Genomics, Phenomics, and Bioinformatics

Department Information

• Program Director:
  Changhui Yan, Ph.D.

• Email:
  Changhui.Yan@ndsu.edu

• Department Web Site:
  www.ndsu.edu/gpb/ (http://www.ndsu.edu/gpb/)

• Application Deadline:
  International applications are due May 1 for fall semester and October 1 for spring and summer semesters. Domestic applicants should apply at least one month prior to the start of classes.

• Credential Offered:
  Ph.D., M.S.

• English Proficiency Requirements:
  TOEFL iBT 71, IELTS 6; Duolingo 100

The Genomics, Phenomics, and Bioinformatics (GPB) program is an interdisciplinary graduate program that spans multiple colleges at North Dakota State University (NDSU). The program offers Ph.D. and M.S. degrees in three program areas: functional genomics, phenomics, and bioinformatics.

The program is designed to provide students the necessary skills and intellectual background to work cooperatively with others in a research area that take a systems-wide approach to the study of the organization of life and expression and regulation of genes in an organism. Students in the program will perform advanced study, training and research in areas that focus on functional genomics, high-throughput phenotyping, and computation analysis of genomic and phenomics data. Students will learn and master the multi-omics approaches for research in many frontiers. Exposure to modern techniques, instrumentation, computational and statistical methods will prepare the student for success in both industrial and academic careers.

Faculty in the program have broad research focuses including plant and human growth and development, reproduction, defense against abiotic and biotic stresses, and computational and statistical methods.

Visit the program website to find more information about the program, including faculty members and their research: www.ndsu.edu/gpb/faculty_and_research/ (https://www.ndsu.edu/gpb/faculty_and_research/).

It is the intent of the program to admit students into one of three tracks. The Functional Genomics track will be for students interested in the generation and application of genomic information. The Bioinformatics track is intended for students interested in using computational and statistical approaches to analyze large amounts of genomic data. The Phenomics track will be attractive to students interested in the application of high-throughput equipment to measure important traits necessary for full expression of the traits necessary for the organism to productively complete its life cycle.

The program is open to qualified graduates of universities of recognized standing. The Graduate School minimum for the TOEFL examination applies. In addition, the following are the requirements to be admitted with full standing.

Functional Genomics track: a Bachelor of Science (B.S.) degree with an introductory biology class emphasizing molecular biology; with courses in genetics, physiology, biochemistry; an upper-division statistics class. A minimum undergraduate GPA of 3.0.

Bioinformatics and Phenomics tracks: a B.S. degree with an introductory biology class emphasizing molecular biology; with courses in calculus, upper-division statistics class, calculus or matrix algebra, and programming language experience. A minimum undergraduate GPA of 3.0.

Students can be accepted conditionally into any track without meeting the course or GPA requirements, but will be required to meet those requirements while in residency.

Adviser and Supervisory Committee

During the first year, the student will form a supervisory committee and submit the Plan of Study to the Graduate School. The committee must include the student’s major adviser, at least one other faculty member of the Genomics, Phenomics, and Bioinformatics program, and a third member from outside the student’s home college. For Ph.D. students only, a fourth member of the committee serves as the Graduate School Representative (GSR). Requirements for GSR can be found here (https://catalog.ndsu.edu/graduate/graduate-school-policies/doctoral-degree-policies/#planofstudysupervisorycommittee).


## Master's Requirements

### Functional Genomics - Thesis Option

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PPTH 755  Population Biology of Plant Pathogens  3
PPTH 759  Host-Parasite Genetics  3
PSCI 617  Pharmacogenomics  2

Computer Science, Statistics, and Computational Biology Electives
ANSC 850  Linear Models in Animal Breeding  1
ANSC 851  Genetic Prediction  1
ANSC 852  Applied Variance Component Estimation  1
ANSC 856  Prediction and Control of Inbreeding in Breeding Programs  1
BIOL 842  Quantitative Biology  3
BIOL 877  Analysis of Population and Demographic Data  3
CSCI 679  Introduction to Data Mining  3
CSCI 724  Survey of Artificial Intelligence  3
CSCI 736  Advanced Intelligent Systems  3
CSCI 765  Introduction To Database Systems  3
CSCI 879  3
MATH 630  Graph Theory  3
MATH 636  Combinatorics  3
MATH 684  Mathematical Methods of Biological Processes  3
MATH 830  Graph Theory  3
MATH 839  Topics in Combinatorics and Discrete Mathematics  3
MATH 867  Topics in Applied Mathematics  3
MICR 724  Applied Epidemiology and Biostatistics  3
PLSC 749  Applied Plant Molecular Breeding  3
PH 674  Epidemiology  3
PH 706  Essentials of Epidemiology  3
PH 731  Biostatistics  3
PH 750  Epidemiologic Methods I  2
PH 752  Epidemiologic Methods II  2
PLSC 724  Field Design I  3
STAT 650  Stochastic Processes  3
STAT 661  Applied Regression Models (required for Bioinformatics Ph.D. option)  3
STAT 711  Basic Computational Statistics using R  3
STAT 712  Applied Statistical Machine Learning  3
STAT 713  Introduction to Data Science  3
STAT 714  Statistical Big Data Visualization  3
STAT 725  Applied Statistics  3
STAT 764  Multivariate Methods  3
STAT 840  Introduction to Statistical Design and Analysis of Gene Expression Experiments  3
STAT 851  Bayesian Statistical Inference  3
STAT 860  Statistical Machine Learning  3

Modeling and Sensing Electives
ABEN 747  Numerical Modeling of Environmental and Biological Systems  3
ABEN 758  Applied Computer Imaging and Sensing for Biosystems  3
CE 725  Biomaterials-Materials in Biomedical Engineering  3
CSCI 628  Artificial Intelligence, Ethics, and the Environment  3
GEOG 655  Introduction to Geographic Information Systems  4
GEOG 666  Advanced Geographic Information Systems  3
GEOG 670  Remote Sensing  3
GEOG 680  Geographic Information Systems Pattern Analysis and Modeling  3
PAG 654  Applications of Precision Agriculture  3
# Doctoral Requirements

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**Modeling and Sensing Electives**

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**Examinations**

1. **Qualifying Exam (Ph.D. only):** This exam consists of written and oral portions. The student will complete a written exam that emphasizes the application of materials presented in the core courses. The members of the graduate program faculty will submit these questions. The oral exam will be administered by the student's supervisory committee and will focus on material beyond the core courses that are specific to the research of the student. Upon completion of the qualifying exam, the student will be accepted as a Ph.D. candidate.

2. **Final Exam:** The final exam will be an oral defense of the student's research results. The student's supervisory committee will administer the exam.