**BIOLOGICAL DATA SCIENCES (BDS)**

**BDS 211, USE AND ABUSE OF DATA: CRITICAL THINKING IN SCIENCE, 3 Credits**
Critically examine how data analysis can support legitimate conclusions from biological datasets and also how deceptive visualizations, misleading comparisons, and spurious reasoning can lead to false conclusions. Analyze data to break down the logical flow of an argument and identify key assumptions, even when they are not stated explicitly.

**Prerequisite:** (MTH 251 (may be taken concurrently) with C- or better or MTH 251H (may be taken concurrently) with C- or better) or MTH 227 with C- or better or MTH 241 with C- or better or MTH 245 with C- or better

**BDS 311, COMPUTATIONAL APPROACHES FOR BIOLOGICAL DATA, 3 Credits**
The theory and practice underlying widely used computational methods for biological data analysis. Focuses on the analysis and visualization of large data sets using Python, with broad applications to genomics, ecology, and other disciplines. Topics may include image processing, time series analysis, dimensionality reduction, and resampling methods.

**Prerequisite:** (BI 223 with C- or better or BI 223H with C- or better) and (MTH 252 [C-] or MTH 252H [C-] or MTH 228 [C-]) and (CS 161 [C-] or BOT 476 [C-])

**BDS 406, SPECIAL PROJECTS, 1-99 Credits**
*This course is repeatable for 99 credits.*

**BDS 411, *ANALYSIS OF BIOLOGICAL DATA: CASE STUDIES, 3 Credits**
Case studies; synthesize previously acquired knowledge and skills in biology, mathematics, statistics, and computer science to implement, in writing, an analysis strategy. *(Writing Intensive Course)*

**Attributes:** CWIC – Core, Skills, WIC

**Prerequisite:** (BI 311 with C- or better or BI 311H with C- or better) or (BB 314 with C- or better or BB 314H with C- or better) or (MTH 252 with C- or better or MTH 252H with C- or better) or MTH 228 with C- or better or MTH 227 with C- or better or MTH 241 with C- or better or MTH 245 with C- or better

**BDS 474X, INTRODUCTION TO GENOME BIOLOGY, 3 Credits**
Explores how genomes underlie and influence biological phenomena, across the diversity of life, from prokaryotic microbes to eukaryotic multicellular organisms. Covers genome organization: the structure of chromosomes and chromatin; genes and gene families; and mechanisms that remodel genomes, such as mutation, recombination and transposable elements in the first part of the course. Focuses on genome expression and regulation: gene expression, cellular functions and biochemical pathways; transcriptional and post-transcriptional regulatory mechanisms; and genotype-to-phenotype relationships in the second part of the course. Emphasizes the use of recent technological advances and genome-wide assays that enable investigation of these topics.

**Prerequisite:** BI 311 (may be taken concurrently) with C- or better or BB 314 (may be taken concurrently) with C- or better

**Equivalent to:** BOT 474X

**BDS 475, COMPARATIVE GENOMICS, 4 Credits**
Explores principles of comparative genomics. Examines methods for genome assembly and annotation. Discusses genomic approaches for the study of structural change, whole genome duplication, gene family evolution, gene networks, gene regulation and epigenetics. Lab topics include the analysis of next generation sequencing data and conducting comparative genomic analyses. CROSSLISTED as BDS 475/BOT 475 and BDS 575/BOT 575/MCB 575.

**Prerequisite:** (BB 314 with D- or better or BB 314H with D- or better) and (BI 311 [D-] or BI 311H [D-] or PBG 430 [D-])

**Equivalent to:** BOT 475

**Recommended:** Basic working knowledge of cell and molecular biology and genetics

**BDS 478, FUNCTIONAL GENOMICS, 3 Credits**
Introduces conceptual approaches and associated laboratory techniques that rely on genome-scale datasets to investigate the function of, and interactions between, genes as well as their RNA/protein products. Examples include: predicting protein function based on nucleotide and amino acid sequence analysis; large-scale genetic approaches to identifying novel genotype-phenotype associations; and analysis of transcriptomic, proteomic and metabolomic datasets, which measure changes in RNA transcripts, proteins and metabolites, respectively, to explore gene function and cellular/organismic networks. Provides a conceptual framework for understanding how the wide range of available large-scale technologies can be applied to solve biological problems.

**Prerequisite:** BB 314 with C- or better or BB 314H with C- or better

**Equivalent to:** BOT 460, BOT 478

**BDS 491, CAPSTONE PROJECTS IN BIOLOGICAL DATA SCIENCE I, 3 Credits**
Quantitative skills and biological thinking will be used to analyze and draw conclusions from real-world biological datasets. Projects will be completed in the context of small groups. Draws on skills in mathematics, statistics, computer science, and biology.

**Prerequisite:** (ST 352 with C- or better or ST 412 with C- or better) and (CS 162 [C-] or BOT 476 [C-] or BB 485 [C-] or MTH 427 [C-])
BDS 492, CAPSTONE PROJECTS IN BIOLOGICAL DATA SCIENCE II, 3 Credits
Quantitative skills and biological thinking will be used to analyze and draw conclusions from biological datasets retrieved in BDS 412. This is a synthesis course that draws skills in mathematics, statistics, computer science, and biology, in which the students will process their curated datasets and draw conclusions.
Prerequisite: BDS 491 with C- or better

BDS 574X, INTRODUCTION TO GENOME BIOLOGY, 3 Credits
Explores how genomes underlie and influence biological phenomena, across the diversity of life, from prokaryotic microbes to eukaryotic multicellular organisms. Covers genome organization: the structure of chromosomes and chromatin; genes and gene families; and mechanisms that remodel genomes, such as mutation, recombination and transposable elements in the first part of the course. Focuses on genome expression and regulation: gene expression, cellular functions and biochemical pathways; transcriptional and post-transcriptional regulatory mechanisms; and genotype-to-phenotype relationships in the second part of the course. Emphasizes the use of recent technological advances and genome-wide assays that enable investigation of these topics.
Equivalent to: BOT 574X

BDS 575, COMPARATIVE GENOMICS, 4 Credits
Explores principles of comparative genomics. Examines methods for genome assembly and annotation. Discusses genomic approaches for the study of structural change, whole genome duplication, gene family evolution, gene networks, gene regulation and epigenetics. Lab topics include the analysis of next generation sequencing data and conducting comparative genomic analyses. CROSSLISTED as BDS 475/BOT 475 and BDS 575/BOT 575/MCB 575.
Equivalent to: BOT 575, MCB 575
Recommended: BB 314 and (BI 311 or PBG 430) and basic working knowledge of cell and molecular biology and genetics

BDS 578, FUNCTIONAL GENOMICS, 3 Credits
Introduces conceptual approaches and associated laboratory techniques that rely on genome-scale datasets to investigate the function of, and interactions between, genes as well as their RNA/protein products. Examples include: predicting protein function based on nucleotide and amino acid sequence analysis; large-scale genetic approaches to identifying novel genotype-phenotype associations; and analysis of transcriptomic, proteomic and metabolomic datasets, which measure changes in RNA transcripts, proteins and metabolites, respectively, to explore gene function and cellular/organismal networks. Provides a conceptual framework for understanding how the wide range of available large-scale technologies can be applied to solve biological problems. CROSSLISTED as BDS 478/BOT 478 and BDS 578/BOT 578.
Equivalent to: BOT 560, BOT 578

BDS 599, SPECIAL TOPICS, 1-4 Credits
This course is repeatable for 99 credits.