

## Biochemistry of Foods

*Biochemistry of Foods* is a two semester course that provides students with opportunities to participate in a variety of activities including laboratory work. This is an in-depth study of the application of scientific principles integrating biology, chemistry, and microbiology in the context of foods and the global food industry. Students enrolled in this course formulate, design, and carry out food-based laboratory and field investigations as an essential course component. Students understand how biology, chemistry, and physics principles apply to the composition of foods, the nutrition of foods, food product development, food processing, food safety and sanitation, food packaging, and food storage. Students completing this course will be able to apply the principles of scientific inquiry to solve problems related to biology, physics, and chemistry in the context of highly advanced industry applications of foods.

- DOE Code:
- Recommended Grade Levels: 11-12
- Recommended Prerequisites: Chemistry, Biology, Nutrition and Wellness, Advanced Nutrition and Wellness
- Credits: 1 credit per semester, maximum of 2 semesters, maximum of 2 credits
- Fulfills a Core 40 Science requirement for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas or counts as an Elective or Directed Elective for any diploma

### Application of Content

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences.

### Career and Technical Student Organizations (CTSOs)

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in FCCLA, the CTSO for the most closely related subject matter areas.

### Suggested FCCLA Project Based Assessments

- Career Investigation
- Entrepreneurship
- Illustrated Talk
- Job Interview
- Nutrition and Wellness
- Food Innovations

<b>Content Standards</b>		
<b>Domain 1-Science of Food</b>		
<b>Core Standard 1.1 <i>Application of Scientific Information</i></b>		
FS-1.1.1	Demonstrate the functions of and proper techniques for using scientific equipment and food preparation equipment in the laboratory setting	
FS-1.1.2	Discuss how research developments lead to improvements in the food products and processing industry	
FS-1.1.3	Conduct research in food science applying scientific inquiry using appropriate laboratory methods, proper safety procedures, and accurate, objective data recording techniques and interpret results to improve food products	
FS-1.1.4	Model the application of chemistry, physics, and biology to food science	
FS-1.1.5	Demonstrate ability to differentiate between pure substances, solutions, and heterogeneous mixtures based on physical properties such as density, melting point, boiling point, and solubility	
FS-1.1.6	Explain how the chemical and physical properties of foods influence nutritional value and eating quality	
FS-1.1.7	Discuss common food constituents (e.g., proteins, carbohydrates, fats, vitamins, minerals) and their nutritional value	
<b>Domain 2-Basic Chemistry of Food</b>		
<b>Core Standard 2.1 <i>Energy: Matter in Motion</i></b>		
FS-2.1.1	Determine heat of fusion, heat of vaporization, and the relationship between heat and temperature	
FS-2.1.2	Explain the role of energy in metabolism and digestion	
<b>Core Standard 2.2 <i>Ions: Charged Particles in Solution</i></b>		
FS-2.2.1	Characterize acids and bases and demonstrate the role of pH in food preservation, baking, other food preparation applications, and in digestion.	
<b>Core Standard 2.3 <i>Water: The Universal Solvent</i></b>		
FS-2.3.1	Describe the ways water content of foods affects food reactions during preparation and storage processes.	
FS-2.3.2	Identify four functions of water in the body and the role of water in a nutritious diet.	
FS-2.3.3	Investigate the importance of oxidation and reduction in food science	
<b>Domain 3-Organic Chemistry</b>		
<b>Core Standard 3.1 <i>Simple and Complex Carbohydrates</i></b>		
FS-3.1.1	Summarize the process of carbohydrate production through the process of photosynthesis.	
FS-3.1.2	Identify the monosaccharides that are combined to form each of the disaccharides.	
FS-3.1.3	Analyze the chemical process and the products of hydrolysis of sucrose and lactose.	
FS-3.1.4	Analyze the characteristics and functions of the four categories of complex carbohydrates (starches, cellulose, gums, and pectins) in food preparation.	
FS-3.1.5	Evaluate the five physical properties of starch and liquid mixtures and their impact on the selection of starches to be used in food products.	
<b>Core Standard 3.2 <i>Enzymes: The Protein Catalyst</i></b>		

	FS-3.2.1	Describe enzymes, the changes they cause in foods and the physical and chemical parameters that affect enzymatic reactions
	FS-3.2.2	Explain how some foods are developed as a result of enzymatic activity
	FS-3.2.3	Compare the effectiveness of five methods of preventing enzymatic browning
<b>Core Standard 3.3 Lipids: Nature's Flavor Enhancers</b>		
	FS-3.3.1	Relate physical characteristics and dietary sources of saturated, monounsaturated, and polyunsaturated fatty acids to their performance in foods.
	FS-3.3.2	Examine and model the molecular structure of glycerides, phospholipids, and sterols and determine how structure affects their functions in food preparation.
	FS-3.3.3	Identify the cause and process of rancidity in lipids and methods used to slow this process
<b>Core Standard 3.4 Proteins: Amino Acids and Peptides</b>		
	FS-3.4.1	Analyze the amino acid classification system based on nutritional use and relationship of chemical properties of elements and side chains.
	FS-3.4.2	Describe the primary, secondary and tertiary structures of proteins, at least six factors that denature proteins, and the functions of protein in food production.
<b>Domain 4-Food Chemistry: The Microcomponents</b>		
<b>Core Standard 4.1 Micronutrients: Vitamins and Minerals</b>		
	FS-4.1.1	Explain the sources and functions of fat-soluble vitamins, water-soluble vitamins, major minerals, and trace minerals impact food processing and preservation methods have on the nutritive value of food and management of food-related disease.
	FS-4.1.2	Demonstrate techniques to reduce vitamin and mineral losses during food distribution, storage, and preparation.
<b>Core Standard 4.2 Phytochemicals</b>		
	FS-4.2.1	Analyze at least eight groups of phytochemicals, food sources for each group, and their role in disease prevention.
	FS-4.2.2	Evaluate the effects of acids, bases, heat, and mechanical processes on phytochemicals in fruits; vegetables, and dairy products.
<b>Core Standard 4.3 Food Analogs and Food Additives</b>		
	FS-4.3.1	Analyze the functions of food analogs and food additives and the advantages and disadvantages they provide for the food supply.
	FS-4.3.2	Evaluate a variety of food additives and analogs and their effects on flavor, texture, appearance, and nutritive value of a variety of foods.
	FS-4.3.3	Describe major chemical and physical properties of food systems that are important to food quality and sensory perception (PU – FS 16100)
	FS-4.3.4	Describe the chemical similarities and differences between sugars and artificial sweeteners in foods and food processing
<b>Domain 5-Biotechnology in Food Preservation and Packaging</b>		
<b>Core Standard 5.1 Thermal Preservation: Hot and Cold Processing</b>		
	FS-5.1.1	Describe food processing/preservation methods and packaging systems, including their application in the conversion of raw materials into food products
<b>Core Standard 5.2 Dehydration and Concentration: Controlling Water Activity</b>		
	FS-5.2.1	Analyze the effects of various methods of commercial and home dehydration on the quality of texture, flavor, appearance, and nutritive value of dried foods, food concentrates, and dehydrated food products.
<b>Core Standard 5.3 Trends in Food Preservation: Irradiation, Packaging, and Biotechnology</b>		
	FS-5.3.1	Use biotechnology to implement food preparation, production, and testing systems

	FS-5.3.2	Evaluate the effectiveness of irradiation, light exposure, and variations in temperature and humidity on bacteria growth, oxidative rancidity, and other spoilage indicators.
<b>Core Standard 5.4</b> <i>Students determine the effects of current governmental regulations on the food, ingredients, and additives that can be used within food preparations and ultimately for human nutrition</i>		
	FS-5.4.1	Analyze the effectiveness of a food product and processing company's Critical Control Point (CCP) procedures
	FS-5.4.2	Describe the role of food laws, regulations and regulatory agencies as they apply to food products, processing and food additives and dietary supplements.
	FS-5.4.3	Describe factors in planning and developing a new food product (e.g., regulation, creativity, and economics)
<b>Domain 6-Scientific and Sensory Evaluation</b>		
<b>Core Standard 6.1</b> <i>Effect of sensory evaluation</i>		
	FS-6.1.1	Illustrate physical, psychological, cultural, and environmental influences on food preferences and their impact on nutritional wellness.
	FS-6.1.2	Control variables that influence sensory perceptions and taste preferences through laboratory taste tests of food products and food analogs.
	FS-6.1.3	Perform sensory-testing and marketing functions to characterize and determine consumer preference and market potential
<b>Domain 7-Health, Safety, and Microbiology of Food</b>		
<b>Core Standard 7.1</b> <i>Microbiology of Food</i>		
	FS-7.1.1	Identify the three categories of microbes that have a positive impact on food
	FS-7.1.2	Examine the principles of fermentation
<b>Core Standard 7.2</b> <i>Health and Safety</i>		
	FS-7.1.3	Discuss the issues of safety and environmental concerns about foods and food processing
	FS-7.1.4	Explain techniques and procedures for the safe handling of food products
	FS-7.1.5	Evaluate food product handling procedures
	FS-7.1.6	Describe and interpret quality assurance test and apply corrective procedures.
	FS-7.1.7	Describe the effects food-borne pathogens have on food products and humans
	FS-7.1.8	Explain the importance of microbiological tests in food product preparation
	FS-7.1.9	Develop and demonstrate personal food selection and food handling habits that will minimize risk of contracting food-borne or water-borne disease
<b>Domain 8-Careers</b>		
<b>Core Standard 8.1</b> <i>Career Opportunities in Biochemistry and Food Science</i>		
	FS-8.1.1	Investigate food science and its role in the economy
	FS-8.1.2	Evaluate and explore the food science career opportunities
	FS-8.1.3	Demonstrate those qualities, attributes and skills necessary to succeed in a chosen career while effectively contributing to society