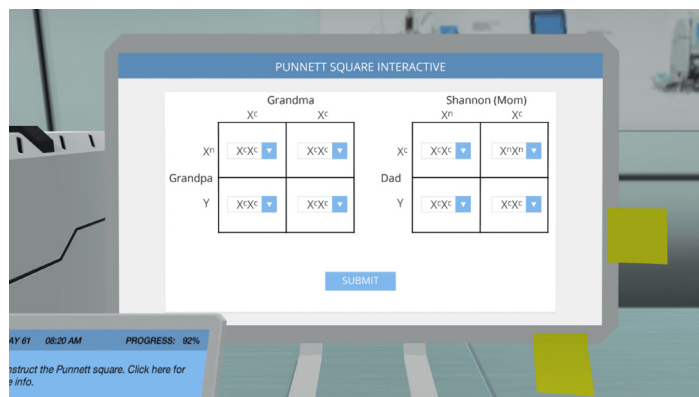
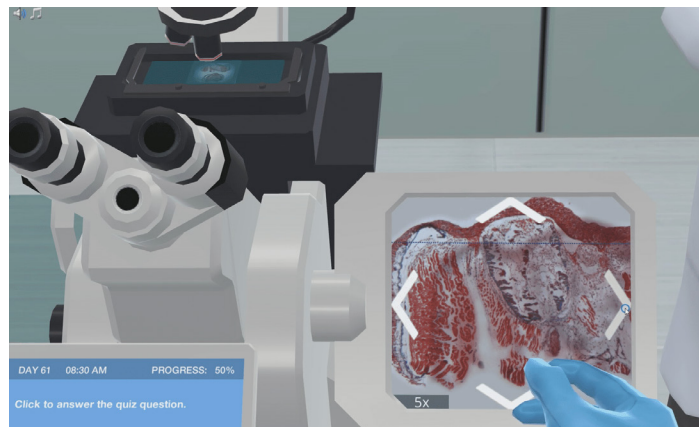
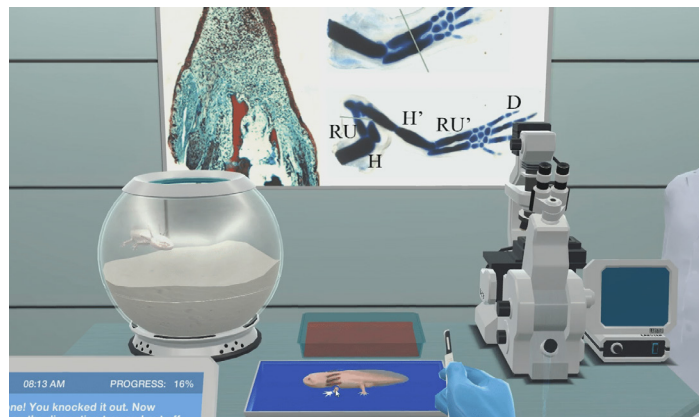


Labster Virtual Lab Simulations for Life Fundamentals



Labster is a world-leading provider of virtual lab simulations for higher education and high schools.

The simulations are designed to let students learn by doing in a virtual laboratory, solving real-case problems. Quiz questions test the students' knowledge, supporting an inquiry-based and deep-learning approach. The students will train real lab skills in a safe virtual environment where they can safely make mistakes, and learn at their own pace.

The most basic simulations are ideal as a self-study activity since the students will review essential concepts. The more advanced simulations are designed to support the course syllabus, reinforcing concepts and giving the students an innovative tool to deepen their learning.



University Life Fundamentals Simulations

Includes 32 simulations:

- Animal Genetics
- Antibodies
- Behavioral Thermoregulation
- BioDiversity Simulation
- Cellular Respiration
- Competition
- Diabetes
- Electron Transport Chain (from PHS)
- Endocrinology: control of reproduction [Q2 '19]
- Evolution
- Food web simulation
- Gene Expression Unit (from GEL)
- Introduction to Food Macromolecule
- Introductory
- Introductory Fermentation
- Introductory Polymerase Chain Reaction
- Meiosis
- Mendelian Inheritance
- Microscopy
- Mitosis
- Molecular Cloning
- Monogenic Disorders
- Next Generation Sequencing
- Pasteurization and Sterilization
- Pigment Extraction
- Polymerase Chain Reaction
- Population growth [Q2 '19]
- Protein Denaturation
- Protein Synthesis
- RNA Extraction VR (from GEL)
- Signal Transduction
- Your Diet and Your DNA

Ready to learn more?

Bring the world of science into the classroom and enable students to bring learning home with Labster's virtual science lab content. No need for additional hardware or lab equipment; access these labs on Chromebooks or any other laptops, and spark creativity in students with this innovative and interactive way to explore science.

It's a million-dollar lab, one click away.

To learn more about how you can incorporate Labster virtual labs in your teaching, visit us at www.labster.com.

Learning objectives covered in Labster's general biology simulations

Animal Genetics

Learning objectives: At the end of this simulation you will be able to...

- Explain different hereditary traits and modes of inheritance
- Construct a pedigree analysis based on observed phenotypes
- Perform genome scanning to identify candidate genes for double muscling in cattle
- Develop a DNA test for double muscling in cattle

Antibodies

Learning objectives: At the end of this simulation you will be able to...

- Understand the structure and function of antibodies:
 - Different isotypes
 - Different parts of an antibody
- Understand the formation of antibody-antigen complex:
 - Types of interaction between antibody and antigen
- Understand the role of different blood types:
 - ABO and rhesus factor
 - Blood typing by using Eldon cards
 - Blood transfusions
 - Rhesus incompatibility and hemolytic disease of a newborn (HDN)

Behavioral Thermoregulation

Learning objectives: At the end of this simulation you will be able to...

- Explain changes in microclimate over small spatial scales and predict how this would influence the energy and water budgets of an organism
- Identify ways that an organism can regulate its body temperature in a given environment and discuss the costs and benefits of each strategy
- Predict and analyze the thermoregulatory behavior of an animal in a natural environment

Biodiversity Simulation

Learning objectives: At the end of this simulation you will be able to...

- Sample for biodiversity
- Use Quadrat, camera trap and Pitfall traps
- Assess and compare biodiversity using the biodiversity index
- Identify species with a dichotomous key
- Prioritize sampling

Cellular Respiration

Learning objectives: At the end of this simulation you will be able to...

- Explain the structural changes of glucose and ATP during glycolysis
- Analyze blood glucose and lactic acid concentrations of athletes before and after exercise
- Determine electron carrier products of the Krebs cycle
- Understand the role of the electron transport chain in generating ATP
- Experiment on oxygen consumption in mice at various exercise intensities

Competition

Learning objectives: At the end of this simulation you will be able to...

- Identify competition between species and quantify the strength of competition between two species
- Establish evidence of competition in an agricultural environment

Diabetes

Learning objectives: At the end of this simulation you will be able to...

- Understand how Type II diabetes is diagnosed
- Understand the risk factors for Type II diabetes
- Understand the function of insulin in the body
- Understand how untreated diabetes affects organ function
- Regulate Type II diabetes
- Know how and when to measure blood sugar levels using a glucose meter
- Understand the effect of insulin and diabetes medication
- Prepare a syringe with insulin and know how to inject insulin
- Understand how a healthy diet and regular exercise help to regulate Type II diabetes

Electron Transport Chain

Learning objectives: At the end of this simulation you will be able to...

- Understand the importance and uses of photosynthesis
- Understand the photolysis of water and electron transport
- Understand properties of light and why pigments are colorful
- Develop a hypothesis and set up an experiment to test it
- Understand how to measure the redox potential of the electron transport chain

Endocrinology: control of reproduction

To be confirmed.

Evolution

Learning objectives: At the end of this simulation you will be able to...

- Understand how populations evolve by adapting to their environment
- Understand the basic mechanisms of evolution
- Understand evolution as the foundation of biology and show evidence for it
- Use DNA sequencing and phylogenetic trees to identify an unknown creature
- Deal with common misconceptions about the theory of evolution

Food Web Simulation

Learning objectives: At the end of this simulation you will be able to...

- Understand food webs
- Explain the differences between different trophic cascades
- Calculate the amount of energy needed for maintenance

Gene Expression Unit

Learning objectives: At the end of this simulation you will be able to...

- Prepare samples for Next Generation Sequencing
- Understand the principles behind the Next Generation Sequencing technique
- Perform a qPCR experiment with the proper controls

Introduction to Food Macromolecules

Learning objectives: At the end of this simulation you will be able to...

- Understand the types of macromolecules found in food
- Understand the structure of carbohydrates, proteins, and lipids
- Detect macromolecules in food samples

Introductory Lab

Learning objectives: At the end of this simulation you will be able to...

- Understand the basics of safety in the laboratory
- Calculate pH of strong acids, weak acids, strong bases and weak bases
- Understand how acid dissociates in water
- Understand the principle of diffusion and osmosis
- Understand the different blood type groups and how to perform blood type test

Introductory Fermentation

To be confirmed.

Introductory Polymerase Chain Reaction

To be confirmed

Meiosis

Learning objectives: At the end of this simulation you will be able to...

- Understand assisted reproduction technology
- Understand the basic principle of meiosis
- Use the microscope to observe the phases of meiosis and understand their main characteristics
- Understand the main differences between mitosis and meiosis

Mendelian Inheritance

Learning objectives: At the end of this simulation you will be able to...

- Explain how traits are passed on from parents to their offspring and what causes variation between siblings
- Describe Mendel's Laws of Inheritance in color deficiency
- Compare and predict the phenotypes of offspring with given genotypes using Punnett squares
- Analyze dominant and recessive alleles, and how they play a part in an individual's biological make-up

Microscopy

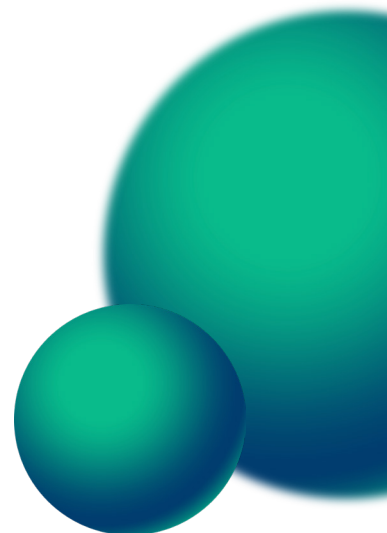
Learning objectives: At the end of this simulation you will be able to...

- Understand different microscopy techniques and their limitations
- Identify various cell types and cellular structures
- Understand coeliac disease and intestinal inflammation
- Understand staining techniques

Mitosis

Learning objectives: At the end of this simulation you will be able to...

- Understand and visualize basic concepts about eukaryotic cells such as main cellular components and DNA packaging by immersive animations
- Understand the key characteristics of the cell cycle's different stages: interphase (G1, S and G2) and mitosis
- Use different microscopy techniques to observe the phases of the mitosis and understand their main characteristics:
 - Prophase
 - Metaphase
 - Anaphase
 - Telophase
- Understand the cell cycle checkpoints and the molecules that control them (cyclins and cyclin-dependent kinases)
- Understand the main differences between mitosis and meiosis



Molecular Cloning

Learning objectives: At the end of this simulation you will be able to...

- Understand molecular cloning techniques: DNA extraction and preparation, ligation, transformation, plate streaking and antibiotic selection
- Understand inducible gene expression regulation
- Understand the use of GFP as a reporter gene
- Understand DNA damage and DNA repair system

Monogenic Disorders

Learning objectives: At the end of this simulation you will be able to...

- Understand the basic concepts of inheritance
- Build and interpret a pedigree based on family data
- Understand genetic risk assessment and counselling
- Understand the work of a genetics laboratory

Next Generation Sequencing

Learning objectives: At the end of this simulation you will be able to...

- Understand the different steps in sample preparation, cluster generation, sequencing and data processing
- Understand the characteristics of ancient DNA
- Understand that Single Nucleotide Polymorphism (SNP) can be tightly correlated to a specific physical feature

Pasteurization and Sterilization

Learning objectives: At the end of this simulation you will be able to...

- Understand the concept of food spoilage and shelf life
- Understand the principle of pasteurization and sterilization
- Analyze the parameters of High-Temperature-Time-Treatment (HTST) pasteurization
- Perform canning as a method of sterilization

- Understand how plastic and metal can be used as materials for packaging

Pigment Extraction

Learning objectives: At the end of this simulation you will be able to...

- Understand the importance and uses of photosynthesis
- Understand properties of light and why pigments are colorful
- Analyze the absorbance spectra and chemical properties of pigments
- Develop a hypothesis and set up an experiment to test it

Polymerase Chain Reaction

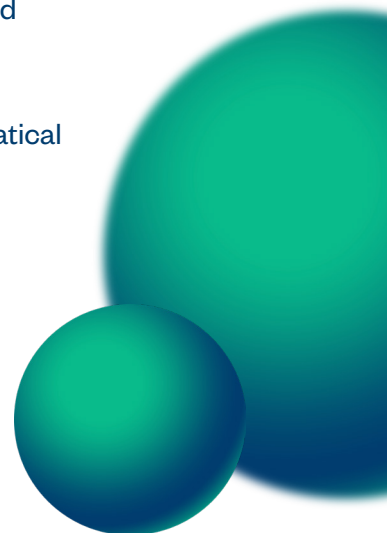
Learning objectives: At the end of this simulation you will be able to...

- Explain the function of DNA polymerase in DNA replication and synthesis
- Perform a PCR experiment using DNA from a blood sample as the template
- Carry out a gel electrophoresis that separates DNA according to its size
- Interpret the unique signature of the human genome and the use of tandem repeated regions (TRR) in DNA profiling

Population Growth

Learning objectives: At the end of this simulation you will be able to...

- Assess the population structure using data from mark-recapture to estimate the average age of death and fecundity
- Predict the growth of a population using a mathematical model



Protein Denaturation

Learning objectives: At the end of this simulation you will be able to...

- Understand what protein denaturation is
- Understand how interactions between side groups influence the protein structure
- Understand the chemical causes of protein denaturation
- Understand the physical causes of protein denaturation
- Remember the steps involved in protein denaturation
- Understand the results of protein denaturation and how food texture changes as a result of it (coagulation)
- Understand how biotechnology is used in daily life

Protein Synthesis

Learning objectives: At the end of this simulation you will be able to...

- Understand the translation process from mRNA to amino acid
- Understand the post-translational modification
- Understand the protein synthesis processing in the ribosome
- Understand the primary, secondary, tertiary and quaternary structures of protein
- Understand the basic principles of mass spectrometry (MALDI-TOF)

RNA Extraction

Learning objectives: At the end of this simulation you will be able to...

- Understand how to extract the total RNA from a cell
- Separate mRNA molecules specifically from the rest of the RNA

Signal Transduction

Learning objectives: At the end of this simulation you will be able to...

- Explain the principles and importance of intracellular signal transduction
- Explain receptor tyrosine kinase (RTK) cell signaling
- Analyze dysregulated signal transduction in human cancer cells
- Understand the connection between angiogenesis and tumor growth
- Investigate the involvement of vascular endothelial growth factor receptor (VEGFR) signaling in human breast cancer

Your Diet and Your DNA

Learning objectives: At the end of this simulation you will be able to...

- Describe nutrient compositions of healthy and unhealthy diets
- Explain how genomic instability may lead to the development of diseases such as cancer
- Summarize the impact of diet on genomic stability

