About Our Staff

Our Bioinformatics program grew out of Dr. Pinto's work at the University of Costa Rica. Few Universities have created Bioinformatics Departments, but it is a emerging science that will result in new degrees and departments. No other field of science stands to gain more as personalized medicine evolves and bioinformatics is a powerful tool. The University of Costa Rica is likely the first in the world to create a Bioinformatics group within the medical school, which paves the way for others, including U.S. universities. Our Bioinformatics scientists work with second year students came from this field at the University of Costa Rica. Our bioinformatics scientists include: Dr. Adrian Pinto, University of Costa Rica; Dr. Gabriel Vargas, University of Wisconsin; Dr. Jose Vargas, MIT; and Ibrahim Zúñinga, University of Wisconsin, PhD Program

Teaming with Industry Partners

The field of medical care will drastically change in the coming decade. The way we do medical research, practice medicine, and make diagnosis will be completely outdated in a few short years. Bioinformatics will play a giant role in the paradigm shift. Seeds of Change is teaming with researchers that are pushing state-of-the-art advancements in utilizing precision biological data sets to diagnosis disease conditions. Our second year students are given the opportunity to work with these partners to create new ways of diagnosing medical conditions by isolating metabolites in the blood very inexpensively. The student will contribute towards the realization of a valuable medical research data base, while also becoming of high value to university campus research labs and potentially helping to pay for college education costs.

What Does This Mean for Students?

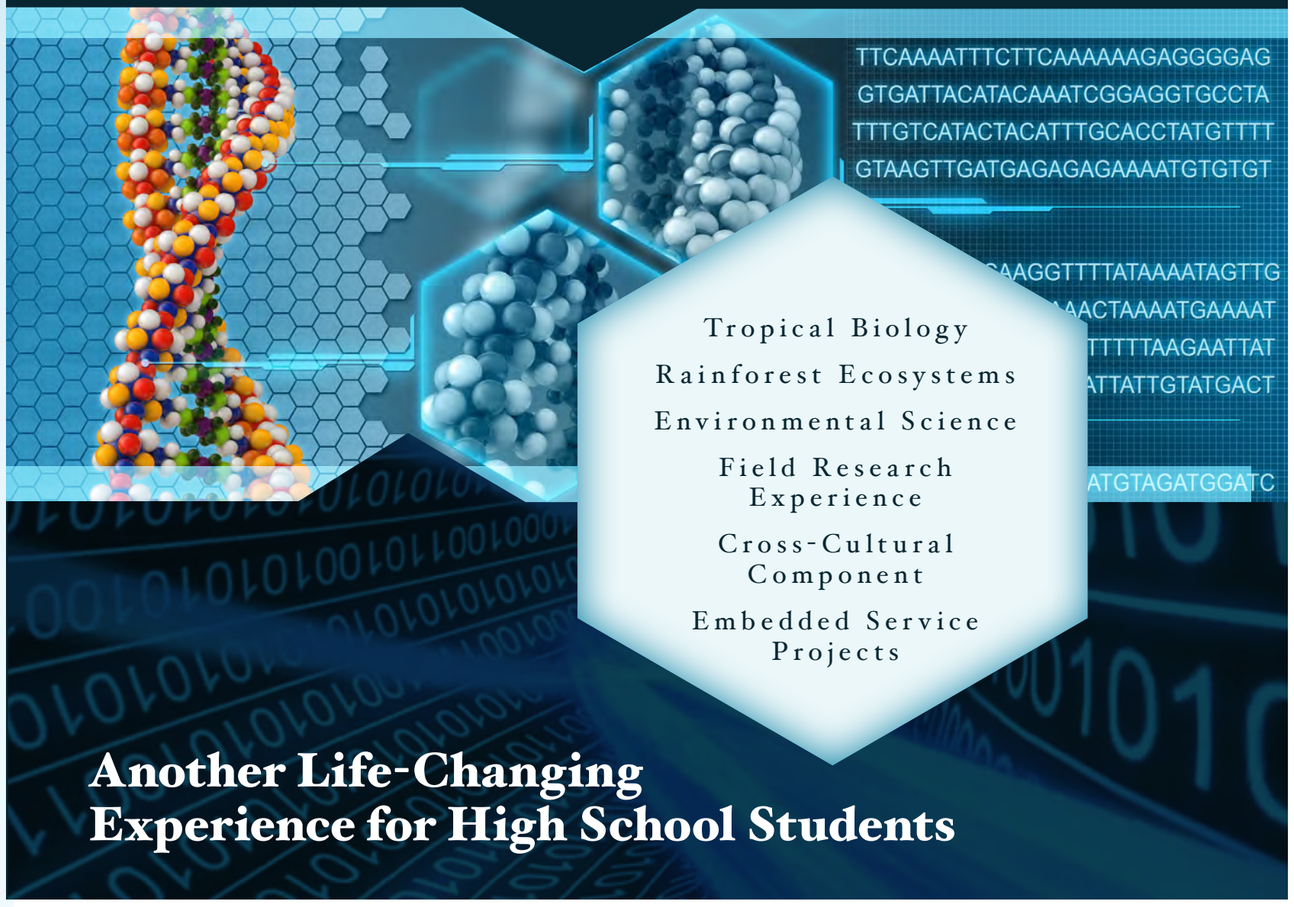
Universities are beginning to recognize the power of this new science and are creating curriculums around this field. In most universities, this bridges two departments, computer science and cellular biology. We find university bioscience departments are keen to recruit our second year students because they are versed in the technology of genomic screening. It has been our experience that a letter of recommendation plus the experience of this program provides a distinct advantage when applying to bioscience schools. If the student will be seeking jobs in science labs at a university, this experience will endear them to lab managers. More importantly, for most students this will create an intense commitment to this new science, which will pave the way for a career path lined with high paying jobs far into the future. This science will completely change the practice of medicine and life span and help accomplish outcomes unimaginable today!

How Is It Possible for Students Achieve this Level?

The principle reason our students achieve this high level of learning is through total immersion in a science environment insulated from outside world distractions, an environment not possible here in the United States. In addition, the students are subjected to "fun" activities unlike any previous life experience. This provides the mental release needed to realize the intellectual commitment to their experiments. Couple this with world expert researchers in the subject of study, this program provides the components of a learning experience not possible in any other venue.

Seeds of Change Inc. RESEARCH
Changing the Landscape of Secondary Science Education

Costa Rica
Second-Year Program
Bioinformatics
for High School Science Students



Another Life-Changing Experience for High School Students

Seeds of Change Inc. RESEARCH
Changing the Landscape of Secondary Science Education

Brought to you by: **Seeds of Change, Inc.** – a nonprofit corporation devoted to helping change the landscape of secondary education.

See our website at www.soc-cr.org

First Year Program

During the first year Seeds of Change Tropical Rainforest Research Program, students learn how to do field research in a real-world tropical rainforest. They learn how to use the scientific method to collaborate with team members in creating their own experiment focused on leaf cutter ants.

These ants are famous for their symbiotic relationship with bacteria that produce long-lasting antibiotics. Students work as a team and overcome failure within resource and time constraints, just as in any real world project. They use statistics to validate the results of their experiments and present the results of their work, just as any scientist would do. This experience is typically an opportunity available during post-grad university years.

This first year program is a success beyond our expectations. The learning curve during the 10 days students are in Costa Rica is beyond what we expect in the normal high school environment. Because of the observed accelerated learning, we have elected to give students the option to take a second step in bioscience. The second year opportunity takes advantage of the first year learning curve.

Second Year Bioinformatics

During their first year experience, as part of their training, students are exposed to the field of genomic sequencing. This will be the basis of a paradigm shift in field of bioscience. We have elected to create a second year program in the field of computational biology or "bioinformatics."

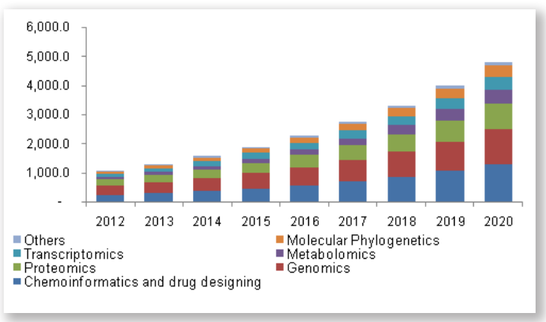


Figure 2. European bioinformatics market share in billions of dollars projected by biofunction in billions of dollars. The global bioinformatics market was valued at $3.51 billion in 2013. This growth represents thousands of new high skill jobs. *Source is grand view research in San Francisco, CA.

This leaf cutter ant fungus garden, harvested by first year students, is a virtual treasure of microbial biodiversity studied by second year students.

Bioinformatics encompasses all fields of bioscience such as: medical research; personalized medicine; agricultural productivity; pharmaceutical indicatives; DNA computing, marine biology; and a host of bioscience-based endeavors. This field is thought to create thousands of high paying jobs as more research uncovers the correlations between DNA anomalies, diseases, life span, plant attributes, or microbial invasions.

Bioinformatics is a science that is bursting onto the scene because of the miraculous development of astounding reductions in the costs of genetic sequencing. This is allowing researchers to undertake realistically funded projects to correlate gigantic genetic data sets to disease and life span situations, thus providing answers to questions that previously where impossible to imagine. In addition to diagnosis, this field has now given us a new technology called CRISPR, whereby it is now practical for a high school student to surgically manipulate a genetic sequence.

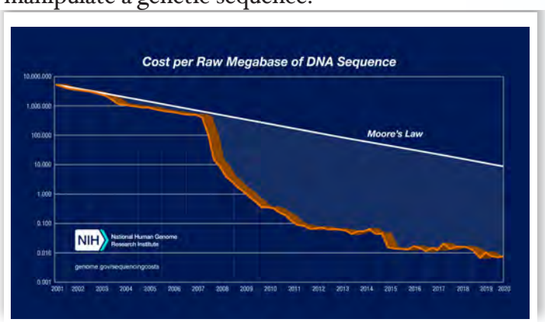


Figure 3: There has been a remarkable reduction in the cost of genetic sequencing in the last two decades which creates the basis for the whole new science of Bioinformatics.

What Students Will Do!

Since students are now familiar with the microbiology of the leaf cutter ant fungus garden and some of its microbial populations, we use this basket of microbial biodiversity as the training ground to catapult students to an entirely new level of understanding DNA replication processes, found in advanced research labs today. While it takes the discovery of between 10,000 and 100,000 new microbes to provide one new candidate for a commercial drug today, the ratio in the leaf cutter ant fungus garden is 1 in 10. By learning how to manipulate correlative genetic searches amongst the gene pool of this amazing source of microbial diversity, students are able to create a new experiment seeking answers to research questions from the genetic cause of a rare disease to the relationship of pollution that might be caused by organic pollution of the worlds oceans. When these students present their experiments on their return home, you will hear a presentation at the level of a scientific symposium.

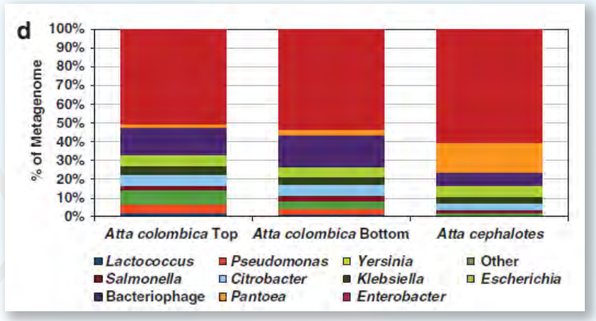
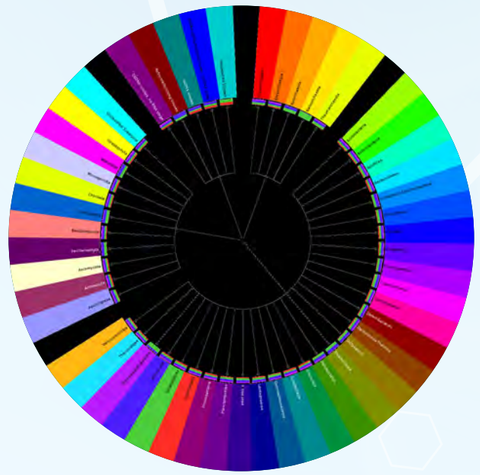


Figure 1. This chart compares the result of a typical microbial communities study at various locations in the Atta colombica fungus garden with those same microbes associated with the Atta cepholotes leafcutter ant. Students discover hundreds of comparison relationships that correlate to their research topic. *Produced by Seeds of Change students

What Do Students Learn!

The U.S. Department of Energy has created a laboratory specifically to enhance the tools available to researchers to be able to make new discoveries analyzing genetic databases. This laboratory is called The Joint Genomics Institute which sponsored the development of the Integrated Microbial Genomes Annotation Collaboration Toolkit (IMGACT). Students learn to use this system, which today is primarily used by post grad researchers. Our students will be given access to the IMGACT system and the computing power of supercomputers at the University of California Berkley to deal with the gigantic DNA data bases available through the U.S. Government to undertake research projects by scientists around the world.



The data sets associated with genetic DNA sequences are so large that is is virtually impossible to create alphanumeric comparisons that show meaningful understanding. This means that correlative studies must be done with graphical representations that allow an understanding of the data. This is an example that all of our students learn to create showing the phylogenetic distribution of the various microbes within the Atta colombica fungus garden and dump metagenomes.