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NATIONAL ENVIRONMENTAL SCIENCE ACADEMY

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From the Editor's

Dear Readers,

Greetings & Happy New Year 2023!!

In the February issue of our Newsletter, we received several popular articles from diverse fields. All the authors deserve great appreciation for sharing articles in huge numbers. Please continue sending articles to our Publication team and share published newsletter with your friends also.

I would like to thank the Editorial team including Print, Designer and Publication committee for their efforts throughout the edition.

Your suggestions are always welcome for improvement.

Dr. R. S. Tomar
Editor-in-Chief

NUTRIGENOMICS: SOCIAL, POLITICAL AND REGULATORY ISSUES

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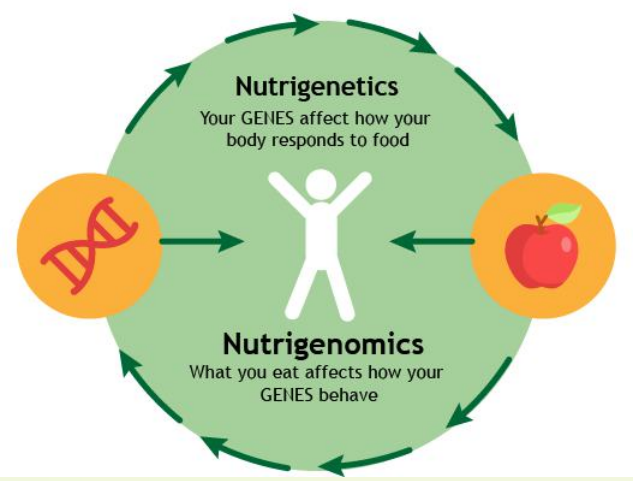
Nutrition is the key factor to stay healthy. As the community is developing, the world is also facing substantial challenges, such as malnutrition, hyper alimentation, and increased chronic diseases. Due to the imbalance of nutrition, chronic disease rates are also drastically increasing in the world. Furthermore, it is leading to high rates of obesity and diabetes in cities and villages. High rise in diet-related disorders such as obesity, cardiovascular diseases, diabetes etc. have resulted in investigating "Genomics of Nutrition" research worldwide. Therefore, present global growth of the epidemic needs to be addressed through the promises of nutrigenomics. Genes and diet interaction play an important role in individual health and also indicate associated risk of developing the illness. Science of nutrigenomics is to study interaction of nutrients with the genome, proteome, and metabolome. Further, it describes the affinity between these specific nutrients for sound health and fitness of an individual. Molecular biology of genes and regulatory regions control the metabolism. It will be helpful in losing weight, and optimize the health (Hyman 2006). It is cardinal to understand human health both by the role of diet in the fluctuating declaration of a genome and the role of genetics in the uncertain responses to diet. It is quite obvious that individuals respond distinctively to the same dietary consumption. More than 60 % of deaths globally are caused by diabetes and non-communicable diseases (NCDs) especially cardiovascular diseases, cancers, and chronic respiratory diseases. This is estimated to enlarge total deaths from NCDs by a further 17 % over the next 10 years. It is forecasted that NCDs will be responsible for 80% of the global burden of disease, causing seven out of every 10 deaths in developing countries. In emerging economies, this positions a substantial (double) burden on limited health budgets. Both in developed and developing countries (Gobard and Hurlimann 2009), consequently the promises of nutrigenomics are compelled to be addressed concerning this current growing epidemic. Considering these factors, it is very necessary to have a regular

evaluation that could contribute to recognizing discrete dissimilarities in nutritional status.

The technology of nutrigenomics focuses on developing an improved understanding of the relationship between human nutrition and human genetics in order to maintain and promote health and prevent the occurrence of disease. Like any other technology, nutrigenomics also faces many constraints in its development (Ronteltap, et al., 2007a). Bottlenecks for the implementation of nutrigenomics include aspects like Social, Political, regulatory issues.

Social issues:

Consumer acceptance is the foremost important factor for any new technology to get spread in society. Low consumer acceptance is related to low level of awareness about the technology (Nutrigenomics) and lack of understanding of the basic concepts of the technology. Accessibility of Nutrigenomics is another issue, whether it will only be in reach of few elite people in society because poor clients may have limited access of nutrigenomics owing to its high cost for genetic testing and limited access to knowledgeable health care professionals (Rosen et al., 2006) and Nutrigenomics may also raise consumer concerns regarding confidentiality or privacy issues (where their genomic data can be stored) and control over sensitive information (who can have access to it, whether it may be used against them) (Ronteltap, et al., 2007a). Leakage of Personal (genetic) information to third parties (insurance companies) lead to risk and uncertainty among public. Cultural Differences- Food choice and eating behaviour are highly based on one's own culture and region. People may have high resistance in changing their food habits and accepting new one based on nutrigenomics (Castle & Ries, 2007). Consumers may also experience personalization (Nutrigenomics recommended individual diet) as an undesirable interference with personal preferences, and as an attempt by marketing companies to influence them (Simonson, 2005). Besides consumer perceptions, considerable scientific uncertainty is involved in the development of nutrigenomics as it is a young science, hampering a clear view on its potential future (Ronteltap et al., 2007a). Evidence base for genotype-specific dietary advice is very limited. The benefits of nutrigenomics research for society in terms of improved health care or disease prevention remain unclear (Castle & Ries, 2007). Nonefficient use of samples and data, application of the wrong study design, or exclusion of certain groups from benefits that arise from the research raises ethical issues among public (Eriksson & Helgesson, 2005). Misinterpretation of nutrigenomics data about individual risk raises anxiety among consumers (Chadwick, 2004). It is important to consider whether public health will be improved with individualized tailored recommendations. Will people be motivated to adhere to a tailored diet? (Fenech et al., 2011). The Dietitians working in the area of nutrigenomics also faces problems regarding the application of nutrigenomics which include, the lack of background knowledge and lack of experts to convey professional expertise and having limited experience with nutrigenomics, and the majority of them were not



confident in their ability to apply nutrigenomics (Rosen et al., 2006). Issues from a research perspective in nutrigenomics include, consent, genotype information, biobanks, and the use and exchange of samples, the use and communication of genetic information and the conduct of large-scale, population-based studies in an international context are most challenging aspects (Castle & Ries, 2007).

Political and regulatory issues

Lack of a comprehensive conceptual framework for consumer acceptance of Nutrigenomics, which can be a critical factor for the success of the emerging science of nutrigenomics and personalised nutrition. Lack of framework for regulating the trade-off between individual costs and benefits of an innovation (Nutrigenomics), which can determine the consumer attitude towards acceptance or rejection of the innovation (Ronteltap, et al., 2007a). Lack of legislation for Medicalisation of food, privacy issues, regulation of product claims related to nutrigenomics (Ronteltap, et al., 2007b). Rules and regulations needed to formulate policies related to fair use of genetic information and policies related to genetic testing, counseling, and informed consent and public and professional education is needed for health professionals, policy makers, and the public on genetics and related nutrigenomic aspects (Kauwell, 2005). Rules and regulations are required to be created to formulate policies for nutrigenomics related direct to consumer (DTC) genetic testing to regulate market (McGuire et al., 2010). Dietary guidelines should be formulated by taking into consideration of the traditional and cultural background, together with socio-economic and environmental issues, to help consumers to make healthy and informed choices (Krishnaswamy,2008). A concise and clear set of rules and regulations to undertake research in nutrigenomics needs to be developed consistent with the Universal Declaration on Bioethics and Human Rights [UNESCO, 2005] and the International Declaration on Human Genetic Data [UNESCO, 2003] (Slamet-Loedin & Jenie, 2007). A strong need is felt to set ethical and scientific guidelines for nutrigenomics research for the collection, analysis, interpretation, implementation and archiving of nutritional and omics data (Bragazzi, 2013). Owing to high cost, it might not be promising for developing countries like India as it will not be possible for most of the people to pay

for nutrigenomics-based test packages. Therefore, regulations should be formulated in order to make it affordable to large section of the society, and relevant to the per capita income of consumers (Godard & Hurlimann, 2009). Strict guidelines and compliance must be framed to prevent false health claims, to ensure health data confidentiality, management of genetic information obtained through nutrigenomics tests, and exclusion of any possible discrimination by insurance companies must be ensured (Vyas et al., 2017). Creating an independent, accountable, transparent regulatory body to address social, political, regulatory issues is needed. NuGO (European Nutrigenomics Organisation) was established by European Union (EU) with an aim to mobilize nutrigenomics studies and since 2010 looking for bigger role globally.

Therefore, it is more beneficial to the public to address genetics, and the nutritional genomics knowledge gap will help to eradicate the social issues and create more awareness, confidence, and trust among the common. Public concerns over nutrigenomics are relevant to science and the food industry. It is evident in the past and present that genetically modified food demonstrates the essentiality of addressing public concerns as early as possible and helps relieve the social issues around science as seriously and technically. It is the most important responsibility to assure the public about the safety of the products and earn the trust, due to which regulations are required. Demanding ordinances and public engagement on manufacturers for the information they provide and illustrating a will to enhance the protection, fidelity, and health benefits of merchandise is essential. The relation between the arising example of nutritional genomics and the functional food market was discussed by Ghosh (2010). The goal of integrating genetics into public health and highlighted by Ghosh and Gorakshakar (2010) in India and general consciousness about the new gene-based technologies was given by Aswini and Varun (2010) that can be simply utilized by the modern healthcare units.

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THE INTERNATIONAL CONFERENCE CALLING FOR STARVATION FREE WORLD

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A 2-day online international conference entitled, "International Conference of Science, Social Science and literature (ICSSL-2023)" was organized in Kolkata by the Centre for Multidisciplinary Research Action (CMRA). Dr. Stephen Cheriyl, Director and Managing Editor, CMRA served as the as the Organizing Secretary of the conference. Ms Neethu L (Registrar, CMRA) and Saikat Kumar Basu from National Environmental Science Academy (NESA) served as joint convenors. The online conference was held between February 27-28, 2023 from Kolkata head quarters of CMRA. The central theme of this international online conference has been "Starvation Free World". The introductory remarks were made by Prof. Stephen Cheriyl and the welcome address was delivered by convenor Saikat Kumar Basu. Professor Sabu Williams, the honourable Vice Chancellor of MG University, Kerala kindly delivered the key note address and imitated the online release of two CMRA journals, namely International Journal of Botanical Research (ISSN-0973-2225) and International Journal of Multidisciplinary Research (ISSN-0973 2226). The program was then fooled by several online presentations by academics, researchers, research scholars and under graduate and post graduate students. The topics mostly covered various aspects of medicinal plant research with particular importance to cinchona, environmental pollution, pollinator conservation, economic, sociological and political aspects of global challenges in regulating Climate Change and Global Warming. Among other noteworthy topics were literary and socio-cultural aspects of hunger free world, gender discrimination, Climate Justice, ecotourism, Bengal famine, COVID-19 pandemic and its impact on the world with specific interest to India and South and South East Asia. The vote of thanks was delivered by Ms. Sutapa Bardhan (Secretary, ECHO) highlighting in the importance of Food for All campaign. Around 100 participants registered for this conference.

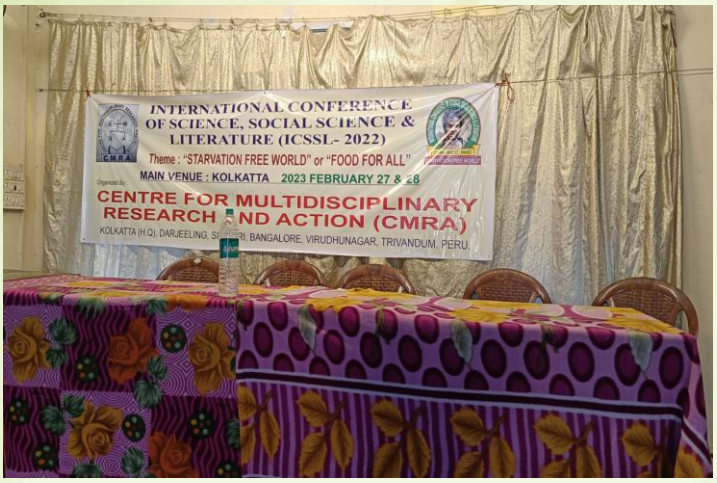

Photo credit: *Saikat Kumar Basu*

ACHARYA P.C. ROY 161ST BIRTH ANNIVERSARY: FROM THE PRISM OF SCIENCE COMMUNICATION

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Celebration of the 161st Birth Anniversary of Prof Prafulla Chandra Roy (Father of Indian Chemistry), better known as Acharya P. C. Roy and the founder of first chemical industrial unit of colonial India (Bengal Chemical) was conducted at Casa Dei Bambini Montessori House [90 A/B Beltala Road Kolkata 700026 West Bengal India. This has been a joint celebration of the I61st birth anniversary of Acharya P. C. Roy by Casa Dei Bambini, the Science Association of Bengal (SAB) and the Educational Counselling and Helping Organization (ECHO).

One of the main objective behind this program has been the fact that it is important to do science communication and build awareness among little children early in their life. It is important to demonstrate to them in simplest terms what science is and that it is a fun to learn science. It is this young India that we need to target for grooming our future generations to learn to become responsible citizen with respect for the nation and nature and empathy for the people. Introduction of basic sciences at an early age can help create a passionate mind and help in shaping the young minds with a logical and scientific approach. What could have been a better day to celebrate this than the birth anniversary of the Father of Indian Chemistry who worked tirelessly in his life to build a nation and a generation of worthy students who took India forward.

Children of Casa Dei-Bambini celebrated 161st birth anniversary of Acharya P. C. Roy with eminent personalities, Prof S. Roychowdhury (Secretary, SAB) accompanied by his assistant Mr. Samar Bez along with agriculture-environmental scientist Saikat Kumar Basu and dedicated ECHO team members like Ms. Sutapa Bardhan and Ms. Tilottama Dey. Many of us will think what do they understand about Acharya P. C. Roy's work and life at the age of 2 to 5 years of age. But to experience it you have to come to Casa Dei-Bambini, working with 22 years in a Montessori House I have observed it "yes they can ", if you wish..and get yourself involved with them you too will believe it, mentioned Principal Santwana Basu.

Today we created a very stimulating environment for the children, where they will learn and experience what is science? Who is a scientist? and how does it work ?..so we prepared the environment by inviting our guests like Saikat Basu and honourable Prof Roychowdhury. We started our day with 'OM chanting and then with a small presentation of dance and recitation. After that children were overjoyed when they experienced some live experiments with vegetable juice mixing with some chemicals and their reactions (it was all with harmless solutions) like lemon juice, white vinegar, potassium permanganate, iodine using plant materials like potato, carrot, beet root, banana peel and so on, narrated Ms. Santwana Basu.

Dr. Montessori believed in Experiential learning and auto education, giving respect and getting respect in return, were ready to greet our guests with a smile and flower garlands. This is the way they learn to do or to create an eye that sees the world with a difference, a hand that creates

and a head that thinks.. focusing on holistic development of a child .

We, at Casa Dei Bambini follows Dr Maria Montessori's vision to build up a child's life holistically. And we believe the journey they have started with us will be remembered it forever. Our journey start from known to unknown, simple to complex and concrete to abstract.. this is the way they learn and grow at Casa- Dei-Bambini. 'It was a beautiful day…. and children enjoyed all the experiments and it went well' suggested Principal Ms. Santwana Basu.

Ms. Sutapa Bardhan, the Secretary of ECHO and a senior IT professional from IBM-India said, "Rich tributes were paid by the children of Casa Dei-Bambini, to Acharya P. C. Roy, eminent academician and founder of India's first pharmaceutical company on the occasion of his 161st birth anniversary". On behalf of the Science Association of Bengal, Secretary, Prof S. Roychowdhury explained the life sketch of Acharya P. C. Roy in simple languages and Saikat Basu demonstrated sone beautiful experiments to trigger the scientific empowerment of the kids. The children were very happy to get an interactive break from their daily routine. They enjoyed the videos on the life and work of Acharya P. C. Roy.

Ms. Bardhan mentioned that "….we ended our day with some musical performance... blessed to have such a beautiful day with all eminent guests and well-wishers with lots of love and showers of happiness for everyone participating in the program including students, teachers, non-teaching staff, parents, guests and other visitors. Ms. Tillotoma Dey, an ECHO member mentioned that "Each and every one in the school was EXCELLENT and made a difference to this program". Prof Roy Chowdhury

mentioned, " The little ones were Angels . God bless them all". Finally the teachers abs the Principal Ms Basu concluded by saying, "….and finally our hard work touched by the gracefulness, empathy and love from all our honoured guests abs visitors today has made this a place of worship for the kids who will slowly start their academic journey."

Photo credit: *Saikat Kumar Basu*

ENROLL YOURSELF TO NESA NEWSLETTER EDITORIAL BOARD MEMBER

Editorial board members of NESA newsletter will be revised for the year 2023. All the interested applicants may send their curriculum vitae to **Editor in Chief** by **15th June, 2023.**

ACTIVITIES AND SPECIAL DAYS AT A GLANCE IN THE MONTH OF FEBRUARY 2023

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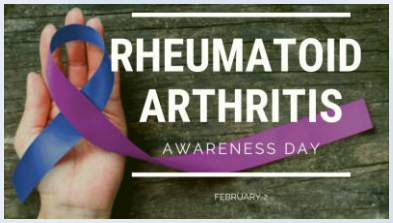
2 February: World Wetlands Day

Every year on 2nd February, World Wetlands Day is celebrated internationally. This day marks the date of the adoption of the Convention on Wetlands on 2 February 1971, in Ramsar, Iran. It was first celebrated in 1997. World Wetlands Day 2020 theme is 'Wetlands and biodiversity'.

2 February: RA Awareness Day

RA Awareness Day is Rheumatoid Arthritis Awareness Day and is observed on 2 February to spread awareness for patients suffering from rheumatoid arthritis.



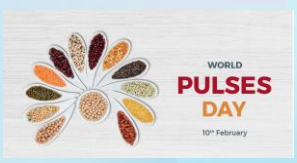
4 February: World Cancer Day

Every year on 4 February World Cancer Day is observed globally and is celebrated by WHO to aware people of the disease Cancer and how to cure it. The 2020 theme is 'I Am and I Will'. According to WHO, the theme is an empowering call to action urging for personal commitment and represents the power of individual action taken now to impact the future.

10 February: National Deworming Day

It is celebrated on February 10th. The Government of India's Ministry of Health and Family Welfare is working to ensure that no child in the nation has worms.

10 February: World Pulses Day



To raise awareness of the nutritional and environmental advantages of pulses as a component of sustainable food production, it is marked on February 10.

11 February: World Day of the Sick

It is celebrated on February 11th. Pope John Paul II established the day to give Christians a chance to pray for individuals who are unwell.

11 February: International Day of Women and Girls in Science

On February 11, it is recognized that women and girls have an important part in science, not only as consumers but also as innovators. The goal of the day is to enable women and girls to participate fully and equally in science.

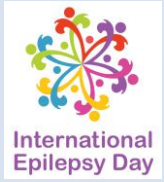
12 February: National Productivity Day

It is observed every year on February 12 in an effort to improve India's production culture. The National Productivity Council (NPC) observes it with a theme.

13 February: Sarojini Naidu Birth Anniversary

Sarojini Naidu, the Indian Nightingale, was born on February 13th, and this day is recognised as her birthday. Her parents, scholar and philosopher Aghornath Chattopadhyaya and Barada Sundari Devi, welcomed her into the world on February 13th, 1879 in Hyderabad.

14 February: International Epilepsy Day



International Epilepsy Day is always commemorated on the second Monday in February; this year, it falls on February 14, the day before Valentine's Day.

20 February: World Day of Social Justice

Every year on February 20, people around the world mark World Day of Social Justice to promote awareness of how social justice affects the fight against poverty.

27 February: World NGO Day

The purpose of the day is to recognize, celebrate, and respect all non-profit and non-governmental organizations, as well as the individuals who work for them and make contributions to society.

28 February: National Science Day

Every year on February 28th, India celebrates National Science Day to commemorate the day that Indian scientist Sir Chandrasekhara Venkata Raman discovered the Raman Effect. On February 28, 1928, he developed the Raman Effect, for which he was awarded the 1930 Nobel Prize in Physics.

SEAWEED: A RESOURCEFUL MEDICINE IN AQUACULTURE

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Introduction

The ocean provides food for its inhabitants because it contains chlorophyll bearing flora, called as producers. Among these important group of producers is the seaweed (algae) that vary in size from microscopic to macroscopic (multicellular). Technically seaweeds are defined as benthic marine algae are the group of plants that live either in marine or brackish water environment. Marine algae widely available in intertidal zone as well as in the coastal region between high tide to low tide and in the sub-tidal region up to a depth where 0.01 % photosynthetic light is available. Marine seaweeds produce food and oxygen through the process of photosynthesis. Similar to plant photosynthesis in the seaweed occur with the help of pigments, sunlight and nutrient present in the seawater. Seaweed is macroscopic and found attached to the bottom in relatively shallow coastal waters. The growth of seaweed is abundant on hard substrates and commonly extending to depths of 30 40 m. Seaweeds are similar in form with the higher vascular plants but the structure and function of the parts significantly differ from the higher plants.

Major types of seaweed

Seaweeds or benthic marine algae are the group of plants that live either in marine or brackish water environment (Dhargalkar and Kavlekar, 2004). The seaweeds are basically divided in three divisions namely, *Chlorophyceae* (green algae), *Phaeophyceae* (brown algae) and *Rhodophyceae* (red algae). This classification is based on the color of the seaweed, their cellular structure, and many other factors. This includes the red algae, brown algae, and green algae.

Green algae (*Chlorophyceae*)

Green algae are found in the fresh and marine habitats. These are range from unicellular to multi-cellular, microscopic to macroscopic forms. The green Algae are green because of the presence of chlorophyll. They need sufficient amount of sunlight to survive which is only accessible in shallow waters.

Entromorpha sp.

Distinctive green algae that is in the family Ulvales. It is both a temperate and tropical species, abundant in different forms worldwide. It grows in large clumps at the low tide zone on mangrove roots and coarse substrate. It tolerates a wide range of salinities from 17 ppt to 40 ppt.

Ulva fasciata

Ulva fasciata is grass-green seaweed, commonly called sea lettuce, because of its lettuce-like appearance. The size range is from 5 to 100 centimeters long and it is a common species in the intertidal to shallow sub tidal, often found in tide pools.

Caulerpa racemosa

Caulerpa racemosa is a species of green alga, belongs to the family Caulerpaceae. It is commonly known as sea grapes and is found in many areas of shallow sea around the world. The branches are a few centimeters apart and can grow to a height of 30 cm.

Brown algae (*Phaeophyceae*)

Brown algae are exclusively marine forms. The Brown Algae is considered the fastest growing seaweed species in the world. They have different forms from simple, freely branched filaments to highly differentiated forms. Many species have large massive thalli with special air bladder, vesicles or float to make them buoyant.

Dictyota dichotoma

Dictyotales is a large order in the brown algae (class: Phaeophyceae). Branches 3-12mm wide and commonly found rock pools and sub littoral zone.

Sargassum johnstonii

Sargassum is a genus of brown (class: Phaeophyceae) macroalgae (seaweed) in the order Fucales. Numerous species are distributed throughout the temperate and tropical oceans of the world, where they generally inhabit shallow water and coral reefs.

Spatoglossum asperum

Plants foliar, extremely variable in size and shape and variously divided into narrow segments. It is found to the intertidal zone, muddy substratum. Colour dark brown, turning to dirty green when decaying.

Red algae *(Rhodophyceae)*

Except for few species they are exclusively marine. Red algae are either epiphytes, grows as crust on the rocks or shells as a large fleshy, branched or blade like thalli. The coloration of Rhodophyta is due to water-soluble pigments, the red phycoerythrin and blue phycocyanin. Other pigments present are chlorophyll a &b, carotene etc. Kelp is a type of seaweed that has large leaf-like protrusions known as fronds and can grow as long as 200 feet.

Gracilaria corticata

Gracilaria is a genus of red algae (Rhodophyta) notable for its economic importance as an agarophyte, as well as its use as a food for humans and various species of shellfish. Found tide pools and on reef flats, intertidal to subtidal 4 meters deep.

Champia compressa

The highly branched plants are small, erect forming clusters, 3-5cm in height. Except for few species they are

exclusively marine. They vary in size and shape and they are either epiphytes, grows as crust on the rocks or shells as large fleshy, branched or blade like thalli.

Hypena sp.
These organisms can present thalli that vary from flattened to foliose, variously lobed and deeply incised, with heights up to 4 cm and widths from 0.5–2 cm, narrowing to short

Entromorpha sp.

Ulva fasciata

Caulerpa racemosa

Green algae species

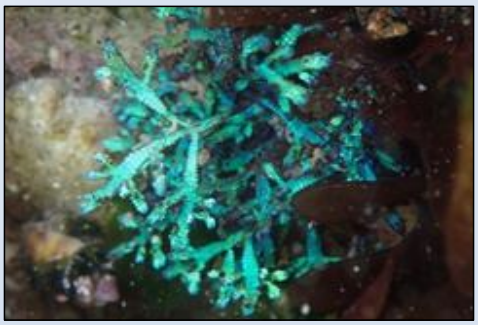
Dictyota dichotoma

Dictyota dichotoma

Spatoglossum asperum

Brown algae species

Gracilaria corticata



Champia compressa

Hypena sp.

Red algae species

Medicinal and pharmaceutical uses of seaweed natural products

Antiviral activity
Some sulphated polysaccharides from red algae show antiviral activities towards viruses responsible for human infectious diseases. Carrageenans demonstrate potential in vitro antiviral activity. Carlucci et al. (1999) noted that -carrageenan and partially cyclized mu/nu-carrageenan from *Gigartina skottsbergii* have potent antiviral effects against different strains of HSV types 1 and 2 during the virus adsorption stage.

Antibiotic activity
Chemicals responsible for antibiotic activities are dispread in macroalgae. Interesting substances in particular are the halogenated compounds such as aloforms, halogenated alkanes and alkenes, alcohols, aldehydes, hydroquinones and ketones (Lincoln, 1991). Many of these could be developed into antiseptics and cleansing agents, but their antibiotic activity in vivo is often only achieved at toxic concentrations (Lincoln, 1991).

Toxins – vermifuges, insecticides, ichthyotoxins, neurotoxins and others
Toxins are better know from microalgae and cyanophytes, but some are also known from macroalgae. Bioactivities of these compounds vary from being neurologically active in humans and other mammals, to algicidal, anthelmintic, insecticidal and ichthyotoxic activities. In some cases they

show acute toxicity and may cause death in humans at naturally occurring concentrations. The most important compounds are kainoids, aplysiatoxin and polycavernosides. Prostaglandin E2 is also sometimes noted for its acute toxicity, and is discussed in a later section.

Carcinogens and ulcer-causing compounds

Carrageenan is used in experimental research in animals where it induces pleurisy and ulceration of the colon (Noa et al., 2000). The carrageenan-induced rat paw edema assay and carrageenan air pouch models are widely used as test systems for the evaluation of non-steroidal anti-inflammatory drugs and cyclooxy-genase activity (Dannhardt and Kiefer, 2001). Despite its role in inducing ulceration in animals carrageenan is an important ingredient in many types of processed food. The role of carrageenans, particularly low molecular weight degraded carrageenans, in promoting colorectal ulcers, tumours and cancers in humans is controversial and much debated and is the subject of other reviews (Tobacman and Walters, 2001).

Meal

Seaweeds are cheap sources of minerals and trace elements. Hence the meals prepared from seaweeds can be given as supplements to the daily rations of the cattle, poultry and other farm animals. Seaweed meal can be obtained by grinding cleaned and washed seaweeds such as *Ulva*, *Enteromorpha*, *Sargassum*, *Padina*, *Dictyota*, *Gracilaria and Hypnea*. Seaweed meal can also be mixed with fish meal and used as poultry feed. Seaweeds have been utilized as animal feed in some countries.

Manure

Use of seaweeds as manure is a common practice in coastal areas throughout the world. In India it is used for coconut plantations especially in coastal Tamil Nadu and Kerala. The high amount of water-soluble potash, other mineral and trace elements present in seaweeds are readily absorbed by plants and they control deficiency diseases. The carbohydrates and other organic matter present in seaweeds alter the nature of the soil and improve its moisture retaining capacity. Hence, large quantities of seaweeds including sea grasses such as *Cymodocea*, *Diplanthera*, *Enhalus* and *Halophila* can be used as manure in all parts of the country either directly or in the form of compost.

Medical

The use of seaweeds in medicine is not as wide spread as it once was, the use of seaweed polymer extract in pharmacy, medicine and biochemistry is well established. Clinical trials are also in progress to make diabetic patients injection free by injecting small insulin secreting "jelly capsule" made of seaweed alginic acid. The capsule renders protection from white blood cells and the patient's immune system.

Cosmetics

An astonishing similarity between human skin tissue and algal cellular structure has helped to solve numerous cosmetic and dietetic problems. Presently, seaweeds have become a key ingredient in cosmetic products such as soaps, shampoos, powders, creams and sprays. A manufacturer of the skin products has found seaweeds to be naturally revitalizing, moisturizing and comprising of amino acids, minerals and vitamins that nourish the skin. Extracts of brown seaweed like *Fucus* spp. are used in thalassotherapy, a massage therapy, which eliminates impurities from the body and simultaneously balances the pH of the skin.

Conclusion

Seaweeds are autotrophic organisms that use sunlight to extract from the water dissolved inorganic nutrients and produce biomass the general functional principle of primary producers in an ecosystem. They play a very potent role in different industries including fertilizers, cosmetics, medical, aquaculture, waste management and pharmaceutical.

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EDIBLE MUSHROOMS: PROMOTING QUALITY LIFE AND IMPROVING HUMAN HEALTH

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Introduction:
Mushrooms have been valued by humankind as a culinary wonder across the globe. The distinctive umbrella-shaped fruiting body of some fungus, known as a mushroom belongs to the order Agaricales of the phylum Basidiomycota. The importance of mushrooms as therapeutics and food is notable in the traditional system of medicine since time immemorial. Mushrooms contain about 20-35% of protein (dry weight). In addition to protein, mushroom is a magnificent source of vitamin D, minerals *viz*., copper, iron, manganese, potassium, selenium and zinc, vitamins such as niacin and riboflavin, amino acids especially glutamic acid and lysine, high fiber content, low in calories, low in carbohydrates, low in fat and sodium, cholesterol free and gluten free. Moreover, the mushroom is an indispensable source of enormous secondary metabolites like glycosides, alkaloids, terpenoids, tocopherols, phenolics, flavonoids, carotenoids, steroids, anthraquinones, benzoic acid derivatives and quinolones. Mushroom possess prodigious nutraceutical efficacy such as antioxidant, anticancer, antidiabetic, antiallergic, immunomodulatory, cardiovascular protector, anticholesterolemic, antiviral, antibacterial, antiparasitic, antifungal, detoxification, hepatoprotective, anti-inflammatory and immune system enhancer. Edible mushrooms are of varied types *viz*., Oyster, White button, Milky and Paddy straw. Oyster mushroom belonging to the genus *Pleurotus* is an edible mushroom having excellent flavor and taste. Oyster mushrooms have been reported to be ideal for people suffering from anemia, hyperacidity and constipation. Amongst all the edible mushrooms, the cultivation of oyster mushrooms has expanded massively because of their aptness to grow at a wide range of temperature, utilizing various agro-based residues and easy availability of the raw materials. Nowadays, mushroom farming is being practiced in several countries. In recent times, greater emphasis has been laid on cultivation of nutri rich crops so as to meet the demand of nutritional security of India's ever-increasing population. Owing to the present context, a diversified agricultural system is the need of the hour. It is very much commanding because it can be grown even by landless farmers, that too on waste material. Keeping these points in view, the scope of mushroom cultivation for rural inhabitants is a profitable venture for the generation of self-employment avenues.

Culture Media for Mushroom Cultivation:
Peel off 250 g potato and are taken in a beaker containing 500 ml distilled water, boiled for about 30 min and the potato extract was collected. Add 20 g dextrose, 15 g agar and mix thoroughly. Raise the volume to 1000 ml. The pH was adjusted to 5.6 ± 0.2 with dilute acid or alkali. The media was transferred in 250 ml conical flasks, corked and sterilized by autoclaving at 15 lb pressure (121˚C) for 15 min.

Inoculum Preparation for Mushroom Cultivation:
(a) Tissue Culture Method: Fresh mushroom is washed with distilled water. The mushroom is surface sterilized with alcohol and its small piece is inoculated on the culture medium in petri plates. Now, the inoculated petri plates are kept in the incubator for 25°C. After 3-5 days small, whitish and fine mycelium emerges. Finally, the mycelium proliferates completely in 10-15 days which is called mushroom culture inoculum.

(b) Sporulation Method: The fresh mushroom gills are sterilized. The gills of mushroom are taken in the sterilized petri plates and kept in the incubator for 3-4 days. The spores from the gills dust out in the petri plates. Thereafter, the spores are collected and kept in the refrigerator. Finally, with the help of an inoculation needle the spores are picked and inoculated on the culture medium and are subjected to the incubator for 25°C. Finally, the mycelium proliferates completely in 10-15 days which is called mushroom culture inoculum.

Mother Spawn Preparation for Mushroom Cultivation:
The healthy wheat grains (1 Kg) are taken and cleaned thoroughly. The grains are then soaked in water for 8-10 h. Subsequently, the grains are boiled in 1.5 liter water for 20-30 min and are finally removed from water and let to dry and cool down. Now, the grains are mixed with Calcium Carbonate (10 g) and Calcium Sulphate (10 g) powder which removes the excess moisture from it. Calcium Carbonate maintains the pH of the medium. Finally, the grains are filled in a glucose bottle and plugged with cotton and are sterilized in the autoclave for 121°C for 2 h. After sterilization, the bottle is allowed to cool down and is taken in the inoculation chamber and inoculated with the mushroom culture inoculum and ultimately kept in the incubator for about 25°C for 10-15 days. After 10-15 days the inoculum spreads the hyphae in all directions and finally the mushroom mycelium spreads all over the grains which is now called the mother spawn.

Mushroom Cultivation Technique:
Firstly, the paddy straw is chopped into pieces of 1 inch. The paddy straw is then soaked in water overnight. Now, the straw is boiled in hot water (80-90°C) for 1 h. Then, the straw is sun dried for 1-2 h or until it retains 60-70% moisture level. Now, spawn the substrate in layer wise in cylindrical poly bags of 40 cm×60 cm. The poly bags are incubated at 28°C for 15-20 days in a dark room for mycelial

growth. The poly bags are housed in a poly house with partial shade for fruiting at 28-35°C. Finally, the pinheads are formed in 6-8 days and are ultimately ready for harvesting in 5-6 days (Fig. 1).

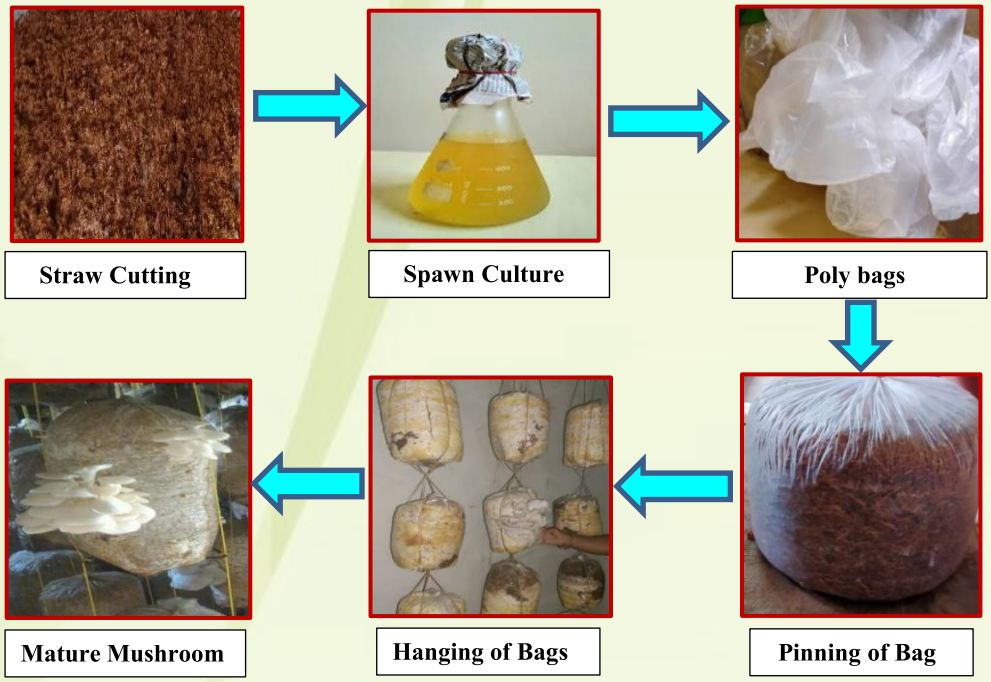

Fig. 1: Mushroom Cultivation Technique.

Precautions for Mushroom Cultivation:

- ❖ All the apparatus used during mushroom cultivation must be clean and sterilized. The clothing of the person handling the entire process must also be neat and clean.
- ❖ The mushroom seed used for cultivation purposes must be free from any contamination.
- ❖ The place where mushroom cultivation is carried out must be cleaned with the mixture of 2% Formalin and 0.05 % Bavistin and applied on the wall surfaces.
- ❖ All the handling instruments during the cultivation process must be sterilized with Potassium Permanganate Solution.
- ❖ The hand of the person harvesting the mushroom must also be cleaned and sterilized.
- ❖ In order to prevent the bacterial contamination during mushroom cultivation the solution of bleaching powder with water is used.
- ❖ The mushroom poly bags which are contaminated must be immediately removed and discarded away from the mushroom cultivation room.

Conclusion:

Mushrooms are endowed with enormous bioactive compounds, in addition to their nutritional and pharmacological properties. Research investigations have well documented that mushrooms contain enormous health promoting components with spectacular properties to prevent and treat several dreadful ailments. In future prospects greater emphasis will be laid on the cultivation of mushrooms and extraction of the bioactive compounds so as to develop an efficient biotechnological method to harness these metabolites for improving the quality of life and rendering tremendous health benefits for mankind. Further detailed studies on the mechanisms of action of mushroom extracts will delineate the properties of diverse bioactive metabolites of mushroom as curatives. Thus, in view of the current scenario, the research on bioactive compounds in cultivated mushrooms is yet deficient. However, there are numerous potential characteristics in the mushrooms possessing nutraceutical and health benefits, which have so far not been completely explored and deserve further extensive investigation in future to unturn the mystery of mushroom.

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