Miami Dade College

Course Description:

Prerequisite: BSC2427 , BSC2427L

Course Competency	Learning Outcomes
Competency 1: The student will demonstrate knowledge of the methods and applications of the history of modern cell and tissue culture and its relevance to research and biotechnology applications by:	
1. Describing the historical origins and landmarks of cell and tissue culture. 2. Comparing the advantages and disadvantages of in vitro cell and tissue culture over in vivo animal and plant studies. 3. Explaining how different scientific disciplines contributed to the development and evolution of the field of cell and tissue culture. 4. Listing examples of historic and contemporary products and applications of cell and tissue culture in the medical, pharmaceutical and basic science research fields.	
Competency 2: The student will demonstrate knowledge of the laboratory safety procedures by:	
1. Describing the elements of a safe laboratory environment and showing the location and purpose of laboratory safety equipment. 2. Describing Occupational Safety and Health Administration (OSHA) worker safety regulations and/or guidelines for the safe handling of biohazards. 3. Listing the potential safety hazards in a tissue culture laboratory; and implementing strategies for minimizing exposure. 4. Evaluating Material Safety Data Sheets (MSDS) and official regulatory compliance policies. 5. Demonstrating the safe use and proper storage of chemicals in the laboratory. 6. Explaining the purpose of laboratory attire and the level of protection requirements for various biohazard procedures. 7. Demonstrating proper handling, usage, storage, and disposal of hazardous materials, biological specimens and/or products. 8. Demonstrating the safe disposal of broken glassware and sharp instruments. 9. Designing a safety plan for a tissue culture laboratory. 10. Demonstrating proper safety procedures in handling emergency situations and contacting appropriate services and personnel.	
Competency 3: The student will demonstrate knowledge of the proper handling and operation of tissue culture and protein purification laboratory equipment, by:	
1. Microscopes and/or basic microscopic techniques 2. Evaluating technical issues and maintenance associated with the upkeep of laboratory equipment: service contracts, maintenance schedules, testing and validation. 3. Maintaining appropriate documentation in scientific notebooks and/or equipment log books. 4. Demonstrating the handling or operation of: Microscopes and/or basic microscopic techniques Laminar flow hood cabinets CO2 incubators and gas tanks Autoclaves Ultraviolet light sterilizing devices Pipettes and/or micropipetting devices Cryogenic freezer Centrifuges Mechanical and/or electrical balances Thermal chambers	

and/or water baths Thermometers Sub-zero freezers Vacuum pumps and/or devises Tissue culture plastic- and/or glass- ware. Tissue culture media and/or reagents Dissecting equipment pH meters, Electrodes Spectrophotometers Chromatography devices Electrophoresis equipment Gel-viewing/drying devices	
Competency 4: The student will demonstrate knowledge of cell and tissue culture maintenance techniques by:	
1. Explaining the environmental requirements for tissue culture in vitro, including: CO2, temperature, buffering, and pH culture media formulations and requirements defined and un-defined media growth factors, antibiotics, and/or supplements glass- or plastic-ware support systems. 2. Demonstrating aseptic technique. 3. Discussing protocols for tissue- and cellular dissociation. 4. Demonstrating primary cell cultures from tissue and/or explants by monitoring cell growth, observing of culture changes, and sub-culturing without contamination. 5. Describing possible effects of mycoplasma, fungal, or bacterial contaminations on experimental results and/or cellular behavior in vitro. 6. Determining cell counts and viability using hemocytometer and die-exclusion techniques. 7. Calculating appropriate cell concentrations for plating and propagation to maintain optimum cell concentrations for running stock and freezing. 8. Demonstrating cryopreservation techniques by successfully performing procedures for freezing and thawing cells. 9. Listing commercial repositories of cell lines and cell culture products.	
Competency 5: The student will demonstrate knowledge of mammalian cell and tissue culture techniques by:	
1. Comparing healthy, senescent and transformed cells cultured in vitro. 2. Explaining the processes of cellular division and growth in relation to the cell cycle and how these processes are influenced by internal and external factors. 3. Listing current methods used for the development of primary mammalian cell cultures in vitro. 4. Comparing the use of in vivo and in vitro cultures for the establishment, propagation and/or growth of cell, tissue and organ cultures. 5. Discussing protocols for cellular enrichment and characterization in mammalian cell cultures. 6. Explaining the development of cell lines from primary mammalian cell cultures. 7. Discussing the use of mammalian cell lines as models systems for normal and disease states.	
Competency 6: The student will demonstrate knowledge of in vitro micropropagation of plants by:	
1. Defining the concept of totipotency and its relevance to plant micropropagation in vitro. 2. Comparing different plant tissues and physiological processes relevant to plant tissue culture. 3. Explaining the environmental requirements for plant tissue culture in vitro. 4. Describing the basic methods of in vitro micropropagation used in agricultural research and/or the commercial production of high value horticultural species. 5. Establishing primary cell cultures from plant tissue and/or shoot explants.	
Competency 7: The student will demonstrate knowledge of the basic steps of protein purification by:	
1. Explaining the nature and structure of proteins. 2. Explaining the mechanisms by which proteins are denatured, their relationship to protein levels of organization, and their biological function. 3. Explaining the steps to follow in the design of a protocol for the isolation of a desired protein. 4. Explaining the use of protein identification assay(s) for the quantitative and/or qualitative determination of a specific protein. 5. Listing primary sources from which proteins can be isolated. 6. Discussing methods for the selective enrichment and/or over-expression of desired proteins.	

7. Evaluating preparative and analytical methods for the isolation and quantization of proteins. 8. Listing procedures to reduce and/or control the protein degradation or contamination. 9. Discussing conditions important in maintaining a stable environment for solubilized proteins in crude extracts. 10. Discussing strategies for the gross fractionation of properly stabilized crude cell homogenates or protein solutions through various physical and/or chemical methods. 11. Explaining at least three distinct selective methods useful for protein purification and identifying the basis of separation for each type.	
Competency 8: The student will demonstrate knowledge of basic preparative methods for concentrating proteins by:	
1. Differentiating between the methods used for detecting and separating proteins. 2. Surveying the methods for extraction, filtration, precipitation and desalting proteins. 3. Explaining the types of centrifugation instrumentation. 4. Using centrifugation to separate precipitated proteins from the supernatant. 5. Discussing the principles and operation of dialysis, diafiltration, ultrafiltration and tangential flow filtration. 6. Analyzing the solubilities of proteins for isolation purposes. 7. Calculating the amount of solid ammonium sulfate needed to raise a given volume of sample to a certain percentage of ammonium sulfate saturation. 8. Demonstrating ammonium sulfate precipitations. 9. Discussing the differences between Biuret, Lowry, and Bradford assays. 10. Demonstrating methods used for determining protein concentration.	
Competency 9: The student will demonstrate knowledge of protein purification and identification through the use of chromatographic techniques by:	
1. Listing the different kinds of column chromatography techniques. 2. Discussing the principles of column chromatography techniques. 3. Contrasting between the different column chromatography techniques. 4. Describing the stages of running a chromatography column. 5. Outlining a multi-step protein purification process at the manufacturing production scale. 6. Calculating the protein's activity, concentration, and/or recovery at the different stages of a multi-step purification process.	
Competency 10: The student will demonstrate knowledge of electrophoretic techniques for the analysis and characterization of proteins by:	
1. Discussing the practical aspects of electrophoresis such as staining and detecting bands, protein blotting and analysis of result. 2. Describing the basis of polyacrylamide gel electrophoresis (PAGE), SDS (sodium doecylsulfate) PAGE, native gel electrophoresis, isolectric focusing and 2D electrophoresis. 3. Comparing native gels and denaturing gels, non-reducing gels and reducing gels, gradient gels and straight gels, and between stacking gels and resolving gels. 4. Interpreting the banding patterns from any of the listed gel types, or combinations of gel types. 5. Performing Western Blotting to detect proteins that react with specific antibodies. 6. Comparing the spectroscopic methods to determine protein concentration. 7. Using spectroscopic techniques to determine protein concentration. 8. Discussing hazards associated with gel electrophoresis and the purpose of different ingredients in the gel recipes and in sample preparations.	
Competency 11: The student will demonstrate knowledge of protein structure determination resources by:	
1. Describing different techniques for the sequential analysis of amino acids in purified peptides and proteins.	

2. Using appropriate protein database and Web site resources used for comparative structure prediction. 3. Listing the basic operational strategies for protein structure determination. 4. Discussing the applications and /or benefits of protein structure models in terms of industrial applications, drug discovery, medicine and the pharmaceutical industry.	