BTP Progress Log: Microswimmer Bimotility Simulation

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Week 1: Project Initiation & Literature Review

Interval: December 15, 2025 – December 21, 2025

- **Paper Analysis:** Reviewed "Self-organization in a bimotility mixture of model microswimmers" by Adyant Agrawal and Sujin B. Babu[cite: 3, 4].
- **Model Definition:** Identified the Taylor line as a discretized model of the Taylor sheet for microswimmer simulation[cite: 20, 36].
- **Research Objective:** To study cooperation and segregation in mixtures differing in propulsion speed[cite: 8, 32].
- **Task Distribution:**
  - **Partner A:** Environment physics (Circular boundary and Steric interactions).
  - **Partner B:** Swimmer internals (Chain physics and Propulsion engine).

Week 2: Implementation of Dry Simulation

Interval: December 22, 2025 – December 28, 2025

Partner A: Boundary & Steric Interaction

- **Confinement Logic:** Implemented rigid circular boundary conditions as per paper specifications[cite: 49, 169].
- **Reflection Algorithm:** Coded velocity reflection along the normal vector for bead-boundary collisions.
- **Steric Force:** Implemented the truncated Lennard-Jones potential[cite: 62, 63]:

$$V_l = 4\epsilon \left[\left(\frac{r_o}{r} \right)^{12} - \left(\frac{r_o}{r} \right)^6 \right] \text{ for } r < 2^{1/6} r_o$$

- **Interaction Parameters:** Set $\epsilon = 13.75$ and $r_o = a_0$ to model swimmer-swimmer repulsion[cite: 66].

Partner B: Taylor Line Internal Physics

- *(Priyanshu will write his log here)*