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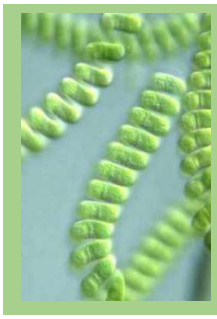
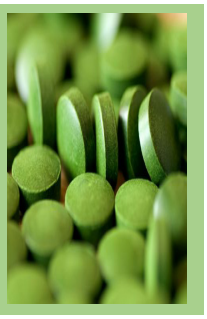
EDITORIAL

Spirulina: The World's First Superfood



***Spirulina*—a blue-green micro-alga—is a super food as is an excellent source of proteins and other nutrients, and can also be used to treat a wide number of common ailments.**



SPIRULINA is a photosynthetic blue-green microalga, one of the oldest life forms on Earth. This microalga was partly responsible for producing the oxygen in the planet's atmosphere billions of years ago which allowed the development of other life forms on the Earth. It also played a key part in the nutritional consumption of ancient civilisations. The Aztecs of Mexico in the 16th century made cakes of *Spirulina*, dried them by the banks of Lake Texcoco and used them as a common food source. *Spirulina* is a spiral-shaped filamentous microalga less than 1 mm long, consisting of transparent cells stacked end-to-end, taking on a spiral shape. It contains chlorophyll a, phycocyanin and carotenoids. It grows naturally in the wild, in the warm oceans and alkaline lakes of Africa, Mexico, and South America. Two species *S. platensis* and *S. maxima* are cultivated worldwide and used as a dietary supplement.

Spirulina is an excellent source of protein and also contains vitamins A, B-complex, C, D, E, minerals like iron, calcium, and essential fatty acids. It contains 65% protein and has all the essential amino acids. Gamma linolenic acid is present in significant amounts in a small percent of *Spirulina* species. It is also a source of many micronutrients such as potassium, chromium, copper, magnesium, phosphorus, manganese, selenium and zinc. Packed with all sorts of nutrients, it is a great source of protein for the non-meat eaters.

Spirulina has a number of health benefits as well. It helps to strengthen the immune system, increases antioxidant protection since this super food helps to fight free radicals responsible for the aging process in the body. It promotes the natural cleansing and detoxification of the body. Gamma linolenic acid found in the alga can be used in the body to form products that are anti-inflammatory and anti-proliferative. It is potentially useful for individuals suffering from rheumatoid arthritis and diabetic neuropathy. Phycocyanin found in *Spirulina* lowers blood pressure. It may also play a role in lowering plasma triglycerides and increasing HDL cholesterol. On the other hand serum lipids and LDL cholesterol may be lowered by its consumption. Researchers also discovered that its supplementation lowered intimal aorta surface by 33 to 48 percent, which suggests that it can prevent atherosclerosis and subsequent stroke. It is a good source of iron and zinc. It boosts energy and speeds up weight loss. *S. platensis* prevents the loss of memory possibly by lessening amyloid beta protein accumulation and oxidative damage, augmenting the catalase activity and holds promise for humans afflicted with neurodegenerative diseases.

However, it is important to make sure that *Spirulina* is bought from a trusted brand or source, as the alga can be easily contaminated with environmental toxins. It should not be taken as a replacement for meals, but as an added nutritional booster. This is also a potential super food for space travel. NASA found that 1 kg of *Spirulina* had the same nutrients found in about 1,000 kg of assorted vegetables. Thus, *Spirulina* has a great future due to its promising nutritional and therapeutic values.

Sutapa Kumar (*Rai*)
Associate Professor & Editor
Earth Day, April 22, 2018

DEPARTMENTAL NEWS

An Excursion to the Palani Hills (Southern Western Ghats)

THE department organised an excursion to Kodaikanal, Tamil Nadu, from October 30 to November 6, 2017 with eighteen Botany Honours second year students guided by Dr. Sutapa Kumar (Rai) and Dr Kuntal Narayan Chaudhuri. The rich flora of the Southern Western Ghats was documented during the urban trails around the Kodai Lake and the forest trails at the Tiger Shola Reserve Forest and the Berijam Lake and Reserve Forest.

Kodaikanal (2,133 m), literally "the Gift of the Forest" in the local language (Tamil), was established in the Palani Hills during the colonial period in 1845. This hill station, also known as the "Princess of Hill Stations," is located above an escarpment, with the town surrounded by meadows, eucalyptus plantations and *shola* forests. There is a central star-shaped artificial lake. The Tiger Shola Reserve Forest is a *shola* vegetation 10 km from the town. The Shembaganur Museum of Natural History, located *en route* to this forest, has a large taxidermy collection of local animals, birds and insects, and preserved specimens of plants of the region including the famous *neelakurinji* (*Strobilanthes kunthianus*). The Berijam Lake located in the Berijam Reserve Forest (fig. above), Kodaikanal Wildlife Sanctuary, is 20 km from the town. There is a botanic garden, Bryant Park, built in 1908 by a forest officer HD Bryant after whom it is named (fig. below).

--Eds

Farewell to Sri Dushasan Jena

ON February 28, 2018, the departmental staff, both present and former, gathered in the Honours Laboratory to felicitate Sri Dushasan Jena, on his retirement after serving the department for more than 40 years. With his well-known "green fingers," he had devotedly nurtured most of the important plants of our college campus over the decades.

--Eds

DEPARTMENTAL NEWS

47th KS Rao Memorial Lecture and Photo Contest

ON November 29, 2017, the 47th KS Rao Memorial Lecture was jointly organized with the department of Zoology in the Vivekananda Sabhaghar of the college. Prof. Biswadip Das, Professor, Department of Life Sciences and Biotechnology, Jadavpur University, was the Chief Guest on this occasion. He delivered the memorial lecture entitled: "Killing Messengers before they are born: A Novel Paradigm for regulation of Eukaryotic Gene Expression."

A photography exhibition-cum-contest themed "Biodiversity around Us" was also organized. Prof. Sirsendu Gayen, Co-ordinator, Photography Cell of the college, adjudicated the 1st position to Tanaya Mondal (3rd year student, Zoology), 2nd position to Sukanya Ghosh (3rd year student, Botany) and 3rd position to Raunak Maity (3rd year student, Zoology).

--Eds

A Few Notable Students' Achievements

SUKANYA Ghosh, Botany Honours 3rd year honours student, got the First Prize of the Interdepartmental (Science Section) Seminar Lecture Competition 2017. She received the winner's trophy from our Hon'ble Principal Dr. Tapan Kumar Poddar (fig. above). Our colleague, Dr. Ashutosh Mukherjee, mentored her on the interesting topic of the Fibonacci numbers in the plant world.

Bipul Halder, Botany Honours 3rd year student, received the Best Leader of Opposition award at the Youth Parliament Competition (South 24 Parganas) held at our college on 1st September, 2017 (fig. below).

Tanmoy Saha, Botany Honours 3rd year student won the First Prize of the Kolkata Police Table Tennis Friendship Cup, 2018 held on 1-4 February, 2018.

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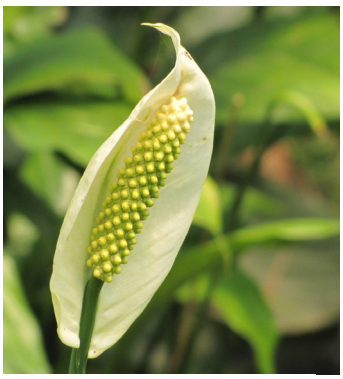
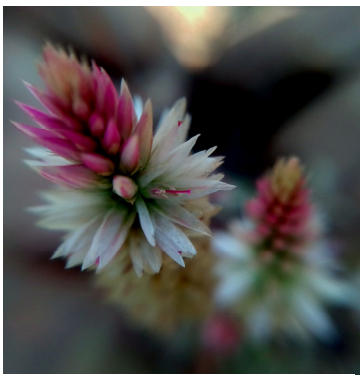
SHUTTERBUGS

PLANTS: PAST AND PRESENT



The Peace Lily
Srijita Ghosh
Botany Hons. Year I



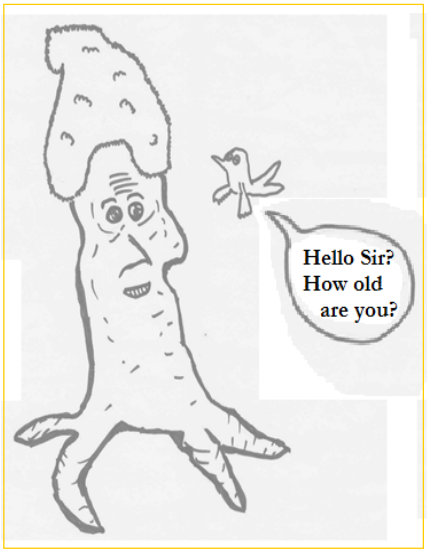
Cockscombs
Titash Samadder
Botany Genl. Year III

The Tree Rhododendron
Sutapa Kumar (Rai)
Associate Professor

The Purple Heart
Kuntal Narayan Chaudhuri
Assistant Professor

Stromatolites: Early Life form the Past
Asis Kumar Pal
Assistant Professor

BIO-TOONS



Old is Gold

Mita Bose
Graduate Laboratory Instructor

The ancient groves of bristlecone pine (*Pinus longaeva*) trees dot the rocky and rugged landscape in the upper reaches of the White Mountains in California, United States.

The oldest known living tree till date, one such timeworn bristlecone pine tree, is 4,848 years old! This tree was lovingly named Methuselah, after the biblical patriarch who lived for 969 years. The exact location of this fragile, timeworn tree has been kept a secret for its own protection from the curious visitors.

REFLECTION

The "True" Web of Life

Kuntal Narayan Chaudhuri
Assistant Professor

THE notion of the "web of life" conjures up visions of the our natural world with its myriad biological species that have evolved on the Earth during the more than 4 billion years of its geological past—all interconnected with each another, and with the physical world in which they live. Most people don't think of themselves as a part of this immense network of interdependence, as if we were separate from this natural world, even nurturing the idea that the humans are the most important and are meant to dominate the rest.

Yet, a holistic relook at our environment would make us realize that humans are part of, not apart from, nature. As a species, we have coevolved with the natural environment since the last 300,000 years and had adapted to it, while drawing both material and non-physical sustenance. Through intimate interactions with each another and the environment, we have developed a plethora of cultures and languages—myriad ways of seeing, knowing, doing, and speaking. Over the millennia, local cultures and languages have been closely, perhaps inextricably, linked with local environments where human societies have lived across generations. Like biological species, human languages and cultures are also not static. They naturally change and evolve over time. This is not merely a story of the past, since even today in this age of urbanization, industrialization and globalization, we continue to be virtually dependent on the natural world for our ultimate existence and welfare.

This profound realization lead us to a new understanding of our relationship with nature. Just as people are not separate from nature, the global biospheres are not separate from its languages and cultures. The "true" web of life is a biocultural web of life. Bio-cultural diversity comprises of the diversity of life in all of its manifestations—biological, cultural and linguistic—which are interrelated (and likely coevolved) within a complex socio-ecological adaptive system. This is an interwoven, multifaceted expression of life's potential in both nature and culture. Human societies depend on biodiversity as a key underlying element of ecological goods and services for sustaining themselves. Biodiversity and ecosystems depend on human stewardship to maintain their vitality and resilience which makes all life, including human life, possible.

Biocultural diversity is crucial for the continuity of life on the Earth. This precious gift is being squandering as economic, political, and social forces across the globe are making the fabric of life increasingly threadbare—leaving our biocultural world ever more fragile and the outlook for humans and all other species increasingly uncertain. Our best hopes for the future reside in the peacefully, equitably, and respectfully sharing this world of differences in nature and culture, for the benefit of all humans and all of life.

PERSONALITY

John Webster (1925-2014): A Gem among Mycologists

Asis Kumar Pal
Assistant Professor

John Webster, an extraordinary mycologist, was a great teacher gifted with an unabated curiosity and passion to learn, experiment and teach. He was unique in his style of inspiring his students to work in the field of mycology in its broadest sense at home and overseas. Along with his immense contributions to mycology, he is probably best known for his influential textbook "*Introduction to Fungi*."

JOHN Webster was born in Kirkby-in-Ashfield, Nottinghamshire, England, on 25 May 1925. He studied at the University of Nottingham from 1943 to 1945 and then joined Hull University in 1946 as an Assistant Lecturer. There he married his wife, Brom, in 1950. They had two children. Then he moved on to Sheffield University where he earned his PhD in 1954 and became a Senior Lecturer and then a Reader in A.R. Clapham's Botany Department. He was appointed Professor and Head of the School of Biological Sciences at the University of Exeter in 1969 from where he retired in 1990.

This 'holomycologist' wanted his students to see and study fungi in their natural habitats. The result of this endeavour was his *Introduction to Fungi*, published in 1971. He also produced several films showing fungal development and life cycles as part of teaching aids. The interactions of the biota, of plants and fungi, loomed large in his works. He initially worked on coprophilous fungal succession, and later focussed on fresh water aquatic fungi, the ingoldian fungi, inspired by Terence Ingold's classic paper on aquatic hyphomycetes in 1943. Webster's greatest contribution to mycology was in determining the mechanism for fungal spore discharge in basidiomycetes using the high-speed video microscopy, which he and his team perfected in the 1980s. His elegant elucidation of the role of Buller's drop in basidiospore discharge is regarded as a classic. The mechanism was demonstrated to be a surface-tension catapult, originally suggested in 1922 by A.H.R. Buller, and by C.T. Ingold in 1939. He authored over 250 scientific publications. He participated in the International Symposium on Taxonomy of Fungi in Madras in 1973 and the Annual Meeting of the Mycological Society of India and the International Mycological Association Committee for Asia at Goa in 1998 where he delivered the Plenary Lecture on "Some advances in fungal ecology over the past 50 years." He was also known for his administrative skills. Mycology showed up remarkably well at the International Botanical Congress at Edinburgh in 1964, thanks to his skills in organization. He also did a splendid job in organizing the First International Mycological Congress in Exeter in 1971.

Prof. Webster was the President of the British Mycological Society in 1969 and again in 1996 during the centennial. In 1987 he was made a Corresponding Member of the Mycological Society of America. He served as the International Mycological Association's third President from 1983 to 1990, and was then made Honorary President for life in 1990. In 1996 the association awarded him their Ainsworth Medal. In 2011 the British Mycological Society conferred on him their President's Award. After his retirement he continued to work and went on to produce a third edition of *Introduction to Fungi* together with his former student, Roland Weber. This was published in 2007, when he was 82. During his last years, illness enfeebled him and he passed away on 27 December 2014.

DO YOU KNOW?

Wollemia nobilis: A Living Fossil from Down Under

Arpita Banerjee
Botany Honours (Year II)

WOLLEMI pine or *Wollemia nobelis* W.G.Jones, K.D.Hill *et* J.M.Allen (Araucariaceae), is a coniferous tree (25-40 m) from Australia. The genus was only known as fossils until David Noble, a canyon explorer, discovered this species in 1994 in the Wollemi National Park in New South Wales, Australia. The genus is named for the National Park and this species is named after discoverer. The oldest fossils of this genus are *ca.* 200 million years old. Before the discovery of this relict population, the most recent fossils of this genus are *ca.* 2 million years old in Tasmania, Australia. It is thus described as a living fossil. The Wollemi pine is a critically endangered species on the IUCN's Red List, and is a protected species in Australia. A plan for the management of the fragile population of this rare gymnospermous species has been drawn to ensure its long-term viability.

Drakaea glyptodon: King-in-his-Carriage

Ishani Barui
Botany Honours (Year II)

KING-in-his-carriage or *Drakaea glyptodont* Fitz. (Orchdaceae) is a species of ground orchid endemic to Western Australia. It has a single, ground-hugging, heart-shaped leaf, an underground tuber, and the stem also bears a single flower. The small flower of the plant has an insect-like labellum which mimics the form and smell of the flightless females of the thynnid wasp *Zaspilothynnus trilobatus*. The intricate labellum has a "head" with few hairs and is covered with dark lumps, while the rest of the labellum representing the "body" is dark maroon in colour, hairy on the upper side and shiny on the lower part. This deceitful orchid flower is pollinated by the male wasps who are lured by the "dummy" female wasps and after landing the males are unwittingly catapulted into the pollinia of the orchid flowers.

Neelakurinji: Behind the Name "Blue Hill"

Kankan Roy
Botany Honours (Year I)

THE famous *neelakurinji* or *Strobilanthes kunthianus* (Wall. *ex* Nees) T. Anders. *ex* Benth. (Acanthaceae) is a plietesial shrub found in the *shola* forests of the Western Ghats (1300 to 2400 m). The Nilgiri Hills in Tamil Nadu, which literally means the "Blue Mountains" in Tamil, is named after this plant with purplish blue flowers which bloom only once in 12 years. Locally, "*neela*" means blue and "*kurinji*" is the name of the plant among the local Paliyan tribe who use the bloom as a reference to calculate their age. It also grows in the Palani Hills, the Annamalai Hills, and other places in the Western Ghats, as even in the Eastern Ghats. The specific epithet "*kunthianus*" is derived from the Kunthi River that flows through the adjoining Silent Valley National Park, Kerala. The Kurinjimala Sanctuary, Kerala, is a protected habitat for this endangered and enchanting plant.

HERBAL HEALER

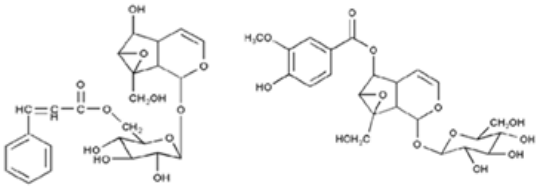
Picrorhiza kurroa: A Himalayan Endemic Herb of Ethnopharmacological Value

Meenakshi Mukhopadhyay
Associate Professor

KUTKI, *Picrorhiza kurroa* Royle ex Benth. of the family Scrophulariaceae, is a critically endangered high-value medicinal plant endemic to the alpine Himalayan regions of India (Garhwal to Sikkim), Nepal, Bhutan, West China, Southeast Tibet and North Burma. It is a perennial herb; rootstock is long, creeping with a bitter taste; leaves are basal and alternate, flat, oval, and serrated; flowers are white or pale purple, borne on a tall terminal spike, and appear from June to August. The plant is propagated by the stolons and it grows in the wild from rock crevices and on moist organic soils. It is called *kutki* in Hindi and Nepali.

P. kurroa rhizome has a long history of use in the Indian (Ayurvedic) and Chinese systems of medicine for the treatment of a wide spectrum of diseases. Today it is viewed as an important therapeutic target in both Western and Eastern medicinal systems .This wonder herb has hepatoprotective, anticholestatic, antioxidant, antidiabetic and immune-modulating properties. It is traditionally used for liver disorders, but has also been implicated in the treatment of numerous ailments, namely upper respiratory tract illnesses, chronic diarrhoea, malaria, jaundice, epilepsy, paralysis, rheumatoid arthritis and skin diseases.

It has been reported that the underground portions of *P. kurrooa* produce a crystalline product "kutkin", which constitute two principle iridoid glycosides—picroside and kutkoside of which picroside I and II (figs. below, respectively) are key bioactive components. Other identified active constituents are apocynin, drosin, and nine cucurbitacin glycosides. It appears that there exist several chemical races of *P. kurroa* in nature. Chemotypes of this species with higher concentrations of picroside I and II need to be multiplied for their economical production.



Their mode of action is still not fully understood. The lack of understanding about the biological and molecular basis of picroside I and II biosynthesis and accumulation has impeded the perusal of a systematic genetic improvement programme in *P. kurroa.*

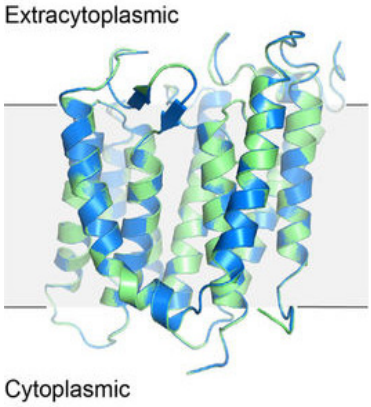
Kutki is among one of the topmost traded 15 plant species in India in relation to its economic value with more than 10,000 kg of its trade takes place in the Delhi market alone. Extensive harvesting from the wild, overexploitation and limited cultivation of *P. kurroa* has threatened its natural presence and is enlisted as a "critically endangered" species by IUCN with the aim of sustainable use and conservation without any compromise. It is the need of the hour to utilize different conservational strategies and save this medicinal wealth from extinction.

A Chink in Bacteria's Armour

Chandan Kumar Chowdhury
Botany Honours (Year I)

RECENTLY, a team of scientists at the Harvard Medical School, led by Andrew Kruse, Associate Professor of Biological Chemistry and Molecular Pharmacology, have discovered that a previously unsuspected family of proteins that regulate cell division and cell shape had a secret skill: building bacterial walls. Published in the journal *Nature*, they were able to untangle the structure of a wall-building protein (RodA) that are found in nearly all bacteria. The study unveiled potential weak spots in the protein's molecular architecture. This finding can pave the way for designing the next generation of broad-spectrum drugs that disrupt this protein's function and disarm harmful bacteria.

Specifically, the molecular profile of the protein revealed structural features and one particular feature caught his attention—a pocket like cavity facing the outer surface. The researchers altered the structure of RodA (see fig.) in two bacterial species—*Escherichia coli* and *Bacillus subtilis*. Even on any mild alteration of the structure of RodA's cavity, the protein lost its ability to perform its function. Bacterial cells with disrupted RodA structure rapidly enlarged and became deformed, eventually bursting and leaking their contents. An inhibitor (a chemical compound) that can bind to this pocket would interfere with the protein's ability to synthesize and maintain the bacterial wall. That would crack the wall, weaken the cells and eventually causes them to die.



DNA: The Future of Data Storage

Ashutosh Mukherjee
Assistant Professor

TWENTY first century is the century of computing and of biology. Recent DNA research has been extremely benefited by the advancement of computing. Presently, the internet and other uses of computers have gone up in such a way that storing data is becoming a mammoth task. Storing data on DNA is becoming a serious prospect. Normally, data is stored in magnetic tapes which are, although very efficient, not enough to store data for a really long period of time. Scientists have seen DNA as a storage medium because it can store large amounts of data in a small space and are stable over thousands of years. In 2012, G. Church and colleagues at Harvard University published a paper in the journal *Science* in which they reported that DNA was encoded with HTML draft of a 53,400 word book written by the lead researcher, 11 images in JPG format and one JavaScript program; and 5.5 petabits (1 petabit = 10^6 gigabits) of data can be stored in each mm^3 of DNA. This research showed that DNA can be an effective data storing medium. Recently, researchers from the University of Washington, Microsoft and Twist Bioscience successfully stored two famous music recordings. They also decoded and played back these two without any loss of quality.

Yet, the main concern of using DNA as storage medium is the cost of encoding data and retrieval which is $12,400 and $220, respectively. However, with the costs of DNA synthesis and sequencing coming down rapidly, we hope DNA will prove itself as an efficient storage device for human created data just as it is doing with genetic information for millions of years.