THE CALIPER

Vernier
Measure. Analyze. Learn.™

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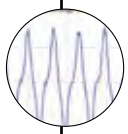
IN THIS ISSUE






## Powerful Just Became a Lot More Affordable


$149 ORDER CODE LQ-MINI

LabQuest Mini brings the power of Vernier's award-winning LabQuest technology to teachers who don't need the versatility of a standalone device. Students can use LabQuest Mini to collect data on a desktop, laptop, or netbook computer, using our Logger *Pro* software or the free Logger Lite software (included with each LabQuest Mini).

**Key features include:**

- Powered by USB, so no AC adapter or batteries are required!
- Small lab-bench footprint: 1"x 3¼"x 4"—literally a small sensor hub beside or behind your computer, half the size of a LabPro.
- Five sensor ports give you the flexibility to collect from 55 Vernier sensors.
- Maximum 100,000 samples per second data-collection rate and 12-bit resolution.
- Free Logger Lite software included.
- The price—$149. No one can match this combination of power and affordability.

*See Frequently Asked Questions about LabQuest Mini on page 6*

## NEW *Hands-On Introduction to NI LabVIEW™ with Vernier SensorDAQ®*


$25 ORDER CODE LWV

This new book is a great way to introduce your students to programming and engineering. It includes a series of eight hands-on exercises and two projects using Vernier sensors (Temperature, Voltage, and Microphone) and our SensorDAQ interface. We think that hands-on projects are the best way to learn programming in LabVIEW.

The book starts with the fundamentals of LabVIEW programming. Each chapter explains concepts of the graphical programming language, followed by an exercise. In the first exercise, you build a working program that graphs temperature readings. The fundamentals of programming, loops, cases, and subroutines are all covered. Since LabVIEW is a graphic programming language, user interfaces with graphs are relatively easy to introduce.

The book wraps up with two open-ended projects for students. One is a program to have the computer indicate temperature reading with a tone. The other is a program to determine what button on a cell phone is pressed by analyzing the tone. These are projects that many students can accomplish in just a few days.

# PHYSICS & ENGINEERING

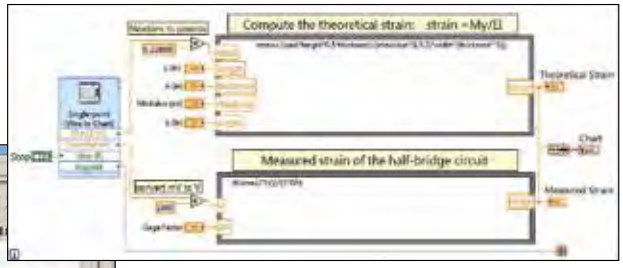
## NEW National Instruments LabVIEW™ Education Edition

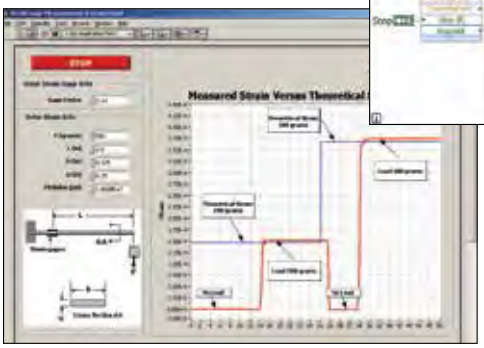
### Graphical Programming Language for High School STEM Education

**Single-User NI LabVIEW Education Edition,** ORDER CODE **LVEE-1, $100**
**25-User NI LabVIEW Education Edition,** ORDER CODE **LVEE-25, $1,500**

The new National Instruments LabVIEW Education Edition software helps teachers bring STEM concepts to life through hands-on learning. This industry-standard NI LabVIEW (used throughout the engineering disciplines) includes modules for educational hardware, including these Vernier products:

- Go! Devices (Go!Link, Go!Temp, Go!Motion)
- NXT Sensor Adapter
- SensorDAQ



*A NI LabVIEW program that reads a Vernier Force Sensor and Vernier Instrumentation Amplifier connected to a strain gage (above right) uses the sensor readings to compute the measured and theoretical strain on a cantilever beam. The results are displayed in the chart (above) for students to learn about strain and strain gages.*

Full integration means that everything required for these Vernier products is included. Install NI LabVIEW Education Edition, connect the Vernier hardware, and begin running examples to:

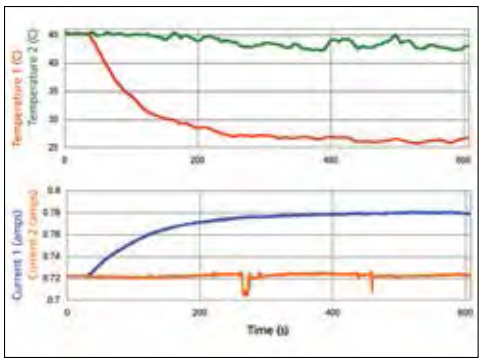
- Log and analyze data
- Introduce engineering measurement and automation concepts
- Build sensor-controlled NXT robots
- Perform feedback and control
- Introduce biomedical concepts with physiology sensors

## Studying the Efficiency of Solar Panels

Nick Glembotski, an engineering student at San Diego State, recently used our Current Sensor, Voltage Probe, and redesigned Surface Temperature Sensor (which can be used in air or water) to investigate whether the efficiency of solar panels can be improved by cooling the panels by spraying them with a mist. In his tests, the answer was yes, by several percent. He feels the extra cost of misting apparatus would pay for itself fairly quickly.

In this experiment, one panel had mist sprayed on it after a few seconds, and the other did not. The upper graph shows the temperature change when misting starts (bottom line). The bottom graph shows the increased current (top line) from the cooler solar panel.

*Solar panel and mist mount (note only one panel has a mist mount)*




## Hands-On LabVIEW Workshop

**July 6–7 | Portland, OR | $149**

Join us at this two-day workshop to become familiar with LabVIEW in the context of working with Vernier sensors. On the first day, we will introduce the basics of the LabVIEW programming environment with hands-on exercises that use the Vernier SensorDAQ and Vernier sensors for data collection, data analysis, and automation. The second day will focus on completing a project and introducing more advanced LabVIEW concepts.

Lunch will be provided and attendees will receive the new *Hands-On Introduction to NI LabVIEW with Vernier SensorDAQ* book.

## NEW PHYSICS PRODUCTS!

We have lots of new physics equipment this year. Don't miss:

**Spectrum Tube Carousel Power Supply**, which holds six gasses simultaneously. **ST-CAR, $275**. Gasses available are argon, helium, neon, $CO_2$, nitrogen and air.

**Optical fiber holders** for both the Spectrum Tube Single Power Supply and the Spectrum Tube Carousel Power Supply, **ST-FHS, $12** and **ST-FHC, $12**.

**Electrostatics Kit** (**ESK-CRG, $109**) provides a Faraday Pail and other tools, while the High Voltage Electrostatics Kit (**HVEK-CRG, $249**) lets you charge spheres and study charge distributions.

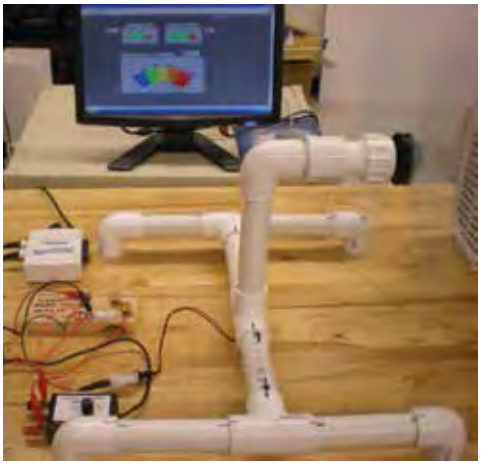
For details on these new products and more, see www.vernier.com/physics

# PHYSICS & ENGINEERING

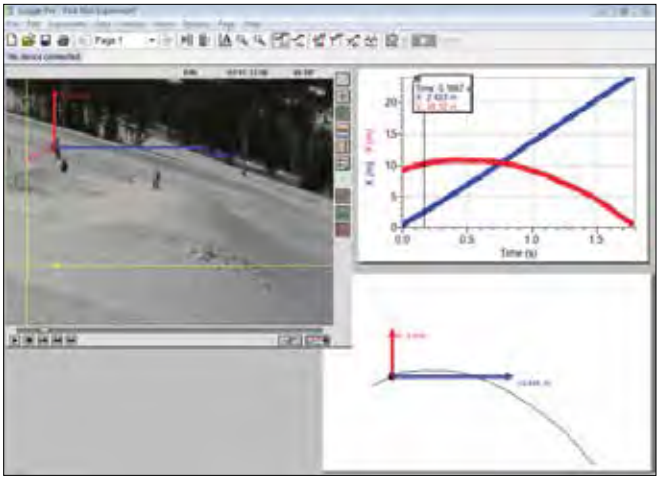
## Green Engineering

Steve Cogger, instructor at Doherty Middle School, Andover, MA, has his students design and test wind turbines. The goal of the project is to optimize the design of turbine blades to generate the highest output power. Using NI LabVIEW software with the Vernier SensorDAQ interface, he wrote a simple LabVIEW program to measure voltage and current from Vernier sensors. In addition, the LabVIEW program computes the output power, and provides results in colored steps—feedback that the students grasp better than digital readings from hand-held meters. The project uses a wind turbine kit that allows the students to easily attach different turbine blades. A room fan provides the wind source.

The project engages students in the design process as they prototype, test, and make measurements. Through this process, they explore and discover the many variables of blade design, allowing them to modify their design and repeat the process. The students also learn about the issues related to fossil fuels, alternative energy, and wind farms.



## Cool Tools: Vail Ski and Snowboard Academy and Video Analysis in Logger *Pro*



Here's a novel use of Logger *Pro*'s video analysis and vector analysis tools. The Vail Ski and Snowboard Academy uses Vernier tools to help their student athletes analyze their motion on the race course and in the terrain park. Miles McGeehan, physics instructor, has developed a course titled Ski Physics.

Each week, students address a different concept in Newtonian physics. For example, they captured a video of a student performing a straight air on a jump to study projectile motion. Video analysis produced beautiful graphs showing constant horizontal velocity, and constantly changing vertical velocity. Miles then had his students use the little-known animated display feature of Logger *Pro* to superimpose velocity vectors on the skier in the video, further reinforcing the independent behavior of the horizontal and vertical motions.

Other activities include the use of the Wireless Dynamics Sensor System to measure accelerations during moguls skiing, slalom courses, or halfpipe rides. Since each high-school student has his or her own ski or snowboard emphasis, this course includes independent student projects. In addition to learning physics, the students may use the data to improve their skiing and riding.

Vail Ski and Snowboard Academy is a public school and is part of Eagle County Schools in Vail, Colorado.

For more information, including the Logger *Pro* file shown here, see www.vernier.com/innovate/123

## NEW Color Mixer for the Vernier Dynamics System

A new Color Mixer accessory for the Vernier Dynamics System is now available. The kit consists of a three-color LED source, a lens, and a screen. These all attach to a Vernier Track, and can be used to study the mixing of red, blue, and green light by additive and subtractive mixing. These simple experiments show how modern computer and television displays work.


Instructors often only describe, rather than perform, these experiments due to the difficulty in setting up appropriate light sources.

The intensity of each LED can be controlled easily, demonstrating color addition. For subtraction, you can create shadows by placing objects in the light path.

# PHYSICS

## Impulse Comparison for Elastic and Inelastic Collisions

Keith Michaelsen, Southington High School, Southington, CT, contacted us to discuss ways to show students that the impulse delivered during an elastic collision is twice the impulse delivered by an inelastic collision. This is a counterintuitive concept, and performing an experiment to observe this can be a challenge. The main issues are:

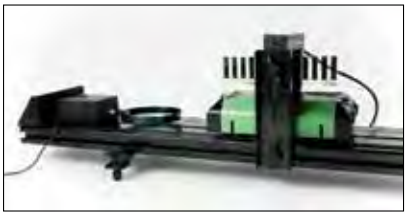
**1.** To compare the change in momentum between the two different types of collisions, you have to perform the experiment multiple times, and for each trial you need to have a consistent initial momentum.

**2.** Friction must be minimized, but that can be accomplished with a low-friction cart. Producing an elastic collision with a low-friction cart is fairly easy since we could use magnets or springs during the collision. For example, a cart could move along a track and collide with a spring at end of the track. Producing perfectly inelastic collisions can be difficult, because objects tend to bounce.

We tried different combinations of equipment and different experimental setups, and came up with a nice experiment. We ended up using a Dual-Range Force Sensor, a Vernier Photogate, our Dynamics System, and our Bumper and Launcher Kit.

On one end of the track, we placed an end stop. We attached a hoop spring from the Bumper and Launcher Kit to the force sensor and laid the force sensor in the track, butted up against the end stop. We attached a photogate to the track and attached a picket fence to the cart.

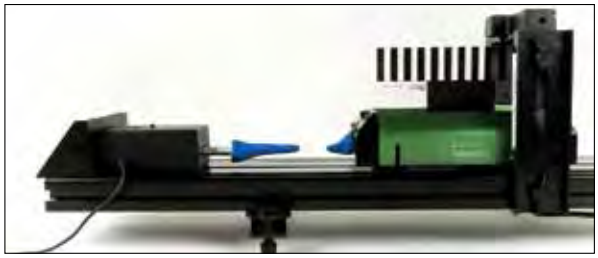
On the other end of the track we placed the track bracket from the Bumper and Launcher Kit, and we attached the other hoop spring to the bracket. We launched the cart from a consistent compression of the hoop spring. This produced a consistent velocity.



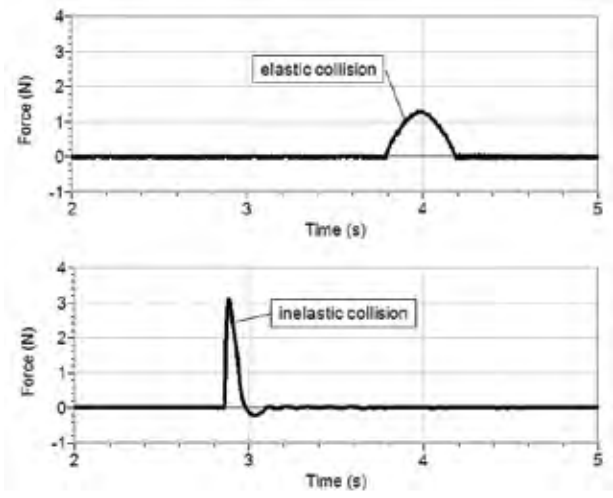
When the cart was launched toward the other end, it collided and rebounded from the hoop bumper on the force sensor. This generated a force *vs.* time graph. We used a data-collection rate of 500 samples/second and collected 10 seconds of data. We set the photogate to work in the Gate mode. We used the integral feature of Logger *Pro* to determine the impulse and collected five trials of data for each collision type.

To collect data during an inelastic collision, we replaced the hoop bumper with a piece of clay rolled into a cone. We also put a small piece of clay on the front of the cart. We then launched it by pulling it back the same amount. When the cart collided on the other end, it stuck to the clay. We collected five runs.

The following graphs show a comparison of the impulse from two runs—one elastic and the other inelastic. The scaling of the graphs



is the same so that you can see the difference in the collisions. The elastic collision shows a longer interaction time and a smaller maximum force. The inelastic collision (the graph on the bottom) displayed some interesting results. The difficulty in performing this experiment is using materials that produce an inelastic collision. We felt that clay was a good choice, however, the bottom graph shows us that the cart is bouncing back very slightly. As a result, when we used the Logger *Pro* integral tool, we selected the region from the beginning of the collision until the force returned to zero and the cart had come to a complete stop.




When we analyzed the data over the five runs, we obtained the following results. The change in momentum was calculated from the mass of the cart and the change in velocity. The impulse is found using the integral of the force *vs.* time graph.

| Trial | Change in Momentum (kg m/s) | Impulse (N s) |
|---|---|---|
| Elastic Collision | 0.32 | 0.32 |
| Inelastic Collision | 0.17 | 0.18 |

The impulse values determined through the velocity-change calculation and the force integral were consistent. The impulse from the elastic collision was very close to twice the impulse of the inelastic collision. This is the result that we sought. The elastic impulse is a little less than twice the inelastic impulse. That the ratio is just under 2 could be due to the fact that the "elastic" collision is losing some energy. We saw this as a slightly smaller speed after the impulse. Perhaps a magnetic bumper would see a more nearly elastic collision, and yield a ratio closer to 2.

# PHYSICS

## Digital Photographs in Physics

We were intrigued by an article in the November 2009 issue of *The Physics Teacher* entitled "Inexpensive Strobe-Like Photographs" by Emil L. Medeiros, Odilon A.P. Tavares and Sergio B. Durate. The article describes a great way to create strobe-like photographs with simple video cameras, or with still digital cameras that have a movie mode. This prompted us to share three ideas with you.

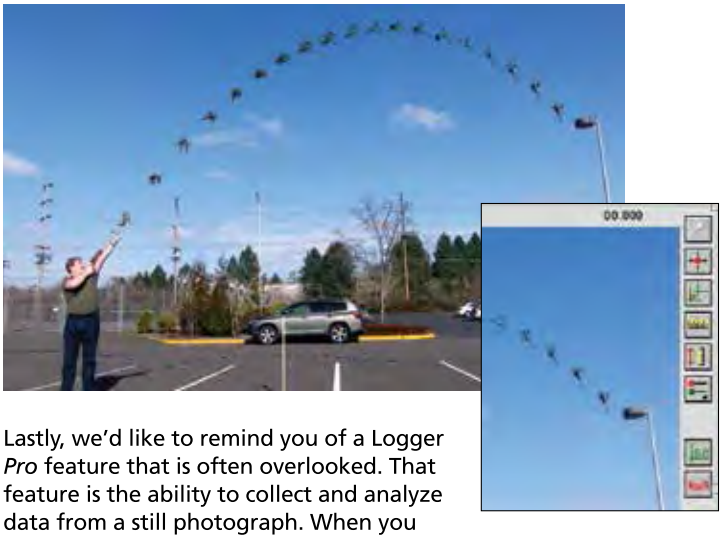
First of all, Vernier is proud to sponsor the AAPT High School Physics Photo Contest (www.aapt.org/Programs/contests/photocontest.cfm). For this contest, students submit photos that illustrate physics concepts and a corresponding description of the physics associated with the photograph. The contest has two categories: "natural" photographs and "contrived" photographs. The photo submitted by Chase Lampe (below left), University High School, Tucson, Arizona was last year's winner in the Natural category. His teacher was Pamela Tautz.

Participating in this contest is an excellent way for students to explore physics in their everyday lives. We hope that you will encourage your students to enter the contest.

Two years ago, a couple of unique photographs were submitted to this contest. In these photographs, students overlaid multiple images into one photograph. The photos then had a strobe-like effect. The photograph entitled "Human Projectile" (above right) was submitted in 2008 by Joey Moro, Ithaca High School, Ithaca, New York. His teacher was Deborah Lynn. This type of photograph was again submitted in the 2009 contest and has resulted in the creation of a new contest category called "Photos with Multiple Images," which brings us to our second point.

The authors of the article mentioned above describe how to create and analyze strobe-like photographs. They point out that traditional strobe photos are made by repeated exposures of a single frame of film to a bright flash of stroboscopic light. Their approach uses modern technology and digital editing software. They extract frames from a digital movie using video-editing software (AVS Video Converter), and then combine the frames in photo-editing software (Paint Shop Pro). We'd like to mention another option:

In the Fall 2009 *Caliper*, we discussed Casio high-speed digital cameras and how you could capture and analyze high-speed movies with them. These cameras are also capable of capturing still digital frames at high-speed bursts of up to 40 fps. After these photos are captured, they can be easily imported into the computer without the need for video-editing software. The photos can then be merged into a single photo using a free, photo-editing program called Paint.net (Windows only). We used a Casio camera and Paint.net to generate this photo of a toy monkey being launched.



Lastly, we'd like to remind you of a Logger *Pro* feature that is often overlooked. That feature is the ability to collect and analyze data from a still photograph. When you import a picture into Logger *Pro*, you have the option to import it with "photo analysis." When you choose that option, the photo analysis tool palette will appear on the right side of the photo. You then use these tools to mark locations on the photograph. If you have an object of known length in the plane of the motion, you can set a scale and apply units of measure to the analysis. We placed a vertical meter stick in the same plane as our projectile. In our Logger *Pro* file, we were able to create a time column, since we knew that the burst rate of the camera shutter was 15 frames per second. We could then use our curve-fitting tools to investigate the velocity and acceleration of the toy monkey.


Wait, there's one more piece of information to share! As mentioned above, in the Fall 2009 *Caliper*, we talked about processing videos from high-speed cameras. An issue to address was the fact that high-speed movies are recorded with a frame rate of 30 fps, instead of the actual frame rate, e.g. 420 fps. In the *Caliper*, we described a way to use calculated columns to generate the real capture rate. Well, we've automated that process within Logger *Pro*, and that new feature is available in version 3.8.2. Now, you simply double-click the movie to bring up the Movie Options dialog box. There, you will find a box labeled "Override frame rate". Check that box, and enter in the actual capture rate. Logger *Pro* then uses this information to calculate velocities and accelerations.

# CHEMISTRY

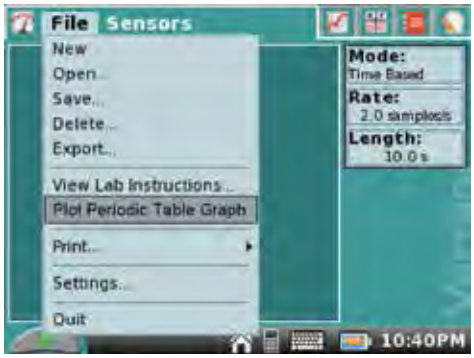
## NEW Periodic Table Graphing

When we originally created the popular Periodic Table application in LabQuest, we realized that there was a gold mine of information in the database that could eventually be used to create periodic table plots, such as atomic radius *vs.* atomic number, first ionization energy *vs.* atomic number, etc. Most introductory chemistry courses introduce periodic trends by having students create these kinds of plots and look for recurring trends in many chemical and physical properties. You can do this in LabQuest App.

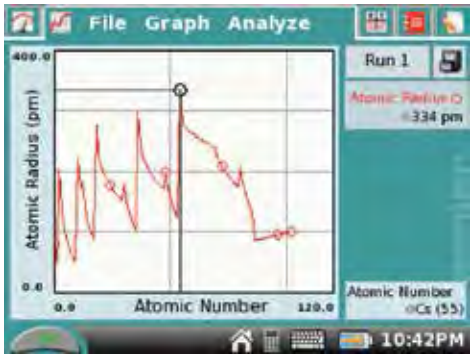
**1.** First, you need to update your LabQuest to version 1.4 (see page 8).

**2.** After the unit is updated, turn on LabQuest without a sensor connected.

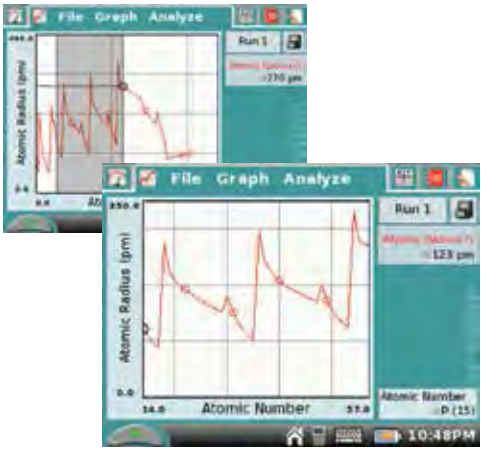
**3.** From the File menu, choose Plot Periodic Table Graph.




**4.** You will now be viewing a plot of Atomic Radius (pm) *vs.* Atomic Number, as shown here. Notice, too, that when you tap on any point along the curve, such as shown here for Cesium (Cs), that its atomic radius value and symbol/atomic number are shown in the info boxes to the right of the graph. This way, students can easily navigate through the periodic table, and observe that elements with similar properties recur at regular intervals.

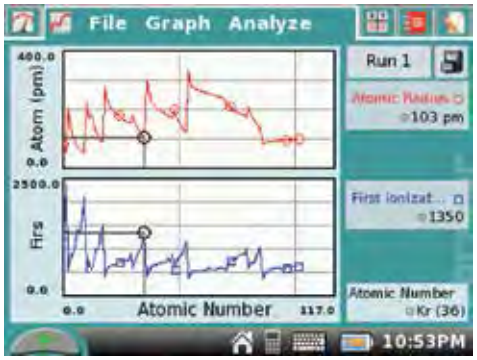



**5.** If you want to see additional detail, you can simply drag your stylus from left to right or right to left across the area of interest, and then choose Zoom from the Graph menu.




**6.** To change to another plot, all you need to do is tap on the y-axis label, and choose one of the other quantities, such as Melting Point, Boiling Point, Density, Electronegativity, or First Ionization Energy.

**7.** Of course, LabQuest App has other graphing features that allow you to plot two different properties on two graphs (choose Show Graph → All Graphs from the Graph menu) or to plot more than one property on a single graph (choose Graph Options from the Graph menu, then in Run 1, check the boxes for any properties you wish to plot).




That's all there is to it. We think you and your students will enjoy incorporating this useful tool into a periodic table discovery exercise. Don't forget, too, that they can easily print paper copies of various graphs using USB-direct or wireless printing.

## LabQuest Mini *(continued from cover)*

**Frequently Asked Questions:**

**Q:** I already own LabPro interfaces, and simply want to add lab stations. Should I purchase LabQuest Mini?

**A:** We will continue to sell LabPros, but with its smaller size, lower price (two-thirds of the cost!) and newer technology, LabQuest Mini can work side by side with LabPros. Both units use the same Logger Lite or Logger *Pro* software.

**Q:** Can I do remote data collection (away from the computer) using LabQuest Mini?

**A:** Only if you want to use a netbook or laptop computer in the field. But keep in mind that our popular LabQuest (with its built-in processor and screen) is the perfect solution for remote data collection, and it can also be used as a computer interface.

**Q:** Is there anything that LabPro does that LabQuest Mini does not do?

**A:** Not much, but here are a few things: LabPro has one additional channel for analog or –BTA sensors (4 instead of 3). In talking to our customers, we found that few made use of the fourth channel. LabPro can be used with TI calculators or Palm OS handhelds for remote data collection; LabQuest Mini cannot. And finally, LabPro has an analog out control feature; LabQuest Mini does not.

**Q:** What if I collect data exclusively on computers or netbooks?

**A:** LabQuest Mini may be perfect for you! It comes with FREE Logger Lite Software to get your students quickly collecting and analyzing data. And if you're looking for more advanced features than Logger Lite provides, our award-winning Logger *Pro* 3 software provides advanced analytical features, including video analysis. Use LabQuest Mini with over 16 core-topic Vernier lab books.

**Q:** How many ports does LabQuest Mini have?

**A:** Three sensor ports for use with 48 compatible Vernier sensors and two digital sensor ports for use with motion detectors, photogates, radiation monitors, rotary motion sensors, and drop counters.

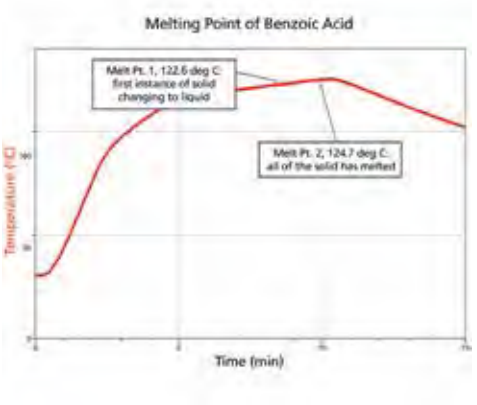
You can find some innovative uses of LabQuest Mini in this issue: the MEL-TEMP story on page 7, the Electric Fish story on page 7, and the Muscle Physiology lab on page 8.

# BIOLOGY

## Using the Wide-Range Temperature Probe with MEL-TEMP®

If your school owns MEL-TEMP units, this is for you. Our new Wide-Range Temperature Probe fits perfectly into the thermometer slot of a MEL-TEMP unit. This is a great option, especially if your school is no longer using mercury thermometers. The Wide-Range Temperature Probe can be used safely to 330°C, and its RTD (resistance temperature detection) technology ensures accuracy to ±0.1°C.

The graph below shows typical results testing the melting point of benzoic acid, using Logger *Pro* 3 software on a computer and our new LabQuest Mini as the computer interface.




## Record Electric Signals from an Electric Fish!

With its increased frequency response and external grounding pin, our new and improved Instrumentation Amplifier (order code INA-BTA, $59) can now be used to record the electric signal from an electric fish. Many animals can sense things that humans cannot; for example, some fish create and sense electric fields. Weakly electric fish, such as the black ghost knifefish, create an electric field around their bodies by activating a very specialized muscle called the electric organ. This organ produces a rapidly oscillating electrical signal around the entire fish. Changes in this electric field are detected by special cells called electroreceptors that are located in the skin of the animal. Weakly electric fish use this sense to navigate in dark and murky water to find food and to communicate with other electric fish.

Follow these steps to record the electric signal from an electric fish:

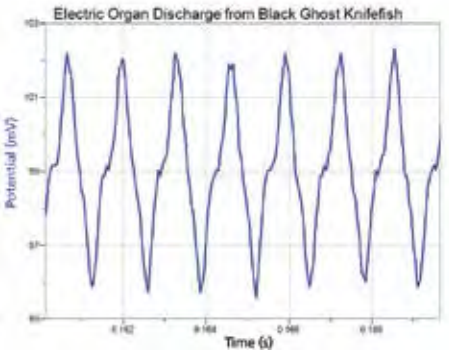
**1.** Purchase a black ghost knifefish from your local pet store. Place the fish in a small fish tank equipped with a heater, and allow the fish to equilibrate overnight.

**2.** Attach a pair of test leads with miniature alligator clips to the inputs of a Vernier Instrumentation Amplifier. The test leads that are supplied with the Vernier Circuit Board can be used for this purpose. Attach a piece of bare copper wire to the free ends of the test leads and place them in the fish tank. To get the best signal, position the test leads at opposite ends of the tank. Attach another test lead to the grounding pin on the back of the amplifier. Secure the free end of this lead to the top or side of the fish tank. Set the switch on the Instrumentation Amplifier to +/–200 mV and connect the amplifier to your Vernier Interface (LabQuest, LabQuest Mini, or LabPro).

**3.** Change the length of data collection to 250 ms and change the sampling rate to 20,000 samples per second. You are now ready to collect data. Turn off the power to the heater, air pump, and any lights for the fish tank. Begin data collection to record the electric signal from your fish. When you have finished sampling, turn on the air pump, heater and lights for your fish.

**4.** Zoom in on a small sample of your data to see the electric signal from your fish. The frequency of the waveform from this species should be between 700–1100 Hz. The amplitude of the signal will vary as the fish moves around in the tank, but should be highest when the tail and head of the fish are parallel to the recording leads.

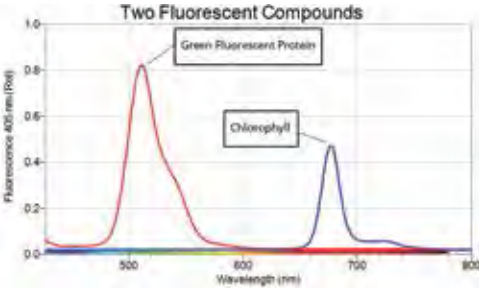
You can see what the electric signal should look like from the graph below. For more information, contact John Melville at jmelville@vernier.com




## Use the SpectroVis® Plus to Explore Fluorescence Spectroscopy

Fluorescent molecules are compounds that absorb light of one wavelength, then re-emit light at a longer wavelength. This emitted light can be quantified using fluorescence spectroscopy. Molecular and cellular biologists use fluorescent compounds to label proteins, gels, and even cellular organelles. In many ways, fluorescent compounds have revolutionized research in the life sciences.

The new SpectroVis Plus spectrophotometer/fluorometer can be used to conduct fluorescence spectroscopy on many compounds, including chlorophyll, fluorescein, and Green Fluorescent Protein (GFP). Sample spectra are provided in the graph below.



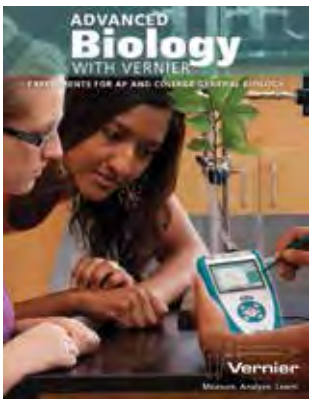

Fluorescence spectroscopy can also be used to teach concepts in chemistry. Fluorescein is a fluorescent molecule that is structurally similar to the pH indicator phenolphthalein. Both compounds are sensitive to changes in pH, but phenolphthalein is not fluorescent. The only difference between these two compounds is a single oxygen atom. Instructions for this simple demonstration can be found at www.vernier.com/innovate/129

# BIOLOGY & SOFTWARE

## Now available: *Advanced Biology with Vernier* 2nd Edition

We have revised the *Advanced Biology with Vernier* lab book to include updated bio-technology experiments to reflect our partnership with Bio-Rad Laboratories, Inc. The updated experiments include

- Easy Transformation of E. coli using pGLO®
- Analysis of precut Lambda DNA; An Introduction to Restriction Enzymes
- Forensic DNA Fingerprinting




We've also added new advanced labs using the SpectroVis Plus Spectrometer. The new experiments include

- Enzyme Analysis using Tyrosinase
- Introduction to Neurotransmitters using AChE
- Macromolecules: Experiments with Protein

The second edition of the book still contains all 12 of the recommended AP Biology labs, plus we've added inquiry ideas to help you prepare for upcoming changes to the AP Biology curriculum.

If you own the first edition of the lab book, you can request an updated copy of the Word files on CD by filling out a request form at www.vernier.com/requestcd

## Osmosis Lab: A New Take

In a recent issue of the *American Biology Teacher*, Stephen Marvel and Megan Kepler presented a method of making an inexpensive osmometer utilizing Vernier's Gas Pressure Sensor (order code GPS-BTA), an interface (LabQuest, LabQuest Mini, LabPro, or Go!Link), software (Logger *Pro* or LabQuest App), and a modified 60 mL syringe barrel. This novel membrane osmometer's construction is described in detail, using commonly found materials around the house and drugstore, and is relatively easy to construct.

Marvel & Kepler's osmometer is a vast improvement over the floss-tied segments of dialysis tubing that often cause frustration, instead of the actual concept of osmotic flow of water across a semipermeable membrane that is key to all living cells. This osmometer is one that students could construct, either at home or in the classroom, and then use in their study of cellular water movement. Though the method is one that will need to run over an extended period (several hours), it does offer assured positive results.

See: Marvel, C.M. & Kepler, M.V. (2009). A Simple Membrane Osmometer System & Experiments that Quantitatively Measure Osmotic Pressure. *The American Biology Teacher*, 71, 355-362.

## SOFTWARE UPDATES

**Logger *Pro* 3.8.2** – This update is free to all users of any previous version of Logger *Pro* 3, and is available at www.vernier.com/tech/lpupdates.html

Version 3.8.2 supports the new LabQuest Mini and the Vernier SpectroVis Plus, as well as adding support for Windows 7.

**LabQuest 1.4** – LabQuest 1.4 is now available. We encourage all LabQuest users to install this free update, available at www.vernier.com/labquest/updates

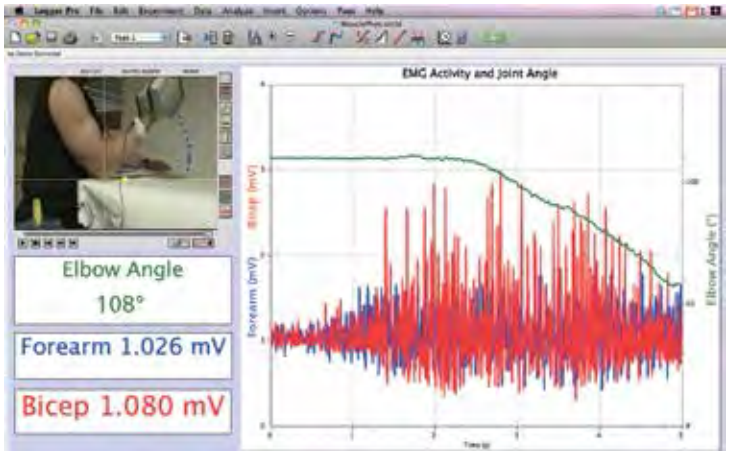
The update adds support for the new SpectroVis Plus, as well as offering improved battery life, support for additional sensors, and printing to wi-fi printers.

**LabQuest Emulator** – Version 1.4 is now available at www.vernier.com/labquest/emulator

## Video Analysis and Muscle Physiology

Our biology staff scientist, John Melville, has been working with our new LabQuest Mini and has found a way to integrate video analysis into a simple muscle physiology experiment. EKG sensors are attached to the bicep and forearm muscles to record muscle activity. A Low-g Accelerometer is then attached to the wrist to measure joint angle. The video capture feature in Logger *Pro* is then used to synchronize video from a DV camera and the physiological data from the LabQuest Mini. The subject is filmed performing a simple bicep curl. Students can then clearly see that muscle activity precedes movement of the arm and that the forearm muscle activity precedes activation of the bicep.

In addition, the advanced video analysis features in Logger *Pro* can be used to correlate muscle activity with the velocity and acceleration of the hand during the bicep curl. Sample data are provided in the figure below. You can also watch a video of this simple lab exercise at www.vernier.com/innovate/130



# TOPICS OF INTEREST

## AAPT Comes to Portland

**July 17–21**

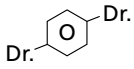
*Mt. Hood, Oregon*

Vernier Software & Technology, and Dave Vernier, have been at 55 American Association of Physics Teachers (AAPT) bi-annual meetings over the past 29 years. For the first time ever, the meeting is coming to our hometown, Portland, Oregon. Please join us here if you can. Portland has wonderful weather in the summer. Visit our office for a tour and take home a Vernier gift. We will be sponsoring the annual demo show and there will be other fun events planned for this meeting.

## SCIENCE HUMOR

**1.**


**2.**

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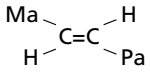


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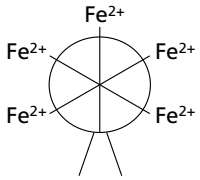
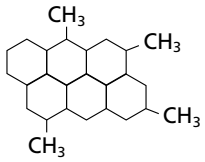



**5.**




**1.** Ortho docs **2.** Para docs **3.** Trans parents **4.** Ferrous wheel **5.** Tetra-methyl chicken wire

## years ago in THE CALIPER

**25 Years Ago in *The Caliper*:**

We had a discussion on how to print graphs on the newly developed, "high res" printers that were coming out for Apple IIs. We also announced that Graphical Analysis II was selected as a software award winner by *Classroom Computer Learning* magazine.

**20 Years Ago in *The Caliper*:**

We introduced the Universal Lab Interface (ULI) and Macintosh software for data collection.

## Vernier on Facebook

**Enter to Win a Free LabQuest**

Find us on Facebook

Become a Facebook Fan of Vernier Software & Technology and you and a friend can win!

Do you know fellow teachers who LOVE Vernier products? Refer them to Vernier Software & Technology's fan page for a chance to win. Vernier is looking for 500, or more, very talented educators (yes, that's YOU!) to become fans of the Vernier Facebook page http://tinyurl.com/yz6ow46

To celebrate friends, Vernier's 500th fan, and the person who referred him or her, will win a LabQuest Quick Start Package. This package includes one LabQuest handheld, one Temperature Probe and the Logger Lite Software application ($350 value). To get started, click on "suggest to friends" below the Vernier logo on the Vernier Facebook page. Good Luck!

## Vernier Adopts National Lab Day Projects

©iStockphoto.com/imgendesign

President Obama recently announced National Lab Day, a nationwide initiative to build local communities of support to foster hands-on learning among volunteers, students, and educators.

Vernier is proud to support National Lab Day by adopting one project per month from now until the official National Lab Day in May 2010. Our February winner is Lisa Devillez of Marshall County High School in Benton, KY. She plans to use Vernier equipment to help her students compete in the Technical Problem Solving portion of the regional and state Science Olympiad. We provided Lisa with $490 worth of Vernier equipment for her project. Congratulations and good luck, Lisa!

Our March winner is Debra Phillips of Garden Lakes Elementary School in Avondale, AZ. Her project, Modeling Car Designs with Efficiency, will have students construct model cars and study their motion using her new Vernier equipment. Congratulations, Debra!

We are excited that many of you have already posted projects using Vernier products. Come up with your project idea and post it to the NLD web site. We will be choosing the next winner in April and May. In addition, we will choose at least one NLD project that used Vernier equipment to share in a future edition of *The Caliper.* Please send us your project results. If your project is published, you will receive a $100 gift certificate for Vernier equipment.

National Lab Day can be found at www.nationallabday.org Vernier's National Lab Day page can be found at http://my.nationallabday.org/vernier

# PROFESSIONAL DEVELOPMENT

## 4 HOUR FREE Hands-On, Data-Collection Workshops

**LabQuest I Computer Data Collection**

Join us for one of our free, 4-hour, hands-on workshops to learn how to integrate our computer and handheld, data-collection technology into your chemistry, biology, physics, middle school science, physical science, and Earth science curriculum. The workshops include lunch or dinner and lab handouts on CD.

**HANDS-ON DATA-COLLECTION WORKSHOPS – SPRING 2010**

**ARIZONA**
Phoenix
**CALIFORNIA**
Pasadena
Riverside
**COLORADO**
Colorado Springs
Denver
Fort Collins
**DELAWARE**
Wilmington
**GEORGIA**
Augusta
**MARYLAND**
Baltimore
**NEW JERSEY**
Newark
**NEW YORK**
Long Island
**NORTH CAROLINA**
Greensboro
Raleigh
**PENNSYLVANIA**
Philadelphia
**SOUTH CAROLINA**
Columbia
**VIRGINIA**
Fairfax County
**WASHINGTON DC**

## 1 DAY One-Day Summer Workshops

Join us for a day to learn how to integrate our data-collection technology into your chemistry, biology, physics, middle school science, physical science, and Earth science curriculum. These 6-hour, hands-on workshops include lunch and lab handouts on CD. The cost of the workshop is $99.

| JUNE | JULY | AUGUST |
|---|---|---|
| Baton Rouge, LA | Minneapolis, MN | Beaverton, OR |
| Houston, TX | La Crosse, WI | Seattle, WA |
| Boise, ID | Rochester, NY | |
| Salt Lake City, UT | Albany, NY | |
| Atlanta, GA | | |
| Tallahassee, FL | | |
| Durham, NC | | |
| Richmond, VA | | |

## Vernier Webinars

Vernier now holds free, one-hour training events online. The presenter will give a tour of Vernier products and answer questions. You can follow along with your own equipment or simply watch and learn. Sessions are broadcast live on the web. All you need is a broadband internet connection and a phone line. Recorded versions will also be available for download.

## LabVIEW Workshop

Learn about LabVIEW using Vernier sensors at a workshop in Portland on July 6–7. See page 2 for more information.

## 2 DAY High School Two-Day Institutes

| San Antonio, TX | |
|---|---|
| June 21, 22 | Biology |
| June 23, 24 | AP Chemistry |
| June 25, 26 | Physics |

| Chicago, IL | |
|---|---|
| July 19, 20 | Biology |
| July 21, 22 | AP Chemistry |
| July 23, 24 | Physics |

**PHYSICS**—These 2-day, hands-on institutes give attendees an opportunity to explore the use of technology in the teaching of physics. You will explore the features of Logger *Pro* software using a variety of Vernier physics sensors. The $199 registration fee includes a copy of *Physics with Vernier*.

**BIOLOGY/AP* BIOLOGY**—These 2-day Biology/AP Biology Summer Institutes will feature hands-on training using a LabQuest or a computer to collect and analyze data from classics like cell respiration, diffusion, and more. You will also perform DNA gel electrophoresis. The $199 registration fee includes a copy of *Advanced Biology with Vernier*.

**AP* CHEMISTRY**—Vernier and Flinn Scientific will co-host these two-day AP Chemistry hands-on technology institutes. The experiments, including 22 recommended by The College Board, will center around Vernier and Flinn equipment, supplies, and kits. The $199 registration fee includes a copy of *Advanced Chemistry with Vernier.*

## 2 DAY NEW College Two-Day Institutes

| Washington, DC | |
|---|---|
| August 9, 10 | Physics |
| August 11, 12 | Chemistry |
| August 13, 14 | Biology |

**COLLEGE PHYSICS**—The 2-day College Physics Institute will survey all data-collection and video tools offered by Vernier. Participants will learn both basic and advanced skills in Logger *Pro*. Video capture and analysis will be emphasized. The $199 registration fee includes a copy of *Physics with Video Analysis*.

**COLLEGE BIOLOGY**—In this 2-day, hands-on institute, participants will conduct a series of laboratory exercises that include cellular respiration, enzyme kinetics, photosynthesis, and transpiration. You will explore fluorescence spectroscopy and basic protein biochemistry using our new SpectroVis Plus Spectrometer/Fluorometer. The $199 registration fee includes a copy of *Advanced Biology with Vernier*.

**COLLEGE CHEMISTRY**—Vernier and Flinn Scientific team up to present this two-day, hands-on College Chemistry Institute. You will investigate thermodynamics, kinetics, acid-base reactivity, and equilibrium. Special experiments will be offered that explore spectroscopy and gas chromatography. The $199 registration fee includes a copy of *Advanced Chemistry with Vernier.*

**Go to www.vernier.com/workshop for more information and to register for these workshops.**

# GRANTS & FUNDING

## 2010 NSTA/Vernier Technology Awards Presented

At the recent NSTA National Convention in Philadelphia, David and Christine Vernier presented the NSTA/Vernier Technology Award to the 2010 Awardees.

### ELEMENTARY LEVEL (GRADES K–5)

**Judy Heitkamp**, Prairie Elementary School, Worthington, MN

Judy will use Vernier data-collection technology with her 4th grade students to study how humans can affect the quality of the water supply in their community.

### MIDDLE SCHOOL LEVEL (GRADES 6–8)

**Nicole Ackerson**, Berkeley Preparatory School, Tampa, FL

Nicole developed an innovative cross-curricular activity that connects biology, mathematics and engineering using LEGO® NXT® robotics and Vernier sensors.

**Cynthia Ollendyke**, Peters Township Middle School, McMurray, PA

Cynthia will have her students use Vernier probeware to determine if the area behind her school is environmentally healthy.

### HIGH SCHOOL LEVEL (GRADES 9–12)

**Steve Ahn**, Abingdon High School, Abingdon, VA

Steve plans to have his students use GPS and sensor data to predict the type of underlying base rock along the Virginia Creeper bike trial.

**Stephen Biscotte**, Cave Spring High School, Roanoke, VA

Stephen has created a Physicians-In-Training program, in which he uses physiology sensors to incorporate real-world experiences into his anatomy and physiology curriculum.

**Deborah Carder**, Fruitvale High School, Fruitvale, TX

Deborah will have her students do water-quality testing on the retention ponds located on school property.

### COLLEGE LEVEL

**Brian Geislinger**, Gadsden State Community College, Gadsden, AL

Brian has his introductory astronomy students use a Light Sensor to measure small variations in light intensity in model solar systems that he created.

Detailed descriptions of these projects can be found at www.vernier.com/nstaawards

## 2011 Vernier/NSTA Technology Award

### Win One of Seven Awards

Full-time science teachers from elementary to college level are eligible to apply for the Vernier Software & Technology/NSTA Technology Award. Vernier will provide up to seven awards, each valued at $3000, for educators who demonstrate innovative uses of data-collection technology using a computer, graphing calculator, or other handheld device in the science classroom.

The awards will be given to one elementary teacher, two middle school teachers, three high school teachers, and one college-level educator. Each will receive a $1,000 cash award, $1,000 in Vernier equipment, and $1,000 towards travel and expenses to attend NSTA's National Convention in 2011.

Go to www.vernier.com/nstaawards.com for guidelines, a grant application, and profiles of previous winners.

### 2011 Entry

It's not too early to start thinking about your NSTA/Vernier Technology Award entry. Deadline for entry is 11/30/10. www.vernier.com/nstaawards

## Vernier Grant Writing Guide

Looking to fund a state-of-the art science lab? Vernier has gathered a variety of resources to keep you informed with up-to-date details on available grants, and tips for writing a winning grant proposal.

Articles in the Vernier Grant Writing Guide include:

- Working with Your Idea
- Finding a Funding Source
- Writing Your Proposal
- Getting Help
- Supporting Your Idea
- Following Up on Your Grant

To access the guide, go to www.vernier.com/grants

"As a high school teacher I am familiar with the excuse that my students lost their assignment. The students in my AP Chemistry class have figured out that all of Vernier's student labs are hosted online. If they lose their lab, they simply go online to print out another copy of the assignment. This entire process helps me from repeatedly distributing 'new' handouts! Thank you, Vernier, for this simple yet very helpful tool."

*Barbara Nelson*
*Idaho Falls High School, Idaho Falls, ID*

*OREGON BUSINESS AWARD*

*2005 PHILANTHROPY AWARD*

*PLACED 9TH OF 100 BEST GREEN COMPANIES IN OREGON*

*INTERNATIONAL AWARD FOR LABQUEST*

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 11 YEARS IN A ROW.

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# NEW SpectroVis® Plus

This updated spectrometer has wider range, improved optical resolution, and now features fluorescence, too. Only **$449!**



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