GAUSSI Program Guide

2016-2017

Mission and Goals

The GAUSSI program was created to provide a much needed opportunity for Ph.D. and M.S. students from Life Sciences, Computer Science, Mathematics, Statistics, and Biomedical Engineering to gain technical expertise in the generation, processing, analysis and interpretation of large biological datasets. In addition, GAUSSI also provides personalized career mentoring and training in important transferrable skills including STEM communication, outreach, collaboration, ethical conduct of research, and entrepreneurship. The pressing academic and industrial needs for expertise in biological data analytics will drive students to enter the program in order to progress in their own research projects while forging new interdisciplinary collaborations.

Primary Goals of the Program:

(1) To provide a flexible and accessible curriculum of modular courses to train graduate students from a variety of disciplines in the approaches used to generate, analyze and understand large biological datasets
(2) To facilitate exploration of non-academic career paths through personalized career development
(3) To provide opportunities for students to recognize and practice the skills required for success in academia and industry
(4) To introduce the public and K-12 students to the concept of big data science through a variety of outreach activities
(5) To stimulate collaborative research in the areas of biosensing, and computational & systems biology

Roles and Responsibilities

GAUSSI DIRECTORS
Director:
Tom Chen, Professor, School of Biomedical Engineering, Electrical & Computer Engineering
Dr Chen is responsible for the overall operation of the GAUSSI program. He also engages with the funding agency (NSF) and other internal and external constituencies to maximize the impact of the GAUSSI program.

Associate Directors:
Asa Ben-Hur, Associate Professor, Computer Science
Dr Ben-Hur is responsible for review of applications, admission of new trainees, and curriculum development.

Carol Wilusz, Professor, Microbiology, Immunology & Pathology
Dr Wilusz is responsible for recruitment of new trainees, advising trainees on curriculum, providing letters of support for grant and fellowship applications, and curriculum development.

All directors participate in meetings with the external advisory board, evaluators and NSF representatives and share responsibility for organizing the annual symposium.

GAUSSI CORE FACULTY

Stuart Tobet		Professor	Biomedical Engineering, Biomedical Sciences
Michael Kirby		Professor	Mathematics
Dan Sloan		Assistant Professor	Biology
Zaid Abdo		Associate Professor	Microbiology, Immunology & Pathology
Hamidreza Chitsaz		Assistant Professor	Computer Science
Laurie Stargell	Outreach	Professor	Biochemistry & Molecular Biology
Rich Feller	Career Development	Professor	Education
Paul Hernandez	External Evaluator	Assistant Professor	West Virginia University

Core faculty members help define the program goals and curriculum, evaluate applicants, recruit and mentor participants, facilitate collaboration, networking and outreach, provide instruction, organize the annual symposium and promote biosensing and computational biology at CSU. Core Faculty will also provide recommendations and letters of support for

trainees as they apply for fellowships and jobs. Some core faculty members are also responsible for specific aspects of the program as specified above.

GAUSSI FACULTY ADVISORS AND INSTRUCTORS

In addition to the core faculty, other faculty members may join the program as instructors of GAUSSI supported courses, as past, current or future advisors of GAUSSI students and/or based on their expertise and interest in research connected to sensing and computational biology.   Faculty members are asked to participate in GAUSSI meetings and the annual symposium, present their research to GAUSSI participants, identify and host speakers and non-academic partners, provide constructive feedback and mentoring to GAUSSI trainees and promote and support a collaborative and inclusive community.

2016-2017 Faculty Advisors and Instructors:

Adam Heuberger	Assistant Professor	Hort	Erin Nishimura	Assistant Professor	BMB
Brad Borlee	Assistant Professor	MIP	Greg Ebel	Associate Professor	MIP
Brad Woods	Associate Dir. For Research	RICRO	Henry Adams	Assistant Professor	Math
Brian Geiss	Associate Professor	MIP	Jane Stewart	Assistant Professor	BSPM
Brian Munsky	Assistant Professor	SBME	Mark Stenglein	Assistant Professor	MIP
Christina Boucher	Assistant Professor	CS	Tai Montgomery	Assistant Professor	Bio
Christie Peebles	Assistant Professor	CBE	Tom Santangelo	Associate Professor	BMB
Courtney Jahn	Assistant Professor	BSPM	Tim Stasevich	Assistant Professor	BMB

GAUSSI COORDINATOR

Kate Sherrill MEd
The program coordinator provides administrative support for program team, advises trainees on GAUSSI activities, tracks trainee progress and provides certificates of completion, maintains the GAUSSI website, participates in recruiting and symposium organization, and distributes information regarding program activities. A primary role of the coordinator is to help build and support a welcoming and inclusive GAUSSI community.

GAUSSI TRAINEES

GAUSSI trainees are individuals who have made a commitment to performing high quality research in the areas of sensing and/or computational and systems biology while developing additional professional skills needed to be successful in their future careers.   Some GAUSSI trainees may be eligible for 1 yr NSF-supported fellowships. Requirements for participation in GAUSSI are similar regardless of whether a student is supported by an NSF fellowship. Student trainees are expected to participate in the program until graduation.

Eligibility

Although GAUSSI is designed primarily for graduate students, GAUSSI trainees can be at any stage of their graduate degree or post-graduate career. Any individual employed or enrolled at Colorado State University with a Bachelor's degree in any science or engineering discipline and an interest in sensing and computational biology may participate.

Roles and Responsibilities

Trainees in the GAUSSI program may be in various stages of their academic program. Some may still be focused on completing the course requirement for their degree programs, including taking GAUSSI-sponsored courses. Others may have completed course requirement and be focused on their research. No matter what stage of an academic program a trainee is in, all trainees are expected to

- Attend and present at bi-weekly GAUSSI project meetings

- Attend at least 4 relevant workshops/seminars/courses per semester in transferrable skills training offered by the Professional Learning Institute (PLI), The Institute for Learning and Teaching (TILT), the Graduate School, and other on-campus events.
- Participate in GAUSSI orientation and the summer symposium.
- Participate in personalized career development activities through on-line surveys and web-based tools administered by Dr. Rich Feller and his graduate students.
- Participate in peer-peer mentoring activities
- Participate in outreach activities at a level of 10-20 hr per semester
- Complete program-wide surveys and interviews administered by the GAUSSI external evaluator, Dr. Paul Hernandez and his team from the West Virginia University, in a timely fashion.

Student Leadership Panel

This panel consists of trainees who have volunteered to take an active role in defining the direction of the GAUSSI program. Ideally, the panel will consist of students from different disciplines and at different stages of the GAUSSI program. The students from the panel play leadership roles in organizing GAUSSI events and provide GAUSSI with valuable feedback to improve the program's broad reach and impact on all participants.

EXTERNAL EVALUATORS

Paul Hernandez, Ph.D., Christina Paguyo, Ph.D.
The external evaluator and his team develop and administer a set of online tools to assess progress of trainees in academic and transferrable skills training on an annual basis. The outcome of the assessment helps GAUSSI adjust program activities to better meet the needs of its participants.

EXTERNAL ADVISORY BOARD

Steve Simske	HP Inc.	Victor Saucedo	Genentech
Lance Ford	BIOO Scientific	Corey O'Hern	Yale University
Larry Hunter	University of Colorado, Denver	John Wuu	AMD
Tina Larson	Achaogen Inc.		

The external advisory board comprises individuals from industry and academia. The board meets twice per year and provides guidance on the direction and progress of the program.

CAREER PARTNERS

These are individuals from within or outside the university who have agreed to mentor and/or supervise individual GAUSSI trainees with regards to career planning and/or training. They may also participate in career panel discussions.

GAUSSI Training Program

GAUSSI MEETINGS

GAUSSI project meetings are held at least every other week during the Fall and Spring semesters. Trainees participating in GAUSSI for less than 2 years are expected to attend meetings, present their research and other activities related to transferrable skills and career development. Trainees who have been with GAUSSI for more than two years are also strongly encouraged to participate as mentors and collaborators. Faculty participation is strongly encouraged. Meetings may encompass:

(i)   Research presentations by trainees, faculty or external speakers
(ii)   Activities to cultivate transferrable skills, particularly STEM communication
(iii)   Career panel discussions
(iv)   Journal club discussions

(v)   Social/networking activities

In conjunction with GAUSSI meetings, trainees will complete assignments such as development of a LinkedIn Profile, participation in an online GAUSSI journal club, and submission and peer review of "7 minutes of Science" video presentations.

GAUSSI ANNUAL SYMPOSIUM

The goals of the Annual Symposium are to increase the visibility of the GAUSSI program and computational and systems biology in general, provide opportunities for networking and collaboration amongst Front Range researchers, and to allow trainees to practice their communication skills. The symposium is held in conjunction with orientation for trainees and faculty and also initiation of outreach activities for the year. The symposium includes local and external speakers, a career discussion panel and poster session.

TECHNICAL COURSES

GAUSSI technical courses are designed to be short and focused. Most courses are 1-2 credits and many are offered over the course of 4 or 8 weeks rather than a whole semester.

There are no required technical courses and no required number of credits. Trainees should only take courses that are directly related to their course of study or research project and may utilize credits to fulfil their degree requirements. Basic GAUSSI modules should normally be offered outside the student's home department/area of expertise and require minimal prior knowledge. Most GAUSSI trainees will complete between 2 and 10 credits including basic, intermediate and capstone courses. The majority of trainees will need to complete at least one graduate level statistics course. STAT511 (4cr) and STAT512 (4 cr) should be accessible for life scientists and those with a weaker quantitative background.   Other statistics courses (STAA courses) may also be helpful for GAUSSI trainees depending on their areas of research and the level of quantitative background. Coursework can generally be completed within a year, but it is acceptable to take longer. GAUSSI trainees will be given priority registration for GAUSSI courses whenever possible.

GAUSSI will offer capstone courses starting in Spring 2017. The purpose of capstone courses is twofold: 1) to provide a platform where concepts learned in other courses can be synthesized and integrated using a set of applications that are related to students' research areas, and 2) to provide a platform where interdisciplinary collaborations become part of the learning experience using applications of common interests.

Summer Bootcamp Courses
The statistics department offers two online self-paced boot camps that GAUSSI students may participate in at no charge. These boot camps are designed to prepare students for graduate level statistics classes:
GSLL 3095: Math Skills for Statistical Analysis
GSLL 3096: Computing Skills for Statistical Analysis

Fall 2016 GAUSSI Courses

Course #	Title	Credits	Instructor	Level
CM581A1	Nucleic Acids for Non-Life Scientists (Lab)	1	Carol Wilusz	Basic
CM580A1	Protein Basics for Non-Biologists	1	Brian Geiss	Basic
CM580A2	Basic Microbiology	1	Brian Geiss	Basic
CM581A2	NGS Libraries and Platforms	1	Carol Wilusz, Mark Stenglein, Dan Sloan	Intermediate
NSCI580A4	Linux as a Computational Platform	1	Asa Ben Hur, Tai Montgomery, Erin Nishimura	Basic
NSCI580A5	Genomics Data Analysis in Python	2	Asa Ben Hur, Tai Montgomery, Erin Nishimura	Intermediate
NSCI580A3	RNA-seq Data Analysis	1	Asa Ben Hur, Tai Montgomery, Erin Nishimura	Intermediate
BIOM581B1	Cells as Circuits	1	Kevin Lear	Basic
BIOM581B5	Electrochemical Sensors	1	Tom Chen/Chuck Henry	Intermedate
MATH58x	Linear Algebra for Biologists	1	Mike Kirby	Basic
STAT511	Design & Data Analysis for Researchers (R)	4	Jana Anderson	Basic
STAT551	Regression Analysis (online)	2	Jana Anderson	Intermediate
STAT561	Probability & Applications (online)	2	Mary Meyer	Intermediate

Spring 2017 GAUSSI Courses

Course #	Title	Credits	Instructor	Level
HORT581A3	Metabolomics: Design & Data Analysis	2	Adam Heuberger	Intermediate
MIP58x	Microbiomes & Metagenomics	2	Zaid Abdo	Intermediate
TBD	Capstone in NGS Data Analysis	1	Asa Ben Hur	Capstone
BIOM581B3	Sensor Circuit Fundamentals	1	Tom Chen	Basic
BIOM581B4	Affinity Sensors	1	Tom Chen/Brian Geiss	Intermediate
BIOM581B6	Biophotonic Sensors/Refractive Index	1	Kevin Lear	Intermediate
BIOM581B2	Signal & Noise in Sensors	1	Kevin Lear	Intermediate
MATH58x	Geometric Data Analysis	1	Mike Kirby	Intermediate
MATH58x	Topological Data Analysis	1	Henry Adams	Intermediate
STAT512	Design & Data Analysis for Researchers II	4	Ann Hess	Basic
STAA574	Methods in Multivariate Analysis	2	Daniel Cooley	Intermediate
STAA551	Regression Analysis (online)	2	Jana Anderson	Intermediate
STAA577	Statistical Learning and Data Mining (online)	2	Darren Homrighausen	Intermediate
STAA566	Computational & Graphical Methods (online)	2	Jana Anderson	Intermediate

Other Relevant Courses

These courses generally have more credits than the short GAUSSI courses, may not be aimed at interdisciplinary students and may have significant pre-requisites. However, they may be relevant/useful for some students.

Course #	Title	Credits	Instructor
MIP570	Functional Genomics	3	Ric Slayden
CS425	Introduction to Bioinformatics Algorithms	4	Asa Ben Hur, Hamidreza Chitsaz
CS581	Big Data	4	Sangmi Lee Pallickara
MATH532	Mathematical Modeling of Large Datasets	3	Mike Kirby
GRAD510	Fundamentals of High Performance Computing	3	Pat Burns
GRAD511	High Performance Computing and Visualization	3	Pat Burns
BZ/MIP577	Computer Analysis in Population Genetics	2	Bill Black/Mike Antolin
BZ360	Bioinformatics & Genomics	3	Tai Montgomery
MATH676	Topics in Mathematics	3	Jennifer Mueller
BIOM400	Biomolecular Kinetics and Cell Dynamics	3	Ashok Prasad
BZ/MATH548	Theory of Population and Evolutionary Ecology	4	Colleen Webb
BZ/BSPM520	Advanced Systematics	3	Mark Simmons
ERHS535	R Programming for Research	3	Brooke Anderson

Questions about GAUSSI Courses

In addition to consulting with your academic advisors, GAUSSI trainees can also consult the following GAUSSI faculty about the relevance of GAUSSI courses.

Math courses:	Dr. Michael Kirby (kirby@math.colostate.edu)
Statistics courses:	Dr Zaid Abdo (Zaid.Abdo@colostate.edu)
Life Science courses:	Dr. Carol Wilusz (Carol.Wilusz@colostate.edu)
Computer Science courses:	Dr. Asa Ben-Hur (Asa.Ben-Hur@colostate.edu)
Biosensor/Bioengineering courses:	Dr. Tom Chen (Thomas.Chen@colostate.edu)

PROFESSIONAL SKILLS TRAINING

The GAUSSI program aims to provide researchers with the skills needed to be successful in academic and non-academic careers. This goal is met in part through completion of coursework covering Ethics, STEM Communication & Grant Writing (Ph.D. students only):

NSCI580A2	Ethical Issues in Big Data Research	Brad Woods	1CR FA
†GRAD544	Ethical Conduct of Research	varies	1CR FA, SP
GRAD550	STEM Communication	Stu Tobet, Jeff Wilusz	1CR FA, SP
*BME750	Grant Writing	Stu Tobet	1CR FA

*MIP643   Grant Writing   Jeff Wilusz   1CR SP

†GRAD544 is acceptable to meet the ethics requirement, but the Big Data ethics course is preferred.
* Trainees should complete one Grant Writing course. The two listed are recommended but those offered through other programs are also acceptable.

In addition to formal courses described above, GAUSSI trainees must participate in at least 4 events comprising a minimum of 6 hours per semester of workshops, seminars or discussions related to professional skills development. These events should be selected to cover skills directly connected to the trainee's career goals and may include:

Time Management	Entrepreneurship
Cultural awareness/sensitivity	Budget Planning
Safety	Project Management
Team-based Science	Conflict Resolution
Leadership	Teaching
	Mentoring

Training opportunities will be highlighted on the GAUSSI website and through weekly emails. Programs offered through TILT, the Professional Learning Institute (PLI) and the Graduate School can be used towards this requirement. Participation will be logged by the student and approved by the GAUSSI Coordinator each semester.

CAREER DEVELOPMENT

All GAUSSI trainees who are currently enrolled in a graduate degree program will have the unique opportunity to participate in personalized career planning (surveys, MyIDP, personal consultations). They are encouraged to identify one or more career mentors and participate in career panel discussions.   Dr Rich Feller oversees this aspect of the program.

INTERNSHIPS/EXTERNSHIPS/CAREER MENTORING

Although internships/externships are not a required component of GAUSSI training, trainees are encouraged to consider gaining experience in this way. Links to internship opportunities will be posted on the GAUSSI website and GAUSSI faculty are happy to provide guidance in how to go about applying. Generally, an internship will last for 2-3 months during the summer. The GAUSSI program may support travel, but stipend support would usually need to be identified through other sources. Externships are shorter (1-3 weeks) and would normally be conducted at a local company. Students interested in this type of experience should consult with Dr Tobet or a faculty member with experience in a relevant field.

During the course of the training program, trainees will identify one or more possible career paths. They will identify individuals who have pursued similar paths and may be willing to act as mentors or participate in a panel discussion. GAUSSI faculty will assist in engaging mentors/panelists.

OUTREACH

Outreach is a central component of the GAUSSI program. As such, all GAUSSI trainees are required to participate in outreach-related activities during each of the Fall & Spring semesters. This requirement can be met through developing and delivering a module connected to big data for the "Biochemistry is Elementary" program overseen by Dr Laurie Stargell, or through other activities arranged by the trainee. All outreach activities should be STEM-related and ideally connected with computational and systems biology, biosensing or DNA sequencing. Some ideas for acceptable outreach activities will be listed on the GAUSSI website.   Each trainee should submit a brief description of their planned outreach activity by the beginning of the Fall Semester, provide a one paragraph description of progress at the end of the fall semester and submit a one page final report by the end of the Spring semester. Lesson plans and other deliverables should be shared with the Program Coordinator and submitted to public repositories if appropriate.

CERTIFICATE OF COMPLETION

A non-transcripted Certificate of Completion can be requested by trainees who have consistently met the requirements of the program over the course of at least two years.

FUNDING

GAUSSI is supported through NSF award DGE-1450032 with additional support from the Provost Office, OVPR, CVMBS, CoE, and CNS. These funds support fellowships, curriculum development, training and outreach activities, the annual symposium and trainee research and travel.

GAUSSI NRT FELLOWSHIPS

Fellowships provide $32,000 stipend, plus tuition and fees for up to 8 fellows per year. Fellows must be US citizens or permanent residents, must be enrolled in a graduate degree program at Colorado State University and must be performing interdisciplinary research connected with Biosensing or Next Generation Sequencing.   Each fellowship is awarded for one year and is non-renewable. Fellowship applications can be submitted online at gaussi.colostate.edu. The application deadline is April 15 each year and awards start June 1st.

TRAVEL AWARDS

Travel awards are available to all GAUSSI trainees to support attendance at conferences and workshops related to professional development or research projects. Travel funds may also be used to support travel for internships/externships. Applications for travel funds will be evaluated on a case-by-case, first come / first served basis. Details on how to apply can be found on the GAUSSI website (gaussi.colostate.edu).

INTERDISCIPLINARY RESEARCH AWARDS

Funds are available to support interdisciplinary research projects involving two or more GAUSSI trainees. The research awards are intended as a supplement for materials & supplies for exploratory activities leading to more sustained long-term collaborations. The awards cannot be used for salary and other personnel costs. The application deadline is Sep 1, 2016, and awardees will be notified by Oct 1, 2016. Details on how to apply can be found on the GAUSSI website.