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9-1-2010

Bioinformatics Across the Sciences

Nigel Yarlett
Dyson College of Arts and Sciences, Pace University

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Recommended Citation
Yarlett, Nigel, "Bioinformatics Across the Sciences" (2010). *Cornerstone 3 Reports : Interdisciplinary Informatics*. Paper 41.
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Thinkfinity grant Final Project Report

Title: Bioinformatics across the sciences

Cornerstone #3 Interdisciplinary Informatics

Principle Investigator: Nigel Yarlett, Dyson College of Arts and Sciences

Date: Oct 2009

A) The goal of the grant was to introduce students in the sciences to bioinformatics, a subject that impacts all of the sciences. The first phase of this goal was to obtain a state of the art computer program and suitable computers to run the program. The program "macVector" was selected based upon two key elements for training students new to this area; 1) Must be user friendly, enabling students to quickly gain experience in navigating and performing bioinformatic analysis. 2) Must interface with all of the leading genomic and protein search engines (NCBI, Sanger, eupath, expasy, etc). The goals would be achieved by: a) Introducing students to the concepts of bioinformatics; b) Provide instruction in the methods used to perform a genome blast search; c) Use of the software to do a genome blast search for a specific protein (eg. human ferredoxin) and then using coding preference information determine the corresponding protein sequence; d) Use the protein data to perform an alignment with the same protein from other sources (eg. mouse, yeast, protozoan, plant); e) Identify conserved areas of the protein indicative of functional residues; f) determine the 3D shape of the protein; construct a phylogenetic tree using UPGMA or maximum parsimony methods. Steps c through f are achievable using the mac Vector software.

B) The thinkfinity grant enabled the purchase of seven mac computers and the macVector software which enabled the goals of the proposal to be achieved. I have implemented the computers into the Biochemistry (CHE326), Advanced Biochemistry (CHE328) and Advanced Biochemistry Laboratory (CHE329) courses.

C) The computers and software have enabled students to experience first-hand the power of bioinformatics. Several has indicated an interest in attending graduate school where they can employ these techniques for research purposes. Other students are looking to careers that utilize these techniques.

D) All goals were achieved. However, an obvious extension of this project is to develop a course potentially at the graduate level which would encompass and extend these skills to a higher level. It is also worth noting that this software could be utilized and extended using ipads. A software program called "Lab Track" allows laboratory data to be saved and analyzed as part of a research project this would allow extension of the current goals to Research in Chemistry (CHE426), Research in Biology (BIO426) and students in graduate programs such as MS in forensic science and MS in environmental science to

use their results in conjunction with multiple other software programs in a handy, portable, easy to access in the field way.

E) The outcome is that students who have taken a course in which this tool has been employed have a stronger grasp of bioinformatic techniques and how to employ them to answer questions relevant to many areas of science. These students consistently scored higher on tests than students in previous classes.

F) 30 students in Biochemistry (CHE326) introduced the essentials of bioinformatics. 16 students in Advanced Biochemistry (CHE328) developed and expanded basic concepts into competency in bioinformatic analysis. 4 students in Advanced Biochemistry Laboratory (CHE329) utilized bioinformatic analysis as part of a typical laboratory tool for analysis and evaluation of data producing at the conclusion a scientific paper prepared according to the ACS standard.

G) This has proved a valuable instruction tool for two faculty members of the forensic science program. Currently Drs. Rita Upmacis and David Zuzga (newly hired tenure-track faculty in Chemistry and Biology, respectively) are interested in incorporating this tool into their research. I am also in discussion with faculty from Biology (Drs. Daniel Strahs and Andrew Weir) and Environmental Sciences (Dr. Melissa Grigerone) to incorporate parts of this system into their courses.

H) The original goals of this project were to introduce a new teaching tool for bioinformatics in the sciences. It has obvious extensions into enhancing student research projects also.

I) Yes the outcomes in terms of 1) introducing bioinformatic analysis to students has been met. 2) A tool that enables students to develop ideas outside of the box has been met. 3) Provide students' with a solid background in bioinformatic analysis has been met.

J) This cornerstone grant came under "Interdisciplinary Informatics". The computers and software purchased using the thinkfinity proposal was used to introduce the skills of bioinformatic analysis to students that are biology, chemistry, biochemistry, forensic science and premed majors it is therefore satisfies the interdisciplinary component. By expanding studies involving technology in particular informatics it satisfies the informatics component. This proposal has enabled me to provide our students across the sciences the power and utility of bioinformatics in every-day life.

K) I will continue to develop the use of the equipment for bioinformatic analysis in current courses and also develop with the assistance of faculty from other Departments (Biology and Forensic Science) a graduate course which centers on instruction using this technology.