

## **Imitating a bacterium's biased random walk in the classroom as an active learning exercise to understand chemotaxis and flagella's movement.**

Carolina Mehaffy, [Carolina.mehaffy@colostate.edu](mailto:Carolina.mehaffy@colostate.edu)

Chemotaxis signal transduction and regulation of flagella's rotation in motile bacteria is a complex and important mechanism that student's need to master in Microbial Physiology courses. This teaching innovation proposal describes the development and implementation of an active learning exercise for upper-level Microbiology courses in the undergraduate Biomedical Sciences or Microbiology program. Specifically, this activity can be introduced in a module related to complex mechanisms of regulation, chemotaxis, and biased random walk (flagella's movement). In this activity, students imitate the random walk or biased random walk of a bacterium in response to an attractant. In the activity, students physically "tumble" and walk, imitating flagella's rotation in the clockwise and counterclockwise directions, respectively. In addition, students are directed to walk for longer if they can "sense" (see) the attractant, imitating the counterclockwise rotation that results in a smooth walk towards the attractant. At the end of the imitation phase, the students graph their position with respect to the attractant. This activity was implemented in the Spring of 2023 in an undergraduate Microbial Physiology course. Students completed a 2-question after a short lecture on flagella's movement in response to stimuli, and then again after the activity. The average quiz score before and after the activity was 69% and 100% respectively. In addition, the majority of students that responded to a brief survey, indicated this activity helped them reach the learning objectives of the module. In summary, this activity can be used as a supplementary active learning approach to successfully introduce students to the complex mechanism of chemotaxis in a fun and interactive manner.