CUBE Kishore Bharati Assistantship Report January 2025 (Second half)

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During the second half of January 2025, I joined 8 out of 15 days. Although I had the opportunity to moderate discussions alongside Theertha M.D., Enas Shirin, and Kiran Yadav, I struggled to coordinate effectively with my fellow interns. Despite the challenges, I still had some key highlights during my time there.

A) Developing Context to Curriculum by addressing Simple questions

1. Understanding Olfactory Behavior and Food Preferences in Drosophila melanogaster - This causerie documents a series of homelab explorations by Cubists across India, aimed at understanding olfactory driven behavior and food preferences in Drosophila melanogaster. Starting with basic culture maintenance such as single-line generational tracking and feeding on TRSV (Tomato-Rava-Sugar-Vinegar) medium, Cubists extended their studies to behavioral assays and attraction experiments using household materials.
   In Kolkata, Batul conducted larval chemotaxis assays with varying dilutions of banana juice. Larvae showed a higher preference for 2X banana solution compared to water or 1X, indicating a dose-dependent olfactory response. Discussions included experimental controls such as substrate type (plastic vs agar), larval developmental stage, and repeatability of results.
   Parallelly, Cubists like Sakshi and Enas carried out trap experiments using kitchen waste (guava, tomato slices, banana peels) to observe adult fly attraction.

2. Understanding Hypoxia Response and Regeneration through Moina and Hydra Models - The causerie revolves around aquatic microorganisms like Moina and Hydra in various CUBE homelabs. The discussions were anchored in the context of physiological and developmental biology focusing on Moina as a model to study hypoxia-induced hemoglobin synthesis (referencing Gorr et al., 2004), and Hydra as a classic system for understanding regeneration and morphogenesis.
   Cubists shared live culture updates, such as Sakshi's homelab maintenance of Moina and Chlorohydra in Bisleri bottles and glasses, tracking their feeding schedules and growth conditions. Simultaneously, a deeper conversation emerged about introducing Moina to new learners, inspired by serendipitous findings (like Rechel discovering Hydra instead). This built

into a broader reflection on experimental storytelling: how a simple water flea from a college tank became a model system for studying hypoxia responses via the HIF pathway. Meanwhile, Hydra regeneration was discussed in the context of actin cytoskeleton reorganization, where topological defects in actin orientation were described as mechanical drivers of head morphogenesis, a compelling intersection of developmental biology and biophysics.

3. Understanding DNA Extraction - The CUBE causerie discussions saw participants from places like Palakkad and Alathur engaging in hands-on DNA extraction from fruits including grapes, onions, and watermelon using easily available materials. These experiments utilized common kitchen ingredients detergents (e.g., Vim), salt, and alcohol demonstrating the feasibility of molecular biology techniques outside traditional labs. The DNA extraction served as a conceptual entry point to discuss the biological structure of plant cells and the principles behind each step in the protocol. Cubists analyzed how mechanical grinding breaks the cell wall, detergent disrupts the lipid bilayers of the cell and nuclear membranes, and salt helps in protein precipitation while keeping DNA soluble in water. The addition of alcohol leads to visible DNA precipitation. A key point raised was the role of papaya juice (from ripe fruit) in some protocols due to its proteolytic enzymes, which may assist in breaking down histones.

4. Understanding Sensory Reflexes and Symbiosis through Everyday Biology - The causerie explored various biological concepts through everyday observations and questions. The *Mimosa pudica* plant prompted discussions on plant movements without a nervous system. Zooxanthellae symbiosis highlighted how microscopic algae provide nutrients to corals through photosynthesis, essential for reef ecosystems. A conversation on reflex actions clarified that touching a hot surface involves at least two neurons and an interneuron, correcting the earlier idea of a single neuron response.

5. Understanding Microbial Growth Through Curd Bacteria Observations - In this segment of causerie, a homelab experiment focused on observing bacterial growth in curd was shared and discussed. The setup involved a time stamped series of observations over 45 hours, documenting visible bacterial colonies and noting the unexpected presence of fungal or other microbial contaminants likely due to non sterile conditions. The objective was to identify curd bacteria, and while this was partially successful, it also opened discussions on contamination and sterilization techniques in microbiological studies. The importance of detailed record keeping (date, time, and photographic evidence) was also emphasized, aligning with scientific documentation practices.

B) Citizen Science Projects

1. Understanding Mango Tree Flowering Across India: A Causerie Based Collaborative Phenology Study - Between November 2024 and January 2025, mango tree phenology was tracked across India through a citizen science initiative. Participants from diverse latitudes including Kerala (~8.5°N), Mumbai (~19°N), Assam (~27°N), and Delhi (~28.6°N) monitored and reported flowering and fruiting patterns in mango trees. A clear latitudinal gradient was observed, with earlier and more intense flowering in southern regions like Kerala and Maharashtra, while northern locations like Delhi showed no flowering during the same period. Interestingly, early flowering in Sonari, Assam (27°N), challenged the simple north-south trend, prompting discussions on local climatic and ecological factors.

   Scientifically, the discussions focused on the role of **florigen**, the flowering hormone identified as **FT protein**, synthesized in mature leaves under inductive photoperiods. Florigen is transported via the phloem to the shoot apical meristem, where it interacts with FD and 14-3-3 proteins to form the **Florigen Activation Complex (FAC)**, triggering floral transition. Cubists explored how environmental cues like day length, temperature, and leaf maturation might regulate FT expression, influencing flowering times across regions. This collaborative effort not only mapped regional flowering dynamics but also engaged participants in applying molecular plant biology to field observations, fostering hypothesis driven learning through citizen science.

C) Homelab updates

Further plans - Culturing and Maintaining Chlorohydra and Moina in Homelab