

# Lilavati's Daughters-

## Indian Women Scientists

Acknowledgement-  
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**Watch this presentation - Link :**  
**<https://www.youtube.com/watch?v=2bQxRpd7ej8&feature=youtu.be>**

## About the Title...

- What is it ? - a collection of biographical sketches of **influential Indian Women scientists of earlier generations**
- By Whom? - Rohini Godbole and Ram Ramaswami , Indian Academy of Sciences
- For what Purpose? - to underline the fact that it is possible to find role models within the country
- one does not have to look only towards the Curies, the Franklins and the Hodgkins (impressive scientists though they all are) to find women scientists of substance.
- especially for young girls with research ambitions, to know of women who functioned and achieved their goals in the **Indian social and academic environment.**
- to mirror our cultural diversity, and to cover a range of disciplines so that any woman student could gain from the insights and experiences of other women **to whom they can relate at many levels** – what passions drive them, tribulations did they go through, what helps ... and what hinders, along this journey on the path of science?

## E.K. Janaki Ammal



4, Nov, 1897 – 7, Feb, 1984

Simple life inspired  
by Gandhi

Research FOR the people

- Thalassery, Kerala
- Father - Diwan Bahadur Edavalathu Kakkat Krishnan & Deviamma
- Sub- Judge of Madras Presidency
- Deep interest in plants-
- notes about their growth, flowering...
- Picks observation skills
- Inspiration – maternal grandfather JC Hannyngton - Judge - Kew Garden - Botanist
- Maternal Uncle– ICS – Entomologist
- 1917-20? –B.Sc.– QMC, Ch
- 1921– B.Sc. Honours – Presidency College, Chennai
- Who inspired in the college??
- Says No to Marriage
- Teaches at WCC, Chennai



# First Oriental Barbour Fellow

- Barbour Scholarship
- For Oriental Girls - in 1917, “If a thousand Japanese girls could be educated in the United States to be physicians and teachers and returned to Japan to ply their work, we certainly never would have any war with Japan...and I think the same is true of other Oriental countries”
- scholars were imagined to be emissaries of peace.
- give them an Occidental education and let them take back whatever they find good and assimilate the blessings among the peoples from which they come”
- 1925- Completes M.Sc @ University of Michigan – Barbour Scholar - \$77
- Joins duty and teaches at WCC
- 1931- first Oriental Barbour – @ University of Michigan completes D.Sc.
- 1932-34 – teaches @ Maharaja College, Trivandrum

# One of the Indian Americans of the Century

- Quote - In an age when most women didn't make it past high school, would it be possible for an Indian woman to obtain a Ph.D. at one of America's finest public universities and also make seminal contributions to her field?
- The Kerala born Ammal was arguably the first woman to obtain a Ph.D. in botany in the U.S. (1931), and remains one of the few Asian women to be conferred a D.Sc. (honoris causa) by her alma mater, the University of Michigan.



- Evolves a cross breed

## Janaki Brengal

- **1932- Ph.D. Thesis- Chromosome studies in Nicandra Physaloides**
- Medicine by locals of Himalayas – Tibetan
- folk remedy -USA- kills houseflies
- EthnoBotany – her roots in Kerala



# A spoonful of Sugar to sugarcane through Cytogenetics

- C A Barber and T S Venkatraman develop Coimbatore canes Co 419 – drought and disease resistant, strong varieties
- 1934- 39 Sweetness awaits Janaki Ammal to join research team @ Coimbatore Breeding Institute
- Intergeneric and interspecies varieties are born
- **Sweeter sugarcane is bred**
- *Spends months in NorthEast and North*
- *Cytogenetics of Saccharum officinarum*
- Bamboo + Sugarcane hybrids
- 1935 – founder Fellow of Indian Academy of Sciences of Sir CV Raman




- 1940 to 1945 - Asst. Cytologist @ John Innes Horticultural Institution, London
- 1945 to 1951- Cytologist @ Royal Horticultural Society
- Co-authors monumental work, "Chromosome Atlas of Cultivated Plants" along with C. D. Darlington
- Magnolia Kobus Janakiammal
- Kapok – her pet Indian squirrel she had under her pallu
- Treks to Ramakrishna Mission to **connect** and converse



# Bird and Magnolia



- 1951- Jawaharlal Nehru invites her to reorganise BSI – later, Director General
- Central Botanical Lab, Allahabad
- Regional Research Lab, Jammu
- BARC
- Original Thinker – born wanderer
- Global Plant Geographer – WiS (Women in Science )
- Princess from India - Padma Shri

- 
- Centre of Origin – Centres of Diversity- Connect
  - Ploidy- why there are so many varieties in NE than dry NW Himalayas – plant speciation
  - Confluence of Chinese, Malayan varieties in NW – leads to more diversification
  - Preserving these areas is vital for growth
  - Students, Scholars from China, Japan should converge her in our Country!!
  - LINK University Women of Asia
  - 1970- 84- CAS Botany, University of Madras, Develops garden of Medicinal plants at Central Field Laboratory, Maduravoyal, Chennai

# Anandibai Joshi

- First Indian Woman to get education abroad and Degree in Western Medicine - 1886
- She graduated from Woman's Medical College of Pennsylvania (WMC) in 1886, Kei Okami - Japan and Tabat - Syria.
- 9 year old Yamuna- married to old Gopal Joshi- turns Anandi to suit his wish
- Scolded- but encouraged to study-
- Escapade - Kalyan - Alibagh- Kolhapur- Calcutta – to be away from relatives' laughter



31,Mar,1865–26,Feb, 1887

## Peculiar challenges

- He wanted to go to USA
- Sent her- lost a child- wanted to do medicine- took help of missionary
- Tries to convert- Carpenter Mausii helps
- Obstetrics among Aryan Hindus – Thesis topic
- Scholarship of \$600 for three years
- Saree – Marathi to Gujarati style
- Bhagwad Gita – “ body is just a covering for the soul which could not be corrupted. I felt if this was true, then how would my wearing western clothes corrupt or destroy my soul? After much debate and wondering, I decided to wear the sari like the Gujarati women wore; I would cover my waist and calves and could also wear a petticoat inside.
- decided not to inform Gopalrao – Scolds seeing a photo for not tucking her pallu



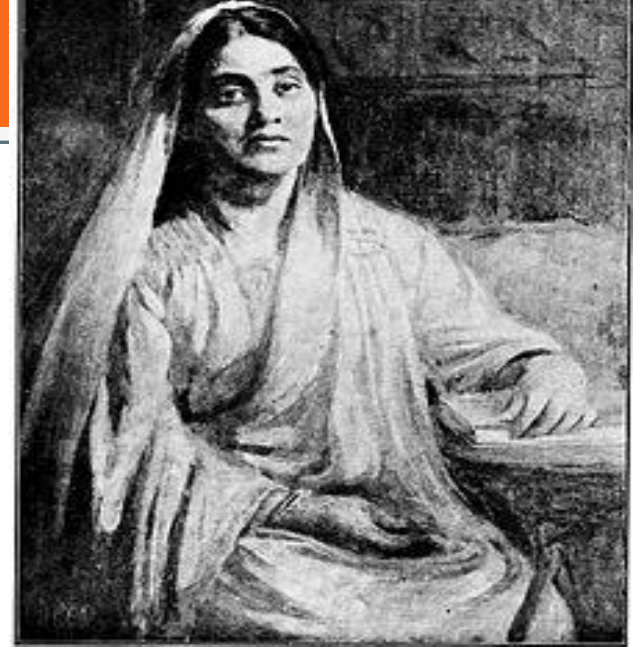
- Taunting and chiding through letters for she may forget culture and HIM
- Where is he - down the ladder?
- Bad fireplace- lead to smoke- Tuberculosis
- Completes course in 1886
- One of the First Woman Doctors of our country
- Gopal @ **USA**
- Health worsens- Women's hospital in Philadelphia- ship - Doctors refuse to touch her- Brown woman
- LOST LIFE ☹️ - ashes to Mrs. Carpenter – Pougkeepsie Rural Cemetery , NY
- 22 years of life – full of struggle- We OWE her
- London School of Medicine – opens door for women- 1876
- Research on connection between women health (???) and learning ☹️



# LADY Ôbola Boshu


Wife of ???? *Clue- LADY*

- Passed out of Bethune School and
- 1881- Medical entrance
- No admission Calcutta Medical College, being a woman



8, Aug,1865- 25, April,1951

- 1882- Comes to Madras - Bengal govt. scholarship to study medicine
- Medical College (1850- estd ;1852 - first batch – diploma ;1857- University of Madras affiliation . 1878– Mary Ann Dacomb Scharelieb and three more LMS,
- UK Medical Act 1876 – sails with 3 kids –London school of Medicine for Women-
- 1882- Bachelor of Med & surgery Degree - woman doc at the age of 37; Back to India- teaches Gynaec at Univ. of Madras -1885- gets permission from Queen herself - Royal Victoria Hospital for Caste and Gosha women - guess ?? -1888- MD from London Univ – Estb.Women's Medical Services in India. ; knighted DAME
- 1878 – MMC admitted first Indian woman- Krupabai sathianathan – drops out)
- She appeared in the final examination but had to return back because of **ill health** before the result was declared
- 1888 – LMS with Rose Govindaraju and Gurdia Singh

- 
- She argued that women should have a deeper and extended education, 'not because we may make better matches for our girls... be more valuable in the home of her adoption
  - **but because a woman like a man is first of all a mind, and only in the second place physical and a body.'**
  - *Inspired by Brama Samaj, Rajaram Mohan Roy, Pandit Eswara Chandra Vidya Sagar, Sister Nivedita*

- Pioneer in Pre-primary, primary teacher training, **suitable textbooks**
- **maternity training**, maternity and child centres
- Establishes 88 Primary schools, 200 schools- rural
- 1915- Nari Siksha Samiti – entrepreneurship , own livelihood for widows, destitute women – Why?
- Deshbandhu Chittaranjan Das, Eminent Scientist Acharya Prafulla Chandra Ray,.... Swami Saradananda, Suprava Ray (Mother of Satyajit Ray) and many other eminent personalities of Bengal Renaissance.
- 1925- Vidyasagar Bani Bhavan Primary Teachers Training Institute
- 1938 -14 Adult education centres
- Muralidhar College for women, widows home ??
- Sister Nivedita Women's education fund- US\$200,000

# Kadambini Ganguly

- 1876- Banga Maha Vidyalaya - Lt.Governor appreciates
- Merger- with Bethune School
- Rs.15 as scholarship gift of books for Rs50 for her performance – VC mentions in address- How to study further? Govt. allows women
- 1880- Completes F.A (First Arts level)- as only student
- 1882 – Bethune School upgrades to college accommodate her and Chandramukhi B ( First M.A & first College Principal – two sisters become Docs)
- 1883- Married and
- 1883 – first women graduates



18, Jul, 862 – 3, Oct, 1923

- Kadambini Ganguly, a Bengali Brahmin became the first woman admitted to the CMC (bigger history Native Medical Institute – translated - abolish- anatomy/ dissection compulsory – 1835)
- 1884-86- ONE of the First South Asian Lady to graduates Western Medicine . Awarded Graduate of Bengal Medical College (Denied Bachelor of Medicine degree)
- Mother of EIGHT children
- 1890 – Address Indian National Congress
- Active in 1892- Sets sails to England
- LRCP LRCS GFPS
- Ether – Civil War- childbirth- women
- Sathyagrahi – women's rights activist  
- women coal miners- education –  
fought against name calling by magazine

## Letter from Florence Nightingale

- February 20, 1888, Florence Nightingale wrote to an acquaintance

“Do you know or could tell me anything about...Mrs Ganguly, or give me any advice? ... [she] has already passed what is called the first licentiate in medicine and surgery examinations and is to go up for the final examination in March next.

This young lady, Mrs Ganguly, married! after she made up her mind to become a doctor! and has had one, if not two children since. But she was absent only thirteen days for her lying-in!! and did not miss, I believe, a single lecture!!”

Elsewhere in the letter, Nightingale wrote that she had been asked to recommend Kadambini to Lady Dufferin, “for any posts about the female wards of Calcutta”.

# Kamala Bhagwat Sohonie




14, Sep, 1912–28, Jun, 1998

- Kamala was born in 1912 - Indore
- Her father Narayan rao Bhagvat and brother Madhav rao were distinguished chemists from IISc
- Soap making @ home
- Family encouraged her to pursue higher education

# Wins the **Struggle** to enter IISc



- Graduated **in chemistry in 1933** from **Bombay University** - University topper
- Still, it was not easy for her to get admission at IISc, Bangalore for further research.

- 
- **Guess! – When do you think women in Oxford University (started 1100-1300s) would have got their graduation?  
1350s/1500s/1700s/1800s?**
  - **1920 - Annie Mary received her degree in 1920, for her course completed in 1877**
  - **Please, Have a look at the timeline of Women's education.**



- Kamala refused to accept refusal based on gender
- **She did satyagraha** in Raman's office
- Science is all about asking why, why not. It is all about questioning ,reasoning and choosing a path. As well daring to change the path.



- Raman granted her conditional admission - for one full year, she would be on **probation**- work would not be recognized until the director was satisfied about its quality- under a strict teacher **Guru. Sreenivasayya – pioneer in microbiology**



Kamala crossed first hurdle in her pursuit of science  
She made life considerably easier for other aspiring women scientists.

A silent revolution had been fought and won - *Anirban Mitra*

- 1935 - first paper, 'Non-protein nitrogen of pulses' - characterization of non-protein nitrogen content of nine of the **well-known Indian pulses**
- 1936 - five research publications
- This NPN fraction was shown to contain the simpler, easily digestible and assimilable peptides, important for boosting the nutrition of children and invalids.
- detailed analysis of amino acid content of NPN from pulses, and had further characterized nutrients of milk – paving the way for her MSc degree
- It was more than a scientific victory.

- More lady students to do research in the institute – many of them became great women scientists of our country
- This was the greatest victory for Kamala, and through her, for other aspiring Indian women scientists.
- Submitted her research done at IISc to **Bombay University and received her MSc degree.**
- Went to **Cambridge University** and first worked in the laboratory of Dr Derik Richter



# CYTOCHROME C

- work under Dr. Robin Hill on potatoes , she found that every cell of plant tissue also contains the enzyme **“cytochrome C”**
- **If so , this enzyme must be involved in a very important common function of a plant**
- Kamala sohonie discovered that cytochrome C is involved in oxidation of all plant cells.
- This was **an original discovery** embracing the entire plant kingdom



Take a few minutes to think how tough it would have been to do research abroad

- Weather
- No kith and kin nearby
- Food – Maths genius Ramanujam !! ☹️
- Language
- Bad dormitories
- No communication
- Physical strain
- **Research for the human welfare – SALUTE !!**

# FIRST INDIAN WOMAN TO GET Ph.D. IN SCIENCE

- Kamala sent a short thesis describing her finding-of 'cytochrome C' in respiration of plant tissue to Cambridge University for her PhD degree.
- Her entire PhD - research and writing took 14 months and consisted of just 40 typed pages!

# Research at Nutrition Research Laboratory, (NRL) Coonoor.

- 1939- returned to India - head newly opened Dept. of Biochemistry at Lady Hardinge College, New Delhi.
- Appointed as Assistant Director of NRL
- Her group had a steady series of publications on the biochemistry of ascorbic acid (vitamin C), thiamin (vitamin B1) and nicotinic acid (of vitamin B complex)
- Other projects – toxic effects of *Lathyrus sativus* (Khesari dal) on guinea pigs, and liberation of amino acids from proteins
- develops chemical and microbiological – for estimation of various vitamins present in different sources of food.
- Kamala and her students systematically lay down the groundwork upon which science of N & D would flourish
- provide scientific guidelines to improve the health of the severely-undernourished Indian population.

## RELEVANT RESEARCH was her Mantra

- @ Bombay, studies involved leguminous proteins, trypsin inhibitors and other compounds which, reduce digestibility of Indian legumes
- Neera, palm gur and palm molasses, and dhanata paddy flour—formed during milling and polishing rice.
- Particularly interested in ‘Bombay fish’ and ‘double beans’
- a thorough analysis of both foods resulted in two series’ of research articles – each with five papers
- protein content of green vegetables
- **Profiling and cataloguing** of nutritive values of Indian foods, thus contributing to our knowledge about ‘what to eat and what not to eat’

# NEERA

Remove the excess of collected neera by washing with distilled water (3 times).



Again put anti-ferment solution in to the collecting

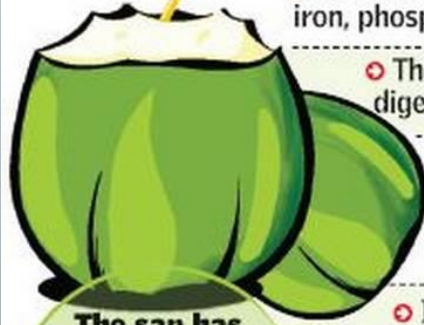


Fit the collecting vessel on top of the inflorescence.

- Her work has great relevance to **Indian societal needs** on food items consumed by the poorest people.
- pioneering work on Neera at the suggestion of our first President Shri.Rajendra Prasad.
- Neera in the diet of tribal malnourished adolescent children and pregnant women caused significant improvement in their overall health.
- Kamala Sohoni received the President's Award for her work on nutritional value of Neera
- **"She has made history"**, said Prof.Derek Richter proud of his student, when she was made Director , Institute of Science, Bombay

# A HEALTHY DRINK

NEERA IS RICH SOURCE OF SUGARS, MINERALS AND VITAMINS



The sap has a low glycemic index of only **35** and hence is diabetic-friendly

- It contains substantial amounts of iron, phosphorus and ascorbic acid
- The product is good for digestion and prevents jaundice
- It's an abundant resource of minerals, **17 amino acids**, vitamin C, broad-spectrum B vitamins
- In ayurveda, neera is considered beneficial to pregnant women and children
- Treated neera can be preserved in cans up to two months at room temperature

Source: Coconut Development Board



# Post-retirement

- Consumer Guidance Society of India (she was one of its founder members and later also served as its Chairperson).
- It was the first society of its kind in the country, - contributed towards testing of various foodstuffs available in the market, and also the **quality of weights and measures used.**
- Designed a kit - housewives - to test the purity of food ingredients.
- Kamala and coworkers were pioneers for the rights of citizens, and were also raising awareness against corrupt practices.
- In addition, she penned several books for young students. The notable thing was that these were written in Marathi-trying to popularize science in the subaltern, non-elite sections of society.



# So... food for thought and take aways

- ◉ Anna Mani
- ◉ Rajeshwari Chatterji
- ◉ Women in Science
- ◉ Women in STEM
- ◉ Challenges we face
- ◉ Challenges with respect to our society
- ◉ Madras Day- Janaki Ammal- Obala Bosh- Anna Mani



# **Thank You all ! Dear Science enthusiasts!!**

Acknowledgement-

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