

Lt Biology and Chemistry: Sensors and Kits

Identify which labs in the Lt Biology and Chemistry Collections use Vernier® Science Education Go Direct® Sensors and Bio-Rad™ Laboratories Kits. Note that only labs in the Lt Biology Collection require Bio-Rad Kits.



Labs

Required Sensors and Kits

Lt Biology Collection

Acid Rain	Go Direct® pH Sensor
Animal Behavior	NA
Aquatic Photosynthesis	Go Direct® Optical Dissolved Oxygen Probe
Bacterial Transformation	Go Direct® Temperature Probe* pGLO Bacterial Transformation Kit
Biological Membranes	Go Direct® SpectroVis® Plus Spectrophotometer Go Direct® Temperature Probe*
Cellular Respiration	Go Direct® CO ₂ Gas Sensor
CRISPR	Out of the Blue CRISPR Kit
Diffusion through Membranes	Go Direct® Conductivity Probe Go Direct® Temperature Probe* (<i>Extension**</i>)
DNA Structure and Replication	NA
Ecology and Biodiversity	NA
ELISA: Giant Panda Problem	Giant Panda Problem Kit
Enzyme Action: Testing Catalase Activity	Go Direct® O ₂ Gas Sensor Go Direct® Temperature Probe* (<i>Extension**</i>) Go Direct® pH Sensor (<i>Extension**</i>)
Exploring the Greenhouse Effect	Two Go Direct® Temperature Probes
Forensic DNA Fingerprinting	Forensic DNA Fingerprinting Kit
From DNA to Protein	NA
Genetics of Drosophila	NA
Interdependence of Plants and Animals	Go Direct® pH Sensor Go Direct® Optical Dissolved Oxygen Probe
Introduction to Cells	NA
Introduction to Microscopy	NA
Introduction to Molecular Evolution	Comparative Proteomics I: Protein Profiler Kit
Limitations on Cell Size	Go Direct® Conductivity Probe
Macromolecules: Proteins	Go Direct® SpectroVis® Plus Spectrophotometer Got Protein? Kit Go Direct® pH Sensor (<i>Extension**</i>)
Measuring Primary Productivity	Go Direct® Optical Dissolved Oxygen Probe
Metabolization of Sugars by Yeast	Go Direct® CO ₂ Gas Sensor Go Direct® Temperature Probe* (<i>Continued over</i>)

* Sensor is not required for sampling and can be substituted with an analog thermometer.

** Optional inquiry-based experiments expanding on concepts presented in the lab.



Lt Biology Collection continued

Mitosis and Meiosis	NA
Modeling Population Dynamics	NA
Osmosis	Go Direct® Conductivity Probe
Photosynthesis	Go Direct® SpectroVis® Plus Spectrophotometer
Polymerase Chain Reaction (PCR)	PV92 PCR Informatics Kit
Population Dynamics	Go Direct® SpectroVis® Plus Spectrophotometer Go Direct® Temperature Probe* (<i>Extension**</i>)
Population Genetics and Evolution	NA
The Visible Spectra of Plant Pigments	Go Direct® SpectroVis® Plus Spectrophotometer
Transpiration	Go Direct® Gas Pressure Sensor
Turnip Peroxidase	Go Direct® SpectroVis® Plus Spectrophotometer Go Direct® pH Sensor (<i>Extension**</i>) Go Direct® Temperature Probe* (<i>Extension**</i>)

Lt Chemistry Collection

Acid-Base Titration	Go Direct® pH Sensor
Beer's Law	Go Direct® SpectroVis® Plus Spectrophotometer
Boyle's Law and Charles' Law	Go Direct® Gas Pressure Sensor Go Direct® Temperature Probe (<i>Extension**</i>)
Conductimetric Titration and Gravimetric Determination of a Precipitate	Go Direct® Conductivity Probe
Determining a Chemical Formula	NA
Determining an Equilibrium Constant	Go Direct® SpectroVis® Plus Spectrophotometer
Determining the K_{sp} of Calcium Hydroxide	Go Direct® pH Sensor
Dissociation Constants	Go Direct® pH Sensor
Electrochemistry: Voltaic Cells	Go Direct® Voltage Probe
Evaporation and Intermolecular Attractions	Go Direct® Temperature Probe
Identifying an Unknown Diprotic Acid	Go Direct® pH Sensor
Liquid Chromatography	NA
Measuring and Predicting Heats of Reaction	Go Direct® Temperature Probe
Molar Volume of a Gas	Go Direct® Gas Pressure Sensor Go Direct® Temperature Probe
Properties of Solutions: Electrolytes and Nonelectrolytes	Go Direct® Conductivity Probe
Rate Law Determination	Go Direct® SpectroVis® Plus Spectrophotometer
Standardizing a Solution	Go Direct® pH Sensor
Synthesis and Analysis of Aspirin	Go Direct® SpectroVis® Plus Spectrophotometer Go Direct® Melt Station
Temperature and State Changes	Go Direct® Temperature Probe

* Sensor is not required for sampling and can be substituted with an analog thermometer.

** Optional inquiry-based experiments expanding on concepts presented in the lab.



Go Direct® Sensors in the Lt Biology Collection

Below is a description of each sensor and which labs require it. All Vernier Go Direct® Sensors connect to a computer by USB, and require a Windows 10 operating system.

Sensor	Description	Labs using the Sensor
Go Direct® O ₂ Gas Sensor	The Go Direct O ₂ Gas Sensor measures gaseous oxygen concentration levels and air temperature.	<ul style="list-style-type: none"> • Enzyme Action: Testing Catalase Activity
Go Direct® SpectroVis® Plus Spectrophotometer	The Go Direct SpectroVis Plus Spectrophotometer quickly measures a full wavelength spectrum. It is used in the Biology Collection to measure Absorbance versus Wavelength, and Absorbance versus Time.	<ul style="list-style-type: none"> • Biological Membranes • Photosynthesis • Population Dynamics • Macromolecules: Proteins • The Visible Spectra of Plant Pigments • Turnip Peroxidase
Go Direct® Conductivity Probe	The Go Direct Conductivity Probe determines the ionic content of an aqueous solution by measuring its electrical conductivity.	<ul style="list-style-type: none"> • Diffusion through Membranes • Limitations on Cell Size • Osmosis
Go Direct® Temperature Probe	The Go Direct Temperature Probe is a rugged, general-purpose sensor that students can use to monitor temperature.	<ul style="list-style-type: none"> • Bacterial Transformation* • Biological Membranes* • Diffusion through Membranes* (<i>Extension**</i>) • Enzyme Action: Testing Catalase Activity* (<i>Extension**</i>) • Exploring the Greenhouse Effect (2) • Metabolization of Sugars by Yeast* • Population Dynamics* (<i>Extension**</i>) • Turnip Peroxidase* (<i>Extension**</i>)
Go Direct® Gas Pressure Sensor	The Go Direct Gas Pressure Sensor measures the absolute pressure of a gas.	<ul style="list-style-type: none"> • Transpiration
Go Direct® Optical Dissolved Oxygen Probe	The Go Direct Optical Dissolved Oxygen Probe makes it easy to measure dissolved oxygen concentration, water temperature, and atmospheric pressure.	<ul style="list-style-type: none"> • Aquatic Photosynthesis • Interdependence of Plants and Animals • Measuring Primary Productivity
Go Direct® CO ₂ Gas Sensor	The Go Direct CO ₂ Gas Sensor measures gaseous carbon dioxide concentration levels, air temperature, and relative humidity.	<ul style="list-style-type: none"> • Cellular Respiration • Metabolization of Sugars by Yeast
Go Direct® pH Sensor	The Go Direct pH Sensor is a general-purpose pH sensor used to monitor pH of aqueous solutions.	<ul style="list-style-type: none"> • Acid Rain • Enzyme Action: Testing Catalase Activity (<i>Extension**</i>) • Interdependence of Plants and Animals • Macromolecules: Proteins (<i>Extension**</i>) • Turnip Peroxidase (<i>Extension**</i>)

* Sensor is not required for sampling and can be substituted with an analog thermometer.

** Optional inquiry-based experiments expanding on concepts presented in the lab.

How to purchase Vernier Go Direct® Sensors

Outside of the United States, users of the Lt Biology Collection will need to procure Vernier Go Direct® Sensors through Vernier's website below. Users should add the required sensors to their cart, request a quote, and add "Lt" in the comments section of the quote request form. This will notify their local Vernier distributor to reach out and fulfill the procurement process.

Vernier Website: <https://www.vernier.com/>

Users in the United States are able to purchase a Go Direct® Biology Sensor Package from ADInstruments (LTGDX1001) that includes one of each sensor listed above. Please contact your local ADInstruments representative for more information, including pricing. For purchasing individual Go Direct® Sensors, users should place orders through the Vernier website as detailed above.



Bio-Rad Kits used in the Lt Biology Collection

Kit	Description	Labs using the Kit
Comparative Proteomics I: Protein Profiler Kit	The Comparative Proteomics I: Protein Profiler Kit provides all the reagents and consumables needed for your students to analyze muscle tissue samples using SDS-PAGE and reveal evolutionary relationships.	• Introduction to Molecular Evolution
Forensic DNA Fingerprinting Kit	The Forensic DNA Fingerprinting Kit includes all the reagents and consumables needed for your students to analyze simulated suspect and crime scene DNA samples using restriction digestion and agarose gel electrophoresis.	• Forensic DNA Fingerprinting
Giant Panda Problem Kit	The Giant Panda Problem Kit includes all the reagents and consumables needed for your students to measure reproductive hormones in simulated panda samples using a real ELISA with real antibodies.	• ELISA: Giant Panda Problem
Got Protein? Kit	The Got Protein? Kit provides all the reagents and consumables needed for your students to easily measure the protein content of liquid samples.	• Macromolecules: Proteins
Out of the Blue CRISPR Kit*	The Out of the Blue CRISPR Kit provides all the reagents and consumables needed for your students to use a robust CRISPR gene editing protocol to modify a chromosomal gene in <i>E. coli</i> .	• CRISPR
pGLO Bacterial Transformation Kit*	The pGLO Bacterial Transformation Kit provides all the reagents and consumables needed for your students to genetically engineer bacteria using a gene from the bioluminescent jellyfish <i>Aequorea victoria</i> .	• Bacterial Transformation
PV92 PCR Informatics Kit	The PV92 PCR Informatics Kit includes all the reagents and consumables needed for your students to extract DNA from their own cells and use PCR to amplify the PV92 region of the human genome.	• Polymerase Chain Reaction (PCR)

How to purchase Bio-Rad Kits

Purchase the relevant Bio-Rad kit via the Bio-Rad website: <http://explorer.bio-rad.com>

*These kits may not be imported into Australia or New Zealand because they contain a genetically-modified organism (lab strain *E. coli*).



Go Direct® Sensors in the Lt Chemistry Collection

Below is a description of each sensor and which labs require it. All Vernier Go Direct® Sensors connect to a computer by USB, and require a Windows 10 operating system.

Sensor	Description	Labs using the Sensor
Go Direct® Conductivity Probe	The Go Direct® Conductivity Probe determines the ionic content of an aqueous solution by measuring its electrical conductivity.	<ul style="list-style-type: none">• Conductimetric Titration and Gravimetric Determination of a Precipitate• Properties of Solutions: Electrolytes and Nonelectrolytes
Go Direct® Gas Pressure Sensor	The Go Direct® Gas Pressure Sensor measures the absolute pressure of a gas.	<ul style="list-style-type: none">• Boyle's Law and Charles' Law• Molar Volume of a Gas
Go Direct® Melt Station	The Go Direct® Melt Station accurately determines the melting temperature of solid substances.	<ul style="list-style-type: none">• Synthesis and Analysis of Aspirin
Go Direct® pH Sensor	The Go Direct® pH Sensor is a general-purpose pH sensor used to monitor pH of aqueous solutions.	<ul style="list-style-type: none">• Acid-Base Titration• Determining the K_{sp} of Calcium Hydroxide• Dissociation Constants• Identifying an Unknown Diprotic Acid• Standardizing a Solution
Go Direct® SpectroVis® Plus Spectrophotometer	The Go Direct® SpectroVis® Plus Spectrophotometer quickly measures a full wavelength spectrum. It is used in the Biology Collection to measure Absorbance versus Wavelength, and Absorbance versus Time.	<ul style="list-style-type: none">• Beer's Law• Determining an Equilibrium Constant• Rate Law Determination• Synthesis and Analysis of Aspirin
Go Direct® Temperature Probe	The Go Direct® Temperature Probe is a rugged, general-purpose sensor that students can use to monitor temperature.	<ul style="list-style-type: none">• Boyle's Law and Charles' Law• Evaporation and Intermolecular Attractions• Measuring and Predicting Heats of Reaction• Molar Volume of a Gas• Temperature and State Changes
Go Direct® Voltage Probe	The Go Direct® Voltage Probe combines a wide-input voltage range and high precision, making it an excellent choice for investigations of both AC/DC circuits and electromagnetism.	<ul style="list-style-type: none">• Electrochemistry: Voltaic Cells

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Users in the United States are able to purchase a Go Direct® Chemistry Sensor Package from ADInstruments (LTGDX2001) that includes one of each sensor listed above, except the Go Direct® Melt Station. Please contact your local ADInstruments representative for more information, including pricing. For purchasing individual Go Direct® Sensors, users should place orders through the Vernier website as detailed above.

Visit [adinstruments.com](https://www.adinstruments.com) or contact your local ADInstruments representative for more information

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