Undergraduate science education should mirror the collaborative nature of discovery-based research and reflect how scientific hypotheses are evaluated and results are communicated in the 21st century. Such an undertaking requires the development of teaching methods that actively engage students in the creative process of scientific inquiry, provide skills necessary for success in the modern research laboratory, as well as foster excitement about the discovery process central to scientific research. To this end, UCLA’s Department of Microbiology, Immunology, and Molecular Genetics launched a project-based laboratory course entitled "I, Microbiologist" in which students explore microbial diversity within environmental samples. The projects presented on this poster represent the accomplishments of student teams participating in the course. In a single 10-week quarter, students generate 16S ribosomal RNA gene data sets, which they use to build phylogenetic trees, characterizing the composition of bacterial communities inhabiting soil samples collected from interesting sites in the Los Angeles area. Because soil microorganisms are prolific producers of antibiotic substances, bacteria isolates are screened for antibiotic production. Isolates are also surveyed for resistance to antibiotics. These phenotypic observations demonstrate a range of ecological strategies employed by microbes in a terrestrial habitat. Some students target the rhizosphere of plants hypothesized to respond to the activities of nitrogen-fixing bacteria. Cultivation of microbes on media lacking a substrate produces isolates which are screened for the presence of the genes encoding the nitrogenase enzyme (nifH). Targeting metabolic genes such as nifH provides a means for students to progress from asking ecological questions such as "Who is there?" to "What are they doing?". Students continue to explore the role microbes play in plant development wherein they assess the effect of nitrogen-fixing bacteria on plant growth by culturing plants inoculated with soil suspensions used for the 16S DNA and nifH molecular analyses. In the process of conducting these experiments, students learn not only about biological nitrogen fixation, plant-microbe interactions, and root biology, but also become active participants in microbial energy research, exploring ways by which these organisms could be commercially exploited as "biofuelizers". Taken together, this research laboratory course represents a model for students in the life sciences to learn the process of scientific inquiry, and for educators to engender student interest and enthusiasm about research.

Methods

The identification of potential Marinitoga strains on 16S RNA and rDNA sequences was used to determine the potential for antibiotic production using Microbesku. Such an undertaking requires the development of teaching methods that actively engage students in the creative process of scientific inquiry, provide skills necessary for success in the modern research laboratory, as well as foster excitement about the discovery process central to scientific research. To this end, UCLA’s Department of Microbiology, Immunology, and Molecular Genetics launched a project-based laboratory course entitled "I, Microbiologist" in which students explore microbial diversity within environmental samples. The projects presented on this poster represent the accomplishments of student teams participating in the course. In a single 10-week quarter, students generate 16S ribosomal RNA gene data sets, which they use to build phylogenetic trees, characterizing the composition of bacterial communities inhabiting soil samples collected from interesting sites in the Los Angeles area. Because soil microorganisms are prolific producers of antibiotic substances, bacteria isolates are screened for antibiotic production. Isolates are also surveyed for resistance to antibiotics. These phenotypic observations demonstrate a range of ecological strategies employed by microbes in a terrestrial habitat. Some students target the rhizosphere of plants hypothesized to respond to the activities of nitrogen-fixing bacteria. Cultivation of microbes on media lacking a substrate produces isolates which are screened for the presence of the genes encoding the nitrogenase enzyme (nifH). Targeting metabolic genes such as nifH provides a means for students to progress from asking ecological questions such as "Who is there?" to "What are they doing?". Students continue to explore the role microbes play in plant development wherein they assess the effect of nitrogen-fixing bacteria on plant growth by culturing plants inoculated with soil suspensions used for the 16S DNA and nifH molecular analyses. In the process of conducting these experiments, students learn not only about biological nitrogen fixation, plant-microbe interactions, and root biology, but also become active participants in microbial energy research, exploring ways by which these organisms could be commercially exploited as "biofuelizers". Taken together, this research laboratory course represents a model for students in the life sciences to learn the process of scientific inquiry, and for educators to engender student interest and enthusiasm about research.

Phylogenetic and Antibiotic Characterization of Soil Communities

Figure 3. Cultivation Independent Phylogenetic Tree

Figure 4. Cultivation Dependent Phylogenetic Tree

Figure 5. Phylogenetic and Antibiotic Characterization of Soil Communities

References


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