

**Lecture Programme for students of class XI and XII,  
in association with National Academy of Sciences, Allahabad,  
to be held at the Chennai Mathematical Institute, Siruseri  
on 8th & 9th July 2019.**

**Monday, 8th July:**

<u>Time</u>	<u>Speaker</u>	<u>Title</u>
10.00-11.00	Prof. S. Sivakumar Krea University	<b>Insights and imagination in physics</b> <u>Abstract:</u> In school we learn about the contributions of Newton, Maxwell, Einstein, Planck, de Broglie, Heisenberg and Schrodinger. Their contributions are very fundamental and it is apt that we learn about them. But the story of physics began much before the era of these great minds. There have been many other scientists who provided very illuminating and expository discussions about natural phenomena. These discussions are particularly relevant in the context of physics teaching. We will discuss a few interesting stories about the size of the earth, size of water molecule, electric current in a metal, speed of light and a few more. These are stories about attempts that were carried out when many of the present day scientific tools were not available. Of course, it goes without saying that the enormous insight and courage to imagine compensated for the lack of tools.
11.00-11.30		<b>Discussion</b>
11.30-11.45		<b>Tea break</b>
11.45-12.45	Prof. T. Subramoniam Sathyabama Institute of Science and Technology	<b>Animal Development: From DNA to Diversity</b> <u>Abstract:</u> All living beings are composed of cells, constructed with the same substances. Living organisms are either single cellular or multicellular. The bacteria are unicellular, but perform all life processes of multicellular organisms, like us. In the multicellular organisms, groups of cells perform specialized functions linked by intricate system of communication. While there is a commonality in the universal features in life forms, there is a genetic diversity in all life forms. Nevertheless, all the animal forms are descended from a common bilaterally symmetrical ancestor that lived in Precambrian seas more than 540 million years ago. With our understanding that DNA is the hereditary material in all organisms, phylogenetic relationships between different species are established based on similarities in the sequence of genes and the protein they encode. Animals

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		<p>diverge from the common ancestors through changes in their DNA, which carries the blue print of animal form, transmitting from generation to generation. Divergent animal forms however share specific families of genes that regulate major aspects of body pattern. These “toolkit genes” form the genetic basis of animal diversity. The discovery of “toolkit genes” laid the foundation for understanding the regulation of genes in different cell types of multicellular organisms and the regulation of genes in space and over time during the development of individual organisms. Changes in the functions of toolkit genes over the course of animal evolution resulted in the species diversity. The metazoan genes not only consist of the coding sequences for a particular protein, but also possess a modular array of <i>cis</i>-elements that act as genetic switches to control gene expression in different contexts. The modularity of <i>cis</i>-regulatory DNA is critical both to the specificity of gene interactions during development and to evolutionary changes in gene expression during the evolution of new morphologies. The patterns in which major developmental genes are expressed within various body regions correspond to the structures of the larvae or adult. In the model organism, <i>Drosophila</i>, the genetic regulatory hierarchies underlying developmental programmes have been well studied. This lecture explains the spatial and temporal expression of <i>Drosophila Hox</i> genes and compares with those of vertebrates. This lecture also discusses the evolution of Hox genes from the basal metazoans like cnidarians to the human beings.</p>
12.45-13.15		<b>Discussion</b>
13.15-14.15		<b>Lunch</b>
14.15-15.15	Prof. K.V. Subrahmanyam CMI	<b>The P vs NP problem</b>
		<u>Abstract:</u> In this talk I will introduce the P versus NP problem a fundamental open problem in Theoretical Computer Science. This problem is listed by the Clay Mathematical Institute as one of the ten Millennium Problems expected to engage computer scientists and mathematicians in this century. I will begin with the history of computation leading up to the P vs NP problem and also discuss some practical implications of settling this open problem.
15.15-15.45		<b>Discussion</b>
15.45-16.00		<b>Tea break &amp; disperse</b>

Tuesday, 9th July:

<u>Time</u>	<u>Speaker</u>	<u>Title</u>
10.00-11.00	Prof. Satyavani Vemparala IMSc.	<b>What can computer simulations teach us about material properties?</b> <u>Abstract:</u> In this talk, I will describe ways in which computer simulations can help us probe properties of materials and how to use basis physics to understand some fascinating phenomena like protein folding, polymers etc. <b>Discussion</b>
11.00-11.30		<b>Tea break</b>
11.30-11.45		
11.45-12.45	Prof. R. Balasubramanian NCM, IIT-B	<b>Number theory and Secure communication</b> <u>Abstract:</u> Modern day secure communication like RSA or ElGamal is based on some results of Number theory like congruences, Eulers theorem, Euclids Algorithm etc. In this lecture we shall give the necessary introduction to these concepts and show how they are used in RSA <b>Discussion</b>
12.45-13.15		<b>Lunch</b>
13.15-14.15		
14.15-15.15	Padmashree Arvind Gupta	<b>Fun of doing Science</b> <u>Abstract:</u> Before children can understand a thing, they need experience: seeing, touching, hearing, tasting, smelling, choosing, arranging, putting things together, taking things apart. Children need to experiment with real things available in their milieu. In India most science is learnt by rote – by mugging up definitions and formulae and spitting them out in the exams. Very few children dirty their hands on making simple models. The Government of India launched the Make in India campaign two years back. They soon realized that the slogan will become a reality only when children start learning science in schools through actual experiments and projects. Now the Government of India is opening hundreds of <i>Atal Tinkering Labs</i> in schools. Arvind Gupta Wiki <a href="https://en.wikipedia.org/wiki/Arvind_Gupta">https://en.wikipedia.org/wiki/Arvind_Gupta</a>
15.15-15.45		<b>Discussion</b>
15.45-16.00		<b>Tea break &amp; disperse</b>