

2014 FACULTY ACTIVITY REPORT

Achievements

I coordinated activities leading to commissioning of the BSL3 lab in the Bioinformatics department, part of which involved introducing and carrying out monthly facility inspection and function tests and part of which required the writing of a facility manual and a training manual with Standard Operating Procedures. Both manuals have been fully reviewed by 2 independent sets of experts and their recommendations have been incorporated. The only thing that remains is to move the SOPs to an new section and revise the Table of Contents.

The Bioinformatics Summer Institute arose from a proposal I initially made to Dr. Gibas, and I have assisted in the planning and marketing of that program, as well as teaching the first module in the first year, the Genomic Biotechnology Lab (BINF 6211/8211) course. Teaching that course in a 12-day format required considerable changes to the lab set-up procedures and generation of back-up materials, refactoring of lab activities, modification of assignments and tests. The module received very favorable comments from the students who took it.

After requesting permission (with Dr. Dan Janies) from the Sponsored Research Office to submit a proposal to acquire an Illumina high-throughput short-read DNA sequencer to the NSF MRI program, the SRO decided to fund the acquisition internally. This is intended to be a resource for all investigators at the University. In order to make that a reality it has been necessary to create a shared laboratory working space that will allow all the necessary activities to be carried out independent of our department's individual researcher labs, to which we can control access to insure that only those we have trained will be using the equipment. With the help of two department Research Specialists, two labs formerly used for microarray research have been converted for this purpose. The new equipment was shipped in December and installed in January. I scheduled the initial installation and training, and we have carried out several (successful) experiments. Training materials and materials cost estimators have been developed, and I have consulted with a number of groups on campus to help them with experimental design and budgets. We have now scheduled training of the first non-departmental researcher.

With my colleagues Jeanne Smith and Erica Putnam of Olympic High School I completed the first of three years of summer research experience funded by a Burroughs Wellcome Foundation Education grant, part of which required that we expand our existing program to include monthly research experiences during the school year. Our first report was submitted in August 2014 and our first

presentation of the results to educators in North Carolina occurred in November 2014. Our activities are documented for the students and their parents on a Facebook page (<https://www.facebook.com/OlympicB3>).

Goals

Complete the sequencing on the UNCC Behavioral Genetics project, carry out the analysis and publish a joint publication with Dr. Sara Levens of Psychology. We will then submit a joint research proposal to NIMH to extend the study to include more subjects, broader genotyping and oral microbiome profiling.

Produce high-quality data on the Fodor and Brouwer projects, establishing my group as a preferred local partner for carrying out DNA library production and sequencing with for departmental colleagues and the Bioinformatics Research Division.

Avoid special projects that involve extensive writing of non-research material. Instead, there are a number of research papers waiting for my attention and time that I will revise and submit this year, including two with Dr. Gibas concerning data sets we have produced and used in our integrated PSM courses, two with former post-docs Carr and Bradburne and three with former PhD students Baciu and Khoshnevis.

Effectively manage the FGED15 meeting in Charlotte in November, bringing favorable attention to our University and department from international genomics scientists.

Highlights

1. Elected to serve as the vice-President of the Functional Genomics Data Society, which is planning a meeting in Charlotte for November of 2015.
2. Elected to the Scientific Advisory Board of the American Chestnut Foundation (3 year terms).
3. I planned for and maintained oversight of two shared University Research facilities allowing experiments that require BSL3 precautions and high-throughput sequence data production.

TEACHING

Courses

| 4 | TITLE | TERM | ENROLLED |
|---|-------|------|----------|
|---|-------|------|----------|

| | | | |
|-----------|---------------------------------|-------------------|----|
| BINF6350L | Biotech & Genomics Hands on Lab | Fall 2014 | 7 |
| BINF6350 | Biotechnology Genomics Lab | Fall 2014 | 7 |
| BINF6211 | Dsg & Impl Bioinfor Databases | Spring 2014 | 11 |
| BINF6350 | Biotechnology Genomics Lab | First Summer 2014 | 10 |

Teaching Accomplishments, Developments and Innovations

The Genomic Biotechnology Laboratory requires updates every year since the research areas are advancing so quickly. I have created homework assignments requiring that students analyze data using a number of software applications – after getting student comments on those that were effective and useful these will be used in a ‘flipped classroom’ mode next fall, during the lecture section. The course is now recommended by graduate students in the Biology and Kinesiology departments to their peers, so it has a sound reputation. I have been asked by faculty at other institutions for the lab set-up guides, protocols and lectures. The data produced has been submitted to the Short Read Archive with all of the student’s names, which is a unique contribution by our program.

The Summer Institute required considerably adaptation, not in goals but in preparation and in presentation.

The Bioinformatics Databases course always requires a considerable level of updating as the accepted methods change rapidly. We have been designing and testing hands-on laboratories for this course, which require a large amount of testing and tweaking and student feedback.

In neither course is there an available textbook so I have been writing 10-12 page Lecture notes *for every lecture in both classes* in order to provide structured background material for the students. This has been a widely popular aspect of the courses.

It has been suggested in each case that the material is the basis for a textbook for the course but, as noted at the beginning, the fields change so quickly that there would have to be annual revisions. I was discussing producing e-textbooks through the University with head librarian Stanley Wilder, but since he has departed I have not known with whom I would work to carry this out.

I have also been asked to give guest lectures each year by my colleagues teaching the Introduction to Bioinformatics (BINF1101) course the Genomics course (BINF 6011).

STEM education has been an ongoing emphasis area for state and federal education and research agencies. I have spent considerable effort in the past 5 years in partnership with Olympic High School in the CMS district developing the B3 Olympic High School Summer Science Camp. It has been funded by a series of grants (from the NCBC, CHS and The Soybean Board, for example)

and one large grant from the Burroughs Wellcome Foundation. Ms. Jeanne Smith of Olympic High School is always the PI as she is part of the CMS school district, and I am the coPI. The Burroughs Wellcome Educational grant (awarded in 2013, for 3 years, for \$107,000) is one of the largest they have given. Our annual reports and posters are published by the BW Foundation. Again, we have made material public through my webpages, and also through a Facebook page but we have not published in education journals – they generally want long-term outcomes so we have been accumulating evidence of the impact but it will be another year before we have 100 outcomes to report. As part of this work we have an extensive interaction with The American Chestnut Foundation, especially the local chapter. The students collect material to carry out genotyping experiments on the back-crossed blight-resistant families that the Foundation members have been breeding for 50 years. The student’s activities were written up in the Fall 2014 edition of the Chestnut Foundation’s journal.

Training: I am active in the lab, carrying out the Levens collaborative work for my own research as well as Fodor and Brouwer initial experiments. I am documenting extensively to optimize our training and organization processes, working with our senior Research Specialist, Dr. Cathy Moore. Our goal is to have a very robust set of project estimation guidelines and practical training modules to manage projects in the future.

RESEARCH

Grants - Proposals (Primary)

| PROPOSAL | STATUS | TITLE |
|-----------------|-------------------------|---|
| 14-0058 | Proposal Approved | Ultra-sensitive Nucleic Acid Detector for Measurement of Reduced Sample Sizes |
| 15-0048 | Under Award Negotiation | Gene Expression of 3 target genes and 5 control genes in a cohort of TBI patients and controls. |

Grants - Proposals (Co PI)

| PROPOSAL | STATUS | TITLE | Primary |
|-----------------|---------------|--|----------------|
| 14-0432 | Not Funded | MRI: Acquisition of an Ion Proton DNA Sequencer for Research at UNC Ch | Daniel Janies |
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|---------|-------------------------|--|---------------|
| 15-0473 | Under Award Negotiation | Analysis and Modeling of Demographic Cohorts in the Scientific Workforce | WenWen Dou |
|---------|-------------------------|--|---------------|

Grants - Awards

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| | <i>No new awards have been added to your Faculty Activity Report</i> |
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Grants - Expenditures

| | |
|--|--|
| | <i>No new expenditures have been added to your Faculty Activity Report</i> |
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Contributions

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| 1 | Other(s): |
| | Various Work in Progress on 01/14 |

Research Accomplishments, Developments and Innovations

Non-NORM grants

Faculty Research Grant with Dr. Sara Levens of Psychology (2012-2013) – the UNCC Behavioral Genomics project, does not go through NORM. (\$12,000)

“Acquisition of a high-throughput short-read sequencing platform for UNC Charlotte”, submitted in Nov 2014, did not go through NORM, it was submitted in the University-wide competition to be one of 3 to be submitted and was then approved and funded internally. (\$139, 000)

Burroughs Wellcome Education grand (2013-2015) - ‘The Olympic B3 Summer Science and Saturday Science Program’ This program does not allow overhead and must go to student activities so we designated the recipient to be CMS district. \$107, 550.

The American Chestnut Foundation contribution to the Weller Lab Fund of \$2000, to support outreach activities with local high school students.

TITAN software from Accelerated Technology Laboratories was given to the Weller lab in 2013, and we have met with developers periodically to provide workflows that the customize. I was told that the value of this can be up to \$1,000,000 depending on the amount of customization.

A great deal of my effort in the past couple of years has been devoted to special projects that have created new resources for the department and the University, but are not basic-research publishable

in refereed journals. Some of the education components are likely of interest and value to others, but most education publications require a significant assessment component that was not built into the design and delivery, so we will have to collect data for some time in order to include that data in the report. I have written reams of material that is used constantly and that I consistently revise. I have had to become knowledgeable in new areas, such as Biosafety. For example, for the BSL3 laboratory to advance to commissioning, I joined the American Biological Safety Association and read a great deal of background material in order to develop policies and procedures that are consistent with best practices. The safety documentation and training modules, and consulting with colleagues who needed my expertise in protocol development for specific experiments may come under the heading of service but have also required application of research expertise. I am also working with a small Laboratory Integrated management Software company, Accelerated Technology Labs, to produce management modules for a software system they have donated to my lab, called TITAN. The goal is to integrate wet lab management, data management and analysis management for genomic projects. They are interested in BLS2 and BSL3 lab management modules for the University as well; Ms. Ramoz was not interested in participating but perhaps the next BSO will be.

SERVICE

Committee(s)

| 7 | Department Committee |
|----------------|--|
| 08/13 08/15 | Undergraduate Curriculum Committee: Member Revise the requirements for the program concentration, revise some of the prerequisites, revise courses to reflect the laboratory as a separate section. Monthly meetings to make sure the undergraduate program fits into the new CCI undergraduate structure. |
| 08/12 08/15 | RPT: Member We have managed the application of Dr. Gibas for promotion, Dr. Du for tenure, Dr. Livesay for promotion, and Dr. Jessica Schlueter for tenure. |
| 08/10 08/15 | Laboratory Infrastructure: Chair Manage one of the Department Research specialists (Dr. Cathy Moore) who has responsibility for some aspects of service contracts and equipment oversight, manage decisions and implementation about departmental purchases for shared use when funds become available (such as sequencers, incubators, etc.). Communicate with IT about laboratory computer and software upgrades, maintenance and security. |
| 08/07 08/16 | PhD advising: Co-Chair Dennis Livesay and I have always divided this task and continue to do so. Twice a year we meet with students and make sure they understand what courses are needed or other milestones are being met appropriately. |
| 12/14 08/16 | Biosafety Committee/BSL3 supervisor duties: Other As the Lab Supervisor for the BSL3 lab I monitor the facilities systems monthly and provide a report to FM and to Research Compliance (and to the BSO when we had one). The IBC chair has requested that I attend when it meets in order to report on its status, even though I am currently rotated off as departmental representative (I will rotate back on in August of 2015). |
| 08/13 08/14 | Seminar: Co-Chair Cynthia Gibas and I organized the seminar speakers for this academic year, striving for balanced representation for female scientists. |
| 08/13 08/16 | Peer Teaching Evaluations: Member I am not sure that this is a formal committee, but it is a department task to which I contribute reports. |

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| 2 | College Committee |
| 08/14 08/16 | FAPSC: Other I am the alternate for Dr. Cynthia Gibas. As such I have reviewed one comprehensive set of documents revising faculty governance procedures, and met for the discussion and vote on those changes. |
| 08/14 08/15 | Review of Chairs: Member I produced surveys of students and faculty and interviewed research staff in person, I synthesized the results for the report into paragraphs incorporated into the final letters. |
| 2 | University Committee |
| 08/14 08/16 | Faculty Research Grants: Member Review proposals for the science and math section, produce reviews and meet to rank the proposals and determine funding awards. |
| 08/14 08/16 | University Hearings : Member This committee met in May to consider one request, which was declined because it did not meet any of the criteria. |
| 3 | Professional Committee |
| 05/14 05/15 | Functional Genomics Data Society: Vice Chair Follow up on meeting agenda tasks, coordinate activities with respect to the next meeting, scheduled for Nov 2015 in Charlotte (downtown campus). |
| 03/14 03/17 | The American Chestnut Foundation: Member Scientific Advisory Board - provided extensive editing and suggestions for the revised Foundation Master Plan for the next 5 years. Reviewed and ranked requests for funding from external scientists, participated in funding meetings. Presented outreach activities with high school students to the local chapter. |
| 01/14 01/15 | NSF grant review panels: Member Review proposals and meet with panel to discuss and rank proposal to recommend funding. |

Department Service:

Laboratory Infrastructure and Personnel management 01/10 - 01/16

The original Ion Torrent DNA sequencer was purchased using a Dean's grant by the College to our department, in 2011. It comes under the heading of 'teaching and training' as the money was from Education and Training funds for setting up a Genomic Biotechnology Laboratory. As such there is no 'PI' but I fulfilled the role as I was responsible for writing the proposal, placing and receiving the orders and setting up the laboratory. Publications include deposition of the datasets in the SRA and the lab protocols I have developed and revised each year for class use (both undergraduate and graduate courses) along with lecture material that is posted – all of this is made available on my Webpages but has not been packaged into a publication for a journal (I don't know how one would do that, it is a better candidate for a text book). As part of overseeing department laboratory infrastructure and serving as daily supervisor for both of the department's Research Specialists (informally in one case, Dr. Fodor asked me to take over that role with Timm Hamp in Spring of 2014 because he had become increasingly less involved in wet lab work), I ensured that complete documentation of the duties and records (communication with instrument vendors and maintenance people, for example) for Timm Hamp, who formerly held the position, was obtained. With Dr. Cathy Moore who was promoted to that position I have instituted a set of policies and procedures to maintain equipment lists, service contract information as well as reports of problems, equipment chemical, materials and training inventories for the labs and lab classes using Quartzly. This is a work

in progress but will eventually allow better assessment of departmental resources. This is particularly important as several labs (Fodor and Gibas) asked that we mothball their labs and at the same time the department is engaged in hiring new faculty, some of whom have an interest in wet-lab space for carrying out research. By providing them with well-maintained if used equipment from the mothballed labs the start-up funds required for them to be effective will be less, and in fact they will be able to start research activities much more quickly. The Illumina MiSeq platform and the Sequencing Lab Suite has generated quite a bit of interest in the Fodor, Brouwer, Steck and Wikstrom labs. I have been requested to produce protocols for the specific sample types and experiment needs, timelines and budget approximations. I believe that part of the reason for the interest is the training we have been providing for the Ion Torrent is perceived as effective; we are trusted to take the same care enabling users of this facility to produce data in a cost-effective way. We always emphasize that the computational steps are as important and require as much expertise as the data-generation steps and that there are consultants as well as collaborators in the department.

Interdisciplinary Nanoscience Program faculty 08/14 - 08/17

I became faculty in the interdisciplinary Nanosciences Program and am currently the research advisor for one of the programs PhD students; he is looking at the accessibility of aptamers to protein binding, both for sequencing and other assays, on the Ion Torrent chip series. This project was started in collaboration with scientists at Wake Forest University with sponsorship by Dean Ding, but the interests of the Wake Forest scientists are specialized in quite a different direction and so the focus areas split.

BiAS Faculty Advisor 08/14 - 08/16

I am the faculty advisor for our graduate student organization, BiAS. One of the activities they are organizing with my help is a series of hackathons using data from department projects and taking a group look at designing an appropriate analysis pipeline, carrying out the implementation of that pipeline with documentation and testing, and then carrying out the data analysis. I am working to bring a former department colleague from GMU who now works at Illumina in as a speaker. Overall, a combination of social and professional training and networking activities are being planned.

College Service:

CEI faculty interest group 08/14 - 08/15

I consistently serve on a range of committees for the college. In addition to Undergraduate curriculum and Awards activities, I am a member of the Center for Education Innovation group led by Dr. Maher of SIS, and have participated in several of the activities and discussions, although in the last semester the time overlapped with our departmental seminar and I was not as involved as I would like to have been.

University Service:

University Service 01/13 - 01/15

In addition to the standing committees on which I have served, I also contribute to less rigorously organized activities. I have served as judge for both undergraduate research fair (2014) and graduate

research fair (2014 and 2015). In Nov 2013 I was on the Open Access Panel as moderator of the panel discussion, as I had served for many years as my college's FALC representative and they knew of my interest in the issue. I continue to be asked to serve as an ADVANCE program mentor to recently recruited faculty. This year my mentee is Dr. Lixia Yao of the SIS department. I have served as a judge for both the Undergraduate and Graduate university-wide research competitions.

Professional Service:

Professional activities 07/14 - 01/15

As a research professional I serve on a number of review panels for federal agencies including the DOE and the NSF, as an ad-hoc reviewer for journals when my expertise is required (mostly PLoS and BMC as my commitment to Open Access publishing mandates), on the Board of societies whose interests align with my own, including the Functional Genomics Data Society and The American Chestnut Foundation. I am also contacted fairly often by former graduate students and post-docs for career advice as well as by companies asking whether we have graduates with particular skills that I can recommend. I am adjunct graduate faculty at both George Mason University and at Wake Forest University, as part of which I am serving on PhD dissertation research committees in the Biology departments. I am a member of a planning committee for an iGEM project with scientists at the Pacific Northwest National Labs (Dr.s Overall, Taylor, Hess). The PNNL would like to host some of our students (at all levels, undergraduate to PhD) for summer internships. I was requested by our Intellectual Property group to work with a group of students at NCSU who had picked up a project for which a patent was granted to UNC Charlotte and InSitu Tech several years ago, for which I was the University inventor. I have been working with these students, meeting with them and providing them working materials and answers to questions. Their advisor at NCSU is Dr. Paul Hamilton.

Community Outreach and Service 06/14 - 01/15

For the local community to feel that the University is an integral part of the community, whose resources are accessible to them, there must be a person they can relate to, one they know how to approach. Our role is properly one of education, but that incorporates modeling ones values through actively engaging on issues that concern us. I have chosen several venues through which to act. Every year I participate in the April Science Festival activities, volunteering for both individual outreach, with lectures and lab activities at either a middle or high school, and UNCC-affiliated activities organized by Jim Hathaway. I teach the B3 Summer Science Camp at Olympic High School for 12 days in June, to 22 juniors and seniors. We recently expanded those experiences to include monthly Science Saturday experiences, bringing in several colleagues at UNC Charlotte, including Adam Reitzel, Baohua Song and Mindy Shi. I also bring graduate students to Career Fair presentations, as the high school students are more likely to ask them about personal choices and family backgrounds that led to taking that educational path. My interaction with the local American Chestnut Foundation chapter has led to being available for a number of interactions with local orchard owners. We have collected material for genetic testing and are providing some tested protocols that yield high-quality DNA for genotyping. My work with Olympic High School students in carrying out research on genetic markers in Chestnut integrated these outreach activities and was featured in both the Charlotte Observer and the Chestnut Foundation quarterly Magazine (Fall 2014). I am also a consultant with a small North Carolina business, Accelerated Technology Laboratories, to translate the biosafety processes for BSL2 and BSL3 labs into interpretable workflows as well as next-generation sequencing wet-lab and computational processing workflows for their system. They

contribute a copy of the software and developer time, and have paid several of our PhD and PSM students to test the resulting modules.