The *Caliper*

Volume 22 Number 2 — Fall 2005

## New! VERNIER easyLink™ : Data Collection Made Easy

With the new Vernier EasyLink and any one of 30 different Vernier sensors, data collection with TI graphing calculators just got easier and more affordable. EasyLink is a single-channel analog interface that plugs into the mini-USB port on a TI-84 Plus or TI-84 Plus Silver Edition graphing calculator. Priced at only $58, EasyLink is an affordable way to get started with calculator data collection.

How easy is data collection with EasyLink and a TI-84 Plus? Simply connect your sensor to an EasyLink and plug EasyLink into the mini-USB port on the calculator. The EasyData application automatically launches and identifies the sensor, and you are ready to collect data. It's as easy as that! (If your TI-84 Plus calculator was manufactured prior to January 2005, your calculator may not have the EasyData App. You can download the free EasyData App from our web site at www.vernier.com/easydata)

New! *Human Physiology with Vernier*
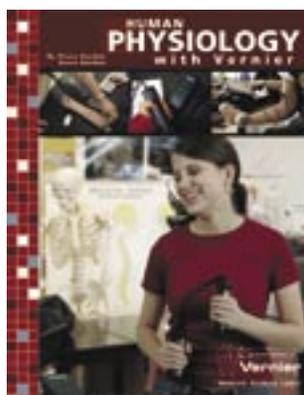
by Diana Gordon and Steven Gordon, M.D.

We introduced several exciting new sensors for teaching physiology this year: Spirometer, Hand Dynamometer, Blood Pressure Sensor, and Hand-Grip Heart Rate Monitor. We are now pleased to announce the release of our new *Human Physiology with Vernier* lab manual. This book contains 24 human physiology experiments using these new sensors, as well as our EKG Sensor, Surface Temperature Sensor, O_2 Gas Sensor, and 25-g Accelerometer.

Experiments in this book will appeal to students at many levels, including high school, advanced placement, and college. Each experiment is designed to encourage students to think about the physiology of the various human organ systems. These activities will guide your students through explorations of the upper respiratory tract, the lungs, the heart, the nervous system, and the musculoskeletal system. Homeostasis is an underlying theme found throughout this book. Several experiments illustrate the response of the human body to stress and other external influences. Other activities simulate disease states that enable students to compare normal and abnormal functioning in a particular system.

Where possible, the authors have pointed out the medical relevance of each experiment with examples and problems drawn from clinical experience. Each of the activities in this book is written with directions for computer-based data collection, using the newly released Logger *Pro* 3.4 software. For more information about all of our physiology products, go to www.vernier.com/physiology

Human Physiology with Vernier | Order Code HP-A | $45

EasyLink–Continued from page 1

Thirty Vernier sensors can be used with EasyLink. Even more sensors will be supported with the release of EasyData 2.0 in November. (EasyData 2.0 will be preloaded on TI-84 Plus calculators manufactured in 2006.)

Sensors supported by EasyData and EasyLink

25-g Accelerometer	Flow Rate Sensor	Relativity Humidity Sensor
Low-g Accelerometer	Force Plate	Salinity Sensor
Barometer	Gas Pressure Sensor	Spirometer
Conductivity Probe	Hand Dynamometer	Stainless Steel Temperature Probe
Charge Sensor	Instrumentation Amplifier	Surface Temperature Sensor
Current Probe	Light Sensor	Thermocouple
Differential Voltage Probe	Magnetic Field Sensor	TI Light Sensor
Dual-Range Force Sensor	O_2 Gas Sensor	UVA Sensor
Electrode Amplifier	ORP Sensor	UVB Sensor
Extra-Long Temperature Probe	pH Sensor	Voltage Probe

Additional sensors supported by EasyData 2.0 *(available November 2005):*

Dissolved Oxygen Probe, Ammonium, Calcium, Chloride, and Nitrate Ion-Selective Electrodes, EKG Sensor, Hand-Grip Heart Rate Monitor, Sound Level Meter, and Turbidity Sensor.

Investigating Boyle's law with EasyLink

Vernier EasyLink FAQs

Can I collect data using two or more sensors with EasyLink?
EasyLink is a single port analog interface; therefore only one sensor per calculator can be used for data collection. We recommend that you use a LabPro or CBL 2 interface for experiments that require two or more sensors.

How do I collect data using digital probes and a TI-84 Plus calculator?
Digital probes, such as Motion Detectors, Photogates, and Radiation Monitors, cannot be used with EasyLink. For motion experiments, we recommend the CBR 2 by Texas Instruments, which is supported by the EasyData application. All other digital probes require the use of a LabPro or CBL 2 interface.

Can I use EasyLink with sensors that I already own?
If the sensors you own are listed above and will auto ID when using a CBL 2 or LabPro, then your sensors will work with EasyLink. Unfortunately, older sensors that have a DIN plug or do not auto ID are not supported by EasyData 1.0, but may be supported with EasyData 2.0. Contact us for more information.

Does the DataMate App support EasyLink?
No. The DataMate App does not have the capability to communicate with the USB port on a TI-84 Plus calculator. EasyLink and EasyTemp require you to use the EasyData App. EasyData 2.0, available in November, will have additional setup and analysis functionality, making it more comparable to the current version of DataMate.

Vernier EasyLink | Order Code EZ-LINK | $58

Inverse Variation in Pressure Data: A Sample Activity Using EasyLink™

Here is a data-collection activity that you can use with your math and science students. The activity describes collecting and analyzing pressure *vs.* volume (Boyle's law) data using a Gas Pressure Sensor, a Vernier EasyLink, and a TI-84 Plus graphing calculator.

Data Collection
Adjust the syringe that comes with the Gas Pressure Sensor so that it holds 10 mL of air before it is attached to the sensor. Set up the EasyData App to collect data using the Events with Entry option. Collect pressure measurements when the volume of the syringe is adjusted to values of 5, 7, 10, 12, 15, 17, and 20 mL. Add .08 mL to each volume before entering to account for the additional air inside the Gas Pressure Sensor. This ensures the most accurate data possible.

Data Analysis
The analysis of the data directs students through logical steps to help them determine the best mathematical model to describe the data. Students are asked to predict possible values for the *x*- and *y*- intercepts by associating conditions of the data collection to these values; for example, pressure values as the volume gets close to zero. Students then use that information to eliminate different

functions as possible models for the data. Once students have eliminated linear and exponential models, they are asked to explore a rational function model *(y = k/x)* and manually adjust the value of *k* to visually fit the data.

The activity goes on to explore the connection between the model *y = k/x* and a definition for inverse variation that involves the product of the variables being constant. The students get a wonderful aha moment when they realize that *PV = K* and *y = k/x* are restatements of the same mathematical principle.

To download this free activity, visit our web site at www.vernier.com/easylink
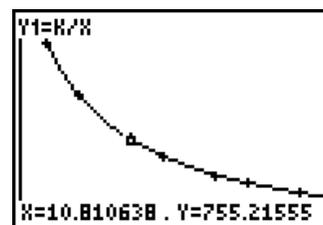
The Microscale Determination of the Molar Mass of Metals Using a Gas Pressure Sensor

Here is a nice lab idea by James Gordon, Amber Boyce, and Thoren Maule (Central Methodist University, Fayette, MO) that was published in *The Chemical Educator* (2004, 9, 1-2). Their experiment uses our Gas Pressure Sensor to collect data using the DataMate program and a TI calculator, but it can be easily adapted for Logger *Pro*, EasyData, or Data Pro software.

In the described experiment, small samples of manganese (0.0500 g) and zinc (0.0600 g) were reacted with 10 mL of 6.0 M HCl in a 250 mL Erlenmeyer flask, according to the general equation:

$$M(s) + 2\ HCl(aq) \longrightarrow MCl_2(aq) + H_2(g)$$
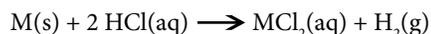
The pressure of the hydrogen gas generated was measured with the Gas Pressure Sensor, as shown here. (Note that the pressure "bump" at the beginning is due to the stopper being added, and is used as the baseline pressure value.) The change in pressure, the temperature, and the volume of the system were used to calculate moles of hydrogen gas, using the ideal gas law:

$$n_{H_2} = \frac{P_{H_2} V_{H_2}}{R T_{H_2}}$$
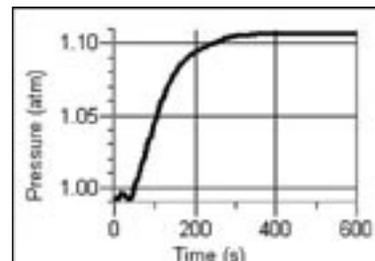
Using the mass and moles of the metals, the average molar masses of manganese and zinc were determined to be 54.3 ± 2.5 g/mol and 62.4 ± 2.9 g/mol, respectively.

We recommend reading the original article on line at http://chemeducator.org/bibs/0009006/960364jg.htm for important tips and details.

TI-Navigator™

TI-Navigator is a classroom learning system that combines TI-73, TI-83 Plus, or TI-84 Plus graphing calculators and your classroom PC to create a wireless learning environment in your class. The TI-Navigator system allows you to capture student input of points, equations, or data in a shared workspace that can bring collaborative activities and lively discussions to your class. Teachers can use the system to assess understanding of key concepts, monitor student progress, and differentiate instruction. Use the included analysis software to automatically grade student assessments and provide timely feedback.

TI-Navigator systems come in 16- and 32-student configurations. Additional hubs that connect four calculators can be purchased to accommodate classrooms with up to 40 students. Add in TI Keyboards to improve student text entry on TI-83 Plus or TI-84 Plus calculators. Calculators are sold separately.
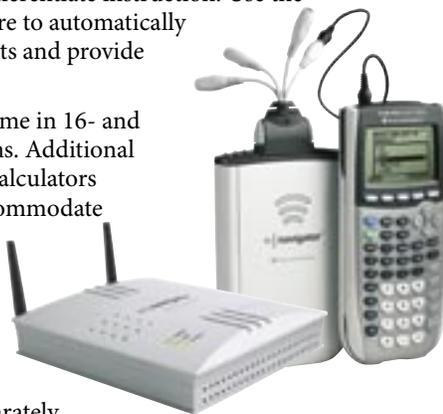
Visit www.vernier.com/calc/tinavigator.html for pricing and information.

Palm® Tungsten E2 and Data Pro

Our Data Pro Multi-Connector Package now supports the new Palm Tungsten E2. The Tungsten E2 uses the same multi-connector that was first introduced with the release of the Tungsten T5 last fall. Our new multi-connector cable connects the E2 and T5 with our LabPro data-collection interface. The Data Pro Multi-Connector Package may be ordered as DP-MP and costs $58.

For those of you considering Palm handhelds for data collection, Palm is currently promoting the E2 with $50 rebates until October 7 for up to nine rebates per customer name or address. See www.palm.com/us/promotions/te2rebate/
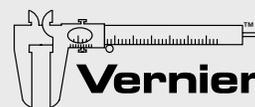
For quantities of 10 or more handhelds, Palm offers education volume sales. Look for "Special Offers" at www.palm.com/us/education/

For an up-to-date list of suppliers of Palm OS devices that we support with Data Pro packages, check our compatible models page at www.vernier.com/palm/palmmodels.html

(In case you missed it, the maker of Tungsten handhelds is no longer known as palmOne. The new name is the old name before palmOne—Palm, Inc.)

Vernier

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AEP Award

The Association of Educational Publishers honored Vernier Software & Technology with a Distinguished Achievement Award for Go!Temp in the category of Instructional Materials. This award is one of several honors Go!Temp has received, including Technology & Learning's Award of Excellence, a 5-star review by *Multimedia & Internet @ Schools*, and selection by SIIA as a Codie Finalist.

Want to learn more about Go!®Temp?
www.vernier.com/gotemp

Ecology/Environmental Science Teaching Award

Congratulations to Gabriel Roman Ayyavoo for winning the Vernier/NABT Ecology Environmental Science Teaching Award! Mr. Ayyavoo teaches biology, chemistry, and environmental science at Francis Libermann Catholic HS in Toronto, Canada.

The Ecology/Environmental Science Teaching Award, sponsored by Vernier Software & Technology, recognizes secondary school teachers who have successfully developed and demonstrated an innovative approach to teaching ecology/environmental science and have carried his/her commitment to the environment into the community.

According to Mr. Ayyavoo, "My teaching of science education incorporates the deliberation of real-world ecological issues, mostly by kinesthetic investigations. I believe in a curriculum that challenges students to observe, explain, and apply strategies to solve crisis."

GIS Mapping Enhances Student Salinity Study

In March 2005, Olathe North HS (Olathe, KS) students Kevin Skov and Greg May, along with teacher Steve Obenhaus, took a trip to the southern reaches of Texas to explore Laguna Madre's hypersaline characteristics. Laguna Madre, a large body of shallow water separating Padre Island from the South Texas mainland, is one of only a few hypersaline lagoons in the world.

Using a Vernier Salinity Sensor, LabPro, and a laptop PC running Logger *Pro* software, they traveled south on the Intracoastal Waterway taking salinity readings from Corpus Christi Bay to Baffin Bay. For comparison, they also measured the salinity in several locations on the Gulf of Mexico.

Latitude and longitude data were collected with a handheld GPS unit and were recorded in Logger *Pro* for each collection site. The data were saved using Logger *Pro*'s "Export in GIS format" feature.

Upon returning home, the data were brought into ArcGIS software to produce the map shown here. The results followed the expected trend of increased salinity from Corpus Christi Bay to Baffin Bay. When mapped, the north to south transition from hyposaline to hypersaline conditions was clearly visible.

Thanks to Steve Obenhaus and his students for the map and photo.
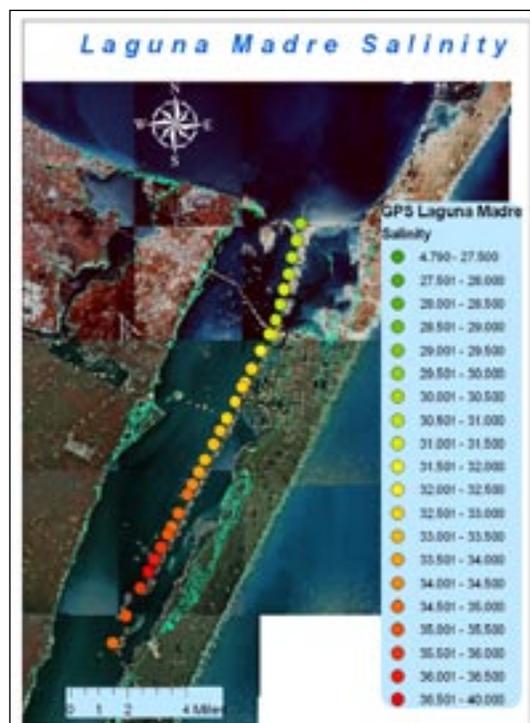
Data in ArcGIS map shows trend in salinity
(Color photo available at www.vernier.com/innovate)

Students gathering data on Laguna Madre

20 Years Ago in *The Caliper*…

We explained how to use our Apple II programs with the new "hard drives" that were just coming out. We also introduced Voltage Plotter, our first program to read voltages via the Apple II game port.

Video Capture for $99

Using the newest version of Logger *Pro* (3.4), you can capture a movie directly within the program, which simplifies integrating video with Logger *Pro*. The Logitech® QuickCam® Pro 4000 web camera is an excellent way to inexpensively bring video capture to Logger *Pro*. The camera has an advanced VGA CCD sensor, and it supports 640 x 480 videos. It has a manual focus lens and is capable of capturing video at 15 frames per second. The QuickCam Pro 4000 connects to the computer through a USB port.

System requirements for video capture on Logger *Pro* with the QuickCam Pro 4000:

- Windows® 2000 or XP with DirectX 9 installed, or Macintosh® OS 10.2, 10.3, or 10.4
- 1 GHz processor (Mac) or 2 GHz (Windows) and 512 MB RAM, and at least 500 MB available hard disk space for temporary storage
- Screen resolution of at least 1024 x 768
- Some Macintosh computers may require the purchase of a third-party camera driver from www.ioexperts.com.

Logitech QuickCam Pro 4000 | Order Code LT-CAM | $99

Go! Toolkit for LabVIEW

We've recently introduced a collection of sample LabVIEW VIs and a Go! Toolkit. These free sample programs provide an ideal way to build custom data acquisition and analysis programs. They are also great for learning LabVIEW or other programming languages, or for engineering and science projects. One university engineering program is having students buy a Go! Link instead of a textbook for their course on sensors and data acquisition. (At $59, Go! Link is probably a lot cheaper!)

The sample programs for the Go! devices will run on Macintosh OS X or Windows computers using LabVIEW 7.x. All of our LabVIEW VIs for Go! devices, LabPro, and NI-ELVIS are available for free download at www.vernier.com/labview

Technical Support FAQs

Did you know that we now have over 230 Frequently Asked Questions on our web site? The support section of our web site lets you browse or search our complete list of technical help articles. These include tips, tricks, common questions, and lots of other stuff. Some of the answers you can find 24/7 on our site include:

- Tips for using and storing sensors
- Compatibility with products made by other companies
- Logger *Pro* tips and power user features
- Calculator and Palm OS tips and updates

You can browse all of our FAQs from the support section of our site at www.vernier.com/tech

Science Humor

The following was found floating around on the internet:

A Party of Famous Scientists

One day, all of the world's famous scientists decided to get together for a luncheon tea. Fortunately, the doorman was a grad student, and was able to observe some of the guests:

- Everyone gravitated toward Newton, but he just kept moving around at a constant velocity and showed no reaction.
- Einstein thought it was a relatively good time.
- Coulomb got a real charge out of the whole thing.
- Cauchy, being the only mathematician there, still managed to integrate well with everyone.
- Thompson enjoyed the plum pudding.
- Pauli came late, but was mostly excluded from things, so he split.
- Pascal was under too much pressure to enjoy himself.
- Volt thought the social had a lot of potential.
- Heisenberg may or may not have been there.
- The Curies were there and just glowed the whole time.

What Causes the Seasons?

Parker Moreland has been volunteering at an intermediate school in New Milford, CT, where he has come up with a clever modification of the "What Causes the Seasons" lab in our *Earth Science with Computers* book. First, instead of taping a temperature sensor to a globe, he opened a cardboard globe and mounted a Surface Temperature Sensor at the school's latitude from the inside of the globe, letting it protrude just a bit. He also mounted a light sensor (homemade, in his case) inside the globe. He then monitored the temperature change when a heat lamp was placed at the appropriate angle for winter and summer sun. You can also monitor the light level and length of a day as the Eharth turns with the sun in the winter and summer positions.
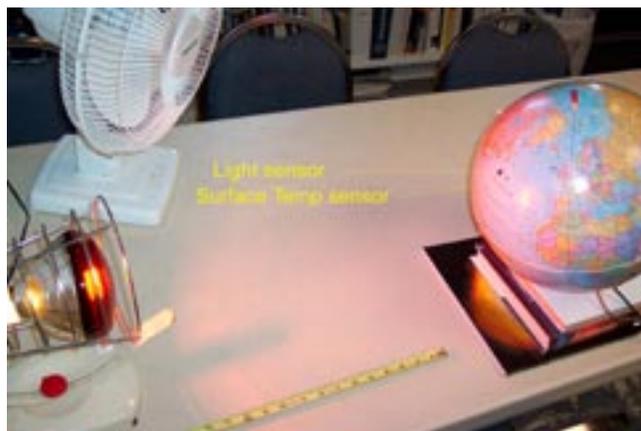
💡 Innovative Uses

Stephen J. Edberg (Jet Propulsion Laboratory, Pasadena, CA) has written two interesting labs using our sensors to study topics in space science. One lab is modeled after spacecraft that use magnetometers to explore the interiors of planets. Students use our Magnetic Field Sensor to investigate models of planets made of clay that have magnets imbedded inside. This lab can be seen at www.vernier.com/physics/vernier_planetmagfield.pdf. There is a lower tech version, with more detailed discussion, at http://eis.jpl.nasa.gov/cassini_epo/education/pdfs/Planetary_Magnetics.pdf

Edberg's second lab uses our Light Sensor to teach students about forward scattering of light with reference to the study of interstellar dust clouds, planetary atmospheres, and planetary ring systems. Water with a few drops of milk added is used to scatter the light. This lab is at www.vernier.com/physics/vernier_scattering.pdf, with a lower-tech version and more detailed discussion at http://eis.jpl.nasa.gov/cassini_epo/education/pdfs/Scattering.pdf

Student Chest Protector Study

Carolyn Purington, a student of Jacklyn Bonneau at Massachusetts Academy of Math and Science, Worcester, MA, did a study of the effectiveness of sports chest protectors in preventing commotio cordis, which is the sometimes fatal damage caused by a blunt impact to the chest of young athletes. She studied various materials and designs, using our Force Plate for many of the impact studies.

Student Rocket Launch

Three different high school groups launched LabPros in rockets as part of the NASA Student Launch Initiative Program this spring. The teams were given the mission of building a rocket that would go one mile high carrying a scientific payload, take data, and then return safely. A team from University School of Milwaukee, WI launched two LabPros with an Accelerometer, UVA, UVB, and CO_2 sensors. A team from Skyline HS, Sammamish, WA, launched a LabPro with a UVA, UVB, and Light Sensor. A third team from Oakton HS, Vienna, VA used a 3-Axis Accelerometer and Surface Temperature Sensor.

The sample graph below shows the acceleration of the Milwaukee rocket during the launch. Marked on the graph are the launch, apogee and drogue parachute deployment, main parachute deployment, and landing. They won the "Best Payload Design" Award.
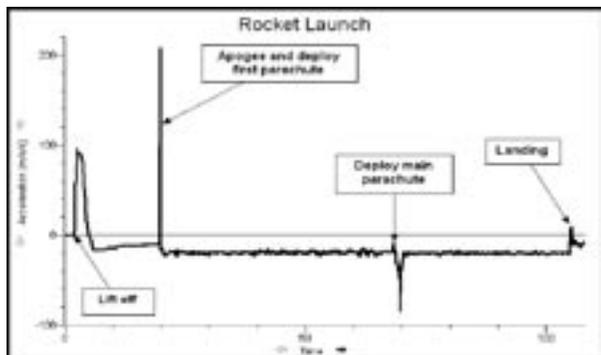

Juggling Physics

Some time ago, Tim Folkerts of Barton Co. CC, Great Bend, KS, posted a note on one of the physics internet discussion groups about juggling on a Force Plate. He even collected data on the apparent "weight" of jugglers as they perform. Well, it turns out Vernier Software & Technology has its own juggler, Scott Van Hoosen. We had Scott try this experiment with three balls and then five balls.
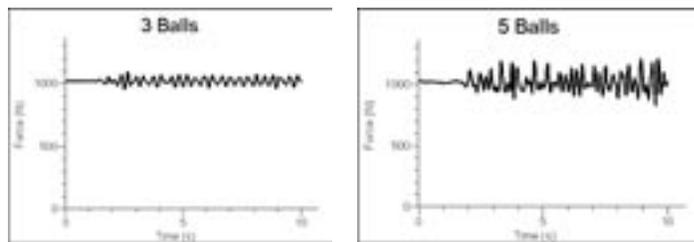
For each trial, Scott first held the objects in his hands, and then started juggling. Note that the average force reading remains about constant, but there is more deviation of the readings with the three balls. (He throws the balls higher when using five balls.) Download a movie and sample data at www.vernier.com/innovate/juggle.zip

Feline Radiation

Richard Taylor (The Hockaday School, Dallas, TX) has a cat (Kinsey) that needed radiation treatment for feline hyperthyroidism. Richard used our Student Radiation Monitor, LabPro, and a TI-84 to monitor the radiation from Kinsey over several days. Kinsey was injected with I-131, which has a half life of about five days. The count rated dropped off faster than the half life would imply, but Richard noted that the litter box was also very radioactive. Also note that Kinsey was more radioactive by a factor or 10 or so than anything you would ever buy for use in a science classroom.
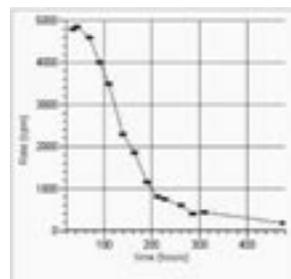
Half life graph from Kinsey's radiation treatment

Lemelson-MIT InvenTeams

Two of the 13 teams awarded grants by the Lemelson–MIT InvenTeams program in 2005 used our products extensively. The West Salem HS, OR team developed several methods of testing the ripeness of watermelon. One method was to measure the frequencies in the sound of the "thump" when the watermelon was hit by an object. They used the FFT graph of Logger *Pro* for the analysis. The team's mentor was Michael Lampert, who is also a 2005 Disney Teacher Award winner.

The Bow HS, NH team developed a remote-controlled submersible for science education. They used our Digital Control Unit and our water quality sensors. The mentor of this project, Stan Wawrzyniak, also won one of the Vernier Technology Awards for this project. For more information on the Lemelson–MIT InvenTeams competition, see http://web.mit.edu/invent/www/InvenTeam/pr.html

Logger *Pro* 3.4 Adds Video Features and More

Once again, we've updated Logger *Pro*, our full-featured data collection program for Macintosh and Windows. Every year or so we release a new version with new features. Do you have a Go!Motion or the new physiology sensors? Now you can use them with Logger *Pro*. Have you wished you could create double-y graphs to display different quantities on a single graph? Now you can. Time-of-day or date-based time columns? Got it.

The list of new features and enhancements is too long to cover here, but here are some of the changes in version 3.4:

■ You can now capture videos or pictures from a web camera or the Bodelin ProScope, synchronized with sensor data collection. It's easy to make a record of what happened in your experiment, whether it's only a quick snapshot to show the setup, or a detailed video to show the motion of a cart on a ramp. Video analysis, introduced in version 3.3, now works with more video files and offers rotated coordinate systems. Analysis of a photo opens up new possibilities—don't miss the example file showing the St. Louis Arch with the superimposed catenary curve.
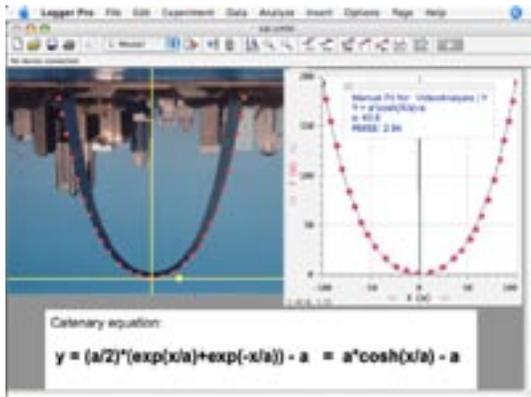
■ The popular TI-84 family of calculators from Texas Instruments has a new USB port and cable, so Logger *Pro* 3.4 now supports importing data from the TI-84 using the USB direct cable.

■ Modeling of data is better than ever, with true function plotting, manual fits that can be adjusted at any time, and user parameters and controls for use in calculated columns. These features make it easy to compare mathematical models to your sensor data.

■ You can now style text in most places in Logger *Pro*, using bold, italic, underlines, Greek characters, and super and subscripted numbers. Formulas will be more readable, now that you can type H_2O and Δt.

■ Long experiments are safer too, as Logger *Pro* now automatically backs up your data.

■ Finally, Logger *Pro* is now easier to install on Windows 2000 and XP, with a Microsoft-signed driver that does not require special privileges when the LabPro is first connected to a USB port. Of course, we support Tiger on the Mac.

As in previous versions, Logger *Pro* 3 has all the features of Graphical Analysis, and contains over 1,000 ready-to-run experiment files and sample movies, including the files for our new *Human Physiology with Vernier* book. Logger *Pro* 3 is your data collection solution.

The upgrade to Logger *Pro* version 3.4 is free to all users of Logger *Pro* 3. See our web site at www.vernier.com/loggerpro for more information and to download the update. If you are new to Logger *Pro* 3, check out the free demo.

Logger *Pro* 3 (version 3.4) | Order Code LP | $149

Upgrade from Logger *Pro* 3.x to Logger *Pro* 3.4 | FREE!

Upgrade from earlier version of Logger *Pro* or Logger Pro 2 to Logger *Pro* 3 | Order Code ULP | $50

Did You Know?

Logger *Pro* is sold around the world and has been translated into Spanish, French, German, Italian, Chinese, and Turkish?
www.vernier.com/loggerpro

Electrode Support

No more scrounging for metal clamps to hold your electrodes! Use this new accessory to support your Vernier electrodes on a ring stand or Vernier Stir Station. This inexpensive and durable support will hold one electrode, such as pH, Conductivity, ISE, or ORP, and/or a Stainless Steel Temperature Probe.

Electrode Support | Order Code ESUP | $8

Vernier Technology Award

Full-time science teachers from elementary to college level are eligible to apply for the Vernier Software & Technology/NSTA 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 $1000 cash award, $1000 in Vernier equipment, and $1000 towards travel and expenses to attend NSTA's National Convention in 2006. Entries will be judged by a panel of experts appointed by NSTA and are due by October 14, 2005. Go to www.vernier.com/grants/nsta.html for guidelines, a grant application, and profiles of last year's winners.

Nationwide, Free, Hands-On Evaluation Workshops

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, math, middle school science, physical science, and Earth science curricula.

The workshops include lunch or dinner and lab handouts. For up-to-date information and registration, dates, times, and locations, visit www.vernier.com/workshop/evaluation.html

September		**October**		**November**	
Sept. 12	Fort Worth, TX	Oct. 1	Minneapolis, MN	Nov. 1	Cleveland, OH
Sept. 13	Dallas, TX	Oct. 3	Madison, WI	Nov. 2	Toledo, OH
Sept. 14	Austin, TX	Oct. 4	Milwaukee, WI	Nov. 3	Detroit, MI
Sept. 14	Reno, NV	Oct. 15	Manchester, NH	Nov. 14	Chicago, IL
Sept. 15	San Antonio, TX	Oct. 17	Portsmouth, NH	Nov. 15	Chicago, IL
Sept. 15	Sacramento, CA	Oct. 17	St. Louis, MO	Nov. 15	Raleigh, NC
Sept. 17	San Antonio, TX	Oct. 18	Boston, MA	Nov. 16	Greensboro, NC
Sept. 17	Concord, CA	Oct. 18	Evansville, IN	Nov. 17	Charlotte, NC
Sept. 19	Houston, TX	Oct. 19	Providence, RI	Nov. 19	Tri Cities, TN
Sept. 19	San Francisco, CA	Oct. 19	Louisville, KY	Nov. 21	Knoxville, TN
Sept. 20	Houston, TX	Oct. 20	Lexington, KY		
Sept. 20	San Jose, CA	Oct. 22	Cincinnati, OH		
Sept. 21	Beaumont, TX	Oct. 24	Indianapolis, IN		
Sept. 22	Pasadena, CA	Oct. 24	Hartford, CT		
Sept. 24	West Hollywood, CA	Oct. 25	Stamford, CT		
Sept. 26	La Jolla, CA	Oct. 25	Columbus, OH		
		Oct. 27	Morgantown, WV		
		Oct. 29	Pittsburgh, PA		

Workshop registration and details may be found at www.vernier.com/workshop
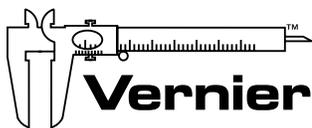
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