



Celebrating women in science

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A life of dedication

The story of Dr. V. Shanta (1927-2021) is the story of The Cancer Institute, Adyar. For her, the Institute and its mission were everything. She admitted that work was her only interest and that she was not social, had few friends, and did not keep in touch with those she had! So tied up was her life to the Institute that when she felt unwell a few days before her death, she said to those around her: "If I die, sprinkle my ashes all over the Institute. I don't want to leave this hospital."

She joined the Institute in 1955, just a year after it was founded by another remarkable lady, Dr. Muthulakshmi Reddy. Dr. Shanta served there till she passed away at the age of 93, still seeing patients and managing the Institute as chairperson. Dr. Shanta, who was related to two of India's Noble Laureates, (Dr. CV Raman and Dr. S Chandrashekar), was a recipient of the Magsaysay Award (2005) and the Padma Vibhushan (2015).

Her Magsaysay citation reads: "In an era when specialised medical care in India has become highly commercialised, Dr. Shanta strives to ensure that the Institute remains true to its ethos, 'Service to all'. Its services are free or subsidised for some 60 per cent of its 100,000 annual patients [...] 87-year-old Shanta still sees patients, still performs surgery and is still on call twenty-four hours a day."

The Adyar Cancer Institute was only the second comprehensive cancer centre in India. It pioneered many areas of cancer care, becoming the first in the country to set up a nuclear medical oncology department, a medical physics department, a paediatric oncology department, to start a medical oncology unit, carry out the country's first rural cancer survey, create the first super-specialty course in oncology in India, set up the first cancer registry... and many, many more.

While it stays at the cutting edge of medical developments related to cancer, the core of the Institute is its mission to provide quality care for every patient, irrespective of their ability to pay. In fact, of the 535 beds in the hospital, only 40 per cent are fully-paid beds, 20 per cent patients pay a nominal amount, 40 per cent beds are free, where not only do patients not pay for treatment, but boarding and lodging is free too – living up to its mission 'To provide state of art treatment to any cancer patient irrespective of his or her economic status.'

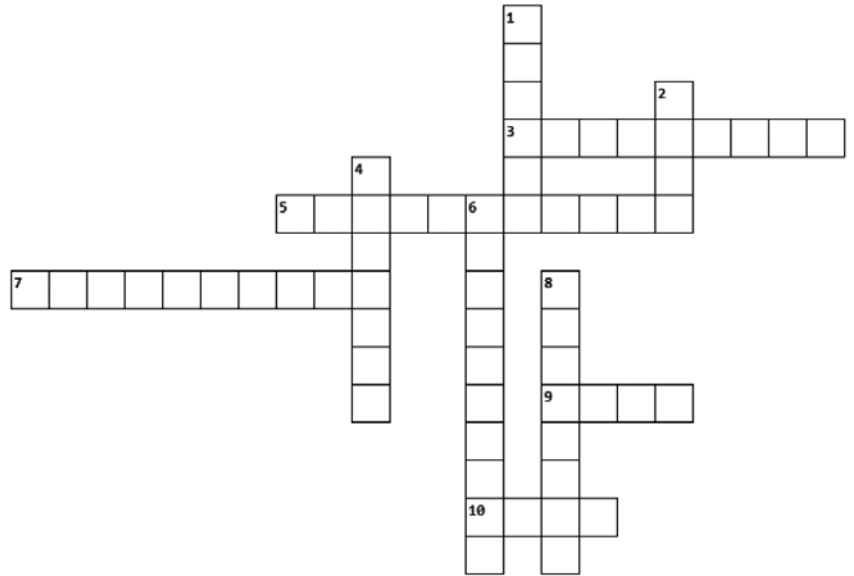
This was the lifework of Dr. Shanta, along with Dr. S. Krishnamurthi, son of the founder Dr. Muthulakshmi.

1. What do the following words mean?
 - a. Oncology
 - b. Subsidized
 - c. Mission
 - d. Citation
2. Pick three lines from the text above, which to your mind, best demonstrate Dr. Shanta's commitment and dedication.
3. The Magsaysay award is often called the Alternate Nobel. For what is it given?
4. Can you find out something about the lives of Dr. Muthulakshmi Reddy and Dr. Shanta?

Women scientists who changed the world

Down

1. This world famous bio-technology company was founded by Kiran Mazumdar-Shaw.
2. Francoise Barre-Sinoussi jointly won the Nobel Prize in Medicine for the discovery of the Human Immunodeficiency Virus associated with this disease.
4. Lise Meitner was responsible for the discovery of Nuclear...
6. Aditi Pant, an oceanographer, was the first Indian woman scientist to visit this frozen continent.
8. Gertrude Elion developed drugs to treat blood cancer, also called this.



Across

3. Marie Curie won Nobel Prizes in physics and...
5. The animals that Jane Goodall studies and works to protect.
7. Rachel Carson's book *Silent Spring* warned the world of dangers due to these.
9. This is the last name of India's leading microbiologist and virologist, whose work helped India during COVID.
10. Dr. Kalaiselvi is director general of this critical council which leads science and technology R&D in India.

Lady with the graph

We all know about Florence Nightingale, the Lady with the Lamp. Born in 1820, this Englishwoman was a pioneer in nursing, working on the war front to take care of soldiers. At a time when women were supposed to stay at home and keep house, and the nursing profession was not considered respectable, she broke convention and trained to be one.

A lesser known fact is that Florence was a statistician par excellence, and in 1860 was elected the first woman Fellow of the Statistical Society. Her meticulous approach to collecting data in the hospital she worked at and analyzing it, at a time when even deaths were not properly tallied, led to a better understanding of the situation and helped reduce deaths. For instance, analysis by her and statisticians appointed by the British government led to the conclusion that 16,000 of the 18,000 deaths in her hospital were not due to battle wounds but due to preventable diseases, spread by poor sanitation. By using applied statistical methods, she effectively made the case for bringing in better hygiene practices, thus saving lives. She was aware that it would be difficult to convince decision makers of the need for change, and maybe out of this requirement was born what is today counted as her major contribution to statistics – the first infographic ever made. The best-known of the infographics she invented are what are called the “coxcomb” diagrams.

Find out what an infographic is.

Here is a table of some key health statistics for selected countries from the World Health Organization. Can you depict some of these aspects graphically, so a viewer can quickly understand the figures and compare them? (Data Source: <https://www.who.int/data/>)?

Data type	Total population (000s)			Life expectancy at birth (years)			Healthy life expectancy at birth (years)			Maternal mortality ratio (per 100000 live births)	Under-five mortality rate (per 1000 live births)	Neonatal mortality rate (per 1000 live births)	Tuberculosis incidence (per 100000 population)	Malaria incidence (per 1000 population at risk)				
	Comparable estimates			Comparable estimates			Comparable estimates								Comparable estimates	Comparable estimates	Comparable estimates	Comparable estimates
	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes									
Member State	2020			2019			2019			2017	2020	2020	2020	2020				
Afghanistan	19976	18952	38928	63.3	63.2	63.2	54.7	53.2	53.9	638	58	35	193	8.4				
Argentina	22049	23147	45196	73.5	79.5	76.6	65.4	68.8	67.1	39	9	5	31	–				
Australia	12699	12801	25500	81.3	84.8	83.0	70.2	71.7	70.9	6	4	2	7	–				
Bangladesh	83259	81430	164689	73.0	75.6	74.3	64.2	64.4	64.3	173	29	17	218	0.4				
Bhutan	410	362	772	72.0	74.4	73.1	63.2	63.5	63.4	183	28	15	165	<0.1				
Botswana	1139	1213	2352	58.9	65.5	62.2	51.9	55.8	53.9	144	45	22	236	1.1				
Brazil	104436	108124	212559	72.4	79.4	75.9	63.4	67.4	65.4	60	15	9	45	3.9				
Canada	18732	19010	37742	80.4	84.1	82.2	70.5	72.0	71.3	10	5	3	6	–				
China	741999	705471	1447470	74.7	80.5	77.4	67.2	70.0	68.5	29	7	3	59	–				
Denmark	2879	2913	5792	79.6	83.0	81.3	70.7	71.4	71.0	4	4	3	5	–				
France	31589	33684	65274	79.8	85.1	82.5	71.1	73.1	72.1	8	4	3	8	–				
Greece	5116	5307	10423	78.6	83.6	81.1	69.9	71.9	70.9	3	4	2	5	–				
India	717101	662903	1380004	69.5	72.2	70.8	60.3	60.4	60.3	145	33	20	188	3.2				
Indonesia	137718	135806	273524	69.4	73.3	71.3	61.9	63.8	62.8	177	23	12	301	2.9				
Japan	61753	64723	126476	81.5	86.9	84.3	72.6	75.5	74.1	5	2	<1	12	–				
Malaysia	16631	15735	32366	72.6	77.1	74.7	64.5	66.9	65.7	29	9	5	92	0.0				
Pakistan	113672	107220	220892	64.6	66.7	65.6	56.9	56.8	56.9	140	65	40	259	2.5				
Saudi Arabia	20131	14683	34814	73.1	76.1	74.3	63.8	64.4	64.0	17	7	3	8	<0.1				
South Africa	29216	30093	59309	62.2	68.3	65.3	54.6	57.7	56.2	119	32	11	554	0.8				
Sri Lanka	10267	11146	21413	73.8	79.8	76.9	65.1	69.0	67.0	36	7	4	64	–				

The girl who played with numbers

Lilavati was the daughter of Bhaskara II, an eminent mathematician of the 12th century. He lived in Maharashtra and wrote many important books on mathematics. One of these was *Lilavati*, named after his daughter. *Lilavati* has 13 chapters, dealing with arithmetic, interest calculations, geometric progressions, plane and solid geometry, a method to solve indeterminate equations, etc. It contains many problems presented in the form of poems, addressed to his daughter Lilavati. Lilavati was obviously an intelligent girl, who had a good foundation in mathematics and enjoyed working on problems.

Here are a few examples from the book, which you could try solving!

Oh Līlavatī, intelligent girl
If you understand addition and subtraction
Tell me the sum of the amounts 2, 5, 32, 193, 18, 10, and 100,
As well as [the remainder of] those when subtracted from 10000.

A fifth part of a swarm of bees came to rest on the flower of Kadamba,
Third on the flower of Silinda.
Three times the difference between these two numbers flew over a flower of Krutaja,
And one bee alone remained in the air, attracted by the perfume of a jasmine in bloom.
Tell me, beautiful girl, how many bees were in the swarm?

A beautiful maiden, with beaming eyes,
Asks of which is the number that multiplied by 3,
Then increased by three-fourths of the product, divided by 7,
Diminished by one-third of the quotient,
Multiplied by itself, diminished by 52,
The square root found, the addition of 8, division by 10
Gives the number 2?

(Source: <https://www.samskritabharatiuk.org/lilavati-of-bhaskara/>; <https://www2.math.uconn.edu/>; <https://gauravtiwari.org/>)

(Note to teachers: The first problem is simple. The answer for the second is 15 and the third is 28. Workings are available on the Internet).

Facing challenges, achieving breakthroughs

Women scientists have not had an easy time. Almost all of them had to fight to pursue their interests in science and math. About two centuries ago, it was not even possible for women anywhere in the world to get a science education or degree. Their achievements were not taken seriously. Working conditions were made difficult. In spite of all this, many brave women persisted and cleared the path for generations to follow.

Did you know?

- It was only in 1920, just about a 100 years ago, that Oxford University allowed women to get degrees?
- At about the same time, Emmy Noether, a brilliant algebraist was not allowed to teach at the University in Erlangen, Germany, because the University felt men would be shocked to have a woman lecturing to them in their university classes.
- In 19th century England, Mary Somerville needed her husband's approval just to write a book about mathematics.
- Lalitha Ayyala Somayajula, India's first engineer, had to take permission not only from the college but also the British government, to enrol in the engineering course. She successfully graduated in 1944, but all her certificates said 'he', instead of 'she'.

Some of us have come a long way. But even today, many girls face barriers to taking up science, engineering, or mathematics related professions. What are some of these challenges? Make a poster on the challenges you see to women entering and succeeding in such careers. Your class can put up an exhibition of these posters on March 8, International Women's Day.

Try to interview a woman who is a senior professional in any of these areas – (maybe someone in their 50s, 60s, or 70s), ask them what challenges they had to face during their education and careers. Were their families supportive? Did they have any friends or mentors who helped them? How did they meet the challenges? What advice do they have for girls who pursue these careers?

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