

Polymerase Chain Reaction—the Fundamental Platform of Rapid Pathogen Detection in Food and Food Production Systems

Learning Objectives—Lecture

The overall goal of this unit is to **understand** the premise of polymerase chain reaction (PCR), a technique which serves as the foundation of numerous technologies employed by food industry to detect foodborne pathogens.

1. Students will be able to **demonstrate** an understanding of the fundamental properties of the Central Dogma
2. Students will be able to **list** and **explain** the function of each component in a PCR reaction.
3. Students will be able to **depict** and **explain** the principle of “temperature cycling” and its role in synthetic DNA synthesis
4. Upon completion of this unit, students will be able to **design** “primers” to target and amplify a specific DNA sequence
5. At the end of this unit, students will be able to list examples of PCR –based foodborne pathogen detection currently utilized in the food industry

Learning Objectives—Laboratory

The overall goal of this laboratory unit is to utilize PCR to **identify** and **differentiate** human foodborne pathogens

6. Students will be able to **extract** DNA from bacterial cells using methodologies employed in industry
7. Students will be able to **successfully amplify** a specific target sequence of DNA by PCR from custom “primers” designed in the *lecture learning objective #4*
8. Students will **demonstrate** the principles of agarose gel electrophoresis and its purpose in PCR-based detection applications

Pulse Field Gel Electrophoresis—an Established Epidemiological Tool

Learning Objectives—Lecture

The overall goal of this unit is to **understand** the premise of pulse field gel electrophoresis (PFGE), a technique which serves as the key technique employed by governmental agencies, academia and the food industry to track and differentiate foodborne pathogens.

1. Students will be able to **demonstrate** an understanding of the separation of DNA using multiple electrical pulse angles.
2. Students will be able to **list** and **explain** the function of each component in a PFGE reaction.
3. Students will be able to **depict** and **explain** the principle of differential DNA band separation on a resultant gel.
4. At the end of this unit, students will be able to explain how PFGE is used for epidemiological studies and the tracing of the bacterial source for foodborne related illnesses.

Learning Objectives—Laboratory

The overall goal of this laboratory unit is to utilize PFGE to **identify** and **differentiate** human foodborne pathogens

5. Students will be able to **digest** DNA by using restriction enzymes and standardized extraction methods
6. Students will **develop** a familiarity with the Chef Mapper XA system, technology used by the Center for Disease Control as well as others involved with Food Safety.
7. Students will be able to **compare** varying PFGE samples by analyzing their specific band profile on a PFGE generated gel.