BIOSCIENCE, 41.0100.00	
1.0	**MAINTAIN A SAFE WORK ENVIRONMENT**
1.1	Identify and wear appropriate lab attire and personal protective equipment (e.g., safety glasses or goggles, lab coat, gloves, closed-toe shoes)
1.2	Identify emergency contacts and practice emergency protocols (e.g., fire procedure, shower safety, eyewash practice, evacuation protocol)
1.3	Apply information from safety data sheets (SDSs) for all chemicals used in the lab (e.g., storage conditions, recommended PPE, first aid)
1.4	Explain the importance of routine maintenance of equipment and reporting unsafe or nonfunctioning equipment
1.5	Maintain equipment log (i.e., eye wash, autoclave, laminar flow hood)
1.6	Identify biological, biohazardous, and chemical materials and explain appropriate handling (i.e., body fluids, ethidium bromide, sodium hypochlorite)
1.7	Identify and comply with safety signs and symbols
1.8	Distinguish the characteristics of biosafety levels (e.g., BSL-1 to BSL-4)
1.9	Identify standard operating procedures (SOPs) for monitoring, using, storing, and disposal of biological, biohazardous, and chemical materials
1.10	Identify standard operating procedures (SOPs) for biological, biohazardous, and chemical spills and/or waste, including broken glass
2.0	**DEMONSTRATE STANDARD OPERATING PROCEDURES (SOPs) IN THE LABORATORY**
2.1	Identify and comply with state, local, and industry regulations (e.g., EPA, FDA, OSHA, NIH, AZDEQ)
2.2	Use industry terminology (e.g., cGMP, GLP, SOP, CIP, SIP)
2.3	Set up and maintain lab documentation according to standard operating procedures (SOPs) (e.g., paper and/or electronic notebook)
3.0	**DEMONSTRATE CRITICAL THINKING AND SCIENTIFIC PROBLEM-SOLVING SKILLS**
3.1	Identify and use industry-recognized observational methods and skills
3.2	Identify and structure tractable, easily managed and controlled questions showing evidence of observation and connection to prior knowledge
3.3	Develop and test hypotheses utilizing experimental design, distinguishing between controls and variables and use experimental, analytical, and statistical design

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3.4	Collect, record, and analyze data
3.5	Support conclusions based on evidence
3.6	Communicate results of scientific investigations in oral, written, and graphical form
4.0	**DEMONSTRATE RESEARCH AND INVESTIGATIVE SKILLS**
4.1	Develop and use relevant terminology found in scientific and technical literature
4.2	Identify and access scientific and technical literature, including patents, peer-reviewed articles, white papers, and technical bulletins, and summarize findings following the structure and convention of a scientific paper
4.3	Review scientific and technical literature and produce a literature review
4.4	Evaluate the scientific merit and commercial viability of prior work and its relevance to experimental design
5.0	**DEMONSTRATE ETHICAL AND LEGAL CONDUCT**
5.1	Examine codes of ethics and ethical protocols used by different organizations that apply to confidentiality and security
5.2	Identify behaviors and practices that could result in liability or negligence
5.3	Examine implications of bioethical issues (e.g., the use of GMOs, the HeLa privacy issue)
5.4	Apply risk management protocols to incident reporting
5.5	Comply with legal, regulatory, and accreditation standards or codes
5.6	Adhere to standards for harassment, labor, and employment laws (e.g., EPA, FDA, OSHA, NIH, AZDEQ)
6.0	**DEMONSTRATE QUALITY CONTROL PROCEDURES**
6.1	Perform quality tests on reagents prepared or used in the lab to ensure reproducibility (i.e., pH, conductivity, spectrophotometry)
6.2	Document results of quality testing by following standard operating procedures (SOPs)
6.3	Describe manufacturing practices pertaining to quality control (QC) (e.g., standards and control chart ramifications)
6.4	Demonstrate reproducibility from an SOP and characterize variation across samples (i.e., trend analysis)

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7.0	**UNDERSTAND THE ROLE OF LIVING ORGANISMS IN BIOSCIENCE RESEARCH**
7.1	Identify model organisms used in research
7.2	Identify proper use and limitations of living organisms, including alternatives when available
7.3	Examine local, state, and federal standards of practice for treatment, care, and maintenance of living organisms
7.4	Identify important cell lines and their uses (e.g., HeLa, CHO)
7.5	Propagate plant and animal samples used as models (e.g., *C. elegans*, Arabidopsis/Wisconsin Fast Plants)
8.0	**DEMONSTRATE BASIC LAB SKILLS IN THE USE OF EQUIPMENT AND INSTRUMENTATION**
8.1	Use software/hardware for scientific analyses and documentation (e.g., Excel, PowerPoint, Word)
8.2	Identify and demonstrate proper use of laboratory glassware
8.3	Identify and demonstrate proper use of laboratory balances
8.4	Identify and demonstrate proper use of micropipettes
8.5	Identify and demonstrate proper use of spectrophotometers to create a standard curve relating absorbance and concentration
8.6	Identify, balance, and operate centrifuges
8.7	Describe the purpose of and how to operate an autoclave
8.8	Describe and operate fume/laminar flow hoods
8.9	Prepare microscopic specimens and interpret results using appropriate microscopes (i.e., dissecting, compound, digital)
8.10	Conduct gram staining and interpret results
8.11	Identify and demonstrate proper use of hot plate/stirrers
8.12	Identify and demonstrate proper use of incubators, including shaking incubators
8.13	Identify and demonstrate proper use of water baths and heat blocks
8.14	Use a pH meter and explain the logarithmic nature of the pH scale

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8.15	Perform electrophoresis (e.g., vertical and horizontal)
8.16	Operate a thermal cycler
8.17	Perform column chromatography [e.g., thin layer chromatography (TLC) and column chromatography]
9.0	**DEMONSTRATE MICROBIOLOGY SKILLS**
9.1	Maintain lab and equipment hygiene
9.2	Identify, prepare, sterilize, dispense, and store media
9.3	Identify, propagate, and quantify microorganisms and cells
9.4	Identify techniques for short- and long-term cultures (e.g., stabs, slants, liquid nitrogen, glycerol stocks)
9.5	Isolate, maintain, and store pure cultures
9.6	Transform and maintain hosts (e.g., *E. coli*)
9.7	Decontaminate and dispose of equipment, glassware, and biologicals, including disinfection with 0.5% sodium hypochlorite solution and sterilization using the autoclave
10.0	**DEMONSTRATE PROTEIN TECHNIQUES**
10.1	Compare and contrast methods to detect specific proteins (e.g., Western Blot and ELISA)
10.2	Extract and precipitate proteins from cells
10.3	Separate and characterize proteins (e.g., column chromatography, SDS-PAGE)
10.4	Perform protein assays (i.e., Bradford and Lowry methods)
11.0	**DEMONSTRATE MATERIAL PREPARATION AND STORAGE**
11.1	Calculate and prepare solutions and buffers (e.g., M/V, %M/V, molarity)
11.2	Calculate and prepare dilutions, including specific and serial
11.3	Calculate the molar mass of a given compound using a Periodic Table of Elements
11.4	Label and store solutions and buffers (e.g., initials, dates, concentration, lots, storage conditions, sterility, hazards, special directions)

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11.5	Use scientific sources to find appropriate solution preparation protocols
11.6	Explain the control inventory process for materials and supplies
12.0	**DEMONSTRATE THE USE OF BIOINFORMATIC RESOURCES**
12.1	Access DNA and protein databases for sequence analysis (NCBI)
12.2	Predict origin and function of unknown sequences (NBCI)
12.3	Retrieve and compare homologous sequences (BLAST)
12.4	Determine the relationship among multiple sequences (i.e., DNA subway, NCBI, MEGA)
12.5	Access and interpret gene and genome maps (i.e., FlyBase, NCBI, genome.org)
12.6	Identify genetic variations (e.g., SNP, inversion, translocation, copy number variant)
12.7	Explain the function of different types of BLAST searches including E-value interpretation and score
12.8	Utilize protein data bank (RCSB PDB) for protein structure analysis (e.g., structure data for Cn3D, RCSB)
12.9	Design primers and perform electronic PCR
13.0	**DEMONSTRATE NUCLEIC ACID TECHNIQUES**
13.1	Isolate nucleic acids and explain the structure of DNA (e.g., DNA miniprep/plasmid and genomic DNA)
13.2	Perform and analyze restriction digests
13.3	Perform and explain the process of vertical and horizontal gel electrophoresis (e.g., electrolysis, buffer selection and preparation, gel concentration preparation)
13.4	Prepare a standard curve based on a DNA or protein ladder to estimate DNA length or protein size
13.5	Identify and troubleshoot common gel electrophoresis errors from a gel image (e.g., punctured well during loading, over loaded well, nuclease contamination, poor separation of bands)
13.6	Describe DNA sequencing methods, including basic and next-generation, and compare and contrast the advantages and disadvantages of each method
13.7	Compare and contrast the method of PCR to cellular process of DNA replication
13.8	Optimize and perform PCR protocols

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13.9	Perform basic molecular biology techniques. (e.g., transformation and optimized protein production)
13.10	Explain gene regulation (e.g., lac operon or trp operon, introns and exons, alternative splicing)
14.0	**DEMONSTRATE SCIENTIFIC MEASUREMENTS**
14.1	Perform biomath calculations and solve problems using scientific notation
14.2	Utilize appropriate SI (International System of Units) base units and prefixes for all measurements (e.g., milli, micro, nano)
14.3	Construct, interpret, and apply graphs using software tools
14.4	Perform appropriate statistical analysis (e.g., mean, median, mode, range, standard deviation, and linear regression)

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