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MYTHS & FACTS



THINK AGAIN

WOLF PACKS RULE BY AN 'ALPHA' THAT FIGHTS OTHER WOLVES FOR DOMINANCE



THE FACT

The popular "alpha wolf" idea largely came from studies of unrelated wolves kept together in captivity. In the wild, most wolf packs are family groups led by a breeding pair

WHAT'S REALLY HAPPENING

1. The "alpha wolf" idea came from captive wolves, often unrelated adults forced to live together, where dominance hierarchies developed
2. In the wild, wolf packs are usually family groups made up of a breeding pair and their offspring
3. The breeding pair generally leads the pack because they are the parents, not because they fought their way to the top
4. Young wolves often leave the pack at around two to three years old to find mates and establish their own packs, rather than challenging their parents for dominance
5. Serious fights for control are rare in typical wild packs, although competition can occur in unusually large packs with more than one breeding pair



SCIENCE IN PLAIN SIGHT

Why do fingers wrinkle in water

THOSE wrinkly fingertips after a long bath are not simply the result of your skin soaking up water. Your nervous system controls the effect. When your fingers remain submerged, nerves signal the tiny blood vessels beneath the skin to constrict. This reduces the volume of tissue underneath the skin, causing the outer layer to fold and form wrinkles.

Scientists believe these grooves may improve grip on wet surfaces. So, wrinkled fingers are an active biological response — not simply waterlogged skin. So, your fingers are not getting soggy; your nervous system is doing the wrinkling.



WAXY BUSINESS

Hydrochar gets a natural carbon shield

A study by researchers at the Shenyang Agricultural University (SAU) in China has found a way to enhance carbon sequestration while remediating soil. They have found that a naturally formed water repellent coating on hydrochar applied on soil can play a role that has been hitherto overlooked in protecting carbon from chemical degradation. Hydrochar is a carbon-rich material made by heating wet biomass or organic waste in water under moderate pressure and low temperatures, turning waste into fuel or soil additives without energy-intensive drying.

BRAIN CANDY • MOST CATERPILLARS HAVE 12 SIMPLE EYES. CALLED OCELLI, THEY LINE THE CATERPILLARS' HEADS

A CURIOUS MIND

Finding order in Chaos

FROM working with Richard Feynman at Caltech to recently winning the Dirac Medal, theoretical physicist Deepak Dhar in conversation with *TNIE's* **Tamreen Sultana** shares about his journey, experiences in research and what it takes to pursue science in India.

Q What sparked your interest in science?
When I was young, my father encouraged me to follow science. He would bring a British popular science magazine called 'Understanding Science', which was a bit expensive by Indian standards. Of course, it was in English. I had to first learn the language, and then to understand the concepts. Eventually, I became better in English, and also developed some interest in science.

Q You studied at Allahabad University, IIT Kanpur and then Caltech. How did these places shape your approach to physics and research?
All of these were very important in developing my understanding and knowledge of basic science. Caltech is certainly one of the world's best places for this kind of work, so I am very happy to have had the opportunity to learn there.

Q You worked with Richard Feynman at Caltech. What did you learn from him?
There were lots of things to learn from him, even just by watching him. The first thing I recall about him was that he was not very pompous and was very kind to students (unlike some other people we meet!). He was also able to explain things in very simple terms without using too much jargon. I learnt the importance of making sure that students understand something well. And the importance of constructive criticism, which helps them do better.

Q Is there a fundamental difference between doing a PhD in the US and India?
I don't think making a very general comparison between a PhD in the US and a PhD in India is very useful.

There are some very good places in the US and there are lots of not-so-great places there as well. Similarly, there is considerable variation in the quality of institutions in India.

Certainly, the best universities in the US are better than the best in India. I do not think many Indians will disagree with this statement. But several institutes in India are very comparable to institutions among the top 50 in the US, though perhaps not the top five.

Q For a general reader, what is statistical physics trying to explain?
We know bulk matter is made up of lots of atoms, and predicting its properties helps us understand the world around us. In principle, knowing how individual molecules behave should let us predict what happens in a large amount of water, for example. But that is very difficult using exact equations of motion.

The advantage of statistical mechanics is that we don't need to know the exact state of every particle.

We can still reliably predict properties such as temperature, pressure and the behaviour of substances. In other words, it allows us to predict the properties of large numbers of particles even when we cannot predict each particle's individual behaviour.

Q Could you explain your widely recognised Abelian sandpile model in simple terms?
A property of the sand that is familiar to everybody is this: you take a pile of dry sand and add grains to it very slowly. When you add a grain, you cannot control its position very well. Sometimes the grain will simply sit on the pile. Sometimes it will move a little and settle there. Sometimes it causes a big avalanche. You may drop one grain, but 100 or 1,000 grains can come down.

What is happening is that you have a system which is being driven by adding grains, but its response is sporadic, irregular and burst-like.

Sometimes nothing happens and sometimes a large event occurs. This is not very periodic. The interval between events is random and not easily predictable. These kinds of avalanche-like relaxations are what people were trying to understand. They made a model called the Abelian sandpile model. I will not describe the model in great detail here, but what they could show was that the model had this basic behaviour: you add one grain, sometimes very little happens and sometimes a much bigger avalanche happens. But this had only been shown using computer simulations. There was no theoretical way of predicting this behaviour. What I did was to show that you can define some quantities called addition operators.

In this model, these addition operators have the property that, if you take a configuration of sand and add a grain at one place A and then another, at place B, or add the grain at B first and then at A, the final configuration is the same after the avalanches are over, and sandpile has a stable configuration.

This property — that the final answer does not depend on the order in which you add the grains— is called the Abelian property.

Using these properties, along with other properties of the model, various quantities could be theoretically calculated. This was the prototypical model of these kinds of driven systems, which are called self-organised critical systems. It was useful in helping us understand the general behaviour of such systems.

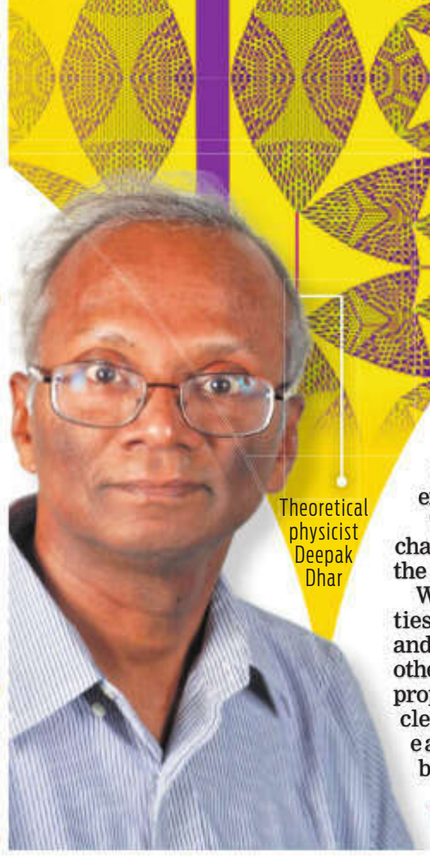
(For the full interview, visit the TNIE website)

A Physicist's Journey

1951: Born in Pratapgarh, Uttar Pradesh
1970: BSc, University of Allahabad
1972: MSc in Physics, IIT Kanpur
1978: PhD in Physics, California Institute of Technology.
1978–2016: Returned to India, joined TIFR as a research fellow and rose to distinguished professor after over three decades in its department of theoretical physics
2016–2024: Distinguished visiting faculty, IISER Pune
Present: Indian Science Academy professor at, ICTS-TIFR, Bengaluru

Trail of Honours

1983 : INSA Young Scientist Medal
1991: Shanti Swarup Bhatnagar Prize
1993: J R Schrieffer Prize
2001 : S N Bose Medal
2002: The World Academy of Sciences (TWAS) Prize in Physics
2022: Boltzmann Medal – first Indian recipient
2022: IIT Kanpur Distinguished Alumnus Award
2023: Padma Bhushan
2026: ICTP Dirac Medal



Theoretical physicist Deepak Dhar

DECODE

Solve the following questions and send your answers to xplore.science@newindianexpress.com along with your name. The correct entries will receive a shout-out in the next edition



THINK IT THROUGH

- Which process converts ammonia into nitrites and nitrates through microbial activity? (13)
- Which chemist proposed that reaction rates depend on the concentration of reactants and established the law of mass action? (4, 8)
- Which documentary examines the consequences of humanity's impact on Earth's ecosystems (1, 4, 2, 3, 6)
- Which environmental process removes nitrogen from ecosystems by converting nitrates into atmospheric nitrogen? (15)
- Which phenomenon describes the transfer of energy through an ecosystem from producers to consumers and decomposers? (6, 4)

Answers to previous puzzle:
Le Chatelier's principle, Jocelyn Bell Burnell, Beta Oxidation, Linus Pauling, Frederick Griffith

SHOUTOUT TO THE SOLVERS
Adisubramanya P Raju, Adisubramanya Raju, Mayank Roy, Anjali Nagaraju, Gregory Koshy Thomas, Rajkumar Rambhatla, Aditya Kamble, K Raja, Jai Kamalesh SG, Poonam M Iyer, Joy Paul, Parthasarathy Mandadi

CHANGE OF NAME
I, Given name: **BHARATHI**
Surname: **SUBRAMANIYAN**
(Old Name)
born on 01.01.1968,
residing at No. S-94 S-TYPE,
9th Street, Phase I,
Sathuvachari, Vellore-632009.
Shall henceforth be known as
Given name: **BHARATHI**
Surname: **SUBRAMANIAN**
(New Name)
Vellore, 18.08.2026
Given name: Bharathi
Surname: Subramaniyan

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The pledges, in specific and the public, in general, are hereby notified that public auction of the gold ornaments pledged in the below accounts is proposed to be conducted at the following branches on 16/09/2026 from 10.00 am onwards. We are auctioning gold ornaments defaulted customers who have failed to make payment of his/her loan amount despite being notified by registered letters. Unauctioned items shall be auctioned on any other days without further notice. Changes in venue or date (if any)will be displayed at auction centre and on website without any further notice.

List of pledges:-

RANIPET, ARCOT, 0104470700728665, 8667, 8671, 8692, 8693, 8694, 8699, 8712, 0104470730011928, 1929, 1934, 1937, 0208, 0209, MUTHUKADAI RANIPET, 0123780700020795, 0798, 0799, 0824, 0830, 0851, 0854, 0865, 0123780730009786, 9787, 9792, 9797, 9809, 9810, 9818, 9819, 9824, 9831, 9846, 9849, 9850, 9859, 0208, OLD BUS STAND CIRCLE, 0128720700013722, 3744, 3754, 3756, 0128720730008262, 0000, 0006, 0010, 0011, 0012, 0014, 0023, 0024, 0029, 0037, 0042, 0050, 0055, 0060, 0065, 0066, 0067, 0256, PANAPAKKAM, 0118790700044005, 4015, 4017, 4024, 4031, 4032, 4035, 4043, 4047, 4068, 4077, 4089, 4093, 4104, 4109, 4122, 0118790730012785, 2786, 6646, 6647, 6648, 6650, 6659, 6666, 6671, 6673, 6674, 6675, 6676, 6677, 6680, 6682, 6690, 6691, 6699, 6715, 6718, 6719, 6720, 6724, 6737, 6739, 6740, 6741, 6744, 6753, 6760, 6771, 6772, 6774, 0350, RANIPET, 0125160700023761, 3770, 3775, 3787, 3796, 3807, 3810, 3814, 3815, 0125160730012628, 2629, 2637, 2638, 2639, 2643, 2644, 2645, 2646, 2647, 2650, 2655, 2656, 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