

Lilavati's Daughters-2

Indian Women Scientists


Acknowledgement-
Indian Academy of Sciences
Rohini Godbole,
Bright Sparks, Arvind Gupta
Anirban Mitra , IISc
Scientifically Yours, Vigyan Prasar

Dr.Uthra Dorairajan

Head, Department of Physics,
DG Vaishnav College, Chennai

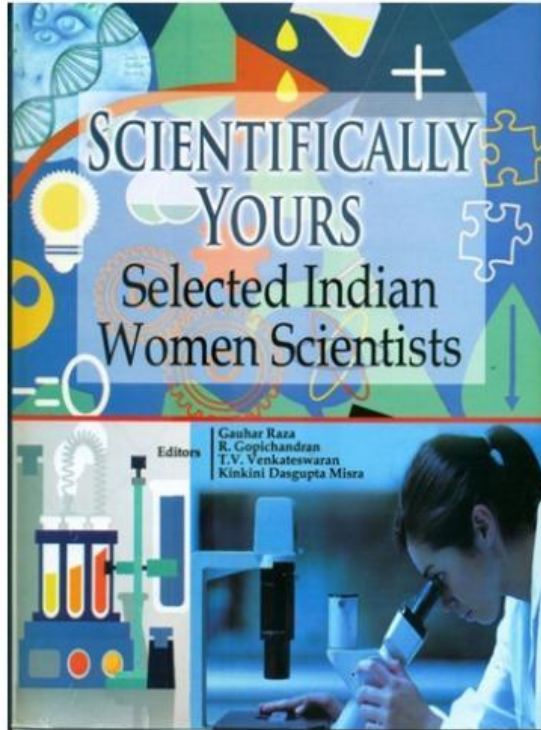
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@ Society of Women Engineers, India
6, March, 2019

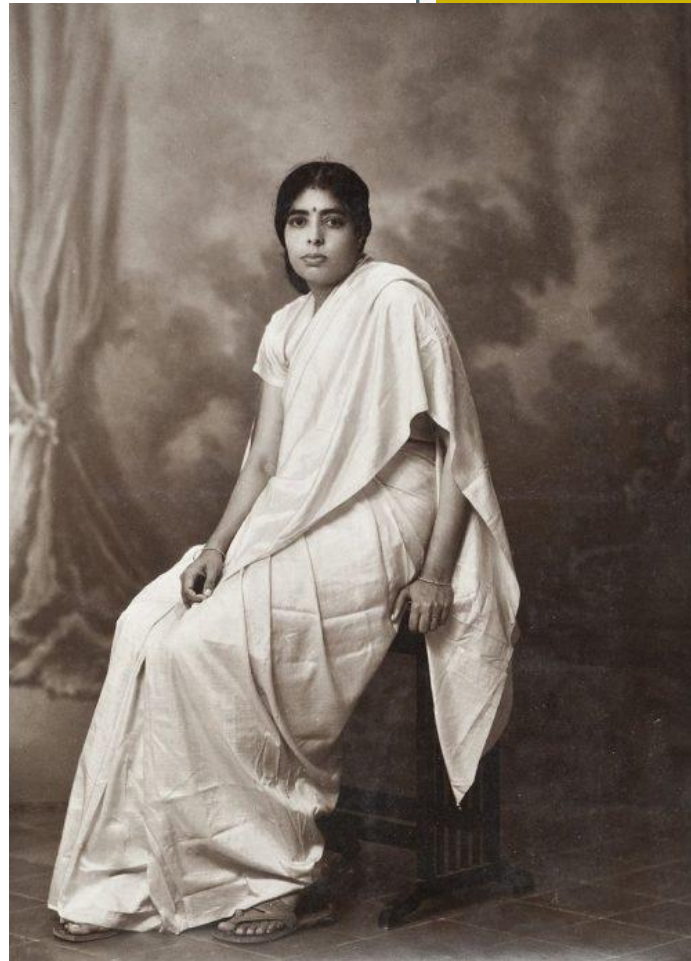
- 
- Can U Name a few...
 - Scientists?
 - Indian Scientists?
 - Indian Women Scientists?
 - Note down-
 - What do you think are/could be the reasons?
 - Challenges-Now and Then?
 - What would have been the status in West then?

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

Dedicated to Janaki Ammal

EthnoBotanist, involved in sugarcane breeding

Simple life inspired by Gandhi

Research FOR the people



Anna Mani

1918-2001



In the 1950, when Homi Bhabha was setting up the infrastructure for atomic energy, Anna Mani's feminist sensibilities were searching for solar and wind energy – Arvind Gupta

- Peermedu, Thekkady- Kumili Kerala
- Cardamom Plantation- Civil Engineer - Father
- 7th Child – Well Read family
- 8th birthday Encyclopaedia Britannica vs 
- 12 years- local library books read
- Inspired by Gandhi- 1925 – Higher Education vs Marriage.
- Khadi all her life , Simple life, socialist 1940- Presidency College- Physics Hons
- CVRaman's lab - Scholarship

- "I had worked hard to gain my academic qualifications and was judged fit to carry out the work that was needed," she would insist when asked whether her being a woman had any impact on her work.
- "Selection for the scholarships at Bangalore and in the United Kingdom had nothing to do with one's sex."
- "For myself, I must say that at no time did I experience professional discrimination as a woman in what was considered largely a man's world.
- I did not feel I was either penalised or privileged because of being female."
- Yet, Mani's assertions that the institutions of science were gender neutral did not reflect insensitivity to women's condition – Abha Sur

- Diamonds Come back to her – She said Yes this time!!
- Worked on the spectroscopy of diamonds and rubies recording their fluorescence, absorption etc.
- She had to expose photographic plates for 16-20 hours .**She often slept in lab!**
- She wrote five research papers on the luminescence of diamonds.
- In 1945 she submitted her PhD dissertation to the Madras University.
- **Lack of a paper PhD never deterred her.**
- government scholarship for an internship in England.
- 1945, went on a troop ship to the Imperial College, London to pursue physics, but landed up specializing in meteorological
- Instrumentation - weather instruments, their Calibration, Standardisation and Procedures

Find a better way to do it!

- Independent India offered ample opportunities and Mani seized the **challenges**.
- In 1948, she joined Indian Meteorology Department (IMD) at Pune in the Instruments Division , headed by S. P. Venkiteshwaran, a visionary with **boundless energy** and a **Nationalist**. 😊
- Before 1947, even simple meteorological instruments like thermometers and barometers imported
- Anna Mani wanted to use her newly acquired expertise and her dreams to make **India self sufficient** in weather instruments in the shortest possible time, inspired by her Head- No man power- She had to make do with what was available.
- 121 men under her – No compromise - believed that wrong measurements were worse than no measurements.
- She insisted on proper design and accurate calibration of all apparatus.

- Anna Mani standardised drawings for nearly 100 different weather instruments and started their production.
- Deeply interested in solar energy as an alternate source for a tropical country like India. However, data on seasonal and geographic distribution of solar energy in India was limited.
- During the International Geophysical Year (1957-58) she set up a network of stations in India to measure solar radiation.
- Initially, only imported equipment was used but soon Mani undertook the design and manufacture of a whole range of radiation instruments.
- In 1960, she started studying ozone – when the word was not so famous. She developed an apparatus ozonesonde.
- This enabled India to collect reliable data on ozone
- Because of Mani's singular contribution she was made a member of the International Ozone Commission.

- 1963 - request of Vikram Sarabhai - successfully set up a meteorological observatory and an instrumentation tower at the Thumba rocket launching facility.
- retired as Deputy Director-General of Indian Meteorological Department in 1976.
- Later she set up a millimetre wave telescope at Nandi Hills, Bangalore.
- Her two books Handbook of Solar Radiation Data for India (1980) and Solar Radiation over India (1981) - standard reference guides for engineers engaged in solar thermal systems.
- A visionary she realized wind energy potential for India and organized round the year wind measurements from over **700 sites using state-of-art equipment.**
- Today as India takes a lead in setting up wind farms across the country, part of the credit goes to Anna Mani.
- For several years Mani headed a small private enterprise in Bangalore manufactured instruments - measuring wind speed and solar energy.
- Mani never married. She was passionate about nature and loved trekking, and bird watching.



RAJESWARI CHATTERJEE


**THE FIRST INDIAN WOMAN SCIENTIST
TO PIONEER THE FIELD OF MICROWAVE
ENGINEERING IN INDIA**

SanskritiCultureOfIndia.com

- “My grandmother, Kamalamma Dasappa, was one of the very first women graduates in the erstwhile Mysore State,
- very active in the field of women’s education, especially those of widows and
- deserted wives.
- Set up an accelerated school syllabus, which permitted students to finish their matriculation by age of 14 - “Special English School” run by “Mahila Seva Samaja”
- Going to college and university were taken for granted in our case, and I went to Central College in Bangalore for my BSc (Honours) and Master’s degrees of the Mysore University.
- after my M.Sc. took up a job at the IISc, Bangalore in Electrical Technology Department. I worked as a Research student “

- After II World War an interim government - offered scholarships to bright young scientists to study abroad.
- selected in 1946, - University of Michigan at Ann Arbor for graduate studies.
- Though I was in my midtwenties by then, my family raised no objections to my going abroad, unmarried though I was then! Remember, this was more than 60 years ago!
- Many young girls today, who can walk into courses and careers of their choice, may have no idea of the kind of restrictions women then had to face, even abroad.
- Many universities even in the West would not admit women till the 1920s or 30s
- **I was indeed very lucky to have faced no such discrimination**

- Working for my Masters in Engineering and later for my PhD in the US was very enjoyable and I learnt many things.
- I learnt to be even more open-minded and receptive to new ideas.
- I learnt that nothing is impossible to achieve if we set our mind to it. I made many new friends and have kept up contact with some of them over the years.
- I went for eight months practical training in radio frequency measurements at the National Bureau of Standards in Washington, DC
- In Sep 1949, I went back to Ann Arbor to continue my studies for my PhD on a **Barbour Scholarship**.
- Back in India in 1953, joined IISc, married Sishir Chatterjee

- 
- Both my husband and I used to take up a number of projects and published several
 - papers jointly. We also taught many courses, mostly in electro magnetic theory, electron tube circuits, microwave technology, and radio engineering and brought out several books on them.
 - My major contribution has been in the field of antennas for special purposes, mainly in aircraft and spacecraft.

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.

Reasoning vs Projection – R u ready gals?

- Sir C.V. Raman was the then director of IISc.
- He was the first Indian to head that prestigious research institute from 1933.
- Till then no women students had sought admission in IISc.
- He denied her admission ???



- 
- **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.**

Satyagraha



- 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*

Guru- Sishya

- 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
- NPN fraction - detailed analysis of amino acid content from pulses important for boosting nutrition of children and invalids
- 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
 - 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.

BRIGHT SPARKS

INSPIRING INDIAN SCIENTISTS
FROM THE PAST



by Arvind Gupta

Illustrated by Karen Hayward

- Can U Name a few...
- Scientists?
- Indian Scientists?
- Indian Women Scientists?

- A. Cursetjee
- Nain Singh Rawat
- J. C. Bose
- P. C. Ray
- Ruchi Ram Sahni
- D. N. Wadia
- S. Ramanujan
- C. V. Raman
- S. K. Mitra
- Birbal Sahni
- J. B. S. Haldane
- P. C. Mahalanobis
- M. N. Saha
- S. N. Bose
- S. S. Bhatnagar
- Yellapragada SubbaRow
- Salim Ali
- K. S. Krishnan
- K. S. Krishnan

- V. N. Shirodkar
- T. R. Seshadri
- P. Maheshwari
- Irawati Karve
- B. P. Pal
- D. D. Kosambi
- Homi Bhabha
- Subrahmanian Chandrasekhar
- Vikram Sarabhai
- Kamala Sohonie
- Laurie Baker
- Anna Mani
- V. Ramalingaswami
- G. N. Ramachandran
- Harish Chandra
- A. S. Paintal
- A. P. Mitra
- Vainu Bappu
- P. K. Sethi
- Shivramakrishna Chandrasekhar
- Anil Agarwal

- Where can I read about them?
- Why do not we read about them in our text books?
- Why are Indian Scientists do not get prominence in our text books?
- Should we know about them?

- IF so....
- Did we ever had any knowledge or is everything only from west?
- Or we always cut- paste?
- What were we before 1700, before Newton?
- Did we have anything that can be called as SCIENCE in modern parlance?
- What about BCE or CE till 1700?
- **Does India ever contribute anything to S & T?**
- **Does our country really have Scientists now? What do they do? How to know about them?**
- **Is doing Ph.D. , the only way to become scientists? Any other ways?**
- **If so can out teachers be called as scientists? Who is a scientist?**





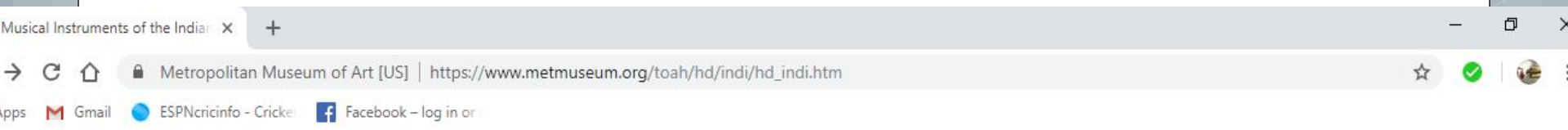
தஞ்சை பெருவுடையார் திருமேனியில் பால் அபிஷேகம்





Temples of 10 CE East & West

Metropolitan Museum of arts US – Online. Can we have one such???



Musical Instruments of the Indian Subcontinent



[See works of art >](#)

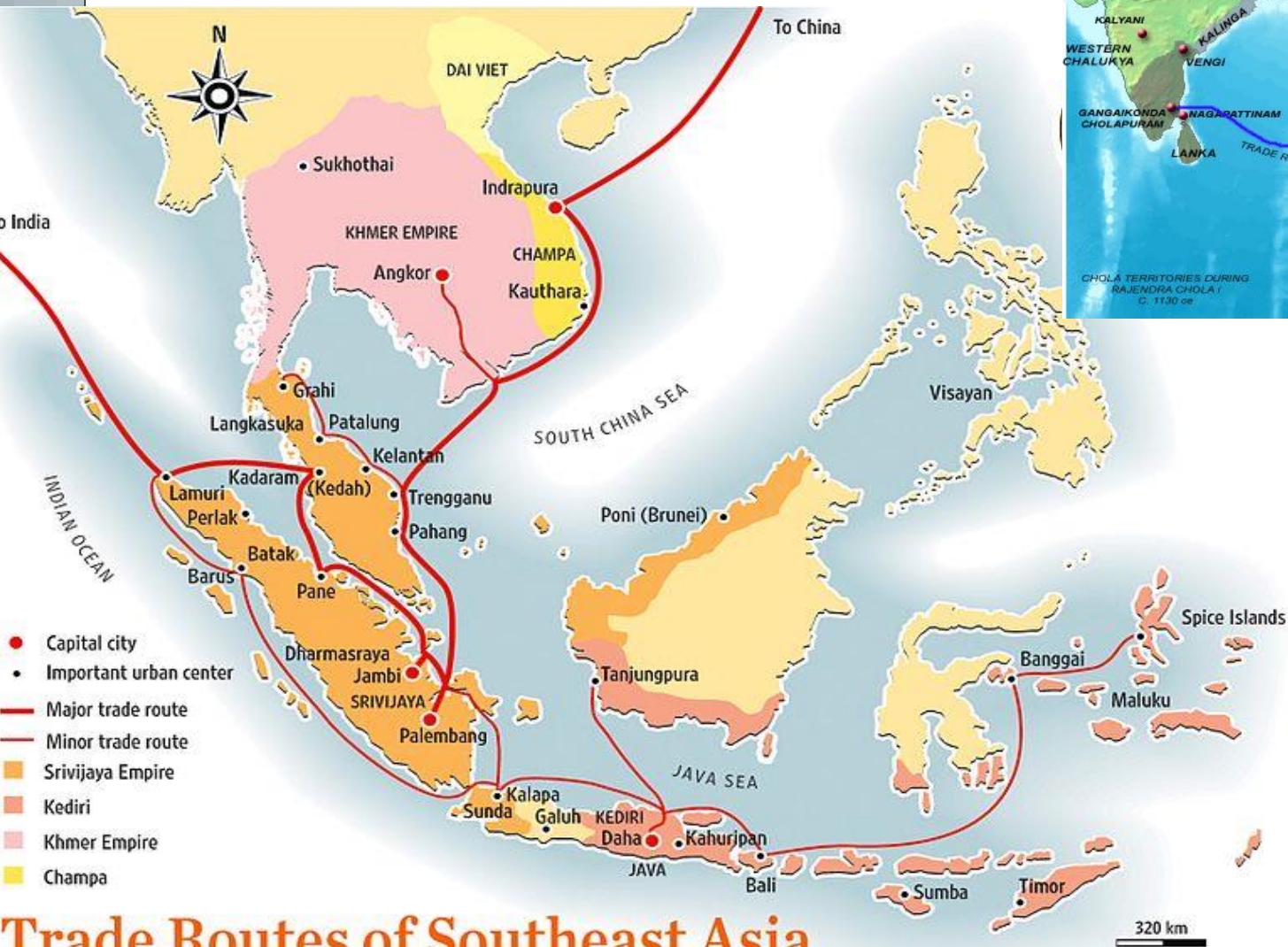
The music of the Indian subcontinent is usually divided into two major traditions of classical music: Hindustani music of North India and Karnatak music of South India, although many regions of India also have their own musical traditions that are independent of these.

RELATED

— PRIMARY ESSAYS

[Company Painting in Nineteenth-Century India](#)
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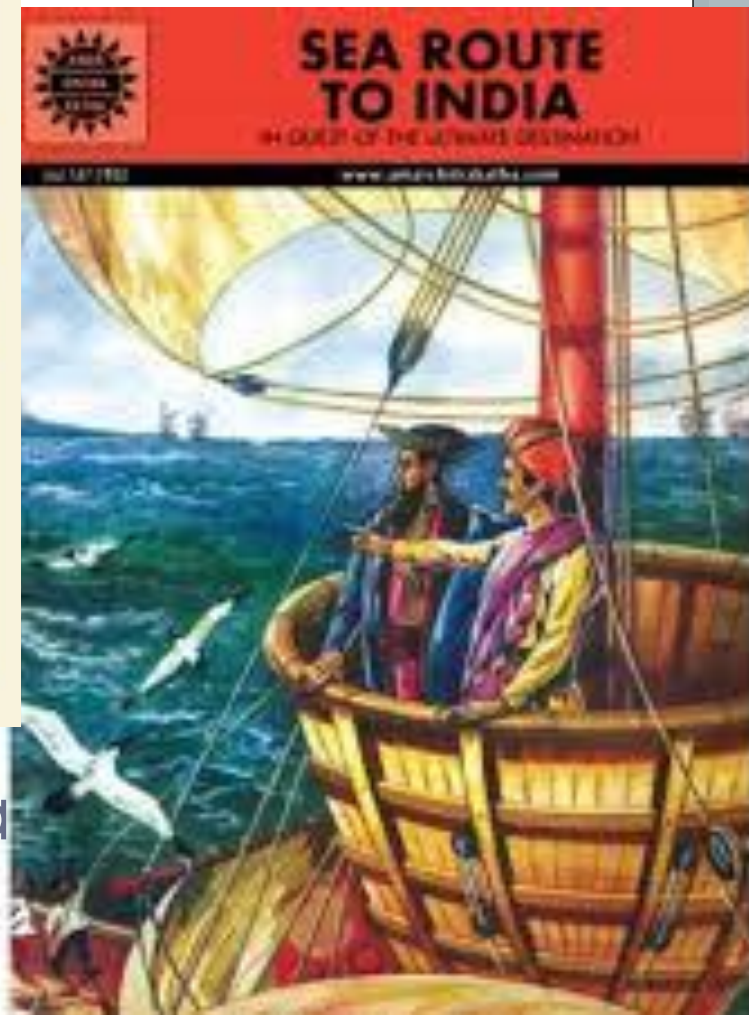
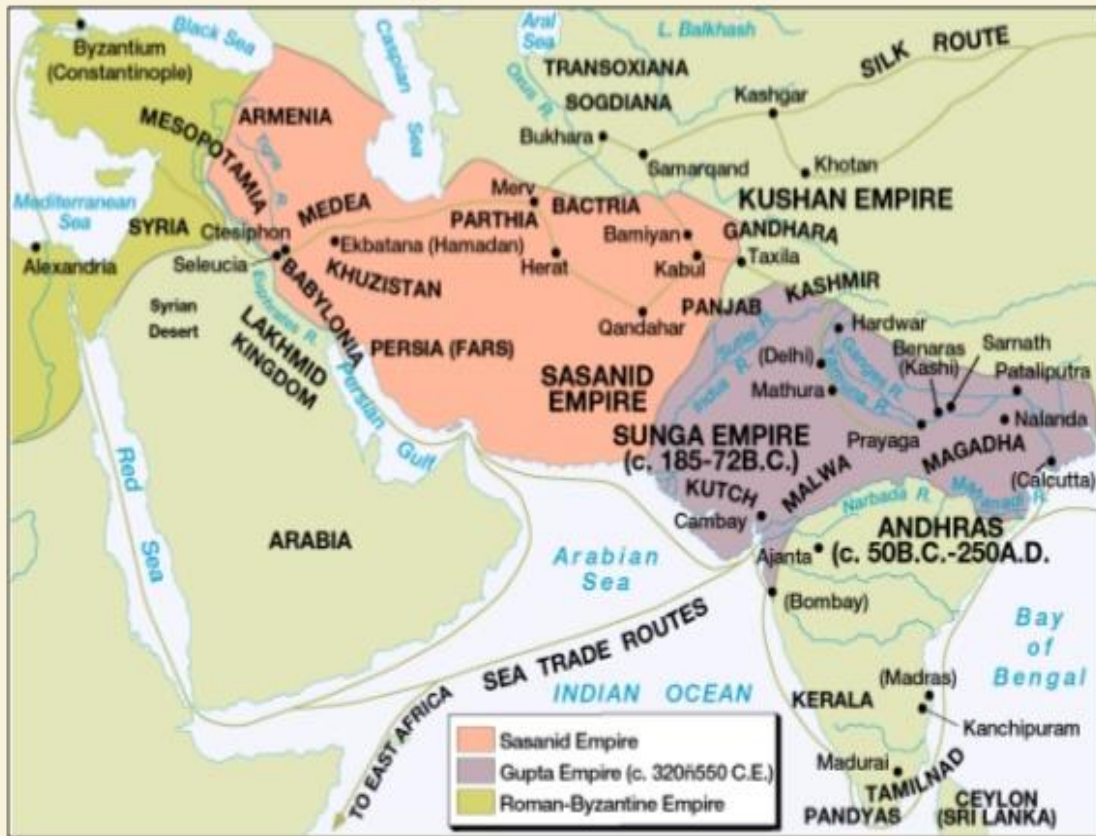
Varun, Sri, Vijaya, Indra



Trade Routes of Southeast Asia

Srivijaya, Kediri, Khmer, and Champa around XII to early XIII century

International Trade Routes during the Guptas



Pic. Coutesy : Greg Sill & Amar Chitra Katha- free read app store

So..... Lets Repeat our questions!!

- Where can I read about them?
- Why do not we read about them in our text books?
- Why are Indian **HISTORY/ Indian Knowledge system** do not get prominence in our text books? Should we know about them?
- Did we ever had any knowledge or is everything only from west?
- Or we always cut- paste?
- What were we before 1700, before Newton?
- Did we have anything that can be called as HISTORY, ARTS, TECHNOLOGY in modern parlance?
- What about BCE or CE till 1700?

So..... No wonder **these people**
did not get due attention?
What should we do.....??
What can you and I do as
ordinary people?

- A. Cursetjee
- Nain Singh Rawat
- J. C. Bose
- P. C. Ray
- Ruchi Ram Sahni
- D. N. Wadia
- S. Ramanujan
- C. V. Raman
- S. K. Mitra

- V. N. Shirodkar
- T. R. Seshadri
- P. Maheshwari
- Irawati Karve
- B. P. Pal
- D. D. Kosambi
- Homi Bhabha
- Subrahmanian Chandrasekhar
- Vikram Sarabhai
- Kamala Sohoni
- Laurie Baker



Shall we -
Bring in a renaissance in our text books,
in our thinking?
Use IT for this or should we always be IT
workers?
Be a beacon of our glory - past, present
and future?

**Question – Can you see a structure next to
the lighthouse? What is it? clue : hillock 😊**

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
- Obsterics among Aryan Hindoos – Thesis topic
- Scholarship of \$600 for three years
- Saree – Marati 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



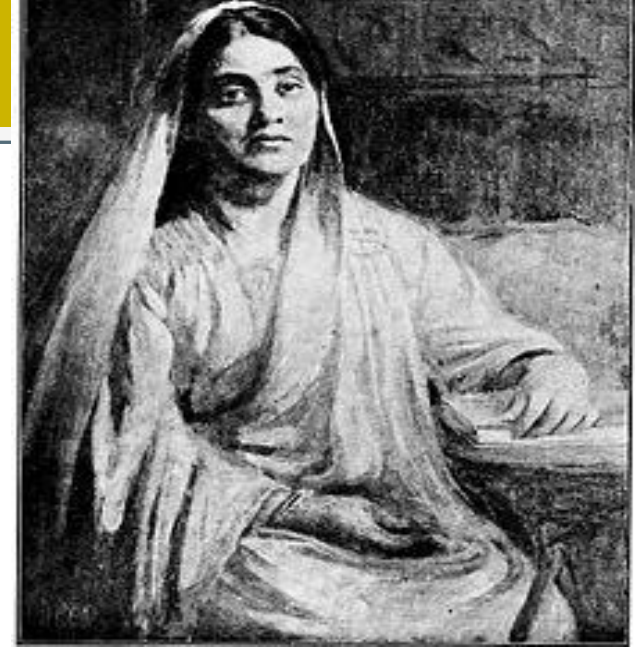
- Taunting and chiding through letters for she may forget culture and HIM
- Where is he - down the ladder?
- Bad fireplace- lead to smoke- Tuberculosis
- Completes course in 1886
- One of the First Woman Doctors of our country
- Gopal @ USA
- Health worsens- Women's hospital in Philadelphia- ship - Doctors 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

Lets do big things together....

- Can we be caregivers- Creche, geriatric, food
- Does our IT complex have mandatory creche, well maintained, 24/7, safe, serves all?
- Do women in office get dignified maternity OFF?
- Do women have safe, usable, enough no.of toilets?
- Feeding rooms accessible to ALL- including janitors
- Footwear for teachers, nurses, janitors, ..
- Health care- rashes, antibacterial, detox, deworm
- Menstrual health – pads, safety,
- Food- A non issue, haemoglobin, anaemia
- Flooring, position of toilets, restrooms, ventilation
- Psychological health

Nether Glorify, Nor Cry



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IIT Delhi launches day care facility for researchers and faculty

As many as 40 kids can be admitted at the centre at a time. The day care is open for children of 18 months till 8 years of age.

By Prachi Verma, ET Bureau | Updated: Aug 09, 2017, 04:30 PM IST

0 Comments

f t in v MORE



NEW DELHI: In a first among the IITs, IIT Delhi campus has recently launched a day care facility to support the researchers and



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So... food for thought and take aways

- Kadambini Ganguly
- 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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