ISSUE -1, JUNE 2016

NORTH EAST BIOLINE

THE NEWSLETTER OF GUWAHATI BIOTECH PARK

GUWAHATI BIOTECH PARK

Discovering through partnership

Department of Science and Technology, Government of Assam

GUWAHATI BIOTECH PARK

Guwahati Biotech Park (GBP) is the first Biotech Park in North East India and is a joint initiative of Govt. of Assam and Department of Biotechnology (DBT), Govt. of India. Guwahati Biotech Park was incepted in the year of 2008 through its registration as a society under Societies Registration Act, XXI of 1860.The objective of GBP is to encourage and support the startup, incubation, innovation led business in the biotechnology and allied area saccelerating entrepreneurship development and biotech industrial ventures in North East India by providing laboratory infrastructure, instrument facility, business enterprise zone, support facility and other scientific and technical support. The park has presently established an incubation centre namely Guwahati Biotech Park Incubation Centre (GBPIC) with a major financial support from Department of Biotechnology (DBT), Govt. of India and technical mentorship of IIT Guwahati. GBPIC is currently functioning from a temporary premise within the IIT Guwahati campus. GBP is coming up with its permanent campus at Amingaon very soon.

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Subscription :
You can subscribe to our Newsletter by sending a Demand Draft in favour of 'CEO, Guwahati Biotech Park', payable at Guwahati to 'Guwahati Biotech Park, Technology Complex, IIT Guwahati, Guwahati – 781 039
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Shri Sarbananda Sonowal

सत्यमेव जयते

Chief Minister, Assam
Guwahati

Dispur
24.06.2016

MESSAGE

I am happy to know that Guwahati Biotech Park is all set to come up with its first newsletter which I believe is the right endeavour in disseminating knowledge and generating awareness of development of the biotechnology and allied areas.

Guwahati Biotech Park, a noble initiative of Assam Government is offering a host of opportunities to tap biodiversity potential of this reason in an impressive way. It is also taking a lead in unleashing biotech industrial revolution and also creating employment generation.

I hope the newsletter going to be published will reflect mission and vision of the Biotech Park which will create an ideal environment conducive for industry oriented research and innovative commercial ventures in the States.

I wish the publication all success.

(SARBANANDA SONOWAL)

SRI KESHAB MAHANTA
Minister,
Water Resources, Science & Technology,
Information Technology

सत्यमेव जयते

Assam Secretariat, Dispur, Guwahati-6
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MESSAGE

I am happy to know that the Guwahati Biotech Park is the first Biotech Park in the North East India, was incepted in the year of 2008 in a joint initiative of Govt. of Assam and Department of Biotechnology, Govt. of India with an objectives to encourage and support the start up, incubation, innovation led business in the biotechnology and allied areas accelerating entrepreneurship development and biotech industrial ventures in North East India by providing laboratory infrastructure, instrument facility, and other scientific and technical support. I am also happy to note that the Guwahati Biotech Park is going to publish a Newsletter for awareness on current happenings in Biotechnology and allied areas.

I hope the Newsletter will provide insight into various Biotech activities and the greater scientific as well as general community will be immensely benefitted.

Wishing the Newsletter a grand success.

(Keshab Mahanta)

Shri V. K. Pipersenia, IAS
Chief Secretary

सत्यमेव जयते

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MESSAGE

Guwahati Biotech Park was established by the Government of Assam with the support of Department of Biotechnology, Government of India with an objective to promote, support and facilitate the overall development of biotechnology in the state. Ever since its establishment, Guwahati Biotech Park has been facilitating the development of infrastructure, research and human resources in the field of bio-technology.

Assam, being one of the 34 biodiversity hotspots in the world, with abundant availability of natural resources, fast growth rate, peaceful labour environment and availability of skilled manpower provides an attractive investment destination. I hope Guwahati Biotech Park will help in realizing the potential of the State in the field of bio-technology.

The publication of a newsletter is a commendable initiative of Guwahati Biotech Park to bridge the gap between the grassroot-level entrepreneurs and the industry.

I wish the Guwahati Biotech Park team all success in this endeavour.

Date : 4th June, 2016

(V.K. Pipersenia)

भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Technology Guwahati

Prof. Gautam Biswas
FNA, FASc, FNAE, FNASc, F-ASME, FIE
Director and J. C. Bose National Fellow

गुवाहाटी–781 039, भारत
Guwahati–781 039, India

MESSAGE

June 3, 2016

It is indeed a great pleasure to know that the Guwahati Biotech Park, the first Biotech Park in the North East India and a joint initiative of Govt. of Assam and Department of Biotechnology (DBT), Govt. of India, has initiated to publish its first "Newsletter cum Journal". I am delighted to write a message for this Newsletter.

It is to be mentioned that establishing an Incubation Centre named Guwahati Biotech Park Incubation Centre (GBPIC) during the past years is a remarkable achievement of the Biotech Park. The Centre facilitates start-up entrepreneurs on a short term basis.

I am sure that this "Newsletter cum Journal" will provide adequate information about the recent advancements in science and technology, in general and the information about the Guwahati Biotech Park Incubation Centre in particular to the stake holders in the North-East India.

I would like to congratulate the team members associated with this "Newsletter cum Journal" and wish them a great success.

Gautam Biswas

(Gautam Biswas)
Chairman
Guwahati Biotech Park Incubation Centre

Shri Biswaranjan Samal, IAS
Commissioner & Secretary
Science & Technology Deptt. Government of Assam

MESSAGE

Biotechnology is recognized as one of the fast growing technology areas and it has seen major developments in recent times. Assam and other North-Eastern states contain huge reservoir of bio-resources most of which are still unexplored. Intervention of modern biotechnology in exploring potential of these resources is likely to usher in a new era of entrepreneurship and growth in this part of the country.

With these objectives, Government of Assam has started Guwahati Biotech Park with support from DBT, Government of India. This park has state-of-the-art infrastructure facilities and it caters to the needs of biotech start-ups in this area. It provides a platform for allied companies to set up ventures which will contribute to the overall economic growth of the state.

I am glad to learn that Guwahati Biotech Park is publishing this newsletter.

My best wishes to the GBP team for this initiative.

Biswaranjan Samal

(BISWARANJAN SAMAL)

From the CEO's desk

सत्यमेव जयते

Shri Vinod Seshan, IAS
Chief Executive Officer
Guwahati Biotech Park

I am truly excited to see GBP come up with the first edition of its newsletter. Congratulations to the entire GBP team!! This newsletter presents many new articles, many new ideas, experiences, views and gives an insight into the functioning of GBP as well. A very sincere attempt has been made to make it as professional as possible with proper designs, attractive cover pages and quality domain-content that is useful to the reader, especially to those in this great inspiring world of biotechnology and its allied areas.

Guwahati Biotech Park (GBP), a society under the Department of Science and Technology, Government of Assam, is the first of its kind in the North Eastern Region (NER) aiming at providing opportunities for technological innovation in the entire Biotech spectrum. Being an intensive knowledge-based sector, enterprises set up under this ever-expanding sector, have immense focus on activities such as research, innovation, product-design, product-analysis and experimentation. While large enterprises have the bullish capital and skilled human resources required to invest on such high-technology activities mentioned above, on the other hand, start-ups, student-researchers and small entrepreneurs with brilliant ideas often struggle with the need for investment-capital and technical support. It is this capital-tech-support gap that GBP intends to fill-in.

It gives me immense pride to share that this park is facilitating such needs of startups, small businesses, students, entrepreneurs and researchers by setting up facilities such as Central Analytical Facility, Common instrumentation facility, Modular Laboratories etc with many high-end equipments. The main business of GBP thus is to lease out quality lab-spaces with state-of-the-art instrumentation support, to promote quality research and innovation in the biotech-domain. We also provide sample testing and analytical services to many organizations at competitive rates. Today GBP is encouraging students to participate in various training programs on different facilities available with us, as well as, providing opportunities for internships, projects and dissertations. This park is also hosting exposure visits for the students of North-East in order to encourage and create awareness in young minds on biotechnology and related areas. GBP has also initiating signing of Memorandum of Understanding (MoU) with different universities for fruitful industry-academia collaboration.

The process of construction of a TECHNOLOGY INCUBATION CENTRE at our permanent campus in Amingaon, Kamrup has already been commenced with the support from the Science & Technology Department, Government of Assam. A detailed DPR is presently under preparation and is expected to be presented to the Government very shortly. The present incubation centre of GBP is temporarily housed within the campus of Indian Institute of Technology, Guwahati, in a hired space.

While the revenue earnings of GBP from its incubation centre are increasing with every passing fiscal, it is however not sufficient to fund and sustain long-term research programs. It is thus also imperative that GBP starts venturing into setting up of a full business zone. We need large capital investments to flow into the park to facilitate product-making, manufacturing and support long-term research. It is with this vision that GBP has started preparatory works for promoting a BUSINESS ENTERPRISE ZONE, which will enable large corporate, multi-nationals, other successful start-ups, researchers or incubates or related industries to set up their units within it. There is already a consensus that this zone should be set up in partnership with a Financial Institution. This will in turn contribute to the economic development of the state and as well as contribute to the demand of quality manpower in this sector.

To ensure a continuous supply of skilled manpower to this vital space of life-sciences, we have proposed to establish a CENTRE FOR BIO-ENGINEERING to promote an integrated study and research in biotechnology, environment, life sciences, research on the abundantly available bio-resources in the north east region, on bio-informatics and other allied areas. Such a centre, apart from ensuring highly skilled human resources, it will also benefit start-ups, students and researchers in this field to seek scientific advice and to fulfill their aspirations.

In the year 2015-16, GBP launched many initiatives like seminars, paper-presentations, workshops and an annual conclave to market its presence as well as to generate significant awareness on the study of biotechnology. We also participated in many national events and regional events on Biotechnology and other related sectors. The responses and queries that we have received from the students, entrepreneurs and researchers in Assam as well as the North-Eastern region, to the activities initiated by us, have been very encouraging and inspiring. As we move into another financial year, we intend to make this awareness generation more stronger, conduct more student-owned programs, see more students come to GBP and its incubation centre, organize more seminars and workshops, promote and support more research projects, recognize innovations and efforts by individuals and institutions, begin construction of our permanent technology incubation centre (TIC), promote our business enterprise zone to invite multi-national corporations to Assam and generate more value to the students and researchers in this region. GBP also aims to serve as a vital link between the academia and industries/start-up entrepreneurs of this time and take a key position in the North-Eastern region as the nodal organization in the biotechnology space.

I hope you find GBP as well as this first edition of its newsletter useful to you. Please write to us with your valuable feedback. As we grow further, we intend to grow more useful, generate more credibility and create more value, even while learning and improving continuously and tirelessly for a better future for all of Assam and this entire bio-region.

(VINOD SESHAN)

ACKNOWLEDGEMENTS

NORTH EAST BIOLINE is a collection of many articles, ideas, proposals and views of many innovators, researchers, practitioners and academicians from the field of Biotechnology and other allied areas. The idea to launch a newsletter for biotechnology was first mooted in the month of FEBRUARY 2016. Since then we have been busily involved in collecting articles and short-listing them for publishing in the first issue. Though initially we hoped to have a monthly newsletter, we however, thought later that a quarterly newsletter may perhaps be good- enough to start with. The number of issues, released may increase with time and credibility.

Today, on the occasion of release of our newsletter, we feel satisfied with the content of this issue. While there is a lot more to improve on the content and a still a long distance to travel to build credibility, I feel, this issue is a good one to start with. For Guwahati Biotech Park, the release of this newsletter is an important milestone and hence we wish to acknowledge the heart-full contributions made by some great people, without whom the GBP team probably would have been left alone...

First of all, we wish to thank **Shri Sarbananda Sonowal**, Hon'ble Chief Minister of Assam for giving time and taking a detailed review of Guwahati Biotech Park in such a short time since taking over the responsibility of the State of Assam and committing all support to the institution.

We sincerely wish to thank **Shri Keshab Mahanta**, Hon'ble Minister, Science and Technology, Government of Assam for his inspiring support to the Biotech Park program ever since he took over as the Minister in charge of the department. His field visits, positive support and patient hearing of problems- faced have given a fresh and much needed boost to the entire park and the entire team.

We wish to sincerely thank, **Shri V.K. Pipersenia, IAS**, Chief Secretary, Assam for his all-time, grand-support to GBP and its work. Ever since the first review was done in the month of October 2015, certain key proposals pending for a long time have been debated and approved under his active leadership. Many strong decisions taken in meetings, chaired by him, have greatly boosted the morale of the entire team of Guwahati Biotech Park. We express our sincere gratitude to him and hope to grow further under his fatherly guidance.

We express our sincere gratitude to **Shri. Biswaranjan Samal, IAS** for having a very caring concern for GBP every time we had to take up proposals for budgetary grants. His great trust in us, his encouragements and our many fruitful decisions with him have helped us a lot in submitting many important proposals related to the Guwahati Biotech Park. We are also grateful to officers and staff of Science and Technology Department for processing all papers related to us.

We sincerely wish to thank **Smti. Aruna Rajoria, IAS**, for her candid, tireless and enthusiastic support to our entire team and GBP as a whole, in all our endeavors in the last 8-10 months. We probably will want to call her our most valuable team member, without whom, many decisions that have come-through in the last few months would probably have still continued to remain in square-one, decaying with time. Her candid approach to the issues we presented, converted our worries into joy within moments.

We also owe, very-very sincere thanks to **Prof. Gautam Biswas**, Director IIT Guwahati, for his continuous encouragement, fledging support, futuristic advices, inspiration and leadership at all times. He is just a call away every time and has always shown such simplicity and warmth that the confidence of our team members multiplied many-times every time we had an opportunity to meet him. He has a great heart for research and great support for students' involvement at GBPIC. We hope, the GBP incubation center would grow very strong under his guidance.

We express our sincere gratitude to all former CEOs of Guwahati Biotech Park namely **Dr. Anil Chandra Ghosh, Dr. M. Angamuthu, IAS** and **Dr. J. Balaji, IAS**, all of whom who have guided GBP to its present position of strength in Assam and in the North east.

We owe our sincere thanks to **Department of Biotechnology, Government of India** for their persistent trust and support to Guwahati Biotech Park, its incubation center and its team. GBP has been a great beneficiary of DBT's kindness and vision and we are resolved to live up to the expectations of DBT as well as Government of India.

Further, we also intend to offer our sincere thanks and gratitude to many great men and women like **Prof. B.G. Unni**, Director, Research, Biological Science, Assam Down Town University, **Prof. D. Yogeswara Rao**, Former Adviser, Government of India, Hyderabad, **Prof. Prasanna**, Dean R &D, IIT Guwahati, all our authors in this issue, all our stakeholders, all our partners and all students, whose contributions and associations with Guwahati Biotech Park have made the park a great beneficiary of their valuable experiences, vision, innovative ideas and thoughts.

We sincerely hope that this issue of **NORTH EAST BIOLINE** is useful to one and all. We will be very elated to receive any feedbacks and reviews on this issue.

FROM THE ENTIRE TEAM OF GUWAHATI BIOTECH PARK

EDITORIAL

"Any Science or Technology which is sufficiently advanced is indistinguishable from magic" – Arthur C. Clarke.

While mankind is shining through its glorious achievements in science & technology, the uncontrolled population burst, rapid urbanization, huge demand for food, shelter, medicine , new lifestyle products and exploitation of natural resourses are now emerging as major challenges to the mankind or more precisely to the science compelling it to enter into extreme competitiveness of new innovation and industrialization. 'Science' now has to eventually transform itself into 'Sustainable Science' in terms of using abundant and easily available raw materials, simple-recyclable-low cost- waste less-environment friendly technology and most importantly parallel replenishment of used natural recourses. For a developing country like India and state like Assam, we need to innovate new processes or products based on local resources using the blend of 'Modern Technology' and 'Sustainable Science' so as to reduce our dependency on importing products or technology from others at high cost. We also need to develop technologies of our own to solve our local problems we are facing from decades like flood, soil erosion and also emerging issues like biodiversity conservation, polution control etc.

Assam and other North Eastern states have to seriously value, wisely choose and effectively utilize its potential biodiversity treasure spread across the forests, hills and the rivers like the Brahmaputra. We really need to innovate some 'New Product' from our region as next generation globally recognized brand after 'Tea', 'Oil' & 'Coal'. We have talents in science but we need to create much more of such talents and build sufficient infrastructure to accomplish such goals. For which, popularization of science and the modern fields like biotechnology will play a vital role. Biotechnology is one of the rapidly growing modern technology sectors offering new innovation driven products and services as per the increasing global demand. From Indian perspective, by 2025, India's Biotech Industry is estimated to reach USD 100 billion. The key segments in the Indian biotech industry are bio-pharma, bio-services, bio-agri, bio-industrial and bio-informatics. Thc NE states with its huge bio-resources and agriculture can find substantial share in the bio-pharma and bio-agri segments of Indian Biotech Industry.

Guwahati Biotech Park (GBP) is offering advanced infrastructure facilities like ready-to-use modular laboratories & high end instrument facilities for young researchers, entrepreneurs and start-up companies to start ventures in biotechnology & allied areas. GBP is also taking initiatives in encouraging young talents through organizing training programs, internship, project disseration work, seminars, conclaves, exposure visits to modern facilities etc. This newsletter is one of such humble initiatives.

I am extremely happy and excited about publishing of GBP's News Letter, 'North East Bioline' the first issue of which is coming up as June 2016 issue. It is my honoured privilege to offer our gratefulness to the Hon'ble Chief Minister of Assam for blessing this initiative with his valuable and encouraging words. It is my great pleasure to offer our gratefulness to Hon'ble Minister of Science & Technology, GoA, the Chief Secretary, GoA, the Director, IIT Guwahati and the Commissioner & Secretary, Science & Technology Dept. GoA for their encoragement with precious words. I would like to thank DBT, GoI & S&T Dept, GoA and all those who are directly or indirectly associated with GBP and for enriching us with their valuable advice and encouragements. I would like to offer my thanks to Shri Vinod Seshan, IAS, Chief Executive Officer, GBP for his initiative, constant encouragement and advice in publishing this newsletter from GBP. I thank all the esteemed authors of the articles for making this newsletter a valuable manuscript through their scholarly thoughts and knowledge. I sincerely thank the sponsoring agencies whose association and contribution helped us a lot in this endeavour. I would like to thank Shri Bishnu Kamal Borah, ACS, Administrator GBP for his support. I offer my thanks to my colleagues in Editorial Team Ms. Jahnabi and Ms. Ashma for their enthusiasm and pro-active role in publishing this newsletter. I would like to thank all my colleagues at Guwahati Biotech Park for their valuable advice and support in this endeavour.

I believe this beginning will give a new momentum to GBP and its initiatives for popularizing biotechnology and allied areas in Assam and entire North East and hope blessings from all will make this initiative of contributing towards science and technology an incessant journey.

Thank You
Dr. Madan Gopal Barthakur

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SCIENCE & TECHNOLOGY DEPARTMENT, GOVT. OF ASSAM - AT A GLANCE

Mandate of the Department:
The Science & Technology Department of the Govt. of Assam was created in order to
1) Providing Science & Technology support for sustained economic development of the state
2) Promoting Space applications for Development and Governance
3) Popularizing the use of Science for Socio-economic benefit in the field of innovation, research, development and intellectual property rights along with environmental understanding and conservation.
4) Harnessing of Solar, and other forms of non-conventional and renewable energy,
5) Supporting start-ups, incubation and innovation led developments
6) Promotingt science among the general people across the state, establish new institutions of excellence in the field of science, maintain the facilities already developed, and encourage the use of science for the benefit of common man.

Organisations / Directorates under the Science & Technology Department:
1. Dirccloratc of Scicnce & Tcchnology
2. Assam Science, Technology & Environment Council (ASTEC)
3. Guwahati Biotech Park (GBP)
4. Assam Energy Development Agency (AEDA)
5. Guwahati Planetarium

Existing Schemes of the Department:
1) Aryabhatta Science Centres
2) Science Mathematics Facilitators
3) Crossword Puzzle
4) Translation of Science Based Books
5) Grooming and Monitoring of Students
6) Discussion Forums with Co-ordinators and Students
7) Training Programme for Skill Formation
8) Students Science Projects
9) Research and Development Programme
10) Innovation, Technology Generation and Awareness
11) Patent Information Centre
12) Radio Astronomy
13) Instrument Repair and Development Centre
14) Establishment of S&T Library
15) State and District Level Children's Science Congress
16) Nalbari, North Lakhimpur, and Kokrajhar Planetarium.
17) Science Popularization at Jorhat Science Centre and Planetarium
18) Science City, Guwahati
19) State Biotechnology Cell.
20) State Climate Cell
21) Setting up of Innovation Hub in Jorhat Science Centre and Planetarium
22) Sensitization on Biodiversity and Climate Change
23) Rapid production of Orchid through Tissue Culture (Phase-II)

ASSAM SCIENCE TECHNOLOGY & ENVIRONMENT COUNCIL (ASTEC)
ASTEC was established as an autonomous Council by the Department of Science & Technology, Government of Assam in the year 1986-87, registered under Societies Act 1860. ASTEC is the principal organ to implement the Science & Technology programmes of the state government as well as "State S&T programmes" of Govt. of India. It has 3 Divisions:
1. Science & Technology Division
2. Environment division
3. Assam Remote Sensing Applications Centre

Goals of ASTEC :
1) To formulate policies on various aspects of science, technology and environment which are in the interest of the state and the country.
2) To formulate schemes/programmes on the various aspects of science, technology and environment.
3) To execute/ implement schemes on science, technology and environment of the Govt. of India, Government of Assam, North Eastern Council and other public bodies.
4) To promote research in the field of science, technology and environment in Assam by giving financial support to scientists, technical persons and experts working in institutions or otherwise in the State.
5) To advise the concerned departments/organisations of the Government of Assam, public bodies' etc. on various aspects of science, technology and environment, in so far as the departments/organisations are concern.

Some major programmes of ASTEC :
1) Science Communication programmes across the state
2) Aryabhatta Science Centre in all the 219 development blocks of Assam
3) Patent Information Centre (instrumental in getting GI for Muga Silk of Assam)
4) Setting up of Planetariums and Science Centres
5) Research & Development programmes

6) Promotion and transfer of technology
7) Environmental Information System (State ENVIS Centre of Ministry of Environment, Forests & Climate Change, Govt. of India)
8) Environmental education, awareness and conservation programmes
9) National Green Corps. 5407 nos. of Eco-clubs sets up in as many schools under this scheme covering all districts
10) Application of Remote Sensing Technology for multiple uses
11) Remote Sensing Division is now implementing SIS-DP programme – a programme of Dept. of Space, Govt. of India
12) Other programmes of remote sensing division includes, wetland mapping preparation of land-use map of the state, etc.
13) Promoting new and renewable sources of energy

ASSAM ENERGY DEVELOPMENT AGENCY (AEDA):

AEDA was carved out of ASTEC in 2002 from the Energy Division to act as the nodal agency of MNRE, Govt. of India and registered under Societies Act 1860.

Major programmes and activities of AEDA:

1) Solar Photovoltaic programmes including Rooftop solar PV
2) Training & implementation of improved Chulha
3) Assessment of wind potentials
4) Demonstration of renewable energy products through active participation in different exhibitions in the state
5) Solar water heaters
6) Use of Bio-mass
7) Energy Conservation & Energy Audit

Highlights of achievements of AEDA :

1) AEDA electrified 771 villages covering 38973 households under Remote village electrification programme
2) Installed about 30000 LPD water heating system
3) Installed SPV power plant of about 700 kWp
4) Wind Resource data are collected for more than 45 sites at different heights covering the entire state
5) Biomass gasifier in 4 locations
6) Distributed 5000 solar home lights & 400 solar street light
7) Conducted more that 100 exhibitions
8) Distributed 1000 solar lanterns under CSR schemes

On-going Projects at AEDA :

1) Installation & Commissioning of 50 KWp Solar Power plant at Gauhati High Court- under commissioning– Sanctioned by MNRE, G.O.I
2) Installation of 10 kWp each Solar Power plant at 9 locations under Piped Water Supply Scheme (PWSS) of PHE Departement in Dibrugarh, Tinsukia and Sivasagar districts(recently completed) - Sanctioned by MNRE, G.O.I.
3) Installation & commissioning of 9 nos 80 M Tall Wind Mast under OIL – NIWE (National Institute of Wind Energy) collaborative project.
4) Installation & Commissioning of 100 kWp Solar Power plant at Assam Secretariat
5) Training on construction of Improved Chulahcurrently on at forest fringe villages of Manas Tiger Reserve

GUWAHATI PLANETARIUM:

Guwahati Planetarium under the Science & Technology Department, Govt. of Assam is a unique institution of its kind in the North- East Region which was open for general public on 17th August, 1994. The prime objective of the Guwahati Planetarium is to promote Scientific and Astronomical knowledge among the students and general public. Since the beginning of the year 2011, a new Hybrid System had been introduced with a view to providing advanced electronic based Planetarium Programme replacing slide projection system.

At present Guwahati Planetarium is showing 5(five) shows daily from 11-00 am to 4-45 pm on 3(three) different topics " Cosmic Collision", "Journey to the Stars" and "Are we alone ? Search for Life!". In addition to regular shows Guwahati Planetarium has been conducting awareness & Sky watching programmes on special astronomical events occurring time to time. Guwahati Planetarium remain closed on 1st and 15th of every month maintenance works; remaining period the planetarium kept open for benefit of public who come from various places of Assam as well as neighbouring States.

Guwahati Planetarium has machineries & equipments of crores of Rupees as well as the planetarium have been visited by hundreds of visitors daily. To serve as knowledge based science communicator, the Planetarium has to take another step by introducing regular training programme to impart knowledge to new generation. All planetarium in other parts of the country and also in the world, have already addressed this vital issue.

It may be mentioned Guwahati Planetarium in association with Scientific NGO's has relentlessly arranging lectures on astronomy, astrophysics and cosmology in the Planetarium in association with the Planetarium over and above guided night sky observation in Planetarium Premises and also in other parts of Guwahati and entire Assam.

Guwahati Planetarium has already been declared as an institution of higher education & scientific research for advancement and development of Science, Technology and Research. To this effect, Guwahati Planetarium has recently procured one sophisticated 14-inch aperture Smith-Cassegrain HD Telescope.

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Kavi-Krishna Laboratory (KKL)

Goals of KKL

- To Spread Global Health Cancer-Biotechnology Research Program by collaborating with National and International Research institutes/ universities / medical colleges.

Vision statement of KKL

- Kavi-Krishna's vision is to help Ideas to Shine.
- Kavi-Krishna identifies and supports creative ideas to grow into action by providing strategic, financial and organizational support to individual who conceive those ideas.

Motto of KKL

Research team of KKL

From right Dr. Bikul Das (Director), Dr. Debabrat Baishya (Consultant Scientist), SeemaBhuyan (Lab Manager) Sorra Sandhyaand Joyeeta Talukdar (Senior Research Assistants)

Mission statement of KKL: To become a leading social entrepreneurship organization by supporting innovative ideas to grow, from its conception in the mind of a single individual (PratakshGyan) to become the potential force of socio-economic action (Samajik Karma). The main purpose and focus is to select and support creative and innovative entrepreneurs having ideas that matter for the society to move towards a sustainable future.

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DBT TO EMPOWER FARMERS IN THE NORTH EAST INDIA BY PROMOTING ORGANIC FARMING

Dr. Pawan Sharma, PhD, FNASc,
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The Department of Biotechnology (DBT), Government of India, has been spearheading biotechnology-based development in the North Eastern Region (NER) of India. Its proactive initiatives in the areas of agriculture, healthcare and aquaculture & animal biotechnology have brought about palpable, positive change in the development scene in NER [1](Sharma and Mohan 2016). DBT implements its programmes in NER through its dedicated cell, namely, the NER Biotechnology Programme Management Cell (NER-BPMC) under the leadership of Dr. T. Madhan Mohan. One of such developmental programmes relates to a network project on training and helping farmers to adopt eco-friendly agriculture practices. Replacing deeply entrenched practice of using chemical fertilizers and pesticides in the traditional farming with organic farming practices, requires sustained engagement with farmers on the subject, providing them with adequate training, requisite bio-inputs and pest- and stress-resistant varieties of various crop plants. During his recent visit of North East India in May 2016, the Honorable Prime Minister, Shri Narendra Modi declared at a public meeting in Shillong (Meghalaya) that North East was poised to emerge as the organic farming capital of India. DBT has contributed towards realizing this dream by imparting necessary training to thousands of farmers at 14 Krishi Vigyan Kendras (KVKs) spread across the eight NER States, in organic farming of key high-value crops. These efforts have shown promising early results in terms of enhanced productivity. Thus, using biofertilizers and biopesticides such as farmland manure, vermicompost, neem cake, Trichodermaharzianum Azospirillumspp., phosphate solubilizing bacteria, etc., farmers have obtained 5 to 29 % increase in the yield of ginger, 6 to 32% of turmeric, 9 to 36% of king chilli, and 5 to 70% of French beans,at various experimental fields in different NER States. Similarly, in pineapple, upto 28% increase in the yield was obtained over a period of three years.

As described by Sharma & Mohan[1], DBT also helped in obtaining group certification from a govt agency, for organic produce of the farms involved in this project.This would help farmers to sell their produce as 'organic certified'. It must be emphasized though that organic certification needs to be obtained at regular intervals as per statutory regulations, to maintain the 'organic' status of the farmland. It may also be pertinent to point out that organic farming does not yield instant good results; it takes sustained and scientific application of suitable bio-inoculants for a few years before the benefits of organic farming become tangible, fruitful and profitable. Thanks to DBT's support, each of the 14 KVKs that participated in this project is now fully capable of large-scale multiplication of Trichodermaspp. and other tested bioinoculants. It is hoped that KVK's will continue to help farmers in adapting agri-biotech knowledge to enhance their production practices using recommended biocontrol agents.

This programme also demonstrated the feasibility of productive collaboration between DBT and research institutions of the Indian Council of Agriculture Research (ICAR) in the North Eastern Hill Region atUmiam, (Meghalaya). Such collaborations between different govt. agencies is a welcome step forward in enhancing integrated support for promotion of knowledge-based agriculture as well as other biotech sectors in NER. It is hoped that individual investigators would now feel empowered to continue further work as fresh projects.

Recently, DBT has launched another unique programme, a collaborative programme between various institutions in several states of NER and those located in the Bengaluru biotech cluster, viz., NCBS, GKVK, IISc and others, on unraveling the chemical interactions between flora and fauna of NER. This programme on Chemical Ecology is the first of its kind in the country and perhaps only the second in the world, aimed at learning the chemical mantras of co-existence of so many species in extremely diverse eco-systems of NER, rightfully dubbed as one of the biodiversity hotspots of the world. Perhaps there are lessons to learn from here which might prove critical for harmonious coexistence of man and nature. Scientists from central universities in all the eight states, DBT's Institute of Bioresources and Sustainable Development (IBSD) in Imphal (Manipur), Nagaland State Council of Science & Technology, bring crucial inputs from NER to this multicentric project. Initial experiments are focused on exploring the chemical nature of naturally occurring plant-derived pesticides and insect repellents, such as those from the plant species of Artemesia, and mechanisms of their action on the insect brain. Highly aromatic oak borer larvae constitute a

prized delicacy in some regions of NER; these larvae are also considered to possess high therapeutic value. The Chemical Ecology scientists are exploring the chemical nature of aromatic compounds of these larvae in order to understand their evolutionary, ecological and medicinal value.Very manynew ecological paradigms are expected to emerge from this programme.

DBT would continue to serve the cause of development of NER through its relentless effort to bring the benefits of biotechnology research to the door step of common man.

[1]Sharma, Pawan and Mohan,T Madhan. 2016. Role of DBT in promoting biotechnology-based development in North East India. Current Science 110 (4): 562-572.

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MUGA SILKWORM
THE PRIDE OF ASSAM

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Muga silkworm, *Antheraea assama* is unique and is indigenous to the North Eastern region of India particularly Assam and its neighbouring states.The climate of North East India is suitable for growth of non-mulberry silkworms i.e., muga. . Muga silkworms are raised primarily on two types of trees i.e., som (Persea bombycina Kost) and soalu (Litsea polyantha Juss). The silk is called muga, the Assamese word for the rich amber colour of the cocoon. Muga is a mono-race, multivoltine in nature and 5-6 crops are raised in a year. Two are commercial crops, viz. Jethua (May-June) and Kotia (October-November) and remaining four are pre-seed (Jarua: December–January and Aherua: June-July) and seed crops (Chotua: February-March and Bhodia: July-August). At present, the business of Muga, the golden silk is worth of Rs 200 crore. With proper organization, the industry could grow up to 10 times of its current size. . On economic front, at present, about 7570 hectares of land is under Muga food plantation, and annual production of raw silk in the region is 100 MT. More than 30,000 families are engaged in Muga culture directly and more than 1 lakh families are involved in the post cocoon sector making it a profit making industry in the region. Muga silk was recognized as a protected geographical indication (GI) in 2007, and was granted a GI logo for trademark purposes in 2014. India produced 158 tonnes of muga silk in 2014–15, out of which 136 tonnes were produced in Assam. India's amounted to 28,708 tonnes. But silk production in muga worms is dwindling day by day. There are many factors responsible for it. One major factor is bacterial infection in these silk worms. The diseases, which are collectively called "flacherie" affects large population of silkworms resulting in decrease in their silk producing capacity. Considering the above facts, serious research work were carried out by my research team for the last couple of years using large number of medicinal plants to have a most suitable eco-friendly antibacterial agent to control this disease. It was discovered that the dried fruits of plant *Terminalia Chebula* (locally called "Helica") is the most suitable medicinal plant to control the most dreaded disease flacherie in muga silkworm. Considering the silk production and its quality, the Muga–Heal is found to be helpful at the field level for the muga farmers of the North Eastern region of India to control the disease Flacherie " and to have more muga silk in terms of quality and quantity. The laboratory process know-how released for commercialization. To sustain the muga silk industry, the utilization of hybrids in silkworm breeding program is very much necessary to develop a farmer preferred high yielding variety. The research work on DNA fingerprinting of muga silkworm and to develop races for a particular geographic region with high yielding silk fibre in terms of quality and quantity has a great scope in the muga sericulture.

Muga Silkworm

Terminalia chebula fruits

" Muga heal" extract

The recent advances in plant and animal (Insects) tissue culture technology, molecular biology and biotechnology in plants and recombinant DNA technology etc. has opened up new avenues of research and development in sericulture as well. It is needless to say that recombinant DNA technology can help enormously to raise disease resistant, pest resistant varieties of food plants with high nutritional values. The sericulture programme envisages use of biotechnology in improving the productivity of silk, the quality of yarn and qualitative and quantitative improvement of the muga host plants. Conservation of wild silk moths in the natural ecosystem will be sustainable and economically profitable, if proper technology adoption will be made in host tree plantation, silkworm egg production, commercial cocoon production, yarn extraction, weaving and finishing of products,proper training to local people and proper marketing facilities. The future prospects for preservation and utilization of natural resources with the help of modern techniques are bright and one must adopt the technology to preserve our flora and fauna of North Eastern Region.

Acknowledgements:

Dr. B.G. Unni is thankful to all his former research students for their scientific contribution and the funding bodies such as CSIR, Department of Science & Technology, Central Silk Board and Department of Biotechnology, Govt of India for financial support during his scientific carrier at CSIR-NEIST Jorhat Assam.

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TEA MANUFACTURING
understand better

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Apart from the critical terms used in describing the tea manufacturing process, it is in fact otherwise not very difficult to understand the process for the common people. In manufacturing of tea or processing of tea from green leaf no external additives of any kind is required.

Mainly, there are three type of tea in common use:

1) CTC tea or black tea.(CTC means Crushing –Tearing-Curling)
2) Orthodox tea
3) Green tea

And White tea

Production of tea has to go through six process..

1) Leaf harvest and transportation to the factory: The green leaf after being plucked is to be handled with care. Once the tea is plucked the anabolic reaction practically ceases and catabolic reaction starts i.e breakdown of larger compound to the simpler molecules. This process is exothermic. In case of damaged leaf these processes goes in an uncontrolled manner, affecting the end quality of the product.

Green leaf of one bud and two leaves(-maximum) are preferred for production of good quality tea.

2) Withering: It is the most important step responsible for quality end product. It is both chemical and physical. Chemical withering starts just after plucking the tea itself, i.e. breakdown of larger complex compound to the simplest one.Physical withering leads to (i) reduction of moisture level in fresh tea, whichis around 74% to 83%; (ii) to make the tea flaccid or rubbery, which is very essential for subsequent step of processing -twisting or curling. Simplest way of withering --Leaf is to be sprayed in evenly in a thin layer and air is to be blown from the bottom. Care is to be taken to ensure that each and every leaf get exposed to the blowing air to a specific period of time. Withering may be continued to even 16 hours of time.

The above mention WITHERING practice /steps is common for both Orthodox and CTC or black tea.

Now, for manufacturing CTC tea withered leaf are to be twisted, crushed and torn or in other words it is to be grinded. In practice big tea factory use CTC roller and Rotovane Screw for that. But ultimate goal is to address the total leaf while grinding. Not even a small portion of untouched leaf should be there. In that case the end product will be flaky.

For manufacturing Orthodox tea : The withered leaf is to be rolled and twisted by using a roller machine or manually(Grinding is not required). After this, process is same for both the tea. It has to go through -Oxidation and Drying.

Oxidation: Now the grinded leaf for CTC and rolled leaf for Orthodox are to be exposed to the humidified air for minimum 30 minutes. Then because of exothermic chemical reaction the color will change to dark maroon color.

Drying: After drying these oxidized processed leaves are to be dried in the presence of hot blowing but smoke less air. Shaking arrangement is to be provided to ensure every particle be exposed to hot blowing air. Direct frying is not the right practice. Drying process should end by maximum 28 minute.

Green Tea: In preparation of green tea withering is not required. The main credit lies in rather selection of leaf. Leaf should be very young and soft. So preferably maximum one bud +two leaves is preferred. And it is to be processed within 6 hours of plucking(maximum). That is why; small green tea plant can only produce best and quality green tea.

Mini green tea plant developed by UddhabBharali

The process includes----

1) Selective plucking
2) Steaming or boiling
3) Rolling (Not compulsory)
4) Drying

Steaming or Boiling- Immediately after plucking the leaves are to be exposed to hot steam for maximum 7 minutes. Even it can be soaked in boiling water for 2 minutes. But after boiling or steaming it is to be cooled immediately by using a fan or spreading it in the open area.

Rolling- Then the leaf is to be subjected to mechanical or manual rolling process. But in case of green tea rolling is not compulsory. It is for physical appearance only.

Drying- Drying of this processed leaf is to be achieved with the help of hot blowing air. Direct heating usingpan sabotage the very meaning of green tea. The final product obtained should be such that when boiled water poured in it the liquor appearance should be just green. Otherwise it cannot be termed as green tea by its value and meaning.

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NEUROSPORA: A SCIENTIFIC JOURNEY BY THE ORANGE MOLD SINCE 1843

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The filamentous fungus Neurospora was existed for millions of years on natural substrates (1). In 1842, the French Minister of War appointed a commission to investigate the cause of an infestation and destruction of large quantities of bread in the army bakeries. The causative organism of orange mold infestation in French bakeries was first reported in scientific literature in 1843 as Oidium aurantiacum (2). The first report in 1843 motioned Lévillé, Montagne and Decaisne as scientists involved in identifying the organism, besides, Mirbel and another one scientific member (Dumas, Pelouze, or Payen) of the commission were involved in chemical and microscopic analysis (3). In 1843, Montagne also independently published a drawing of the same orange fungus with a Latin description and named as Penicillium sitophilum (4).The same bakery fungus was studied by Shear and Dodge and they published a classic paper in 1927 describing the genus-Neurosporaand the species crassa(5). Lindegren tpublished the genetic map of the sex chromosome of Neurospora crassa that was also the first map for a fungus chromosome (6). Thus, N.crassa was established as an experimental organism bypioneering work of Shear and Dodge (5) and Lindegren (6). In 1941, George Wells Beadle and Edward Tatum published their landmark paper "Genetic control of biochemical reactions in Neurospora," which eventually led to the famous "one gene-one enzyme hypothesis" (7). In 1958, Nobel Prize in "Physiology or Medicine"was divided, one half was jointly awarded to Beadle and Tatum for their discovery that genes regulate definite chemical events, and the other half was awarded to Joshua Lederberg for his discoveries of genetic recombination and organization of the genetic material of bacteria (8).

We started first Neurospora laboratory at the Department of Biosciences and Bioengineering (formerly known as Department of Biotechnology), Indian Institute of Technology Guwahati in 2009. Since then, we have characterized several calcium signaling mutants. We have identified novel functions of calcium signaling genes including their role in growth, pigmentation, survival upon ultraviolet irradiation, tolerance to various stress conditions including heat shock, regulating reactive oxygen species, and fertility (29-33). Calcium ion impacts almost all biological process starting from fertilization to death and therefore called as "molecule of life and death" (34). Calcium signaling proteins also play a key role in memory and learnings in higher organisms. A calcium signaling protein, Neuronal Calcium Sensor-1 (NCS-1) is shown to be upregulated in several human brain disorders such as-Schizophrenia(SCZ) and bipolar disorder(BPD) etc. (35).We hope to understand the complex pathway and mechanism of calcium signaling proteins that could potentially shed light in our understanding of complex biological process in higher organisms including human.

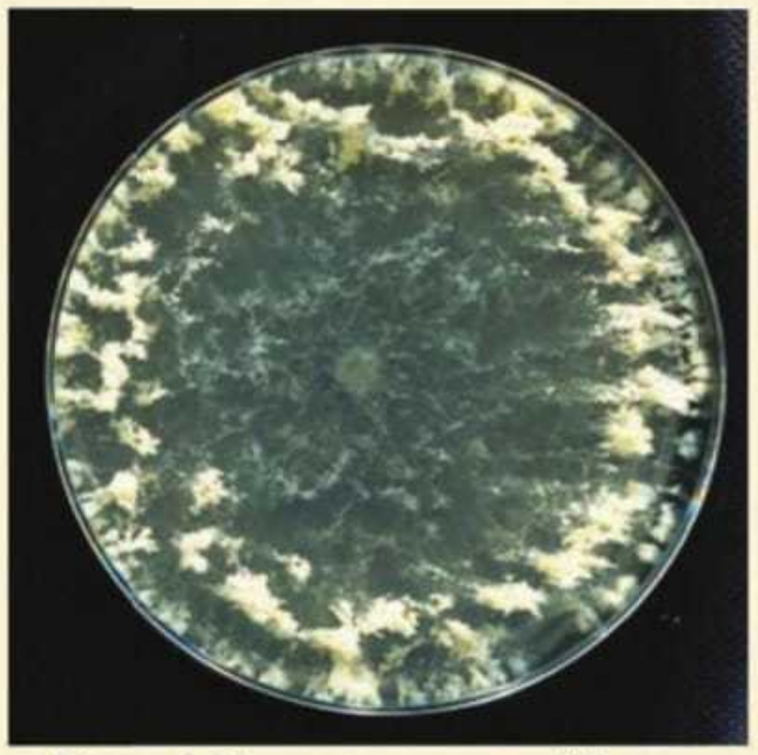

Figure 1:Neurosporacrassa wild type strain (FGSC 2489) grown on Vogel's medium (22) for 24 h at 30^0 C and 16 h in light at room temperature.

Figure 2:Neurosporacrassa wild type strain (FGSC 4200) grown on Vogel's medium (22) for three days at 30 C and 24 h in light at room temperature.

Thus, a simple model filamentous fungus N. crassa is continuing its glorious journey since 1843 and contributed immensely to the current understanding of numerous biological processes ranging from biochemistry, cell biology, circadian rhythms, ecology, evolution, gene silencing, population and molecular genetics, physiology, nanotechnology, and vaccine production (Table 1; 36-39). Therefore, N. crassa indeed can be considered as champion among the model organisms. In the years ahead, we expect many more contributions from this outstanding model organism.

Table 1: Reverse chronology of Neurospora research

Year	Major breakthrough	Reference
2006	A high-throughput gene knockout procedure is developed for N. crassa.	(9)
2006	Non homologousintegration of foreign DNA is shown completely dependent on MUS-53, a homolog of humanLig4, in N. crassa.	(10)
2003	The genome sequence of N. crassais published.	(11)
2001	DNA methylation is shown to depend on histone methylation.	(12)
2001	Meiotic silencing of unpaired DNA during meiosis is discovered and shown to require an RNA-dependent RNA polymerase SAD-1.	(13)
1999	Quelling is shown to require an RNA-dependent RNA polymerase QDE-1.	(14)
1997	355 chromosome rearrangements in N. crassa are analyzed and published.	(15)
1987	Duplicated DNA segments are shown to be mutated and methylated after fertilization and before karyogamy by repeat-induced point mutation (RIP).	(16)
1982	Physical and genetic maps of the N. crassa mitochondrial genome are published.	(17)
1982	Genetic linkage information on chromosomal loci of N. crassa is published.	(18)
1979	Spore killer (Sk) factors resembling the meiotic drive elements in Drosophila and mouse are introgressed and meiotic drive is demonstrated in N. crassa.	(19, 20)
1973	Three circadian clock mutants of N. crassa are isolated and published.	(21)
1970	Broad description of genetic and microbiological research techniques for N. crassa is published.	(22)
1968	Collection of wild Neurosporapopulations begins.	(23)
1960	The Fungal Genetics Stock Center (FGSC) is established.	(24)
1956	Individual heterokaryon incompatibility (het) mutants are isolated.	(25)
1955	The first definitive proof of gene conversion is shown using ascus analysis.	(26)
1945	McClintock identifies and describes the seven chromosomes of N. crassa.	(27)
1941	Beadle and Tatum have studied genetic control of bio chemical reactions in N. crassa using X-ray induced mutants.	(7)
1939	Neurosporais used as a textbook example to illustrate crossing over and first- and second-division segregation in meiotic tetrads.	(28)
1936	Lindegren published the genetic map of the sex chromosome of N. crassa.	(6)
1927	The genus Neurospora is named, species are described, and genetic and cytological studies are initiated by Shear and Dodge.	(5)
1843	The first published report of Neurospora describes material from contaminated bakeries in Paris.	(2)

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The contributions of countless scientists and researchers in advancement of Neurosporaresearch have been greatly acknowledged.

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STUDIES ON MITOCHONDRIAL DYSFUNCTION IN MODEL ORGANISM CAENORHABDITISELEGANS MAY REVEAL MOLECULAR MECHANISM OF AGE ASSOCIATED DISEASES

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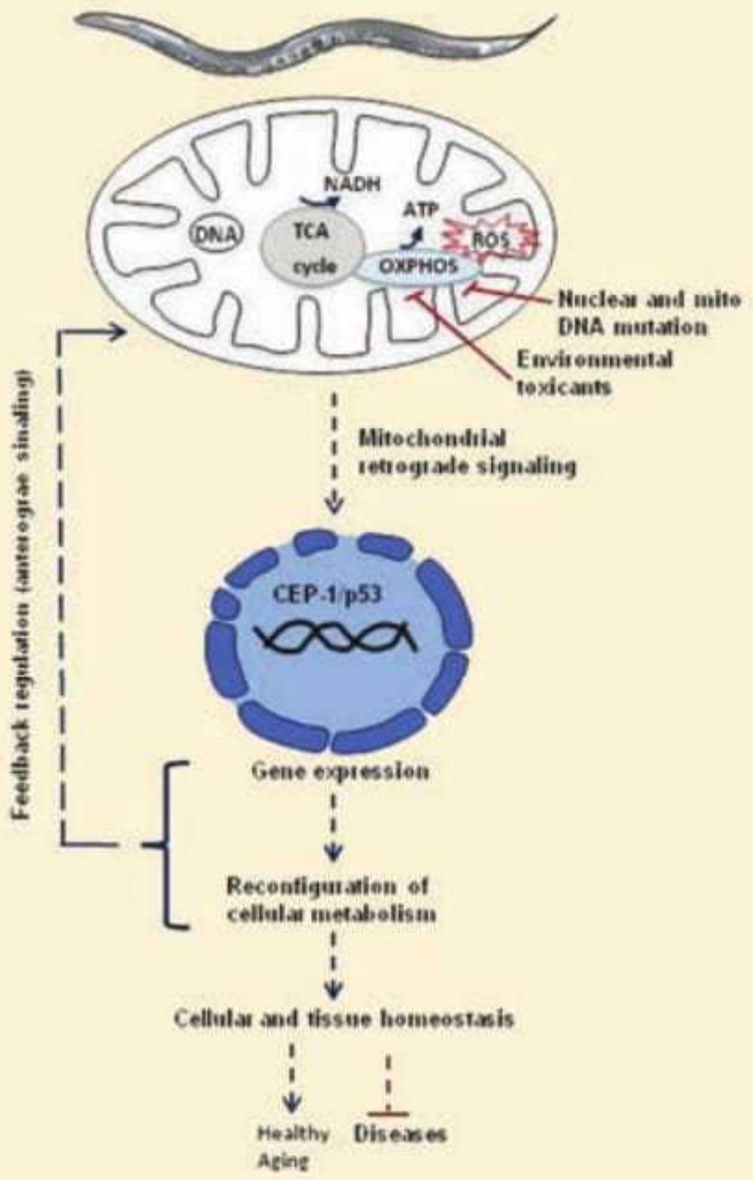
The electron transport chain (ETC) in the mitochondrion is the site of oxidative phosphorylation that produces most of cellular energy in eukaryotes. Mitochondria are also the major site of cellular metabolism. Mitochondria have its own genome but most of the mitochondrial proteinsare encoded by nuclear genome. ETC dysfunction cause by genetic mutation, environmental toxicant etc will cause energy stress, increase production of reactive oxygen species (ROS), imbalances in metabolism etc which will impact organisms physiology.Defects in the mitochondrial electron transport chain (ETC) (complexes I, II, III, IV, V and Co-Enzyme Q) effects high energy demanding tissue and organs leading to symptoms such as encephalomyopathy, myopathy, cardiomyopathy, ataxia, and lactic acidosis. Mitochondria are also critical regulators of cell death, a key feature of human neurodegenerative diseases. Many age-associated diseases are also caused by accumulated damages in the mitochondria.

Communication between mitochondria and nucleus is essential for cellular survival (Figure). Mitochondrial function is under tight nuclear control through anterograde regulation which effects mitochondrial function and also promotes mitochondrial biogenesis, depending on cellular needs. Conversely, mitochondrial originate signaling to nucleus known as retrograde signaling alter the expression of nuclear genes to modify cellular function and reprogram cell metabolism. The molecular players that sense the status of mitochondria and cause metabolic changes that impact the overall well being of an animal are not well understood. The p53 is a transcription factor and a well known tumor suppressor gene that regulates the expression ofgenes involved in various cellular functions. Recent studies have shown that the p53 protein is important for monitoring metabolism also. However, how p53 is able to judge the state of mitochondrial function and induce different responses accordingly is not well understood.



In our laboratory, we will use the soil nematode Caenorhabditiselegans as a model to study the effect of mitochondrial status on p53 function. Worm is easy to maintain and manipulate genetically. Different mutation and RNAi knockdown of ETC complexes in C. elegans effects lifespan and development similar to human mitochondrial diseases symptoms. C. elegans CEP-1 is the only homolog of the mammalian p53-family (p53, p63 and p73) which provides a simpler system to study p53 mediated gene regulation. Genetic tools available in worm will help to analyze the mechanisms by which p53 accurately gauges the status of mitochondria and confers metabolic changes. This will help designing drugs that can manipulate mitochondrial signaling to engage p53 for protective function.

Funding Agency: DBT, Govt. of India.

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THE CORE OF TRADITIONAL KNOWLEDGE IN INDIA WITH REFERENCE TO NORTH-EASTERN REGION: ITS ORIGIN, PERSPECTIVES, AND NEED FOR PROTECTION

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Ancient India had no explicit geographical demarcations. Search for livelihood options like suitable land for habitat, food, shelter, agriculture, fodder, trade, attorney, religion, superstitions, authority, supremacy, influence and escape from diseases compelled human populations to travel and wander from place to place which led to the settlement of human colonies in discrete pockets. When several distinct communities/tribes started sharing the same geographical space, it assisted in the blending of intermingled cultures which, in recent times, has been regarded as a threat to the existence of aboriginal ethnicity. Indian history had been a vibrant spectator of pitfalls and rise of empires led by some powerful rulers and whose influence shaped the account of the country at different time periods throughout the chronological time scale. With time, these populations turned ethnic and shaped the entire demography of the country through establishment of institutions in the form of art, culture, tradition, custom and religion which bear the epitome of civilizations in the entire Indian sub-continent.

Undoubtedly India is an immense diverse country since time immemorial with many distinct pursuits, dissimilar assurances, widely divergent customs and authentic banquet of perspectives. Indian traditions have evolved in thousands of years and these traditions are inextricably linked to the societal set up, customs, religious beliefs and customary view point. Every culture comes up with its own understanding of life and reacts according to the environmental set up. These reactions had been perpetuated by the ancestors and the predecessors, shall transmit them to the future generations in the form of stories, rituals, customs and religion. Unexplored mythological scriptures of communities and tribes assist in the subjective understanding of life believed by individual communities with differences in opinions and this is how traditional knowledge is being propagated. India's socio-cultural life, thus, bears the mark of its interactive and multi-religious history. Understanding the relationships and interrelationships of different cultures and understanding the importance of distinctions of the heterogeneous character of individual local communities is highly remarkable. The importance of inter-cultural communication and also the recognition of internal diversity within each culture has to be appreciated which will emphasize the importance of individuality of each culture and will also maintain the heterogeneity within the participants of the local communities.

The present Northeast India comprises of eight sister states that include Assam, Meghalaya, Nagaland, Manipur, Arunachal Pradesh, Tripura, Mizoram and Sikkim. The entire region is rich in biodiversity of flora, fauna and indigenous human communities that has been residing for hundreds of years practising their traditional customs and traditions. The diversified human population contributed by multiple ethnicity ranging from Caucasian, Mongoloid, Mandarin, Aryan to races of the Tibetian and the Burmese descent. All these races are a treasurehouse of traditional knowledge and this rich heritage has not been properly documented till date. It's high time to document the traditional knowledge of the people thriving under harsh climatic conditions ranging from high altitude Himalayan cold deserts of Arunachal Pradesh and Sikkim, the hilly terrains of Mizoram and Nagaland, the risen plateau of Manipur and Meghalaya to the tropical evergreen hot and humid climatic conditions of the Plains of Assam and Tripura. This varied landscape and meteorological mysticism has maintained human existence through ages despite all odds. The ethnic races have twisted themselves against the fury of diseases and overcame the wrath of endemic epidemics through knowledge dissemination gained in the course of experiences and practice. These communities have been utilizing innumerable goods inherent in plants, animals, insects, worms, microbes and abiotic components in nature for supporting their livelihood preferences like sustainable agriculture, domestication of crops and animals, indigenous piscicult

ure and indigenous fishing gears, sericulture and apiculture, traditional medicine, herbal remedies and natural cosmetics, food processing and preservation, water harvesting and purification, storage and drainage systems, ecofriendly house building etc. It is assumed that there are countless knowledge systems that need to be rediscovered, nurtured and protected. The Government of India should initiate steps to safeguard the ethical concerns and proprietary rights of the community/ family/ individual practising a tradition and thereby conserve the traditional rights as per regulations of the National Biodiversity Act. It has also been noticed that the Government is keen to ensure food security of the country and the food security bill had seen through a lot of hiccups at the national agenda in the last few years. It is to be understood that to ensure food security of a 1.25 billion people, the necessity to recognize traditional food habits of countless indigenous communities, their traditional food processes and products need immediate consideration. Another role towards sustainable food security would be to promote traditional cultivation of endemic crops and promulgate endemic fish cultivation at different regions of the country. The northeastern region is rich in diversity of food crops as well as diversity of fishes, insects and edible molluscs. One possible channel for poverty alleviation in the region through strengthening food security would be the exploration and restoration of traditional agriculture endemic to the region. The highly rich agricultural, ethnobotanical and ethnopharmacological practices of the indigenous communities may lead us unearthing of infinite novel processes and products for societal benefit provided they are understood, decoded and documented in a fashion whereby science culminates ingenuity and folklore institution. Amongst many attributes of understanding traditional forms of knowledge, one basic factor is the habit of speech and behaviour that is yet be thoroughly appreciated. Countless languages and dialects need conservation measures. The feasibility of documenting traditional knowledge can only be made possible through understanding the social set up of individual community. This is possible through decoding both 'explicit' (articulated knowledge, expressed and recorded as words, numbers, codes, mathematical and scientific formulae or musical notations that is easy to communicate, store, distribute and is the knowledge found in books, on the web, and other visual and oral means) and 'tacit' (knowledge that are intuitive, hard to define skills, ideas and experiences that are difficult to access or transfer from person to person by means of some code, writing or verbalizing)knowledge paradigm inherent in traditional community lifestyle. The entire lot of age old traditional livelihood options has to be revealed and explored which will invariably addto more productive outcome of research output of the country and will push forward the socio-economic upliftment of the region.

Photo (Left): Traditional system of terrace or jhum cultivation being practiced in Phek district of Nagaland. Photo (Right): Sustainable agricultural practices in the Apatani Plateau of Arunachal Pradesh. Courtesy: www.panoramio.com

Photo (Left): Traditional fish cultivation in majuli, AssamPhoto (Right):A few endemic fish species of Assam. Courtesy: www.google.co.in

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Photos (Left): Fermented fish processed by Manipuri community Photo (Right): Chidal, a fermented fish of the Bengalis residing in Assam

Photos (Left): Fermented food processed by Nyshi community of Arunachal Pradesh Photo (Right): Endemic millet varieties sold in a local market in Nagaland. www.google.co.in

EPILEPSY
A CHALLENGE FOR NEUROSCIENTIST

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Epilepsy is a serious neural disorder in which normal functions and activities of the nerve cells become disrupted resulting unusual behaviors and sometimes loss of consciousness. It is an abnormal electrophysiological activity of the brain characterized by repeated seizures caused by electrical firing of different brain cells. Though neurons are primarily involved in seizure other non-neuronal cells of the brain like microglia and astrocytes also take part in controlling brain electrical burst firing. Generally a single seizure is not harmful but repeated or long lasting seizures cause anatomical deformation of the brain including neuronal loss.

Epilepsy and Neuro-pathology: Neuro-inflammation and progressive loss of cognition are the characteristics of this complex neurodegenerative disorder. Mutational change of different membrane channel proteins, dysfunction of blood brain barrier, change of ionic concentration in the interstitial space of brain, traumatic brain injury are the common causes of epilepsy. Today newer and newer anti-epileptic drugs and other treatment methods are developed but good response is not found around one third of epilepsy cases. So, new drugs or other treatment methods are in great demand particularly to control epilepsy and neuro-protection.

Epilepsy is not an electrophysiological alteration of brain but it is a complex neuro-pathological phenomenon. Before, during and after seizure there is a remarkable change of biochemical components in the brain and immunological responses in the body. Excito-toxic activity of neuron generates free radicals which may cause dysfunction of the neuronal membrane resulting cellular necrosis. Antioxidant therapy may be beneficial in some cases for protection of neurons.

Blood brain barrier dysfunction is associated with abnormal electrical activity of brain. Leakage of serum proteins and invasionof leukocytes into brain after disruption of blood brain barrier lower the seizure threshold which may alter the channel sensitivity of neurotransmitter uptake or release. Seizure onset alters the function of blood brain barrier leading to entry of extrinsic inflammatory molecules from the blood into the brain finally causing the drug resistance type of epilepsy.

Gene mutation and epilepsy: Channel proteins present in the neuronal membrane control excitability of the neuron. Sodium channels are associated with depolarization of the neurons and the genetic modification of sodium channel protein causes the over activation of sodium channel. Sodium channel blockers are considered as a drug to control epilepsy. Potassium channel are considered as fine tuner of neuronal activity. Genetic mutation of potassium channel causes the loss of proper function of potassium channel and disturbed the normal functions of the neuron and initiates epileptic firing. Calcium channels also associate with initiation of epileptic activity.

Neurotransmitter and epilepsy: Neurotransmitters present in the nerve terminals regulate the normal brain activity. Over expression of excitatory neurotransmitter like acetyl choline, glutamic acid etc. causes excite-toxicity of the nerve cells while inhibitory neurotransmitter like Gama Amino Butyric Acid (GABA) normalizes the neuron after depolarization. Lower level of GABA after depolarization causes the epilepsy while over expression of GABAtransaminase, anenzyme responsible for breakdown of GABA in nerve terminal, initiates seizure in some cases.

Diagnosis of epilepsy: Epilepsy diagnosis and identification of its types are very important to control the brain disorder. Electroencephalography (EEG) is a technique commonly used for epilepsy diagnosis. Discovery of video EEG recording further improves the diagnosis of epilepsy. Magnetic Resonance Image (MRI) of brain helps the neurologist to identify the focal point of the seizure.

Epilepsy treatment: Treatment of epilepsy patient is a great challenge for clinicians and neuroscientists. Even drug therapy is not fruitful in some epilepsy cases. Serendipitous discovery of anticonvulsant properties of phenobarbiton marked the foundation of modern pharmacotherapy of epilepsy.

In 1980s to1990s, a good number

of antiepileptic drugs are developed of which 14 new drugs are licensed as add-on therapyof epilepsy difficult to control adult and pediatric cases. Although a remarkable number of antiepileptic drugs are available but till today current treatment of epilepsy remains difficult.Moreover, high dose antiepileptic drug treatment and early onset of epilepsy also appear to be a risk for cognitive development.

Other treatment methods: Drug therapy is the first choice of epilepsy but due to limited effectiveness other treatment methods like vagal nerve stimulation, surgical removal of epileptogenic tissue, corpus callosotomy etc. are developed. Even dietary alteration sometimes show better results than drug therapy. Shifting to ketogenic diet from normal carbohydrate rich food to control epilepsy is now practised for some types ofdrug resistance epilepsy.

Efforts are being given to develop new drug but till today epilepsy treatment is a major challenge for epileptologists, neurologists and neuroscientists. Epileptic animal models are developed to study the etiology of this neural disorder to develop better diagnosis and treatment. Help groups for epilepsy patients are formed all over the world with the aim to make the society free from social misbelieve on epilepsy and to help the patients to get presently available better treatment. Research scientist from diverse fields should come forward to fight epilepsy.

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INTENSIVE PADDY FARMING THROUGH AGRICULTURE MECHANIZATION

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Assam is one of the most poorly mechanized states in terms of machineries used in agriculture. In paddy cultivation, machines have overtaken the use of traditional equipments, but in other agricultural operations, the penetration of machines is very low.

Also, due to high population growth and limited land resources, the per capita availability of cropping area is going down drastically.

In order to meet these challenges, intensive farming is required. Some of the approaches of intensive farming include multiple-cropping and mechanization. Our cropping system should aim not only to reach the benchmark levels of production, but also do it at a much lower input cost. Another important dimension that is added to this complex system is the sustainability issue.

In 2013-14, the area under rice cultivation was 2.5 m ha and production was 5.19m tonnes giving an average yield of 2.10 tonnes per hectares. This is lower compared to the Indian average of and much lower compared to theoretical upper limit of 8 to 10 tonnes per hectares. Even Bangladesh had a productivity of 4.2 tonnes per hectare in 2011.Australia and Egypt's productivities are in the range of 8 to 10 tonner per ha, which is possible only due to use of technology in agriculture and has reached the maximum limit.

The purpose of mechanization is not only to increase productivity; it is also to reduce drudgery of physical labour during intense heat and rainy season. More and more farmers are giving up paddy farming and also the new generation is not interested in farming purely because the physical labour that entails paddy farming is commensurate with the level of physical hardship required for paddy farming.

There is another aspect of non-mechanization. Consider the example of Baksa district. There is no procurement center of Food Corporation of India operating from Baksa district. This is because even though our produce is good, we do not have the facility to supply grains as per standards of FCI.

Picture the life of a paddy farmer during the growing season. He waits for the rainy season to start cultivation. He waits for the rainy season to stop to start harvesting. In the traditional system, the cost of production is in the range of Rs. 4000 to 5000 per bigha (one third of an acre). This does not include the costs incurred indirectly by the farmer family or their labour inputs. This is outgoing expense. Production will be in the range of 15 to 18 mons (1 mon is 40kgs) and it will fetch a market price of Rs. 350 to 400 per mon. Given this, the farmer really does not earn anything significant. Mechanization will help in multiple ways:

1. Increase productivity by reducing cost of cultivation and increasing production: cost of cultivation can be brought down to Rs 3000 to 4000 per bigha and scope of increasing productivity multifold.
2. Reduce human drudgery: Physical labour of farmers can be reduced drastically.
3. Enable production of good quality grains, thereby increasing marketability.

Suitability of the various agricultural machines developed elsewhere is always questioned. Development has to happen holistically. If machineries have come, so must come irrigation facility. If crops are harvested, the market should also be there.

We also need to tweak the system a bit. Consider the case of rice transplanter. The transplanter is not effective if water level in the field is high, which is the case in case of our traditional paddy cultivation. But if we start the transplantation before the heavy monsoon rain with controlled irrigation, then we can easily use the transplanter. We will have to change our cultivation habit and do the activities before time.

Machines are invented based on the particular requirement of a crop. The ideal condition required by a particular crop needs to be created as much as we can. We may have to move away from our traditional cultivation habits and adopt more scientific methods in order to increase our productivity.

In the Indian context, we will have to go for smaller machineries as our individual plots are quite small and land-holding is also quite small. Another factor that does not allow for big farm machineries is that we do not have proper road infrastructure in our fields.

In short, machines are very useful in reducing human drudgery. Machines can be harnessed to achieve our productivity goals. If we can use machines in our fields, we will be able to shorten our cropping periods and take up several crops in a year, thereby increasing farm income.

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Training Under EST&P Component Under NULM

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MSME Clusters

SFURTI Clusters

One Panchayat One Product

Model Village Approach

Rural Livelihood Enhancement

ENTREPRENEURSHIP DEVELOPMENT INITIATIVE

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Women Entrepreneurship Development Programme (WEDP)

Entrepreneurial Awareness Programme (EAP)

Faculty Development Programme on Entrepreneurship (FDP)

Comprehensive Entrepreneurship Development Programme (CEDP)

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RESEARCH & CONSULTANCY

Udyami Mitra Cell

Third Party Evaluation/Assessment

Project Report Preparation

Rural Micro Planning

NEW INITIATIVES

Implementation of CSR Activities

Area Approach Livelihood Development

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NUTRACEUTICALS: THE NATURAL PRODUCTS

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Nutraceuticals have been defined as any substance that may be considered as a food or part of a food and provides medical and health benefits including the prevention and treatment of disease. Traditionally the nutraceutical was contained in a medicinal format such as a capsule, tablet or powder in a prescribed dose, although more modern nutraceuticalsare probiotic drinks, yogurt, different strains of Lactobacillus like L. acidophilus, L. planatrum, L. reuteri, L. rhamnosus etc. as probiotics and prebiotic compounds viz Polydextrose, Soybean Oligosaccharides,Isomalto-oligosaccharides, Fructo-oligosaccharides, Gluco-oligosaccharides etc. are also considered as tnutraceuticals.

Nutraceuticals from indigenous plant: Natural products have been shown to be a tremendous and consistent resource for the development of new drugs. The number of individual phytochemicals already identified in fruits and vegetables is estimated in >5000, but a large percentage still remain unknown and need to be identified before we can fully understand the health benefits of phytochemicals (Liu, 2004). Indigenous populations and those involved in ethno-medicine already know many of these medicinal plants for its nutraceuticalvalue; however, there is relative lack of research, equipment, training and expertise required to develop this knowledge and to enter nuturaceutical market with scientifically validated products. It should be mentioned that North-Eastern part of India is on 6th position among the 25 biodiversity hot spots in the world (Myers, 2001). This rich biodiversity is a potential source for the development of nutraceuticals or the novel drugs. Reporting lesser known plants having nutraceutical value may draw an attention towards integrative conservation mechanisms of these plants in order to sustain their pharmacological applications.

Research on Nutraceuticals:Knowledge of the phytochemical constituents is very essential to enable investigation of the actual effectiveness of the plant in medicine. This is an interdisciplinary research which requires a thorough knowledge on phytochemistry, biochemistry, microbiology and pharmacology. Research on nutraceutical values on plants can be initiated by:- Selection of the proper plant which is based on the traditional knowledge → Authentication of the plant with the help of herbarium preserved in a Govt. Institute like Botanical Survey of India → Extraction of the bioactive compound by different solvents→ Purification by any one of the methods of chromatography→ Assay → Identification of the bioactive compound by Chromatography such as TLC, GLC, HPLC, LCMS and UV, VISIBLE,IR spectroscopy → Structural determination by NMR spectroscopy → Field trials → Evaluation → Patent → Marketing.

Recent research finding claims for nutraceuticals are resveratrol from red grape products as an antioxidant, soluble dietary fiber products, such as psyllium seed husk for reducing hyper cholesterolemia, soybeans and soy-based foods (isoflavonoids) for maintenance of bone health, brain and immune functions for women, soy-based foods may reduce risk of coronary heart disease, sulfides/ Thiols Dithiolthiones from Cruciferous vegetables for maintenance of healthy immune function, broccoli (sulforaphane) as a cancer preventativeetc. Other nutraceutical examples are flavonoids, antioxidants, alpha-linolenic acid, beta-carotene, anthocyanins and many herbal extracts viz.Ajoene, ginseng, garlic oil etc. Amongst the phytochemicals, several groups of terpenoids, polyphenols, glucosinolates, phytosterols, thiosulfonates, anthraquinones, capsaicin, piperine, chlorophyll, betaine, pectine, oxalic acid etc. are currently used in the nutraceutical industry.

In the global marketplace nutraceuticals have become a multi-billion dollar industry. According to the market report published by Transparency Market Research "Nutraceuticals Market - Global Industry Analysis, Size, Share, Growth and Forecast, 2015 - 2021", global nutraceuticals market was valued at US$165.62 billion in 2014 and is expected to reach US$278.96 billion by 2021, whereas with the recent India's nutraceuticals market is likely to cross $6.1 billion by 2020.

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EDIBLE INSECTS A TRADITIONAL DELICACY OF NORTH EAST INDIA

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Entomophagy literarily means the art of consuming insects. Insects are important natural resource that constitutes a basic component of diet among different aboriginal tribes of Northeast India. Entomophagy among these tribes is an age old traditional practice. Studies previously conducted on the nutrient composition of edible insects around the globe ranks edible insects as a rich source of quantitatively good quality proteins, mineral, amino acids and fatty acids. Investigations of the nutrient composition of edible insects of Northeast India reveal similar outcomes. Edible insects throughout history has been declared a nutrient source that can alleviate malnutrition due to protein deficiency and assuage anemic conditions by virtue of its high iron content if consumed as emergency food or as a part of daily diet. So inthose perspectives, insect consumption by the tribes of Northeast Indiais regarded healthy traditional practice. Contrary to that insects are still viewed as pests and unpalatable food by a majority of people, despite the increasing literature pointing towards their valuable contribution to human diets. The arguments such as the high nutritional aspects of edible insects and their palatability may contribute to demystifying the pessimistic view associated with edible insects.Learning, realizing, recognizing and accepting insects as food will suggest tackling unenthusiastic attitudes towards insects in general.

The practice of entomophagy in Northeast India is observed among the tribes likeWangcho,Nocte, Shingpo, Tangsa, Deori and Chakma of Arunachal Pradesh; Meitei, Tarao, Tangkhul, Chothe and Thadouof Manipur;Bodo, Mishing and Karbi of Assam. Scientific studies reported that fifty one numbers of insect species are consumed in Arunachal, forty one in Manipur and twenty five species is consumed by the Bodo tribe of Assam. Insect foods are very much preferred by these tribes not because they are nutritionally rich but because they taste good. From zoological view point, the most commonly consumed insect orders include Hymenoptera, Hemiptera, Orthoptera, Coleoptera and Lepidoptera. Few species are also consumed from order Odonata. Orthoptera encompasses a large number of edible species of long horned and short horned grasshoppers. According to a report by Food and Agriculture Organization (FAO, 2013) about eighty grasshopper species are consumed worldwide.Most edible insects are pests to valuable forest trees and vegetations. In Northeast India most of the edible grasshopper species are harvested from paddy fields so most of them are pests of paddy. Consumption of these grasshopper species highly benefits the environment and human health by minimizing the use of pesticides.Crickets are collected from gardens and roadsides by pouring water into their holes. They are regarded as an awfully tasty delicacy when fried or blended into a paste with chilies.The consumption of termites is another common facet among these tribes.Termites are mainly known for the damage it causes to buildings and agricultural crops, but they are regarded as important natural resources by the tribes, because of their wide use in traditional medicine and consumption. The practice of harvesting termite during their swarming season at their nuptial flight by attracting them with illumination in the evening hours is a very popular practice not only among the tribes of Northeast India but also among different aboriginal tribes around the world.In rural areas; termites are harvested from the termite mound itself by digging. The Giant Water Bug is probably the best known edible aquatic insect whose specialty is more prominent among the tribes of Manipur and Assam. The exclusive reason of the fondness is the appetizing aroma of this insect that enhances its flavor. This species is a popular food sold in tribal markets almost all throughout the year. Lepidopteron species are preferred for their delicacy and good taste, the reason of this being its high fat content that enhances its taste especially when fried. The larva of Hymenoptera is consumed desirably and preferably. In spite of the painful sting the hymenoptera wasps deliver, people reluctantly are ready to harvest them from housetops, trees and shrubs.

Edible insects are consumed as raw, dried, boiled, steamed or in fried form.For the most part insects smell strong and release disagreeable flavors when raw but they need no elaborate preparations or seasonings when cooked, this is what the tribes say about insect cons

umption. Insects are also harvested for commercial purposes. Vendors are often seen selling different edible insects species at locations inhabited by the tribal communities at different seasons of the year. A majority of the insects are only seasonally available,most Orthoptera and Hymenopterans becomes available for consumption between April to October mainly in summer. Insect harvesting in Northeast India particularly increases during the rainy seasons and floods especially when hunting fish becomes difficult which reflects the use of insects as emergency and alternative foods among the tribes. The aboriginal population in northeast India is also involved in insect rearing for commercialization both for food and cocoon, one of which is the Eri Silkworm. The prepupae and pupae of Eri Silkworm are considered a delicacy in Northeast India. They are the most common and extensively sold species in the local markets of Northeast India. Bee rearing is also a popular occupation among these tribes. Bees are reared both for honey production and its larvae consumption. Thus, insect contribute considerably to the tribe's food security and livelihoods. Life cycles of insects are characterized by metamorphic stages, the tribes are so acquainted to this practice that they hold a rich understanding of the metamorphic stages of the consumable species as they know exactly at which stage edible insects can be harvested and consumed.This knowledge can be called a blend between science and traditions which requires special scientific attention.

Fig. 1:Giant Water Bugs sold in local markets

Fig.2: Edible insects sold by tribal vendors

The existence of the culture of eating insects among the tribes in Northeast India ensures nutritional needs of the indigenous people are being met. Collecting, processing, trading and consuming edible insects are an integral part of local cultures.

Insects, as a significant natural food resource needs to be further exploited and popularized. Insects are good in taste and are rich sources of nutrients, vitamins and minerals. Therefore, insect food if popularized can play an important role in tackling food crises and natural resource depletion in future. Compiling and storing data's on taxonomic identities of this nutrient rich species can help in assessing their species richness and estimate their survival status. Effects of climate change and its impact on the distribution and availability of edible insects yet need to be focused to capture public attention as they are a potential natural resource especially for a biodiversity hotspot like Northeast India.

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SQUALENE: A NOVEL CYTOPROTECTIVE AGENT THAT PROTECTS NORMAL STEM CELLS WITHOUT PROTECTING CANCER CELLS

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The need for cytoprotective agent in cancer therapy

Cancer, a major public health problem worldwide, is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. Being one of the leading causes of death in the world its incidence is still increasing, particularly in developing countries (1). Chemotherapy is the treatment used to cure cancer. The use of anti-cancer drugs such as carboplatin, cyclophosphamide etc. are given as part of standardized chemotherapy regimen which consists of regulated course such as a diet, exercise or medical treatment, designed to give positive results. Some chemotherapeutic agents are however cytotoxic, which causes indiscriminate injury to normal tissues thus leading to multiple organ toxicity. This means that chemotherapy also harms cells that divide rapidly under normal circumstances: cells in the bone marrow, digestive tract and hair follicles. Recently, this multiple organ toxicity is thought to be the major cause of failure in cancer chemotherapy research (2). To find a solution of protecting normal cells from side effects of chemotherapeutic drugs, Dr. Bikul Das conducted several researches on cancer chemotherapy and observed that squalene; an isoprenoid antioxidant compound has a non-toxic selective cytoprotective activity which preferentially protects normal tissues without protecting malignant tissue during chemotherapeutic treatment. Presently, Kavi Krishna the research laboratory at Guwahati Biotech Park, IIT-Guwahati run by Dr. Bikul Das along with his team is conducting squalene related research.

Squalene

Squalene derived its name from shark liver oil (Squalus spp.) which is also known to be the richest source of squalene. Squalene (2,6,10,15,19,23-Hexamethyltetracosa-2,6,10,14,18,22-hexaene) also known as a triterpene because of its chemical structure contains six isoprene units (Figure 1), an intermediate for the biosynthesis of phytosterol or cholesterol in plants/animals. In human body squalene is synthesized by the liver and is secreted in large quantities by the sebaceous glands, where it may protect skin from Ultraviolet (UV) radiation (3, 4, and 5).It is widely distributed in nature, with reasonable amounts found in olive oil, palm oil, wheat-germ oil, amaranth oil, and rice bran oil.

Figure 1: Chemical structure of Squalene

Squalene as selective cytoprotective agents

In 2003, Das B etal., reported that squalene (12.5-25 μM) increase growth and protected bone marrow derived hematopoietic stem cells colonies from cisplatin-induced toxicity that is equipotent to glutathione as standard control but did not protect the neuroblastoma cell lines from carboplatin, cyclophosphamide, etoposide and doxo-rubicin-induced toxicity during in vitro studies (5). In vivo study on mouse model 2008, by Bikul Das etal., also reported that squalene selectively protects mouse bone marrow progenitors against cisplatin and carboplatin-induced cytotoxicity without protecting tumor growth (6).

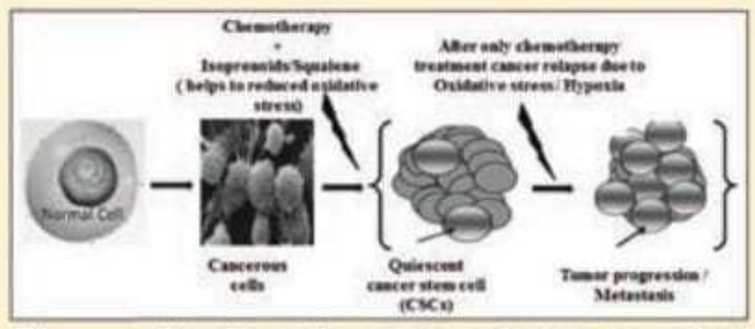

Figure 2: Squalene as cytoprotective agent. During chemotherapy treatment, chemotherapeutic drugs shows side effects on normal cells and have the ability to generate Quiescent Cancer Stem cell (CSCs) which when oxidative stress/ hypoxic situation occurs it divide and grow to form tumor again i.e. tumor relapse but if we use squalene along with chemotherapeutic drugs, it helps to reduced oxidative stress in cell by protecting normal tissue against cyto toxicity.

From the above evidences it can be suggested that squalene might be a potential candidate for future development as a cytoprotective agent against chemotherapeutic toxicity.

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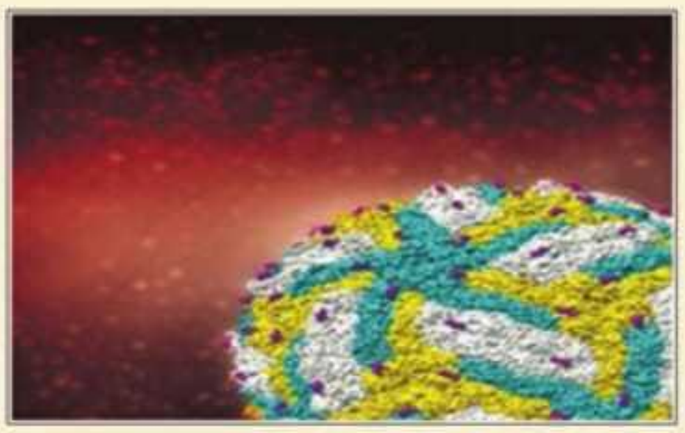
Science Break Throughs

Lifestyle has a strong impact on intestinal bacteria, which has a strong impact on health

Everything you eat or drink affects your intestinal bacteria, and is likely to have an impact on your health. That is the finding of a large-scale study into the effect of food and medicine on the bacterial diversity in the human gut.
That is the finding of a large-scale study led by RUG/UMCG geneticist CiscaWijmenga into the effect of food and medicine on the bacterial diversity in the human gut, which is published in the research journal Science.

Source: Science Daily, 28 Apr, 2016; https://www.sciencedaily.com/releases/2016/04/160428151853.htm

Indian firm announces breakthrough for Zika vaccine



Hyderabad, India based Vaccines and Bio-Therapeutic manufacturer, Bharat Biotech, announced breakthrough in developing world's first, 2 promising candidates ZIKAVAC vaccines for Zika infection.
WHO just announced a disease linked to the Zika virus in Latin America poses a global health emergency requiring a united response. Zika virus is spread by mosquitoes of the Aedes genus. The mosquito-transmitted infection is related to Dengue, Yellow Fever and West Nile virus.

Source: BioSpectrum, 5 Feb, 2016; http://www.biospectrumasia.com/biospectrum/news/223248/indian-firm-announces-breakthrough-zika-vaccine

Brain Chip, Electro-Sleeve Help Paralyzed Man Move His Hand

The goal of restoring movement to victims of paralysis, stroke or brain injury has consumed medical researchers for the past century.
A team of scientists says that they made another step toward that goal by recording and translating brain signals to bypass a spinal cord injury and allow a 24-year-old man to move his hand again.
Bouton and colleagues from Batelle Research and Ohio State University report in the journal Nature on an experiment in which they implanted a small chip in a section of the brain called the motor cortex of a paraplegic male patient.

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WILD SILK MOTH DIVERSITY IN NORTH-EASTERN REGION OF INDIA A POTENTIAL SOURCE OF NOVEL SILK

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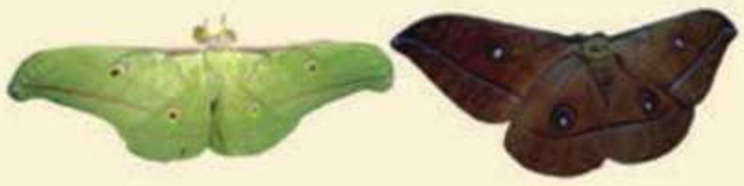
Fibre is an important commodity for human kind and about 46.0% are of natural origin such as silk, cotton and wool. Silk is a natural filament created by the silkworm and contributes only 0.2% of production in the world. India, second largest producer of the world raw silk, producing 14% of total world production, however, Indian silk exports in the global silk trade are 4-5%. This is because India has a large domestic market for silk goods and about 85% of silk goods produced are sold in the domestic markets. The history of silk is as long as that of civilization itself. Silk is named in legend, fable and folklore. The superiority of silk as a textile fibre has been recognized from time immemorial; luxurious look, sleek feel and lustre of silk fabric are unquestionably inimitable. From its origin in China in about 2200 B. C. the silk industry has had an adventurous course of evolution, becoming established from time to time in other parts of the world. The natural silks are broadly classified as mulberry and wild or non-mulberry. Bombyx raw silk is the only best known mulberry silk and most popular textile material for the high class fabrics and its uniqueness is highly praised, especially its special shininess and other than mulberry silk such as muga, tasar, eri, fagara etc. are the wild silk or non-mulberry. However, the wild silks, A. yamamai and A. assamensis are even shinier than B. mori silk. The reason is probably because there are fine porous structures in the filament. Commercially, porous silk is highly valued because of its shininess, its soft feeling and the retention of desired warmth and comfort in the fabric.

Wild silk moths or the non-mulberry silk moths, also known as 'Vanya silks' are economically and ecologically important forest based insects which are in general not reared in captivity. Majority of them belong to the family Saturniidae, containing 1861 species in 162 genera and 9 subfamilies all over the world; of these, about 80 species occur in Asia and Africa to produce lustrous silk of economic value and estimated over 50 species found in the Indian sub continent. They constitute part of the "Charismatic mega fauna" of the insect world which include medium to very large size, bright and strikingly coloured moths which produce lustrous silk. The North-Eastern region of India makes ideal home for a number of wild sericigenous insects and is centre of wild silk culture including muga (Antheraea assamensis Helfer), eri (Samia ricini Donovan), oak tasar (Antheraea proylei Jolly) and mulberry silk (Bombyx mori Linn.). A recent review of the species composition of India has enlisted 47 species of wild silk moths in which 27 species under 13 genera of the family Saturniidae, Bombyciidae and Lasiocampidaeare recorded from the North East India.

They exhibit variation in their food habits, consumption, morphological traits; voltinism and adaptability to severe winter at higher altitudes of the region. Experimental findings of various qualitative and quantitative characters of all unexploited wild silk moths N-E India indicate a promising future in terms of novel silk with high economic

Actiasselene



Antheraearoylei

Antheraeaassamensis

value for the region.

Wild silk moth populations comprising diverse gene pool hold great potential utility for mankind. Hence, conservation of this precious genetic resource would be imperative for breeding of better adapted and more desired genotypes. The recent advances in molecular biology and biotechnology could play a major role for improvement on characterization, classification and documentation of all the sericigenous insects. As molecular markers are accurate for genetic diversity studies, similarly; characterization of moth sex pheromone will give complete information about inter and intra-species, subspecies, race, strains and ecotype; together help us to maintain uniform EST database of wild silk moth of the region. Hybridization between cultivated species and their wild counterparts/related species to evolve commercially and economically desirable improve strains or species and to evaluate the hybrids in the natural condition is one of the tool for molecular biology application. Eri culture (Samia ricini) in North-Eastern Region has been practiced since time immemorial in traditional way for its silk and more often for pupa which form a delicious food items for a large section of the population. If the superior quality of the eri cocoons (Samia ricini) could be achieved through cross breeding with Samia canningi, it could be a breakthrough in the field of eri culture. Use of biotechnology in improving the productivity of silk, the quality of yarn and qualitative and quantitative improvement of the host plants etc. are some of the prospects for the development of the sericulture industry of the region. Further, the genetically useful and important traits of these wild silk moths such as hibernation, reelability may be a sound basis for all future breeding programmes of other domesticated silk moths in evolving commercially and economically desirable improved strains of species. Wild silk moth culture not only has an economic bearing on the local inhabitants of North-Eastern India but also helps to save forest ecosystem.

Antheraeaproylei

Antheraea sp. Novo

Attacus atlas

Antheraeamylitta
(male and Female, Yellow one is female)

Samiaricini (Male and Female)

Samiacanningi (Male and Female)

Theophilareligiosa

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BIOINFORMATICS

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1. What is Bioinformatics?

Bioinformatics is the field of science in which biology, computer science, and information technology merge to form a single discipline. Bioinformatics uses techniques and concepts from informatics, statistics, mathematics, chemistry, molecular biology, biochemistry and physics. It has many practical applications in different areas of biology and medicine. The term bioinformatics was coined by Paulien Hogeweg in 1978. The main concern of bioinformatics was the creation and maintenance of a database to store biological information such as the nucleotide sequence (DNA & RNA) and protein sequence (amino acid).

Bioinformatics uses many areas of computer science, mathematics and engineering to process biological data. Complex machines are used to read in biological data at a much faster rate than before. Databases and information systems are used to store and organize biological data. Analyzing biological data may involve algorithms in artificial intelligence, soft computing, data mining, image processing, and simulation. Commonly used software tools and technologies in the field include Java, C#, XML, Perl, C, C++, Python, R, SQL, CUDA, MATLAB, and spreadsheet [3-5].

2. What is a biological database?

Biological databases are libraries of life sciences information, collected from scientific experiments, published literature, high-throughput experiment technology, and computational analyses. They contain information from research areas including genomics, proteomics, metabolomics, expression, and phylogenetics. Information contained in biological databases includes gene function, structure, localization (both cellular and chromosomal), clinical effects of mutations as well as similarities of biological sequences and structures.

The International Nucleotide Sequence Database Collaboration (INSDC) consist of the following three databases: (a) NCBI – National Centre for Biotechnology Information, USA (b) EMBL – European Molecular Biology Laboratory (c) DDBJ – DNA Databank of Japan, Japan

3. Applications of bioinformatics

Some of the major research applications of bioinformatics include sequence analysis, sequence alignment, sequence mining, genome annotation, gene finding, computational evolutionary biology, comparative genomics, computational systems biology, protein structure prediction, molecular docking and molecular interaction studies.

3.1 Sequence alignment

A sequence alignment is a way of arranging the sequences of DNA, RNA, or protein to identify regions of similarity that may be a consequence of functional, structural, or evolutionary relationships between the sequences. Aligned sequences of nucleotide or amino acid residues are typically represented as rows within a matrix. Gaps are inserted between the residues so that identical or similar characters are aligned in successive columns.

3.1.1 Pairwise alignment

Pairwise sequence alignment methods are used to find the best-matching piecewise (local) or global alignments of two query sequences. Pairwise alignments can only be used between two sequences at a time, but they are efficient to calculate and are often used for methods that do not require extreme precision (such as searching a database for sequences with high similarity to a query).

3.1.2 Multiple sequence alignment

Multiple sequence alignment is an extension of pairwise alignment to incorporate more than two sequences at a time. Multiple alignment methods try to align all of the sequences in a given query set. Multiple alignments are often used in identifying conserved sequence regions across a group of sequences hypothesized to be evolutionarily related. Such conserved sequence motifs can be used in conjunction with structural and mechanistic information to locate the catalytic active sites of enzymes.

3.2 Sequence analysis

Sequence analysis refers to the process of subjecting a DNA, RNA or peptide sequence to any of a wide range of analytical methods to understand its features, function, structure, or evolution. Methodologies used include sequence alignment, searches against biological databases, and others.

3.3 Genome annotation and Gene finding

Genome annotation is the process of marking the genes and other biological features in a DNA sequence. The first genome annotation software system was designed in 1995 by Owen White, who was part of the team at The Institute for Genomic Research that sequenced and analyzed the first genome of a free-

living organism to be decoded, the bacterium Haemophilus influenzae. While gene prediction or gene finding refers to the process of identifying the regions of genomic DNA that encode genes. This includes protein-coding genes as well as RNA genes, but may also include prediction of other functional elements such as regulatory regions. Gene finding is one of the first and most important steps in understanding the genome of a species once it has been sequenced.

3.4 Computational evolutionary biology:

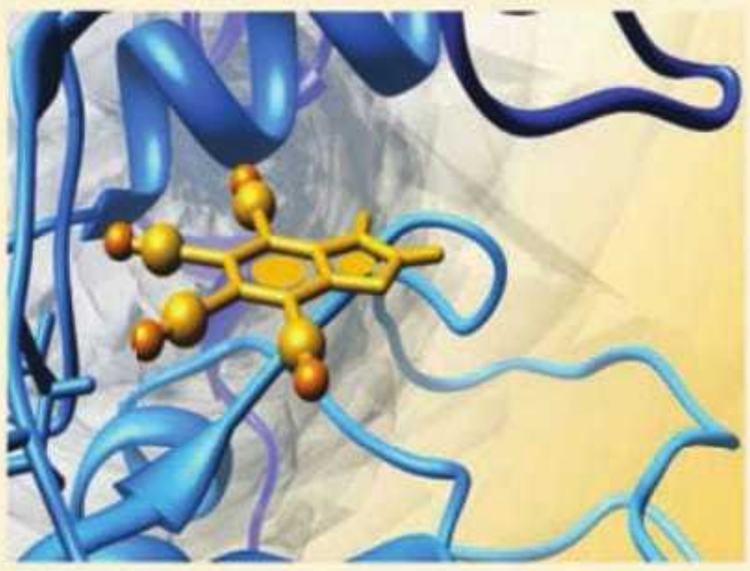
Evolutionary biology is the study of the origin and descent of species, as well as their change over time. Informatics has assisted evolutionary biologists in several key ways; it has enabled researchers totrace the evolution of a large number of organisms by measuring changes in their DNA, rather than through physical taxonomy or physiological observations alone, more recently, compare entire genomes, which permits the study of more complex evolutionary events, such as gene duplication, horizontal gene transfer, and the prediction of factors important in bacterial speciation, build complex computational models of populations to predict the outcome of the system over time.

4. BLAST (Basic Local Alignment Search Tool)

BLAST is an algorithm for comparing primary biological sequence information, such as the amino-acid sequences of different proteins or the nucleotides of DNA sequences.

A BLAST search enables a researcher to compare a query sequence with a library or database of sequences, and identify library sequences that resemble the query sequence above a certain threshold. The types of BLAST included

- blastn - Nucleotide-nucleotide BLAST
- blastp - Protein-protein BLAST
- blastx - Nucleotide 6-frame translation-protein
- tblastx - -Nucleotide 6-frame translation-nucleotide 6-frame translation



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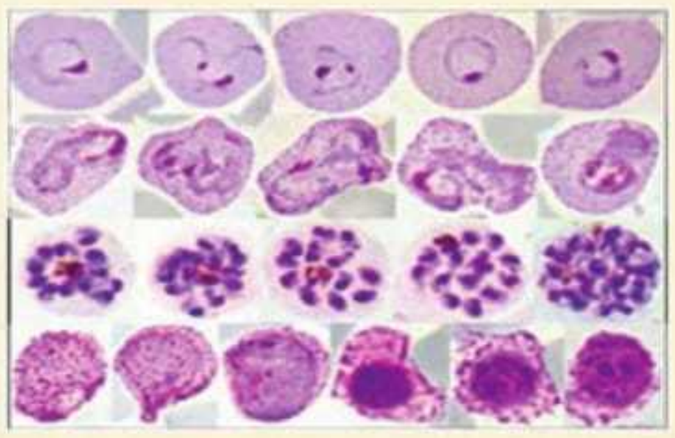
Science Break Throughs

Evolving Make-Up of Malaria Species



A team of scientists has uncovered the global, evolving, and historic make-up of Plasmodium vivax, one of the five species of malaria that infect humans. The research, which links the spread of the parasite back to colonial seafaring, among other phenomena, underscores the challenges health experts face in controlling the parasite.

Source: Science Daily, June 2016; https://www.sciencedaily.com/releases/2016/06/160627124430.htm

Regenerating memory with neural stem cells

Although brains -- even adult brains -- are far more malleable than we used to think, they are eventually subject to age-related illnesses, like dementia, and loss of cognitive function. Someday, though, we may actually be able to replace brain cells and restore memory.

Source: Science Daily, June 2016; https://www.sciencedaily.com/releases/2016/06/160614121902.htm

BIOTECHNOLOGY: A BOON TO MANKIND

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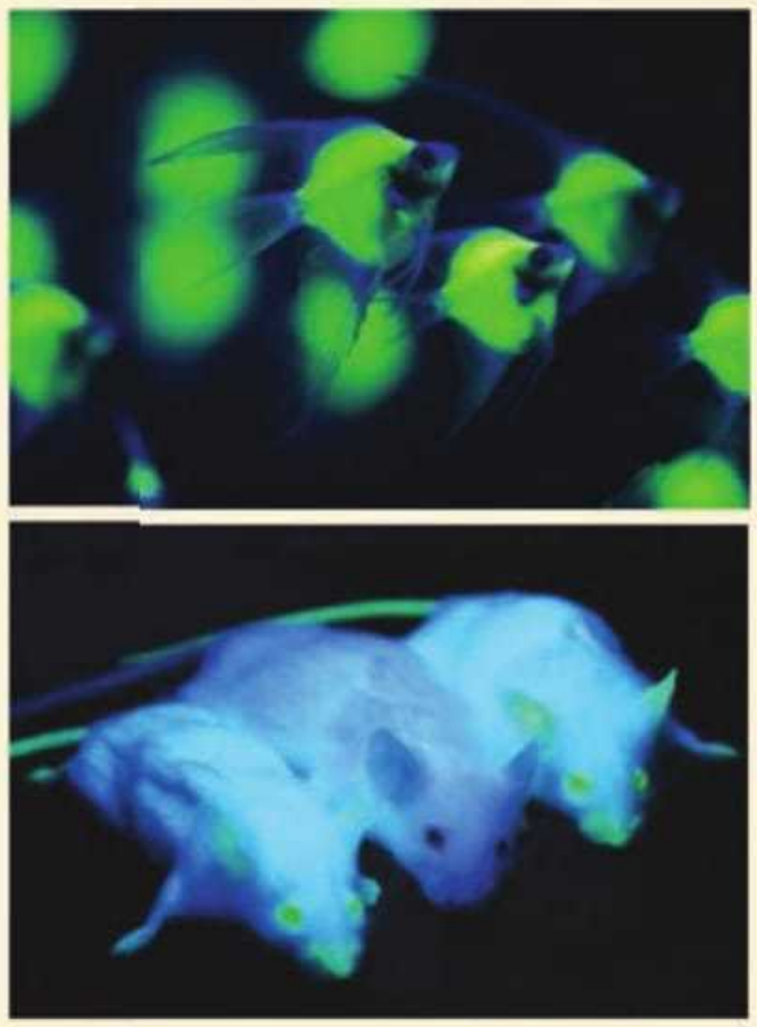
We have been using biotechnology whether knowingly or unknowingly from a period of more than 10,000 years. In ancient times, it was recognized by us only in the form of microscopic organisms in the form of bacteria and fungi that could be used for making different food stuff including cheese, bread, wine and beer. According to the definition of the Codex Alimentarius Commission (CAC 2001a), modern biotechnology is defined as the application of: (i) in-vitro nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or (ii) fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers, and that are not techniques used in traditional breeding and selection. The modern biotechnology offers a diverse area for the growth and development of the human health starting from the diagnosis and prevention of diseases to production of good food. Application of modern biotechnology in terms of food production presents new opportunities for human health and development. The recombinant gene technology enables plants, animals and microorganisms to be genetically modified with novel traits beyond opening newer opportunities to mankind. Techniques such as cloning, tissue culture and marker-assisted breeding are often regarded as modern biotechnologies, in addition to genetic modification. The introduction of transgenic crop plants with agronomic traits generally referred

the first generation of transgenic plants and its development is still in continuation. The key areas in the Research and Development in case of plants include: (i) Agronomic taints such as Pest, disease and virus resistant trait, whereas the other is (ii) Altered nutrition and composition such as Vitamins enriched, improved protein content, increasing anti-oxidant concentration and removal of allergens. Amongst the most frequently marketed genetically modified crops includes soybean, maize, cotton, potatoes, tomatoes, squash, canola, papaya and rice. The agronomic traits are the most prominent traits introduced among genetically modified crops and estimated to dominate new traits of genetically modified crops indeed.



Modern biotechnology has equally contributed towards the diagnosis, treatment and prevention of human health. Biotechnology has gifted us with many health products which includes stem cell therapy, gene therapy, recombinant blood products, cytokines, monoclonal anti-bcdies, interferons, insulins, tissue engineered products such as bone graft, heart valves, xenograft and different

radiolabelled biotherapeutics used in diagnostic kits. In around 25 countries throughout the globe have one or more bio-new molecular entities in clinical trial which includes seven non-organizations for Economic Cooperation and Development countries (OECD), the United States and 17 other OECD countries. There are fewer in Phase-I than Phase-II trials depicting a clear picture of a huge future supply of biopharmaceuticals to the health market. The major disease targets in these trials consist of cancer (258 trials), cardiovascular disease (57 trials), arthritis (28 trials), diabetes (18 trials) and asthma (11 trials) approximately. Monoclonal anti-bodies accounts for 25.1% of the total clinical trials followed by recombinant vaccines 18.6% and recombinant therapeutics 15.6%. This aforementioned data clearly reveals a very strong biotechnology pipeline for these unproven or experimental therapies.

In the recent years, Biotechnology is playing a very important role in the production of functional food and nutraceuticals. These food stuffs are meant for consumption that provides physiological benefits against chronic disease. Moreover, Bioinformatics cover the manipulation and analysis of large datasets of genetic and health information. The maximum contribution of biotechnology to the pharmaceutical sector would be reached if biotechnology contributed to 100% of all new therapeutics, vaccines, and diagnostics.Thus we can conclude that, the modern biotechnology has remarkably contributed to the two most important aspect of human life especially health and food; thus finally redefining the level of life expectancy in the mankind.

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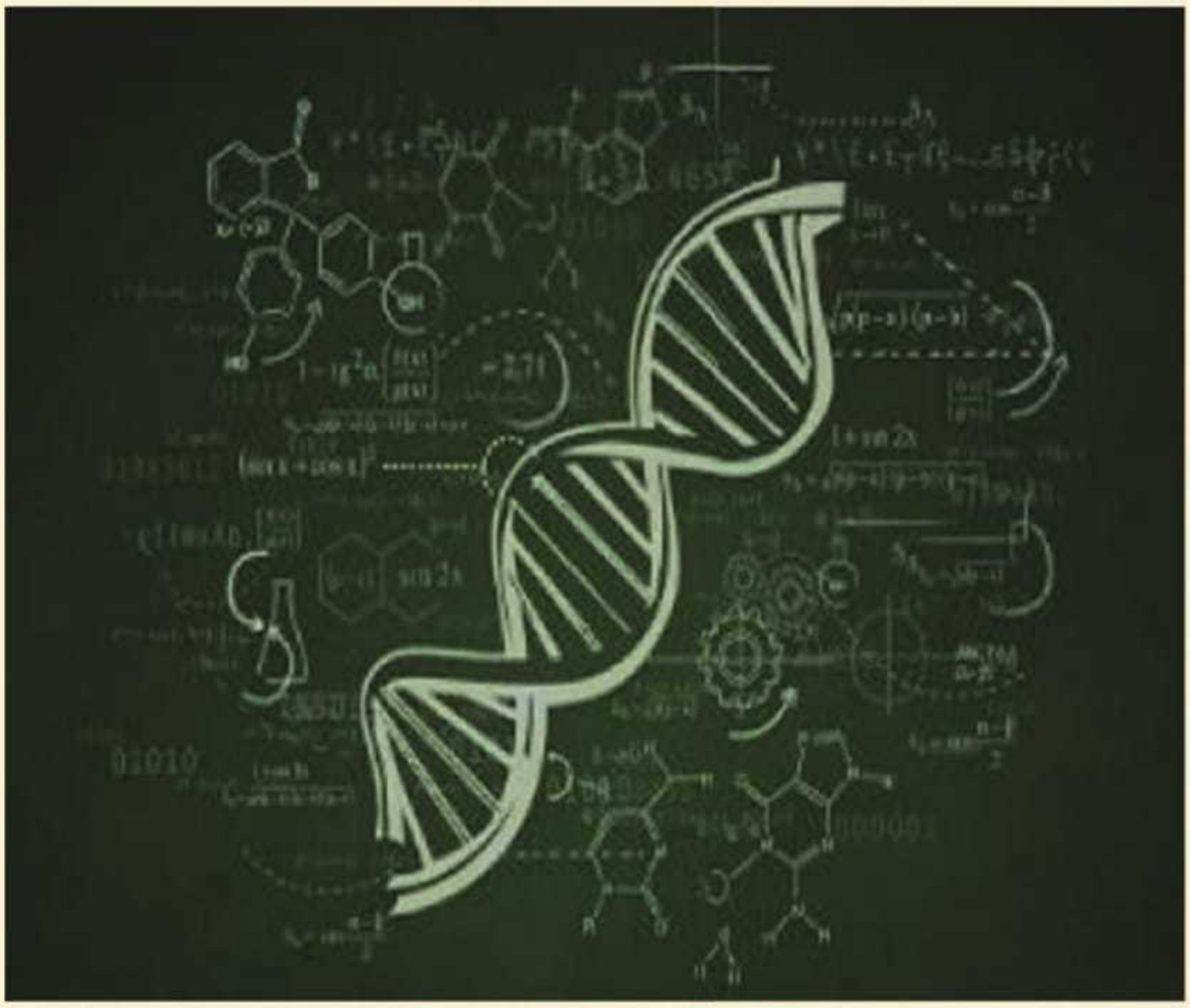

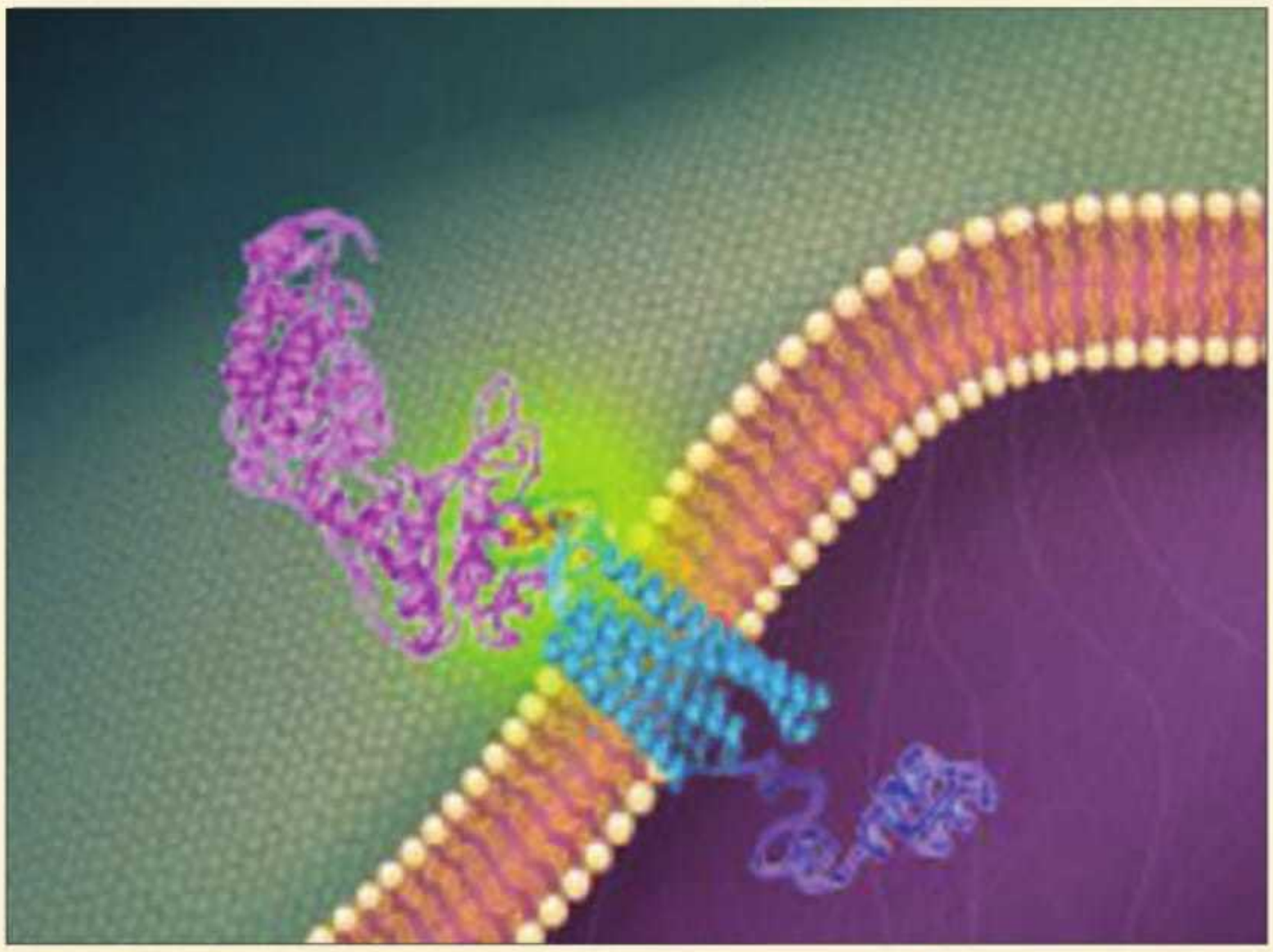

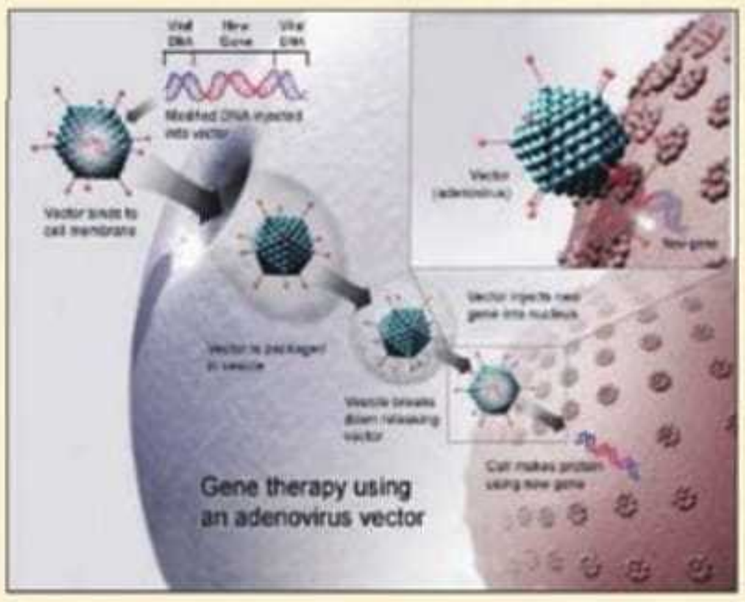

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PLANT DNA BARCODING: CHALLENGES AND PROSPECTS

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Most of us are familiar with the term "barcode" nowadays. The barcode with varying widths and spacings of parallel lines as printed in packets of different products contain all the important information about the product. Once the barcode is scanned, the details can be retrieved easily. Considering this in mind, a similar technology is being used in identifying a particular organism. This technique is called DNA Barcoding. DNA barcoding is a taxonomic method to identify a particular species, as proposed by Paul Hebert (2003) in the paper entitled "Biological identifications through DNA barcode". It uses short genetic sequence from a standard part of the organism's genome. It differs from molecular phylogeny as its main goal is not to determine relationship pattern but to identify an unknown sample in terms of a pre-existing classification.

Earlier biological specimens were identified using traditional taxonomy. Morphological features like the shape, size and colour of body parts were taken into consideration. But in case a specimen is damaged or is in an immature stage of development, it is be difficult for even specialists to make identifications. DNA barcoding solves these problems as they can serve supplement the knowledge of the taxonomists. Moreover, non-experts can also make a quick identification.

The Consortium for the Barcode of Life (CBOL) is an international initiative devoted to developing DNA barcoding as a global standard for the identification of biological species. Established in 2004 through support from the Alfred P. Sloan Foundation, CBOL promotes barcoding through Working Groups, networks, workshops, conferences, outreach, and training. CBOL has 200 Member Organizations from 50 countries and operates from a Secretariat Office located in the Smithsonian Institution's National Museum of Natural History in Washington, DC.

The DNA region which is being used as the standard barcode for most of the animal groups, is a 648 base-pair region in the cytochrome oxidase 1 gene (COI) present in mitochondria which is highly effective in identifying birds, butterflies, fish, flies and many other animal groups. But for plants, one single or common gene is not that effective for DNA barcoding studies. COI is not suitable for Plant DNA barcoding as it evolves too slowly in comparison to animal COI. The three regions from chloroplast DNAare in practice for plant DNA brcoding, viz.trnH-psbA intergenic spacer,matK, and rbcL. The DNA sequences within each species are unique and can provide a means of connecting a specimen to a wealth of information about that species.Though these DNA regions are being widely used there are some limitations, as these sequences may not be sufficient as a barcode sequence for many plants. That's why, the search for better DNA barcodes for plants continues. Very recently, the chloroplast ycf1 region has been proposed as a suitable barcode sequence.

DNA Barcoding studies have four main components:

The Specimens: Specimens are obtained from various sources such as natural history museums, frozen tissue collections, botanical gardens, seed banks, fields etc.

The Laboratory Analysis: DNA is extracted from tiny piece of tissue of the specimen and DNA barcode region is isolated, amplified using PCR and sequenced. The data are then placed in a database for subsequent analysis.

The Database: An important component of the Barcode initiative is the public reference library of species identifiers that can be used to identify unknown specimens. Two major databases, The International Nucleotide Sequence Database Collaborative (INSDC) and Barcode of Life Database (BOLD) are widely being used.

The Data Analysis: Specimens are identified by finding the closest matching reference record in the database. CBOL's Data Analysis Working Group has created the Barcode of Life Data Portal which offers researchers new and more flexible ways to store, manage, analyze and display their barcode data.

With the advancement of molecular techniques, DNA Barcoding studies have become very popular and sensitive.

These tools can be used to identify different species with less effort and their phylogeny can also be traced. As per the record of BOLD database, there are around 2,52,433 species for which Barcodes have been developed. The Department of Biotechnology, Government of India (DBT) has taken major initiatives in setting up Biotechnology labs in different universities and colleges through setting up different Biotech Hubs and in Higher Secondary Schools through BLiSS schemes. DNA sequencing facilities have also been created in different institutes of North East India. As we are aware that North East India is rich in Biodiversity and many of the species are endemic to the region, there are many plants from which not a single nucleic acid has sequence has been deposited in NCBI GenBank database. With DBT initiatives, these laboratories may play a key role in DNA Barcoding of these species.

Source:

Dong W, Xu C, Li C, Sun J, Zuo Y, Shi S, Cheng T, Guo J, Zhou S (2015) ycf1, the most promising plastid DNA barcode of land plants. Scientific Reports 5: 8348.

Gregory TR (2005) DNA barcoding does not compete with taxonomy. Lett Nat 434(7037):1067

Krishnamurthy P.K., Francis Robert A.(2012), A critical review on the utility of DNA barcoding in biodiversity conservation. Biodivers Conserv 21:1901-1919

Meyer CP, Paulay G (2005) DNA barcoding: error rates based on comprehensive sampling. PLoS Biol 3(12):e422

Lahaye R, Bank M, Bogarin D, Warner J, Pupulin F, Gigot G, Maurin O, Duthoit S, Barraclough TG, Savolainen V (2008) DNA barcoding the floras of biodiversity hotspots. PNAS 105 (8) 2923-2928.

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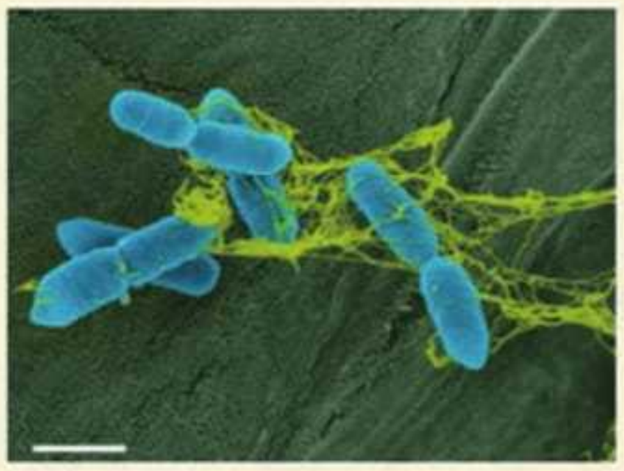
Science Break Throughs

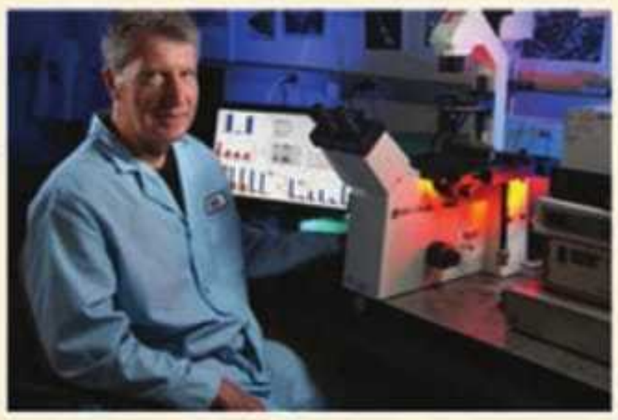
Arms race at the plant root: How soil bacteria fight to escape sticky root traps



Soil is full of microbes. Specialized border cells at the outer surface of plant roots fight off these microbes as the roots penetrate the soil in search of water and nutrients. A new study reveals how plant pathogens fight back against entrapment by sticky root border cell secretions.

Source: Science Daily, June 2016; https://www.sciencedaily.com/releases/ 2016/06/ 160623145922.htm

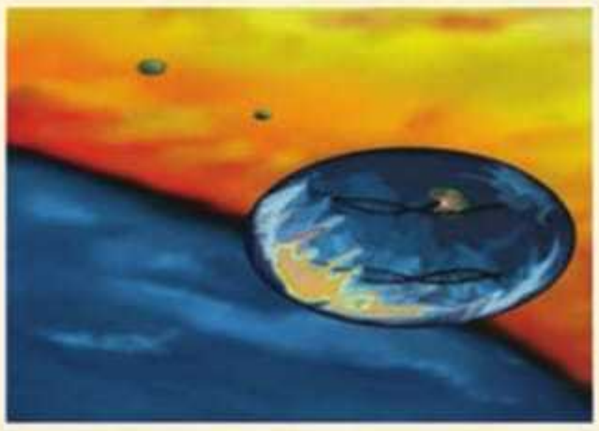
Cannabinoids remove plaque-forming Alzheimer's proteins from brain cells



Scientists have found preliminary evidence that tetrahydrocannabinol (THC) and other compounds found in marijuana can promote the cellular removal of amyloid beta, a toxic protein associated with Alzheimer's disease.

Source: Science Daily, June 2016; https://www.sciencedaily.com/ releases/ 2016/06/ 160629095609.htm

Fix for 3-billion-year-old genetic error could dramatically improve genetic sequencing



Researchers found a fix for a 3-billion-year-old glitch in one of the major carriers of information needed for life, RNA, which until now produced errors when making copies of genetic information. The discovery will increase precision in genetic research and could dramatically improve medicine based on a person's genetic makeup.

Source: Science Daily, June 2016; https://www.sciencedaily.com/ releases/ 2016/06/ 160623150109.htm

GOLD NANOPARTICLES AS MICROBIAL EFFLUX PUMP AND BIOFILM INHIBITOR- THE FUTURE PROSPECT OF ANTIMICROBIAL METAL NANOPARTICLES

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The rise of multidrug resistant (MDR) pathogens is a significant clinical problem. Apart from the acquisition of acquired resistance traits, such as transposons and plasmid encoding proteins that inactivate antibiotics. Many of these organisms have increased resistance resulting from mutations that alter the expression of genes that are involved in intrinsic resistance to antibiotics (Nikaido and Pages 2012). One of the major roles played in decreasing the effectiveness of the conventional drugs is multidrug efflux system (MES). The efflux systems have been classified into the following six super-families: ATP-binding cassettes (ABC), resistance-nodulation cell division (RND), Multidrug and Toxic compound efflux (MATE), small multidrug resistance family (SMR), multi- antimicrobial extrusion protein family, and multi-drug endosomal transporters (MET) (Kourtesiet al., 2013). MET is restricted to higher organisms while the rest are prevalent in microorganism.Resistance-Nodulation-Division (RND) family efflux is one of the major contributors to intrinsic resistance in Gram-negative bacteria extruding a broad spectrum of antibiotics and biocides (Opperman and Nguyen 2015). Due to higher resistance against antibiotics, biofilm formation by bacteria forms a problem for the treatment of many infectious diseases. (de la Fuente-Nunez et al., 2013). In a biofilm, self-formed extracellular matrix, called slime encapsulates the cells. This slime, also called a hydrogel consisting of proteins, polysaccharides and DNA, contains a large amount of water. The slime has elastic characteristics, hence as a consequence is resistant to fluid flow (Harrison et al., 2005; Hall-stoodleyand Stoodley, 2009). During stress condition, cells can be released from the extracellular matrix and can revert back to their planktonic form can adhere to another surface and forms a new biofilm; altogether the biofilms are called consortia (Harrison et al., 2005). Among the most effective ways to prevent biofilm formation is to interfere with the adhesion of planktonic cells on the surface, which is a crucial step of colonization (M. Kostakiotiet al., 2013). Infections caused by multi-drug-resistant (MDR) bacteria caused 300 million cases of severe illness every year and killing 16 million, including 2 million children. The chronic diseases are resulting from acute illness due to colonization of bacteria into biofilm, three-dimensional complex bacterial community. The increase in complexity of the biofilm matrix and decrease in efficacy of antibiotics have undermined the scenario of clinical diagnosis and treatment e.g. performs surgeries, or conduct life saving treatments such as cancer chemotherapy and organ transplants (Gupta et al., 2016).

Nanoparticles (NPs) have emerged as antimicrobial weapons due to their unique tunable chemical and physical properties owing to the the high surface area to volume ratio. This enables promising synergy from loading of therapeutics and their multivalent interactions.A variety of techniques like Optical density measurement, Spread-plate (colony counts on agar), Cell counting devices, Crystal violet staining, Live/dead fluorescent stain MTS/MTT/XTT assays are available to evaluate bacteria viability, each with unique advantages and disadvantages in order to determine the effectiveness of nanoparticles as antimicrobial agents (Seil and Webster, 2012). NPs of various metals (e.g. Au, Ag, Cu, ZnO, Pdetc.) addresses the common mechanisms of antibiotic resistance by multiple mechanism inhibiting the multi-drug efflux system, permeability regulation, ROS (reactive oxygen species) generation that leads to target site binding affinity mutations, and antibiotic degradation (Dizajet al.,2014; Salehet al.,2015).Following this strategy, several NP-based systems have been developed to improve antimicrobial efficacy. One of such system is gold-based and is exploited for their unique optical, physical and chemical properties for regulation of gene, conjugating, loading, unloading, imaging, sensing and transporting the biologicals and pharmaceuticals (John et al., 2015; Rosiet al., 2016). The gold nanoparticles (Au NPs) have drawn more attention due to its biocompatibility and thiol linkages leading to high versatility of functions. The photo physical properties can make available the drug release at remote places along with that the gold core is essentially non-toxic and inert, the ease in synthesis of mono- disperse nanoparticles make it a bright candidate for drug delivery (Ghoshet al., 2008).

Thus Au NPs in biology and medicine plays an important role due to its strong scattering and absorption, tunable sur

face plasmon resonance (SPR), easy surface functionalization, facile synthesis methods, and low toxicity.

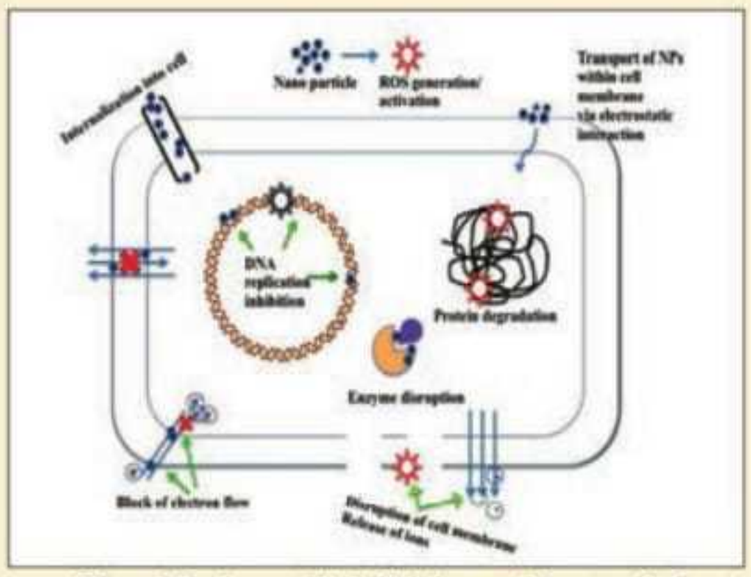

Fig: Modes of inhibition of bacterial growth by metal nanoparticles

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Biotechnology Ignition Grant Scheme (BIG) - Opportunity for start-ups

BIRAC (Biotechnology Industry Research Assistance Council) believes that the "bio-innovation capital" of the nation would come from novel ideas which have a commercialisation potential and that evolve out from start-ups or academic spin-offs. BIRAC's strategy is therefore to support the numerous exciting ideas which have an unmet need for funding and mentorship. This strategy is fulfilled through a grant funding scheme called Biotechnology Ignition Grant (BIG) which is available to scientist entrepreneurs from research institutes, academia and start ups. The Applicant must be either an Incubatee or have a registered company with a functional R&D laboratory to be eligible for this grant. The scheme is designed to stimulate commercialization of research discoveries by providing very early stage grants to help bridge the gap between discovery and invention.

The purpose of the BIG Scheme is to :

* Foster generation of ideas with commercialisation potential
* Upscale and validate of proof of concept
* Encourage researchers to take technology closer to market through a start up
* Stimulate enterprise formation

The call for proposal is announced twice every year, on 1st January and 1st July. As part of this scheme, successful BIG Innovators receive up to INR 50 lakh (appox. $100K) for research projects with commercialisation potential with duration of up to 18 months.

The BIG Scheme is currently managed through 5 BIG Partners across the country who works with the Ignition grantees (BIG Innovators) to provide mentoring, monitoring, networking and other business development related activities.

Link: www.birac.nic.in

GENOMICS IN ENVIRONMENTAL MANAGEMENT

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Genomics is a broadly used term encompassing numerous scientific disciplines and technologies including genome sequencing; assigning function to identified genes; determining genome architecture; studying gene expression at the transcription level (transcriptomics); studying protein expression at the proteome level (proteomics); and investigating metabolite flux (metabolomics).

Application of "omics" technology to (eco)toxicology:

"Omic" technologies have the potential to reduce uncertainties in risk assessment and facilitate a more rapid evaluation of a chemical's toxic potential and the response of populations to environmental change. Exposure to environmental toxins represents a stimulus that can induce changes in gene expression, which may be typical of that type of toxin. These changes can be monitored using genomic approaches, providing vast numbers of potential biomarkers. As the function of more genes is discovered, toxicogenomics offers the ability to unravel the mechanism underlying toxic effects of chemicals. This information will be used to elucidate new biological signalling pathways; new biomolecules; to understand mechanism of action; and the identification of sensitive and insensitive phenotypes and species.

Molecular genetics in epidemiology:

Advances in molecular biology and in technologies for measuring and processing data at the molecular level will likely impact the use of biomarkers in epidemiology studies. Molecular epidemiology studies are proliferating in the scientific literature, exploring markers of genetic damage, genetic risk factors for disease, and possible interactions among genetic factors, disease, and environmental exposures. The application of genomics to environmental science will be reliant on continued high quality ecological and chemical monitoring programmes.

Environmental Perspective:

Fundamental research to understand the genome is also intensifying for many other 'model' species including fish, insects and worms. Inevitably, the science of environmental risk assessment will need to develop in order to be able to take this new knowledge into account in a pragmatic way.

TECHNIQUES IN GENOMICS

Molecular techniques to study ecological condition:

Even before the advent of genome sequencing projects and the subsequent development of transcriptomic, proteomic and metabolomic tools that exploit such information, the potential to assess the status of environmentally relevant organisms through measurement of their genes and proteins was already being investigated. Many of the methods and studies focused on assessing changes in the expression of single genes and also organelle level changes.

In the development of all of these molecular based assays, the most significant advances came upon the development of the polymerase chain reaction (PCR) devised by Mullis et al. (1986) and has proved itself to be the most versatile yet precise of all the biological techniques. To date PCR based methods have been applied in a number of techniques with potential for biological assessment of environmental quality.

Microbial community profiling:

The profiling can be eitherculture dependent or culture independent. Cultureindependent studies extract total DNA or RNA from microbial communities and use universal forward and reverse primers in combination with the PCR reaction to amplify species- orgenera specific DNA fragments from a whole community sample previously isolated directly from soil. After PCR, fragments can beused in a range of post amplification analyses.

Denaturing and temperature gradient gel electrophoresis (DGGE and TGGE):

PCR products are separated by electrophoresis on an acrylamide gel containing a denaturing urea gradient (DGGE) or a temperature gradient (TGGE). The denaturing conditions induce strand melting at a point dependent on the nucleotide composition. These melted fragments migrate slower through the gel matrix, thus separating the fragments of differing nucleotide composition.

Single strand confirmation polymorphism (SSCP):

PCR is conducted with a phosphorylated and non-phosphorylated primer. Products are converted to single strands by lambda exonuclease digestion of the phosphorylated strand and electrophoresed Amplified ribosomal DNA restriction analysis (ARDRA)

PCR amplification is followed by cutting with restriction enzymes. Digests are then electrophoresed on agarose or acrylamide gels allowing identification of sequence dependent banding patterns.

Terminal-restriction fragment length polymorphism (T-RFLP):
T-RFLP is similar to ARDRA, but a fluorescent primer is included in the PCR reagent mixture. After restriction enzyme digestion, fragments are analysed on an automated sequencer.

Fluorescence in situ hybridisation (FISH):
FISH allows the direct scrutiny of microbial populations within their three-dimensional ecological niche. An environmental sample is fixed, using paraformaldehyde and the cell membranes permeabilised. Fluorescent oligonucleotide probes are introduced into the samples that are specific for certain genera or species of bacteria which will hybridise with the specific bacteria against which they are targeted towards.

Flow cytometry:
Flow cytometry is a generic technology which counts and measures multiple characteristics of individual particles in a flow stream. This is now being used as a tool to identify different taxonomic groups of bacteria and phytoplankton using spectral differences in auto fluorescence excitation and emission.

Eukaryotic community profiling:
Identification of the presence of eukaryotic species has traditionally relied on morphologically based taxonomy. As an answer to this problem, it has been suggested that PCR based 'molecular barcoding' techniques could be used. The method is based on the amplification and sequencing of specific regions of the small subunit ribosomal(SSU) RNA gene. The approach allows the presence of specific genera or species to be identified within a community and can be linked either to classical biodiversity statistics, specific indices or potentially to multivariate based analytical tools.

Genome mutation analysis using RAPD or AP-PCR:
Exposure to genotoxins can result in covalent binding between DNA and the parent chemical and/or a metabolite to form adducts. Faulty repair of adducts can result in point sequence mutations. A number of techniques exist that can be used for the direct detection of DNA adducts. Changes in sequence or DNA strand breaks will affect either PCR product amplification or size. These changes are detected by gel electrophoresis.

Single gene transcript quantification methods:
Quantitation of expression of specific gene transcripts has been used successfully to provide environmentally relevant information.Advances in the handling and detection of nucleic acids has made a number of methods available for detection and quantification of gene transcription.

Northern blotting: Total RNA is electrophoretically resolved under denaturing condition and then transferred via capillary action to a nitrocellulose membrane. The membrane is probed with a radiolabelled oligonucleotide probe designed with a sequence that matches the target gene product. When a gene is highly expressed, more mRNA is present on the nitrocellulose and as a result there is greater hybridisation of the labelled probe. When viewed by exposureof audioradigraphic film to the membrane, such samples show a larger 'blot' than low expression samples. Image analysis can be used for formal quantification.

Dot and slot blotting: In dot and slot blotting, samples of cloned DNA matching the gene of interest are denatured and identical amounts uniformly spotted onto a single nitrocellulose membrane. The filter is then hybridised with a radioactivity labelled probe, containing the corresponding sequence in unknown amounts. The extent of hybridisation is estimated semi-quantitatively by visual comparison to similarly spotted radioactive standards.

RT-PCR for measurement of gene expression: The power and specificity of PCR makes the procedure ideal for detecting responses of specific gene. Initially an obstacle to the use of PCR for gene expression quantification was the nature of amplification. As a result, comparisons of product levels at amplification end would show no difference between samples containing different amount of starting material.

The fluorogenic 5' nuclease assay: This utilises the 5′ nuclease activity inherent as a secondary function of Taq DNA polymerase. For the procedure an oligonucleotide probe complementary to the target is included within the reaction. The 3′ end of the probe is labelled with a fluorescent molecule, such as FAM (6-carboxy-fluorescein), and the 5′ end with a complementary quencher, such as TAMRA(6-carboxy-tetramethyl-rhodamine). When both are present on the probe, the quencher suppress the fluorescent molecule and no light can be detected.

Direct quantification of mRNA transcripts by chemiluminescence :Chemiluminescent RNA hybridisation offer an alternative to quantitative RT-PCR for detection of specific mRNAs.For the assay, labelled probes complementary to target gene are added to an RNA sample. This hybridises to the target and a reaction occurs from which light is given off. The light generated is proportional to the number of genetranscripts present and thus gives a measure of the concentration of the gene product present in the sample.

POTENTIAL OF ENVIRONMENTAL GENOMICS

The scientific benefits and potential of genomics to increase our understanding of the biology of organisms is immense. Furthermore, by proactively assessing outputs from genomics research, we can add value to our current biological tests and methodologies.

Genomics as an Information Provider:
The greatest attribute of environmental genomics is its power as an information provider. The challenge faced, however, is the robust interpretation of the data to generate finite answers to specific questions because; the quantity of data provided is so large.It provides -

- A better understanding of mechanisms of action.
- A more robust extrapolation of laboratory data to natural populations.
- Predictive toxicity
- Insights into sensitive sub-populations

and species.
• Understanding of sustainability of populations.
• Confirmation that levels of protection are adequate.
• Potential to reduce uncertainties in risk assessment.
• An insight into genetic risk factors for disease (predisposition) and interactions between genetic factors and environmental exposure.

Obstacles, data gaps and solutions

It is important to manage the expectation for genomics to deliver as there are significant hurdles which must be overcome before its full potential can be realized. These include - lack of genomic knowledge of non-model organisms, robustness of the data generated, limited validated, lack of baseline data and uncertainty.

CONCLUSIONS :

Environmental genomics has the potential to act as the vehicle through which the public can be made aware of, and can understand the direct benefits of genomics. However, for this to be delivered it is essential that the Agency manages this issue carefully and proactively. With the potential for irresponsible presentation of non - validated data into the public domain, leading to unsubstantiated public concern, there is a requirement for genomics issues to be addressed promptly if risks are to be minimised.

Academic, government and industrial scientists have been investigating the biological,chemical and physical impacts of toxicants on gene and protein expression in wildlife populations for a number of years. This strategy should include the underpinning of the Water Framework Directive where it can provide additional information relating to ecological structure and function. However, it is also essential to moderate expectation and realize the limitations and potential threats posedby genomic technologies.

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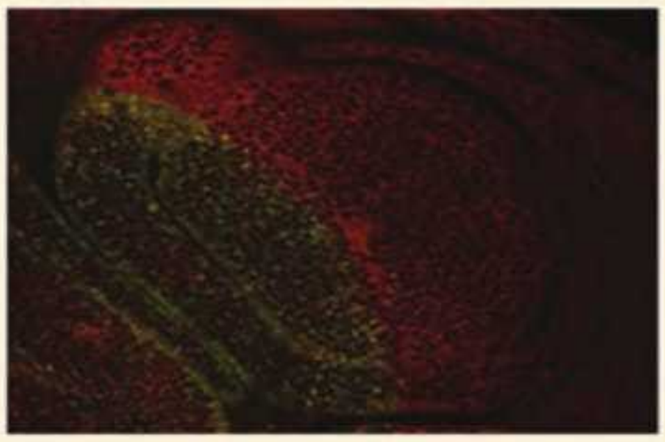
Science Break Throughs

How Do Stem Cells Know What to Become?



How do the cells in a human embryo know where they are located in the body and how they should develop? Why do certain cells form a finger while others do not? Biologists have explained the mechanisms that control these steps by showing why veins form at particular points in the wing of a fruit fly. The protein Pentagone spreads a particular signal in the wing that tells the cells how to behave.

Source: Science Daily, June 2016; https://www.sciencedaily.com/releases/2016/06/160628141235.htm

Jasmonate-deficient tobacco plants attract herbivorous mammals

Tobacco plants which lack the hormones responsible for nicotine production are feasted on by rabbits, other mammals.

Scientists have demonstrated the importance of jasmonate-dependent nicotine production for the survival of tobacco plants which are attacked by mammalian herbivores.

Source: Science Daily, June 2016; https://www.sciencedaily.com/releases/2016/06/160629105803.htm

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RHIZOREMEDIATION STRATEGY TO EXPLOIT RHIZOSPHERE FOR BIOREMEDIATON

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Rhizoremediation is a process where microorganisms degrade soil contaminants in the rhizosphere. Soil pollutants that are remediated by this method are generally organic compounds that cannot enter the plant because of their high hydrophobicity. Intense industrial activity in the 20th century, especially in developing countries, has led to serious environmental pollution, resulting in a large number and variety of contaminated sites which became a threat to the local ecosystems. In India, the application of industrial and city effluents to land has become popular in recent years as an alternative means of treatment and disposal (Zhang et al. 2010). So there is increasing and widespread interest in the maintenance of soil quality and remediation strategies for management of soils contaminated with organic and persistent pollutants.

Traditional remediation techniques of soils contaminated with organic and hazardous materials involve excavation of soils, followed by incineration or landfill storage and containment (USEPA 2011). These remediation approaches are usually expensive and sometimes only move the contamination from one place to another.The application of bioremediation strategies in the treatment of contaminated soils has increased in recent decades because of public concern over threats that contaminants pose and the need to degrade pollutants to concentrations below limits established by regulatory agencies.

There has been much interest in bioremediation technologies which use plants and microorganisms to degrade toxic substances. The importance of plant microbe partnership in the remediation of contaminants was confirmed at the level of rhizosphere. Rhizoremediation is considered as the most potential approach for remediation in soil. Here the plants create a niche for rhizosphere microorganisms to do the degradation. Degradation is facilitated through a rhizosphere effects where plants exudes organic compounds through their roots and thereby increase the density and activity of potential remediating microorganisms in the zone (Carcer et al. 2007), as elucidated in figure from one of our publications (Bisht et al., 2015). The process of rhizoremediation may be classified into following two types:

1) **Rhizovolatilisation:**

Rhizovolatilisation of inorganic contaminants differs significantly from other remediation techniques as it releases the contaminants in the atmosphere. The concern related to volatilisation of contaminants is significant especially for elements such as mercury and arsenic, which are not essential and can form extremely toxic volatile compounds. Studies on arsenic uptake and distribution in higher plants indicate that arsenic predominantly accumulated in root and only small quantities are transported to shoots. However, plant may enhance the biotransformation of arsenic by rhizospheric bacteria, thus increasing rates of volatilization.

2) **Rhizodegradation:** Field-contaminated soils that have undergone prolonged periods of ageing generally appear to be much less responsive to rhizodegradation than fresh soil. Characterising root exudation in terms of chemical composition and quantity and investigation of utilization pattern by microbial strains competent to degrade organic pollutants is a prerequisite for this purpose. Selection and engineering of plants and microbial strains that can modify solubility and transport of organic pollutants through exudation of biosurfactants holds promise. Recent attempts to genetically engineer plant– microbial systems to enhance rhizodegradation include gene cloning of plants containing bacterial enzymes for the degradation of organic pollutants such as PCBs and of recombinant, root-colonising bacteria (e.g. Pseudomonas fluorescens) expressing degradative enzymes (e.g. ortho-monooxygenase for toluene degradation) (Yee et al. 1998). Soils and sediments polluted with crude oil hydrocarbons (HC) are of major environmental concern on various contaminated sites. Hydrocarbon-degrading microcrganisms are ubiquitously distributed in soils and constitute less than 1% of the total microbial communities but may increase to 10% in the presence of crude oil (Atlas 1995).

Degradation of hydrocarbon further

requires a balanced nutrient supply in soil which can be achieved by fertilisation (biostimulation). Mainly nitrogen and, to a lesser extent, phosphorus are reported to be limiting factors of HC degradation processes in oxic soil environments (Bragg et al. 2003). Microorganisms are able to use HC as a carbon and energy source preferentially in the absence of a readily available carbon source like labile natural organic matter. Read et al.(2003) observed increased phosphorus mobilisation due to exudation of biosurfactants by lupine (Lupinus angustifoliusL. cv. Merrit). The identified biosurfactants consisted of phospholipids which could provide an additional phosphorus source to microorganisms. Polycyclic aromatic hydrocarbons (PAHs) are contaminants generated from many sources such as the combustion of coal and fossil fuels for energy production and are potential carcinogens that can induce mutations. As lipophilic compounds, they present a significant health risk if they enter the food chain (Henner et al. 1997). These compounds can be used by soil microorganisms as an energy and carbon source, although four-, five-, and six-ring PAHs are more resistant to biodegradation. Bacteria initiate PAH degradation via dioxygenase attack, increasing PAH chemical reactivity and solubility (Harvey et al. 2002).

We had been actively working on PAH degrading bacteria, isolated and applied through rhizosphere for effective rhizoremediation (Bishtet al., 2010; 2014; 2015). Also, multiple purpose bioinoculanthas been formulated with these bacteria in variouslignocellulosic agro waste products for proper dissemination. The rhizospheric colonization abilities of isolates was detected using green fluorescent protein tagged variants. Catechol di oxygenases have been studied and characterized. Recently, we reported rhizoremediation of toluene using pWWO transformed R. leguminosarum (Goel et al., 2012), and, di-chloro benzene in soil using Jatropha rhizosphere (Pant et al., 2016). Considering the fact of growing industrialization in North-East India, the strategy of rhizoremediation have potential for providing a sustainable biotechnological alternative for eco-restoration and soil health improvement.

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Significant Events & Discoveries in Biotechnology in Last Two Decades

1995: Researchers at Duke University Medical Center transplanted hearts from genetically altered pigs into baboons, proving that cross-species operations are possible. The bacterium Haemophilusinfluenzae is the first living organism in the world to have its entire genome sequenced.

1996: Biogen'sAvonex is approved for the treatment of multiple sclerosis. The discovery of a gene associated with Parkinson's disease provides an important new avenue of research into the cause and potential treatment of the debilitating neurological ailment.

1997: Researchers at Scotland's Roslin Institute report that they have cloned a sheep--named Dolly--from the cell of an adult ewe. The FDA approves Rituxan, the first antibody-based therapy for cancer.

1998: The first complete animal genome the C.elegans worm is sequenced. James Thomson at Wisconsin and John Gearhart in Baltimore each develop a technique for culturing embryonic stem cells.

1999: A new medical diagnostic test will for the first time allow quick identification of BSE/CJD a rare but devastating form of neurologic disease transmitted from cattle to humans.

2000: "Golden Rice," modified to make vitamin A. Cloned pigs are born for the first time in work done by Alan Coleman and his team at PPL, the Edinburgh-based company responsible for Dolly the sheep.

2001: The sequence of the human genome is published in Science and Nature, making it possible for researchers all over the world to begin developing genetically based treatments for disease.

2002: Researchers sequence the DNA of rice, and is the first crop to have its genome decoded.

2003: The Human Genome Project completes sequencing of the human genome.

2004: UN Food and Agriculture Organization endorses biotech crops, stating biotechnology is a complementary tool to traditional farming methods that can help poor farmers and consumers in developing nations. FDA approves the first antiangiogenic drug for cancer, Avastin®.

2006: FDA approves the recombinant vaccine Gardasil®, the first vaccine developed against human papillomavirus (HPV), an infection implicated in cervical and throat cancers, and the first preventative cancer vaccine. USDA grantsDow AgroSciences the first regulatory approval for a plant-made vaccine.

2007: FDA approves the H5N1 vaccine, the first vaccine approved for avian flu.

2009: Global biotech crop acreage reaches 330 million acres.FDA approves the first genetically engineered animal for production of a recombinant form of human antithrombin.

2010: Dr. J. Craig Venter announces completion of "synthetic life" by transplanting synthetic genome capable of self-replication into a recipient bacterial cell.

2011: Trachea derived from stem cells transplanted into human recipient. Advances in next generation sequencing enable human whole genome sequencing in less than one week for under $2,000.

Some Activities and Events of GBP during JAN-MAR 2016

GBP's participation in Science Fair, 28-29 Feb, 2016

GBP participated in a 'Two Day Science Fair' held on the occasion of National Science Day on 28 and 29 Feb, 2016 jointly organized by Cotton College State University (CCSU) and Institute of Advanced Study in Science and Technology (IASST). The facilities & activities of GBP was showcased by putting up an exhibition stall in the event, coordinated & attended by Dr. Madan G. Barthakur, Research Scientist, Dr. Bula Choudhury, Research Scientist, and Ms. Ashma Begum, Research Associate, GBP.

Seminar cum Poster presentation on "Trends in Global Health Research", 18 Feb, 2016

Kavi-Krishna Laboratory (KKL) housed at GBP organized this event on 18th February, 2016. The seminar aimed to leverage the Global Health related education and research techniques from national and international research institutes/ universities/ medical colleges through interaction with students/research scholars and delegates.Shri. Vinod Seshan, IAS (CEO, GBP) inaugurated the seminar where highly interactive discussions by Dr. Ranjan Tamuli (Assoc. Prof., Dept. of Biosciences and Bioengineering, IITG), Dr. Debabrat Baishya (Asstt. Prof., Deptt. of Bioengineering and Technology, GU IST) covered a range of topics which would gear towards developing action items for advancing global cancer research priorities.

Exposure Visit to GBP by trainees of IIE,12 Feb, 2016

A group of 13 traineesvisited GBP on 12 Feb, 2016, who was taking up training at Indian Institute of Entrepreneurship (IIE), Guwahati. These students/researchers/entrepreneurs were enthusiastic to visit the Park and were keen to know regarding the various lab facilities available here. Dr. Bula Choudhury, Research Scientist, Ms. Ashma Begum, Research Associate,Ms. Jahnabi Choudhury, Administrative Officer, and Dr. Madan Barthakur, Research Scientist, explained the facilities available, viz., bioprospecting, CAIF, etc., wherein the group showed lot of interest and had few queries answered.

Project Dissertation work carried out by BTech student from Mangalayatan University, Aligarh, UP at GBP

GBP is encouraging project dissertation works by students in different topics utilizing different facilities at GBP. A B.Tech. Biotechnology final year student Mr. Priyaranjan Mishra from Mangalayatan University, Aligarh, UP has completed a 3 months project dissertation work at GBP in the field of Biochemistry. The topic of the project is 'Fatty Acid profiling of Fish species of North East region of India (Assam) with special reference to Omega-3 and Omega-6 Fatty Acids'. The study was focused on the fatty acid composition evaluation in some locally found fish species of Assam. This project work was supervised by Dr. Madan Gopal Barthakur, Research Scientist, GBP.

Some Activities and Events of GBP during JAN-MAR 2016

GBP's participation in Global Biotechnology Summit 2016, 5-6 February 2016

As a run up to the DBT celebrating its 30th Foundation Day on 26th Feb, 2016, the Global Biotechnology summit on "Destination India" was held at Vigyan Bhawan, New Delhi on 5-6 February 2016. The event was attended by Ms Ashma Begum, Research Associate, GBP. The main agenda of the summit was to bring all stakeholders to discuss opportunities, collaborations and prepare a joint action plan for achieving a target of 100 billion US dollars for the biotech sector by 2020. The event was marked by interactions with eminent scientists as well as overseas experts in association with various autonomous institutes and star colleges.

Promotion of GBP through association with UDGAM'16, 15-17 Jan, 2016

Guwahati Biotech Park has been the title sponsor for Udgam 2016, an annual entrepreneurship summit in association with Entrepreneurship Development Cell-Indian Institute of Technology, Guwahati. This 3 day event from 15th to 17th January 2016 was focused to develop and spread the spirit of entrepreneurship among the youth of North-East and India, in general. Through the various workshops and panel discussions scheduled during this event it has been an excellent platform for marketing and networking opportunity

A hands on training program on CLSM, 3-5 Feb, 2016

A hands-on training program on Confocal Laser Scanning Microscopy was held from 3-5 Feb., 2016 at GBP, in association with Leica Microsystems. 10 participants of various institutes attended the program and awarded certificates. The event was coordinated by Dr. Bula Choudhury, Research Scientist, GBP, and Dr.Anupam Banerjee, Application Manager, Leica Instruments.

CEO, Lucknow Biotech Park visited GBP, 29 Jan, 2016

Prof. Pramod Tandon, CEO of Lucknow Biotech Park, and Professor VeenaTandon and one student visited Guwahati Biotech Park on 29 Jan, 2016. They visited the various facilities of GBP and noted the activities as appraised by the staff in a short discussion. Prof. Tandon shared the activities and initiatives of Lucknow Biotech Park and encouraged GBP with his valuable advice. He gave an insight about variousscope in the field of biotechnology and contribution of biotech parks to the society

Some Activities and Events of GBP during JAN-MAR 2016

GBP's participation in Workshop at Pub Kamrup College, 10 Feb, 2016

GBP has participated in a four day workshop on 'Biomolecule Screening and Computational Biology' was organized at Institutional Level Biotech Hub of Pub-Kamrup College from 9-12 Feb, 2016. Ms Ashma Begum, Research Associate, GBP, and Mr Kumar Saurav Dey, Technical Officer, GBP, conducted a session on basic chromatographic techniques and high-end chromatographic instruments on 10 Feb, 2016. They also supervised practical demonstrations on extraction and distillation procedures.

Short term Training on Analytical Instruments, 15-17 Mar, 2016

A 3 day 'Short-term Training Program on Analytical Instruments (GCMS, LCMS & HPLC systems)' was held during 15-17 March, 2016 at Central Analytical Instrumentation Facility (CAIF) of GBP. 21 participants of various institutes have taken up the training and awarded certificates. The event was coordinated & conducted by Dr.Madan G. Barthakur, Research Scientist & In-charge, CAIF, GBP and Kumar SauravDey, Technical Officer, GBP.

Project Dissertation work carried out by M.Sc (Bioinformatics and Clinical Trial Management) student at GBP

A M.Sc (Bioinformatics and Clinical Trial Management) third semester student Mr. Ridipjyoti Choudhury from Mohamed Sathak College of Arts & Science, Madras is taking up a 40 dayinternship work at GBP on 'Microbial Techniques with Imaging'. This internship is being supervised by Dr. Bula Choudhury, Research Scientist, GBP.

Feedbacks from a few Trainees at GBP

- As I am bring research in medical plants for treatment of different disease, so this training is quite relevant to my work. If something is included in preparation of sample for confocal microscopy then, it will more beneficial. -*Dr. (Mrs.) Rajlakshmi Devi, IASST, Guwahati*
- It trained me to use the confocal microscope. This training will be helpful in future work. It was very useful. I got to operate the machine myself and had my doubts cleared. Please include a session on sample preparation from next time. - *Angkana Kalita, BSBE, IIT Guwahati*
- It is related to my research, however, more towards bio. It should be extended to from days. - *Shasanka Sekhar Borkotoky, CoE, IIT Guwahati*
- It did cover and it was managed properly. It is very relevant to our occupation. Very useful it had lot of take have message. We would be happy is more samples are covered. - *Takhellambam Chanu Machathobi, Manipur University*
- Now I am a confidant though in to handle instrument like that as I am a student of physics there was some differently. But I have be observed a lot. But it other instruments are also included, there with a period of 1 week of more and can learn more. - *Kabita Deka, Assam University*
- Apically the imaging and 3-D analysis. It was quite relevant should be extended for some more days for basis training of sample preparation. Document must be provided for better how of work principle of instruments.- *Ajeet Kumar, BSBE, IIT Guwahati*
- I am going to use confocal microscopy in my project work. - *Tapash Chakraborty, Dept of Pharmaceuticals, Dibrugarh University.*

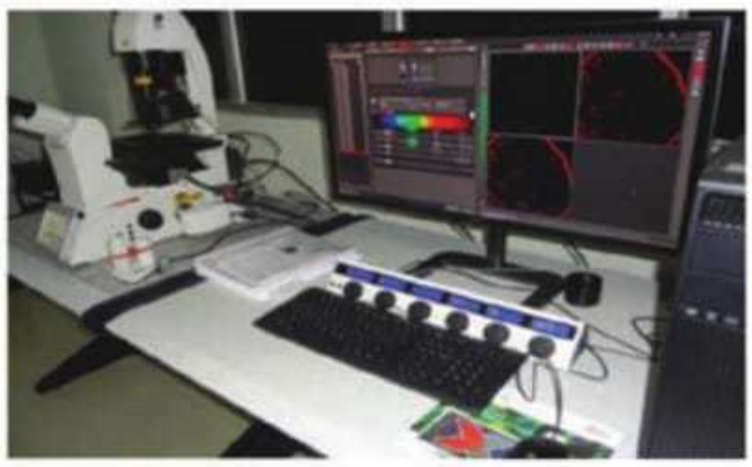
Some of the Equipment Facilities at GBPIC

GCMS

LCMS-MS

HPLC

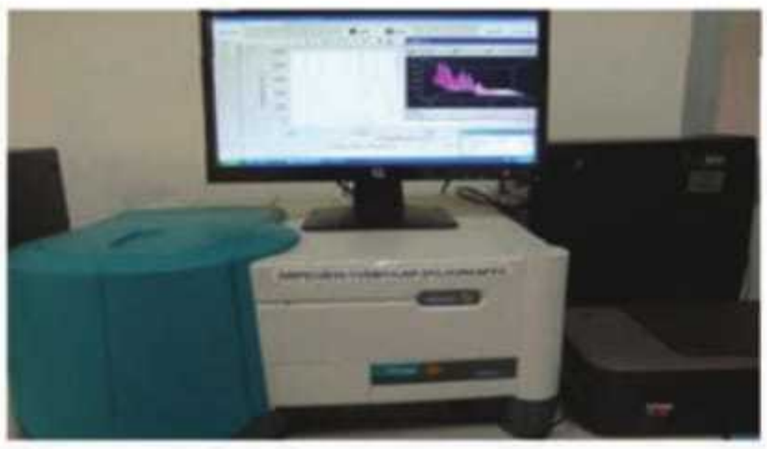
Confocal Microscope



CHNS Analyzer

Ultra Centrifuge

Fluorescence Spectrophotometer



HPTLC

Some of the Equipment Facilities at GBPIC

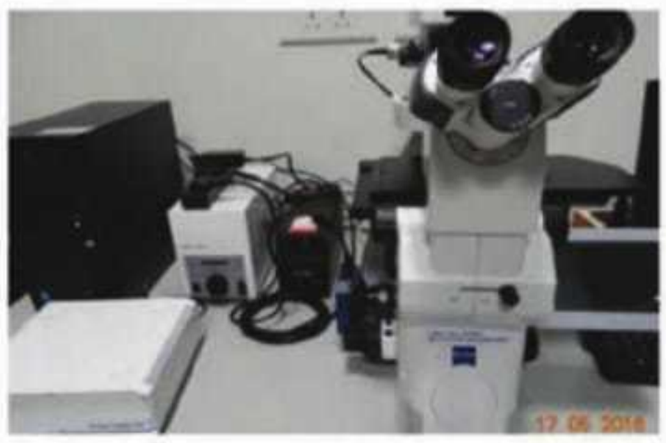
Gel Doc System

Lyophilizer

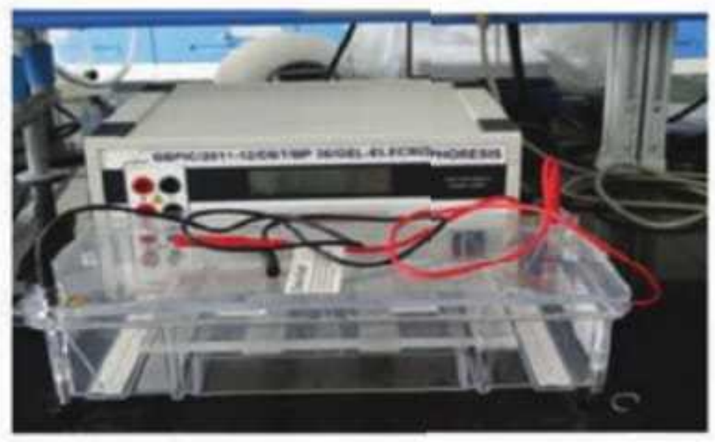
CO_2 Incubator

Bio Safety Cabinet

Fluorescence Microscope



Electrophoresis Unit



BOD Incubator

20 Liter Rotavapor

Modular Laboratory and other Support Facilities at GBP

List of various types of Instruments/Equipments currently available at GBPIC:

Instruments/Equipments
1. LC MS/MS
2. GC MS
3. CHNS Elemental Analyzer
4. Mass Directed auto-purification system
5. UV Spectrophotometer
6. IR Spectrophotometer
7. Speed Vac (Vacuum Concentrator)
8. Ultracentrifuge
9. Digital Polarimeter
10. Digital pH Meter
11. Sonicator
12. High Precision Electronic Balance (5 Digit)
13. Millipore water filtration system
14. Rotavapour (5L) with Pump &Chiller
15. Rotavapour (20L) with Pump &Chiller
16. Magnetic Stirrer with Hot Plate
17. Microcentrifuge (Non Refrigerated)
18. Flourescence spectrophotometer
19. Microcentrifuge (Refrigerated)
20. High Speed Refrigerated Centrifuge
21. Continuos Flow Centrifuge
22.BOD Incubator
23. CO2 Incubator
24. Biosafety Cabinet
25. Gel Dryer
26. Horizontal Mini and Max Sub-Marine Electrophoresis Unit
27. Electroporator
28. PCR
29. Incubator/Environmental Shaker
30. Hybridization Oven/Shaker

Instruments/Equipments
31. Autoclave (Vertical)
32. Vortex
33. Slot-Blot Apparatus
34. Rotary High Vacuum Pump
35. Ice Flaking Machine
36.Bench Fume Hood and Walk-In Fume Hoods
37.Laminar Air Flow
38. Deep Freezer (-40° C)
39. Deep Freezer (-86° C)
40. Stereo zoom Microscope
41. Gel Documentation System
42. Hot Air Oven
43. Water Bath Shaker
44. HPTLC
45. Lyophilizer
46. HPLC (Analytical) & HPLC (Preparative)
47. High Precession Electronic Balance (6 digit)
48. Heating Mantle (500mL, 1LX2, 2L)
49. Glass Distillation Unit
50. SS Water Bath (10L & 20 L)
51. Hot air oven with built in blower fan & digital control
52. Hot air oven
53. Horizontal Autoclave
54. Confocal Microscope
55. Fluorescence Microscope
56. Ion Exchange & Fixed Gel Chromatography Unit
57. Passbox
58.Microwave Oven

List of a few Institute/University/Colleges in Assam & other North Eastern States having Biotechnolgy Discipline

1. IIT Guwahati
2. CSIR-North East Institute Science &Technolgy (CSIR-NEIST), Jorhat
3. Gauhati University, Guwahati
4. Dibrugarh University, Dibrugarh
5. Tezpur University, Tezpur
6. Assam University, Silchar
7. North Eastern Hill University (NEHU), Shillong
8. Assam Agricultural University, Jorhat
9. Institute of Science & Technology (IST), Gauhati University
10. Institute of Advanced Study in Science and Technology (IASST), Boragaon, Guwahati
11. Institute of Bioresources& Sustainable Development (ISBD), Imphal, Manipur
12. Tocklai Experimental Station, Tea Research Association(TRA), Jorhat
13. Central MugaEri Research & Training Institute(CMERTI), Lahdoigarh, Jorhat
14. Rain Forest Research Institute(RFRI), Jorhat
15. Assam Govt. Ayurvedic College, Guwahati
16. National Institute of Technology(NIT), Silchar
17. Central Institute of Technology(CIT), Kokrajhar
18. College of Veterinary Sciences, AAU Campus, Khanapara
19. Guwahati Medical College, Guwahati
20. Assam Engineering College, Guwahati
21. NIPER, Guwahati
22. Cotton College , Guwahati
23. Cotton College State University, Guwahati
24. B.Borooah College, Guwahati
25. AryaVidyapeeth College, Guwahati
26. Pandu College, Guwahati
27. Pragjyotish College, Guwahati
28. Handique Girls College, Guwahati
29. LCB College, Guwahati
30. Guwahati College, Guwahati
31. Pub Kamrup College
32. Rangia College
33. Assam Down Town University, Guwahati
34. Assam Don Bosco University, Guwahati
35. University of Science & Technology (USTM), Meghalaya
36. NETES Institute of Technology & Science(NITS), Mirza
37. GirizanandaChoudhury Institute of Management and Technology, Azara
38. Regional Institute of Science &Technolgy, Meghalaya
39. Asian Institute of Management &Technology, Guwahati
40. Royal Group of Institutions, Guwahati
41. St. Anthony's College, Shillong
42. St. Edmund's College, Shillong
43. Karimganj College
44. D.K. College, Mirza
45. DakshinKamrup College, Guwahati
46. ERD Foundation
47. North East Regional Institute of Science and Technology (NERIST), Nirjuli, Arunachal Pradesh
48. Manipur University
49. Nagaland University
50. Tripura University

AROMA INDIA

Planters & Manufacturers of Citronella Oil

Aroma India Group is amongst the pioneers of aromatic oils in the North Eastern Region of India. It is one of the few companies engaged in the plantation & distillation of citronella oil in the organized sector. It has more than 2500 acres of land under citronella cultivation all across the North East India. It has set up distillation units at various locations and has combined distillation capacity of more than 100 MT p.a. It provides direct / indirect involvement of more than 2000 people & 400 families.

The company has been accredited by North East Institute of Science & technology, Jorhat, Assam, India.

Shri Shanti Kumar Jain is the Chairman & promoter of the company. He has been recognized & awarded for his efforts all these years by all quarters:

- Special Recognition Award 2008 for Entrepreneurship by Govt of India, Ministry of MSME.
- The North East Institute of Science and Technology (Formerly RRL, Jorhat) has felicitated him with an award conferred by the Director General- Prof Samir K Brahmachari himself for his contribution in this field.
- He has been conferred with 2nd North East Excellence Award, 2010 by Indian Chamber of Commerce in the medium sector.



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SAVE THE ONE-HORNED RHINO - SAVE THE PRIDE OF ASSAM

The greater one-horned rhino (Rhinoceros unicornis) is a vulnerable species and now only found in India and Nepal. Historically it existed across the entire northern part of the Indian subcontinent, along the Indus, Ganges and Brahmaputra River basins, from Pakistan to the Indian-Burmese border, including parts of Nepal, Bangladesh and Bhutan. The most recent surveys as of June 2012 confirm numbers continue to increase, reaching 3, 624, up from 2,800 in January 2007. Assam is the stronghold for the species in India with about 2,501 rhinos in four populations. Average adult size of a greater one-horned rhino is around 335 cm and weighs around 1800 Kg. It is the second largest mammal in India after the Asiatic elephant. It has a typical single horn and two large skin folds across its flank. The hooves of the Greater One-horned Rhino are large and three toed. Body colour is deep slate-grey. This grassland species diet consists mostly of grasses, but they also eat leaves, branches of shrubs and trees, fruits, and submerged and floating aquatic plants. They feed in the mornings and evenings. Major threat to the greater one-horned rhino is poaching. There is a huge demand for rhino horn in illegal wildlife trade. It is used in traditional Chinese medicine.

Info & Picture courtesy: Mr. Jayaditya Purkayastha, General Secretary, Help Earth

LETS SAVE THE BEAUTIFUL GREATER ADJUTANT

The Greater Adjutant (Leptoptilos dubius) is an endangered species of bird found only in Bangladesh; Cambodia; India; Nepal; Thailand; Viet Nam. The total global population is estimated to be between 800-1,200 individuals. In India, 650-800 individual birds are estimated to live of with almost all are confined to Assam with a small stray population noted in Bihar. This bird is very large (145–150cm), with an equally impressive wing-span of about 250cm. It has very thick bill (30cm) and pendulous neck-pouch. The plumage of the body is black, grey and off-white. The bare skin of the head and neck is dirty yellow or flesh colour. Underwing-coverts paler than flight feathers. This bird is mostly associated with wetlands and garbage dumps. It feeds upon wide range of prey including fishes, frogs, snakes etc. It is also a scavenger. Due to destruction of wetlands and lack of tall trees as breeding site, this birds is fast losing its fight for existence.

Info & Picture courtesy: Mr. Jayaditya Purkayastha, General Secretary, Help Earth

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