Biotechnology Foundations in Health and Medical Sciences

8344/36 weeks

Table of Contents

Acknowledgments ................................................................................................................................... 1
Course Description .................................................................................................................................. 2
Task Essentials Table .............................................................................................................................. 2
Curriculum Framework ........................................................................................................................... 4
Exploring Foundations in Biotechnology ................................................................................................. 4
Investigating Genetic Engineering ........................................................................................................... 6
Preparing for Biotechnology Experiences ................................................................................................ 8
Examining the Role of Biotechnology and Bioinformatics in Medicine .................................................. 11
Understanding Bioengineering ................................................................................................................ 15
Examining Social, Legal, and Ethical Aspects of Biotechnology ............................................................ 16
SOL Correlation by Task ....................................................................................................................... 19
Appendix: Credentials, Course Sequences, and Career Cluster Information ........................................... 22

Acknowledgments

The components of this instructional framework were developed by the following curriculum
development panelists:

- Myron Blosser, Codirector, Governor’s STEM Academy, Harrisonburg High School, Harrisonburg City Public Schools
- Faison Dana, Assistant Professor of Biology, Blue Ridge Community College, Weyers Cave
- Mary Klinger, Crosby High School, Chesterfield County Public Schools
- Amy White, Dean, School of Science, Technology, Engineering, and Mathematics, Virginia Western Community College, Roanoke

Correlations to the Virginia Standards of Learning were reviewed and updated by the following:

- Leslie R. Bowers, English Teacher (ret.), Newport News Public Schools
Course Description

Suggested Grade Level: 10 or 11 or 12

This course focuses on various cutting-edge technologies and techniques relevant in the field of health and medical sciences. Students will explore the interconnected health of all organisms and the environment. Students will explore deoxyribonucleic acid (DNA) analysis, bioinformatics, and ethical considerations in biotechnology. Students will gain insight and understanding about biotechnology career fields in health and medical sciences.

Task Essentials Table

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential.
- Tasks/competencies designated by empty-circle icons (○) are optional.
- Tasks/competencies designated by minus icons (⊖) are omitted.
- Tasks marked with an asterisk (*) are sensitive.
<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exploring Foundations in Biotechnology</strong></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Define <em>biotechnology</em>.</td>
</tr>
<tr>
<td>40</td>
<td>Outline biotechnology milestones.</td>
</tr>
<tr>
<td>41</td>
<td>Identify careers related to medical biotechnology.</td>
</tr>
<tr>
<td><strong>Investigating Genetic Engineering</strong></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Define <em>genetic engineering</em>.</td>
</tr>
<tr>
<td>43</td>
<td>Develop a historic timeline of genetic engineering milestones.</td>
</tr>
<tr>
<td>44</td>
<td>Assess the importance of the genetic information contained in DNA.</td>
</tr>
<tr>
<td>45</td>
<td>Explain how genetic engineering is related to disease prevention.</td>
</tr>
<tr>
<td>46</td>
<td>Analyze social effects of genetic engineering.</td>
</tr>
<tr>
<td><strong>Preparing for Biotechnology Experiences</strong></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Demonstrate safe laboratory procedures.</td>
</tr>
<tr>
<td>48</td>
<td>Develop accuracy with measurements.</td>
</tr>
<tr>
<td>49</td>
<td>Demonstrate aseptic technique.</td>
</tr>
<tr>
<td>50</td>
<td>Describe tools used in biotechnology.</td>
</tr>
<tr>
<td><strong>Examining the Role of Biotechnology and Bioinformatics in Medicine</strong></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Define <em>One Health</em>.</td>
</tr>
<tr>
<td>52</td>
<td>Research the use of personalized medicine.</td>
</tr>
<tr>
<td>53</td>
<td>Identify examples of biotechnology in medicine.</td>
</tr>
<tr>
<td>54</td>
<td>Explain vaccine research and development.</td>
</tr>
<tr>
<td>55</td>
<td>Describe the effects of biotechnology on preventive health care.</td>
</tr>
<tr>
<td>56</td>
<td>Define <em>bioinformatics</em>.</td>
</tr>
<tr>
<td>57</td>
<td>Describe how bioinformatics is used.</td>
</tr>
<tr>
<td>58</td>
<td>Apply the tools of bioinformatics.</td>
</tr>
<tr>
<td><strong>Understanding Bioengineering</strong></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Define <em>bioengineering</em>.</td>
</tr>
<tr>
<td>60</td>
<td>Identify examples of biowarfare.</td>
</tr>
<tr>
<td><strong>Examining Social, Legal, and Ethical Aspects of Biotechnology</strong></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Define <em>bioethics</em>.</td>
</tr>
<tr>
<td>62</td>
<td>Describe the ethical, legal, and social effects of biomedicine.</td>
</tr>
<tr>
<td>63</td>
<td>Assess the effects of biotechnology (including gene therapy, patenting of living tissue, cloning).</td>
</tr>
<tr>
<td>Task No.</td>
<td>Task</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>64 ☐</td>
<td>Identify regulations that affect biotechnology.</td>
</tr>
<tr>
<td>65 ☐</td>
<td>Research the social effects of biotechnology.</td>
</tr>
</tbody>
</table>

Legend: ☐Essential ☐Non-essential ☐Omitted

Curriculum Framework

Exploring Foundations in Biotechnology

Task Number  39

Define biotechnology.

Definition

Definition should include the concept that biotechnology consists of any technique that uses living organisms (or parts of an organism)

- to make or modify products
- to improve plants or animals
- to modify microbes for specific use.

Process/Skill Questions

- What is the origin of the word biotechnology?
- What is an example of a biotechnology application?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number  40

Outline biotechnology milestones.

Definition
Outline may include a timeline with major events from the discovery of the cell to current knowledge (e.g., Mendel, Pasteur, germ theory of disease, Human Genome Project, synthetic genomics).

**Process/Skill Questions**

- How have historical events influenced and been influenced by biotechnology?
- What discoveries have increased the pace of breakthroughs in biotechnology?
- How is information from the Human Genome Project used in medicine today?

**HOSA Competitive Events (High School)**

HOSA Bowl (HB)

Biomedical Laboratory Science (BT)

**Task Number 41**

**Identify careers related to medical biotechnology.**

**Definition**

Identification should include careers within each of the following main areas:

- Biomedical research
- Medical and pharmaceutical product development
- Teaching
- Healthcare

For each career, the following should be addressed:

- Responsibilities
- Salaries
- Working environment
- Required education/training
- Job outlook

**Process/Skill Questions**

- What certifications, licenses, and degrees are available for careers in biotechnology?
- What is the outlook for careers in biotechnology?
- What resources have information about careers in biotechnology?
- What educational opportunities in biotechnology are available in higher education?
Investigating Genetic Engineering

Task Number 42

Define *genetic engineering*.

**Definition**

Definition should include the concept that *genetic engineering* involves the direct manipulation of an organism’s genome by introducing or eliminating specific genes using biotechnology.

**Process/Skill Questions**

- What are the building blocks of an organism’s genome?
- How are genes introduced or eliminated from the genome of an organism using biotechnology?

Task Number 43

Develop a historic timeline of genetic engineering milestones.

**Definition**

Development should include major events in genetic engineering, such as

- Mendel's discovery
- deoxyribonucleic acid (DNA) modeling
- gene therapy
- cloning.

**Process/Skill Questions**
• What was Mendel's contribution to the field of genetic engineering?
• What is the importance of DNA modeling?
• What is the importance of gene therapy in modern medicine?
• What is cloning, and why is it controversial?

HOSA Competitive Events (High School)

HOSA Bowl (HB)

Biomedical Laboratory Science (BT)

Task Number 44

Assess the importance of the genetic information contained in DNA.

Definition

Assessment should include the student constructing the components of a DNA model and explaining how DNA contains the genetic information for making proteins.

Process/Skill Questions

• How is the DNA molecule different in prokaryotes and eukaryotes?
• What are the components of a DNA molecule?
• How does DNA direct the formation of proteins?
• How is gene expression a regulatory mechanism?
• How does DNA affect the genetic makeup of a living organism?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 45

Explain how genetic engineering is related to disease prevention.

Definition

Explanation should include current information on the contribution of genetic engineering in developing disease prevention through diagnostics and therapeutics.

Process/Skill Questions
• How is genetic engineering used to diagnose disease?
• How is genetic engineering used to treat disease?

HOSA Competitive Events (High School)
Biomedical Laboratory Science (BT)

Task Number 46
Analyze social effects of genetic engineering.

Definition
Analysis should include implications such as

• ethical
• humanitarian
• economic
• legal.

Process/Skill Questions

• Who benefits from genetic engineering?
• How do government regulations affect product development and distribution?
• How does consumer confidence affect product development and distribution?

HOSA Competitive Events (High School)
Biomedical Laboratory Science (BT)

Preparing for Biotechnology Experiences

Task Number 47
Demonstrate safe laboratory procedures.

Definition
Demonstration should

• reflect a knowledge of general safety rules (e.g., those related to fire, electricity, infection prevention, transmission of diseases), aseptic technique, and industry-specified guidelines
(e.g., Occupational Safety and Health Administration [OSHA] and Clinical Laboratory Improvement Amendment [CLIA])

- follow manufacturers' guidelines for equipment and material use
- include safety procedures related to the use and disposal of sharps, hazardous materials, and other items
- reflect knowledge of biosafety levels.

**Process/Skill Questions**

- What are specific rules and procedures involved in aseptic technique?
- Why are aseptic rules important?
- What is the *chain of infection*? Why is it important?
- What are appropriate cleanup procedures for hazardous materials?
- What are safety data sheets (SDS)? Why are they important?
- Why is documentation important to safety?

**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)

**Task Number 48**

**Develop accuracy with measurements.**

**Definition**

Development should include

- demonstration of pipetting and micropipetting
- use of a graduated cylinder
- use of a balance
- serial dilution
- preparation of experimental solutions.

**Process/Skill Questions**

- How should pipetting be demonstrated?
- How does one read volume on a graduated cylinder?
- What mathematical principles are applied when performing a serial dilution? What principles are applied when prepping solutions for use in the laboratory?

**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)
**Task Number 49**

**Demonstrate aseptic technique.**

**Definition**

Demonstration should include

- use of personal protective equipment (PPE)
- maintenance of an aseptic work environment.

**Process/Skill Questions**

- What is an example of an organism in each of the four biosafety levels?
- What restrictions exist within each of the four biosafety levels?
- How does one safely glove and deglove?

**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)

**Task Number 50**

**Describe tools used in biotechnology.**

**Definition**

Description should include listing tools and explaining the roles and importance of each. Tools may include

- gel electrophoresis
- polymerase chain reaction (PCR)
- DNA sequencing
- gene editing
- bioinformatics
- microarray
- enzyme-linked immunosorbent assay (ELISA).

Teacher Resource: [Bacterial Identification Virtual Lab](https://www.biointeractive.org), BioInteractive

**Process/Skill Questions**

- What is GenBank? What is the role of databases such as this?
- How is bioinformatics used?
- What are the effects of CRISPR in medicine?
Examining the Role of Biotechnology and Bioinformatics in Medicine

Task Number 51

Define *One Health.*

Definition

Definition should include the concept that *One Health* is a collaborative, multisectoral, and transdisciplinary approach—working at the local, regional, national, and global levels—with the goal of achieving optimal health outcomes, recognizing the interconnection between people, animals, plants, and their shared environment. CDC’s One Health Office leads the agency’s efforts in the United States and abroad.

Teacher Resources:

- [Centers for Disease Control and Prevention (CDC) One Health](https://www.cdc.gov/onehealth)

Process/Skill Questions

- How do antibiotics in animal feed affect human health?
- What is antibiotic resistance, and how does it come about? What are its implications?

Task Number 52

Research the use of personalized medicine.

Definition

Research should include

- the definition of *personalized medicine*
- an example of the application of personalized medicine
- the necessary elements to the use of personalized medicine
• the benefits and risks of personalized medicine.

Process/Skill Questions

• What is personalized medicine?
• What biotechnology tools are used in personalized medicine?
• What are designer drugs?
• How does a drug affect a patient and treatment?
• What are the positive and negative effects of genetic applications in pharmacology on a patient?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 53

Identify examples of biotechnology in medicine.

Definition

Identification should include historical, societal, cultural, and financial examples of biotechnology in the medical fields.

Process/Skill Questions

• What medical discoveries would be categorized under biotechnology as opposed to biomedicine?
• How has biotechnology in medicine improved society?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 54

Explain vaccine research and development.

Definition

Explanation should include current information on the contributions of biotechnology to the development and improvement of vaccines.

Process/Skill Questions
• How does industry develop new vaccines?
• How can biotechnology improve the effectiveness of vaccines?
• How are vaccines an example of preventive health care?

HOSA Competitive Events (High School)
Biomedical Laboratory Science (BT)

Task Number  55

Describe the effects of biotechnology on preventive health care.

Definition
Description should include examples of biotechnology-related ethical, legal, and social issues in preventive health care, as well as new advances in the preventive healthcare field.

Process/Skill Questions

• How has the Human Genome Project affected immunology?
• How have society and governmental influences affected preventive health care?
• What are basic preventive healthcare processes, and what is their relation to biomedicine?

HOSA Competitive Events (High School)
Biomedical Laboratory Science (BT)

Task Number  56

Define bioinformatics.

Definition
Definition should include the concept that bioinformatics is the science of recognizing meaningful patterns within large pools of biological data using computing tools.

Teacher Resource: NIH glossary entry for bioinformatics

Process/Skill Questions

• What is annotation in the context of bioinformatics?
• How are various disciplines (i.e., math, computer science, biology) involved in bioinformatics?
- What is *data science*? How is it related to bioinformatics? What is *metadata*?

**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)

**Task Number  57**

**Describe how bioinformatics is used.**

**Definition**

Description should include

- comparative uses
- diagnostic uses.

**Process/Skill Questions**

- How is the human genome information important?
- How are protein information databases important?
- Why is it important to be able to compare genomics across species?

**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)

**Task Number  58**

**Apply the tools of bioinformatics.**

**Definition**

Application should include

- comparing DNA sequences across various individuals and species
- comparing genomics with proteomics
- identifying susceptibility to disease
- diagnosing disease
- identifying evolutionary connections by comparing the same gene across two or more species.

**Process/Skill Questions**

- How can bioinformatic data be used to diagnose disease?
• What are the limitations of bioinformatics?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Understanding Bioengineering

Task Number 59

Define *bioengineering*.

Definition

Definition should explain that *bioengineering* is the design and manipulation of materials and organisms to create new products for medical applications.

Process/Skill Questions

• What are examples of bioengineered products in the field of medicine?
• What are ethical and legal issues associated with bioengineering?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 60

Identify examples of biowarfare.

Definition

Identification should include

• the history of biowarfare
• applications of biowarfare
• circumstances surrounding the use of biowarfare
• the use of PPE.

Process/Skill Questions

• Why and how is PPE used in biowarfare?
- Why is a knowledge of biotechnology important for military leaders, other military personnel, and for civilians?
- How is biotechnology used to combat biowarfare? (e.g., airborne, waterborne, food safety)?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Examining Social, Legal, and Ethical Aspects of Biotechnology

Task Number 61

Define bioethics.

Definition

Definition should include the standard description of ethics and the relationship of biotechnology to ethics. Definition should also include social, economic, religious, and political perspectives.

Process/Skill Questions

- Why does the study of biotechnology require the study of ethics?
- What are prominent ethical issues raised by biotechnology?
- How are ethics different from laws?
- Why are ethical principles essential?
- Why are there differences in ethical principles from one person or group to another?
- Whose ethics should guide biotechnology, and why?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 62

Describe the ethical, legal, and social effects of biomedicine.

Definition

Description should
• address the ethical, legal, and social effects of biomedicine throughout history
• include the ethical decision-making processes involving governmental impacts on biomedical research.

Process/Skill Questions

• What are the positive and negative effects of genetic selection, gene therapy, and cloning?
• What are examples of negative effects of biomedicine?
• How is legislation developed and influenced by biomedicine?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 63

Assess the effects of biotechnology (including gene therapy, patenting of living tissue, cloning).

Definition

Assessment should include

• historical impacts (e.g., eugenics)
• current impacts (e.g., gene therapy, patenting DNA sequences, cloning, synthetic genomics)
• positive and negative impacts.

Process/Skill Questions

• What are the implications from cloning insulin?
• How has society benefited from biotechnology?
• How has biotechnology been affected by society?
• What is gene therapy meant to do?
• What is cloning?
• How and why are patents given to living tissue products and gene products?
• Who was Henrietta Lacks?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)
**Task Number  64**

**Identify regulations that affect biotechnology.**

**Definition**

Identification should include

- legislation
- safety guidelines
- ways that private and government organizations and business and industry influence the regulation of biotechnology.

**Process/Skill Questions**

- What are the regulatory agencies and organizations that influence biotechnology? How do they influence it?
- Why do these regulatory agencies and organizations regulate biotechnology?
- What are the advantages and disadvantages of biotechnology regulations from the consumer's perspective?

**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)

**Task Number  65**

**Research the social effects of biotechnology.**

**Definition**

Research should include

- positive and negative effects
- desired and undesired effects
- cultural, financial, political, ethical, legal, and other effects.

**Process/Skill Questions**

- How is biotechnology interrelated with ethical, legal, and social issues?
- When making biotechnology decisions, why is it important to include cultural issues in the decision-making process?
- What are historical examples of the social effects of biotechnology decisions or events?
- What is the role of biotechnology in different countries?
- How is biotechnology research and development funded?
- What is the effect of marketing on biotechnology research?

**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)

**SOL Correlation by Task**

<table>
<thead>
<tr>
<th>Exploring Foundations in Biotechnology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>39</strong></td>
<td><strong>Define biotechnology.</strong></td>
</tr>
<tr>
<td><strong>40</strong></td>
<td><strong>Outline biotechnology milestones.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>41</strong></td>
<td><strong>Identify careers related to medical biotechnology.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investigating Genetic Engineering</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>42</strong></td>
<td><strong>Define genetic engineering.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>43</strong></td>
<td><strong>Develop a historic timeline of genetic engineering milestones.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>44</strong></td>
<td><strong>Assess the importance of the genetic information contained in DNA.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>45</strong></td>
<td><strong>Explain how genetic engineering is related to disease prevention.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>46</strong></td>
<td><strong>Analyze social effects of genetic engineering.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| Preparing for Biotechnology Experiences |  |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
|47 | Demonstrate safe laboratory procedures. | English: 10.5, 11.5, 12.5  
Science: CH.1, BIO.1 |
|48 | Develop accuracy with measurements. | English: 10.1, 10.5, 11.1, 11.5, 12.1, 12.5  
Science: CH.1, CH.4 |
|49 | Demonstrate aseptic technique. | English: 10.5, 11.5, 12.5 |
|50 | Describe tools used in biotechnology. | English: 10.5, 11.5, 12.5  
Science: BIO.5 |
|51 | Define One Health. | English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5  
History and Social Science: Govt 7, 8, 9 15, 16 |
|52 | Research the use of personalized medicine. | English: 10.8, 11.8, 12.8 |
|53 | Identify examples of biotechnology in medicine. | English: 10.5, 11.5, 12.5  
History and Social Science: WHII 4, 8  
Science: BIO.5 |
|54 | Explain vaccine research and development. | English: 10.5, 11.5, 12.5 |
|55 | Describe the effects of biotechnology on preventive health care. | English: 10.5, 11.5, 12.5  
History and Social Science: Govt 9, 15, 16  
Science: BIO.5 |
|57 | Describe how bioinformatics is used. | English: 10.5, 11.5, 12.5 |
|58 | Apply the tools of bioinformatics. | English: 10.5, 11.5, 12.5 |
Science: BIO.5 |
|   | Identify examples of biowarfare. | English: 10.5, 11.5, 12.5  
**History and Social Science:** WG 17; WHII 4, 8, 14; VUS 14 |

**Examining Social, Legal, and Ethical Aspects of Biotechnology**

|   | Define *bioethics*. | English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5  
**History and Social Sciences:** Govt 9, 15, 16  
**Science:** BIO.5 |
|   | Describe the ethical, legal, and social effects of biomedicine. | English: 10.5, 11.5, 12.5  
**History and Social Sciences:** Govt 9, 15, 16 |
|   | Assess the effects of biotechnology (including gene therapy, patenting of living tissue, cloning). | English: 10.5, 11.5, 12.5  
**History and Social Sciences:** VUS 11  
**Science:** BIO.5 |
|   | Identify regulations that affect biotechnology. | English: 10.5, 11.5, 12.5  
**History and Social Sciences:** Govt 7, 8, 9, 113, 15, 16 |
|   | Research the social effects of biotechnology. | English: 10.8, 11.8, 12.8 |
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials (Only apply to 36-week courses)

- College and Work Readiness Assessment (CWRA+)
- National Career Readiness Certificate Assessment
- Workplace Readiness Skills for the Commonwealth Examination

Concentration Sequences

A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.

- Biomedical Technician (8347/36 weeks)
- Forensic Technology (8409/36 weeks)
- Introduction to Health and Medical Sciences (8301/18 weeks)
- Introduction to Health and Medical Sciences (8302/36 weeks)
- Medical Laboratory Technology I (8377/36 weeks)
- Medical Terminology (8383/36 weeks)
- Medical Terminology (8384/18 weeks)

Career Clusters, Pathways, and Occupations

<table>
<thead>
<tr>
<th>Career Cluster: Agriculture, Food and Natural Resources</th>
<th>Pathway</th>
<th>Occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Service Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Products and Processing Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power, Structural, and Technical Systems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Career Cluster: Health Science</th>
<th>Pathway</th>
<th>Occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotechnology Research and Development</td>
<td></td>
<td>Biochemist</td>
</tr>
<tr>
<td>Diagnostics Services</td>
<td>Cardiovascular Technologist</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer Tomography (CT) Technologist</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical, Clinical Laboratory Technician</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nuclear Medicine Technologist</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radiologic Technologist, Radiographer</td>
<td></td>
</tr>
<tr>
<td>Health Informatics</td>
<td>Epidemiologist</td>
<td></td>
</tr>
<tr>
<td>Support Services</td>
<td>Environmental Sampling and Analysis Technician</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical, Clinical Laboratory Technician</td>
<td></td>
</tr>
<tr>
<td>Pathway</td>
<td>Occupations</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------------------</td>
<td></td>
</tr>
<tr>
<td>Engineering and Technology</td>
<td>Agricultural Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biomedical Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental Engineer</td>
<td></td>
</tr>
<tr>
<td>Science and Mathematics</td>
<td>Biologist</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental Scientist</td>
<td></td>
</tr>
</tbody>
</table>