

CUBE Kishore Bharati Assistantship Report February 2025 (First half)

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During the first half of February 2025, I joined 11 out of 15 days.

A) Developing Context to Curriculum by addressing Simple questions

1. Understanding Immune Memory and Behavioral Adaptations in *Drosophila* - In thecauserie, we explored fascinating aspects of immune memory and behavioral responses in *Drosophila melanogaster*, especially in the context of parasitic wasp infections. Studies discussed reveal that fruit flies not only exhibit enhanced survival on secondary infections (suggesting an innate form of immune memory) but also display behaviorally adaptive responses such as seeking ethanol rich environments post infection. This alcohol seeking behavior is driven by inhibition of Neuropeptide-F (NPF) signaling, which activates germline caspases, an effect that can be inherited across up to five generations, demonstrating transgenerational behavioral inheritance. In parallel, ongoing efforts at home labs, including the 11th generation of a suspected *Drosophila bipectinata* line in Kolkata, continue to support the development of long term experimental lines. Additionally, students at Azim Premji University initiated fruit fly trapping as part of their first day CUBE workshop highlighting the growing outreach and hands-on engagement with *Drosophila* as a model system for both neuroethological and immunological research.
2. Understanding Soil Nematode Isolation Techniques - The causerie explored the characteristics of *Caenorhabditis elegans* (*C. elegans*), a transparent, unsegmented nematode often used as a model organism. Comparisons were made with *Ascaris lumbricoides*, a parasitic roundworm with a cylindrical body, in contrast to flat bodied tapeworms. A simple homelab experiment for soil nematode isolation was discussed using raw and boiled potatoes. It was observed that boiled potatoes promote faster bacterial growth, accelerating the emergence of nematodes from the soil sample, whereas raw potatoes slow down this process.
3. Understanding Low Cost Molecular Identification: *Moina macrocopa* from India - This update highlights a major milestone in CUBE's 15 year evolution, the first DNA barcoding of the water flea species *Moina macrocopa* (strain JSK1) from India. Isolated by cubists from a pond near Mumbai, this *Moina* strain was morphologically and molecularly identified through a

collaborative effort. To make molecular biology more accessible, especially in college and homelab settings, the team developed a cost effective DNA extraction method using porcelain abrasion instead of hazardous techniques like liquid nitrogen or commercial kits. The method proved efficient, yielding high quality DNA suitable for restriction digestion, ligation, and PCR. Barcoding loci (COI and ITS) were sequenced and submitted to GenBank (accession numbers: MH734122.1 and MH745035.1), marking a significant achievement in *democratizing molecular biology through affordable protocols*.

4. Understanding Model Systems in Cancer Detection and Epigenetic Regulation - This segment of causerie focused on exploring the use of model organisms like *Hydra* and *C. elegans* for introducing basic biological concepts and their potential applications in cancer research. One central discussion was how *C. elegans* can serve as a model to study early stage cancer detection due to its genetic tractability and transparent body, which allows direct visualization of cellular changes.

Another important thread revolved around epigenetic mechanisms, particularly in the *Moina* model system, where phenotypic changes were observed not due to genetic mutations but due to histone demethylation, affecting gene expression. This highlights how epigenetic regulation, rather than DNA sequence alone, can lead to significant observable traits.

B) Citizen Science Projects

1. Understanding Mango Flowering Across Latitudes - Cubists across India collaboratively tracked mango tree flowering to understand how geography and climate influence phenology. Data collected from locations like Ranchi, Kanpur, Jammu, and southern regions such as Trivandrum and Mumbai revealed a clear pattern, flowering decreases from south to north. For instance, Ranchi reported ~48% flowering, Kanpur around 60% in some areas, while predictions for northern cities like Delhi suggested almost none. This gradient aligns with the understanding that cooler temperatures during the flowering induction phase (below 17°C) are optimal for mango trees. Discussions also explored the role of latitude, climate change, and global comparisons, while raising questions about integrating data science tools to enhance analysis.

C) Homelab updates

Further plans - Culturing and Maintaining *Chlorohydra* and *Moina* in Homelab