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Contributors

Taxus baccata ssp. Wallichiana

-Dr. Anjali Kulkarni

During 1990s, a hugely neglected family of Gymnosperms: Taxaceae suddenly shot into limelight when it was shown to contain highly potent **anticancer diterpenoid alkaloids**.

India has one species: ***Taxus baccata ssp. Wallichiana*** growing at restricted locations in the Himalayas. Various plant parts of this plant contain **Taxol** & a number of related molecules (**Taxanes**) necessary for the semi-synthetic route of Taxol preparation. These **Taxanes** have been the most potent anticancer agents discovered so far to treat breast, lung and ovarian cancers. New & multi-faceted effects of these Taxanes against a number of unrelated diseases like Cystic Fibrosis, AIDS etc. are also being discovered continuously & hence the demand for these compounds is still increasing.

The plants of *Taxus* spp. are endangered in their natural habitats due to merciless felling & indiscriminate stripping off the bark for extraction of Taxanes. Plants of *Taxus* spp. are dioeceous with less no. of female plants & the seeds have a dormancy requirement of two years. They are also very slow growing.

Thus there is an urgent need to conserve natural populations of *Taxus* spp. and to use biotechnological tools like Plant Tissue Culture, Suspension Culture to multiply these plants and also to produce Taxanes under laboratory conditions.

A Twig of *Taxus* spp.

Plant of the Month – *Nothapodytes nimmoniana (Mappia foetida)*

-Ravina Ray, Msc I

Mappia foetida is from family Icacinaceae and is commonly known as Amruta, Kalgur or Narkya*. Mappia foetida* now renamed as *Nothapodytes nimmoniana* is a moderate sized tree which grows upto 4-10 mts high.

This plant has anti cancer properties which has made it an endangered species. It is being exploited clandestinely in the domestic market and is also shipped abroad. The profit potential is enormous as the alkaloid camptothecin is extracted from the plant. This alkaloid is an essential component of chemotherapy, each dose of which costs 1.5 – 2 lakhs in India.

As per a year-old estimate, 1500-2000 tonnes of Narakya logs are consumed in India every year and almost the same quantity exported to other countries in powdered form. Reports suggest that at least 1000 tonnes of the plant is consumed in and around the city of Bengaluru every year.

The active componentis camptothecin (CPT) alkaloid. Its imaximum in leaves, and effective in colon, gastric, ovarian, lung cancer. The alkaloid camptothecins have anti-tumour activity based on their binding to and inhibition of Topoisomerase I, a nuclear enzyme which reduces torsional stress during DNA replication. Topotecon and Irinotecan(widely used for colon cancer) have been approved for medication use by the US Food and Drug administration (FDA).

Foetidine 1 and 2, are alkaloids which also have anti-cancer properties. These alkaloids are soluble in water and present in all parts of the plant. They are precursors of campothecin and 9-methoxy campothecin which are alkaloids known to have pharmacodynamic properties. But these alkaloids are also insoluble in water. The particular water solubility of the compounds make them particularly suitable for the treatment of the patients by the parental route, that is avoiding the use of the toxic excipients or of the unsuitable chemical derivatizations.

The medicines available in the market for cancer extracted from Nothopodytes are known as : Topotecan, Camptothecin, Irinotecan, Topotican, Camptosar (Irinotecan hydrochloride).

The Scientist Lady- First Indian Woman Scientist

Kamala Sohoni (1911-1995)

Only a few people know about her contributions. We all have always been taught about some most prominent scientists who contributed largely in the field of science. But there are few who worked but never took the lime light but have contributed immensely.

One such great lady was Kamala Sohonie. She crossed many hurdles to be well known as “A WOMEN IN SCIENCE”, which is self explanatory to describe her contribution.

She did her graduation in physics and chemistry from Bombay University. She applied for admission in TATA Institute of Science (now IISc Bangalore) in 1933 and got a prompt refusal, the sole reason cited for the refusal that “she was a woman”. The illustrious director Sir C.V. Raman, Noble Laureate didn’t think a women scientist capable of undertaking research. Kamala refused to accept this refusal based on gender biased. She decided to do Satyagraha outside Raman’s office, till she was admitted. Prof. Raman granted her permission for working for one full year but on probation and her work would not be recognised until her quality of work was assured.

At Institute of Science, Bangalore she worked hard under her teacher Shri. Shriniwasaya. After observing for a year Prof. Raman was satisfied with her dedication and discipline for work, she was allowed to do regular research in biochemistry. He was impressed and from there on admitted lady student.

Her major contribution were-

- She worked on milk proteins, pulses and legumes, which had important implications for nutritional practices in India. She was the first graduate student to work on pulse protein. Se submitted her research work and received her M.Sc degree.
- She went to Cambridge University and worked with Dr. Derik Richter and Dr. Robin Hill. Under guidance of Nobel Laureate Sir Hopkins she found that every cell of plant tissue also contain an enzyme 'cytochrome C', just like animal cells and cytochrome C is involved in oxidation of plant cell. This was an original discovery embracing entire plant kingdom.

Kamala sent a short thesis (40 pages) describing her findings on cyt C in respiration of plant tissues, to Cambridge University for PhD degree. She was the first Indian women "on whom the title of PhD degree was conferred", in 1939.

Instead of settling abroad she returned to India and worked at Lady Hardings Medical College, New Delhi, (1939), as a professor and HOD of biochemistry. Later she was Assistant Director of Nutrition Research Lab, Coonoor. She conducted important research on effect of vitamins. She was selected as professor at (Royal) Institute of Science, Bombay, and worked with her students on nutritional aspects of Neera, pulse and legumes protein as well as dhan (paddy) atta.

Her work showed that introduction of Neera in the diet of tribal malnourished adolescent children adn pregnant women caused significant improvement in their overall health. She received RASHTRAPATI AWARD for this work. She also showed presence of superior quality proteins, vitamins, minerals in leaves of ***Amaranthus paniculatus.***

When Dr. Satyavati, chairperson of Indian Council of Medical research learnt of Kamala Sohonie and her work, she decided to make amends. She invited kamala who was 84 and felicitated her in an impressive ceremony in New Delhi. Ironically she collapsed. What better end one can wish for?

Female scientists have contributed immensely and this was a tribute to a scientist, a lady who worked enough for our country's development.

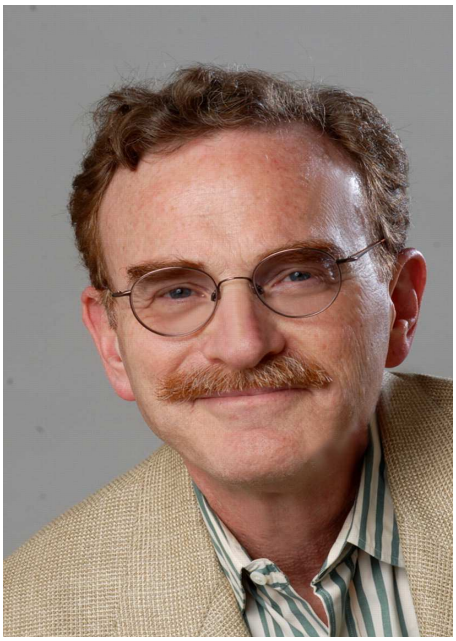
-Sakshi Mehta
Msc. II

Nobel Laureates– 2013

- Sripad Joshi M.Sc. II

The 2013 Nobel Prize in Physiology or Medicineis awarded to **Dr. James E. Rothman**, **Dr.Randy W. Schekman** and **Dr. Thomas C. Südhof** fortheir discoveries of machinery regulating vesicletraffic, a major transport system in our cells.Working independently, the researchers described components of the machinery that moves cargo around cells and gives the signal to dispatch it to its destination.Specificity in the delivery of molecular cargo is essential for cell function and survival. Their discoveries explain a long-standing enigma in cell biology and also shed new light on how disturbances in this machinery can have deleterious effects and contribute to conditions such as neurological diseases, diabetes, and immunological disorders.

Traffic congestion reveals genetic controllers- Dr.Randy W. Schekman.

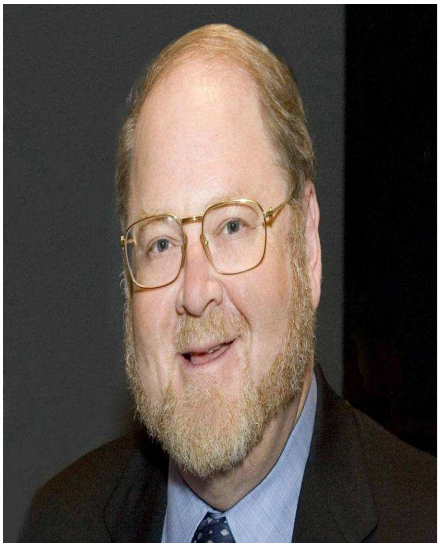


In 1976, Schekman began a search for the transport molecules in yeast (*Saccharomyces cerevisiae)*. Schekman created yeast cells that have mutations in any one of 23 genes, all of which produce proteins involved in vesicle transport. When the mutations disabled the proteins, vesicles backed up in cells like cars in a traffic jam. By noting where within the cell the pileups happened, Schekman teased out where each transport protein works.Schekman identified two genes, sec1 and sec2, but when refined, the screen led to a further identification of 23 genes. Importantly the 23 genes could be assigned to three different classes, based on the accumulation of membranes that reflected blocks in traffic from the ER and the Golgi complex.

Schekman provided a genetic basic for vesicle traffic and fusion by identifying key regulatory genes for vesicle traffic. He systematically unravelled the events along secretory pathways involved in vesicle traffic and in the interaction of trafficking vesicles with target membranes.

Journey to identify key proteins in the fusion process- Dr. James E. Rothman.

Rothman was also trying to work out how cells transport molecular goods. He took a biochemical approach to the problem, breaking open hamster ovary cells and reconstructing vesicle transport in a test tube. Rothman studied how cells move a viral protein called VSV-G, which builds up in infected cells. That protein gets tagged with a sugar, providing a



convenient tracking device for the scientist to follow. He purified particular proteins that were part of the machinery for moving VSV-G (vesicular stomatitis virus) and other proteins.He then used the assay to study both vesicle budding and fusion, and purified proteins from the cytoplasm that were required for transport. The first protein to be purified was the N-ethylmaleimide-sensitive factor (NSF). Rothman's discovery of NSF paved the way for the subsequent identification of other proteins important for the control of vesicle fusion, and the next one in line was SNAP (soluble NSF-attachment protein).

Genes controlling the timing of vesicle fusion- Dr. Thomas C. Südhof.

Dr. Thomas Südhof was interested in how nerve cells communicate with one another in the brain. The signalling molecules, neurotransmitters, are released from vesicles that fuse with the outer membrane of nerve cells by using the machinery discovered by Rothman and Schekman. But these vesicles are only allowed to release their contents when the nerve cell signals to its neighbours. Südhof elucidated how calcium regulates neurotransmitter release in neurons and discovered that complexin and synaptotagmin are two critical proteins in calcium-mediated vesicle fusion.

Vesicle fusion and its importance in medical science

Vesicle transport and fusion is essential for physiological processes ranging from control of nerve cell communication in the brain to immunological responses and hormone secretion. Deregulation of the transport system is associated with disease in these areas. For example, metabolic disorders such as type 2 diabetes are characterized by defects in both insulin secretion from pancreatic beta-cells and insulin-mediated glucose transporter translocation in skeletal muscle and adipose tissues.

The Western Ghats- Hotspot

-Phoebe Borde, M.Sc. I

A **biodiversity hotspot** is a bio-geographical region with a significant reservoir of biodiversity that is under threat from humans.

The concept of biodiversity hotspots was originated by Norman Myers in two articles in **"The Environmentalist"** (1988) & later revised in 1990.

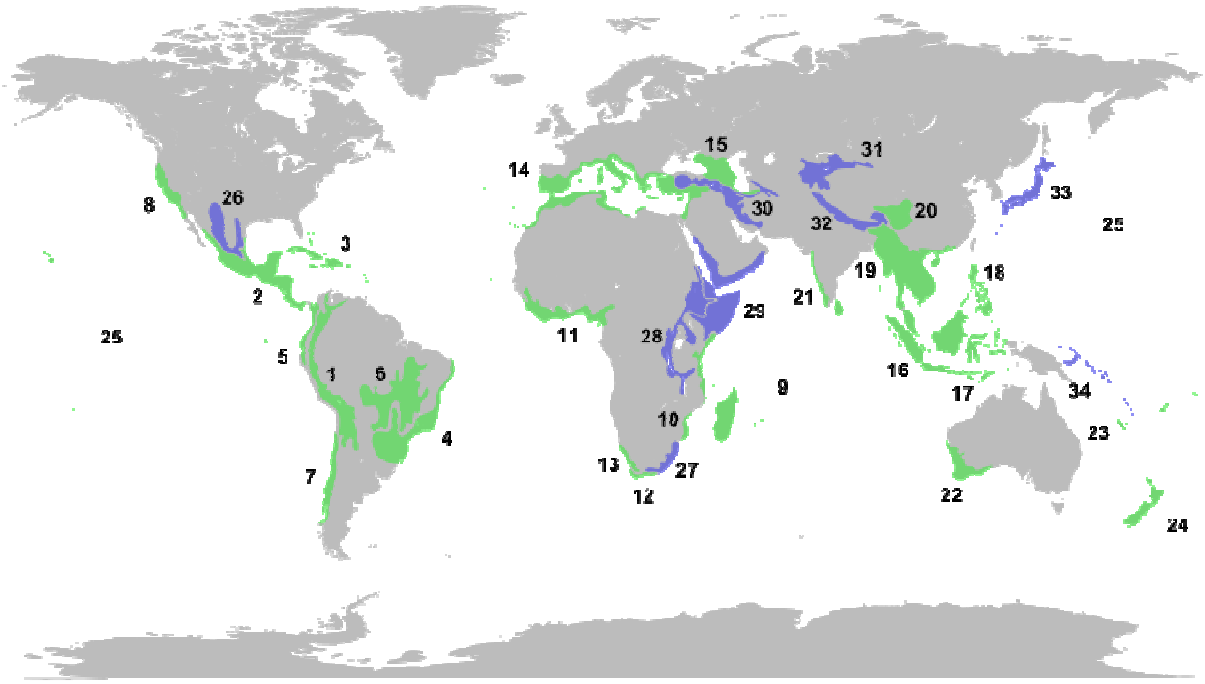
To qualify as a biodiversity hotspot, a region must meet two strict criteria (Myers (2000) edition of the hotspot-map): it must contain at least 0.5% or 1,500 species of vascular plants as endemics, and it has to have lost at least 70% of its primary vegetation. Around the world, 25 areas qualify under this definition, with nine others possible candidates. These sites support nearly 60% of the world's plant, bird, mammal, reptile, and amphibian species, with a very high share of endemic species.

The **Western Ghats** or the **Sahyadri** constitute a mountain range along the Western side of India. It is a UNESCO World Heritage Site and is one of the eight hottest hotspots of biological diversity in the world. It is sometimes called the **Great Escarpment of India.** The range runs north to south along the western edge of the Deccan Plateau, and separates the plateau from a narrow coastal plain along the Arabian Sea.

The range starts near the border of Gujarat and Maharashtra, south of the Tapti River, and runs approximately 1,600 km (990 mi) through the states of Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala ending at Kanyakumari, at the southern tip of India.

These hills cover 160,000 km^2 (62,000 sq mi) and form the catchment area for complex reverine drainage systems that drain almost 40% of India. The Western Ghats block rainfall to the Deccan Plateau. The average elevation is around 1,200 m (3,900 ft).

The area has over 5000 species of flowering plants, 139 mammal species, 508 bird species and 179 amphibian species. It is likely that many undiscovered species live in the Western Ghats. Nature has its own rules which being followed is fruitful and not followed causes imbalance. Interference in this cycle by humans has caused the depletion of certain plant species from a particular area, these species are called as **ENDANGERED SPECIES**. At least 325 globally threatened species occur in the Western Ghats.



Hotspots all over the world.

No. 21 is the Western Ghats

Petro Crops

-Aishwarya Dhall
M.Sc. I

At a time when society is becoming increasingly aware of the declining reserves of oil for the production of fossil fuels, it has become apparent that bio fuels are destined to make a substantial contribution to the future energy demands of the domestic and industrial economies. Petro crops refer to those crops which yield bio fuel compounds like biodiesel. The sharp increase in the prices of petroleum products, the finite nature of fossil fuels, growing danger of environmental pollution from such fuels thereby causing innumerable health hazards have forced the search for alternative fuels. Use of food crops such as corn, rapeseed, sugarcane, etc. for production of bio-fuels by developed countries might endanger the food security of the world. Petro crops are specially grown to produce some form of energy which may be generated through direct combustion or gasification of the crops to create electricity and heater by converting them to liquid fuels such as ethanol for use in vehicles.

- **Some important petro crops**: *Euphorbia sp, Calotropis procera,Simmondsia chinensis, Jatropha curcas,Azadirachta indica, Pongamia pinnata.*

The use of vegetable oils from plants mentioned above has the potential to provide an environmentally acceptable fuel, the production of which is greenhouse gas neutral, with reductions in current diesel engine emissions. Importantly, the successful adoption of biofuels is reliant on the supply of feedstock from non-food crops with the capacity to grow on marginal land not destined to be used for the cultivation of food crops.

Oleic acid is viewed as an optimal fatty acid for biodiesel production as it generates a low cloud-point fuel. The seeds of ***P. pinnata*** contain 30% to 40% oil, which can be converted to biodiesel (**fatty acid methyl esters; FAMEs**) by esterification with methanol in the presence of KOH. The predominant fatty acid is **oleic acid (C18:1; 40% to 55%)**. The composition of the seed oil and the properties of the FAMEs meet North American and European industry standards with respect to tropical and semi-temperate regions.

Biofuels from petro crops are the most valuable form of renewable energy that can be used directly in any existing, unmodified diesel engine. Rather than importing other countries' ancient natural resources, we could be using our own living resources to power our development and enhance our economies. Hence, bio fuels have enormous potential for change for the better.

Extraction of Bio-Fuels from Plant Resources