**VII. Broader Impact on Education and Outreach Activities of Proposed Project**

*Data and software distribution:* To meet Aims 2 and 3, project web designer will create a dedicated web site and community sequence database to publicize the results of this project and to make public the associated software. We will also provide amplified DNA release the genome assemblies immediately upon completion of quality control, and post the alignments at public repositories (NCBI) and by publishing them at the project web site to spur research with these novel data and tools.

*Undergraduate training:* Over the next decade, the President’s Council of Advisors on Science and Technology (PCAST, 2013) forecasts the need for approximately one million more college graduates in STEM fields than expected under current graduation rates (Holdren, 2012). The US needs to produce a significantly larger number of technically proficient scientists and technicians to meet current and future demand in rapidly expanding fields such as genomics and bioinformatics. More specifically, The Bureau of Labor Statistics predicts that demand for biophysicists and biochemists trained in bioinformatics will rise by 19% from 2012-2022. Advanced /specialization degrees, such as bioinformatics, biostatistics and computational biology, as well as engineers with the ability to manage complex biological process scale-up, are in exceptional demand (CSBI and Booz & Company. 2012.) Fewer than 40% of students who enter college intending a STEM major complete a STEM degree and recent findings of the National Science and Technology Council Committee on STEM education (Federal STEM Education Strategic Plan, 2013) suggest that new strategies are needed, including (1) revision and replacement of traditionally uninspiring introductory courses, (2) opportunities for professor-supported student mentorship in core mathematical skills, and (3) programs to help students, particularly underrepresented students, see themselves as STEM professionals.

For the past five years, our laboratory trained and placed numerous undergraduate and graduate students in industry positions. These individuals who were from minority backgrounds also contributed to high impact publications (REFS included here from PI) that helped launch their careers.

Given the success in placing trainees in the work force, we propose to train two undergraduates per year in the fields of genomics and bioinformatics. By the end of the grant, we will have produced six highly trained individuals who can work effectively in either the academic or private workplace. We currently are training two undergrads from diverse backgrounds in the fields of functional genomics and biofuel research. The undergraduate trainees will also receive valuable international experience by interacting with collaborator through annual research visits between the Rutgers and Paris labs.

Undergraduate trainees and graduate students(recruited using other sources of funding) associated with this project and other members of the PI’s labs will host a 2-day symposium in Year 3 of the project on the application of bioinformatic methods to elucidate genome evolution. This will be coordinated within the existing PhD program and will be open to all members of the university community. PI X hosted a highly successful international genome symposium that was used to plan publications based on the *Cyanophora paradoxa* genome (REF). This model will be used for the genome evolution symposium.

To provide additional opportunities for students to gain hands on experience, PI X will teach an existing course in Algal Genomics and a new Fundamentals of Genomics course in Spring XXXX. These courses will incorporate genome training with real-life research application. For example, in the 2012, Algal Genomics course version, graduate students contributed to a genome project that was published in *Nature Communications* (REF).

*K-12 Education:* All PIs and a team of educators and instructional designers from the E& O outreach group at university X will contribute to the development, evaluation, and distribution of a high school enrichment program, which will highlight the contributions of bioinformatics in STEM. More specifically, it will focus on the relationship between phenotype and genotype and how scientists use genomic screening to gain a greater understanding of the capabilities of microorganisms in the ocean. This lesson, which builds upon an existing module on DNA and DNA sequencing lesson, will be grounded in the Next Generation Science Standards (NGSS; NGSS Lead States. 2013). Students will develop and use models with appropriate and sufficient evidence to explore how inheritance (genome) influences the variety of traits (phenotype) (eg. MS-LS3 in NGSS).

Because the educational literature shows there is a need for connecting formal and informal STEM education to increase young people’s interest in STEM and ability to identify with STEM careers (e.g. see themselves as scientists; King 2014), we will pilot and utilize this lesson as part of informal programming through multiple 4-H programs and the university science bus program. These programs strive to improve science technology, engineering and math (STEM) education. By combining non-formal education with hands-on inquiry-based learning in a youth development context, 4-H is responding to our nation's concern for improving human capacity and workforce abilities in STEM areas.

We will evaluate the use of the lesson, make adjustments based on evaluation data, and collaborations with the National Association of Biology Teachers (NABT) and the National Science Teachers Association. In addition, we will offer professional development training at the NABT conference to engage teachers in using the revised lesson in their classrooms.

**Budget**

*Data and software distribution:*  We request 5% support for a web designer to develop and publish this information in year 2 and 3 of the award.

*Undergraduate training:* We request $10K/year to support each of two undergraduate trainees during the Fall and Spring semesters. We have also budgeted funds to support travel and lodging for 4 international and 8 domestic participants. The workshop will be used to generate collaborative arrangements to aid in the further analysis and publication of the rich genome data to be generated by the proposed research.

*K-12 Education:*  The PI requests 15% of FTE for a member of the E& O team in years 2 and 3 of this three-year award to develop and test a DNA/genomic lesson plan. We also request stipends for summer module development (2 NABT member teachers, 5 days@$200/day). Funds are requested to support 1 staff and 1 NABT teacher to present at conference in yr. 3 at a regional NABT regional conference

Finally, we request funds for miscellaneous supplies, printing, postage, fax, @ $300/year in year 2 and 3.

**Facilities**

The PIs host institution has two university campus centers, and our University Inn and Conference center. The Inn and Conference Center has approximately 3000 square feet of conference space and thirty guest rooms. We are close to a major international hub airport, which will allow us to efficiently and effectively host the symposium and workshops.

The E& O team are members of XXXX Cooperative Extension program. Extension helps the diverse population of XXXX adapt to a rapidly changing society and improve their lives and communities through an educational process that uses science based knowledge. Through science-based educational programs, Cooperative Extension brings the wealth of knowledge of the state university to local communities.

The University Science Bus is an example program that the proposed research would make a major contribution to teaching and learning. The Science Bus offers activities suitable for middle school students that encompass the area’s most frequently covered in middle school curricula: life sciences, earth science, and the physical sciences. Many activities also incorporate mathematics and/or technology. The activities include a very popular lesson on DNA that would be the focus of our enrichment efforts.