School of Life Sciences, Department of Biology

Program of Bioinformatics for International Students (2022)

I. Introduction

Life science has been central to the development of the 21st century natural sciences, and its development is related to people's health and well-being. Today, life and health industry has become a new driving force to promote the development of the world economy. Therefore, the central and local governments set the strategic priorities to foster advancing emerging life science related industries.

Life science is one of the key disciplines of the Southern University of Science and Technology (SUSTech). Founded in 2012, the Department of Biology is among the first established academic departments in the university. Since its founding, the Department has assembled groups of faculty members with diverse research interests and expertise to tackle fundamental problems of life science. All of the faculty members had prior research experience at top internationally-acclaimed universities before joining SUSTech and some of them had been awarded tenures in these universities or research institutions worldwide.

The faculty of the department are supported by the state-of-the-art scientific research platform facilities and talent recruitment programs, such as the Guangdong Provincial Key Laboratory of Cellular Microenvironment and Disease Research, Key Laboratory of Molecular Design for Plant Cell Factory of Guangdong Higher Education Institutes, Guangdong Provincial "Pearl River Talent Program" for Innovation and Entrepreneurship, Cryo-EM Center, Plant and Food Research Institute, SUSTech-UQ Joint Centre for Neuroscience and Neural Engineering and Experimental Animal Center. Concentrated on five major areas, namely molecular cell biology, neurobiology, plant biology, system biology and structural biology, their research focuses on the frontiers of life science and high-impact human health issues, with cross-disciplinary approaches.

The Department of Biology's life science program was approved as a key discipline at the provincial level (Guangdong) in 2016. In 2018, the Department was authorized to confer doctorate and master's degrees to graduate students, and was designated as a postdoctoral workstation in 2019. These developments set the department on track to be developed as a top-tier academic institution of Guangdong province.

On this basis, we set up a special major in Bioinformatics to meet the urgent needs of the society for talents in this field. With the strength of its excellent basis and faculty in bioinformatics

research, the Department of Biology is committed to cultivating excellent comprehensive and innovative talents with strong biological information research and practical abilities.

Academic subject area: Biological Sciences (0710); Program code: 071003

II. Objectives and Learning Outcomes

1. Objectives

It aims to cultivate high-level comprehensive and innovative talents with complete moral, intellectual and physical development, who master the basic knowledge of biological science, systematically master the basic theory, knowledge and skills of computer science and biological information, and have strong practical and research ability in the acquisition, processing, development and utilization of biological information. We focus on developing students' creative ability, independent thinking and scientific research capabilities, so that students will become scientists in the field of bioinformatics in the future, or core technology developers in enterprises.

2. Learning Outcomes

(1) Mastering the basic theoretical knowledge of mathematics, physics and life science.

(2) Mastering the basic theories, knowledge and skills of computer science and biological information; understanding the frontiers and latest developments in bioinformatics.

(3) Having the ability to independently design experiments, conduct experiments, collect and analyze experimental results, and write reports; having internationalized version with the ability to write, communicate and present scientific results in English.

III. Study Length, Degree, and Graduation Requirements

1．Study length: 4 years. The academic credit system of SUSTech allows flexible study years, but not less than 3 years or more than 6 years

2．Degree conferred: Students who complete and meet the degree requirements of the undergraduate program will be awarded a bachelor's degree in Science

3．The minimum credit requirement for graduation: 151 credits. The specific requirements are as follows.

Module		**Category**	**Minimum Credit Requirement**
General Education Courses	Chinese Language and Culture Module	Chinese Language and Culture	16
	Arts and Physical Education Module	Physical Education	4
		Arts	2
	Competence Development Module	Computer Programming	3
		Writing	2
		Chinese Studies	2
		Foreign Languages	14
	Humanities and Social Sciences Module	Humanities	6
		Social Sciences	
	Mathematics and Natural Sciences Module	Mathematics	12
		Physics	10
		Chemistry	3
		Biology	3
	Introduction to Majors Module	Introduction to Majors	2
Major Courses	Major Required Courses	Major Foundational Courses	11
		Major Core Courses	16
		Practice-based Learning (Undergraduate Thesis, Internships, Research projects, etc.)	12
	Major Elective Courses	Major Elective Courses	33
Total			151
Note: please see the General Education Requirement for more details on Chinese Language and Culture Module, Arts and Physical Education Module, Competence Development Module（Foreign Languages & Chinese Studies & Writing）, Humanities and Social Sciences Module, and Introduction to Majors Module.			

IV. Course Requirements for the Mathematics and Natural Sciences Module and Computer Programming

Category	Course Code	Course Name		Requirement	Credits	Terms	Prerequisite	Dept.
Mathematics	MA101a	Mathematical Analysis I	Category A	Required Choose one set from two sets	5	1 Fall	None	Department of Mathematics
	MA102a	Mathematical Analysis II			5	1 Spring	Mathematical Analysis I	
	MA117	Calculus I	Category B		4	1 Fall	None	
	MA127	Calculus II			4	1 Spring	Calculus I	
	MA107	Advanced Linear Algebra I		Required Choose one from two	4	1 Spring	None	
	MA113	Linear Algebra			4	1 Spring	None	
Physics	PHY101	General Physics I	Category A	Required Choose one set from two sets	5	1 Fall	None	Department of Physics
	PHY102	General Physics II			5	1 Spring	General Physics I	
	PHY105	College Physics I	Category B		4	1 Fall	None	
	PHY106	College Physics II			4	1 Spring	College Physics I	
	PHY104B	Experiments of Fundamental Physics		Required	2	2 Fall	None	
Chemistry	CH103	General Chemistry		Required Choose one from two	4	1 Fall	None	Department of Chemistry
	CH105	Chemistry: The Central Science			3	1 Fall	None	
Biology	BIO103	Principles of Biology		Required	3	1 Fall	None	Department of Biology
Computer Programming	CS109	Introduction to Computer Programming		Required Choose one from five	3	1 Fall	None	Dept. of Computer Science and Engineering
	CS110	Introduction to Java Programming			3	1 Fall	None	
	CS111	Introduction to C programming			3	1 Fall	None	
	CS112	Introduction to Python Programming Python			3	1 Fall	None	
	CS113	Introduction to Matlab Programming			3	1 Fall	None	

V. Prerequisites for Major Declaration

Major Declaration Time	Course Code	Course Name		Prerequisite
Declare major at the end of the first academic year	MA101a	Mathematical Analysis I	Choose one from two	None
	MA117	Calculus I		None
	MA102a	Mathematical Analysis II	Choose one from two	Mathematical Analysis I
	MA127	Calculus II		Calculus I
	CS109	Introduction to Computer Programming	Choose one from five	None
	CS110	Introduction to Java Programming		None
	CS111	Introduction to C programming		None
	CS112	Introduction to Python Programming Python		None
	CS113	Introduction to Matlab Programming		None
	BIO103	Principles of Biology		None
Declare major at the end of the second academic year	MA101a	Mathematical Analysis I	Choose one from two	None
	MA117	Calculus I		None
	MA102a	Mathematical Analysis II	Choose one from two	Mathematical Analysis I
	MA127	Calculus II		Calculus I
	CS109	Introduction to Computer Programming	Choose one from five	None
	CS110	Introduction to Java Programming		None
	CS111	Introduction to C programming		None
	CS112	Introduction to Python Programming Python		None
	CS113	Introduction to Matlab Programming		None
	BIO103	Principles of Biology		None
	PHY101	General Physics I	Choose one from two	None
	PHY105	College Physics I		None
	PHY102	General Physics II	Choose one from two	General Physics I
	PHY106	College Physics II		College Physics I

Note:

1. **If the number of students entering a major at the end of the first academic year in the department is greater than or equal to the total number of the teaching-research faculty (PI)*2*60%, all majors in the department may implement the prerequisites for major declaration at the end of the second academic year.**
2. **If the number of students entering a major at the end of the first academic year in the department is less than the total number of the teaching-research faculty (PI)*2*60%, all majors in the department do not implement the prerequisites for major declaration at the end of the second academic year.**
3. **Suppose the number of students applying for a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), then the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).**
4. **For departments that do not implement prerequisites for major declaration at end of the second academic year, if the cumulative number of students applying for a major at the end of the second academic year and the number of students who have entered a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), the department may select students according to predetermined rules. In principle,**

the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).

VI: Major Course Arrangement

Table 1: Major Required Courses

Program of Bioinformatics

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Major Foundational Courses	BIO104	General Biology Laboratory	2	2	1/Spr	Principles of Biology	BIO
	BIO201	Biochemistry (Macromolecules)	3		2/Fall	Principles of Biology, General Chemistry	BIO
	MA212	Probability and Statistics	3		2/Fall	Mathematical Analysis II or Calculus II	MATH
	BIO202	Biochemistry II (Metabolism)	3		2/Spr	Biochemistry (Macromolecules)	BIO
	Total		11	2			
Major Core Courses	BIO206	Cell Biology	3		3/Fall	Principles of Biology	BIO
	BIO309	Computational Biology	3	1	3/Fall	None	BIO
	BIO306	Bioinformatics	4	2	3/Spr	Computational Biology	BIO
	BIO320	Molecular Biology	3		3/Spr	Biochemistry (Macromolecules)	BIO
	BIO350	Genomics	3		3/Spr	Principles of Biology	BIO
	Total		16	3			
Practice-based Courses	BIO492	Thesis	12	12	4/Fall-Spr	None	BIO
	Total		12	12			
Total			39	17			

Table 2: Major Elective Courses

Program of Bioinformatics

Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
"Biological Integrated Laboratory Research Training" Module, choose one from five, 6 credits.						
BIO481	Integrated Laboratory Research Training--Plant Biology	6	6	2,3/Summer	None	BIO
BIO482	Integrated Laboratory Research Training--Immunology & Microbiology	6	6	2,3/Summer	None	BIO
BIO483	Integrated Laboratory Research Training--Systems Biology	6	6	2,3/Summer	None	BIO
BIO484	Integrated Laboratory Research Training--Chemical Biology	6	6	2,3/Summer	None	BIO
BIO485	Integrated Laboratory Research Training--Neuroscience	6	6	2,3/Summer	None	BIO
Total		30	30			
"Computer science and technology" Module, choose 3 from 9, 9 credits.						
CS203B	Data Structures and Algorithm Analysis B	3	1	2/Fall	Introduction to Computer Programming or Introduction to Java Programming	CSE
CS205	C/C++ Program Design	3	1	2/Fall	None	CSE
CS307	Principles of Database Systems	3	1	2/Fall	Introduction to Computer Programming	CSE
CS201	Discrete Mathematics	3		2/Spr	Calculus II, Linear Algebra	CSE
CS208	Algorithm Design and Analysis	3	1	2/Spr	Introduction to Computer Programming, Data Structures and Algorithm Analysis	CSE
CS303B	Artificial Intelligence B	3	1	3/Fall	Data Structures and Algorithm Analysis B, Probability and Statistics	CSE
CS306	Data Mining	3	1	3/Spr	Data Structures and Algorithm Analysis B	CSE
CS324	Deep Learnin	3	1	3/Spr	Artificial Intelligence B	CSE

CS332	Information Retrieval	3	1	3/Spr	Data Structures and Algorithm Analysis	CSE
Total		27	8			
"Mathematics and Statistics" Module, choose one from six, 3 credits						
STA217	Introduction to Data Science	3		2/Fall	Calculus II or Mathematical Analysis II	STA
MA201b	Ordinary Differential Equations B	4		2/Spr	Calculus II or Mathematical Analysis II	MATH
MA329	Statistical Linear Models	3		3/Fall	Probability and Statistics	STA
MA206	Mathematical Modeling	3		3/Spr	Ordinary Differential Equations B	MATH
MA234	Introduction to Theoretical and Practical Data Science	4	1	3/Spr	Probability and Statistics	MATH
MA405	Survival Analysis	3		4/Fall	Statistical Linear Models	STA
Total		20	1			
"Life Sciences" Module, 15 credits						
BIOS201	Genome, why we are different?	2	2	1/ Smr	None	BIO
BIO203	Microbiology	3		2/Fall	None	BIO
BIO205	Microbiology Laboratory	2	2	2/Fall	General Biology Laboratory	BIO
BIO207-15	Plant Physiology	3		2/Fall	Principles of Biology	BIO
BIO217	Biological Psychology	3		2/Fall	Principles of Biology	BIO
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	2/Spr	General Biology Laboratory, Biochemistry（Macromolecules）	BIO
BIO301	Genetics	3		2/Spr	None	BIO
BIO303	Genetics Laboratory	2	2	2/Spr	Genetics, Biochemistry and Molecular Biology Laboratory	BIO
BIO308	Frontier in Life Sciences Seminar and Journal Club	2		2/Spr	None	BIO
BIO471	Field Trips I	1	1	1/Smr	None	BIO
BIO208	Cell Biology Laboratory	2	2	3/Fall	Cell Biology	BIO
BIO311-14	Animal Physiology	3		3/Fall	None	BIO
BIO336	The Biology of Cancer	3		3/Fall	None	BIO
BIO340	Protein Engineering	3		3/Fall	Biochemistry (Macromolecules)	BIO

BIO347	Basic Principles of Biophysics	3		3/Fall	Biochemistry (Macromolecules)	BIO
BIO401-16	Genetic Engineering	3		3/Fall	Biochemistry (Macromolecules)	BIO
BIO302	Modern Biotechnology	3		3/Spr	Biochemistry (Macromolecules)	BIO
BIO304	Systems Biology	3		3/Spr	Principles of Biology, Biostatistics or Probability and Statistics	BIO
BIO305	Model Organism and Developmental Biology	3		3/Spr	Principles of Biology	BIO
BIO310	Neurobiology	3		3/Spr	Biochemistry (Macromolecules)	BIO
BIO331	Protein Structure and Function	3	1	3/Spr	Biochemistry (Macromolecules)	BIO
BIO344	Modern Biotechnology Laboratory	2	2	3/Spr	General Biology Laboratory	BIO
BIO405	Immunology	3		4/Fall	Cell Biology	BIO
BIO348	Scientific Writing and Communication	1		4/Spr	None	BIO
BIO504*	Advanced Cell Biology	3		4/Spr	None	BIO
BIO470	Summer Off-Campus Internship	2	2	1,2,3/Smr	None	BIO
Total		66	16			

Note:

1. Only after passing the course of “Biological Integrated Laboratory Research Training”, students can choose BIO492 “Thesis”.
2. For international students who can return to school before the start of the third year，she/he can choose one from five courses to meet the standard. For international students who cannot return to school before the start of the third year，she/he can only choose BIO483 "Integrated Laboratory Research Training--Systems Biology" which can be completed online.
3. “Data Structures and Algorithm Analysis B” could be replaced by “Data Structures and Algorithm Analysis “
4. “Artificial Intelligence B” could be replaced by “Artificial Intelligence”

Table 3: Overview of Practice-based Learning

Program of Bioinformatics

Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
CS109	Introduction to Computer Programming	3	1	1/Fall	None	CSE
CS110	Introduction to Java Programming	3	1	1/Fall	None	CSE
CS111	Introduction to C programming	3	1	1/Fall	None	CSE
CS112	Introduction to Python Programming Python	3	1	1/Fall	None	CSE
CS113	Introduction to Matlab Programming	3	1	1/Fall	None	CSE
CS203B	Data Structures and Algorithm Analysis B	3	1	2/Fall	Introduction to Computer Programming Introduction to Java Programming	CSE
CS205	C/C++ Program Design	3	1	2/Fall	None	CSE
CS307	Principles of Database Systems	3	1	2/Fall	Introduction to Computer Programming	CSE
CS208	Algorithm Design and Analysis	3	1	2/Spr	Introduction to Computer Programming, Data Structures and Algorithm Analysis	CSE
CS303B	Artificial Intelligence B	3	1	3/Fall	Data Structures and Algorithm Analysis B, Probability and Statistics	CSE
CS306	Data Mining	3	1	3/Spr	Data Structures and Algorithm Analysis B	CSE
CS324	Deep Learnin	3	1	3/Spr	Artificial Intelligence B	CSE
CS332	Information Retrieval	3	1	3/Spr	Data Structures and Algorithm Analysis	CSE
MA234	Introduction to Theoretical and Practical Data	4	1	3/Spr	Probability and Statistics	MATH

	Science					
PHY104B	Experiments of Fundamental Physics	2	2	2/Spr	None	PHY
BIO104	General Biology Laboratory	2	2	1/Spr	Principles of Biology	BIO
BIOS201	Genome, why we are different?	2	2	1/ Smr	None	BIO
BIO205	Microbiology Laboratory	2	2	2/Fall	General Biology Laboratory	BIO
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	2/Spr	General Biology Laboratory, Biochemistry（Macromolecules）	BIO
BIO303	Genetics Laboratory	2	2	2/Spr	Genetics, Biochemistry and Molecular Biology Laboratory	BIO
BIO471	Field Trips I	1	1	1/Smr	None	BIO
BIO208	Cell Biology Laboratory	2	2	3/Fall	Cell Biology	BIO
BIO309	Computational Biology	3	1	3/Fall	None	BIO
BIO306	Bioinformatics	4	2	3/Spr	Computational Biology	BIO
BIO331	Protein Structure and Function	3	1	3/Spr	Biochemistry (Macromolecules)	BIO
BIO344	Modern Biotechnology Laboratory	2	2	3/Spr	General Biology Laboratory	BIO
BIO470	Summer Off-Campus Internship	2	2	1,2,3/Smr	None	BIO
BIO481	Integrated Laboratory Research Training--Plant Biology	6	6	2,3/Summer	None	BIO
BIO482	Integrated Laboratory Research Training--Immunology & Microbiology	6	6	2,3/Summer	None	BIO
BIO483	Integrated Laboratory Research Training--Systems Biology	6	6	2,3/Summer	None	BIO
BIO484	Integrated Laboratory Research Training--Chemical Biology	6	6	2,3/Summer	None	BIO
BIO485	Integrated Laboratory Research Training--Neuroscience	6	6	2,3/Summer	None	BIO

BIO492	Thesis	12	12	4/Fall-Spr	None	BIO
Total		114	79			

Curriculum Structure of Bioinformatics