Undergraduate Research in Santa Fe College Biotechnology Program
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Introduction
Biotechnology is a fast developing scientific area widely used in medicine, industry and research. It compromises a wide range of powerful experimental tools and applies to the areas of genomics, proteomics, and bioinformatics. Each methodology is taught separately at Santa Fe College’s Perry Center for Emerging Technologies. Two courses: Biotechnology Methods 1 and 2 integrate undergraduate research into the curriculum serving as research based courses and comparative studies within all members of the class. The courses provides broad coverage on molecular biology, details on contemporary laboratory techniques and practical applications that can be applied to the field.

Methodology
- Course based undergraduate research (GAPDH sequencing): each student works with a different organism (ex: plant). After performing DNA extraction, PCR amplification, cloning, and sequencing the student’s findings are compared to the rest of class. Students jointly utilize the class data and research, in order to validate their individual findings.
- Individual research project: students research and use the molecular techniques learned in the lab to investigate an area of interest while monitored by faculty mentors.

Outcome and Impact
- Research projects are presented in a college wide Science, Technology, Engineering and Math (STEM) Fest Meeting.
- Projects are presented in the SF College and FL State Undergraduate Research Conferences.

Individual and Class Related Research Projects
- Engineering a Hotter Pepper by Willie Adams. Mentor: Eileen Monck
- Testing Tomatoes for Genetic Modification by Mary Daliberti & Sheila Rojas. Mentors: Birgitta Kimura & Eileen Monck
- Identification of Aptomers for Alzheimer’s Therapy by Jennifer Griffis. Mentor: Aaron Hirko
- Ancient Guinea Pig DNA to Study Human Migration by Hilary Knodel, Michelle Turner & Natalia Fitzsimmons. Mentor: Birgitta Kimura
- Analysis if Ionized Water for Nano silver Particles by Jennifer Griffis. Mentor: Birgitta Kimura
- Mystery Meat Identification by PCR Amplification and Restriction Digestion – BSC 2426 Biotechnology Methods 1

GAPDH Sequencing Project
Biotechnology Methods 2 (BSC 2427)

OBJECTIVE
To isolate, clone and subsequently analyze a portion of the GAPDH gene, more specifically the GAPC portion of such gene. This was done through DNA extraction from two plant sources, an initial PCR and a nested PCR, purification of the PCR products, ligation to vector, transformation of E. coli, clone screening by restriction enzyme digest, and finally sequencing of the cloned gene.

BACKGROUND
GAPDH (Glyceraldehyde 3-phosphate dehydrogenase) is a highly conserved housekeeping gene necessary for organism survival involved in the glycolysis pathway.

METHODS
1. PCR Amplifications
   - Purified PCR product ready for cloning
   - Initial PCR with degenerate primers: no specific amplification
   - Nested PCR with specific primers: expected size amplification

2. Ligation, Transformation & Digestion
   - Restriction digestion confirming cloning of GAPDH gene
   - Ligate the GAPC gene into plasmid vector.
   - Transform E. Coli with the recombinant plasmid.
   - Isolate plasmid from bacteria via plasmid purification.

3. Sequencing & Bioinformatics
   - Electropherograms showing nucleotide sequence
   - Sequence data in FASTA format for bioinformatics
   - Results from BLAST search to find homologous sequences from the GenBank Database

CONCLUSIONS
1. Primers for GAPDH can be used to amplify different plants because it is a conserved gene that shares homology between several organisms.
2. It is crucial to incorporate the proper controls for every experiment and always analyze the results in each step before continuing to the next experiment.
3. The plants successfully sequenced were: Arabidopsis, sweet gum, pepper, forget me not flower, grass, and key lime.