

# **Program of Bioinformatics for International Students (2020)**

## **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.

## **II. Objectives and Learning Outcomes**

### **(I) 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.

#### (II) Requirements

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 and Graduation Requirements

Study length: 4 years

Degree conferred: Bachelor of Science

The minimum credit requirement for graduation: 138 credits (not including English courses);

Category	Module	Minimum Credit Requirement
General Education (GE) Required Courses (50 credits)	Science	30
	Physical Education	4
	Chinese Languages & Culture	16
General Education (GE) Elective Courses (15 credits)	Humanities	4
	Social Sciences	4
	Arts	2
	Science	5
Major Course (73 credits)	Major Foundational Courses	22
	Major Core Courses	17
	Major Elective Courses	24
	Research Projects, Internship and Undergraduate Thesis / Projects	10
Total (not including English courses)		138

### IV. Discipline

Bioinformatics

### V. Main Courses

For details please refer to Major Required Course (Foundational and Core Courses) (Table 1).

### VI. Practice-Based Courses

See Table 3

## VII. Pre-requisites for Major Declaration

Major Declaration Time	Course Code	Course Name	Prerequisite
Declare major at the end of First Year	MA101B	Calculus I A	
	MA102B	Calculus II A	MA101B
	CS102A	Introduction to Computer Programming A	
	BIO103	Principles of Biology	
	BIO104	General Biology Laboratory	BIO102B or MED101
Declare major at the end of Second Year	MA107B	Linear Algebra B	
	PHY103B	General Physics B (I)	
	PHY105B	General Physics B (II)	PHY103B
	CH101A	General Chemistry A	
	BIO201	Biochemistry (Macromolecules)	BIO103, CH101A
	BIO320	Molecular Biology	BIO103
Note: Students need to complete all the courses above (include the pre-requisites for Major Declaration at the end of First Year) when they declare major at the end of Second Year.			

## VIII. Requirements for of GE Required Courses

### (I) Science Module

Course Code	Course Name	Credit	Lab Credits	Hours/week	Term	Language Instruction	Prerequisite	Dept.
MA101B	Calculus I A	4		4	Spr/ Fall	B/E	NA	MATH
MA102B	Calculus II A	4		4	Spr/ Fall	B/E	MA101 B	MATH
MA107B	Linear Algebra B	4		4	Spr/ Fall	B/E	NA	MATH
PHY103 B	General Physics B (I)	4		4	Spr/ Fall	B/E	NA	PHY
PHY105 B	General Physics B (II)	4		4	Spr/ Fall	B/E	PHY10 3B	PHY
CH101A	General Chemistry A	4		4	Spr/ Fall	B/E	NA	CHEM
CS102A	Introduction to Computer Programming A	3	1	4	Spr/ Fall	B/E	NA	CSE
BIO103	Principles of Biology	3		3	Spr/ Fall	B/E	NA	BIO
Total		30	1					

### (II) Physical Education

Course Code	Course Name	Credits	Hours/week	Terms	Instruction language	Prerequisite	Dept.
GE131	Physical Education I	1	2	Fall	C	NA	PE Center
GE132	Physical Education II	1	2	Spr	C	NA	
GE231	Physical Education III	1	2	Fall	C	NA	
GE232	Physical Education IV	1	2	Spr	C	NA	
GE331	Physical Education V	0	/	Fall	C	NA	
GE332	Physical Education VI	0	/	Spr	C	NA	
GE431	Physical Education VII	0	/	Fall	C	NA	
GE432	Physical Education VIII	0	/	Spr	C	NA	
Total		4	8				

Note: All physical education courses are general required courses. For Semester 1-4, each course (GE131, GE132, GE231, GE232) counted as 1 credit ; for semester 5-8, (GE331, GE332, GE431, GE432) are extracurriculum courses without no credits, details can be referred to Physical Education Curriculum Program of Sustech.

**(III) Chinese Languages & Culture**

Course Code	Course Name	Credit	Hours/week	Term	Language Instruction	Prerequisite	Dept.
CLE008	Elementary Chinese I	2	4	1/Fall	B	NA	CLE
CLE009	Elementary Chinese II	2	4	1/Spr	B	CLE008	
CLE027	Intermediate Chinese I	2	4	2/Fall	B	CLE009	
CLE028	Intermediate Chinese II	2	4	2/Spr	B	CLE027	
CLE031	Advanced Chinese I	2	4	3/Fall	B	CLE028	
CLE032	Advanced Chinese II	2	4	3/Spr	B	CLE031	
CLE033	Chinese Culture	2	2	Spr/Fall	B/E	NA	CLE/ HUM/ SSC
CLE034	Chinese History	2	2	Spr/Fall	B/E	NA	

**(IV) English Language**

Students will undertake the English Placement Test and be placed into three levels according to the result of the test and their performance in the National College Entrance Exam. Students at different levels are required to take the courses with a different credit value in total.

Level A: 6 credits; SUSTech English III, and English for Academic Purposes

Level B: 10 credits; SUSTech English II, SUSTech English III, and English for Academic Purposes

Level C: 14 credits; SUSTech English I, SUSTech English II, SUSTech English III, and English for Academic Purposes.

Course Code	Course Name	Credit	Hours/week	Language Instruction	Prerequisite
CLE021	SUSTech English I	4	4	E	NA
CLE022	SUSTech English II	4	4	E	CLE021
CLE023	SUSTech English III	4	4	E	CLE022
CLE030	English for Academic Purposes	2	2	E	CLE023

### IX. Requirements for of GE Elective Courses

(I) Students are required to complete 4 credits for the Humanities Module and Social Sciences Module respectively, and 2 credits for the Music and Art Module. (Information about the available courses and the instruction language will be announced before the course selection session)

(II) Students are required to complete 5 credits for Science Module

Course Code	Course Name	Credit	Lab Credits	Hours/Week	Term	Instruction Language	Prerequisite	Dept
BMEB131	Introduction to Biomedical Engineering	2		2	Fall	B	NA	BMEB
CS101A	Introduction to Computer Science A	2		2	Fall	E	NA	CSE
CS104	Introduction to Mathematical Logic	2		2	Spr	E	NA	CSE
ESE202	Introduction to Environmental Sciences	2		2	Spr/ Fall	E	NA	ESE
ESE313	Introduction to Ecology	3		3	Fall	E	ESE202	ESE
PHY104B	Experiment of Fundamental Physics	2	2	4	Spr/ Fall	B/E	NA	PHY
Total		1 3	2					

## X. Major Course Arrangement

**Table 1: Major Required Course (Foundational and Core Courses)**

Course Category	Course Code	Course Name	Credit	Lab Credits	Hours/week	Term	Advised term to take the course	language Instruction	Prerequisite	Dept
Major Foundational Courses	CS103	Introduction to Artificial Intelligence	2		2	Fall	1/Fall	B	NA	CSE
	BIO104	General Biology Laboratory	2	2	4	Spr/Fall	1/Spr	B/E	BIO102B or MED101	BIO
	BIO201	Biochemistry (Macromolecules)	3		3	Spr/Fall	2/Fall	B/E	BIO103 CH101A	BIO
	BIO320	Molecular Biology	3		3	Spr/Fall	2/Fall	B/E	BIO103	BIO
	CS203 B	Data Structures and Algorithm Analysis B	3	1	4	Fall	2/Fall	B/E	CS102A	CSE
	BIO202	Biochemistry II (Metabolism)	3		3	Spr/Fall	2/Spr	B/E	BIO201	BIO
	BIO210	Biostatistics	3		3	Spr/Fall	2/Spr	E	BIO103	BIO
	MA212	Probability and Statistics	3		3	Spr/Fall	2/Spr	B/E	MA102a MA102B	MATH
	Total			22	3					
Major Core Courses	BIO 301	Genetics	3		3	Spr/Fall	2/Spr	B/E	NA	BIO
	BIO 206-15	Cell Biology	4		4	Spr/Fall	3/Fall	B/E	BIO103	BIO
	BIO304	Systems Biology	3		3	Spr/Fall	3/ Fal	B/E	BIO103 MA212	BIO
	BIO309	Computational Biology	3	1	4	Fall	3/Fall	B	NA	BIO
	BIO306	Bioinformatics	4	2	6	Spr	3/ Spr	B	BIO309	BIO
	Total			17	3					
Major Practical	BIO480 A17	Projects of Science and Technology Innovation I	2	2	4	Fall/Spr/Smr	1/Smr	B/E	NA	BIO
	BIO490	Thesis	8	8	16	Spr	4/Spr	B/E	NA	BIO
	Total			10	10					
Projects of Science and Technology Innovation accept students to start their laboratory training from the 2nd to the 10th semesters.										

**Table 2: Major Elective Courses**

Course Code	Course Name	Credit	Lab Credits	Hours/week	Term	Advised term to take the course	Instruction language	Prerequisite	Dept
CS205	C/C++ Program Design	3	1	4	Spr/Fall	2/Fall	E	NA	CSE
CS307	Principles of Database Systems	3	1	4	Spr/Fall	2/Fall	E	CS102A	CSE
CS201	Discrete Mathematics	3		3	Spr/Fall	2/Spr	E	MA102B MA107A	CSE
CS208	Algorithm Design and Analysis	3	1	4	Spr/Fall	2/Spr	E	CS102A CS203	CSE
CS303	Artificial Intelligence	3	1	4	Fall	3/Fall	E	MA212 CS102A CS203	CSE
CS306	Data Mining	3	1	4	Spr	3/Spr	E	CS203B	CSE
MA201b	Ordinary Differential Equations B	4		4	Spr/Fall	2/Spr	B/E	MA102B	MATH
MA305	Numerical Analysis	3		3	Fall	3/Fall	B	MA203a or MA213-16	MATH
MA206	Mathematical Modelling	3		3	Spr	3/Spr	B	MA201a or MA201b	MATH
MA333	Introduction to Big Data Science	3		3	Fall	3/Spr	B	MA215 or MA212	MATH
BIO211	Basic Synthetic Biology and Laboratory	2	1	3	Smr	1/Smr	B	BIO103	BIO
BIO203	Microbiology	3		3	Spr/Fall	2/Fall	B/E	NA	BIO
BIO205	Microbiology Laboratory	2	2	4	Spr/Fall	2/Fall	B/E	BIO104	BIO
BIO207-15	Plant Physiology	3		3	Fall	2/Fall	B	BIO103	BIO
BIO217	Biological Psychology	3		3	Fall	2/Fall	B	BIO103	BIO
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	4	Spr	2/Spr	B/E	BIO104 BIO201	BIO
BIO303	Genetics Laboratory	2	2	4	Spr	2/Spr	B/E	BIO222 BIO301	BIO
BIO308	Frontier in Life Sciences Seminar and Journal Club	2		2	Spr	2/Spr	B	NA	BIO
BIO208	Cell Biology Laboratory	2	2	4	Spr/Fall	3/Fall	B/E	BIO206-15	BIO
BIO311-14	Animal Physiology	3		3	Spr/Fall	3/Fall	B/E	NA	BIO
BIO332	Stem Cell and Regenerative Medicine	2		2	Fall	3/Fall	B	BIO206-15	BIO
BIO340	Protein Engineering	3		3	Fall	3/Fall	B	BIO201 BIO320	BIO
BIO401-16	Genetic Engineering	3		3	Spr/Fall	3/Fall	B/E	BIO320	BIO
BIO302	Modern Biotechnology	3		3	Spr	3/Spr	B	BIO201	BIO
BIO305	Model Organism and Developmental Biology	3		3	Spr	3/Spr	B	BIO103	BIO
BIO310	Neurobiology	3		3	Spr/Fall	3/Spr	B/E	BIO201	BIO



BIO323	Advanced Cell Biology	2		2	Spr	3/Spr	B	BIO206-15	BIO
BIO331	Protein Structure and Function	3	1	4	Spr/Fall	3/Spr	B	BIO201	BIO
BIO344	Modern Biotechnology Laboratory	2	2	4	Spr	3/Spr	B	BIO208	BIO
BIO348	Scientific Writing and Communication	1		1	Spr	3/Smr	E	NA	BIO
BIO405	Immunology	3		3	Fall	4/Fall	E	BIO206-15	BIO
BIO411-16	Dynamical Systems Simulation in Biology	3		3	Fall	4/Fall	B/E	BIO103 MA101B MA107B	BIO
BIO480B17	Projects of Science and Technology Innovation II	2	2	4	Fall/Spr/Smr		B/E	BIO480A17	BIO
BIO480C17	Projects of Science and Technology Innovation III	2	2	4	Fall/Spr/Smr		B/E	BIO480B17	BIO
<b>Total</b>		90	21	111					

Note: A minimum of 24 credits ( include at least 3 lab credits ) MUST be taken to fulfill Major Requirements.

**Table 3: Overview of Practice-Based Courses**

Course Code	Course Name	Credit	Lab Credits	Hours/week	Term	Advised term to take the course	Instruction language	Prerequisite	Dept
CS102A	Introduction to Computer Programming A	3	1	4	Spr/Fall	1/Fall	B/E	NA	CSE
CS203B	Data Structures and Algorithm Analysis B	3	1	4	Fall	2/Fall	B/E	CS102A	CSE
CS205	C/C++ Program Design	3	1	4	Spr/Fall	2/Fall	E	NA	CSE
CS307	Principles of Database Systems	3	1	4	Spr/Fall	2/Fall	E	CS102A	CSE
CS208	Algorithm Design and Analysis	3	1	4	Spr/Fall	2/Spr	E	CS102A CS203	CSE
CS303	Artificial Intelligence	3	1	4	Fall	3/Fall	E	MA212 CS102A CS203	CSE
CS306	Data Mining	3	1	4	Spr	3/Spr	E	CS203B	CSE
CS307	Principles of Database Systems	3	1	4	Fall	2/Fall	B	CS102A	CSE
PHY104B	Experiment of Fundamental Physics	2	2	4	Spr/Fall	1/Spr		NA	PHY
BIO104	General Biology Laboratory	2	2	4	Spr/Fall	1/Spr	B/E	BIO102B or BIO103 or MED101	BIO
BIO211	Basic Synthetic Biology and Laboratory	2	1	3	Smr	1/Smr	B	BIO103	BIO
BIO205	Microbiology Laboratory	2	2	4	Spr/Fall	2/Fall	B/E	BIO104	BIO
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	4	Spr	2/Spr	B/E	BIO104 BIO201	BIO
BIO303	Genetics Laboratory	2	2	4	Spr	2/Spr	B/E	BIO222 BIO301	BIO
BIO306	Bioinformatics	4	2	6	Spr	3/Spr	B	BIO309	BIO
BIO208	Cell Biology Laboratory	2	2	4	Spr/Fall	3/Fall	B/E	BIO206-15	BIO
BIO309	Computational Biology	3	1	4	Fall	3/Fall	B	NA	BIO
BIO331	Protein Structure and Function	3	1	4	Spr/Fall	3/Spr	B	BIO201	BIO
BIO344	Modern Biotechnology Laboratory	2	2	4	Spr	3/Spr	B	BIO208	BIO
BIO480A 17	Projects of Science and Technology Innovation I	2	2	4	Fall/Spr/S mr	1/Smr	B/E	NA	BIO
BIO480B 17	Projects of Science and Technology Innovation II	2	2	4	Fall/Spr/S mr		B/E	BIO480A17	BIO
BIO480C 17	Projects of Science and Technology Innovation III	2	2	4	Fall/Spr/S mr		B/E	BIO480B17	BIO
BIO490	Thesis	8	8	16	Spr	4/Spr	B/E	NA	BIO
<b>Total</b>		61	40	101					

**Table 4: Overview of Course Hours and Credits**

<b>Course Category</b>	<b>Total Course Hours</b>	<b>Total Credits</b>	<b>Credit Requirements</b>	<b>Percentage of the Total*</b>
<b>General Education (GE) Required Courses (not including English courses)</b>	1072	50	50	36.2%
<b>General Education (GE) Elective Courses</b>			15	10.9%
<b>Major Foundational Courses</b>	400	22	22	15.9%
<b>Major Core Courses</b>	320	17	17	12.3%
<b>Major Elective Courses</b>	1776	90	24	17.4%
<b>Research Projects, Internship and Undergraduate Thesis/Projects</b>	320	10	10	7.2%
<b>Total (not including English courses)</b>	3856	187	138	100%

\* Percentage of the total= Credit requirements of each line / Total credit requirements

## Curriculum Structure of Bioinformatics

