Health Science Cluster  
Essentials of Biotechnology  
Course Number: 25.57000

Course Description:  
This is the second course in the career pathway that introduces students to the broad understanding of the fundamentals of biotechnology and the impact on society. The knowledge and skills in this course provide a basic overview of current trends and careers in biotechnology, with an emphasis on basic laboratory skills, along with the business, regulatory, and ethical aspects of biotechnology. The prerequisite for the course is Introduction to Healthcare Science Technology.

Course Standard 1

HS-EB-1  
The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.

Standard: Demonstrate employability skills required by business and industry.  
The following elements should be integrated throughout the content of this course.

1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.

<table>
<thead>
<tr>
<th>Person-to-Person Etiquette</th>
<th>Telephone and Email Etiquette</th>
<th>Cell Phone and Internet Etiquette</th>
<th>Communicating At Work</th>
<th>Listening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with Your Boss</td>
<td>Telephone Conversations</td>
<td>Using Blogs</td>
<td>Improving Communication Skills</td>
<td>Reasons, Benefits, and Barriers</td>
</tr>
<tr>
<td>Interacting with Subordinates</td>
<td>Barriers to Phone conversations</td>
<td>Using Social Media</td>
<td>Effective Oral Communication</td>
<td>Listening Strategies</td>
</tr>
<tr>
<td>Interacting with Co-workers</td>
<td>Making and Returning Calls</td>
<td>Effective Written Communication</td>
<td>Ways We Filter What We Hear</td>
<td></td>
</tr>
<tr>
<td>Interacting with Suppliers</td>
<td>Making Cold Calls</td>
<td>Effective Nonverbal Skills</td>
<td>Developing a Listening Attitude</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Handling Conference Calls</td>
<td>Effective Word Use</td>
<td>Show You Are Listening</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Handling Unsolicited Calls</td>
<td>Giving and Receiving Feedback</td>
<td>Asking Questions</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nonverbal Communication</th>
<th>Written Communication</th>
<th>Speaking</th>
<th>Applications and Effective Résumés</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicating Nonverbally</td>
<td>Writing Documents</td>
<td>Using Language Carefully</td>
<td>Completing a Job Application</td>
</tr>
<tr>
<td>Reading Body Language and mixed Messages</td>
<td>Constructive Criticism in Writing</td>
<td>One-on-One Conversations</td>
<td>Writing a Cover Letter</td>
</tr>
<tr>
<td>Matching Verbal and Nonverbal communication</td>
<td>Small Group Communication</td>
<td>Things to Include in a Résumé</td>
<td></td>
</tr>
<tr>
<td>Improving Nonverbal Indicators</td>
<td>Large Group Communication</td>
<td>Selling Yourself in a Résumé</td>
<td></td>
</tr>
</tbody>
</table>
### Nonverbal Feedback
- Making Speeches
- Terms to Use in a Résumé
- Showing Confidence Nonverbally
- Involving the Audience
- Showing Assertiveness
- Answering Questions
- Organizing Your Résumé
- Visual and Media Aids
- Writing an Electronic Résumé
- Errors in Presentation
- Dressing Up Your Résumé

### 1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.

<table>
<thead>
<tr>
<th>Teamwork and Problem Solving</th>
<th>Meeting Etiquette</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking Creatively</td>
<td>Preparation and Participation in Meetings</td>
</tr>
<tr>
<td>Taking Risks</td>
<td>Conducting Two-Person or Large Group Meetings</td>
</tr>
<tr>
<td>Building Team Communication</td>
<td>Inviting and Introducing Speakers</td>
</tr>
<tr>
<td></td>
<td>Facilitating Discussions and Closing</td>
</tr>
<tr>
<td></td>
<td>Preparing Visual Aids</td>
</tr>
<tr>
<td></td>
<td>Virtual Meetings</td>
</tr>
</tbody>
</table>

### 1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.

<table>
<thead>
<tr>
<th>Problem Solving</th>
<th>Customer Service</th>
<th>The Application Process</th>
<th>Interviewing Skills</th>
<th>Finding the Right Job</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferable Job Skills</td>
<td>Gaining Trust and Interacting with Customers</td>
<td>Providing Information, Accuracy and Double Checking</td>
<td>Preparing for an Interview</td>
<td>Locating Jobs and Networking</td>
</tr>
<tr>
<td>Becoming a Problem Solver</td>
<td>Learning and Giving Customers What They Want</td>
<td>Online Application Process</td>
<td>Questions to Ask in an Interview</td>
<td>Job Shopping Online</td>
</tr>
<tr>
<td>Identifying a Problem</td>
<td>Keeping Customers Coming Back</td>
<td>Following Up After Submitting an Application</td>
<td>Things to Include in a Career Portfolio</td>
<td>Job Search Websites</td>
</tr>
<tr>
<td>Becoming a Critical Thinker</td>
<td>Seeing the Customer’s Point</td>
<td>Effective Résumés: Who Are They Seeking</td>
<td>Traits Employers are Seeking</td>
<td>Participation in Job Fairs</td>
</tr>
<tr>
<td>Managing</td>
<td>Selling Yourself and the Company</td>
<td>Matching Your Talents to a Job</td>
<td>Considerations Before Taking a Job</td>
<td>Searching the Classified Ads</td>
</tr>
<tr>
<td>Handling Customer Complaints</td>
<td>When a Résumé Should be Used</td>
<td></td>
<td></td>
<td>Using Employment Agencies</td>
</tr>
<tr>
<td>Strategies for Customer Service</td>
<td></td>
<td></td>
<td></td>
<td>Landing an Internship</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Staying Motivated to Search</td>
</tr>
</tbody>
</table>

### 1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.

<table>
<thead>
<tr>
<th>Workplace Ethics</th>
<th>Personal Characteristics</th>
<th>Employer Expectations</th>
<th>Business Etiquette</th>
<th>Communicating at Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrating Good Work Ethic</td>
<td>Demonstrating a Good Attitude</td>
<td>Behaviors Employers Expect</td>
<td>Language and Behavior</td>
<td>Handling Anger</td>
</tr>
<tr>
<td>Behaving Appropriately</td>
<td>Gaining and Showing Respect</td>
<td>Objectionable Behaviors</td>
<td>Keeping Information Confidential</td>
<td>Dealing with Difficult Coworkers</td>
</tr>
<tr>
<td>Maintaining Honesty</td>
<td>Demonstrating Responsibility</td>
<td>Establishing Credibility</td>
<td>Avoiding Gossip</td>
<td>Dealing with a Difficult Boss</td>
</tr>
<tr>
<td>Playing Fair</td>
<td>Showing Dependability</td>
<td>Demonstrating Your Skills</td>
<td>Appropriate Work Email</td>
<td>Dealing with Difficult Customers</td>
</tr>
<tr>
<td>Using Ethical Language</td>
<td>Being Courteous</td>
<td>Building Work Relationships</td>
<td>Cell Phone Etiquette</td>
<td>Dealing with Conflict</td>
</tr>
</tbody>
</table>
### December 2013

#### Course Standard 2

**HS-EB-2**

**Research required safety practices and procedures in the classroom and laboratory environment.**

- **2.1** Define health and safety regulations, including Occupational Health and Safety.

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**Showing Responsibility**

<table>
<thead>
<tr>
<th>Expected Work Traits</th>
<th>Teamwork</th>
<th>Time Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrating Responsibility</td>
<td>Teamwork Skills</td>
<td>Managing Time</td>
</tr>
<tr>
<td>Dealing with Information Overload</td>
<td>Reasons Companies Use Teams</td>
<td>Putting First Things First</td>
</tr>
<tr>
<td>Managing Change</td>
<td>Team Responsibilities</td>
<td>Overcoming Procrastination</td>
</tr>
<tr>
<td>Adopting a New Technology</td>
<td>Problems That Affect Teams</td>
<td>Organizing Workspace and Tasks</td>
</tr>
<tr>
<td>Expressing Yourself on a Team</td>
<td>Staying Organized</td>
<td>Finding More Time</td>
</tr>
<tr>
<td>Giving and Receiving Constructive Criticism</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Leaving a Job Ethically**

1. **Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills.**

- **Expected Work Traits**
  - Demonstrating Responsibility
  - Dealing with Information Overload
  - Managing Change
  - Adopting a New Technology

- **Teamwork**
  - Teamwork Skills
  - Reasons Companies Use Teams
  - Decisions Teams Make
  - Team Responsibilities
  - Problems That Affect Teams
  - Staying Organized
  - Giving and Receiving Constructive Criticism
  - Finding More Time

- **Time Management**
  - Managing Time
  - Putting First Things First
  - Overcoming Procrastination
  - Organizing Workspace and Tasks

2. **Present a professional image through appearance, behavior and language.**

- **On-the-Job Etiquette**
  - Using Professional Manners
  - Introducing People
  - Appropriate Dress
  - Business Meal Functions

- **Person-to-Person Etiquette**
  - Meeting Business Acquaintances
  - Meeting People for the First Time
  - Showing Politeness
  - Showing Professionalism

- **Communication Etiquette**
  - Creating a Good Impression
  - Keeping Phone Calls Professional
  - Proper Use of Work Email
  - Proper Use of Cell Phone
  - Proper Use in Texting

- **Presenting Yourself**
  - Looking Professional
  - Dressing for Success
  - Showing a Professional Attitude
  - Using Good Posture
  - Presenting Yourself to Associates

- **Support of CTAE Foundation Course Standards and Georgia Standards of Excellence L9-10RST 1-10 and L9-10WHST 1-10:**

  Georgia Standards of Excellence ELA/Literacy standards have been written specifically for technical subjects and have been adopted as part of the official standards for all CTAE courses.

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**Course Standard 2**

**HS-EB-2**

**Research required safety practices and procedures in the classroom and laboratory environment.**

- **2.1** Define health and safety regulations, including Occupational Health and Safety.
2.2 Administration (OSHA), Environmental Protection Agency (EPA), and Right to Know under OSHA regulations CFR 1910.1450.

2.3 Demonstrate procedures for documenting and reporting hazards and compliance.

2.4 Demonstrate health and safety practices, including use of Material Safety Data Sheets (MSDS), appropriate personal protective equipment (PPE) for the situation, emergency equipment, storage of chemicals, reagents and compounds, and maintenance of equipment.

2.5 Identify disaster preparedness procedures related to biotechnology related emergencies.

2.6 Exhibit standard precautions including proper storage, handling and disposal of biohazardous materials and biotechnology related emergencies.

2.7 Demonstrate following Standard Operating Procedures (SOP).

Course Standard 3
HS-EB-3
Identify the basis for biotechnology products and how such products affect the quality of life.

3.1 Describe the major scientific discoveries that lead to the development of recombinant DNA technology, including those in the fields of biology, chemistry, genetics, and microbiology, and explain how these advances in DNA technology are used today.

3.2 Identify past and current discoveries and developments in fields, such as agriculture, diagnostics, medical devices, pharmaceuticals, and research and development.

3.3 Classify the steps in production and delivery of a product made using recombinant DNA technology.

3.4 Discuss the implications of the genomics and proteomics on biotechnology and current healthcare.

Course Standard 4
HS-EB-4
Analyze careers in research and development, human health and diagnostics, biomanufacturing, environmental applications, and agriculture that utilize biotechnology.

4.1 Describe the educational requirements and responsibilities for various positions within the biotechnology industry.

4.2 Compare and contrast careers within academic, government, and private sectors.

4.3 Describe the role of Career Technical Student Organizations and their importance in leadership and career development.

Course Standard 5
HS-EB-5
Demonstrate how concepts of physical science connect to biochemical applications and techniques.

5.1 Calculate and prepare buffers, stock solutions, and reagents.

5.2 Apply the concepts of homeostasis, normality, and molar relationships to biochemical reactions.

5.3 Demonstrate reading and using graphs (using Microsoft Excel).

5.4 Demonstrate understanding of the role of solution pH on protein function and structure.

5.5 Analyze enzyme activity using assays for reactants and products.

5.6 Demonstrate proficiency in the use of basic laboratory equipment, electronic and analytical balances, autoclave, micropipetting, pouring agarose/agar, etc.

5.7 Apply electrophoresis, chromatography and microscopy techniques (including oil immersion) (spectrophotometry removed) to identify, separate and draw conclusions about biological molecules.
5.8 Demonstrate using antibody specificity for antigens to test for the presence of protein (e.g., ELISA) (Western Blot and antibody staining removed as they are covered in the Applications course).

### Course Standard 6

**HS-EB-6**

**Compare and contrast common organisms used in biotechnology and relate the manipulation of living organisms to product and procedure development.**

6.1 Demonstrate CPR, First Aid, and the AED utilizing current standards.

6.2 Distinguish between prokaryotic cells, eukaryotic cells, and non-living entities, such as viruses.

6.3 Describe the characteristics and life cycles of model organisms used in biotechnology, including bacteria (e.g., E. coli and insulin), fungi (e.g., yeasts and Aspergillus), and animals (e.g., C. elegans, fruit flies, and rodents).

6.4 Monitor how environmental factors affect the growth of cells and model organisms in the laboratory.

6.5 Apply the basic concepts of cell growth to manipulate cultures under aseptic conditions in the laboratory and demonstrate proficiency in gram staining, streaking culture plates and Stock bacterial cultures.

6.6 Identify bacteria using morphology and metabolic analysis.

6.7 Perform transformations, including competency, selection, antibiotic resistance, and analysis of transformation efficiency.

### Course Standard 7

**HS-EB-7**

**Analyze economic, social, ethical, and legal issues related to the use of biotechnology.**

7.1 Differentiate between moral, ethical, and legal biotechnology issues.

7.2 Research ethical issues presented by evolving science, including genetically modified foods, cloning, bioterrorism, gene therapy, and stem cells.

7.3 Compare and contrast attitudes about the use of biotechnology regionally, nationally, and internationally.

7.4 Evaluate the regulatory policies impacting biotechnology research (e.g., use of animals in research and applications of recombinant DNA).