



# The Western New York Genetics in Research Partnership

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## Abstract

Bioinformatics is in a period of rapid growth and genomics is becoming increasingly important to the life sciences and health care. Growth has been so rapid that some areas are experiencing shortages of trained researchers and the health professions have been challenged to keep up with developments. Moreover, this era of great research potential coincides with a trend of declining student interest in science, and the nation has had particular difficulty addressing minority underrepresentation in STEM. There is an urgent need for teacher training and student exposure to science role models, as well as approaches that allow students to work with real scientific data and tools, and to make connections between what they are studying and the problems their families and communities are facing. The Western New York Genetics in Research Partnership project is designed to support career paths for students in scientific research, emphasizing underrepresented and disadvantaged groups.

## Introduction

The Western NY Genetics In Research Partnership is funded by an ITEST Strategies Award from the National Science Foundation. The Research Partnership will develop an ongoing partnership with the University at Buffalo, The New York State Area Health Education Center System (NYS AHEC), and disadvantaged schools across a 14-county region in Western New York that will serve as a pipeline for teacher and student recruitment, training and mentorship in STEM, with a particular focus on basic genome analysis and bioinformatics in a Strategies project.

The STEM-related goals of the project are to:

1. allow high school students and teachers to participate in scientific research
2. stimulate the interest of students in pursuing careers in science and technology through the use of a unique, interactive learning environment combined with intensive support intervention
3. encourage teachers to include bioinformatics and genomics in their curriculum.

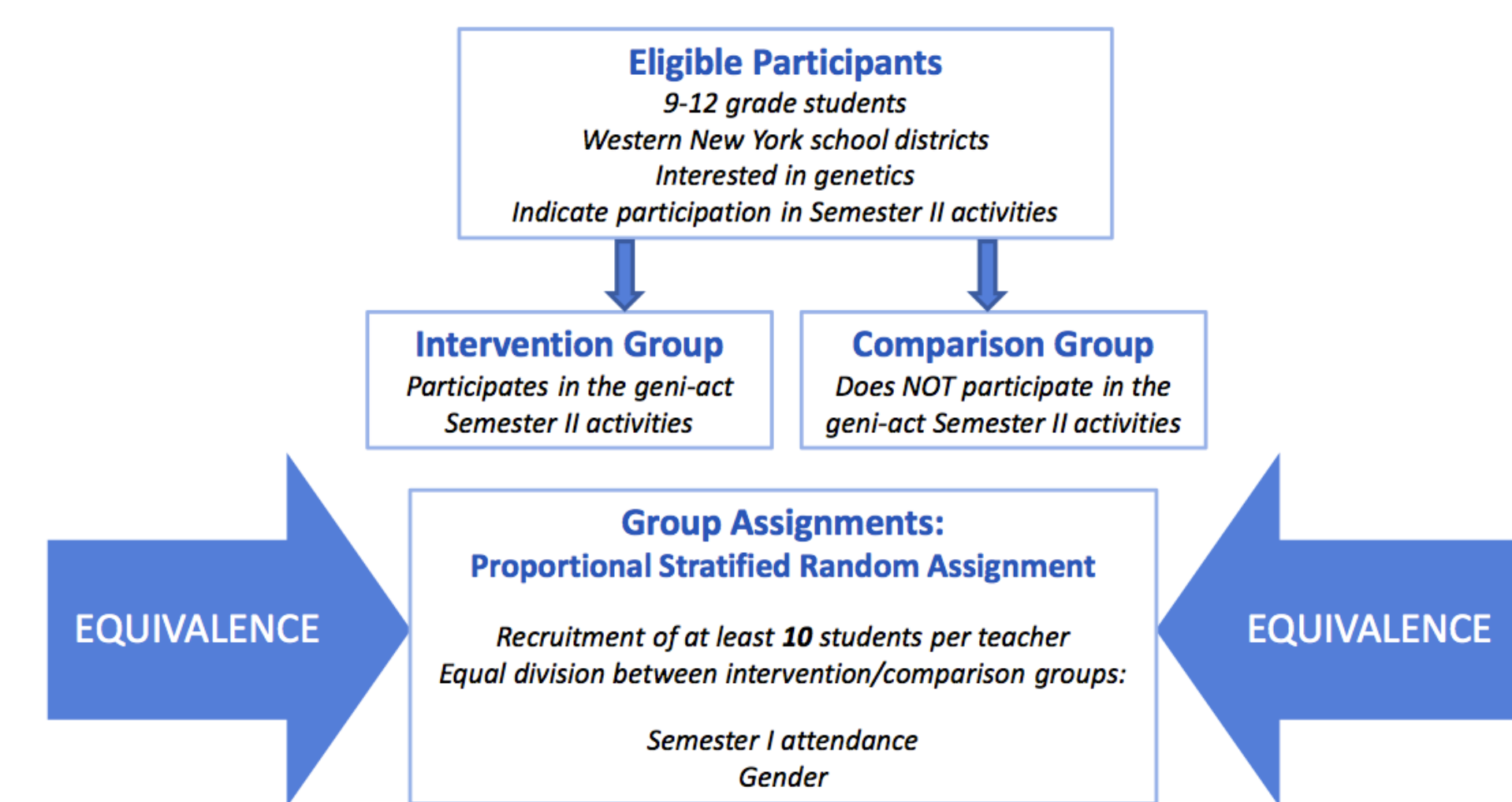
Year 2 of The Western New York Genetics in Research Partnership project began during the week of July 7-11<sup>th</sup>, 2014, with a one-week workshop at UB, where 31 high school teachers received training in microbial genome annotation using GENI-ACT.

## Program Components

- A week long summer training workshop for teachers (30 per year) to learn the fundamentals of gene annotation using the geni-act system.
- 4 fall semester activities to build interest among student participants and to recruit students to participate in the spring semester genome annotation exercises.
- Spring semester teacher guided genome annotation projects for 5 or more students per teacher (150 total per year). A control group of students will be included for comparison
- A capstone symposium for student and teacher participants to present the results of their genome annotations

Pre and post surveys are taken before and after the teacher training workshop for teachers and again after the capstone symposium. Control and annotation student groups will be surveyed before and after semester 2

## Student Participant Selection



## The geni-act system

geni-act ([geni-act.com](http://geni-act.com)) uses a modular approach to allow students and teachers to perform basic bioinformatic analyses on genes of the bacterium *Kytococcus sedentarius*. All that is required to perform the modules is an internet connection and the Firefox web browser.

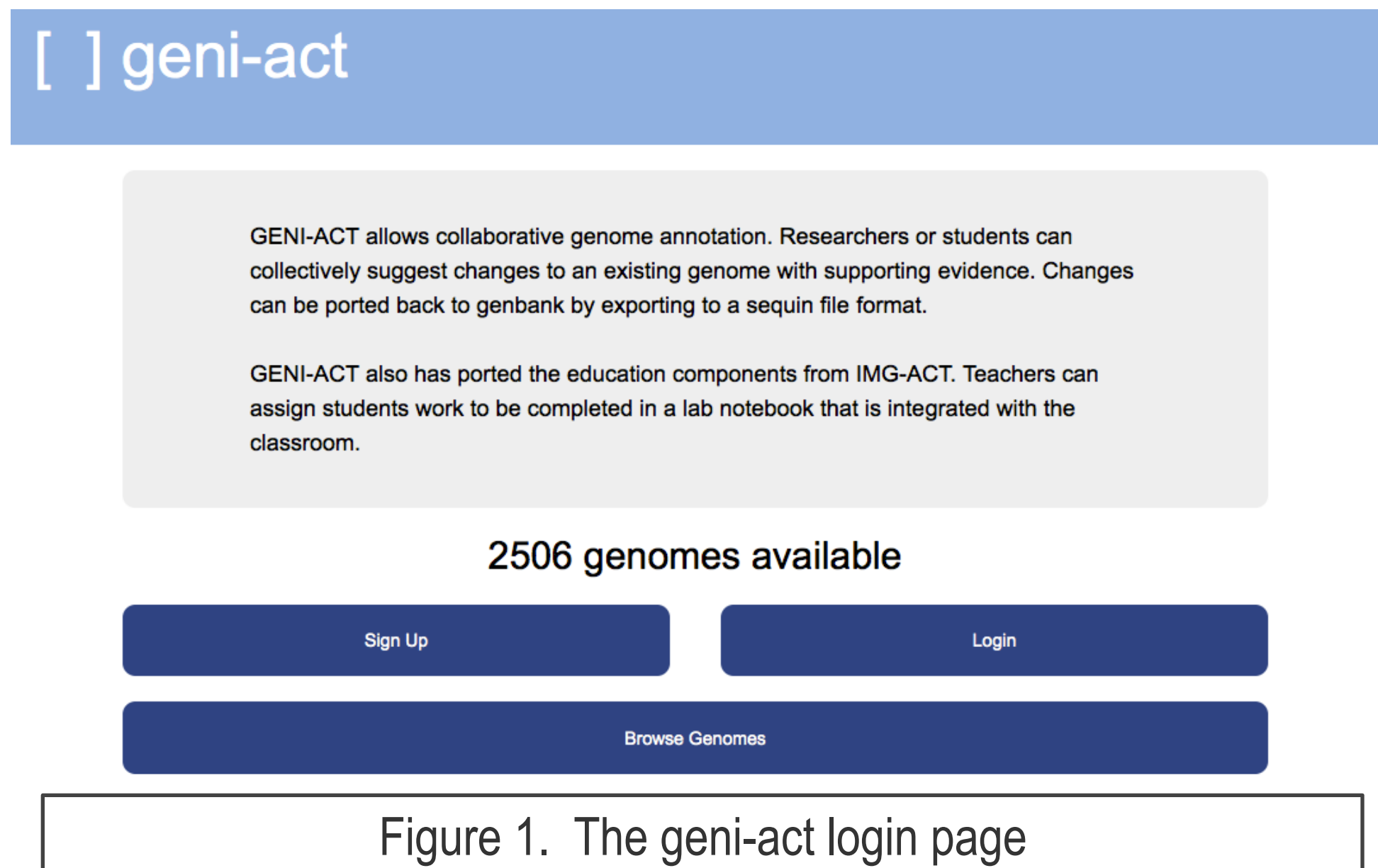


Figure 1. The geni-act login page

## geni-act notebook

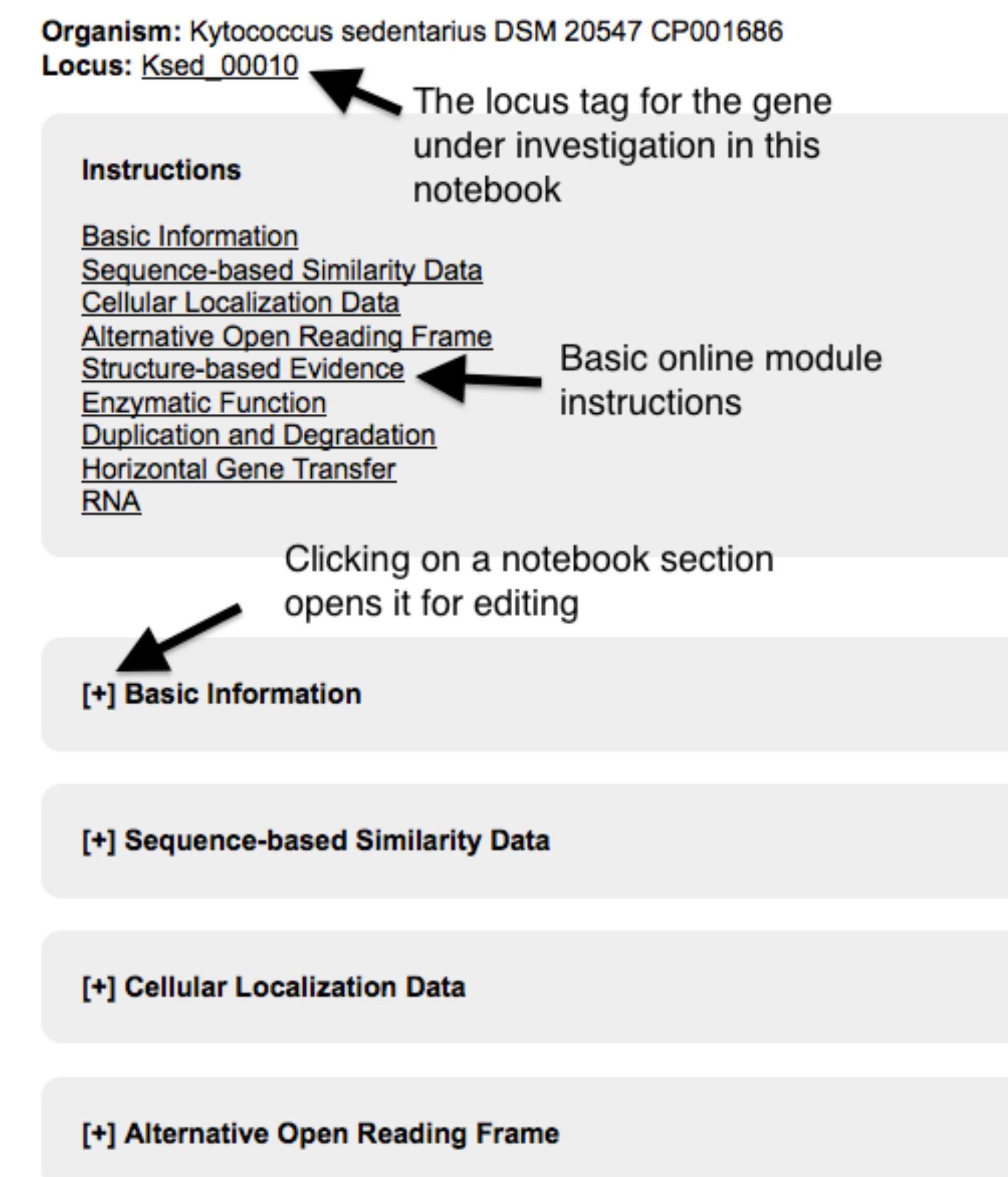


Figure 2. An example online geni-act notebook page with some key features indicated.

## geni-act modules and activities

Modules	Activities	Questions Investigated
Module 1- Basic Information Module	DNA Coordinates and Sequence, Protein Sequence	What is the sequence of my gene and protein? Where is it located in the genome?
Module 2- Sequence-Based Similarity Data	Blast, CDD, T-Coffee, WebLogo	Is my sequence similar to other sequences in Genbank?
Module 3- Cellular Localization Data	Gram Stain, TMHMM, SignalP, PSORT, Phobius	Is my protein in the cytoplasm, secreted or embedded in the membrane?
Module 4- Alternative Open Reading Frame	IMG Sequence Viewer For Alternate ORF Search	Has the amino acid sequence of my protein been called correctly by the computer?
Module 5- Structure-Based Evidence	TIGRFam, Pfam, PDB	Are there functional domains in my protein?
Module 6- Enzymatic Function	KEGG, MetaCyc, E.C. Number,	In what process does my protein take part?
Module 7- Gene Duplication/ Gene Degradation	Paralog, Pseudogene	Are there other forms of my gene in <i>Kytococcus</i> ? Is my gene functional?
Module 8- Evidence for Horizontal Gene Transfer	Phylogenetic Tree,	Has my gene co-evolved with <i>Kytococcus</i> ?
Module 9- RNA	RFAM	Does my gene encode a functional RNA?

Figure 3. The 9 geni-act modules, activities associated with them and questions that are investigated during each. Annotation exercises are guided by an instruction manual created for the assignment.

## The Capstone Symposium

The Capstone Symposium takes place at a research setting each May/June. It allows students and teachers from different schools to interact with one another as well as with UB faculty and will reinforce student and teacher recognition as members of the research community. Teachers receive training in the preparation of posters for scientific meetings as part of the project training and then guide their students during the preparation of their posters. Posters are returned to the participating schools after the capstone for display. The Capstone is attended by UB faculty, Partnership staff, teachers, students and parents/guardians. Regional academic programs and biotechnology industry representatives will be invited to display/distribute materials about opportunities for college-level study and STEM careers. A proceedings booklet listing participants and abstracts will be distributed. The second part of the Capstone is a bioinformatics-related research talk (appropriate for students) given by a member of the UB faculty working in bioinformatics, including a question-and-answer period.

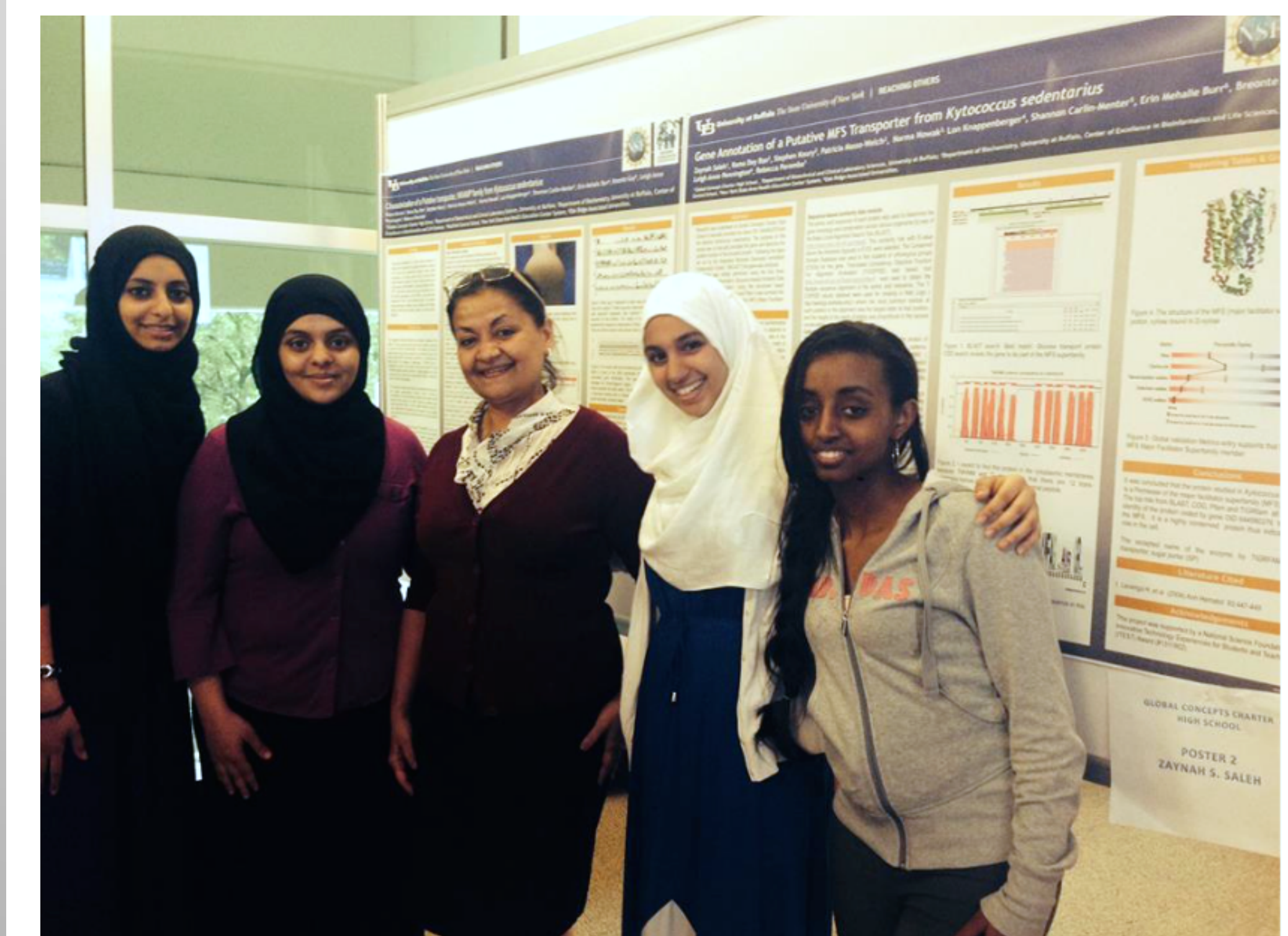


Figure 4. UB Faculty facilitator, Dr. Rama Dey-Rao with some high school student participants at the 2013 Capstone Symposium

## Conclusions

Evaluation data from year one of the project is currently being analyzed and the pre and post surveys given to teachers during the 2014 summer training have been collected. Anecdotal evidence from student and teacher feedback from year 1 of the project suggests project participation was correlated with gains of confidence in working with bioinformatics tools.

## Acknowledgements

This project is supported by a National Science Foundation Innovative Technology Experiences for Students and Teachers (ITEST) Award (#1311902).