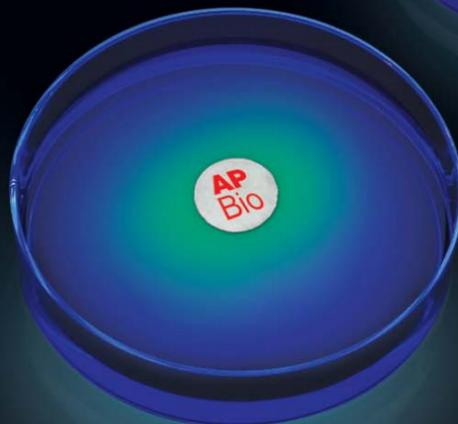


Biotechnology
ExplorerTM
CAPTIVATING SCIENCE EDUCATION



BIO-RAD

ThiNQ!TM Investigations make inquiry in the classroom easy.

Story on page **2**

What does inquiry in the classroom look like?

Does it evoke visions of disorder and fear?

Does open inquiry mean having an open budget to allow your students to follow their ideas anywhere they choose to go? A look inside AP Biology teacher Julianne Zedalis' classroom shows how inquiry can look in a classroom — and it's not scary or disorderly and can be done with a good value for your money. Follow Julianne and her class through their journey to inquiry. See her teacher model process in action in a video or in writing.

We've taken the best of Julianne's process and made it available for all teachers.

Introducing ThINQ!™ Investigations — inquiry-based kits designed to make students think. The *pGLO™ Transformation and Inquiry Kit* is the first ThINQ! Investigation. It provides a 5-in-1 inquiry solution that includes four new guided and open inquiry investigations that build on the structured pGLO Bacterial Transformation lab.



Julianne Zedalis

Bishop's School
AP Biology teacher
AP Biology reader
AP Summer Institute trainer

See the new inquiry video on YouTube. Find out how veteran teacher Julianne Zedalis has reshaped her AP biology classes to address inquiry for the next millenium. This in-depth video dives deep into biology protocols to kick-start the *inquiry* process in her students — in fact they run the show. bio-rad.com/pGLOvideo





Classic pGLO Bacterial Transformation Kit



Inquiry Investigation #1
Structured Inquiry
Bacterial Transformation

Inquiry Investigation #2
Guided Inquiry



Transformation Efficiency

Inquiry Investigation #3
Open Inquiry



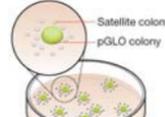
Effect of Ampicillin on
Bacterial Growth

Inquiry Investigation #4
Open Inquiry



Effect of Arabinose on
GFP Expression

Inquiry Investigation #5
Open Inquiry



Satellite Colonies

Class Discussions for Investigations 2, 3, 4, and 5

Classic + Four Inquiry Investigations = New ThINQ! Investigation:
pGLO Transformation and Inquiry Kit for AP Biology

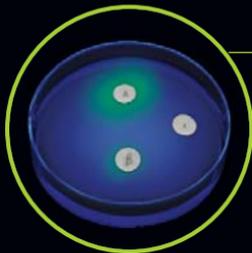


Ordering Information

EDU Price

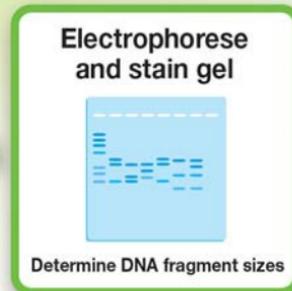
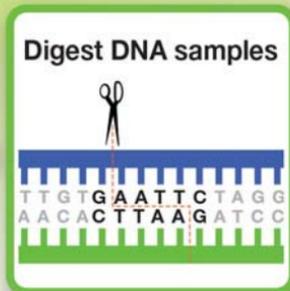
166-0335EDU	New pGLO Transformation and Inquiry Kit for AP Biology	\$224.00
166-0336EDU	pGLO Inquiry Kit refill package	111.20
166-0003EDU	Classic pGLO Bacterial Transformation Kit	119.20

Visit bio-rad.com/thinq_pglo or call 1-800-268-0213 for more information and for a list of required equipment/accessories for this laboratory activity.



Forensic DNA Fingerprinting Kit — AP Biology Big Ideas 3 and 4

bio-rad.com/DNAfingerprinting1



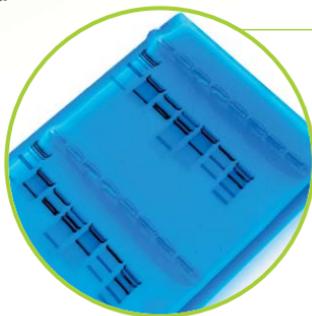
Learn More

- Check out our 20 Questions to Master Inquiry
- Aligns with AP Biology Big Ideas 3 and 4

Watch as your students become investigators!

Imagine how engaged your students will be as they play the role of crime scene investigators, using real DNA as evidence. They will digest each sample, using a mixture of DNA restriction enzymes, and separate the fragments via electrophoresis. This allows them to match the DNA of a suspect to the DNA found at the crime scene and solve the mystery.

* Short on time? **Check out our precast agarose gels!** Save 1–4 hours!



Ordering Information

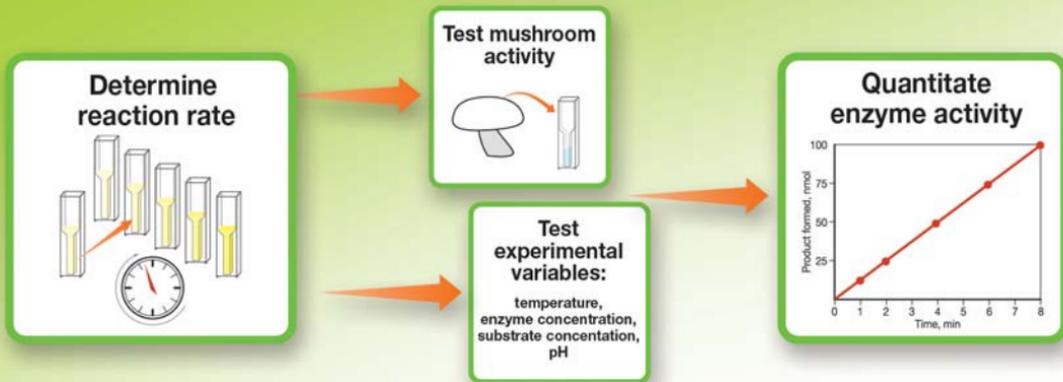
EDU Price

166-0007EDU	Forensic DNA Fingerprinting Kit Free curriculum manual is available online.	\$179.20
166-0037EDU	Forensic DNA Fingerprinting Kit Includes printed curriculum manual.	185.60

Visit bio-rad.com/DNAfingerprinting1 or call 1-800-268-0213 for more information and for a list of equipment/accessories required for these laboratory activities.

Biofuel Enzyme Kit — Use fungi to explore AP Biology Big Ideas 1, 2, and 4

bio-rad.com/biofuelenzyme1



Learn More

- Aligns with AP Biology Big Ideas 1, 2, and 4
- Student inquiry using mushrooms
- Check out our 20 Questions to Master Inquiry

What do enzymes and biofuels have in common?

Everything! Organisms such as ruminants, termites, and fungi use an enzyme called cellobiase to break down cellulose from plants — a very important step in the production of cellulosic ethanol. Your students will love exploring this enzyme by studying different species of mushrooms with varying levels of cellobiase activity. Activity levels in some mushrooms even vary among different parts of the sample (cap, stalk, gills). The Biofuel Enzyme Kit provides a great model for inquiry, investigation, and real data analysis of enzymes for applications from ecology to evolution to industry.



Ordering Information

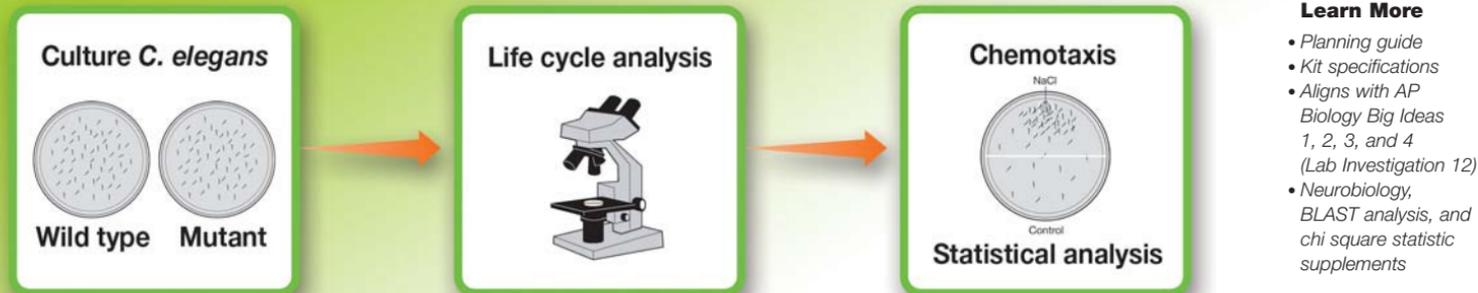
EDU Price

166-5035EDU	Biofuel Enzyme Kit	\$160.00
166-5036EDU	Biofuel Enzyme Kit Reagent Refill Pack	102.40

Visit bio-rad.com/biofuelenzyme1 or call 1-800-268-0213 for more information and for a list of equipment/accessories required for this laboratory activity.

C. elegans Behavior Kit — AP Biology Big Ideas 1, 2, 3, and 4

bio-rad.com/celegansbehaviorkit1



Learn More

- Planning guide
- Kit specifications
- Aligns with AP Biology Big Ideas 1, 2, 3, and 4 (Lab Investigation 12)
- Neurobiology, BLAST analysis, and chi square statistic supplements

Did you know that *C. elegans* can learn?

Imagine your students discovering how the loss of a single gene impacts the learning capacity of a neurological mutant through a chemotaxis experiment. They will learn concepts that tie into all four big ideas — making this not only a regular activity for AP Biology, but also the capstone activity prior to the AP exam. As AP Biology Summer Institute Trainer Mary Wuerth states, there are not many other activities that allow you to tie together neurobiology, physiology, genetics, statistics, and more.



Ordering Information

EDU Price

166-5120EDU **C. elegans Behavior Kit** \$219.20

Visit us at bio-rad.com/celegansbehaviorkit1 or call 1-800-268-0213 for more information and for a list of equipment/accessories required for this laboratory activity.

Check out the UCSF Legoscope project to find a great way to infuse science, technology, engineering, and mathematics (STEM) into this activity — have your students build their own microscopes using Legos! ([youtube.com/watch?v=hAZadBsE-R4](https://www.youtube.com/watch?v=hAZadBsE-R4))

Visit OpenWorm to view the entire worm connectome — you can see every neuron within the worm and how they all connect! (openworm.org)

Ask a Whole Bunch of Experts! — Bio-Rad's Technical Support Team



Our team is ready to provide world-class scientific support. Our award-winning technical support team has been supporting educators such as you since the inception of the Biotechnology Explorer™ Program. The roster, featuring 25 PhDs, three MSs, and two BSs, represents approximately 600,000 hours of laboratory bench experience. This team answered 56,513 calls from researchers and educators in 2014. Every educator-related case was reviewed by our marketing and R&D teams to better refine our kits and products.

Our friendly and knowledgeable Technical Support team is available from 5 AM–5 PM, Pacific time, Monday–Friday. Call them at **1-800-424-6723**, option 2, or email to **Support@bio-rad.com**.

“They are knowledgeable, fast, and to the point.”

An Educator's Remark

Our Technical Support team loves educators:

“There is nothing more rewarding than feeling that you may have played a part in someone's future scientific career!”

Kathy Silvey, PhD and education support specialist

“Teachers are some of our most important national resources. So I always strive to give them the best that Bio-Rad has to offer.”

Kate Clark, PhD and Bio-Rad support specialist

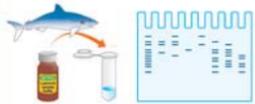
Comparative Proteomics Kits — Evolutionary! — AP Big Ideas 1, 3, and 4



Learn More

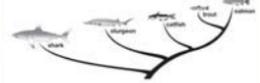
- Check out our *20 Questions to Master Inquiry*
- The kit guides students through the thought processes involved in a laboratory-based scientific investigation
- Aligns with AP Biology Big Ideas 1, 3 and 4

Extract fish muscle protein



Electrophoresis and stain gel

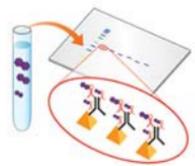
Analyze results



Create cladograms to infer evolutionary relationships

Extension

Optional: western blot extension



The open-ended, inquiry-based Protein Profiler

Module moves beyond DNA and allows students

to employ the most widely used life science research technique, protein electrophoresis, to study protein structure and function. Students learn to use SDS-PAGE to generate protein profiles from muscles of both distantly and closely related species of fish. From their results, they compare the different species' profiles to test the hypothesis that protein profiles can be indicators of evolutionary relatedness.



Ordering Information

EDU Price

166-2700EDU	Comparative Proteomics Kit I: Protein Profiler Module	\$220.00
166-2850EDU	Comparative Proteomics Kits I and II: Protein Profiler and Western Blot Modules	453.60
166-2875EDU	Rapid Blotting and V3 Western Workflow™ Starter Kit	712.00

Visit bio-rad.com/proteinprofiler1 or call 1-800-268-0213 for more information and for a list of required equipment/accessories for these laboratory activities.

Science Framework **Kit Selection Guide**

Visit explorer.bio-rad.com/spring2015 to learn more.



Legend: ★ Content contained in kit curriculum
☆ Content addressed in extension activities

Life Sciences Disciplinary Core Ideas

LS1: From Molecules to Organisms: Structures and Processes
LS2: Ecosystems: Interactions, Energy, and Dynamics
LS3: Heredity: Inheritance and Variation of Traits
LS4: Biological Evolution: Unity and Diversity

Physical Sciences Disciplinary Core Ideas

PS1: Matter and Its Interactions
PS2: Motion and Stability: Forces and Interaction
PS3: Energy
ADV: **Advanced Scientific Practices**

SEP: Science and Engineering Practices

SEP	LS1	LS2	LS3	LS4	PS1	PS2	PS3	ADV			
★	★	★	★	☆						C. elegans Behavior Kit (166-5120EDU) — AP Big Ideas 1, 2, 3, 4	Introductory
★					★	★	★			IDEA Kit — Inquiry Dye Electrophoresis Activity (166-5075EDU)	
★					★	★	★			STEM Electrophoresis Classroom Kit (166-5090EDU)	
★	★	★		☆						Biofuel Enzyme Kit (166-5035EDU) — AP Big Ideas 1, 2, 4	
★	★	★								Microbes and Health Kit (166-5030EDU)	
★	★		★							Genes in a Bottle™ Kit (166-2300EDU) — AP Big Idea 3	
★	★	★	★	★						pGLO™ Bacterial Transformation Kit (166-0003EDU) — AP Big Ideas 1, 2, 3, 4	
★	★	★	★	★						New pGLO™ Transformation and Inquiry Kit for AP Biology: A THINQ!™ Investigation (166-0035EDU) — AP Big Ideas 1, 2, 3, 4	
★	★									Green Fluorescent Protein Chromatography Kit (166-0005EDU)	
★	★									Secrets of the Rainforest™ Kit (166-0006EDU)	
★	★									Size Exclusion Chromatography Kit (166-0008EDU)	
★										Got Protein?™ Kit (166-2900EDU)	
★	★									ELISA Immuno Explorer™ Kit (166-2400EDU)	
★	★		★	★		★				Forensic DNA Fingerprinting Kit (166-0007EDU) — AP Big Ideas 3, 4	
★	★					★				Analysis of Precut Lambda DNA Kit (166-0001EDU) — AP Big Idea 3	
★	★					★				Restriction Digestion and Analysis of Lambda DNA Kit (166-0002EDU) — AP Big Idea 3	
★	★									pGLO Kit SDS-PAGE Extension (166-0013EDU) — AP Big Idea 3	
★	★		★	★		★				Crime Scene Investigator PCR Basics™ Kit (166-2600EDU) — AP Big Idea 3	
★	★		★	★		★				Comparative Proteomics Kit I: Protein Profiler Module (166-2700EDU) — AP Big Ideas 1, 3, 4	
★	★		★	★		★				Comparative Proteomics Kit II: Western Blot Module (166-2800EDU)	Advanced
★	★	★	★	★				★		Fish DNA Barcoding Kit and DNA Barcoding Sequencing Module (166-5100EDU and 166-5115EDU) — AP Big Ideas 1, 2, 3, 4	
★	★		★	★				★		PV92 PCR Informatics Kit (166-2100EDU) — AP Big Ideas 1, 3	
★	★		★	☆		★				GMO Investigator™ Kit (166-2500EDU)	
★	★		★	★		★		★		Crime Scene Investigator PCR Basics Real-Time PCR Starter Kit (166-2660EDU)	
★	★		★			★		★		GMO Investigator Real-Time PCR Starter Kit (166-2560EDU)	
★	★		★	★				★		Cloning and Sequencing Explorer Series (166-5000EDU) — AP Big Ideas 1, 2, 3, 4	
★	★							★		Protein Expression and Purification Series (166-5040EDU, 166-5045EDU, or 166-5050EDU)	

Educational Pricing Contract Application

As an educator you are entitled to discount pricing on all Bio-Rad products. To initiate setup of a new education account, simply fax or mail this page to Bio-Rad. If you are ready to place your first order, send this page and attach a purchase order with the numbers and descriptions of the items you wish to purchase.

Biotechnology Explorer Program

Bio-Rad Laboratories (Canada) Ltd.
1329 Meyerside Drive
Mississauga, ON L5T 1C9



Fax to 1-888-913-9779 or 1-905-364-3434.

Re: Educational Discount

We are an educational facility interested in using Bio-Rad products to teach our students. We would like to receive a teaching lab discount and understand that the Bio-Rad education discount is available only to educators at the K-12 and undergraduate levels. This letter is our confirmation that the products we order through our educational account will be used only to educate students in a classroom or teaching lab environment and will not be used for basic scientific research. We are sending this letter in order to:

- Initiate setup of a new educational account with Bio-Rad Laboratories (if tax exempt, please include a copy of the school's tax certificate)
- Place a new order, with PO attached
- Confirm an order identification number (please fill in order number) _____

Name of contact: _____

Department: _____

School or institution: _____

We are a (please check one): High school Two-year/Community college
 College or undergraduate teaching laboratory Other _____

Bill to address: _____

City/Province/Postal Code: _____

Phone number: _____ Fax number: _____

Ship to address: _____

City/Province/Postal Code: _____

Phone number: _____ Fax number: _____

Email address: _____

Signature: _____

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SmartSpec Plus Spectrophotometer

SmartSpec Plus Spectrophotometer

Provides performance and stability at an affordable price. Perfect for protein assays, quantitation of DNA, and monitoring cell culture growth.



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This is a compact, automated imaging system that gets you to your image in three easy steps.



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Trans-Blot Turbo Transfer System

Provides innovation with ease of use for protein transfers in as little as 3 minutes.



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We want to hear from you!

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Which biotechnology skills would you like to see addressed in a kit? _____

Please have a Bio-Rad curriculum training specialist contact us about meeting our teaching goals and professional development needs in our own district today.

Fill in and return this card today or visit us online at bio-rad.com/info/explorercatalog115 to request your free catalog. For immediate information, call **1-800-268-0213**.

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2015 Teacher Conference and Workshop Schedule

Go to bio-rad.com/explorerworkshops1 for a complete schedule.



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2015

May 7-9

Sciematics 2015
Regina, SK

June 5

AESTQ journée des TTP
Drummondville, QC

July 7-10

Western Conference on Science Education
London, ON

October 15-16

Congrès annuel de l'AESTQ
Sherbrooke, QC

October 23

Catalyst 2015
Richmond, BC

November 12-14

STAO 2015
Toronto, ON



Careers In Biotech

Chapter 2

2

Katie Dalpozzo

Laboratory Research Associate,
Bavarian Nordic Immunotherapeutics,
Mountain View, CA



At Bavarian Nordic, Katie's main work focuses on preclinical trials to develop drugs to battle breast and prostate cancers. She is responsible for setting up experiments, recording the results, and analyzing data which she presents weekly to the research team. Katie has learned that documenting data by following good laboratory practice (GLP) is critical in preclinical trials. **One piece of advice from Katie is to record every step in your laboratory notebook while it is being performed and not to wait until the experiment is over.**



Excerpt
from textbook

This laboratory textbook provides you and your students with background information about the methods and techniques used in today's laboratories. Each student chapter includes an introduction, real-world vignettes of careers, bioethics, key skills, case studies, and hands-on activities that allow your students to understand the powerful impact science has on their everyday lives. The teacher edition includes a DVD set with technique videos and PowerPoint presentations to provide the support you need in the classroom. Don't forget to get a set of Laboratory Notebooks — good lab notebooking skills are essential!

Learn More

- *The technique videos are also posted online*

Ordering Information

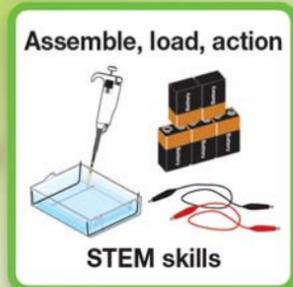
EDU Pricing

166-1027EDU	Teacher Edition <i>Includes 166-1025EDU, 166-1026EDU, and 166-1052EDU.</i>	\$150.40
166-1025EDU	Student Edition	117.60
166-1026EDU	Teacher Supplement <i>Teacher reference guide.</i>	44.00
166-1051EDU	Laboratory Notebook	19.20
166-1052EDU	Supplementary Materials DVD Set	16.00

Visit bio-rad.com/biotextbook or call 1-800-268-0213 for more information.

How to Use Pop Culture in Your Life Science Class

bio-rad.com/idea1



Learn More

- Check out our new Pop Culture Powerpoint™ with ideas on how to “set the stage” for your students
- Inquiry lab
- Complete in two 45 min lab sessions
- Visible results

Do your students perk up when the conversation is about pop culture?

Use popular science to engage your students and increase integrated science literacy in your classroom. Connect popular movies to real-world discoveries and issues through the use of the IDEA (Inquiry and Dye Electrophoresis Activity) and STEM Kits. This fun hands-on lab is sure to increase student involvement and understanding!



Ordering Information

		Workstations	EDU Price
166-5075EDU	IDEA Kit	8	\$68.00
166-5076EDU	IDEA Kit Reagent Refill Pack	8	32.80
166-5077EDU	IDEA Kit Starter Pack*	8	225.60
166-5080EDU	STEM Electrophoresis Teacher Demonstration Kit	2	124.00
166-5085EDU	STEM Electrophoresis Kit	2	68.80
166-5090EDU	STEM Electrophoresis Classroom Kit	8	332.00
166-5095EDU	STEM Electrophoresis Kit Starter Pack*	8	531.20

* Starter packs include eight 10 µl fixed-volume micropipets.

Visit bio-rad.com/idea1 or call 1-800-268-0213 for more information. For more details about infusing STEM into electrophoresis, check out our IDEA/STEM Kit curriculum manual.

GMO Investigator™ Kit — The GMO debate rages on!

bio-rad.com/gmo1



Learn More

- Extract and amplify DNA from eight food samples
- Perform genuine diagnostic procedures
- Use PCR and electrophoresis
- Complete in three 45 minute lab sessions

Acquire sample



Amplify DNA samples



Engage class debate



Are GM crops a good thing?

Do all countries have the same genetically modified (GM) food labeling requirements? Wouldn't your students be intrigued to know which items they eat are GM foods? After testing common grocery store food products for the presence of GMOs using such current and exciting techniques as DNA extraction, PCR, and gel electrophoresis, your students can prepare arguments for a mock debate on GMOs — relevant, engaging, and fun!



Ordering Information

EDU Price

166-2500EDU	GMO Investigator Kit	\$232.80
166-0450EDU	Small Fast Blast™ DNA Electrophoresis Reagent Pack	108.00
166-2550EDU	GMO Investigator Kit Plus Small Fast Blast DNA Electrophoresis Reagent Pack	287.20

Visit bio-rad.com/gmo1 or call 1-800-268-0213 for more information and for a list of equipment/accessories required for these laboratory activities.

Contagion! Zombie Apocalypse!



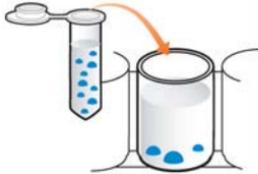
Learn More

- Check out our *Zombie Apocalypse* workshops this fall at bio-rad.com/zombie

Students simulate spreading of disease



Set up ELISA



Add enzyme substrate and watch for color development



Students track the progress of the outbreak through the classroom

Are your students talking about the recent Ebola or measles outbreak?

What about the Zombie Apocalypse? See how engaged your students will be as they use real antibodies to identify patient zero with the power of ELISA — the same way human immunodeficiency virus (HIV), flu, genetically modified organisms, and the molecular markers of cancer, pregnancy, or drug use are detected in the real world.

Enzyme-linked immunosorbent assay (ELISA) is a powerful antibody-based biodetection tool used to hunt pathogens. Its use in this lab facilitates teaching about the immune system and the unique properties of antibodies that have revolutionized medicine, epidemiology, and life science research.



Ordering Information

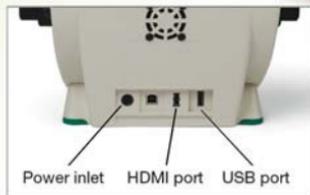
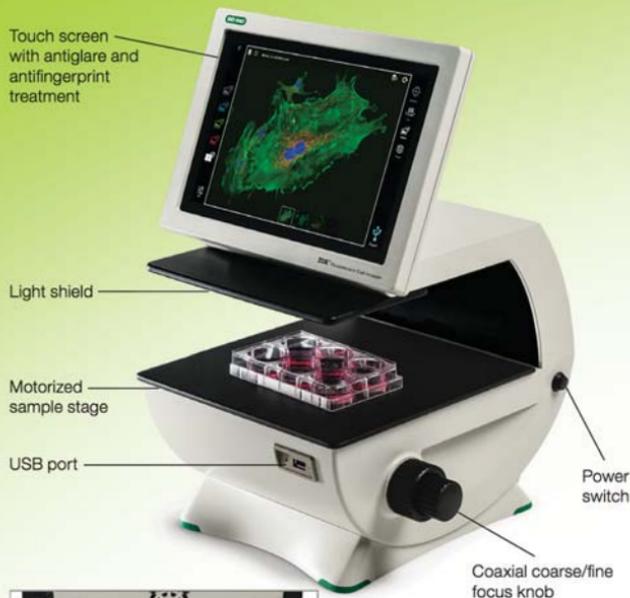
EDU Price

166-2400EDU **ELISA Immuno Explorer Kit** \$176.80

Visit bio-rad.com/elisakit1 or call 1-800-268-0213 for more information and for a list of equipment/accessories required for this lab activity.

Get Out of the Dark with the **ZOE™** Fluorescent Cell Imager

bio-rad.com/ZOEedu115



Back of ZOE unit

HDMI port
allows you to project to the whole class.

With the **ZOE Imager**, your students will see exactly the images you want them to see. Gone are the days of cramming students into a dark room or fussing with focus on microscopes. The ZOE Imager's HDMI port allows you to project fascinating images to the entire classroom to easily visualize biological processes, illustrate scientific concepts, and develop fluorescence imaging skills.

The ZOE Imager's intuitive touch screen interface minimizes the learning curve for students to use it. And its compact portable design lets you take the ZOE Imager into the classroom, lecture hall, and teaching lab all in the same day. Please visit bio-rad.com/zoedu115 for more details about how ZOE can be the perfect teaching assistant.

Learn More

- Check out our *Fluorescent Cell Imaging Activity Ideas Guide*
- Read teacher testimonials
- Find dye kits for vibrant cell staining

Ordering Information

EDU Price

145-0031EDU **ZOE Fluorescent Cell Imager** ~~\$14,000.00~~
Special offer — save \$863.33 **13,136.67**

Visit bio-rad.com/explore/promotions1 for ordering details. Must use quote #15-Q14371.

Visit bio-rad.com/zoedu115 or call 1-800-268-0213 for more information.

Great Buys for \$650 or Less...

Save
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Set of Four **Classroom Micropipets**

Buy a set of four Classroom Micropipets for only \$500 — a \$136.80 savings. Choose from 0.5–10 μ l (166-0550EDU), 2–20 μ l (166-0551EDU), 20–200 μ l (166-0552EDU), or 100–1000 μ l (166-0553EDU). Must use quote #15-Q14371 when ordering. Not available for online web orders.

Save
\$106⁰⁰



Mini Incubation Oven

Buy a Mini Incubation Oven (166-0501EDU) for only \$450.00 — a \$106.00 savings. Must use quote #15-Q14371 when ordering.

Save
\$119⁰⁰



Digital Dry Bath

Buy a Digital Dry Bath (166-0562EDU) for only \$525 — a \$119 savings. Includes 1.5 ml heating block. Must use quote #15-Q14371 when ordering.

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\$101⁶⁰



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Save
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Temperature-Controlled Water Bath

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Save
\$142⁰⁰



Support 8 Workstations with the **PowerPac™ Basic Class Set**

Order **two** PowerPac Basic Power Supplies (164-5050EDU) for \$650 — a \$142.00 savings. Must use quote #15-Q14371 when ordering.



For \$2,995 or Less...

For \$8,000 or Less!

Save
\$140⁰⁰



UView™ Mini Transilluminator

Buy a UView Mini Transilluminator (166-0531EDU) for only \$980 — a \$140.00 savings. Must use quote #15-Q14371 when ordering.

Save
\$1,001⁰⁰



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New ThINQ!™ Investigations, page 2

New pGLO™ Transformation and Inquiry Kit, page 3

Help! Scientists When You Need Them, page 7

Get Some Pop Culture, page 14

We love this idea! Teachers think of special ways to make lasting memories for their students! Sherry Annee from Brebeuf Jesuit Preparatory School shared this creative idea with the Explorer Community — photo frames as gifts for her students. After students delve into the study of proteins using SDS-PAGE gels in her class, Sherry takes the used gel cassettes and repurposes them into **photo frames**. She then creates a photo-documentary style memory of their time in her class and gives them to the students at the end of the year. **Share your creative ideas** with the **Explorer Community!**



Check out our Explorer Community — where you can find great resources, see what other educators are having fun doing at Bio-Rad.com/explorercommunity.

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