

# The CALIPER



THE CALIPER IS A PUBLICATION FOR USERS OF VERNIER PRODUCTS

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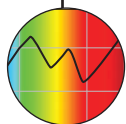
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## LabQuest Earns Five-Star Review



MultiMedia & Internet@Schools

### REPORT CARD

Installation **A**

Content/Features **A**

Ease of Use **A**

Product Support **A+**

You may download the full review at [www.vernier.com/labquest-mias-award](http://www.vernier.com/labquest-mias-award)

from MultiMedia & Internet@Schools

“Students will enjoy using LabQuest.... This device is designed for all levels of learners. Young children will appreciate the simplicity in operating the main features. At the same time, the advanced features make this tool a must-have in every high school science lab....I was impressed by the rugged construction. This is definitely a tool that will last, which makes it an excellent buy—especially with today's tight funding....I have no doubt that LabQuest is going to get plenty of use in my classroom. I would highly recommend it for every classroom that is serious about engaging students in meaningful scientific investigations.”

MultiMedia & Internet@Schools, Sally Finley, Country Hills Elementary School, Coral Springs, Florida

## Advanced Biology with Vernier

by Kelly Redding, David Masterman, Jack Randall, Mike Collins, and WARD'S Natural Science

This new book was written especially to help instructors incorporate technology into their AP Biology\*, Advanced Biology, and college General Biology courses. The first 12 experiments have a direct correlation with the 12 labs prescribed in the 2001 College Board's AP Biology Lab Manual. Most of these experiments use Vernier sensors to collect, display, print, graph, and analyze data. Several others use Vernier technology, such as our Blue Digital Bioimaging System or our new SpectroVis spectrophotometer. Others use no sensors at all, but are included to provide the convenience of a complete set of experiments for those teaching the AP Biology curriculum.

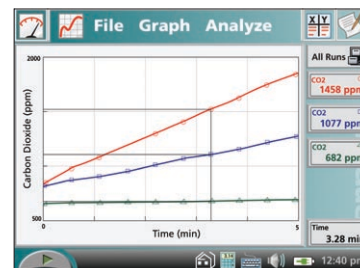
\*AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.



ORDER CODE BIO-A | \$45

### FREE sample labs

from *Advanced Biology with Vernier* available at [www.vernier.com/labs](http://www.vernier.com/labs)



AP Experiment 5 Cell Respiration using a CO<sub>2</sub> Sensor and the Vernier LabQuest

# NEW Vernier Rotary Motion Sensor at an Affordable Price



Our new Rotary Motion Sensor lets you monitor angular motion precisely and easily, and it is direction sensitive. You can use it to collect angular displacement, angular velocity, and angular acceleration data. Even though we call it a Rotary Motion Sensor, it can also be used to measure linear position to a fraction of a millimeter.

We also carry two accessory kits. The Rotational Motion Accessory Kit includes the equipment needed to measure moments of inertia, verify the conservation of angular momentum, and conduct investigations of physical pendula. The Rotary Motion Motor Kit contains a small electric motor that connects to the Rotary Motion Sensor. This allows you to drive the Rotary Motion Sensor and determine the efficiency of a motor when it lifts weights, measure torque produced by the motor, or use the motor as a generator.

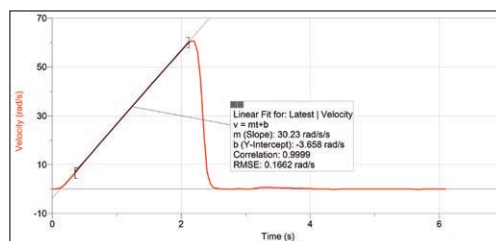
Here's a great example of the use of the sensor and the Rotary Motion Accessory Kit to determine the moment of inertia: This photograph shows an aluminum disk from the kit placed horizontally on the Rotary Motion Sensor. A thread is attached to the pulley that holds the aluminum disk. A weight on the end of the thread falls and applies a torque that causes the disk to undergo angular acceleration. Angular position and velocity data are collected as a function of time. (See the Logger Pro graph below.) A linear fit on the angular velocity vs. time graph allows you to determine that angular acceleration, which is used to calculate the moment of inertia.

Rotary Motion Accessory Kit used to determine the moment of inertia

Rotary Motion Sensor  
ORDER CODE **RMV-BTD** | \$169

Rotary Motion Accessory Kit  
ORDER CODE **AK-RMV** | \$110

Rotary Motion Motor Kit  
ORDER CODE **MK-RMV** | \$12



Logger Pro graph of angular position and velocity data

# Digital Radiation Monitor

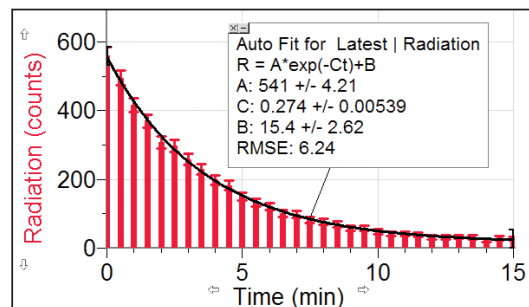


ORDER CODE  
**DRM-BTD** | \$229

Our new Digital Radiation Monitor is sensitive to alpha, beta, gamma, and X-rays. This versatile monitor can be used with LabQuest, LabPro, or CBL 2, or it can be used alone with its built-in timing system. Like our older radiation monitors, this device is based on a Geiger-Mueller tube, but it also includes a digital rate meter.

When used for computer- or LabQuest-based measurements, you can study topics such as radiation statistics, nuclear decay rates, and the effect of shielding on count rates. In addition, you can now use just the Digital Radiation Monitor to measure counts per minute for count durations you can set, all on a free-standing device.

The Digital Radiation Monitor is also our first auto-ID radiation monitor. (This feature is available on LabQuest only.) It includes a cable for connection to Vernier interfaces and a 9 V battery.



Logger Pro graph of radioactive decay

**FREE sample lab from Nuclear Radiation with Vernier available at [www.vernier.com/labs](http://www.vernier.com/labs)**



ORDER CODE **NRV** | \$25

## Nuclear Radiation with Vernier by John Gastineau

We have a new edition of our nuclear book, titled *Nuclear Radiation with Vernier*. This short book is designed for either a chemistry or physics course. The six experiments cover types of radiation, the inverse-square law for point radiation sources, half-life measurements, the statistics of counting, shielding,

and background radiation sources, such as radon. New in this edition are instructions for LabQuest. Student instructions for Logger Pro, DataRad for TI calculators, and DataPro for Palm are also included with the book.

It is easier than you think to do basic nuclear experiments

with your students. Instructor notes discuss sources of radionuclides appropriate for school use. You'll need a radiation monitor (either the new Digital Radiation Monitor or one of our older models), a LabPro or LabQuest, and a computer, Palm, or calculator, if using LabPro.

## PLTW Chooses SensorDAQ for their New Biomedical Engineering Courseware



*Student project: automated blood pressure monitor using SensorDAQ, Blood Pressure Sensor and the Digital Control Unit*

Project Lead The Way (PLTW) is a national organization that works with the nation's schools to increase the number of young people who pursue engineering and engineering technology programs. They provide educators with the training and course materials needed to prepare students to be successful in these pursuits.

We have worked with Project Lead The Way to integrate our SensorDAQ interface and our physiology sensors into their new Biomedical Sciences courseware. The SensorDAQ is a powerful Vernier interface that has connectors for Vernier sensors. In addition, a screw terminal connector provides versatility to build circuits, create custom sensors, control servo or stepper motors, turn on electronic devices, and more.

The SensorDAQ uses LabVIEW software to acquire, analyze, and save the data to a file. The combination of the Vernier SensorDAQ, easy-to-connect physiology sensors, and LabVIEW's powerful engineering software provides a wealth of experience for students taking part in this new program.

## NEW LabVIEW Software for High Schools at a Special Price

National Instruments LabVIEW™ software can be used to communicate with and control Vernier interfaces and sensors. This opens new possibilities for data acquisition, custom analysis, student projects, and instrument control. More importantly, it introduces students to a programming language used extensively throughout the engineering discipline in academia and industry.

LabVIEW can be used with our SensorDAQ, LEGO NXT Sensor Adapter, Go! devices, and LabPro. We have made it easy to get started with LabVIEW and Vernier hardware by posting free examples and projects at <http://engineering.vernier.com>. Using the examples, you can introduce engineering and science concepts with very little, or no, programming; however, because LabVIEW is a powerful development software, students are able to modify the code. They can turn on a motor when the sensor reading is too high, build their own analysis into the data acquisition, or design a better user interface.

Purchase either a single-user LabVIEW license or save on a 25-user license. The LabVIEW licenses are available only to U.S. high schools and include Windows, Macintosh, and Linux versions. LabVIEW for use in colleges and universities, or for individual use, should be purchased from National Instruments ([www.ni.com/academic](http://www.ni.com/academic))



Single User LabVIEW  
ORDER CODE: LV-1, \$100  
25 User LabVIEW  
ORDER CODE: LV-25, \$1,500  
(For U.S. high schools only.)

### Want LabVIEW Training?

Virtual Instruments and Control Systems (VICS) Workshop  
September 25-27, 2008 at Southeast Community College, NE  
More details at [www.physicsworkshops.org](http://www.physicsworkshops.org)

## Robolab and the Vernier NXT Sensor Adapter



ORDER CODE  
BTA-NXT | \$39

For several months, students and teachers have been using our LEGO NXT Adapter, along with the Mindstorms NXT programming language, to write programs. We support that with our Vernier Sensor Block, which you can download from [www.vernier.com/nxt](http://www.vernier.com/nxt). Now there are two other programming languages you can use to program the NXT and use our sensors:

- Robolab, the popular programming language, developed by Chris Rogers of the Tufts University Center for Engineering Outreach (CEEO), now supports our adapter. To use the adapter with Robolab, you will need version 2.9.4b of Robolab. See [www.engineeringeducation.com](http://www.engineeringeducation.com) for details. There are also great sample Robolab VIs for using our sensors and the adapter at that site, and also at [www.vernier.com/nxt](http://www.vernier.com/nxt)
- You can also write programs to use the NXT and our adapter in LabVIEW. To do this, you need the LabVIEW Toolkit for LEGO Mindstorms NXT, which you can download from [www.ni.com](http://www.ni.com). You will also need LabVIEW and some special VIs we wrote to make programming easier. These and sample LabVIEW data-collection programs for use with our sensors are at [www.vernier.com/nxt](http://www.vernier.com/nxt)



engineering & physics

# Capturing Monarch Metamorphosis in Logger Pro

Ben Carter, a 12-year-old from Nashville, TN, captured a beautiful time-lapse video of a monarch caterpillar pupating into a chrysalis using Logger Pro and a ProScope HR camera (order code BD-HRB, \$275). After planting milkweed and purchasing caterpillars, Ben used the 1-10X lens on a ProScope HR digital USB camera connected to a laptop computer running Logger Pro. Ben shared his results with us. Show it to your own students, or let it inspire you to take your own unique video.

You can download Ben's video at [www.vernier.com/innovate/innovativeuse91.html](http://www.vernier.com/innovate/innovativeuse91.html)



Logger Pro video of a caterpillar pupating into a chrysalis

## Vernier Tech Support on National TV Series!

by Dave Vernier

With the recent writers' strike, there have been a rash of new reality programs, and Vernier Software & Technology has even gotten involved. We were selected to participate in the new Fox television series "Please Help Me!" The show matches the technical support teams of different companies in a five-week competition. The technical support teams come from many different types of industries.

The series is underway as I write this. The format is somewhat like other reality shows. Each week, one team is eliminated, or as they say on this show, "Their lines are cut." So far, the Vernier team is doing well. On the first episode, "Let's Get Technical," we were given difficult technical questions and, other than a few problems with Windows Vista upgrade questions, we did great. In fact, we came out on top for the highest score, tied with the team from Victoria's Secret. The next episode, "Can You Feel My Pain?", involved dealing with very angry

customers. Our team was not nearly as experienced in this area as some of the teams (especially the cell phone companies), but we survived the round. The most recently filmed episode, "How Friendly are You?", offered bonus points for any tech support person who got asked out on a date or was sent flowers or chocolate. The next episode, "Shouldn't These Guys Be Retired?", involved only senior members of the tech support teams. With both of the founders of Vernier and three other long-term company owners on our team, we feel confident on this one. We are, however, a little worried about the team from Reader's Digest. The teams from Google and You Tube have no one to participate in this round.

The program wraps up with a final showdown on April 1, 2008. Please tune in to support our technical support department.

To see snippets from each episode, go to [www.vernier.com/AprilFools](http://www.vernier.com/AprilFools)

## Restriction Enzymes And Lambda DNA

From Advanced Biology with Vernier

This new lab from Vernier correlates with Lab 6: Exercise 6B in the 2001 College Board's AP Biology Lab Manual. Using Logger Pro software, along with Vernier's Blue Digital Bioimaging System, students can capture digital images of DNA migration, analyze their results to determine base pair values, and learn techniques used by scientists in the field of biotechnology.

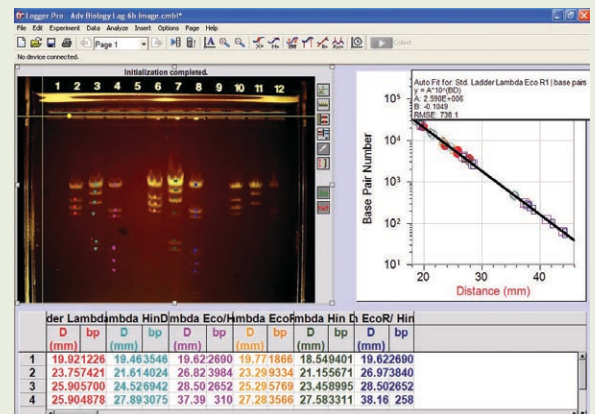
During this lab activity, prepared samples of bacteriophage lambda DNA are used to perform agarose gel electrophoresis. The DNA samples have been cut with various restriction enzymes to illustrate this powerful biotechnology tool. The electrophoresis is performed quickly and easily using the E-Gel® Pre-Cast Agarose System with SYBR Safe stain. A digital photograph is captured by Logger Pro software using our Blue Digital Bioimaging System. This System includes a ProScope HR digital camera and lens, camera stand, imaging hood, and the BlueView Transilluminator. Logger Pro's Gel Analysis features then allow the students to determine migration distances and base pair values.

In this experiment, students will

- Perform agarose gel electrophoresis with the E-Gel System using four different samples of lambda DNA.
- Photodocument and examine gel results with the Blue Digital Bioimaging System.
- Use Logger Pro to construct a standard curve and determine the base pair values from the gel.

To download this activity go to [www.vernier.com/labs](http://www.vernier.com/labs)

For ordering information on the E-Gel® Pre-Cast Agarose System or the Blue Digital Bioimaging System, go to [www.vernier.com/biotech](http://www.vernier.com/biotech)



Capture digital images of DNA migration and analyze the results in Logger Pro

# NEW SpectroVis Spectrophotometer

## Exploring Chlorophyll Content in Olive Oil

SpectroVis is our new visible spectrophotometer that measures at 100 wavelengths over a range of 400 nm to 725 nm. With 3 nm resolution, it satisfies the needs of most educational applications.

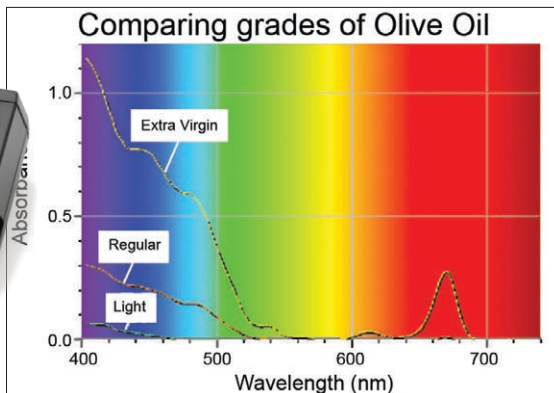
Our new *Advanced Biology with Vernier* lab book contains two experiments that feature spectroscopic analyses that can be conducted with SpectroVis. One of the labs directs

the student to measure the visible light absorbance of different grades of olive oil. Commercially available olive oil contains varying amounts of chlorophyll, depending on the grade (light, regular, or extra virgin). Students can easily see the differences in chlorophyll content by examining the absorbance plots of the various samples of olive oil.

In addition, the experiment can be used as the first step in a larger study of the components in olive oil, learning how this product is processed, or investigating and testing techniques for separating the chlorophyll from the olive oil.



ORDER CODE  
SVIS | \$399



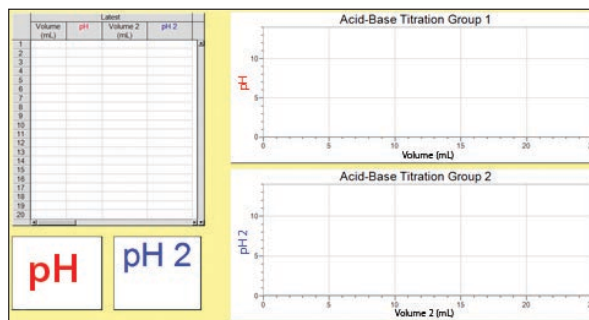
Comparing chlorophyll content of olive oils

## Creative Classroom Solutions

### Lab modification gives students more hands-on experience

Peter O'Connor, a teacher from Boonsboro High School in Maryland, described a situation facing many teachers—lots of students and only a few computers. "Having used Logger Pro for many years dating back to the ULI days, my school has been happy using it in our labs. However, as class size increased, we have had issues with maintaining a small lab group size for each lab. This is a large issue when it comes to doing Vernier labs with computers. We only have 8 computers in each classroom and try to do many labs with 24 students or more. One of the hardest labs to accommodate is Vernier Lab 24a "Acid-Base Titration." This year, we decided to find a new way to have more groups or individual students work on their own setup instead of having larger groups for this lab. In order to accomplish this, a modification to Lab 24a was made. This modification uses one LabPro device with two pH sensors to perform two different titrations at the same time. This allows us to have two smaller groups (or individuals) to be next to each other with their own buret performing the experiment. This year, we were able to do this lab with almost every student doing their own titration, which allowed them to get a better hands-on understanding of the material, and less time watching others do an experiment."

Using this custom file, two groups can run their titration independently, and the only part of the experiment that must be coordinated is the moment when a reading is recorded. Each group has its own data set, graph, and meter on the computer screen. The data can be separated later, if desired, or shared by the two groups. You can download Peter's custom file at [www.vernier.com/innovate/innovativeuse88.html](http://www.vernier.com/innovate/innovativeuse88.html)

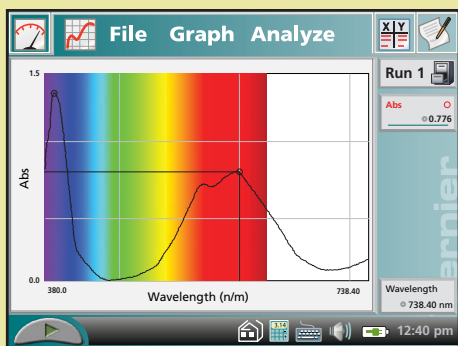


Screen shot of Peter O'Connor's custom file for Acid-Base Titration

5 years ago  
The **CALIPER**

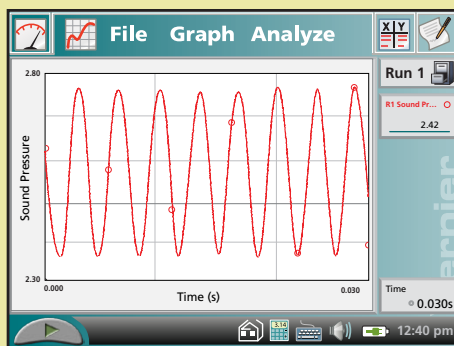
We introduced Logger Pro 3 and unveiled the Vernier Technology Awards.

# LABQUEST APP. VERSION 1.1 NEW FEATURES



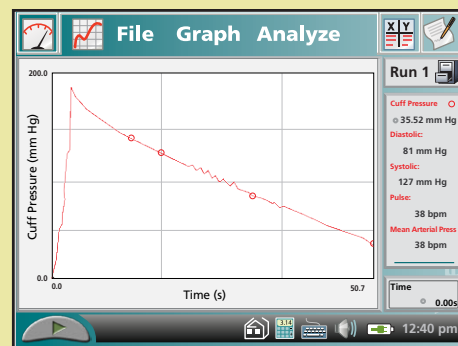
## Ocean Optics and Vernier Spectrometers

Collect a full spectrum for the range of a spectrometer in one second or less, or select a peak wave length and continue with a Beer's law experiment, or time-based experiment. All analysis tools are at your fingertips.



## Internal Microphone

Use the built-in microphone as a sensor (in addition to LabQuest's initial support for recording voice annotations using the internal microphone). Tuning fork wave form shown above.

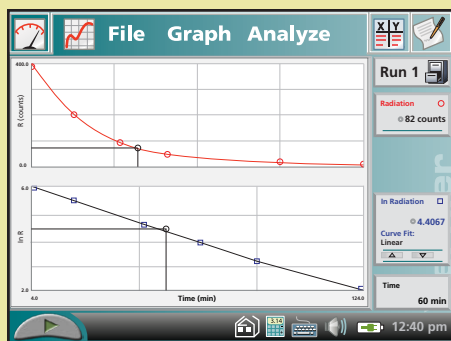


## Blood Pressure Sensor

Now you can study blood pressure with LabQuest in your physiology and biology courses.

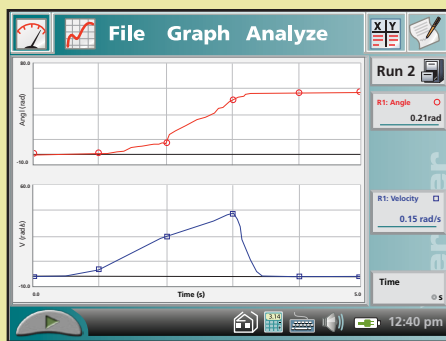


Students conduct and analyze Beer's law with a Vernier Spectrometer and LabQuest



### Radiation Monitor

Includes full support for our new Digital Radiation Monitor and our legacy radiation monitors.



### Rotary Motion

Monitor angular motion precisely and easily using LabQuest and our new Rotary Motion Sensor.



### International Versions

Collect and analyze data in Spanish, French, Italian, and German.

#### WITH A COMPUTER



#### STAND ALONE



#### IN THE FIELD



BREAKTHROUGH DATA-COLLECTION TECHNOLOGY

## FREE LabQuest App Version 1.1 NOW AVAILABLE!

One of the nice features of LabQuest is the ease with which you can update its flash memory to obtain the latest features from Vernier. People who received LabQuest during our first six months of shipping can now easily update their LabQuest App software to version 1.1. This new version includes support for Ocean Optics and Vernier spectrometers, rotary motion sensors, radiation monitors, our Blood Pressure Sensor, and more. See the complete list of new features described above.

### How do I download? It's as simple as 1-2-3!

- 1 Go to [www.vernier.com/labquest/updates](http://www.vernier.com/labquest/updates), and download the v. 1.1 updater files to your computer's desktop.
- 2 Drag and drop the updater files to a USB flash drive or SD card.
- 3 With the flash drive or SD card in LabQuest, open the Control Panel → System Info, and choose to Install Updates and follow the prompts. It's as easy as that!

As Vernier continues to make improvements and add capability to LabQuest through the years, you will be able to quickly obtain updates at [www.vernier.com/labquest/updates](http://www.vernier.com/labquest/updates) (without going through your IT department!).



[www.vernier.com/labquest](http://www.vernier.com/labquest)

Take the LabQuest product tour and watch a video demonstration



Students use Go!Temp with the OLPC computer

## Vernier Go! Sensors Now Compatible with the OLPC Computer

Our new LabQuest is really a Linux computer using GNOME desktop environment and the X Window System display system. There is another well-known computer that shares these features. It is the One Laptop Per Child computer, also known as the \$100 Computer or XO. When we were developing the operating system and initial programs for LabQuest, our programmers got to know the OLPC programmers as part of the open source community. We got an OLPC computer, and we found it relatively easy to move our LabQuest App to the OLPC computer. If you have an OLPC computer, you can download our LabQuest App (free) from [www.vernier.com/olpc](http://www.vernier.com/olpc), and use Go!Temp, Go!Motion, or Go!Link and any of 40 of our sensors with it.



A model house built to test the transfer heat through the walls with the Infrared Thermometer

## Hot House

### Investigating Insulation with Vernier's Infrared Thermometer

Clarence Bakken, a retired physics teacher from California, explored insulating capabilities of different wall materials. Clarence used an Infrared Thermometer (order code IRT-BTA, \$159) to study the rate at which heat is transferred through the walls in a model house. He used a simple cube that students built out of wood, glass, or plastic. During the activity, students investigate basic concepts in heat transfer. Download this sample activity at [www.vernier.com/innovate/innovativeuse90.html](http://www.vernier.com/innovate/innovativeuse90.html)

## Software Updates

### LOGGER PRO 3.6



We released Logger Pro 3.6 last year, primarily to support LabQuest and Macintosh Leopard. If you are currently using Logger Pro 3.5,

you should update only if you are using LabQuest or if you have upgraded to Leopard (OS 10.5) on Macs. We will release a minor update to Logger Pro, version 3.6.1, in late spring to add support for additional sensors, update some experiment files, as well as to fix a few bugs. If you are installing Logger Pro on computers over the summer, you'll want to use Logger Pro 3.6.1. We recommend that everyone with computers running Windows XP, Vista, or Mac OS 10.3, 10.4 or 10.5 download this update. The update is free to current users of any version of Logger Pro 3. See [www.vernier.com/tech/lpupdates.html](http://www.vernier.com/tech/lpupdates.html) or download information.

### LOGGER LITE 1.4

Logger Lite, our award-winning simplified data-collection software, will soon be available in a new version. Logger Lite ships with all Go! products, LabQuests, and LabPro QuickStart Package. Logger Lite 1.4 adds the following features:

- Support for LabQuest: You will be able to collect data directly from LabQuest, or retrieve remotely collected data from the LabQuest.
- Automatic Graph Match generation: Graph Match exercises are always a hit with students; you will be able to generate as many new target graphs as you like.
- Improved thermometer and analog gauge appearance: It is sometimes helpful to have a non-digital means of displaying a sensor reading.

If you already have Logger Lite and want an update, go to [www.vernier.com/downloads](http://www.vernier.com/downloads) to get the update, available in late April. Logger Lite works with Windows XP and Vista, and MacOS 10.3, 10.4, and 10.5.



## Solve this Crime Using Sensors in Forensic Science

How can high school students use a force sensor to solve a counterfeiting case? How can young scientists use Newton's law of cooling to determine time of death, or use colorimetry to identify the ink on a ransom note? These answers and more can be found in Vernier's new book, *Forensics with Vernier*, which contains engaging and realistic laboratory activities using

Vernier probeware. The book contains 14 lab activities identified as "Case Files." Each Case File deals with various aspects of forensic science investigation; for example, Case File 7 explores the science behind drug testing. Students learn to distinguish between qualitative and quantitative analysis, and they learn how to analyze physical and chemical properties

of an unknown substance. Using a Vernier pH Sensor and a Conductivity Probe, students help solve a fictitious case involving reckless driving and the identity of an unknown chemical substance. You can download "Case File 7, Drug Tests" and learn more about forensic investigations using sensors at [www.vernier.com/forensics](http://www.vernier.com/forensics)

ORDER CODE FWV | \$30

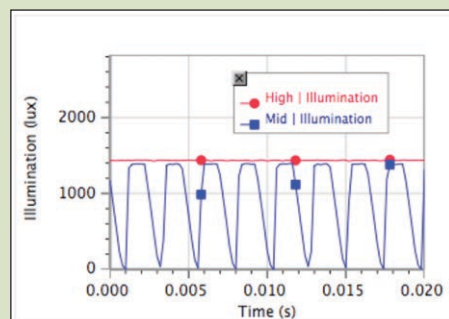


## Innovative Use

### How Do You Dim an LED?

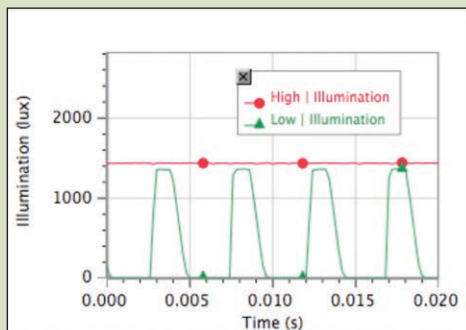
Have you ever seen an LED-based headlamp that has selectable brightness? Sometimes the brightness change is from turning on more or fewer LEDs, but sometimes the individual LEDs seem to change brightness. How does this work? Usually when you reduce the voltage across an LED, it just goes out. We looked into this question using a Vernier Light Sensor and a LabQuest. You could do this with any visible light sensor and a computer or calculator interface.

The first clue was an observation: When dimmed, and when moved rapidly across the eye's field of vision, the LED leaves a flash trail. When at full brightness, the eye just perceives a solid streak. Could the headlamp be built so that the LEDs are pulsed? This suggests an experiment: Measure the light intensity as a function of time for a dimmed LED light. What would be a reasonable data-collection rate and duration? Well, we know from looking at the light that it looks more or less steady to the eye, so it must be doing something very quickly. A television refreshes the screen at about 30 Hz, and that sometimes appears to flicker. The LED doesn't visibly flicker in standard use, so it must flash faster than that. As a starting guess, then, how about taking data at 5000 Hz for a tenth of a second? If we need to change that later, we can. Here's what we saw, after adjusting the time displayed to 0.02 seconds:



Comparison of light intensity for full brightness, always-on settings and the medium brightness pulsed setting

Aha! On high, the LED stays on; but on the mid-level setting, the LED is going on and off at some 400 Hz! What happens if we switch down the brightness a little more? Same parameters, new graph:



Comparison of light intensity for full brightness, always-on settings and the low brightness pulsed setting

Here we see that the brightness is about the same when the LED is on, but that the LED is just not on as much of the time. In technical terms, the duty cycle is lower. When the LED is off, it is not consuming energy from the battery. We get less light, but the battery will last longer. So, this headlamp manages to have a low-power, battery-saving mode by flashing the LED on and off. Said another way, the device uses pulse-width modulation to alter the power. It would be hard to see or understand this behavior without data-collection tools being used to extend our senses.

#### Extension questions:

- Does the average power used by the headlamp scale with the duty cycle of the LED, or is there some significant overhead to perform the modulation?
- How does the pulsing sleep light on some computers work?
- Does it also use pulse-width modulation?

To download this innovative use go to [www.vernier.com/innovate/innovativeuse89.html](http://www.vernier.com/innovate/innovativeuse89.html)

## Great Ideas from The Physics Teacher

As usual, *The Physics Teacher* has been full of good ideas for experiments and demonstrations using our products. Here are some examples:

**"Is It More Thrilling to Ride at the Front or the Back of a Roller Coaster?"** by Stefano Alberghi, Alessandro Foschi, Giovanni Pezzi, and Fabio Ortolani (all of Italy), December 2007. They used our equipment to do a thorough study of the accelerations involved.

**"Measuring the Forces between Magnetic Dipoles"** by Lisa E. Gayetsky and Craig L. Caylor (Westminster College, PA), September 2007. They use a triple-beam balance to measure the forces, but the experiment could be done more easily using a Dual Range Force Sensor. You can also use our new Rotary Motion Sensor to measure the position. You could also use an Ohaus balance.

**"Acoustic Measurement of the Potato Cannon Velocity"** by Michael Courtney and Amy Courtney (Ballistics Testing Group, West Point), November 2007. They used a LabPro and our Microphone to measure the time the potato takes to travel down the barrel and then an additional 10 meters. This allows an accurate calculation of speeds.

**"A Simplified Adiabatic Compression Apparatus"** by Michael J. Moloney and Albert P. McGarvey (Rose-Hulman Institute of Technology, IN), October 2007. This "Apparatus for Teaching Physics" article explains how to make an inexpensive adiabatic compression apparatus out of a plastic bottle and our Gas Pressure Sensor.



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VERNIER IS PROUD TO BE RECOGNIZED FOR ITS PHILANTHROPIC COMMITMENT, STEADY GROWTH, AND AS ONE OF THE BEST 100 COMPANIES TO WORK FOR IN OREGON—FOR 9 YEARS IN A ROW.

## Vernier Summer Hands-On Workshops



These one-day, general, data-collection workshops feature a wide variety of activities in chemistry, biology, physics, math, middle school science, physical science, and Earth science. The \$99 fee includes training, lunch, and lab handouts.

This is a great opportunity for teachers who

- want to evaluate our award-winning data collection technology.
- are new to data collection.
- need a refresher course on their Vernier equipment.
- want to learn from the experts.

### JUNE

June 11: Sioux Falls, SD  
 June 13: Omaha, NE  
 June 18: Dallas, TX  
 June 20: Shreveport, LA  
 June 23: St. Louis, MO  
 June 25: Indianapolis, IN  
 June 27: Atlanta, GA  
 June 30: Knoxville, TN

### JULY

July 10: Hartford, CT  
 July 12: Boston, MA

### AUGUST

Aug 4: Beaverton, OR  
 Aug 7: Seattle, WA  
 Aug 9: Cleveland, OH  
 Aug 11: Pittsburgh, PA

## NEW Elementary Hands-On Workshop

Join us for a day to learn how to integrate Vernier technology into your Elementary classroom. We will explore data collection on computers using Go!Temp, Go! Link, Go! Motion, and Logger Lite software. We will also explore the use of the LabQuest and features in our Logger Pro software appropriate for use in the elementary classroom. This 6-hour, hands-on workshop includes lunch and lab handouts. The \$99 registration fee includes a copy of *Elementary Science with Vernier*.

**July 14: Boston, MA**

**July 15: Boston, MA**

The registration form can be found at [www.vernier.com/workshop/elementary.html](http://www.vernier.com/workshop/elementary.html)

## Subject-Specific Summer Workshops

### Biology/AP\* Biology

The Tech Trio—Vernier, Ward's, and Texas Instruments—will host three 2-day Biology/AP Biology Summer Workshops that will feature hands-on training integrating technology into your biology and AP Biology classes. A variety of experiments will be offered, including seven of the AP Biology lab activities recommended by The College Board. You will have the opportunity to collect data using probeware on computers and TI graphing calculators. The \$149 registration fee includes a copy of *Biology with Vernier*.

**June 25-26: Baltimore, MD**

**July 21-22: Chicago, IL**

**August 11-12: San Diego, CA**

### Advanced Chemistry

Vernier and Flinn Scientific will co-host three AP Chemistry hands-on technology workshops. During these 2-day summer workshops, teachers will do many of the 22 experiments recommended by The College Board. These experiments will center around Vernier and Flinn equipment, supplies, and kits, and are from the Vernier-Flinn lab book, *Advanced Chemistry with Vernier*. The \$149 registration fee includes a copy of *Advanced Chemistry with Vernier*.

**June 23-24: Baltimore, MD**

**July 23-24: Chicago, IL**

**August 13-14: San Diego, CA**

### Physics

These 2-day hands-on workshops give novice and experienced users an opportunity to explore the use of technology in the teaching of physics. The activities will be built around the use of Vernier sensors and software. Three major areas of exploration will be provided:

- One will focus on the features of Logger Pro software that are especially useful to physics teachers; e.g, the analysis of movies and the addition of vectors to graphs and movies.
- The second area will explore a variety of data-collection options; i.e., computers, graphing calculators, wireless, and remote.
- The third area will give participants an opportunity to use each Vernier physics sensor in at least one traditional experiment, inquiry activity, or lab practical.

The \$149 registration fee includes a copy of *Physics with Vernier*.

**June 27-28: Baltimore, MD**

**July 25-26: Chicago, IL**

**August 15-16: San Diego, CA**



THE TECHNOLOGY TRIO



\*AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.



More information on all Vernier workshops at [www.vernier.com/workshop](http://www.vernier.com/workshop)



## NSTA/Vernier Technology Award

At the recent NSTA National Convention in Boston, Christine and David Vernier presented the Vernier/NSTA Technology Award to the 2008 awardees. The award, co-sponsored by Vernier and NSTA, is part of the NSTA Teacher Award Program. Each year, educators are recognized for their planned or current innovative use of data-collection technology. Seven awards are available: one elementary, two middle level, three high school, and one college level. The awards, each valued at \$3000: include \$1000 in cash, \$1000 in Vernier Technology, and up to \$1000 in expenses for attending the NSTA Convention. Below are brief synopses of the 2008 award-winning entries.

### ELEMENTARY LEVEL (GRADES K – 5)

*Allison Needham, Watkins Elementary School, Midlothian, VA*  
Allison plans to enhance the Children's Engineering and Design Technology activity on sound using data-collection technology.

### MIDDLE SCHOOL LEVEL (GRADES 6 – 8)

*Mary Cook, Roosevelt Middle School, Glendale, CA*  
Mary plans to use Vernier technology to improve students motivation and interest in STEM education topics.

### HIGH SCHOOL LEVEL (GRADES 9 – 12)

*Steve Ahn, Watauga High School, Boone, NC*  
Steve will have his students use various sensors to create a digital field guide comparing environmental conditions at locations around the school.

*Rebecca Morrison, Runnels High School, Baton Rouge, LA*  
Rebecca will have her students produce instructional videos on physics activities that can be done at an amusement park.  
*Danielle Spaete, Pleasant Valley High School, Bettendorf, IA*  
Danielle will have her students analyze sounds from various instruments and use the information to program a synthesizer to recreate the sound characteristics of that instrument.

### COLLEGE LEVEL

*Dr. Irina Lyublinskaya, College of Staten Island, Staten Island, NY*  
Irina created a set of inquiry-based lab activities that integrate data-collection technology into the elementary science and math curriculum.

Detailed descriptions of these projects can be found at [www.vernier.com/nstaawards](http://www.vernier.com/nstaawards)

### 2009 Entry

It's not too early to start thinking about your 2009 entry.  
[www.vernier.com/nstaawards](http://www.vernier.com/nstaawards)



*Studying bungee force and acceleration using a Wireless Dynamics Sensor System*

### Activity-Based Physics Faculty Institutes

These one-week summer institutes are for college and university faculty who wish to change their students' physics learning environment to a more active one.

Instructors: Priscilla Laws, Dickinson College; David Sokoloff, University of Oregon; and Ronald Thornton, Tufts University.

**June 16-20 or June 23-27** (attend either) at Dickinson College, Carlisle, PA

For more information, go to <http://darkwing.uoregon.edu/~sokoloff/abpi.htm>

### Show and Tell Innovative Uses Online!

Doing something innovative in your classroom? Send us your ideas for innovative uses of Vernier data-collection technology, and we might publish your ideas in a future print or electronic newsletter or on our web site.

Include your original data and images of the experiment setup. (Images that include students will require signed release forms prior to being published.) If we choose to publish your idea, we will send you a \$100 Vernier gift certificate.

**Send us your ideas today!**  
[innovativeuses@vernier.com](mailto:innovativeuses@vernier.com)

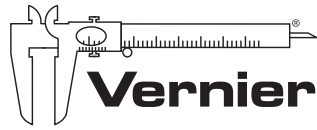
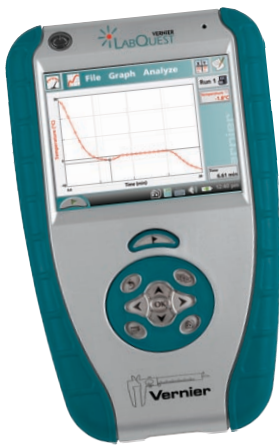
professional development

20 years ago  
The **CALIPER**

We introduced our first program for IBM (MS-DOS) computer. It was Precision Timer for photogate timing. This was actually the third time Dave Vernier wrote this popular program. It was first on Apple II, then on Commodore 64 in 1984.

for more  
information

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