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

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# Governing principles of cellular decision-making: gene regulation


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**About the speaker:**

Dr. Sandeep Choubey is currently a post-doctoral fellow at the Max Planck Institute for the Physics of Complex Systems/Max Planck Institute of Molecular Cell Biology and Genetics in Germany with Frank Jülicher and Stephan Grill as advisors. Prior to this, he was a post-doctoral fellow with Sharad Ramanathan at Harvard University. He obtained his PhD in Physics in 2015 from Brandeis University under the mentorship of Jane Kondev and Alvaro Sanchez, during which he received the Berko Award for excellence in research during PhD.

**Abstract:**


Cells constantly make decisions regarding which genes to express and which genes not to express based on intra-cellular and environmental cues. By doing so, they generate and maintain cell identity, react to changing milieu, and execute developmental programs. While the identities of the various molecular players involved in regulating gene expression are known, the physical principles that govern their action remain elusive. Jacques Monod once famously asserted that 'Anything found to be true of E. coli must also be true of elephants'. Using the example of human pioneer transcription factor Klf4, I will discuss how this assertion is being challenged; an intriguing picture of gene regulation is emerging in higher organisms wherein transcription factors, co-factors, etc. form liquid-like condensates in the vicinity of the DNA to regulate gene expression. Such collective behaviour of transcription factors stands in sharp contrast to the view of single transcription factor molecules regulating gene expression in E. coli, for instance. I will discuss my attempts to unravel the grammar of gene regulation in eukaryotes using tools from statistical mechanics.