



**Indian Institute of Science**  
**Centre for BioSystems Science and Engineering**  
**BSSE Seminar**



**8<sup>th</sup> April 2019, 4:00PM, Monday, MRDG Seminar Hall, 1<sup>st</sup> floor,  
Biological Sciences Building**

**How and Why Temperate Bacteriophage Count Genomes to Make a Binary  
Choice between Two Cell Fates**

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**ABOUT THE SPEAKER:**

Dr. Sandeep Krishna's research lies at the interface of biology and physics/math. In particular he is interested the dynamics of biological systems across a wide range of time and length scales, ranging from molecular mechanisms of protein regulation, to decision-making in microbial cells, to collective behaviour in populations. He works at the Simons Centre for the Study of Living Machines, which is a group of like minded theorists embedded in the National Centre for Biological Sciences in Bangalore.

**ABSTRACT**

Temperate bacteriophage are amongst the simplest organisms that can be said to make a developmental decision. Upon infecting a bacterium, they either produce many offspring and kill the bacterium (lysis), or lie dormant and replicate along with the bacterium (lysogeny). This lysis-lysogeny decision depends on the state of the bacterium, environmental conditions, and interestingly the number of phage that have simultaneously infected the bacterium. Phage lambda can even distinguish between one or two viral genomes being present in an infected cell. I will discuss work in which we examined computer models of millions of small genetic networks to see what features are required to produce such an ability to count genomes and bias the developmental decision accordingly. We found that the networks that did this in the most robust way tended to separate the functions of decision-making and decision-maintenance, which may provide an interesting way of looking at other developmental decisions. If there is time I'll also describe population dynamics models of phage-bacteria ecosystems which indicate why such a counting strategy may be useful for phage when they compete with other phage.