INSTRUCTING MICROBE GENES

PROF. DIPANKAR CHATTERJI

Prof. Dipankar Chatterji (b.1951) is an Indian molecular biologist and an Emeritus professor in the Molecular Biophysics Unit at the Indian Institute of Science, Bangalore. He earned his BSc and MSc in chemistry from Jadavpur University and a PhD in molecular biology from IISc in 1977. After postdoctoral research in the USA, he returned to India and spent 15 years at the Centre for Cellular and Molecular Biology in Hyderabad before joining Molecular Biophysics Unit, IISc in 1999. He later chaired the same department and chaired Molecular Biology and Genetics unit of JNCASR. Prof. Chatterji is known for pioneering research on bacterial gene regulation, expression and stress responses in *E. coli* and *Mycobacterium* species. His lab has produced over 200 peer-reviewed publications, and he has mentored more than 40 doctoral students. In the scientific community, he has held leadership roles, including serving as Secretary (2010–12) and President (2013–15) of the Indian Academy of Sciences. He has been honored with prestigious awards such as the Shanti Swarup Bhatnagar Prize (1992) and the Padma Shri (2016), notably reflecting his impact in molecular biology and biophysics.

NOTES OF FUTURE

- **Molecular Recognition as the Foundation:** We are continually enhancing our understanding of molecular recognition, which remains the guiding principle of my own life's work. This concept, how one molecule recognizes another, defining geometry and shape is still central to resolving problems like how antibiotics recognize disease mechanisms and how proteins are synthesized, forming the basis for many future discoveries.

- **Unlocking the Gut-Brain Axis:** A major frontier currently under intense investigation is the gut microbiome and the crucial gut-brain axis. Researchers are actively exploring how our gut environment, influenced by diet and surroundings, is intimately connected to our health, emotion, dreams, and even mental problems, suggesting that key decisions about our future physiology may already be decided within the first six months of life.

- **Harnessing Artificial Intelligence (AI) for Design and Prediction:** The application of AI is rapidly progressing and has already achieved fantastic job in areas such as protein folding and drug development. Startups and research teams are leveraging AI to design and predict effective small molecules that can be used as drug starters, pushing forward the pace of pharmaceutical innovation.

- **Temporal Manipulation of Gene Expression:** Startups are currently designing small molecules intended to influence the level of gene expression in a specific, temporal manner. This effort focuses on manipulating protein synthesis only when needed, such as when treating a disease characterized by protein deficiency, representing a highly targeted approach to future therapeutics.

- **Sustaining the Scientific Ecosystem through Policy:** A crucial project in progress is the necessity of securing robust government funding and protecting the scientific environment. More scientists need to pivot from "hardcore science" into policy roles to successfully convince decision-makers and the public about the importance of scientific support and to prevent the degradation of the established, robust ecosystem.

- **Closing the Funding Gap:** Although we have highly talented students, a constant struggle is that India's science community is not being able to catch up with the rest of the world because the amount of money received for grants is "so less" compared to other countries. This resource issue is an ongoing challenge that must be overcome to fully realize India's potential, especially when competing with highly organized nations demonstrating logarithmic scale progress.

- **The Critical Role of RNA and Early Life Decisions:** The study of RNA remains a highly critical frontier; four Nobel Prizes in the last decade alone underscore its importance to molecular biology. A major challenge we are actively trying to solve is understanding how fundamental decisions are made about our physiology and health very early in life it is now suggested that a person's future is almost decided within the first six months after birth. This profound and challenging biological mystery underpins the future development of truly predictive personalized medicine.

- **Preserving the Scientific Ecosystem and Combating Non-Science:** A significant and ongoing effort must be directed toward protecting the robust, testable scientific ecosystem that took decades

to build. Scientists must actively engage in policy to secure necessary funding and prevent the degradation of this environment. We are consistently challenged by non-scientific approaches and views such as using things like *go mutra* to treat infection which pose a tremendous risk of destroying established methodology.

- **The Promise of Natural Discovery in Therapeutics:** The possibilities for fundamental discovery remain enormous, especially in areas requiring new therapeutic agents. Research continues to uncover very good entities for applications like antibiotics, sometimes emerging from the most unexpected places, such as soil samples from kitchen garden. This ongoing work highlights that innovative discovery, which provides solutions to complex issues like antibiotic resistance, can still emerge from highly rudimentary beginnings.

- **Enhancing Industry-Academia Collaboration:** The relationship between academia and industry is "bound to go up". It is important for academics to recognize that industry will follow up on important discoveries, and this relationship requires both academicians to increase engagement with industry and industry to support that movement, facilitating the transfer of academic knowledge

“Nature is God, in my belief,
DNA is part of that truth”

- Dipankar Chatterji