

## 生物医学工程专业培养计划（四年制留学生班）

### Undergraduate Program for Specialty in Specialty in Biomedical Engineering (4-year schooling)

#### 一、培养目标

##### I. Program Objectives

面向生物医学前沿，培养具有坚实的专业知识基础和理工医多学科交叉背景的拔尖人才，成为世界生命与健康领域的顶尖科学家和未来引领者。

Facing the frontier of Biomedical, this program cultivates top-notch talents with solid professional knowledge and interdisciplinary background of science, engineering and medicine, whom will become the world's top scientists and future leaders in life science and healthcare.

#### 二、基本规格要求

##### II. Learning Outcomes

本专业学生应掌握扎实的数理化基础、系统的生物医学工程专业基础理论、知识和技能，具有良好的科学素质和创新创业能力。

毕业生应获得以下几方面的知识和能力：

1. 具有较好的人文艺术和社会科学素养，较强的社会责任感和良好的职业道德，良好的语言表达能力和人际交流能力；
2. 具有良好职业道德，在生命科学领域中理解并遵守职业道德和规范；
3. 具有好的团队意识和协作能力，能在多学科团队合作中承担个体、团队成员或负责人的角色；
4. 具备人文社科和经济管理科学的基本知识和综合素质；
5. 具备良好的自主学习和探索实践能力，以及较好的表达交流能力和计算机及信息技术的应用能力；
6. 具有国际视野、终生教育的意识和继续学习的能力；
7. 具有良好的创新意识和创业精神，以及批判性思维和可持续发展理念；
8. 扎实的数理化基础；
9. 具有生物医学、药学、信息科学等基本理论和基本技能；
10. 具有良好的文献检索、资料查询、和撰写科学论文的能力。

By the time of graduation, the students of this program are required to possess:

1. A knowledge foundation of liberal arts and social sciences, an understanding of social, professional and ethical responsibility, and an ability to communicate effectively in oral, written and visual forms;
2. Have the professional ethics, understand and abide the professional ethics and specification in life Sciences;
3. Have the good team work spirit and coordination ability, and could undertake the roles of individual, team member, or team leader under the background of multidisciplinary;
4. Have basic knowledge and comprehensive quality of humanities, social sciences and economic managements;

5. Have a good ability to self-learn and explore independently, as well as good communication skills and the ability to use computer and information technology;

6. International vision, a recognition of the need for lifelong learning, and an ability to engage lifelong learning to remain effective in a climate of continually emerging technologies;

7. Have a good sense of innovation and entrepreneurship, and critical thinking and sustainable development concept;

8. Have solid ground in mathematics, physics and chemistry;

9. Have fundamental theory and skills in the areas of biomedical, pharmacy, and information science;

10. Have good abilities to search academic literature, query information, and write scientific papers.

### 三、培养特色

#### III. Program Highlights

培养具有坚实的专业知识基础和理工医多学科交叉背景，强调宽口径培养，着眼全面提高学生的综合素质，培养具有创新能力的复合型国际人才。配备最顶尖的师资、最顶尖的学习科研条件、最顶尖的教辅团队。

To cultivate students a solid professional knowledge base and a multi-disciplinary background of science, engineering and medicine. The program emphasizes wide-caliber training, aims at improving students' comprehensive quality and cultivating compound talents with innovative ability. Equipped with the best teachers, the best conditions for learning and scientific research, the best teaching assistant team.

### 四、主干学科

#### IV. Main Disciplines

生物医学工程 Biomedical Engineering、前沿生命科学与技术 Frontier Life Science and Technology

### 五、学制与学位

#### V. Program Length and Degree

学制：四年

Duration: 4 years

授予学位：工学学士

Degrees Conferred: Bachelor of Engineering

### 六、学时与学分

#### VI. Credits Hours and Units

全英文授课生物医学工程专业（四年制留学生班）下设三个方向：智能医学工程、纳米医药与生物制药和人工智能生物信息与系统生物技术。各专业方向完成学业最低课内学分（含课程体系与集中性实践教学环节）要求：140 学分。其中，专业核心课程学分原则上不允许用其他课程学分进行学分冲抵和替代。

Biomedical Engineering (Four-year Program) is taught in English. It has three major directions: intelligent medical engineering, nanomedicine and biopharmaceuticals, and artificial intelligence bioinformatics and systems biotechnology. Minimum Credits of Curricular (Comprising course system and intensified internship practical training): 140 credits. Major-related core courses cannot be covered using credits from other courses in the program.

## 1. 课程体系学时与学分

Course Credits Hours and Units

课程类别		课程性质	学时/学分	占课程体系比例 (%)
素质教育通识课程		必修	704/42.5	30.1
学科基础课程		必修	568/31.4	24.3
专业课程	专业核心课程	必修	336/35	14.4
	专业选修课程	选修	192/21.3	8.2
集中性实践教学环节		必修	21w/9.5	23
合计			2000+21w/140	100

Course Type		Required / Elective	Hrs/Crs	Percentage (%)
Essential-qualities-oriented Education General Courses		Required	904/42.8	30.1
Basic Courses in Discipline		Required	568/31.4	24.3
Courses in Specialty	Common Core Courses	Required	336/35	14.4
	Specialty-Oriented Courses	Elective	192/21.3	18.2
Intensified Internship Practical Training		Required	21w/9.5	23
Total			2000+21w/140	100

## 2. 集中性实践教学环节周数与学分 (可拓展)

Weeks/Credits of Intensified Internship and Practical Training

实践教学环节名称	课程性质	周数/学分	占实践教学环节学时比例 (%)
科研认知训练	必修	2w/1	10.5
工程训练 (三)	必修	2w/1	10.5
工程训练 (八)	必修	1w/0.5	5.2
创新创业训练	必修	2w/1	10.5
毕业设计 (论文)	必修	12w/6	63.2
合计		23/9.5	100

Course Title	Required / Elective	Weeks/Credits	Percentage (%)
Scientific Research Cognitive Training	Required	2w/1	10.5
Engineering training (III)	Required	2w/1	10.5
Engineering Training (VIII)	Required	1w/0.5	5.2
Scientific Research Innovation Training	Required	2w/1	10.5
Undergraduate Thesis	Required	12w/6	63.2
Total		23/9.5	100

## 七、主要课程及创新 (创业) 课程

## VII. Main Courses and Innovation (Entrepreneurship) Courses

## (一) 主要课程 Main Courses

微积分 Calculus、概率论与数理统计 Probability and Statistics、数据库技术及应用 Technology and Application of Database、大学物理 College Physics、有机化学 Organic Chemistry、生物化学 Biochemistry、细胞生物学 Cellular Biology、分子生物学 Molecular Biology、解剖与生理学 Anatomy and Physiology、生物信息学 Bioinformatics、系统生物学 Systems Biology、生物信息资源与实践 Bioinformatics Resources & Practice、仪器分析 Instrumental Analysis、生物统计学 Biostatistics、生物芯片 Biochip、药物化学 Medicinal Chemistry、纳米药物制剂 Nanopharmaceuticals、纳米诊断与检测技术 Nano-diagnostic and Detection Technology、电路理论 Circuit Theory、模拟电子技术 Analogue Electronics、生物医学传感检测与仪器 Biomedical Sensing, Testing and Instrumentation、生物医学数字信号处理 Biomedical Digital Signal Processing、医学影像系统原理 Medical Imaging

System Principle、医学图像处理 Medical Image Processing、生物材料学 Biomaterials 等。

(二) 创新(创业)课程 Innovation (Entrepreneurship) Courses

行业产业认知实习 Industry Perceive Practice、专业创新创业训练 Specialty Innovation and Entrepreneurship Training。

### 八、主要实践教学环节(含专业实验)

#### VIII. Practicum Module (Experiments Included)

解剖与生理学实验 Experiments in Anatomy and Physiology、生物化学与分子生物学实验 Experiments in Biochemistry and Molecular Biology、工程训练(二) Engineering Training II、生产实习 Engineering Internship、学科交叉综合训练 Interdisciplinary Comprehensive Training、毕业设计 Undergraduate Thesis-----电路测试基础实验 Fundamentals of Circuit Testing Lab、电子测试与实验(一) Electronic Testing and Lab (I)、应用光子学基础实验 Experiments in Fundamentals of Applied、生物医学数字信号处理实验 Experiments in Biomedical Digital Signal Processing、系统生物学实验 Experiments in Systems Biology、遗传学实验 Experiments in Genetics、纳米药物制剂实验 Experiments in Nanopharmaceuticals、纳米生物材料实验 Experiments in introduction of Nano-biomaterials、纳米诊断与检测技术实验 Nano-diagnostic and detection technology Lab、生物医学传感检测与仪器实验 Experiments in Biomedical Sensing, Detection and Instrumentation、生物医学光子学实验 Experimental of Biomedical Photons、微机式医学仪器设计实验 Design of Microcomputer Based Medical Instrumentation Experiments、医学图像处理实验 Medical Image Processing Experiments、生物材料与组织工程实验 Experiments for Biomaterials and Tissue Engineering。

### 九、教学进程计划表

#### IX. Course Schedule

院(系): 生命科学与技术学院

专业: 生物医学工程

School (Department): School of Life Science & Technology

Major: Biomedical Engineering

课程类别 course type	课程性质 required/ elective	课程代码 course code	课程名称 course name	学时 hrs	学分 crs	其中 Including		设置学期 semester
						实验 exp.	上机 operation	
Essential- qualities- oriented Education General Courses 素质教育 通识课程	必修 Required	CHI0021	中国概况 Survey of China	32	2			2
	必修 Required	MAN2661	大学计算机基础 Introduction to Computer Technology	48	3		16	1
	必修 Required	CHI0011	初级汉语 Elementary Chinese	120	7.5			1
	必修 Required	EIC0031	微积分(六) Calculus (VI)	96	6			1
	必修 Required	EIC0041	微积分(七) Calculus (VII)	96	6			2
	必修 Required	EIC0061	线性代数 Linear Algebra	56	3.5			1
	必修 Required	EIC0071	复变函数与积分变换 Complex Functions and Integral Transforms	56	3.5			3
	必修 Required	EIC0081	概率论与数理统计 Probability and Statistics	56	3.5			2

续表

课程类别 course type	课程性质 required/ elective	课程代码 course code	课程名称 course name	学时 hrs	学分 crs	其中 Including		设置学期 semester
						实验 exp.	上机 operation	
	必修 Required	EIC0091	大学物理（六） Physics（VI）	96	6			1
	必修 Required	EIC0051	物理实验 Physics Experiments	48	1.5	48		2
学科基础课程 Discipline-Related General Courses	必修 Required	CHE0741	基础化学（二） Chemistry（II）	88	5.5	38		1
	必修 Required	CHE0801	有机化学 Organic Chemistry	64	4			2
	必修 Required	CHE0831	有机化学实验 Experiments in Organic Chemistry	32	1	32		2
	必修 Required	BIO0691	生物化学与分子生物学（一） Biochemistry and Molecular Biology（I）	56	3.5			3
	必修 Required	BIO0681	生物化学与分子生物学（二） Biochemistry and Molecular Biology（II）	32	2			4
	必修 Required	BIO0711	生物化学与分子生物学实验（一） Laboratory for Biochemistry and Molecular Biology（I）	24	0.8	24		3
	必修 Required	BIO0701	生物化学与分子生物学实验（二） Laboratory for Biochemistry and Molecular Biology（II）	24	0.8	24		4
	必修 Required	BIO0782	细胞生物学 Cellular Biology	56	3.5			3
	必修 Required	BIO0791	细胞生物学实验 Experiments in Cellular Biology	24	0.8	24		3
	必修 Required	EEE0641	电路理论（三） Circuit Theory（III）	64	4			3
	必修 Required	EEE0711	电路测试基础实验 Fundamentals of Circuit Testing Lab	32	1	32		3
	必修 Required	BIO2081	解剖与生理学 Anatomy and Physiology	64	4			5
	必修 Required	BIO2091	解剖与生理学实验 Laboratory for Anatomy and Physiology	32	1	32		5
学生从以下模块中选择一个模块后，则需要修完该模块全部核心课程								
智能医学工程核心课程 Major-specific Core Courses	选修 Elective	EIC0591	模拟电子技术（二） Analog Electronic Technology（II）	56	3.5			4
	选修 Elective	EIC0661	信号与线性系统 Signals and Linear System	64	4		8	4
	选修 Elective	BIO2391	应用光子学基础 Fundamentals of Applied Photonics	56	3.5			4

续表

课程类别 course type	课程性质 required/ elective	课程代码 course code	课程名称 course name	学时 hrs	学分 crs	其中 Including		设置学期 semester
						实验 exp.	上机 operation	
智能医学工程 核心课程 Major-specific Core Courses	选修 Elective	BIO2401	应用光子学基础实验 Experiments in Fundamentals of Applied Photonics	8	0.5	8		4
	选修 Elective	EIC0751	数字电路与逻辑设计 Digital Circuit and Logic Design	56	3.5			5
	选修 Elective	EIC0531	电子测试与实验（一） Electronic Testing and Lab（I）	56	1.8	56		5
	选修 Elective	BIO2281	生物医学数字信号处理 Biomedical Digital Signal Processing	48	3			5
	选修 Elective	BIO5451	生物医学光子学 Biomedical Photonics	32	2			5
	选修 Elective	BIO2261	生物医学传感检测与仪器 Biomedical Sensor, Testing and Instrumentation	40	2.5			6
	选修 Elective	BIO5621	医学图像处理 Medical Image Processing	32	2			7
	选修 Elective	BIO5641	医学图像处理实验 Medical Image Processing Experiments	24	0.8	24		6
	选修 Elective	BIO5681	组织工程导论 Introduction to Tissue Engineering	32	2			6
	选修 Elective	BIO5291	人工器官概论 Introduction to Artificial Organs	16	1			6
	选修 Elective	BIO5361	生物材料学 Biomaterials	48	3			5
	选修 Elective	EIC5761	C 语言程序设计 C Programming	64	4		24	2
	选修 Elective	BIO2441	基础信息论 Fundamentals of Information Theory	40	2.5			4
	选修 Elective	BIO2431	现代编程和人工智能 Introduction to Artificial Intelligence Theory	48	3			6
	选修 Elective	BIO2382	仪器分析 Instrumental Analysis	56	3.5			4
选修 Elective	BIO5631	医学影像系统原理 Principles of Medical Imaging Systems	32	2			6	
人工智能生物信息 与系统生物技术 核心课程 Major-specific Core Courses	选修 Elective	EIC0691	数据结构与算法 Data Structure and Algorithm	56	3.5		16	4
	选修 Elective	BIO2382	仪器分析 Instrumental Analysis	56	3.5			4
	选修 Elective	BIO2231	生物信息学 Bioinformatics	56	3.5		16	4
	选修 Elective	BIO2352	系统生物学 Systems Biology	56	3.5			5
	选修 Elective	BIO0161	生物统计学* Biostatistics	56	3.5			5

续表

课程类别 course type	课程性质 required/ elective	课程代码 course code	课程名称 course name	学时 hrs	学分 crs	其中 Including		设置学期 semester
						实验 exp.	上机 operation	
人工智能生物信息与系统生物技术核心课程 Major-specific Core Courses	选修 Elective	BIO2011	定量生理学 Quantitative Physiology: Cells & Tissues	32	2			6
	选修 Elective	BIO2331	微生物学 Microbiology	48	3			6
	选修 Elective	BIO2341	微生物学实验 Experiments in Microbiology	32	1	32		6
	选修 Elective	BIO2212	生物芯片 BioChip	56	3.5			7
	选修 Elective	BIO0511	生物医学工程与信息技术概论 Introduction to Biomedical Engineering and Information Technology	16	1			4
	选修 Elective	BIO0181	组学数据分析和可视化* Analysis and Visualization of Multi-omics Data	56	3.5			7
	选修 Elective	BIO2261	生物医学传感检测与仪器 Biomedical Sensor, Testing and Instrumentation	40	2.5			6
纳米医药与生物制药核心课程 Major-specific Core Courses	选修 Elective	BIO0821	药物化学 Medicinal Chemistry	48	3			3
	选修 Elective	BIO2131	纳米药物制剂 Nanopharmaceuticals	32	2			5
	选修 Elective	BIO2131	纳米药物制剂实验 Experiments of Nanopharmaceuticals	32	1	32		5
	选修 Elective	BIO2111	纳米生物材料 Introduction of Nano-biomaterials	32	2			5
	选修 Elective	BIO2121	纳米生物材料实验 Exp. In Introduction of Nano-biomaterials	32	1	32		5
	选修 Elective	BIO0161	生物统计学* Biostatistics	56	3.5			5
	选修 Elective	BIO2151	纳米诊断与检测技术 Nano-diagnostic and Detection Technology	32	2			7
	选修 Elective	BIO2161	纳米诊断与检测技术实验 Exp. of Nano-diagnostic and Detection Technology	32	1	32		7
	选修 Elective	BIO5231	免疫学（理论课与相应实验课须打包共选） Immunology	32	2			4
	选修 Elective	BIO5241	免疫学实验 Immunology Lab	24	0.8	24		4
	选修 Elective	BIO2331	微生物学 Microbiology	48	3			6
	选修 Elective	BIO2341	微生物学实验 Experiments in Microbiology	32	1	32		6
	选修 Elective	EIC0691	数据结构与算法 Data Structure and Algorithm	56	3.5		16	4

续表

课程类别 course type	课程性质 required/ elective	课程代码 course code	课程名称 course name	学时 hrs	学分 crs	其中 Including		设置学期 semester
						实验 exp.	上机 operation	
	选修 Elective	BIO2382	仪器分析 Instrumental Analysis	56	3.5			4
	选修 Elective	BIO2231	生物信息学 Bioinformatics	56	3.5		16	4
	选修 Elective	BIO5681	组织工程导论 Introduction to Tissue Engineering	32	2			6
专业选修课程 Major-specific Elective	选修 Elective	MAT0701	数理方程与特殊函数 Mathematical Physics Equation and Special Function	40	2.5			4
	选修 Elective	BIO5271	纳米生物医学分析技术 Nano-biomedical Analytical Technology	32	2			5
	选修 Elective	BIO5571	新材料概论 Introduction to Advanced Materials	32	2			5
	选修 Elective	BIO5531	文献阅读与论文写作 Scientific Literature Reading and Writing	32	2			5
	选修 Elective	BIO5091	蛋白质组学 Proteomics	32	2			7
	选修 Elective	BIO5301	神经生物学 Neurobiology	32	2			7
	选修 Elective	BIO5201	结构生物学 Structure Biology	32	2			7
	选修 Elective	BIO5211	结构生物学实验 Structure Biology Experiments	32	1	16	16	6
	选修 Elective	BIO5071	代谢生理与代谢工程 Metabolic Physiology and Metabolic Engineering	32	2			6
	选修 Elective	BIO5521	微弱信号获取方法 Acquisition Method of Weak Signal	32	2			7
	选修 Elective	BIO5341	生物材料的分子结构 Molecular Structure of Biological Materials	32	2			6
	选修 Elective	BIO5061	超声概论 Introduction to Ultrasound	32	2			6
	选修 Elective	EIC0691	数据结构与算法 Data Structure and Algorithm	56	3.5		16	4
	选修 Elective	BIO0031	计算机网络 Computer Network	48	3			4
	选修 Elective	AUT5481	人工智能 Artificial Intelligence	32	2			5
	选修 Elective	BIO5501	微机式医学仪器设计 Design of microcomputer- Based Medical Instrumentation	40	2.5			6
	选修 Elective	BIO5051	PET 概论 Fundamentals of PET	32	2			6
选修 Elective	BIO5921	组织工程与人工器官 Tissue Engineering & Artificial Organs	32	2			7	

续表

课程类别 course type	课程性质 required/ elective	课程代码 course code	课程名称 course name	学时 hrs	学分 crs	其中 Including		设置学期 semester
						实验 exp.	上机 operation	
实践环节 Major-specific Elective	必修 Elective	BIO3671	科研认知训练 Scientific Research Cognitive Training	2w	1			2
	必修 Elective	ENG3541	工程训练（三） Engineering Training (III)	2w	1			3
	必修 Elective	ENG3571	工程训练（八） Engineering Training (VIII)	1w	0.5			4
	必修 Elective	BIO3661	科研创新训练 Scientific Research Innovation Training	2w	1			4-6
	必修 Elective	BIO3511	毕业设计（论文） Undergraduate Thesis	12w	6			8