Teaching Statement – Sonali Roy

I was awarded an NSF teaching grant to develop a CRISPR-Cas-based curriculum for advanced undergraduates in plant sciences. This was offered as a dual enrollment 3-credit course, accessible to both advanced undergraduate and graduate students with a focus on biotechnology. My teaching experience stems from developing and teaching this course (AGSC 4630/5630) at Tennessee State University which I discuss here, along with delivering guest lectures both within and outside my university. For example, in 2018, I developed and published lecture notes and accompanying slides covering the breadth of peptide hormone in plants for the journal *The Plant Cell* (See Roy et al., 2018, Small and Mighty: Peptide Hormones in Plant Biology) which I then taught as a guest lecture at UC Berkeley and Texas Woman's University. I am now working with the same journal to publish teaching materials developed in this course titled 'Introduction to Gene Editing with CRISPR-Cas". A second manuscript describing effective engagement strategies co-written with graduate and undergraduate students is under review and available as a pre-print on Biorxiv doi.org/10.1101/2025.10.10.681630.

Philosophy: My teaching philosophy centers on making learning engaging and, therefore, memorable. To achieve this, I structure my lectures with regularly interspersed activities that promote interaction. Each class begins and ends with intentional exercises tied to the course content, such as journal club discussions, reflective exit tickets, and themed icebreakers. To continuously assess student understanding in real time, I incorporate audience response tools such as PollEverywhere. These help me identify and address misconceptions early. After each session, I engage in reflective teaching by noting what strategies were effective, which areas need improvement, and how student engagement evolved throughout the class improving my content for the next class offering.

Course development: I use a 40-20-40% principle for developing Course Learning Outcomes (CLOs). Of the total number of CLOs, 40% are lower-level outcomes on the bloom's taxonomy scale which involve understanding and remembering facts, 20% for interpreting data and the remaining 40% involve creating arguments to justify student perspective and designing practical experiments. Student assessments, including written blog posts, online debates, midterm and final exam questions, are aligned with these levels to ensure a balanced evaluation that reflects the diversity of cognitive engagement. I use principles of backward design to match exams, assignments and activities with the CLOs I set out to reach.

Student Learning Assessment: I design the grading structure to reduce the weight off written exams, ensuring that students who attend all practical classes are able to achieve a minimum passing grade. Additional marks are awarded through exams, class participation and assignments, which alleviates the pressure to learn purely for grades and encourages students to engage with the subject material. I assess student learning through written assignments, online debates on platforms like eLearn to encourage peer engagement. I also use short quizzes, provide feedback on 'exit ticket' questionnaires for guest lectures that encourage students to listen and think about questions they still have about the research. Completion of hands-on demonstrations, including guide RNA design with CRISPR-P, cloning with Golden Gate assembly, and maintenance of electronic lab notebooks are used to assess practical skills and bridge theoretical learning with laboratory experience.

Inclusion within the classroom: Students have diverse learning preferences therefore I ensure that I use components of all five – Visual, Aural, kinesthetic, social, and verbal. In addition to lectures and practical demonstrations, I gamify in-class activities such as a 'stupid questions round' to encourage students to get comfortable asking questions or provide opportunities to critique experimental designs from real graduate research in my lab. As an instructor at an HBCU, I teach a racially diverse student body and am intentional about ensuring my teaching materials reflect the contributions of scientists from various backgrounds. I deliberately incorporate stories, and examples of scientists from different racial, and national origins, recognizing that representation plays a critical role in retention in STEM fields.

Evidence of effectiveness: My teaching methods are effective and student evaluations consistently rate my classes higher than university teaching averages (4.93, 4.81 compared to ~4.4). External evaluations demonstrate a measurable increase in self-reported student comfort in executing CRISPR-based experiments before and after they took my course (RTRES consulting - *available upon request*).