The Building of a Transformative Technology

CRISPR

Nobel Prize-Winning Science

HIV Gene Therapy

The U.S. FDA has approved clinical trials of a CRISPR-based single-dose gene therapy to be evaluated that may cure humans with HIV. (2021)

Nobel Prize for Gene Editing

Emmanuelle Charpentier and Jennifer Doudna won the Nobel Prize in Chemistry for the development of a method for gene editing. This Nobel Prize winning science is the first given to two women without a male collaborator also being included in the award and builds upon over a century of Nobel Prize winning scientific achievements awarded to women. (2020)

UTI Studies

Pathogenic bacteria developing antibiotic resistance is a growing problem in medicine. Rather than using traditional antibiotics, Locus Biosciences began conducting clinical studies to cure common UTI (urinary tract infections) caused by *E. coli* using CRISPR phage therapy. (2020)

T-Cell Clinical Trials

The number of clinical trials for CAR T-cell therapies has exploded in recent years. Gene editing–enhanced CAR T-cell therapies are also on the rise. In clinical trials with three late-stage patients with cancer, the PD-1 protein (programmed cell death protein 1) was removed from T-cells, preventing cancer cells from protecting themselves using PD-1. (2019)

Sickle Cell Clinical Trials

Clinical trials utilizing gene editing to treat sickle cell disease are underway in the U.S. (2019)

Huntington's Disease Studies

Emory University and the Chinese Academy of Sciences researchers use CRISPR to control expression of the mutant *huntingtin* gene in lab mice and stop the development of Huntington's disease symptoms. (2017)

Lung Cancer Clinical Trial

A lung cancer patient in China was the first to receive an injection of CRISPR-modified cells intended to inhibit cancer cells from multiplying. (2016)

Skin and Bone Cancer Clinical Trials

Researchers at the University of Pennsylvania received NIH approval to conduct a clinical trial with 18 late stage melanoma, sarcoma, and multiple myeloma cancer patients where CRISPR was used to alter genes in patients' own immune cells to help them target the cancer cells in their bodies. (2016)

"Safe Genes" Research Initiative

U.S. Defense Advanced Research Projects Agency (DARPA) invested $65 million to increase the accuracy and safety of CRISPR editing techniques, in a project called "safe genes". (2017)

Nobel Prizes Awarded to Women in Science

1900 — Present

1903, 1911 — Marie Sklodowska Curie (Poland and France)
Nobel Prizes in Physics and Chemistry for her role in the "research on the radiation phenomena discovered by Professor Henri Becquerel" and her "discovery of radium and polonium"

1935 — Irene Joliot-Curie (France)
Nobel Prize in Chemistry for her role in the "synthesis of new radioactive elements"

1947 — Gerty Theresa Cori (United States)
Nobel Prize in Physiology or Medicine for the "discovery of the course of the catalytic conversion of glycogen"

1963 — Maria Goeppert-Mayer (United States)
Nobel Prize in Physics for her role in the "discoveries concerning nuclear shell structure"

1964 — Dorothy Crowfoot Hodgkin (United Kingdom)
Nobel Prize in Chemistry for "her determinations by X-ray techniques of the structures of important biochemical substances"

1977 — Rosalyn Sussman Yalow (United States)
Nobel Prize in Physiology or Medicine for "the development of radioimmunoassays of peptide hormones"

1983 — Barbara McClintock (United States)
Nobel Prize in Physiology or Medicine for "her discovery of mobile genetic elements"

1986 — Rita Levi-Montalcini (Italy and United States)
Nobel Prize in Physiology or Medicine for her role in "discoveries of growth factors"

1988 — Gertrude B. Elion (United States)
Nobel Prize in Physiology or Medicine for her role in "discoveries of important principles for drug treatment"

1995 — Christiane Nüsslein-Volhard (Germany)
Nobel Prize in Physiology or Medicine for her role in "discoveries concerning the genetic control of early embryonic development"

2004 — Linda B. Buck (United States)
Nobel Prize in Physiology or Medicine for her role in "discoveries of odorant receptors and the organization of the olfactory system"

2008 — Françoise Barré-Sinoussi (France)
Nobel Prize in Physiology or Medicine for her role in the "discovery of HIV, human immunodeficiency virus"

2009 — Ada E. Yonath (Israel)
Nobel Prize in Chemistry "for studies of the structure and function of the ribosome"

2009 — Elizabeth Blackburn (Australia and United States)
Carol W. Greider (United States)
Nobel Prize in Physiology or Medicine "for the discovery of how chromosomes are protected by telomeres and the enzyme telomerase"

2014 — May-Britt Moser (Norway)
Nobel Prize in Physiology or Medicine for her role in the "discoveries of cells that constitute a positioning system in the brain"

2015 — Tu Youyou (China)
Nobel Prize in Physiology or Medicine "for her discoveries concerning a novel therapy against Malaria (artemisinin)"

2018 — Frances Arnold (United States)
Nobel Prize in Chemistry for her role "for the directed evolution of enzymes"

2018 — Donna Strickland (Canada)
Nobel Prize in Physics for her role in the "method of generating high-intensity, ultra-short optical pulses"

2020 — Andrea M. Ghez (United States)
Nobel Prize in Physics for "the discovery of a supermassive compact object at the centre of our galaxy"

2020 — Emmanuelle Charpentier (France)
Jennifer Doudna (United States)
Nobel Prize in Chemistry "for the development of a method for gene editing"

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The Bio-Rad Explorer Program brings you the next generation of inquiry-based biotechnology curricula, kits, equipment, and supplies. ***1-800-4BIORAD***

BIO-RAD Explorer

Bio-Rad Explorer Program

Bio-Rad Laboratories, a global leader in the development and manufacture of products for life science research and clinical diagnostics, understands its responsibility to support the education of a science-literate population. Over 20 years ago, the company established the Bio-Rad Explorer Program.

The Bio-Rad Explorer Program strives to make science accessible and to keep students at the center of instruction. By leveraging the expertise within Bio-Rad and working in close partnership with educators, researchers, and industry leaders, the program brings state-of-the-art science and technology into the classroom. It offers:

- ***Hands-on laboratory activities*** that both prepare students with foundational skills and expand their experience with cutting-edge techniques — all in a format that is appropriate for classroom laboratories
- ***Engaging labs*** that connect concepts with techniques and provide the context of real-world scenarios
- ***Industry-quality instruments and reagents*** that allow students to gain experience with the tools scientists use in their research
- ***Professional development opportunities and teaching resources*** that support teachers in their quest to spark interest in life sciences

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Bio-Rad Explorer Life Science and Biotechnology Classroom Kits

ThINQ! Investigation Kits

Designed for students to experience open inquiry in the class

Photosynthesis and Cellular Respiration Kit for AP Biology
Design quantitative experiments to discover how environmental conditions impact both photosynthesis and cellular respiration — with algae beads!
(Cat. #17001238EDU)

Photosynthesis and Cellular Respiration Kit for General Biology
Create models and design qualitative experiments with algae beads to explore photosynthesis and cellular respiration. (Cat. #12005534EDU)

pGLO Transformation and Inquiry Kit for AP Biology
Investigate the functional elements of pGLO bacterial transformation, including heat shock, antibiotic selection, promoters, and satellite colony formation.
(Cat. #1660335EDU)

Biofuel Enzyme Reactions Kit for AP Biology
Connect mushroom ecology and enzyme activity as students assume the role of bioengineer to optimize the function of cellobiase for biofuel production.
(Cat. #17001235EDU)

A Giant Panda Problem Kit for AP Biology
Explore reproductive endocrinology in the context of giant panda conservation. Design hormone assays to monitor fertility using the power of ELISA. (Cat. #17002878EDU)

Introductory Kits

Science of Opioid Dependence Kit
Discover genetic and environmental links to opioid dependence. (Cat. #17005316EDU)

Engineering Solutions for Global Health Kit
Measure protein in foods and design a treatment plan for undernutrition. (Cat. #17005278EDU)

pGLO Bacterial Transformation Kit
Use bacterial transformation with an inducible promoter to make glowing *E. coli*. (Cat. #1660003EDU)

Microbes and Health Kit
Practice microbiology culturing techniques to produce yogurt and test Koch's postulates. (Cat. #1665030EDU)

Size Exclusion Chromatography Kit
Separate solution components using size exclusion chromatography. (Cat. #1660008EDU)

Got Protein? Kit
Use a colorimetric test to quantify protein in different liquids.
(Cat. #1662900EDU)

ELISA Immuno Explorer Kit
Track the spread of disease in the classroom using an ELISA with real antibodies. (Cat. #1662400EDU)

Genes in a Bottle Kit
Extract your own DNA from cheek cells and bottle it in a keepsake necklace. (Cat. #1662300EDU)

IDEA and STEM Electrophoresis Kits
Engineer a gel electrophoresis chamber and separate food dyes based on molecular charge. (Cat. #1665080EDU)

Intermediate Kits

***C. elegans* Behavior Kit**
Study the learning and behavior of the model organism *C. elegans* through observing chemotaxis.
(Cat. #1665120EDU)

Green Fluorescent Protein Chromatography Kit
Use chromatography to purify glowing green fluorescent protein from your pGLO bacteria. (Cat. #1660005EDU)

pGLO SDS-PAGE Extension
Use protein electrophoresis to view the expression of proteins in your pGLO bacteria. (Cat. #1660013EDU)

Secrets of the Rainforest Kit
Simulate the drug discovery process in your classroom with a glowing protein. (Cat. #1660006EDU)

Biofuel Enzyme Kit
Explore enzyme kinetics to optimize the industrialization of alternative fuels. (Cat. #1665035EDU)

Comparative Proteomics Kit I: Protein Profiler Module
Examine fish proteins by SDS-PAGE to make cladograms and study evolution. (Cat. #1662700EDU)

Forensic DNA Fingerprinting Kit
Use restriction enzymes and gel electrophoresis to solve a crime scene. (Cat. #1660007EDU)

Lambda DNA Kits
Analyze precut lambda DNA (Cat. #1660001EDU) or perform a restriction digest and analyze lambda DNA.
(Cat. #166002EDU)

Advanced Kits and Topics

Out of the Blue CRISPR and Genotyping Extension Kits
Edit a bacterial gene with CRISPR-Cas9 and use PCR to verify the edit. (bio-rad.com/outoftheblue)

Comparative Proteomics Kit II: Western Blot Module
Probe your Protein Profiler SDS-PAGE gel with antibodies to identify LC myosin. (Cat. #1662800EDU)

Rapid Blotting — V3 Western Workflow Starter Kit
Complete the comparative proteomics kit sequence in just 3 hours using the V3 western workflow.
(Cat. #1662875EDU)

Crime Scene Investigator PCR Basics Kits
Use PCR and gel electrophoresis to solve a crime in your classroom. (Cat. #1662600EDU)

PV92 PCR Informatics Kit
Use PCR and gel electrophoresis to analyze your PV92 Alu repeat allele. (Cat. #1662100EDU)

Fish DNA Barcoding Kit and Mammals, Insects, and Fungi DNA Barcoding Kit
Use PCR, DNA sequencing, and bioinformatics to identify fish or mammals, insects and fungi species. Fish DNA Barcoding (Cat. #17007432EDU) and Mammals, Insects, and Fungi DNA Barcoding (Cat. #17007366EDU) Kits.

GMO Investigator Kit
Use PCR and gel electrophoresis to determine if food you eat contains a GMO. (Cat. #1662500EDU)

Real-Time PCR Kits
Use real-time PCR to quantify DNA in the GMO Investigator (Cat. #1662560EDU) and Crime Scene Investigator (Cat. #1662660EDU) Kits.

Cloning and Sequencing Explorer Series
Extract DNA from a plant, clone the *GAPDH* gene, sequence, and publish to GenBank. (bio-rad.com/mail/cs)

Protein Expression and Purification Series
Express and purify human DHFR in *E. coli* using a real-world biomanufacturing workflow. (bio-rad.com/mail/peps)

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