristics. The article will be a guideline for basic understanding of the process control, usefulness and restrictions applicable to each technology.

1.1 Thin film Technology

There are large numbers of techniques to prepare single crystal or poly crystalline films of all types of materials. Deposition rates may range from a fraction of an angstrom to thousands of angstroms per second.

1.1.1 Classifications of thin film deposition techniques :

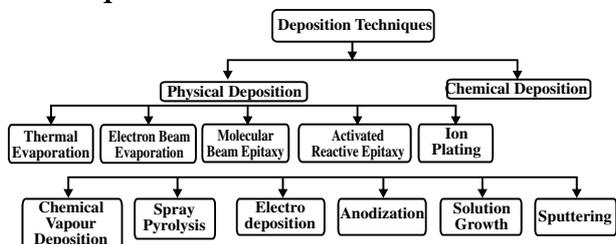


Chart 1.1 Classifications of Thin Film Deposition Techniques

Important methods of preparation of thin films may be broadly classified as (1) physical deposition and (2) chemical deposition. Physical deposition method is further classified into (a) thermal evaporation (b) electron beam evaporation (c) molecular beam epitaxy (d) activated reactive evaporation and (e) ion plating. Chemical deposition includes (a) chemical vapor deposition (b) spray pyrolysis (c) electro-deposition (d) anodization (e) solution growth and (f) sputtering. The detail classification of these two methods is shown in the chart 1.1³.

1.1.1 Physical Déposition Techniques :

According to deposition mechanism physical deposition techniques are classified in five major types as follows :

(1) Thermal evaporation : Thermal evaporation is one of the most well known PVD techniques. It is simple technique and one can evaporate a large variety of materials (metals, semiconductor, or dielectric.) on different substrate.

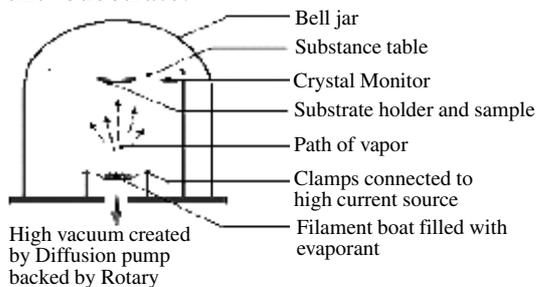


Fig.1 Experimental set up for thermal evaporation

In the thermal evaporation, as shown in fig.1[4], material is created in a vapor form by heating bulk material in vacuum with resistive heater (RF). The vapor atoms thus created are transported through vacuum to get deposited on substrate only at pressure less than 10^{-5} torr. Due to this the mean free path between collisions becomes large enough so that the vapor beam arrives at substrate unscattered³. A low vacuum has an additional effect that the gas molecules strike the substrate, which results in contamination of film that is being deposited.

Almost all materials vaporize from a solid or liquid phase as neutral atoms or molecules.

The evaporation of material is done in vacuum system, which comprises a diffusion pump backed by a rotary pump. The evaporant material is supported by a continuous source which is then heated to a sufficiently high temperature to produce desired vapor pressure $>10^{-2}$ torr. According to shape of evaporant material like wire, foil, or ingot evaporation temperature ranges from 1000°C to 2000°C . If uniform thickness is desired, the substrate has to be rotated in a manner that each point on substrate receives almost same amount of material during deposition. If stoichiometric compound /alloy film is to be deposited the evaporation rates from the two sources have to be carefully controlled.

Some of the advantages of this method includes that, it is simple and cheap method with less substrate surface damage. Excellent purity of films can be achieved with this method.

This method has been embedded with disadvantages like, use of this method is limited to low melting point metals, and hence dielectric materials cannot be evaporated. The film has poor density and adhesion.

(2) Electron beam evaporation :

The temperature of the evaporant material can also be raised by electron bombardment instead of resistive heating. In electron beam evaporation, an electron beam is accelerated through potential of 5 to 10 kV and focused on the material, as shown in fig.2⁵.

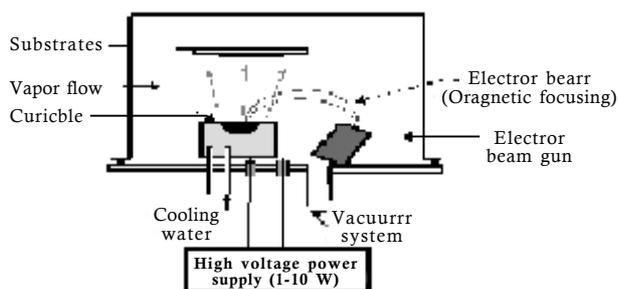


Fig. 2 Experimental set up for electron beam evaporation

The electrons lose their kinetic energy mostly as heat energy. Temperature at the focused spot can rise up to 3000°C. At such high temperature extremely high rates of evaporation can be achieved even for high melting point materials. The electron gun used for evaporation consists of a heated filament for electron emission. The filament is normally shielded to prevent any sputtering by vapor species and gaseous ions. Electron guns are of two types. In both types, electrostatics or electromagnetic focusing is used to focus the electron beam. The path of electron beam in both these guns is straight line. These guns can be used at higher voltages.

Advantages of electron beam evaporation can be stated as follows :

The material utilization efficiency is high relative to other methods and the process offers structural and morphological control of films. Due to the very high deposition rate, this process has potential industrial application for wear resistant and thermal barrier coatings in aerospace industries, hard coatings for cutting and tool industries, and electronic

and optical films for semiconductor industries and thin film solar applications.

Disadvantages of electron beam evaporation can be stated as follows:

This process cannot be used to coat the inner surface of complex geometries. Another potential problem is that filament degradation in the electron gun results in a non-uniform evaporation rate.

(3) Molecular Beam Epitaxy (MBE) :

The deposition of single crystal (epitaxy) films by the condensation of one or more beams of atoms and or molecules from Knudsen sources under Ultra High Voltage (UHV) condition is called molecular beam epitaxy. The Knudsen effusion source shown in fig.3 consists of a metallic chamber, containing the evaporant with a small orifice[6]. The orifice dimension is smaller than the mean free path of the vapor in chamber. Flow of molecules from source is by effusion. The effusion molecular beam has a large mean free path compared to source-substrate distance. The flux of beam is precisely determined by the partial pressures of the vapor species within the chamber, their molecular weight, source temperature and orifice dimension. The beam is directed on the substrate by orifice slits and shutters.

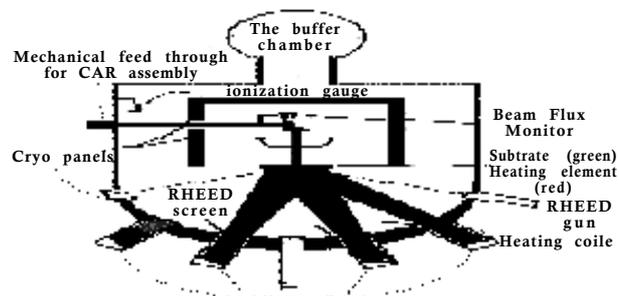


Fig. 3 Experimental set up for molecular beam evaporation

UHV vacuum system is required for MBE to provide a clean ambient. To control the deposition condition at substrate, situ

techniques such as electron diffraction, scanning electron microscopy, auger electron spectroscopy, and ESCA etc. are built in to the system. MBE make it possible to deposit precisely controlled properties of epitaxial films with compound semiconductors like CdTe etc. In MBE the growth temperature is low typically about 600°C. It minimizes the unwanted thermal effect like diffusion. The growth rate is small i.e. 1 to 10 Å/sec, which makes possible to deposit films with precise thickness control up to few Å.

MBE technique has been used to deposit multilayer structures of compound semiconductors to form quantum well superstructure, heterostructure, heterojunction and graded composition structures. Whereas, substrate rotation is required for uniformity in thickness and conformity since MBE has individual effusion cells for each element. Large effusion cells and efficient heat dissipation make multiwafer scale up more difficult.

(4) Activated reactive evaporation (ARE):

If the evaporated material is transported through reactive gas (oxygen, acetylene etc) plasma, then its compound formed with the gas gets deposited on the substrate, as shown in fig.4⁷. The deposition technique has been mainly used to deposit highly adherent films of oxides and carbides namely if Ti metal vapor is passed through acetylene plasma. TiC is formed and is deposited on substrate.

ARE technique is divided in two main types.

(1) Biased ARE : The substrate is biased normally negative to attract the positive ions and positively biased electrode between source and substrate is used to create the plasma.

(2) Enhanced ARE : The plasma in ARE is enhanced by accelerating electrons emitted from tungsten filament under electric field perpendicular to the vapor beam. The ionization can be further enhanced using a magnetic field. This has the advantages that deposition can be done at a lower pressure⁸.

Some of the advantages of ARE technique

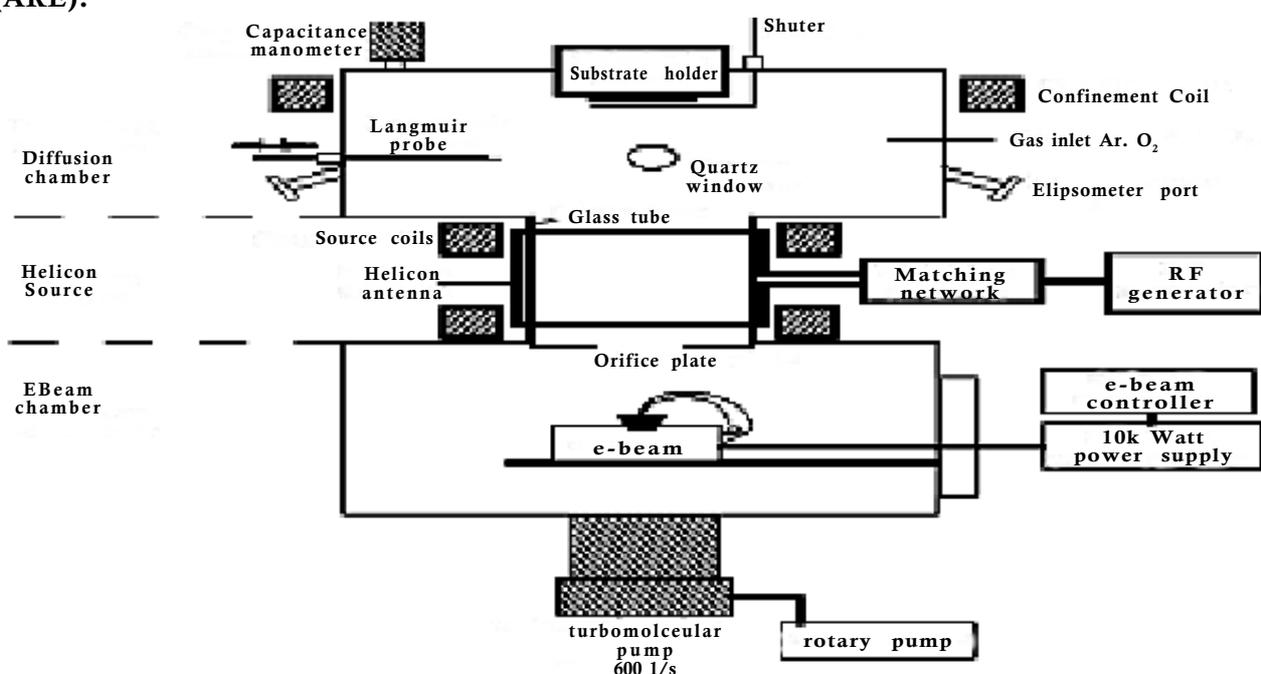


Fig. 4 Experimental set up for Activated Reactive Evaporator

includes, variety of coating compositions with precise control of stoichiometry. This gives better adhesion and denser microstructure of film than direct evaporation.

Disadvantages of ARE technique includes, high substrate temperature, addition of an extra electrode, complicated system compared to evaporation, and substrate must generally be rotated for uniform coating.

(5) Ion plating :

Ion plating refers to process in which substrate and film are exposed to flux of high-energy ions during deposition. The energy of ions is high enough to cause changes in the interfacial region. Due to it film properties such as adhesion of film, its morphology, density, stress in the film and average of the substrate surface also changes. However, there is a sputter etching of film during growth by these energetic ions. The substrate temperature can also be raised to obviate the need of subsequent heat treatments. Ion plating has been used to get better films adhesion especially for an incompatible substrate film combination. This technique also gives a better electrical contact for film of Pt, Au, and Si. The technique has also been used to deposit films for lubrication wear resistance and corrosion resistance⁹.

(6) Pulsed Laser Deposition :

This technique is based upon laser induced vaporization of a material. Fig.5 shows synthesis of thin films of composite materials by this method¹⁰. In laser deposition, the solid is irradiated by high power laser pulses in a background pressure of few Torr to 10⁻⁶ Torr. Due to absorption of the laser power, surface layers of the solid can vaporize.

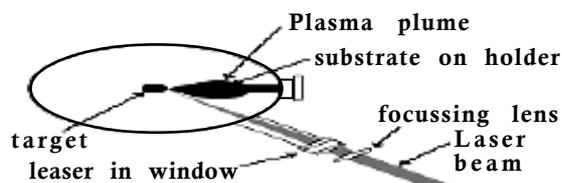


Fig. 5 Experimental set up for pulsed laser deposition

The evaporated material is collected on the substrate to form a thin film. Except laser wavelength transparent material this method is useful for various composite materials.

1.1.2 Chemical Deposition Techniques :

Chemical deposition techniques are most important method for growth of films owing to their versatility for depositing a very large no. of elements and compounds at relatively low temperature. According to growth processing chemical deposition processes are classified in six major types as follows:

(1) Chemical vapor deposition (CVD) :

In CVD a condensation of compound or a compound from the gas phase reacts at or near the substrate. Such reaction produces the desired material in the form of deposit on substrate, as shown in fig.6¹¹.

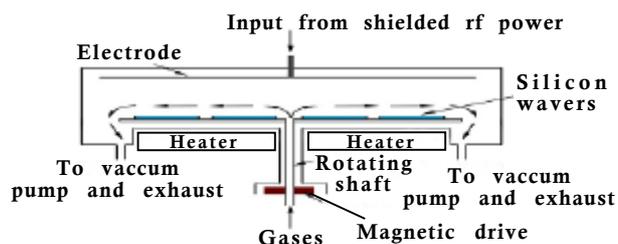


Fig.6 Experimental set up for Chemical vapor deposition

In some processes the chemical reaction may be activated through an external agency, such as application of heat, RF field, light or X-rays, an electric arc or glow discharge, electron bombardment etc. The various chemical reactions involved in CVD are as follows.

(1) Thermal decomposition (2) Hydrogen reduction (3) Nitridation, Carbide, or oxidation. (4) Disproportionate (5) Chemical transport reaction (6) Combined reaction

In most of the reaction the deposition is heterogeneous in character. The sequence of event that occurs at the surface in a CVD process may be separated into five steps as follows :

(a) Adsorption of gases (b) Reaction on surface (c) Desorption of product (d) Transport of liberated product from surface into the bulk gas phase. Transport of the gaseous reactants to the surface.

(2) Spray pyrolysis :

Spray pyrolysis is essentially a thermally stimulated reaction between clusters of liquid/vapor atoms of the different chemical species. The spray technique involves spraying a solution containing soluble salts of the constituent's atoms of the desired compound on a substrate maintained at elevated temperature. Fig.7 shows experimental arrangement for deposition of layer with spray pyrolysis¹². The sprayed droplets on reaching the hot substrate undergo pyrolytic decomposition and form a single crystal or cluster of the crystallites of the product. The other volatile by-product and excess solvent escape in the vapor phase.

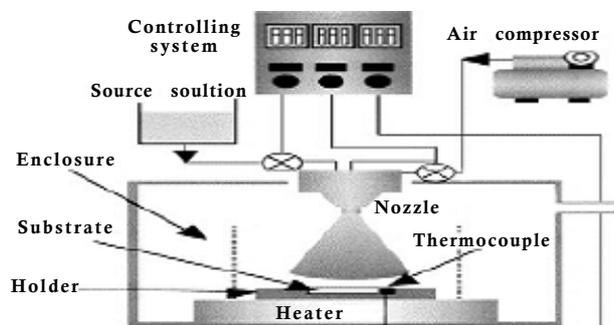


Fig.7 Experimental set up for spray pyrolysis

The chemicals used for spray pyrolysis have to satisfy the following condition.

(1) The desired thin film material must be obtained as a result of thermally activated reaction between the various species /complex dissolved in the spray solution and

(2) The remainder of the constituents of the chemicals including the carrier liquid should be volatile at the pyrolysis temperature.

The spray deposited films are in general strong and adherent, mechanically hard, pinhole free and stable with time and temperature. The topography of the film is generally rough and depends on spray condition. Amorphous to polycrystalline deposit are obtained depending upon the droplet motilities and chemical reactivities of various constituents. Typical grain size of sulphide and selenide films range from 0.2 to 0.5 μm and those of oxide films from 0.1 to 0.2 μm

(3) Electro deposition :

In recent years, there has been considerable interest in the electro deposition of semiconductor films for photovoltaic applications. Electro deposition of metallic film (commonly known as electroplating) has been and used for preparing metallic mirrors and corrosion-resistant surfaces. Electro deposition is the process of depositing substance by passage of electric current through the conducting medium called electrolyte by producing a chemical change (electrolysis), as shown in fig.8¹³. The system used for electro deposition consists of an anode and cathode immersed in a suitable electrolyte containing metal ions. When current flows through the electrolyte the cations and anions move toward the cathode and anode respectively and may deposit on the electrodes after undergoing a charge transfer reaction. The properties of electrodeposited film depend on electrolyte, electrode, and current density¹⁴.

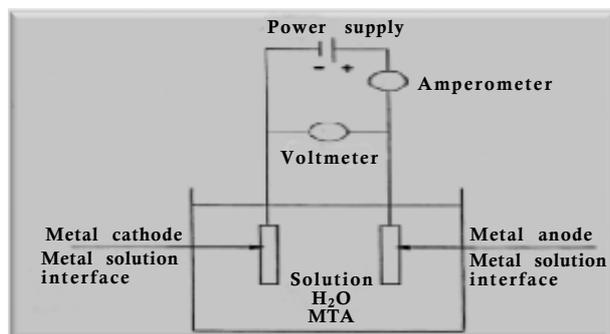


Fig.8 Experimental set up for electrodeposition and anodization techniques.

Suppose copper is to be electrodeposited then electrodepositing bath should contain some Cu salt such as copper sulfate. The Cu^{2+} ions deposit on substrate (cathode) and copper coating is obtained. The discoveries of electroplating can be traced back to Michael Faraday and his famous laws of electrolysis.

(4) Anodization : Anodization is an electrolytic process in which the metal is used as the anode in suitable electrolyte. As shown in fig. 8, when an electric current is passed through electrolyte, the surface metal is converted to form its oxide having decorative, protective or other properties. The cathode is a metal or graphite where H_2 evolution takes place. The metallic anode is consumed and converted to an oxide coating. The oxygen required originates from the electrolyte used, which may be aqueous, non-aqueous or fused salts. The pH of the electrolyte plays an important part in obtaining a coherent film. If the bath is too acidic or too alkaline a porous film results. The thickness of the oxide coating depends on the metal, voltage applied, temperature of bath and time during which the metal is immersed in the electrolyte.

(5) Solution growth : The films can be grown on metallic or non-metallic substrates by dipping it in appropriate solution containing

metal salts. In this technique no electric field is applied. Fig.9 shows experimental set up for solution growth method of deposition¹⁵. Deposition may occur by homogeneous chemical reactions like reduction of a metal ion in solution by a reducing agent. If this occurs on a catalytic surface it is called an autocatalytic or electroless deposition.

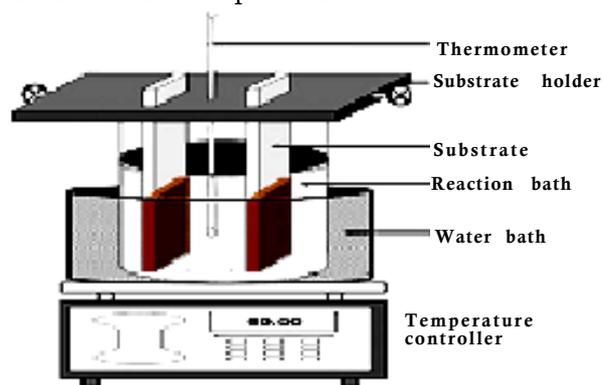


Fig.9 Experimental set up for solution growth method of deposition.

The metals which can be deposited include Cu, Au, Ni, Co, Cd, Zn, Hg and Pb. Compound films such as sulphide and selenide of metals and their alloy have been deposited by this technique. The rate of growth and degree of crystallinity depends upon the temperature of solution which is kept between 40°C to 100°C . Average rate of growth of film is $500 \text{ \AA}/\text{min}$. The chief advantage of such method is that it is possible to deposit film on non-accessible surface i.e. inside of glass tube, where they will be protected from physical damage.

(6) Sputtering Technique : When a solid surface is bombarded with energetic particles, the surface is eroded and surface atoms are removed due to collision between surface atoms and the energetic particles, as shown in fig.10¹⁶. This phenomenon is named sputter or sputtering. Sputtering was first discovered more than 130 years ago by Grove.

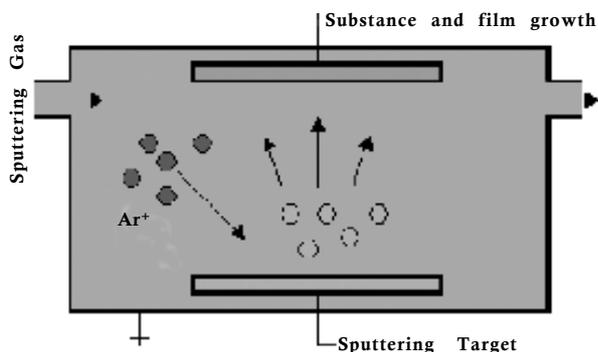


Fig.10 Experimental set up for sputtering technique

Today sputtering is widely applied to surface cleaning, etching and for sputter ion sources. Sputtering is predominant at energy regions of incident ions from 100 eV to 100 KeV. Sputtering yield is influenced by the following factors:

(1) Energy of incident particles. (2) Target materials (3) Incident angle of particles (4) Crystal structure of target surface.

CONCLUSIONS

The article explains briefly various methods used for deposition of thin films. All such thin films deposited with various techniques have two main applications i.e. electronic semiconductor devices and optical coatings. But thin films are also used in all aspects of modern life ranging from decorative paint coatings, anticorrosion coating to TiN hardness coating of machine tools and medical devices.

A wide variety of processing technologies available for the deposition of thin films differs to a large degree in their physical and chemical principles of operation and in commercially available types of equipment. Each processing technology has been developed because it has unique advantage over others. However, each processing technology has its limitations. In order to optimize the desired film

characteristics, a good understanding of the process control and the advantages and restrictions applicable to each technology is necessary.

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OBESITY : A GLOBAL PROBLEM AND MANAGEMENT

Binduja Saraswat and Pradeep Visen

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have adverse effect on health. It has severe health consequences which include cardiovascular diseases (CVD), diabetes, dyslipidemia, cancer, musculoskeletal and respiratory problems. Anti-obesity drugs are not prescribed generally because of side effects. The main treatment modalities for overweight and obesity are higher activity levels, dietary management (low fat intake) and physical exercise.

WHAT IS OBESITY ?

Obesity and overweight are medical conditions in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems.¹ The WHO definition is :

BMI greater than or equal to 25 is overweight

BMI greater than or equal to 30 is obesity

Body Mass Index (BMI) provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults.

OBESITY AND HEALTH PROBLEMS

Excess bodyweight is the sixth most important risk factor contributing, to the overall burden of disease worldwide and global death¹⁻³. Risk increases progressively as BMI increases.

The non-fatal, but debilitating health problems associated with obesity include respiratory difficulties during sleep, chronic musculoskeletal problems, skin problems and infertility. The more life-threatening problems fall into four main areas : Cardiovascular disease (CVD) problems including dyslipidemia; conditions associated with insulin such as type 2 diabetes; certain types of cancers, especially the hormonally related and large-bowel cancers; and gallbladder diseases.¹ At least 2.8 million adults die each year as a result of being overweight or obese. In addition, 44% of the diabetes burden, 23% of the ischemic heart disease burden and between 7% and 41% is the increasing incidence of child obesity and authorities view is as one of the most serious public health problems which is associated with a higher chance of premature death and disability in adulthood. Once considered a high-income country problem, overweight and obesity are now on the rise in low and middle income countries, particularly in urban settings. Close to 35 million overweight children are living in developing countries and 8 million in developed countries.^{1,3-5}

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Based on recent national surveys, the prevalence of overweight among adult men and women is increasing. Data from NHANAS III, 1988-1994, indicated that 63% of adult men and 55% of adult women are overweight, defined as a BMI more than 25.0 kg/m².⁶ In India, obesity has reached epidemic proportions in the 21st century with morbid obesity affecting 5% of the country's population. Unhealth processed food has become much more accessible following India's continued integration in global food markets.⁷

CAUSES OF OVERWEIGHT AND OBESITY

The fundamental cause of obesity and overweight is an energy imbalance between calories consumed on one hand, and calories expended on the other hand. As incomes rise and populations become more urban, diets high in complex carbohydrates give way to the obesity and overweight to more varied diets with a higher proportion of fats, saturated fats and sugars but low in vitamins, minerals and other micronutrients. The key dietary factors that have been most often associated with weight gain or obesity include high dietary fat intakes,⁸⁻¹⁰ over consumption of energy-dense foods,^{11,12} and based on recent research, diets characterized by a greater reliance on carbohydrate rich foods with a high glycemic index compared to those with a low glycemic index,¹³ combined with reduced physical activity and sedentary lifestyle have led to obesity.

The studies also suggest that high consumption of soft drinks, both regular and artificially sweetened varieties, could be a marker for non-nutrient dense diets that increase likelihood of positive energy balance and subsequent weight gain.¹⁰ Complex behavior and psychological factors also cause over-eating and may be one of the reason for increasing body weight. It is thus associated with serious diet-related chronic diseases.^{3, 14}

Further, the genes¹⁵ are also important in determining a person's susceptibility to weight gain where energy balance is determined by calorie intake and physical activity, although a few cases are caused primarily by endocrine disorder, medications or psychiatric illness.

Thus societal changes¹⁶ and worldwide nutrition transition are driving the obesity epidemic. Economic growth, modernization, urbanization and globalization of food markets are just some of the forces through to underline the epidemic. Large, shifts towards less physically demanding work have been observed worldwide.¹⁷ Moves towards less physical activity and sedentary life are also found in the increasing use of automated transport, technology in the home, and more passive leisure pursuits.¹⁸ Using data from a large prospective cohort study, the Health Professionals' Follow-up Study, it has been demonstrated that increasing TV watching is strongly associated with obesity and weight gain, independent of diet and exercise.¹⁹

Developing countries are undergoing rapid nutrition transition concurrent with increases on obesity, the metabolic syndrome, and type 2 diabetes mellitus (T2DM). From a healthy traditional high-fiber, low-fat, low-calorie diet, a shift is occurring toward increasing consumption of calorie dense foods containing refined carbohydrates, fats, red meats, and low fibre. Data show an increase in the supply of animal fats and increased intake of saturated fatty acid (SFAs) (obtained from coconut oil, palm oil, and ghee [clarified butter]) in many developing countries, particularly in South Asia and South-East Asia. In some South Asian populations, particularly among vegetarians, intake of n-3 polyunsaturated fatty acids (PUFAs) (obtained from flaxseed, mustard, and canola oils) and long-chain (LC) n-3 PUFAs (obtained from fish and fish oils) is low. In

addition, in some developing countries, intake of n-6 PUFAs (obtained from sunflower, safflower, corn, soybean, and sesame oils) and trans-fatty acids (TFAs) is increasing. These data show imbalanced consumption of fats and oils in developing countries, which may have potentially deleterious metabolic and glycaemic consequences, although more research is needed.²⁰

In India, there is clear evidence of a demographic, epidemiological and nutrition transition in India that is fuelling the epidemic of chronic diseases and obesity, particularly in the urban areas.²¹ Rural to urban migration appears to be associated with both positive (higher fruit and vegetables intake) and negative (higher energy and fat intake) dietary changes. These changes may be relevant to cardiovascular health in adults and children and warrant public health interventions.^{22, 23} LMNA 1908 T/T and C/T genotypes emerged as independent genetic risk factors for generalized obesity in Asian north Indians.

The National Sample Survey Organisation (NSSO) conducts dietary intake surveys in rural and urban India, asking about household consumption over the past 30 days. The 2004-2005 survey found total energy intake to be very similar in rural and urban areas (2047 kcal and 2020 kcal respectively), but fat intake was much higher in urban (48 g) compared with rural (36 g) areas. While the proportion of energy from cereals was higher in rural than urban people, the proportion of energy from most other food groups was higher in urban people, most notably milk products and oils and fats, but also fruit and vegetables.²⁵

The studies also show the association of leisure time physical activity (LTPA) and watching TV with lipid profile & obesity in a South Indian adult population which can be important CVD risk factors²⁶.

CLINICAL PARAMETERS AND METHODOLOGY FOR WEIGHT LOSS STUDY

A. Clinical parameters

Primary Outcome Measures

- Body weight : Body Mass Index (BMI)

Secondary Outcome Measures

- Body composition : DEXA (Dual Energy X-Ray Absorptiometry (circumferences of the hip and thigh)
- Abdominal fat : DEXA, circumference of the waist

B. Methodology

Body Weight and Height

Body weight should be assessed to the nearest 0.1 kg, and height to the nearest 0.1 cm, using a calibrated medical-grade balance scale. Subjects should be weighed in a fasted state. Subject should remove all heavy clothes (e.g. jackets, coats, shoes) empty all pockets.

Height is measured without shoes by using a stadiometer. Hair ornaments, barrettes braids, jewellery is removed before the measurement is taken. Patients shall stand with the heels of their feet against the vertical backboard a wall, with feet pointing outward at approx at 60 degree angle. Once the subject is positioned the headboard or a flat ruler will be placed on the top of the head, with sufficient pressure to compress the hair.

Body Mass Index (BMI)

Body mass index (BMI) is a measurement which compares weight and height and defines people as overweight (pre-obese). BMI is calculated by using formula weight (Kg)/height (m²). Following is BMI range in different groups of adult people :

Severely underweight-less than 16.5

Underweight from 16.5 to 18.4

Normal from 18.5 to 24.9

Overweight from 25 to 30

Obese Class more than 30 BMI is used differently for children. It is calculated the same age. A BMI that is less than the 5th percentile is considered underweight and above the 95th percentile is considered obese for people and older. People under 20 with a BMI between the 85th and 95th percentile are considered to be overweight.

Waist, Hip, Thigh Circumferences :

Waist, hip and thigh circumference measurements will be assessed using an inelastic flexible measuring tape and measured to the nearest 0.1 cm. Waist circumference should be taken at the mid-point between the bottom rib and the hip bone, approximately 5 cm above the umbilicus. The measurement should be taken 3 times and the average reported.

Hip circumference will be taken at the largest girth. The inelastic tape is placed around the buttocks in a horizontal plane. Fatty aprons should be excluded from the hip circumference measurement. The measurement should be taken 3 times and the average reported.

Thigh circumference will be taken 1 cm below the gulleal fold (at the midpoint between inguinal crease and anterior patella along the long axis of the femur). The subject should be standing erect, with the feet slightly apart and the body mass distributed equally on both feet. The site on the subject's non-dominant leg will be measured 3 times and the average will be reported.

Skin Fold Measurement

Biceps, triceps, thigh, calf, sub-scapular, anterior axillary, and supra-iliac, skinfolds will

be measured carefully by using Lange's skinfold calipers.

Dual Energy X-ray Absorptiometry (DEXA)

Dual energy x-ray absorptiometry (Hologic QDR 4500 A with fan beam) is used to measure body composition and abdominal fat. It allows regional and global measurement of whole body fat. The anatomical areas analysed in whole body DEXA scan are trunk, right upper limb, left upper limb, right lower limb and left lower limb. The procedure takes less than 10 minutes and the amount of radiation exposure is about one tenth the dose of standard chest X-ray.

MANAGEMENT OF BODY WEIGHT

Dietary management

At the individual level, people can :

- limit energy intake from total fats ;
- increase consumption of fruit and vegetables, as well as legums, whole grains and nuts;
- limit the intake of sugars;
- achieve energy balance and a healthy weight.

Individual responsibility can only have its full effect where people have access to a healthy lifestyle. Therefore, at the societal level it is important to :

- support individuals in following the recommendations above, through sustained political commitment and the collaboration of many public and private stakeholders;
- make regular physical activity and healthier dietary patterns affordable and easily accessible too all especially the poorest individuals.

The good industry can play a significant role in promoting healthy diets by ;

- reducing the fat, sugar and salt content of processed foods;
- ensuring that healthy and nutritious choices are available and affordable to all consumers;
- practicing responsibility marketing;
- ensuring the availability of health food choice and supporting regular physical activity practice in the workplace.

Low-carbohydrate diets or low-carb diets are dietary programs that restrict carbohydrate consumption usually for weight control or for the treatment of obesity. Foods high in digestible carbohydrates (e.g. bread, pasta) are limited or replaced with foods containing a higher percentage of proteins and fats (e.g. meat, poultry, fish, shellfish, eggs, cheese, nuts, seeds, peanuts, and soy products) and other foods low in carbohydrates (e.g. most salad vegetables), although other vegetables and fruits (especially berries) are often allowed.^{27, 28}

The Atkins diet, officially called the Atkins Nutritional Approach, is a low-carbohydrate diet created by Robert Atkins. The Atkins diet involves limited consumption of carbohydrates to switch the body's metabolism from metabolizing glucose as energy over to converting stored body fat to energy.²⁹

There are four phases of the Atkins diet : induction, ongoing, weight loss, pre-maintenance and lifetime maintenance.

Induction

Two weeks are recommended for this phase. Carbohydrate intake is limited to no more than 20 net grams per day (grams of carbohydrates minus grams of fiber, sugar alcohols, or glycerin), 12 to 15 net grams of which must come in the form of salad greens and other fruits and vegetables such as broccoli, spinach, pumpkin, cauliflower, turnips, tomatoes, and asparagus,

to name a few of the 54 allowed by Atkins (but not legumes, since they are too starchy for the induction phase). The allowed foods include a liberal amount of all meats, poultry, fish, shellfish, fowl, and eggs; up to 4 ounces (113 g) of soft or semi-soft cheese such as cheddar cheese; most salad vegetables; other low carbohydrate vegetables; and butter, olive oil and vegetable oils. Drinking eight glasses of water per day is a requirement during this phase. Alcoholic beverages are not allowed during this phase. Caffein is allowed in moderation so long as it does not cause cravings or low blood sugar.

A daily multivitamin with minerals, except iron, is also recommended. A normal amount of food, on Induction, is around 20 grams of sugar (or net carb), at least 100 grams of fat. The Induction phase is usually when many see the most significant weight loss—reports of losses of 5 to 10 pounds per weeks are not uncommon when Induction is combined with daily exercise.

Ongoing weight (OWL)

The target daily carbohydrate intake increases each week by 5 net grams per day. A goal of OWL is to find the "Critical Carbohydrate Level for Losing" and to learn in a controlled manner how food groups in increasing glycemic levels and foods within that group affect your craving control. The OWL phase lasts until weight is within 10 pounds (4.5 kg) of the target weight.

During the first week, one should add more of the induction acceptable vegetables to one's daily products. The next week, one should follow the carbohydrate ladder that Dr Atkins created for this phase and add fresh dairy. The ladder has 9 rungs and should be added in order given. One can skip a rung if one does not intend to include that food group in one's permanent way of eating, such as the alcohol rung.

The rungs are as follows :

Induction of acceptable vegetables in larger quantities

- Fresh cheese
- Nuts and seeds
- Berries
- Alcohol
- Legumes
- Other fruits
- Starchy vegetables
- Whole grains

Pre-maintenance

Daily net carbohydrates intake is increased again this time by 10 grams each week from the later groupings and the key goal in this phase is to find the "Critical Carbohydrate Level for Maintenance", this is the maximum number of carbohydrates you can eat each day without gaining weight.

Lifetime maintenance

This phase is intended to carry on the habits acquired in the previous phases, and avoid the common end-of-diet mindset that can return people to their previous habits and previous weight. Whole, unprocessed food choices are emphasized, with the option to drop back to an earlier phase if you begin to gain weight.

Dieting

Diets to promote weight loss are generally divided into four categories : low-fat, low-carbohydrate, low and very low calorie. Very low calorie diets provide 200-800 kcal/day, maintaining protein intake but limiting calories from both fat and carbohydrates. They subject the body to starvation and produce an average weekly weight loss of 1.5–2.5 kilograms. These diets are not recommended for general use as

they are associated with adverse side effects such as loss of lean muscle mass, increased risks of gout and electrolyte imbalances.

Exercise

With use, muscles consume energy derived from both fat and glycogen. Due to the large size of leg muscles, walking, running, and cycling are the most effective means of exercise to reduce body fat. Exercise affects macronutrient balance. During moderate exercise, equivalent to a brisk walk, there is a shift to greater use of fat as a fuel.

According to American Heart Association, for obese children, 30 to 45 minutes of physical activity of moderate intensity, performed 3 to 5 days a week, should be encouraged. All adults should set a long-term goal to accumulate at least 30 minutes or more of moderate-intensity physical activity on most, and preferably all days. It appears that as long as the increase in energy expenditure is sufficient, low-intensity endurance exercise is likely to generate beneficial metabolic effects that would be essentially similar to those produced by high-intensity exercise. The clinician should therefore focus on the improvement of the metabolic profile rather than on weight loss alone. Realistic goals should be set between the clinician and the patient, with a weight loss of approximately of 0.5 to 1 pound per week. It should be kept in mind that since it generally takes years to become overweight or obese, a weight loss pattern 0.5 or 1 pound per week will required time and perserverance to reach the proposed target.³⁰

Weight loss programs (Diet and physical activity)

Weight loss programs often promote lifestyle changes and diet modification. This may involve eating smaller meals, cutting down on certain types of food, and making a conscious effort to exercise more. A balanced daily caloric intake

is calculated using Harris-Benedicts Equations (Table-1) which is needed in maintaining current body weight.

Table 1 : Calculation of daily balanced caloric intake (kcal)

Using the Harris Benedict Equations

Step 1 Calculation of Basal Metabolic Rate (BMR)

Men	$BMR = 66 + 13.7 \times \text{weight in kg} + (5 \times \text{height in cm}) - (6.8 \times \text{age in years})$ $BMR = 66 + (6.23 \times \text{weight in pounds}) + (12.7 \times \text{height in inches}) - (6.8 \times \text{age in year})$
Women	$BMR = 655 + (9.6 \times \text{weight in kg}) + (1.8 \times \text{height in cm}) - (4.7 \times \text{age in years})$ $BMR = 655 + (4.35 \times \text{weight in pounds}) + (4.7 \times \text{height in inches}) - (4.7 \times \text{age in years})$

Step 2 Applying in Physical Activity Factor

Little to no exercise	BMR \times 1.2
Light exercise (1-3 days per week)	BMR \times 1.375
Moderate exercise (3-5 days per week)	BMR \times 1.55
Heavy exercise (6-7 day per week)	BMR \times 1.725

If a person is overweight/obese, it is advisable to reduce the daily caloric intake by 400-500 kcal from the balanced diet. It is important to note that the total daily caloric should not be less than 1200 kcal which is essential for normal basal metabolic rate (BMR). The method of assessing energy intake would be weight food record which require the person to weigh or measure all foods prior to consumption; thus, the information provided can be used to capture quantitative information. A 1200 kcal diet plan is recommended to prevent overweight and obesity.

Chart

1200 Kilocalories Diet Plan

Protein-50 gm (17%)	Fat 30 gm (22.6%)
Carbohydrate 180 gm (60%)	
24 hrs Intake	Among (g)
Food Group	
Milk (doulble toned)	300 (milk, tea, curd, coffee)
Pulse (Whole dals skin)	60 (cooked/sprouted/ roasted chana)

Cereal	150 (5-6 chapatis)
Seasonal vegetables	200
Green leafy vegetables	150
Fruit	100 (1 mediumj sized)
Fat	15 (3 teaspons)

1 Chappati - 1/2 Katori of boiled rice or 3/4 Katori of umpa or 3/4 Katri of khichdi 3/4 Katori of poha or 3/4 Katori of Dalia or 1 slice of Bread (preferably whole wheat bread) or 1 Idli or 3-4 biscuits.

1. Katori Medium size

Avoid

- Revined flour and fried food lime maida, naan, white bread, polished rice, samosa, mathri, kachodi, parantha etc.
- Whole milk, cream butter, ghee, khoa and cheese.
- Alcoholic drinks, fruit juices, coals, aerated drinks.
- Sugar, sweets, jam, jelly, honey, cholcolates and candies. etc.
- Egg yellow, organ meat (liver, kidney and brain), fatty, meats (mutton, pork and their products)
- Potatoes, yam, arbi, sweet, potatoes.
- Mango, banana, litchi, chiku, custard apple, and grapes.
- Namkeen, Cakes, Pastries and other barkery products.
- Avoid smoking and chewing of tobacco.

Take

- Green leafy vegetables, tomatoes, cucumber, radish, lemon
- Clear soups, black coffee and tea without sugar, buttermilk, soda.

Points to remember :

- Chicken/Fish (preferably fish) can be taken 1-2 times per week (30-50 gms each)
- The patient is supposed to skip egg/paneer on the day he takes chicken/fish.
- Do not sieve the flour.
- Mix 8 parts of wheat flour to 1 part of gram flour and 1 part of soybean flour.
- Fenugreek seeds can be taken in the form of power and spouts. It can also be mixed with vegetables.
- Eat small meals regularly at frequent intervals. Do not miss any meal.
- Do not Starve yourself and overeat subsequently,
- Chew your food properly.
- Eat the salad before your meal.
- Almonds/Walnuts/Pistachio-4-5 pcs/day.

Exercise

1 40-45 min brisk walking daily.

Samle Menu

Early Morning

Tea—1 cup (30 ml milk)

Biscuits—2 (Marie)

Breakfast

Milk—1 cup (150 ml)

Bread/Dalia/Cornflakes—1 bowl

Egg—1 (without yolk)
 Mid-Morning
 Salad/Fruit—1
 Lunch
 Salad/Soup-1 bowl
 Chappatis-2
 Vegetables 1K
 Dal-1k
 Curd/raita—1/2k
 Evening Tea
 Milk/salted lassi—1 cup (150 ml)
 Poha/upma/roasted chana/spouts salad/any other
 roasted snack
 Diner
 Salad/Soup 1 bowl
 Chapattis—2
 Vegetables—1 k
 Dal—1 K
 Curd—1/2 K

Physical activity levels is assessed via a questionnaire (International Physical Activity Questionnaire-IPAQ) and via the use of pedometers to calculate the number of steps walked each day. Pedometers is used to monitor daily physical activity levels, with the IPAQ used intermittently during the study to gage foorms of physical activity other than walking.

Medication

Only two anti-obesity medications are currently approved by the FDA for long term use. One is orlistat (Xenical), which reduces intestinal fat absorption by inhibiting pancreatic lipase; the other is sibutramine (Meridia), which acts in the brain to inhibit deactivation of the neurotransmitters norepinephrine, serotonin, and dopamine (very similar to some anti-depressants), therefore decreasing appetite. Because of potential side effects, it is recommended that anti-obesity drugs only be prescribed for obesity where it is hoped that the benefits of the treatment outweigh its risks. Alternative medicine has insufficient evidence to support or oppose its anti-obesity activity.

Surgery

Bariatric surgery (weight loss surgery) is the

use of surgical intervention in the treatment of obesity. It is only recommended for severely obese people (BMI > 40) who have failed to lose weight following dietary modification and pharmacological treatment. Weight loss surgery relise on various principles : the two most common approaches are reducing the volume of the stomach (e.g. by adjustable gastric banding and vertical banded gastroplasty), which produces and earlier sense of satiation, and reducing the length of bowel that comes into contact with food (gastric bypass surgery), which directly reduces absorption. Band surgery is reversible, while bowel shortening operations are not. The effects of liposuction on obesity are less well determined.

CONCLUSION

Obesity has reached epidemic proportions globally, with more than 1 billion adults overweight at least 300 million of them clinically obese and is a major contributor to the global burden of chronic disease and disability.² As of 2005 the the WHO estimates higher rates among women than men³, followed by alarming rise in child obesity.¹ Current evidence suggests that the prevalence is likely to remain on the rise and it will not be possible to meet the objectives set for Healthy People 2010 of reducing obesity prevalence in adults to 15% and in children to 5%.⁵

Because of concerns about the long-term effectiveness of weight-loss programs, several studies have attempted to identify strategies that help formely overweight individuals maintain a reduced weight. In particular, 3 factors have been suggested to improve weight maintenance; higher activity levels, lower fat intake and lifestyle factors that support weight loss efforts. Supportive environments and communities are fundamental in shaping people's choices, making the healthier choice of foods and regular physical activity the easiest

choice, and therefore preventing obesity. There is evidence that both physical active lifestyle and healthy eating (as defined by various scoring methods) can increase the likelihood of maintaining a normal body weight.^{31,32} One attribute of a healthy eating pattern is a liberal intake of fruits and vegetables as well as whole-grain breads and cereals because these foods are markers for nutrient dense diets that provide adequate level of dietary fiber.

Adopted by the World Health Assembly in 2004, the WHO Global Strategy on Diet, Physical Activity and Health describes the actions needed to support healthy diets and regular physical activity.

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RECALCITRANT SEED – PROBLEMS AND PROSPECTS

K. Raja

Recalcitrant seeds have the problem in storage due to its desiccation and freezing sensitivity. It is estimated that 15 per cent of the world's flora possess recalcitrant seeds i.e. approximately 37,500 species. Moist storage of seeds for short-term storage and cryopreservation and *in vitro* conservation of embryos for long-term storage has been found suitable to store the seeds.

SEED CLASSIFICATION

Seed is a basic input in agriculture and therefore it must be handled very carefully during production and storage. In general the seeds are classified into two groups *viz.*, "orthodox seeds" and "recalcitrant seeds" based on their desiccation and temperature sensitivity. Most of the agricultural and horticultural crop seed comes under orthodox class. These seeds have the ability to tolerate reduction in moisture content and temperature, which increase the life span of seeds. These groups of seeds remain viable for longer periods even up to hundreds of years when they are dried and stored properly. They can be even stored at very low temperature of -196°C . While recalcitrant seeds are killed if their moisture contents are reduced below some relatively high critical value of 20 to 35%. Also, the recalcitrant seeds are not capable of withstanding the low temperatures.

RECALCITRANT SEEDS

Recalcitrant seeds are well known for their sensitivity to desiccation and freezing

temperatures. Generally recalcitrant seeds are large in size and weigh more as compared to orthodox seeds because of their high moisture content. Many recalcitrant seeds are covered with a fleshy layer, which is often edible, as in case of avocado, durian, jackfruit, jamun, litchi, mango, mangosteen, and rambutan. Similarly some recalcitrant seeds are large and are found in a single-seeded, simple fruit such as arecanut and coconut or as seeds in a composite fruit such as jackfruit. The shape and size of recalcitrant seeds of different species are differing greatly even within species or even within the same fruit¹. The other important property of recalcitrant seeds is their high moisture content, even after they have been shed from the mother plant. Unlike orthodox seeds, they do not undergo maturation drying. These recalcitrant seeds generally have high moisture content, ranging from 30 to 70%. For example the freshly collected arecanut fruit and seed have 63.6% and 50.1% moisture content, respectively². The main characteristics of orthodox and recalcitrant seeds³ are given in table 1.

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Table 1. Characters of orthodox and recalcitrant seeds

Characters	Orthodox seeds	Recalcitrant seeds
1. Tolerance to drying	Can be dried to low moisture content	Can not be dried
2. Tolerance to desiccation	Tolerant	Sensitive
3. Tolerance to low temperature	Tolerant	Sensitive
4. Size of the seeds	Small to medium	Large
5. Storage life	Many years	Few days to few months
6. Storage methods	Ordinary storage is enough	Special methods required
7. Seed moisture content at harvest	Low	High
8. Examples	Cereals, Millets, Pulses, Oil seeds, Vegetables.	Mango, Jack, Jamun, Arecanut, Coconut.

Desiccation and freezing sensitivity

Recalcitrant seeds are well known for their sensitivity to desiccation, especially large seeded species generally found in the tropics. In recalcitrant seeds, decline in viability occurs abruptly below a certain moisture level, which is called "Critical Moisture Content (CMC) or "Lowest Safe Moisture Content (LSMC)"⁴. Generally the critical moisture content is 20-35% below which the seeds will be killed. For example, the Critical Moisture Content of few recalcitrant seeds is given in table 2.

Table 2. Critical Moisture Content for safe storage of recalcitrant seeds

Crop seeds	Critical Moisture Content (%)
1. <i>Quercus robur</i>	38
2. <i>Nephelium lappaceum</i>	20
3. <i>Shorea talura</i>	17
4. <i>Hopea helferi</i>	35
5. <i>Hevea brasiliensis</i>	15-20
6. <i>Theobroma cacao</i>	26
7. <i>Litchi sinensis</i>	40
8. <i>Hancornia sp.</i>	25
9. <i>Myristiga fragrans</i>	45
10. <i>Artocarpus heterophyllus</i>	39
11. <i>Euterpe edulis</i>	39
12. <i>Persia americana</i>	49
13. <i>Murraya koenigi</i>	34
14. <i>Areca catechu</i>	33

The extent of desiccation damage that occurs on the removal of water from desiccation sensitive seeds and thus the water content at which they lose viability, depends upon number of factors like the rate at which the seeds are dried and their metabolic activity when they are subjected to drying (which affect the 'metabolism-induced damage') as well as the extent to which any of the protective mechanisms are expressed⁵.

Generally the orthodox seeds can be stored even up to the temperatures of -196°C without loss of viability. But the recalcitrant seeds cannot be stored at lower temperatures; even some species do not survive the temperatures of $10-15^{\circ}\text{C}$. It is because of chilling injury to the seeds, which varies according to species. Here there is a High Moisture Freezing Limit (HMFL) which is the threshold, and if it is exceeded the viability of a seed sample will be reduced during storage. Thus the chilling sensitivity in moist recalcitrant seeds is mainly due to the formation of ice crystals in between the cells when the moisture content is higher than 14 to 20%⁶. For example, in cocoa sharp reduction in storability was observed at 15°C and 10°C for arecanut.

Recalcitrant seed species

Generally, recalcitrant seeds occur in humid forest environment. They may also occur in tropical, subtropical or temperate regions. The fruit crops *viz.*, mango, few species in citrus, avocado, jack, jamun, litchi, mangosteen, durian and rumbutan comes under the recalcitrant seed. The plantation crops like arecanut, coconut, cocoa, coffee, clove, nutmeg, rubber, and tea and the spices like pepper, cardamom, curry leaf, cinnamon and cassia are also some of the examples of recalcitrant seed. Forest tree species belonging to the Araucariaceae and Dipterocarpaceae have recalcitrant behaviour.

STORAGE OF RECALCITRANT SEEDS

The longevity of recalcitrant seed is very short; it varies from a few days to a few months or a year under proper storage conditions. Therefore recalcitrant seeds are to be sown immediately after collection. Then only they will give the higher germination. In general, most of the above said horticultural crop seeds are sown immediately after collection. Because their longevity is very short; varies from few days to few months. For example, the arecanut seed lose its viability within 24 days under ambient open condition². Some seeds may be kept within the fruit itself for few days. But due to the high moisture content it may enhance the pathogen entry and create the germination loss. There can be no doubt in the mind of any investigator working on desiccation – sensitive (recalcitrant) seeds that microorganisms, more particularly fungi, play a significant role in post harvest deterioration⁷. Thus the recalcitrant seeds can be stored by the following methods:

- (a) Moist or imbibed storage
- (b) Partial dehydration

(c) Controlled atmospheric storage

(d) Cryopreservation and *in vitro* conservation

Among the four methods first three methods are short-term storage methods. Now a day the cryopreservation and *in vitro* conservation has gaining importance for long-term conservation of recalcitrant seeds.

(a) Moist or imbibed storage

To avoid the desiccation sensitivity, the recalcitrant seeds are to be stored in moist media like damp charcoal, saw dust, moist sand and other moisture conserving materials and chemicals. This is a short-term storage method and the viability can be maintained up to three months or little bit more. For example, in arecanut storage of fresh seeds with 5% moist sand or 0.2 M potassium dihydrogen phosphate premixed with sand at 5% level (seed: sand ratio 1:3) and packing loosely in 350 gauge polythene bags and stored in zero energy cool chamber recorded higher germination (85%) after four months of storage⁸. In imbibed storage, the seeds are stored under water but only for a short period, for example the rubber seeds stored under water recorded only 60% germination, after one month of storage⁹. But in this method the problem is the fungal growth during storage. Therefore it is necessary to give some chemical treatment to control the pathogens during storage.

(b) Partial dehydration

In partial dehydration, the recalcitrant seeds are dried to certain critical moisture content by air at a temperature of 20°C and then stored. Rubber seeds can be stored for one year with 50% germination if they are cleaned, soaked in 0.3% benlate, surface air dried and stored in perforated polythene bags at an ambient temperature of 25°C¹. Similarly, the

cocoa seeds can be stored up to 24 weeks with more than 50% viability.

(c) Controlled atmospheric storage

The recalcitrant seeds can be stored in controlled atmosphere of carbon dioxide or sealed containers. For example, cocoa seeds can be stored up to 45 days in carbon dioxide atmosphere and durian seeds in sealed containers for about 32 days. Similarly the wax-coated arecanut seeds stored in gunny bag under ambient condition were successfully extended the storage life up to 50 days with 60% viability. While, uncoated seeds stored in ambient condition loses its complete viability within 24 days¹⁰. The litchi seed retained with fruits treated with benomyl (0.05%) and wax emulsion (6%) and sealed in polythene bags maintained 42% viability for 24 days¹¹.

(d) Cryopreservation and *in vitro* conservation

The recalcitrant embryos are tolerant to desiccation and low temperatures than whole seeds and together with their smaller size are amenable and practical for conservation. The strategy adopted for long-term genetic conservation of these recalcitrant seeds is to cryopreserve the embryos, which are more resistant to adverse conditions. A number of species of recalcitrant type, both temperate and tropical clones have been known to survive after cryopreservation, which includes *Juglans*, *Carya*, *Fagus*, *Corylus*, *Castanea*, litchi, coffee and areca. For successful cryopreservation, at very low temperature, excised embryos must be dried to suitably low moisture content¹². For example, the arecanut embryos can be stored through cryopreservation and *in vitro* conservation provided the embryos moisture content should be around 21%¹³. Sometimes, the damage to viability of axes exposed to liquid nitrogen at high moisture content results from the presence of freezable water in tissues,

which contributed to the formation of ice crystals in the intercellular space within the axes¹⁴. Therefore, *in vitro* conservation of recalcitrant embryos for germplasm storage has become more feasible, particularly with the cryopreservation. However, for many species there are several prerequisites that have to be fulfilled before *in vitro* conservation.

CONCLUSION

It is concluded that the storage of recalcitrant seeds is a problem, as these seeds can't tolerate the desiccation and freezing temperatures. However, it is important to maintain the viability of these seeds for long-term genetic conservation. The cryopreservation and *in vitro* conservation of the recalcitrant seed embryos has become more feasible for long-term storage.

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TRICHODERMA SPP. : A BOON FOR FARMING COMMUNITY

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In the current scenario Bio Control Agents (BCAs) are in great demand for replacing the chemical pesticides to control plant pathogen. Almost 70% of fungal BCAs market comprises of *Trichoderma* spp. On 26th March 1999, *Trichoderma* has been included in the gazette of India as a potential biocontrol agent. *Trichoderma harzianum* is extensively used for accomplishing dual roles include controlling several soil and seed borne phytopathogens and its ability to act as a biofertilizer. The *Trichoderma* spp. is mainly preferred to other fungal biocontrol agents owing to the antagonistic properties include the production of antibiotics, hydrolytic enzymes and competition for nutrients. This article presents the marketing potential of *Trichoderma* spp. reviewing its status in various characteristics viz., plant growth promotion, bioremediation, pest control in addition to its potential for the production of enzymes hemicellulases, cellulases, proteases, and β -1, 3-glucanase at industrial scale.

TRICHODERMA SPP. AS BIOFUNGICIDES

In general, scientific evidence signifies that several seed and soil borne diseases can be controlled by *Trichoderma* spp. They have been commonly used as bio-agents. The *Trichoderma* spp. antagonizes the pathogen in different modes include :

(a) Mycoparasitism

Trichoderma spp. produces lytic enzymes which facilitates pathogen cell wall lysis and ultimately leading to host death. This phenomenon occurs by coiling the *Trichoderma* mycelium around the mycelium of the

pathogen. The several enzymes include proteolytic, β -1, 3-glucanase, chitinases performs a crucial feature in lysis of cell wall of pathogen during mycoparasitism has been reported.

(b) Antibiosis

This mechanism involves the secretion of anti-microbial compounds or antimicrobial metabolites like volatiles, extracellular enzymes which are portable in nature and thereby suppressing or killing the pathogens around the surrounding area. The principal functions of these antibiotics are cell membrane disruption, metabolic activity inhibition and stimulation of plant defense system¹.

(c) Competition

Microorganisms living in soil and on plant surfaces which suffer the scarcity of certainly available nutrients which may ultimately result

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in nutrient competition between microbial population. Besides *Trichoderma* spp. releases compounds known as siderophores which would complex the micronutrient iron and render it as unavailable form, this leads to competition.

Applications of *Trichoderma* spp. in Agriculture

Crop protection through seed treatment

Trichoderma spp. are fungal antagonists of crops/seeds pathogens which is well-recognized by the government and farming community. The interconnected synergistic complex strategies of antagonistic fungi *Trichoderma* namely mycoparasitism, antibiosis, and competition assist in the control of pathogens. Seed treatment of all types of cereals, fruits, vegetables and cash crops by *Trichoderma* for control of diseases is a thought provoking fact for farmers (Table 1).

Table 1. Biological control of some major plant pathogens by various *Trichoderma* spp.².

<i>Trichoderma</i> spp.	Plant Pathogen	Disease Caused
<i>T. harzianum</i>	<i>Crinipellis perniciososa</i>	Witches' broom disease of cocoa
<i>T. lignorum</i>	<i>Rhizoctonia solani</i>	Damping-off of bean
<i>T. harzianum</i>	<i>Sclerotium rolfsii</i>	Rotting of common vegetables
<i>T. virens</i>	<i>Serpula lacrymans</i>	Wood decay
<i>T. viride</i>	<i>Rhizopus oryzae</i>	Cotton seedling disease
<i>T. harzianum</i>	<i>Pythium ultimum</i>	Damping-off of cucumber
<i>T. virens</i>	<i>Colletotrichum truncatum</i>	Brown blotch disease of cowpea
<i>T. asperellum</i>	<i>Fusarium udum</i>	Pigeon pea wilt
<i>T. harzianum</i>	<i>Sclerotinia sclerotiorum</i>	Sunflower head rot

Application potential against invertebrates

Trichoderma spp. is saprophytic fungi which reside in the soil. They possess the innate ability to produce several chitinolytic enzymes (endochitinases and exochitinases) which enables them to degrade chitin (major component of cellular structure in invertebrates) to antagonize the pathogen⁴ and survive on.

Trichoderma as Nematicides

Nematodes residing in rhizospheric soil are a major problem for crops. Destructive root-knot nematode is effectively controlled by *Trichoderma virens* as it parasitizes, splits, and grooves the nematode eggs. The chitinolytic activity of *Trichoderma* spp. attributes an antagonistic effect on nematode mainly because chitin acts as the major component of nematode cellular structure⁴.

Trichoderma as herbicides

Weed control by *Trichoderma* spp. is comparatively an unexplored field and in some cases herbicidal action of *Trichoderma* spp. has also been reported. *T. virens* with a combination of composted manure and rye cover crop restricted the growth of weeds like grass weeds and broadleaf weeds. The herbicidal activity was due to (a) the herbicidal

molecules, namely, (3H)-benzoxazolinone (BOA) and 2,4-dihydroxy-1,4-(2H)-benzoxazine-3-one (DIBOA) liberated during composting chicken manure and rye cover crop⁴. (a) viridiol a potent weedicidal compound produced by *T. virens*.

Trichoderma in Plant Growth Promotion

Plant growth promotional activity of *Trichoderma* spp. is well studied and

understood. Plant growth promotion of *Trichoderma* spp. is due to the production of plant growth hormones and improved transport of minerals from rhizosphere and the reports suggests that above mentioned factors governs the remarkable activity of *Trichoderma* spp.

***Trichoderma* and Induced Systemic Resistance in plants**

Induced Systemic Resistance (ISR), a plant defense pathway is also a key feature elicited in plants on interaction between *Trichoderma* and roots of host plants in addition to its mycoparasitic nature.

Commercial Status of *Trichoderma*

Currently, *Trichoderma* spp. occupies 5% of global BCA's market which also comprises viral and nematode based biopesticides comparatively younger type rather *B. thuringiensis* (Bt) biopesticides and it shares about 95% of global biopesticides markets. Besides true market size is unclear and the information regarding the registered as well as non-registered biofungicides are scattered. However *Trichoderma* spp. based BCAs products are registered frequently and they share about 70% of all fungal based BCAs. Many biopesticide companies are recommending these products on regular basis and field trials throughout the world are being consented. The increasing steady success of *Trichoderma* spp. based BCAs are due to its distinctive characteristics mainly simultaneous biocontrol activity and growth promotion activity.

SUMMARY

Trichoderma spp. enhances crop yields by playing multiple roles such as promoting plant growth activity with its application as biopesticide and bioherbicides. The information regarding the genus classification, *Trichoderma* and its mechanism of action is well studied and documented. The commercial production processes should be improved in order to enhance marketability of these fungi as BCAs. There is need for optimizing the operating parameters to increase conidia production by adapting cheaper and alternative substrates to achieve economically good yield. promising results were obtained and reported by researchers around the world. In the near future it is projected that exploitation of *Trichoderma* based BCAs would be maximized.

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LIVESTOCK REARING, METHANE EMISSION AND ITS IMPACT ON GLOBAL WARMING

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Agriculture is the largest source of methane emissions accounting for approximately 50 per cent of global anthropogenic methane. Livestock systems contribute about 40 per cent of the total green house gas production from agriculture. Among animals, ruminants are the primary emitters of methane. Methane from enteric fermentation by ruminants is not only an important greenhouse gas associated with environmental problems, but it also represents a loss of feed energy leads to lower animal production. The projected climatic changes due to the greenhouse effect are likely to have an effect on water supplies and the increase in temperature will induce a new distribution of deserts and wet areas in the world and will alter the range of numbers of pests that affect plants or diseases that threaten animals or human health.

INTRODUCTION

Accumulation of greenhouse gases, mainly carbon dioxide, methane and nitrous oxide, in the atmosphere is contributing to an increasing earth surface temperature³. Agriculture is the largest source of methane emissions accounting for approximately 50 per cent of global methane production. Out of this, livestock rearing contribute around 12 per cent of total greenhouse gas emission. Emission of greenhouse gas in livestock rearing originates mainly from the animals through enteric fermentations, the manure and the agricultural land used for the production of feed and forages.

Livestock contribute about 42 per cent of the total green house gas production from agriculture with 28 per cent associated with direct emission of enteric fermentation and 14 per cent from manure handling, storage and land application. Methane emission from Indian livestock is about 9.02 Tg. The world recognizes global warming as an immediately threat that is caused by fluctuations in temperature, recurrence of droughts, floods and heat and cold weather, rise in sea level, local and global eco-system upsets and change in the cropping pattern.

METHANE EMISSION FROM LIVESTOCK

Ruminants are the primary emitters of methane. Methane production during ruminal fermentation as a result of methanogenic bacteria and protozoa is a product of rumen fermentation². In ruminants, feed is converted to short chain fatty acids in the rumen, which are used as a source of energy and the

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hydrogen generated as an intermediate is converted rapidly to methane by the methanogens⁶. Methane synthesis in rumen is usually associated with decreased propionate production and increased acetate to propionate ratio⁵. Rumen microbial utilization of carbohydrates in the gut of animals results in the production of volatile fatty acids, microbial protein, carbon dioxide and methane with little hydrogen (H₂).

Methane from enteric fermentation by ruminants is not only an important greenhouse gas associated with environmental problems, but it also represents a loss of feed energy leads to lower animal production. Enteric fermentation can vary widely depending on factors such as type of animal, the amount and type of feed, environment, addition of dietary fat, feed additives and body weight of the animal³.

MICRO-ORGANISMS INVOLVED IN METHANE PRODUCTION IN THE RUMEN

Methane is produced by strict anaerobes belonging to the sub-group of the Archaea bacteria. Methanogens like *Methanobacterium formicicum*, *Methanobacterium ruminantium*, *Methanobacterium bryanti*, *Methanobrevibacter ruminantium*, *Methanosarcina barkeri*, *Methanomicrobium mobile* and *Methanoculleus olentangyi* are present in the rumen in a large number in rumen liquor depending upon the type of diet given to animals, especially the fibre content in the ration. On a fibre rich diet, production of acetic acid is more coupled with more production of methane¹. More than sixty species were isolated from various anaerobic habitats like sanitary landfills, waterlogged soils, salt lakes, thermal environments and intestinal tracts of animals.

Only five of these species belonging to *Methanobrevibacter* and *Methanosarcina* genera, were isolated from rumen digesta.

METHANOGENESIS BY METHANOGENS

Enteric methane emission is produced as a result of microbial fermentation of feed components. Methane, a colorless, odorless gas, is produced predominantly in the rumen (87 per cent) and to a small extent (13 per cent) in the large intestines. Rumen methane is primarily emitted from the animal by erucation. The conversion of feed material to methane in the rumen involves the integrated activities of different microbial species, with the final step carried out by methanogenic bacteria³. Primary digestive microorganisms (bacteria, protozoa and fungi) hydrolyze proteins, starch and plant cell wall polymers into amino acids and sugars. These simple products are then fermented to volatile fatty acids (VFA), hydrogen (H₂), and CO₂ by both primary and secondary digestive microorganisms. Acetate, propionate and butyrate, which are the major VFA, are then absorbed and utilized by the host animal. The major producers of H₂ are the organisms which produce acetic acid in the fermentation pathway.

METHANE EMISSION FROM DIFFERENT CATEGORIES OF LIVESTOCK

Total methane emission from Indian livestock has been estimated 10.07 Tg/year. Contribution of crossbred cattle, indigenous cattle, buffaloes, goats and sheep in methane emission was 4.63, 48.49, 38.96, 4.71 and 1.79 percent, respectively. The other livestock produced only 1.42 per cent of total methane emission. Out of total emission, the contribution from male animals was 34.12 per

cent in which working males were the major source of methane emission due to their large population.

Diary crossbred cows, indigenous cows and buffaloes emitted 52.37, 44.75 and 62.5 per cent of total methane emitted by female livestock. On an average, dairy animals emitted 54.2 per cent of total methane emitted by female livestock as a result of enteric fermentation. Methane emission/crossbred cow was similar to the dry crossbred cow, however, indigenous dairy cow emitted more methane than non-dairy cow, possibly due to their low productivity. Dairy crossbred cow, indigenous cow, and buffalo emitted 38.98, 35.9 and 76.6 kg CH₄/hd/yr, respectively.

The methane emission/kg milk worked out to be 175.7 g/kg milk, which appears to be higher than that recorded in US and other countries due to the higher productivity of their animals and feeding of high concentrate diets. It is also evident from Indian animals as the methane emission/kg milk was about 25% lesser in crossbred cows (having higher productivity) than indigenous cows (having low productivity). Buffaloes and indigenous cows emitted similar amount of methane/kg milk but buffaloes had higher milk yield owing to higher energy value (due to higher fat) than indigenous cows.

METHANE EMISSION FROM MANURE

Green house gas emission from manure has an important contribution to total emission and offers mitigation opportunities. Green house gases emitted from manure are mainly CH₄ and N₂O. Methane is produced in anaerobic conditions and is the main green house gas emitted from liquid manure. The intensity of production depends mainly on manure organic matter and on temperature

and duration of storage. This means that systems with long term storage of liquid manure indoors or outdoors at high ambient temperature will result in much higher CH₄ emission.

Methane may also be emitted from anaerobic zones in solid manure. This means that, depending on litter management, more CH₄ or more N₂O will be emitted. Compared to liquid slurry, the use of straw or sawdust litter bedding in pig production resulted in 120 per cent increase of green house gas emission from manure. For instance in litters from ruminants methane seems to remain the main contributor to green house suggesting that conditions are more anaerobic. Consequently, as regard to green house gas emission it seems that litter-based systems should not be recommended. For liquid slurry the main mitigation options are reducing storage duration, especially in hot conditions, the treatment of manure and improved spreading techniques. In this context a rapid removal of the slurry followed by an anaerobic digestion appears an efficient way to reduce, or even nearly suppress, not controlled methane emission during storage. Moreover the process results in the production of renewable energy. In the case of ruminants, raising the animals on pasture in an efficient way to reduce methane emission from manure, because storage is supposed.

IMPACT OF METHANE ON GLOBAL WARMING

The greenhouse effect is thought to be due to the absorption of solar infrared (IR) radiation by gases and the earth's surfaces, which, as a result, are heated and then re emit IR radiation at low frequency with a high absorptive power³. In fact greenhouse gases in the atmosphere

are essential for maintaining life on earth, as without them the planet would be permanently frozen because all of the incoming heat from the sun would be radiated back into space by the earth's surface⁴.

Warming of the earth's surface is achieved by solar energy being radiated and passing through the atmosphere of the earth without being absorbed. Some of the solar energy is reflected back into space by clouds and about 7% is radiated in the ultra-violet region of the spectrum (below 0.4 μm), which is absorbed by the ozone layer in the atmosphere. The solar energy reaching the earth's surface warms the earth and is radiated back from the surface. The remaining radiation is absorbed by water vapour and carbon dioxide, thus there is warming of the lower layer of the atmosphere (troposphere), which in turn radiates, heat, keeping the earth warmer⁷.

CONSEQUENCE OF THE GREENHOUSE EFFECT ON ENVIRONMENT

The consequences of the increase in concentration of the gases that generate the greenhouse effect are that average global temperatures will rise, along with many consequences on human life. The degree to which these changes are projected to occur is dependent upon a reliable greenhouse gas policy model and a range of scenarios for the levels of greenhouse gas emissions. By the year 2030, the world is likely to be 1–2°C warmer than today, the range could be from 0.5°C to 2.5°C. The concomitant rise in global mean sea level is 17 to 26 cm, with a full range of 5 to 44 cm, due mainly to thermal

expansion of the oceans and increased melting of ices in the Arctic and Antarctic areas³.

The projected climatic changes in the next century due to the greenhouse effect are likely to have an effect on water supplies and the increase in temperature will induce a new distribution of deserts and wet areas in the world and will alter the range or numbers of pests that affect plants or diseases that threaten animals or human health. Also of interest are the effects on unmanaged ecosystems, mainly forests³. The rising concentration of methane is correlated with increasing populations and currently about 70 per cent of methane production arises from anthropogenic sources and the remainder from natural sources.

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KNOW THY INSTITUTIONS



THE INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH, KOLKATA

The basic idea of IISER is to create research Universities of the highest calibre in which teaching and education will be totally integrated with the state of the art research. These Universities are devoted to Undergraduate and Postgraduate teaching in sciences in an intellectually vibrant atmosphere of research. One of the important objectives of creating these Universities is to make education and careers in basic sciences more attractive by providing opportunities in integrative teaching and learning of sciences and break the barriers of traditional disciplines.

DEPARTMENTS**Biological Sciences**

The Department of Biological Sciences has been conducting research and teaching in a

broad spectrum of areas in Biology. We work on animal behaviour, biodiversity, cell and molecular biology, conservation biology, developmental biology, ecology, evolution, genetics, immunology, marine biology, microbiology, neurobiology, plant biology, physiology, population biology, structural biology and biophysics. In our research, we not only encourage interdisciplinary scientific explorations, we also aim to apply our research in addressing health and environmental issues.

Chemical Sciences

The Indian Institute of Science Education and Research-Kolkata was founded in 2006 by the Ministry of Human Resource Development (MHRD), Government of India and one of the first departments to be established was the

Department of Chemical Sciences (DCS). From the beginning, the Department has incarnated the Institute's mission of excellence in both research and teaching. The DCS has appreciable strength in the core areas of physical, organic and inorganic chemistry as well as in interdisciplinary research areas at the boundaries with physics, biology, earth science and materials science. An extremely wide range of state-of-the-art instrumentations are available in different research groups to carry out the DCS research activity.

Earth Sciences

Indian Institute of Science Education & Research, Kolkata is the first among five IISERs, to have established a Department of Earth Sciences. The department started its journey in 2007, a year after IISER-Kolkata was established. The Department of Earth Sciences is committed to building a community of researchers including students and faculty members. The goal of the Department is to develop a modern center for Earth Science Education and Research in three core areas: Environmental and ecological studies in modern and ancient systems, Isotope Geochemistry and Biogeochemical studies, Solid Earth studies.

Mathematics and Statistics

As an integral part of the fresh, dynamic and promising new concept called IISER Kolkata, the department is committed to its central theme of integrating education with research so that undergraduate teaching as well as doctoral and postdoctoral research work could be carried out in symbiosis.

Physical Sciences

Department of Physical Sciences focuses on the cutting edge research in the fields of condensed matter, astrophysics and cosmology,

nano-science, optics, quantum information, non-linear, and high energy physics. In synchrony with the institute's motto, the department also aims at teaching and training students from basic to advanced level.

PROGRAMME

5 Year BS-MS Dual Degree Programme

IISER Kolkata offers a Bachelor and Masters (BS-MS) dual degree programme in synchrony with other IISERs. The selection for the BS-MS programme is conducted through an common annual summer selection. IISER Kolkata offers a unique training programme to the selected candidates through a balanced schedule of class room lessons, project and research works. While the Institute aims to comprehensively train the students in each of the major subjects, much attention is also directed to the development of the interdisciplinary skills. The broad outline of the training programme is as follows :

In the first year, all students are introduced to basic sciences, viz., Biological, Chemical, Mathematical, Physical and Earth Sciences. In the second year, the students select three pre-major subjects from the above mentioned disciplines. In the third and fourth years, students choose a major subject from the above disciplines and need to take optional interdisciplinary courses. The fifth year almost completely devoted to full time research/technical project/specialized training in which the students need to prepare a dissertation. At the end of the fifth year, both Bachelor and Masters degrees are awarded to successful candidates.

MS By Research Programme

IISER Kolkata offers a Masters degree programme for engineering students who want to pursue their career through research in

specific areas of Physical Sciences. Selected students take up a project under a faculty member of IISER Kolkata and conduct her/his research. After successfully defending their thesis students are awarded the Masters degree.

Integrated PhD Programme

Integrated Doctor of Philosophy (IP) programme at IISER Kolkata is a combination programme which starts with a comprehensive Masters programme (MS) followed by a research programme (PhD). Individual Department selects deserving candidates from the pool of applicants based on their academic backgrounds and their performance in the selection test.

Doctor of Philosophy Programme

The Doctor of Philosophy (PhD) programme at IISER Kolkata is an introduction to cutting-edge research. In both theoretical as well as experimental subjects IISER Kolkata strives to provide world-class training. The Institute offers Doctorate degree in the fields of Biological, Chemical, Mathematical, Physical and Earth Sciences. Individual Department selects deserving candidates from the pool of applicants based on their academic backgrounds, research interests and their performance in the selection test (often an interview). The selection is conducted twice a year (advertisement goes public tentatively in the months of March and September). The applicants who has their own fellowships (such as, UGC/CSIR-NET, INSPIRE etc) may apply at any time of the year. The Institute reserves the provision of offering rolling admission to these candidates. The candidates who do not have their own fellowship must apply through the bi-annual selection process.

Post Doctoral Research Programme

IISER Kolkata has provisions for post-doctoral research in Biological, Chemical, Mathematical, Physical and Earth Sciences. Individual Departments invites applications depending on the vacancies and scope of work. Such positions are also advertised through and funded by individual faculty members.

RESEARCH VISION OF THE INSTITUTE

The office of Research and Development of IISER Kolkata leads the research agenda across the Institute. It provides the foundation for continued development of departmental research and interdisciplinary research initiatives. The agenda include :

- Providing a supportive research environment in which faculty members and research students can flourish and develop in every stage of their career.
- Encouraging collaboration and partnership with other research institutes and industries, nationally and internationally.
- Encouraging multidisciplinary and interdisciplinary research programmes to address many of the major challenges faced by our society.
- Facilitating submission of project proposals to external funding agencies.

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CONFERENCES / MEETINGS / SYMPOSIA / SEMINARS

National Conference on Ethical Issues in Scientific Writing, 03-04th September 2015, Bangalore.

Topics :

- Effective writing in Scientific Communications
- Reporting the data and Plagiarism
- Intellectual Property Right and Patents
- Issues on Scientific Misconduct

Contact : Dr. Nagesh babu R, Organizing Secretary, Department of Chemistry, Maharani's Science College for Women, Palace Road, Bangalore-560 001, Ph : 09739438698, E-mail : conference. mscw@gmail.com

6th World Congress on Biotechnology, October 05th to 07th, 2015, New Delhi, India.

Topics :

- Current Scenario of Biotechnology
- Biotechnology in Agriculture
- Biotechnology in Health Care
- Cancer and Genomics Research
- Petroleum and Environmental Biotechnology
- Immunology and Stem Cell Therapy
- Genetic Engineering and rDNA Technology
- Biochemistry, Cell and Molecular biology
- Microbiology and Marine Biotechnology
- Animal Biotechnology and Cell Culture
- Bioinformatics and Biosensor
- Food and Bioprocess Technology

Contact : biotechnology.conference@omicsgroup.us or biotechnology@conferenceseries.net, website : <http://biotechnologycongress.com/india>

24th National Laser Symposium (NLS-24), December 3-6, 2015, Indore, (M.P.)

Topics :

- Physics and Technology of Lasers
- Lasers in Nuclear Science & Technology

- Laser Materials, Devices and Components
- Nonlinear, Quantum and Atom Optics
- Ultra-fast Lasers and Applications
- Lasers in Materials Science
- Laser Plasma Interaction
- Lasers in Industry and Defense
- Laser Spectroscopy and Applications
- Lasers in Chemistry, Biology & Medicine
- Laser Based Instrumentation
- Electronics and Instrumentation for Lasers

Contact : H. S. Vora, Convener, Laser Electronic Support Division, Raja Ramanna Centre for Advanced Technology (RRCAT), Indore (M.P) 452 013; Phone : +91-731-2442401 E-mail : vora@rrcat.gov.in

5th World Congress on Virology, December 7-9, 2015, Atlanta, USA.

The theme of the conference is “Anti-Viral Immunity and Counter Measures to Control Disease Pathogenesis”.

- General Virology and Basic Science
- Clinical and Neuro Virology
- Respiratory and Emerging/Re-emerging Viruses
- Agriculture and Plant Virology
- Therapeutic Approaches and Targets for Viral Infections
- Veterinary Virology
- Viral Immunology
- Viral Hepatitis
- HIV and Other Retroviral Diseases Affecting Afro-Asian Continents
- Organ Specific Cancer and Tumor Virology
- Regulatory and Economical Aspects in Virology
- Recent Advances in Drug Discovery
- Current Focus in Virology Research

Contact : Conference Secretariat : 5716 Corsa Ave., Suite 110, West Lake, Los Angeles, CA 91362-7354, USA Ph: +1-650-268-9744, Fax: +1-650-618-1414, Toll free: +1-800-216-6499
Email : virology@omicsgroup.com, website : <http://virology.omicsgroup.com/Virology-2015>

S & T ACROSS THE WORLD**MICROBES PLAY VILLAINOUS ROLE IN ARCTIC CLIMATE CHANGE**

Living creatures are often seen as the innocent victims of climate change. But some life forms are emerging as villains, partly to blame for the rising temperatures in the Arctic.

By releasing methane from newly thawed soil or by absorbing the sun's heat and warming the ocean around them, tiny microbes and marine phytoplankton leave a significant mark on the Arctic environment – with a potentially global impact.

Mette Svenning from the University of Tromsø in Norway and her team show that soil microbe communities become greenhouse gas factories as soon as the surrounding soil thaws. They already knew that higher temperatures cause microbes in the Arctic soil to release methane – a greenhouse gas some 25 times more potent than carbon dioxide – at a faster rate as they feed on underground carbon stores.

What they didn't expect was just how effective they are at lower temperatures. Microbes from warmer climates grind to a virtual standstill at 4° C, but their Arctic relatives continue producing methane at a quarter of the rate that they would at 27° C.

These temperatures are increasingly being reached during the longer summer seasons, so this could result in far greater methane emissions. With Arctic soils containing twice as much carbon as the entire atmosphere, one estimate puts the impact of thawing permafrost in the same ballpark as global deforestation, and equivalent to a warming of 0.25° C by the end of the century.

Another study, published last week suggests that, as the sea ice melts the dark bodies of marine phytoplankton absorb more of the sun's rays, which could warm the surrounding Arctic waters by 20 per cent more than current climate models predict. For the worst hit areas, this could mean up to a tenth more sea ice disappears and around 50 more ice-free days during summer than had been thought. On top of this, plants and bacteria that live on glaciers and snow banks are doing similar things on land.

However, some researchers argue that thriving microorganism communities may not be a bad thing entirely. Carbon-based life forms could lock away dangerous greenhouse gases in their bodies as well as sustaining the rest of the food chain.

Yet, Jørgen Hollesen from the University of Copenhagen in Denmark, says far too little data exists on the exact size and global importance of these biological influences. Current climate models that do not include biological factors could be underestimating the scale of the changes to come, says Hollesen.

Source : PNAS, 10.1073 ; PNAS, 10.1073

PAPER MICROPHONE MAY HELP CHARGE YOUR CELLPHONE

Screaming with rage at your dying cell phone battery doesn't help much, but that could be about to change. Researchers have developed a postage stamp-sized microphone that can harvest acoustic energy to top up your charge on the go.

Zhong Wang of the Georgia Institute of Technology in Atlanta and his colleagues created their microphone from a thin sheet of paper just a few centimetres across. They used a laser to zap a grid of microscopic holes in the paper, then coated one side in copper

and laid it on top of a thin sheet of Teflon, joining the two sheets at one edge.

Sound waves vibrate the two sheets in different ways, causing them to come in and out of contact. This generates an electric charge, similar to the one made when you rub a balloon on your hair, which can charge a phone slowly.

The paper microphone could also be used as a way to recycle sound energy from the environment, getting free electricity from the “waste” sounds all around us. The charge can also be converted into a range of sound frequencies, allowing the initial sounds to be amplified.

The amount of power the microphone provides depends on its size, but it's around 121 milliwatts per square metre. “It can be made into any size you like,” says Wang, though he admits a stamp-sized microphone fitted to your phone would only provide a small amount of power rather than fully charging your phone.

Source : *ACS Nano*, 2015, 9 (4), pp 4236–4243

COULD BEES BE ADDICTED TO PESTICIDES?

Like nicotine for humans, certain pesticides seem to hold an addictive attraction for bees, which seek out tainted food even if it may be bad for them, according to new research.

Not only did bees show no signs of avoiding neonicotinoid-laced food in lab tests, they seemed to prefer it, says a study in the journal *Nature*. “We now have evidence that bees prefer to eat pesticide-contaminated foods,” says study author Geraldine Wright of Newcastle University, UK. This suggests, she says, “that like nicotine, neonicotinoids may act like a drug to make foods containing these substances more rewarding”.

Neonicotinoids are lab-synthesised pesticides based on the chemical structure of nicotine. They are widely used to treat crop seeds - designed to be absorbed by the growing plant and attack the nervous system of insect pests.

Previous research, however, has linked them to scrambling memory and navigation function in bees, affecting the little pollinators' ability to forage.

Bees have been hit in Europe, North America and elsewhere by a phenomenon called “colony collapse disorder”, which has alternatively been blamed on mites, a virus or fungus, pesticides, or a combination of factors.

A second study, also published in *Nature* this week, found further evidence of risk for some bee species from neonicotinoids, which come in three types: clothianidin, imidacloprid and thiamethoxam. Scientists in Sweden sowed eight fields with clothianidin-treated canola seeds, while another eight were untreated. “The most dramatic result that we found was that bumble bee colonies almost didn't grow at all at the .. treated sites compared to the control sites,” says project coordinator Maj Rundloef of Lund University.

There were also fewer wild bees in the contaminated sites, but honeybee colonies did not appear to be affected.

In the other study, Wright and her team used hundreds of bumble bees and thousands of honeybees in lab experiments — allowing them to feed freely from either a sucrose solution with a neonicotinoid added in concentrations found in floral nectar in nature, or one without.

“Foraging-age bees of both species did not avoid any of the concentrations of any of the three neonicotinoids,” Wright says. “Instead,

they chose to feed on tubes containing either imidacloprid or thiamethoxam," she says.

Bees did not exhibit a preference for the third type, clothianidin.

"I believe that the experiments show that these compounds have a pharmacological effect on the bee's brain," she says.

This meant that even if alternative food is provided for bees in areas where pesticides are used, a solution suggested by some, the insects may prefer to forage on the contaminated crops anyway.

Source : Nature 22 April, 2015 online

THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresh Guha Street
Kolkata - 700 017

ANNOUNCEMENT FOR AWARDS : 2015-2016

Applications in prescribed forms are invited from Indian Scientists for following Awards :

- Prof. Hira Lal Chakravarty Award-Plant Sciences
- Pran Vohra Award-Agriculture and Forestry Sciences
- Professor Umakant Sinha Memorial Award—New Biology
- Dr. B. C. Deb Memorial Award for Soil/Physical Chemistry-Chemical Sciences
- Dr. B. C. Deb Memorial Award for Popularisation of Science
- Professor K. P. Rode Memorial Lecture-Earth System Sciences
- Dr. (Mrs.) Gouri Ganguly Memorial Award for Young Scientist-Animal, Veterinary and Fishery Sciences
- Prof. Sushil Kr. Mukherjee Commemoration Lecture-Agriculture and Forestry Sciences
- Prof. S. S. Katiyar Endowment Lecture-New Biology/Chemical Sciences
- Prof. R. C. Shah Memorial Lecture-Chemical Sciences
- Prof. Archana Sharma Memorial Award-Plant Sciences
- Dr. V. Puri Memorial Award-Plant Sciences
- Prof. G. K. Manna Memorial Award-Animal, Veterinary and Fishery Sciences
- Prof. W. D. West Memorial Award-Earth System Sciences

For proforma of application forms and necessary information, please write to the **General Secretary (Hqrs.), The Indian Science Congress Association, 14, Dr. Biresh Guha Street, Kolkata-700 017. E-mail : essciencecongress@nic.in/iscacal@vsnl.net Fax No. 91-33-2287 2551. The form can also be downloaded from <http://sciencecongress.nic.in> Last date of submitting application is **July 31, 2015.****

THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresb Guha Street, Kolkata - 700 017

Nominations for "Asutosh Mookerjee Fellowships of ISCA" 2016-2017

ISCA has instituted 10 senior Fellowships in the name of **Asutosh Mookerjee Fellowship** in the Centenary year to utilize the services of the Life Members of the Association who are active in high quality research in their specialized disciplines but have superannuated from their service.

Objective : The objective is to utilize the expertise of ISCA Members after superannuated primarily for research work in some R&D Center/University/Colleges/Institute in India.

Eligibility :

- (i) The fellowship is open to ISCA Life Members who have superannuated and are between the age of 65 to 70 years.
- (ii) The applicant should possess a Ph.D. in Sciences/Engineering or MD in medicine.
- (iii) The fellowship is meant for those who have a proven track record as evident from their Research Publications and recognition.

Number of Fellowships : The number of Fellowship to be selected each year shall be decided by the Executive Committee from the panel recommended by the Selection Committee, to be constituted by Executive Committee. Usually, the number of Scientists to be selected each year will be based on the availability of vacancies and funds available with the Association. The total number of Fellowships at a time should be more than 10. The Fellowship will start from 1st April of every year.

Tenure : The term of **Asutosh Mookerjee Fellowship** will be tenable initially for a period of three years extendable for another two years after a review of the achievement of three years works.

Emoluments :

- (a) The fellowship carries an honorarium of ₹ 30,000/- p.m. such that ₹ 30,000 + pension does not exceed the gross salary drawn at the time of retirement. The honorarium of ₹ 30,000 will be reduced wherever. The honorarium will be taxable at source.
- (b) Contingency grant will be ₹ 1,00,000/- which includes the expenditure of chemical glasswares, stationary, part time services of a scientific assistant/ secretary for typing and travel within country only.

Nominations : Nominations for the position shall be invited from the Life Members of the Association. The Nominations papers duly completed in all respect, signed, and routed through the Head of the Institute, where a scientist intends to work, should be sent to the General Secretary (Membership Affairs), so as to reach **latest by July 15, 2015**.

Announcement Report and Renewal of Scheme : Fellows will submit an Annual Report of his/her research work at the end of each financial year along with statement of expenditure for renewal and release of grant for the next financial year.

Contact Details : General Secretary (Membership Affairs), The Indian Science Congress Association, 14, Dr. Biresb Guha Street, Kolkata - 700 017, Fax : 033 22872551, Phone : 033 22874530, Email : iscacal@vsnl.net, website : www.sciencecongress.nic.in

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