

NOW IN ITS THIRD YEAR!

Headline Discoveries presents information teachers can use to reinforce the concepts they teach in their classrooms with real-world events.

- Informative articles that focus on current events in science
- Innovative products that can be used to reinforce real-world science concepts
- Reviews on educational books and movies for use in the classroom
- A fun crossword puzzle with answers that are hidden throughout the publication

SUBSCRIBE NOW!

Headline Discoveries is free to educators.

To subscribe, send an email to FSE.headline@fishersci.com



INSIDE THIS ISSUE:

PROFILE	2	SCIENCE FAIR.....	12
ASTRONOMY	3	ENVIRONMENTAL.....	13
PHYSICS	4	BIOTECHNOLOGY	14
FORENSICS	5	BIOLOGY	15
HUMAN PHYSIOLOGY	6-7	BOOK REVIEW	19
CONSUMER CHEMISTRY	8	VIDEO REVIEW	19
HUMAN BIOLOGY	9	CROSSWORD	20

Price offers in this publication are good until December 31, 2006 unless otherwise stated.



Fisher Science Education

FISHER SCIENCE EDUCATION

HEADLINE DISCOVERIES

MAKING SCIENCE MATTER™

ALTERNATIVE FUELS



With oil prices soaring and continued unrest in the Middle East, the need for alternative fuels that will reduce dependence on foreign oil is a renewed focal point of countries around the world.

Dollars and tax incentives are being funneled to research agencies that are working to improve existing alternative fuels and develop new sources of renewable energy. And scientists are rising to the occasion, creating fuel out of everything from vegetable oil to turkey guts to animal waste.

Currently the three most commonly used alternative fuels are Biodiesel, Ethanol, and Natural Gas. Despite the fact that they are being used commercially, alternative fuels continue to be studied and developed to improve their viability and bolster the grade of fuels being produced.

Here's a look at three common alternative fuels and how they are produced and used today.

Biodiesel

Biodiesel is a renewable energy source manufactured from vegetable oils, animal fats, or recycled restaurant greases. These fats and oils are combined with methanol to produce fatty acid methyl esters and glycerol. The fatty acid methyl esters are the biodiesel; and the glycerol, a co-product, is used for soaps, pharmaceuticals, and cosmetics.

Biodiesel is biodegradable and burns cleaner than petroleum diesel, emitting significantly

less hydrocarbons, particulates, carbon monoxide and sulfates while providing the same payload capacity as petroleum diesel. The best reduction in emissions is achieved with pure

biodiesel, called B100. Although it can be used in some diesel engines without modifications, some engine manufacturers question its impact on engine durability. B100 is a solvent that will degrade natural rubber hoses and gaskets. It is also not suitable for winter use because it thickens in cold temperatures.

B20 is a blend of 20% biodiesel and 80% petroleum diesel that can be used in just about any diesel engine without making engine modifications. It is compatible with existing fuel storage and distribution equipment and will not degrade rubber engine parts.

Today, only about half of the biodiesel processing plants in the country are able to use any fat or oil feedstock to produce this alternative fuel. The rest are limited to using vegetable oil, typically soy oil, for production. In theory, the entire industry could produce 1.9 billion gallons per year or about 5% of the on-road diesel used in the U.S.

In 1998, the Energy Policy Act was amended by the Energy Conservation Reauthorization Act to allow federal, state, and public utility vehicle fleets to meet alternative fuel requirements and qualify for tax incentives by using biodiesel. Today, biodiesel users include the U.S. Postal Service,

the U.S. Departments of Defense, Energy, and Agriculture, national parks, school districts, transit authorities, public utilities, waste management, and recycling companies across the country.

Ethanol

Ethanol is an alcohol-based alternative fuel that is produced by fermenting and distilling starch crops such as corn, barley, and wheat after they have been converted to simple sugars. Ethanol is most commonly used as a fuel additive to increase fuel grade and lower gasoline emissions.

All gasoline vehicles can use ethanol/gasoline blends with up to 10% ethanol and many states actually require its seasonal or year-round use as a fuel additive to reduce ozone formation. However, these low ethanol blends are not considered alternative fuels by the government and do not qualify the user for tax incentives. Ethanol vehicles are those that run on a blend of up to 85% ethanol and 15% gasoline. This blend is called E85 and it is considered an alternative fuel. Vehicles that use this fuel are typically called flexible fuel vehicles or FFVs.

Ethanol-fueled vehicles typically produce lower carbon monoxide and carbon dioxide emissions; and the same or lower levels of hydrocarbon and non-methane hydrocarbon emissions than gasoline-fueled vehicles. Oxides of nitrogen (NO_x) emissions are about the same for both.

Because ethanol is produced using domestically grown crops like corn, sugar beets, sugar cane, barley, and wheat, its increased use will help to reduce the nation's dependence on foreign oil while boosting the agricultural sector's economy at the same time. Continued research is focused on developing refined methods of using cellulosic biomass such as grass and trees to further support the production of an alternative fuel called Bioethanol.

Already, a Canadian company has developed a new, more cost-efficient process to make ethanol from farm waste. Researchers are using plant-digesting enzymes to produce inexpensive ethanol fuel using a process that also produces a byproduct called lignin that can be burned as fuel to power the processing plant, making it totally self-sufficient. The main ingredient of this innovative process is also a byproduct—the straw that is left after wheat is harvested. Commercial scale processing plants could theoretically provide significant amounts of renewable fuel in an environmentally responsible way.

Natural Gas

Natural gas is produced during crude oil production or acquired from gas wells and is a mixture of hydrocarbons. Its main constituent is methane, a relatively unreactive hydrocarbon, but it also contains other hydrocarbons such as ethane and propane as well as gases such as nitrogen, helium, carbon dioxide, hydrogen

sulfide, and water vapor. Consumed in the residential, commercial, industrial, and utility markets, natural gas has gained attention as an alternative fuel because of its clean burning properties, its domestic availability, and its commercial availability.

The majority of natural gas used in the United States is domestically produced. Gas streams produced from reservoirs contain natural gas, liquids, and other materials, which need to be processed to remove petroleum liquids and contaminants. Natural gas can also come from landfill gas and water/sewage treatment.

The processing involves separating the gas from free liquids such as crude oil, hydrocarbon condensate and water. The gas is then processed further to meet quality specifications pertaining to its intended use.

Medium- and heavy-duty natural gas engines have demonstrated reduced emissions of carbon monoxide (over 90%), particulate matter, and nitrogen oxides (more than 50%) as compared to diesel engines. Because of its gaseous nature, natural gas must be stored onboard a vehicle as either compressed natural gas (CNG) or liquefied natural gas (LNG).

Natural gas may also have the potential to be used in fuel cell vehicles to produce hydrogen. Researchers say that a fuel cell vehicle using hydrogen produced by natural gas would be a viable solution for reducing greenhouse gas emissions.

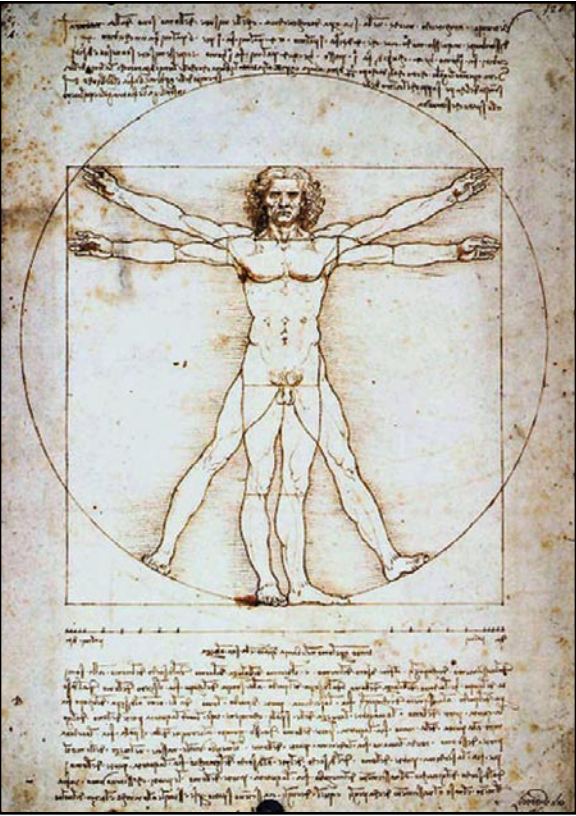


New Directions

In addition to the commonly used alternative fuels mentioned above, scientists have been busy trying to develop methods to turn everything and anything into oil. In Carthage, Missouri, a thermal conversion process plant turns up to 270 tons of turkey slaughterhouse waste and 20 tons of pig fat into 500 barrels of oil. Thermal conversion plants can process slaughterhouse waste, municipal sewage, plastics, old tires, and other waste materials into oil. The oil is headed for an oil company where it will be added to fossil fuel oils to upgrade the stock. The waste that cannot be converted into fuel oil is used for high-grade fertilizer.

continued on page 16.

LEGENDS OF SCIENCE PROFILE: LEONARDO DA VINCI



Da Vinci's Vitruvian Man.

Few eras in human history compare with the High Renaissance for its impact on Western civilization. Centered in Italy in the late 15th-early 16th Century, this period is famed for an unprecedented explosion of creativity in the arts and sciences. Through countless advancements in expression and thought, the Renaissance can be considered Western civilization's bridge from medieval times to the modern world. The three greatest paragons of this age were Michelangelo, Raphael, and Leonardo Da Vinci.

Origins

Florence was the hub of the art world at the time when Leonardo Da Vinci was born in 1452. Showing talent as a youth, at 15 Leonardo was apprenticed to the respected artist Andrea del Verocchio by his father. Under del Verocchio's tutelage Leonardo learned the fundamentals of painting, sculpture and anatomy. At 22, Leonardo's talent had surpassed his teacher's, and he struck out on his own, eventually selling his services as a military engineer to his first patron, the Duke of Milan. For 17 years under the duke's sponsorship, Leonardo's versatile talents blossomed.

The painter

For all his accomplishments, Leonardo is perhaps best known as a painter. Around the time when Columbus discovered America, Da Vinci brushed his powerful Last Supper fresco on a wall at the refectory of Santa Maria dell Grazie in Milan. A decade later, Leonardo painted a portrait of a nobleman's wife that became the most famous work in art history.

Today millions of visitors descend on The Louvre in Paris for a glimpse of the Mona Lisa and her enigmatic smile.

The sculptor

Leonardo's prowess as a sculptor is somewhat questionable, as precious few surviving works have been credited to him. One notable piece is a small bronze called Horse and Rider, probably made for his final patron, Francis I of France.

Scientist and inventor

Leonardo's voluminous notebooks and sketches reveal his curious nature, attention to detail, and penchant for invention. He was keenly aware of the importance of precise scientific observation.

Geometry, anatomy, hydraulics, weaponry, costumes, riddles, physics and mechanics are a mere sampling of topics culled from Leonardo's folios. Leonardo's Flying machine (circa 1488) presaged the invention of the airplane by more than 400 years. No drawing defines his study of the human form better than the Vitruvian Man (pictured).

Leonardo's machines

Leonardo sketched plans for work machines as well as military weapons. His inventions include the hygrometer, odometer, revolving fan, and an underwater diving suit. For the battlefield he envisioned a 33-barrel machine gun, giant crossbow, and an armored car—a forerunner to the tank. Although most of these inventions never came to fruition, they show Leonardo's remarkable fusion of imagination, engineering and grasp of scientific principles. Leonardo explored the unknown. He contemplated the possible and imagined the impossible. Today, we would call him an "out of the box" thinker.

An irony of Leonardo's remarkable life is that while he left behind more than 6000 folios, he never formally published any of his ideas. Leonardo also left many of his masterworks unfinished; it seems he had difficulty bringing his projects to an end. And so much of his legacy survives only in his drawings, sketches and notes, to inspire the generations of scholars who followed him.

Leonardo died at age 67 in the court of Francis I. Many years later, the French monarch described his favorite artist in a single sentence. "No man had ever lived who had learned as much about sculpture, painting and architecture, but still more than that [Leonardo] was a very great philosopher."

Da Vinci Decoded

Born: April 15, 1452 in Vinci, Italy
Died: May 2, 1519 in Cloux, France

- Leonardo was a vegetarian
- A lefthander, Leonardo wrote in mirror style—right to left—to make his note-taking faster
- He was fascinated by animals and made many sketches of two of his favorite animals, horses and cats
- A polymath, or "Renaissance Man," is one who excels at a variety of intellectual pursuits in multiple fields, particularly the arts and sciences; in Italian, such a person is called uomo universale, literally "man of the world"
- The Mona Lisa portrait is officially named La Gioconda, for her husband's surname

Renaissance career guide

- In the 15th century, an apprenticeship—studying under the wing of an accomplished artist—was similar to an internship today
- Professionals like Leonardo made their living in the employ of patrons—rich nobles who commissioned their works or services for a period of years
- Throughout his life, Leonardo worked for a veritable Who's Who of the richest men and women in Italy and France.
- To learn more about Leonardo's machines, visit www.museoscienza.org/english/leonardo or www.mos.org/sln/Leonardo/LeosMysteriousMachinery.html.

How do you get 35 students into one fume hood? Use a Basic™ 47 Fume Hood and Video Flex® Fume Hood Camera!

CRAMPED FOR SPACE? TIGHT BUDGET? GET DOWN TO BASICS!

Basic™ 47 Laboratory Fume Hoods are designed specifically for modular laboratories, classrooms and light-duty applications where safe ventilation is required. Constructed of epoxy-coated steel, Basic Hoods are economical so your budget stays on track; and the smaller overall height and depth allow them to fit in areas with low ceilings or narrow aisles.

Demonstrating a chemical reaction from inside a fume hood to a group of students? Now it can be done with the **Video Flex® 5400 Fume Hood Camera** from Ken-A-Vision®. Mounted inside Labconco's Basic 47 Fume Hood, the camera displays a live image on a TV Monitor or computer, allowing students to watch the experiment as it happens. That's one way to get a group of students inside a fume hood!



FREE GUARDIAN™ JR. AIRFLOW MONITOR WITH PURCHASE OF BASIC™ 47 FUME HOOD AND KEN-A-VISION VIDEO FLEX® 5400 FUME HOOD CAMERA!

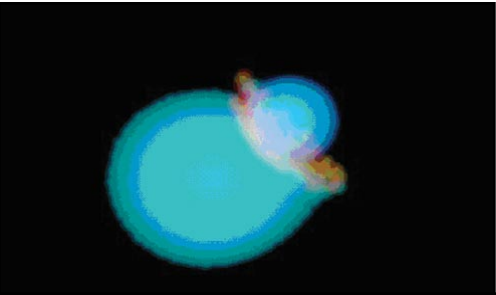
Visualize curriculum aids that take advantage of current technology and everyone "getting it" at the same time. Ken-A-Vision® Video Flex® 5400 Fume Hood Camera provides the tool to make your teaching experience everything you can envision. Installed in Labconco's Basic 47 Fume Hood, scientific demonstrations can be viewed live, in living color, allowing students to watch as a group.

OVER \$700 VALUE!

To receive your free monitor, Basic 47 Fume Hood (HS51259MF) and Video Flex 5400 (HS93701) must be ordered at the same time. Valid thru December 31, 2006. Vouchers must be returned by February 28, 2007.



COSMIC MASH-UP!!! WHEN STARS COLLIDE...



Two stars of unequal mass crash together in this computer simulation.

“911 Operator here. What’s the nature of your emergency?”

It’s a horrifying air-traffic accident. Two gigantic flying thermonuclear fusion reactors have crashed together. Each is torn open, pouring fresh hydrogen fuel directly onto the other’s hyperactive core. Both are blown wide apart, superheated ions radiating rapidly in all directions.

It looks like a scene of utter devastation. But among stars, it’s actually a form of mating: evolution by annihilation.

Sub-Compacts vs. Big Rigs

What kinds of stars collide? All kinds. From the tiniest brown dwarfs to the most bloated red giants, even neutron stars, pulsars and black holes. It only depends upon how close the stars are packed. “You’ve got to stuff a lot of stars into a small volume,” says Dr. Mike Shara, world-renowned astrophysicist who has used the Hubble Space Telescope and supercomputer simulations to study stellar smack-downs. Here in the galactic rural backcountry, we’re relatively safe from the kind of traffic congestion that leads to catastrophic crashes. “But in places like the

cores of globular clusters and probably in the very hearts of galaxies, stars are stuffed up to a million times more densely,” says Shara. Stars burn for hundreds of million of years: ample chance to slam-dance.

Mergers and Acquisitions ... or Death Blows?

Stars, it turns out, aren’t the everlasting, never-changing fixtures we used to believe. Instead, they have lives: birth, growth, aging and death. But stars can do something we can’t: transform into completely different types if they gain—or lose—enough mass. That’s just what happens in a star-crash.

When stars collide, one of two scenarios will play out. If you see a pair of similar stars closing in for a head-on collision—two dwarfs, two sun-like stars, etc.—they’ll most likely merge to form a larger star of the same type. As they approach, each will bulge towards the other. Then both will tear up and distort. The crash site almost always looks messy; a hurricane of star-bits seeking to orbit a common center of mass. This tornado will gradually settle down. And, you might say, a new star is born.

With more hydrogen added to the new star’s core, it’ll likely burn hotter than either of its parents. But it will usually be of the same type. “Unless,” Mike Shara points out, “you push a white dwarf over its mass-limit; in which case it’ll collapse down to the next densest state of star.” Two heavy white dwarfs could, for instance, spawn a neutron star.

But if the combatant stars are completely different types? Well, as with cars, the heavier vehicle generally sustains less damage. If you observe a small, but very dense, star hurtling toward a larger (although less dense) star, you can expect



“Blue Straggler” type stars are former crash sites of colliding stars.

that very little harm will come to that highly dense star. But the big one will be ripped up beyond recognition. That’s the nightmare scenario of a white dwarf plowing through our Sun—which is a hundred times bigger but a million times less dense than the “attacking” dwarf. As Shara explains: “The white dwarf will set up a hypersonic shock wave as it traverses the main sequence star; super heat that main sequence star; blast it to smithereens!”

Now remember, we’re still talking about head-on smash-ups here. If the stars just sideswipe—barely grazing one another’s surfaces—it’ll be more like a polite fender bender. They’ll go their separate ways and eventually repair the damage. (There’s no Galactic Insurance Company to cover these accidents.)

Proof of Close Encounters

All this theorizing is well and good, but unless you really see a collision—or its predicted result—you can’t be confident that it’s correct. Amazingly, we do see quite a few crash-sites.

Deep within the cores of globular clusters—those busy urban star-streets—we observe mad-large numbers of what are called “blue stragglers.” They’re hotter, bluer, and bigger than stars of similar type. Their characteristics match exactly what astrophysicists expect of collisions. And nobody’s yet come up with any other good way to explain their existence.

They were first spotted 7200 light years from Earth, in the globular cluster called NGC 6397 (see image), one of the two globular clusters closest to us. Globular clusters are very old structures. All their stars are about the same age. They’re all about the same weight. More massive stars that may once have lived there died long ago when their hydrogen supply ran out. But astronomers found five anomalously large blue stars. Each is the product of a stellar collision. Shockingly, one of the five turned out to be THREE times heavier than the average for the cluster. That’s probably the scene of a titanic three-star pile-up!

There’s a whole other line of evidence, too. We can essentially see strobe lights marking the places where another type of star-clash has gone down. These rapid beacons are known as “millisecond pulsars.” Picture spheres whose diameters are about the width of a large city, say Chicago or San Francisco. Now imagine that these things each weigh as much as the Sun. As if that wasn’t enough, set them furiously spinning at speeds in the range of 1000 times per second!

And they’re vampires! They’ve taken other stars prisoner and sucked the hydrogen—the life-blood of stars—out of them. With this new nutrient supply, they spin up faster.

A Time to Be Born, a Time to Die...

How long a crash takes depends on who’s crashing. “If you have two neutron stars colliding,” says Shara, “all the action happens in about 2 milliseconds. If you blinked, you’d have missed it—you’d have missed 20 of them.” On the other hand a white dwarf burrowing through a red giant would need nearly a decade to cross the giant’s expanse.

In between, the event no human ever wants to witness: a white dwarf would need only an hour to completely destroy our Sun.

Starry Night®

Prepare Your Students for NCLB Science Testing

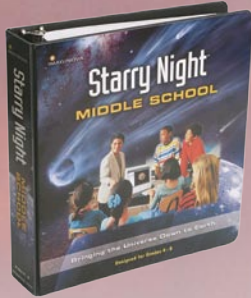
Starry Night gives you and your students engaging simulations and easy-to-follow lesson plans that teach the critical space science concepts in the 2007 NCLB science assessments.

Aligned to State and National Standards

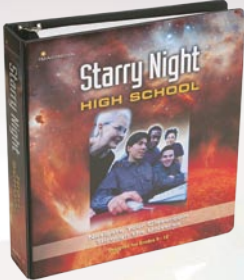
Each of the more than 24 lesson plans include unit by unit formative assessments and comprehensive summative assessments for key concepts students need for No Child Left Behind.

Independent research confirms that Starry Night is an effective science instructional tool.

Site Licensing Discounts Available for as Few as 5 Computers



Description	Cat. No.	Price
MS Single Seat	HS90410A	107.95
MS 5 Seat	HS90410B	378.95
MS 30 Seat	HS90410C	1677.95
MS 35+ (per seat)	HS90410D	50.95



Description	Cat. No.	Price
HS Single Seat	HS90408A	183.95
HS 5 Seat	HS90408B	644.95
HS 30 Seat	HS90408C	2841.95
HS 35+ (per seat)	HS90408D	86.95

Starry Night®

A Division of IMAGINOVA.

Bring the Universe to your classroom with top-quality telescopes from Orion®

StarBlast™ is ready to go from the moment it comes out of the box. With a 4½” parabolic mirror and EZ Finder scope, locating night objects will be a snap. Swivel base will track objects as they move through the sky.

IntelliScope™ telescopes take stargazing to the next level. Controller will move telescope to any of 14,000 objects automatically. Choose from models with an 8, 10, or 12” parabolic mirror.

DESCRIPTION	CAT. NO.	PRICE
StarBlast	HS90227	164.95
XT8 IntelliScope	HS90225A	706.95
XT10 IntelliScope	HS90225B	965.95
XT12 IntelliScope	HS90225C	1374.95





ORION
TELESCOPES & BINOCULARS

NANOTECH POWERS NAVY INTO THE FUTURE



grow in an attempt to realize this potential to produce materials that offer high performance accompanied by reliability and affordability. Understanding the value of extensive nanotech research, the Naval Research Institute has established a Nanoscience Institute. The Navy can now collaborate with other government organizations as well as academic and commercial organizations in their effort to realize the potential of this emerging field.

A New Field Emerges

Nanotechnology is a hybrid science that encompasses a huge range of activities in fields such as biology, physics, chemistry, material science, and engineering. It involves the design, characterization, production, and application of structures, devices and systems by controlling shape and size at the nanoscale. Dimensions between 1 and 100 nanometers (nm) are generally considered nanoscale. For perspective, eight to ten atoms span one nanometer and a sheet of paper is about 100,000 nanometers thick. Working in such a small scale opens new avenues for discovery because the ordinary rules of physics and chemistry no longer apply. Characteristics such as color, strength, conductivity and reactivity of materials can differ substantially in the nanoscale compared to the macroscale. Therefore, a nanomaterial can have considerably different properties than those observed for macroscale material of the same composition. The unique phenomena observed with nanomaterials enable novel applications.

Physicist Richard Feynman introduced the world to the innovative concept of gaining advantages from manufacturing on a very small scale in a lecture to the American Physical Society in 1959. Norio Taniguchi, however, originated the term "nanotechnology" in 1974 to refer to techniques that achieved greater dimensional accuracy

than 100nm. Nanotechnology has advanced significantly with the development of instruments such as the scanning tunneling microscope (STM) and the scanning probe electron microscope (SPM), which allow scientists to view and manipulate individual nanoscale particles. As the ability to manipulate atoms individually and place them in a pattern to produce desired structures improves, nanotechnology research increasingly transitions into important, practical applications.

Navy Turns to Nanotech

Modern naval vessels are power-hungry machines that can require up to six times the energy needs of a commercial liner. The surging demand for electricity on naval vessels served as the impetus for establishing this two-year, multimillion-dollar project sponsored by the Defense Advance Research Projects Agency. The Navy and its scientists at the Naval Research Laboratory teamed up with CNSE and MTECH Laboratories to develop a nanotechnology-based electronics system that will dramatically reduce the size and weight of motors onboard warships. Nanoscale technology offers the potential to meet the Navy's goal of transitioning to all-electric ships by creating smaller, lighter and more reliable integrated power systems.

Researchers have combined their expertise to develop and successfully demonstrate the world's first 50,000 Watt cryogenic power inverter. CNSE uses nanotechnology to produce semiconductors for low temperature functions. These consist of 200 millimeter thick wafers that carry 1,000 microchips on a disk smaller than a dinner plate. These semiconductors are then used by MTECH Laboratories to create power system components such as inverters and inducers. The power inverter, which is created by stacking the semiconductor disks, works with no mechanical parts. The recently demonstrated power inverter utilized a revolutionary approach in which metal heat sinks and other bulky cooling

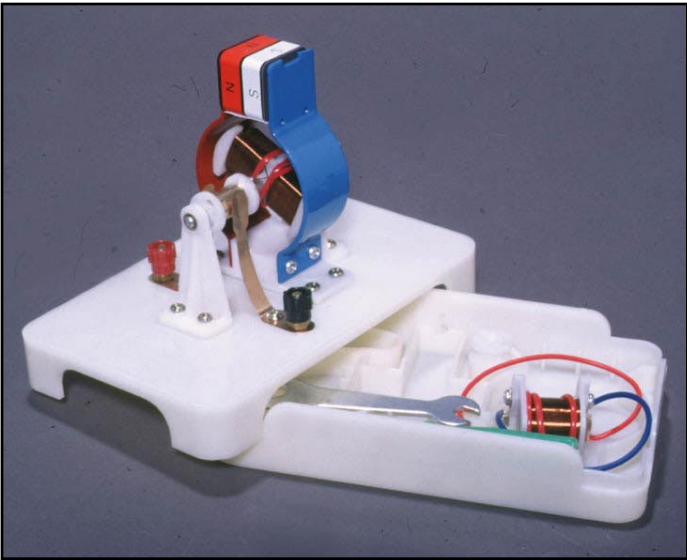
hardware were replaced by a liquid nitrogen bath, a cooling method that is compatible with superconducting device technologies that will be incorporated into the nanoscale electronic system. The Naval Research Lab is focusing on developing superconducting wires that can conduct electricity without any resistance when cooled to minus 322 degrees Fahrenheit.

The development of electric propulsion offers several advantages over current systems. This next-generation technology provides the opportunity to reduce the size of a Navy ship's motors, which are typically the size of a truck trailer, by about half and cut the weight by a third. This technology offers further advantages. It is designed to provide an integrated power system throughout a Navy vessel so that in addition to propulsion it would support sensors, high-energy weapons, and auxiliary systems. The anticipated benefits of this technology include enhanced ship survivability, improved combat capability, reduced crew size, and lowered ship life-cycle costs.

Success Drives Project Forward

Researchers involved with this project view the early success of this program as a great example of the enabling power of nanotechnology and predict that this technology will impact a wide variety of important areas, including energy and national defense. The next phase of this project will attempt to extend the technology to higher power levels and to even more compact packaging. Ultimately, the goal is to develop a technology for integrated power systems that offer dramatic reductions in size and weight and increases power density for vital military applications. Although commercial applications for the technology are years away, it could eventually be utilized in a variety of applications including aircraft, industrial plants and commercial buildings.

GINSBERG SCIENTIFIC— A DIVISION OF AMERICAN EDUCATIONAL PRODUCTS, LLC



MINI-MOTOR MODEL

This mini-motor model demonstrates both permanent and electromagnetic motors. Self-contained model of both an AC and DC motor is easy to assemble and disassemble, and even includes a wrench and screwdriver. Everything comes packed in a protective case which also serves as the motor base. Instructions included.

MINI-MOTOR MODEL HS66413 11.80



CHALK MARKABLE GLOBE

This wonderful markable globe adds an interactive dimension to any global issue. Students can add and subtract political boundaries as borders change, test basic global concepts of migration, trade, transportation, and culture, or plot weather patterns right on the globe. Continental land masses, major political boundaries, Tropics of Cancer and Capricorn, as well as Arctic and Antarctic Circles, are permanently outlined in yellow. Measures 11 1/4 inches in diameter.

DESCRIPTION:	CHALK MARKABLE GLOBE
CATALOG NO:	HS45171
PRICE:	81.10



American Educational Products, LLC
TEACHING TOOLS FOR UNDERSTANDING OUR WORLD

BUGS ON THE BEAT

Some may think of flies and maggots as one of the more gruesome elements of a crime scene. Drawn by the unique environment provided by a corpse, insects may arrive within minutes of death and provide the only witness to the unfortunate events. Using these insects, scientists can exploit the ecology of a crime scene to find clues that may not be discovered using other techniques.

Insects are the most diverse group of animals on Earth and, as such, have developed to survive in highly specialized niches. Forensic entomology exploits the knowledge of the specific environmental conditions under which particular species of insects thrive to reveal crucial information about a crime scene.

Estimating Post Mortem Interval

One of the most common uses of insect evidence is the estimation of the elapsed time since death or Post Mortem Interval (PMI). Traditional methods of estimating PMI, such as body temperature or the progression of Rigor Mortis, are subject to a number of variables that can be difficult to account for. In the first three days post mortem, insect evidence can be used to confirm PMI established through traditional methods, with any contradictions suggesting the need for further scrutiny of the crime scene. After three days, insect evidence may be the most accurate or even the only way of determining PMI.

There are two common methods that use insects to determine PMI. The first method utilizes maggot age and development and is used in the first few weeks after death. This method tracks the development of the first insects to arrive at a corpse, the Calliphoridae or blowflies. Blowflies, also known as bluebottle flies or greenbottle flies,



can be recognized by their metallic blue, metallic green, or black bodies. A blowfly will lay eggs in a wound, if present, or in any of the natural orifices of the body. Blowfly development follows a predictable cycle, with each developmental stage requiring a known time based on food supply and temperature. Food supply is not a limiting factor in the case of a human corpse. So, by identifying the age of the oldest stage of blowfly on the corpse and the temperature of the region in which the body was discovered, the day or range of days in which blowfly eggs were laid can be determined. Based on this information, PMI can be determined.

The second method of using insects to determine PMI utilizes the predictable successional waves of insects that populate a corpse as it decomposes. This method is used when the decedent has been dead from a few weeks up to a year or more. For example, the Sarcophagidae or fleshflies may arrive at the same time or a few hours later than the blowflies, while other insects,

such as the Piophilidae or cheese skippers, are only attracted to the corpse much later.

Additional Clues

In addition to being used to determine PMI, insects may also reveal other details about a particular crime. The identification of insects that are not native to the habitat in which the corpse was found would suggest that the corpse was moved. Similarly, the absence of insects that one would expect to find

in a given environment could suggest that the corpse was moved there from another location.

The tendency of blowflies to lay eggs in wounds before laying eggs in the natural orifices may provide valuable information in a decomposed corpse. Decomposition may obscure wounds, but the presence of maggot activity in locations other than the natural orifices can identify a likely wound site.

Additionally, maggots can be used to determine the presence of drugs. In cases where there is not enough flesh left to analyze, maggots can be analyzed instead, as they bioaccumulate.

Careful Sample Collection is Key

For a forensic entomology investigation to be successful, great care must be taken to properly collect insect evidence at the crime

scene. First responders must recognize insects as evidence, instead of perceiving them as a nuisance. Some of the eggs and larvae found at the scene should be collected and immediately preserved for subsequent age determination. A separate portion of eggs and larvae need to be kept alive, so they can be reared to adulthood for species identification. Pupae are also valuable in determining PMI, but are easily missed since insects seek out a secure place away from the food source to pupate. Adult flies are not as important as flies in other life stages, as they can be difficult to associate with the corpse. However, adult stages of other insects, such as beetles, can provide valuable information.

A Rich History

The earliest recorded use of forensic entomology details a murder in a Chinese village in 1235. When questioning the villagers proved unsuccessful, the local death investigator instructed all of the villagers to lay their sickles out before the crowd. Flies were drawn to one of the sickles, possibly due to minute remnants of blood or tissue still adhering to it, and the owner of the sickle broke down and confessed.

In 1668 Francesco Redi studied rotting meat that was either exposed to or protected from flies. In addition to refuting the hypothesis of "spontaneous generation" of life, Redi's work provided an analysis of blowfly infestation.

The use of forensic entomology has become more commonplace over the last decade. Research in this area has focused on developing more detailed information of the developmental rates of insects commonly found at crime scenes under different environmental conditions. Other research has focused on providing identification of species at the larval stage, either through physical observation or through genetic methods, to allow more rapid identification.

The Mystery of Lyle and Louise

A tragic car accident.
A horrific double homicide.
Business schemes. Drug rings.
Can you and your students solve
The Mystery of Lyle and Louise?

The Mystery of Lyle and Louise is a premier forensic science curriculum designed for high school and introductory undergraduate education. Comprised of independent hands-on lab modules, Lyle and Louise introduces your students to a broad range of techniques in forensic analysis, including DNA Typing, Forensic Entomology, Bite Mark Analysis, Blood Spatter Analysis and more.

Each module has been matched to the National Science Education Standards, and includes a detailed scientific background written by industry experts, extensive teaching tools, and much more!



Module 1: DNA Typing Available Now!

Identity Crisis! Two women have been identified post-mortem as Louise Mondelo. It is up to your students to use the latest in DNA technology to determine who is actually Louise.

Kit includes materials for 6 lab groups and includes the innovative BlueVis™ buffer, allowing you to visualize the DNA as the gel runs.

DESCRIPTION	CAT. NO.	PRICE
The Mystery of Lyle & Louise Module 1: DNA Typing	HS94583	\$149.00

Look for all modules in January 2007!



Offers new and accurate ways of determining factors of time and place of death

EXPLORE THE IMPORTANCE OF INSECTS IN FORENSICS

Includes:

- 8 vials (4 for adult specimens, 4 for maggots)
- 3 containers for live specimens
- Tweezers
- Pencil
- 3 pairs of latex gloves
- 2 different solutions for specimens
- Identity labels
- Instruction sheet
- Carrying case that can be sent to entomologists (addresses included)

Entomology Kit	Cat. No. HS69005	27.90
Specimen Net	Cat. No. HS69006	22.10

AUTISM AND THIMEROSAL: IS THERE A LINK?



Not so long ago, autism was a rare condition, but now it seems to be occurring at an almost epidemic rate across the country. This life-altering diagnosis is being explained to more and more parents each year and as their numbers grow, so does their resolve to push for increased funding for research into the causes of and possible treatments for the disorder. One area of focus for the past twenty years has been the possibility that a component of childhood vaccines called Thimerosal is linked to the disorder. Thimerosal is a mercury-based preservative that halts the growth of bacteria and fungi in multi-dose vials of vaccine.

There have been a number of studies that have purported to have proved or disproved a link between Thimerosal and autism. In May 2004 The Institute of Medicine's (IOM) Immunization Safety Review Committee released a report that said there is no evidence that the preservative

causes autism. The report also suggested that research dollars be focused on other possible causes.

But many prominent scientists are publishing studies that they say present strong evidence of a link. Parents who are convinced that Thimerosal caused their child's autism are pointing to this research as they lobby for more funding to explore the issue further.

What is Autism?

First identified in 1943 by Dr. Leo Kanner of Johns Hopkins Hospital, autism is a complex neurobiological disorder that is typically diagnosed in early childhood and lasts throughout a person's lifetime. It is part of a group of developmental disorders known as Autism Spectrum Disorders (ASD). Autism impairs the way a child thinks, feels, communicates, and relates to others. It ranges in severity from severe autistic disorder through pervasive development disorder not otherwise specified (PDD-NOS), to a much milder form, called Asperger syndrome. Autism is typically diagnosed by age 3, although new research is pushing this back to as early as 6 months. It occurs more often in boys than girls and is found in children of every racial, ethnic, and social background.

Is Mercury to Blame?

The intense debate over the impact of mercury exposure from vaccinations began because of significant changes in the recommended vaccination regimen from 1988 through 1991. In 1988, the Centers for Disease Control (CDC) added to the number of recommended vaccinations in the nation's infant immunization program. The new vaccinations included three

Hepatitis B immunizations and three Haemophilus B shots—all delivered by six months of age. At the time, neither the CDC, nor the FDA (which is responsible for monitoring the safety of vaccinations) expressed concerns about the relatively high doses of mercury that newborn babies and infants would receive from these shots.

Thimerosal is 49 percent ethyl mercury, a potent neurotoxin that targets the brain and nervous system. Exposure to mercury during gestation and in early life can disrupt basic brain development. Organic mercury accumulates in the neuronal cells of the cerebellum where it kills brain cells. This brain region is associated with movement and cognition and is also a region of impairment in autistic children.

But, given the number of children that receive vaccinations every year, if Thimerosal were the problem, why don't all children get autism? Researchers theorize that there is a genetic glitch that prevents autistic children from ridding their bodies of mercury at a typical rate causing it to concentrate in brain cells and wreak havoc.

The IOM and Others Say No

The report released by the IOM stating that there is no evidence that Thimerosal causes autism was based on several large studies conducted in the United States and Europe. The studies tracked thousands of children starting in 2001 and found no association between autism and Thimerosal.

It was a blow to parents of autistic children who are lobbying for continued research on the Thimerosal-autism link. It also seemed to nullify the 2001 Institute of Medicine review that called the potential link unproven but medically

plausible. The hope that Thimerosal critics had derived from that earlier statement was dashed by the new report and the recommendation that future research should focus on other possible causes.

Increase in Cases Vs. Better Diagnosis

That there has been an increase in children being diagnosed with autism is indisputable. In the 1960s according to the CDC it affected only about one person in every 2,500. By 1980 the rate had risen to 1 in 1,667 and today it is 1 in 166 individuals.

A study released by the Mayo Clinic in 2001 suggests that the increase is due to improved awareness and refinements to the diagnostic criteria, not environmental factors or vaccines. A review of the medical and school records of the subjects in the Mayo Clinic study showed that the rate of autism was stable until the new diagnostic criteria were introduced between 1988-1991.

An issue of safety

Although Thimerosal had not been proven to be unsafe, in 1999 public health officials urged manufacturers to phase it out of common vaccines. This measure was taken after the number of recommended vaccinations increased again and experts were concerned that infants might be exposed to too much of the chemical. Today all childhood vaccinations are Thimerosal-free, with the exception of flu shots.

With seemingly strong evidence on both sides of the issue there is no doubt that research into the cause and possible treatments for this complex neurobiological disorder will continue. In the meantime, public health officials strongly caution parents against refusing immunizations for their children. They point out that the risks of the diseases that the immunizations protect against are very real, while the link between autism and vaccines, is not.

INSIDE EVERY SCIENCE TEACHER IS A SERIOUSLY COOL MICROSCOPE SCREAMING TO GET OUT!

Introducing the revolutionary Swift M²

What's your idea of the perfect classroom microscope?

We asked. You told us. And the result is the new and exciting M².

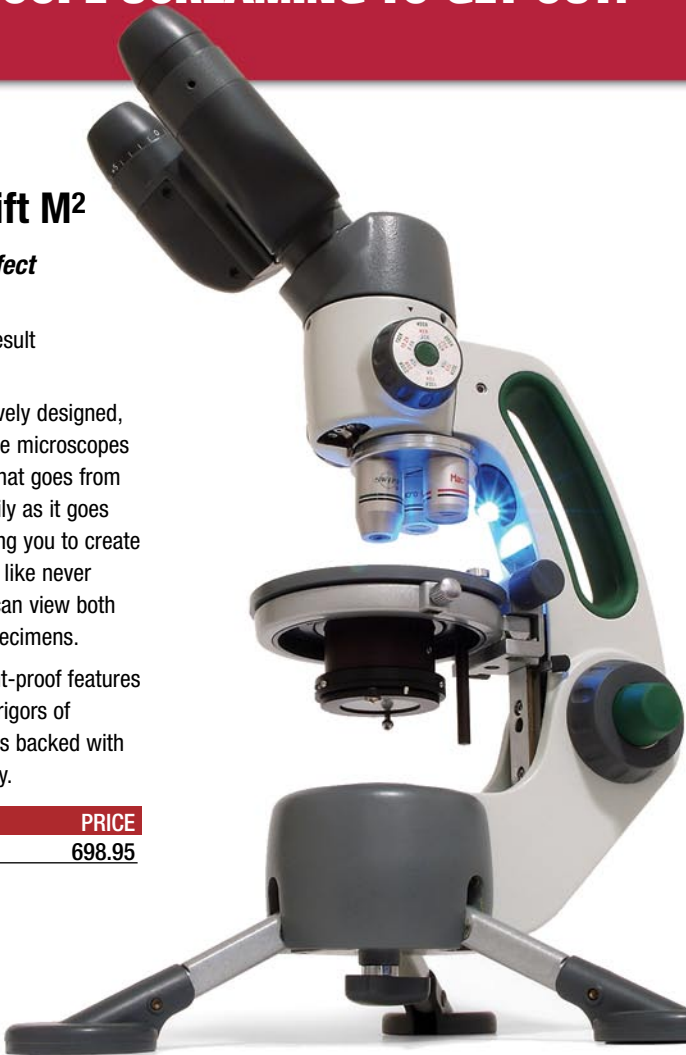
Remarkably flexible and distinctively designed, the revolutionary Swift M² is three microscopes in one—with a modular design that goes from the classroom to the field as easily as it goes from compound to stereo—freeing you to create new and interactive lesson plans like never before. Multiple stage positions can view both macroscopic and microscopic specimens.

It also comes with unique student-proof features that ensure it can withstand the rigors of classroom use. And, of course, it's backed with the Swift limited lifetime warranty.

CAT. NO.	PRICE
HS85273B	698.95



ENVISIONED BY TEACHERS. DESIGNED FOR STUDENTS. BUILT TO LAST.



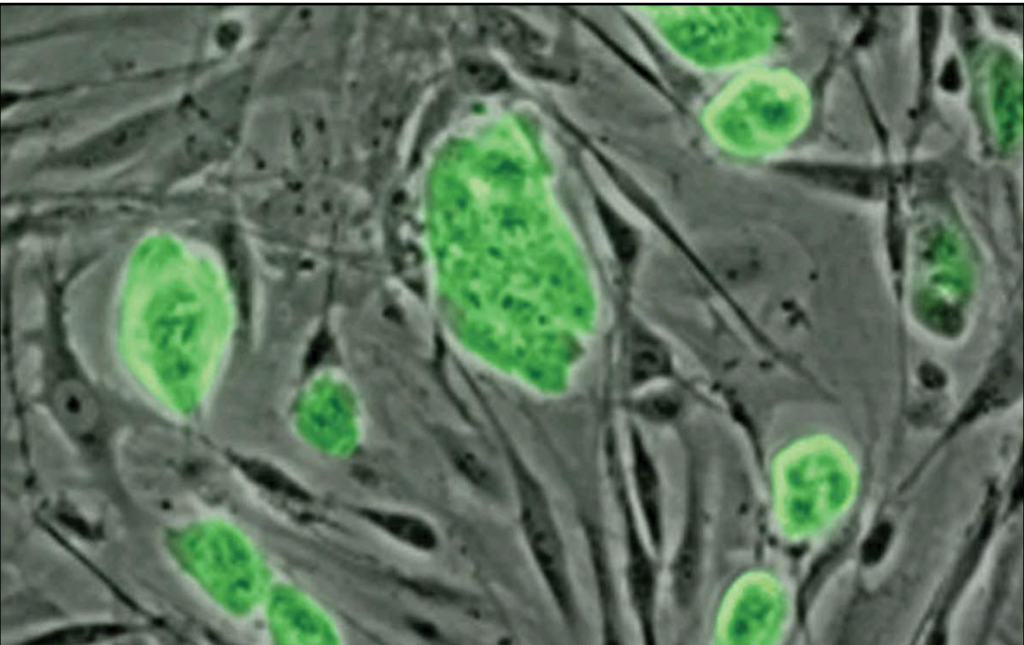
The All in One pH Bench meters, HI207 and HI208 were designed with the classroom in mind. Both offer built-in beaker holders, electrode holding beaker caps. The HI208 beaker stand has a built-in stirrer. These meters are easy to use with graphic icons on a large dual level screen to assist the user in calibration and the stabilization of a reading. Extended range pH (-2.00 to +16.00) with high accuracy (+/-0.02 pH units).

Small and compact so they need less desk space and are easy to store—plus they are battery operated. Measures temperature and pH in one electrode.

MODEL	CAT. NO.	PRICE
H1207	HS90162A	249.95
H1208	HS90162B	294.95



GETTING UP THE NERVE: NEW INSIGHTS IN STEM CELL RESEARCH



Embryonic stem cells of a mouse.

Researchers at Johns Hopkins University (JHU) in Baltimore have successfully transplanted mouse embryonic stem cell-derived motor neurons (nerve cells) into the spinal cords of paralyzed rats. The stem cells were able to make connections with skeletal muscles partially restoring function in the lower limbs. This study funded in part by the NIH's National Institute of Neurological Disorder and Stroke (NINDS) suggests that one day, stem cells could be used to treat such disorders as spinal cord injury, transverse myelitis, (inflammation of the spinal cord) amyotrophic lateral sclerosis (ALS, or Lou Gehrig's disease).

Directing stem cells

Stem cells are unspecialized cells that have no identity until they receive cues or signals from molecules, chemicals or factors within neighboring cells or environments. These cues encourage stem cells to differentiate into specific types of cells, like muscles cells, insulin secreting cells, red blood cells, or neurons. Unlike neurons or blood cells, which do not normally divide, stem cells can divide and proliferate for long periods of time. Scientists speculate that stem cells could be used to treat diseases like Parkinson's, diabetes, heart disease and even paralysis.

In this study, mouse embryonic stem cells were exposed to chemicals that encouraged the cells to differentiate into motor neurons. The researchers added other chemicals that could potentially increase stem cell survival and their ability to extend axons. Axons are long extensions of nerve cells that conduct electrical impulses down the body of the cell; bundles of axons make up nerves. Other chemicals were injected subcutaneously to offset the inhibitory effects of myelin on axonal growth. Myelin, an insulating layer that surrounds axons, can also prevent axonal growth in the adult nervous system.

The cells were allowed to divide and grow into motor neurons until enough cells, were present to inject them into the spinal cords of the paralyzed rats. After these cells were injected another group of nerve cells that express a growth factor were injected into the sciatic nerves of the rats. These new cells provided a focal point to attract the axons of the injected mouse embryonic cells. They encouraged the transplanted mouse embryonic cells to migrate to the peripheral

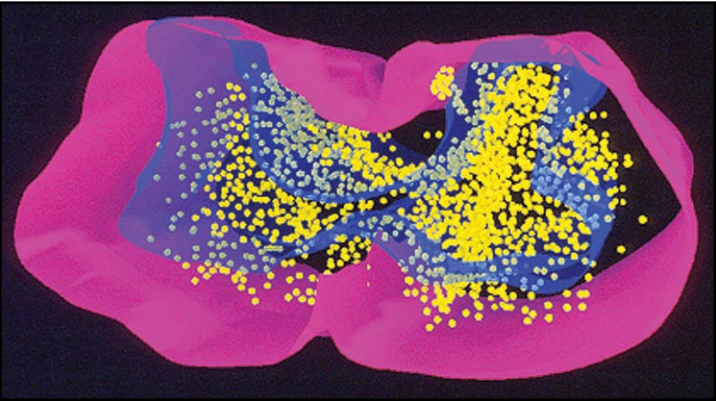
nervous system, and form neuromuscular junctions to restore broken neural pathways.

Recovery from paralysis

To determine the recovery of the rats, scientists assessed weight, suggesting the animals would gain more weight as their ability to become more mobile allowed them to search for food. Rats that were exposed to a combination of all treatments had significant improvement in weight; they also were able to flex and push off with the foot on the same side as the injection site and showed an increase over time in motor unit function.

Future directions

This study was the first to show that transplanted mouse embryonic stem cells could interact with adult nerve cells and form functional connections in the mammalian nervous system. The results of this research are very promising; however, much more work is needed before this approach can be tried in humans.



Adult nerve cells.

*Provide your students with
REAL transfer tools
used in research labs
worldwide.*

**And now, Pipettes
are FREE**

- Fast Release (Scienceware®) Pipette Pump™ III - designed for speed and accuracy
- Lightweight for one-handed operation
- Quickly aspirate, then dispense the entire contents using the trigger
- Use the thumb-wheel for precision control down to a single drop
- Thumb wheel rotation can "blow out" the pipette
- A self-stabilizing collar inside the silicone chuck holds either glass or plastic pipettes
- Disassembles for cleaning, repair and lubrication

Overall length 171mm (6.75")

**...Buy a package of five
Scienceware® Pipette Pumps
and receive 10 pipettes FREE!**

Cat. No.	Description	Size	Price
HS90361	5 Pipette pumps 10 Fisherbrand® Serological Plastic Pipettes	10mL	\$69.95

This offer is available in the 10mL size, the one most commonly used in schools.

**Fisher Science
Education**

For customer service, call 1-800-955-1177.
To fax an order, use 1-800-955-0740.
To order online: www.fisheredu.com

Scienceware®

ECONOMICAL BLOCK DRY ICE MAKER FOR ON DEMAND USE

Save the time and expense of receiving a delivery of dry ice by using Bel-Art's new, economical Frigimat® Cub Dry Ice Maker. The Frigimat® Cub Dry Ice Maker complements the range of other Bel-Art ice makers at just a fraction of the cost. In only a few minutes, this small unit can be attached to a liquid CO₂ cylinder (available locally) and will produce a ready-to-use 250 to 350g block of dry ice.

- Each 50 lb. cylinder makes from 10 to 16 blocks of dry ice
- Setup and use is safe and simple
- System operates at very low pressure (displayed on the built-in dial gauge) and incorporates multiple pressure relief safeguards

DESCRIPTION	CAT. NO.	PRICE
Frigimat Cub	HS90141	298.95



DEADLY BARBECUE?

The cookout. Whether the grill is gas, electric, or charcoal; whether the food of choice is meat, chicken, fish, or veggie kabobs; most Americans look forward to this beloved summertime tradition. But can this tasty food be considered deadly?

The Claim

Recent research has suggested that grilled food contains small amounts of two compounds that can increase the risk of cancer. These carcinogens are known as heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs). HCAs form deep inside meat when it is cooked at a very high temperature. The hotter the temperature and the longer period of time the meat is cooked, the dryer it becomes. A chemical reaction occurs inside the meat that creates HCA compounds. Conversely, fat that drips onto the flames of a grill cause the flames to shoot up and char or carbonize the outside of the food. PAHs are formed in these carbonized areas of the food.

The Findings

Researchers have investigated the effects of PAH compounds by feeding laboratory rats large quantities of charred food on a daily basis and observing the effects of PAH compounds on the digestive tract. Based on these studies researchers have found that digesting large amounts of charred foods on a frequent basis may increase the risk of getting cancer.

While the results of the study do not suggest that cancer will develop as a direct result of a grilled meat, it does support the theory that eating grilled or charred foods frequently may be a contributing factor in the development of cancer. The types of cancer HCAs and PAHs might contribute to remain unknown, but the results suggest a possible link to pancreatic or colon cancer. So while eating grilled foods is not cause for immediate concern, the possibility that it could contribute to cancer should raise a caution flag for those who consume these types of food regularly.

Reducing the Risk

It is always wise to limit your exposure to carcinogens, but that doesn't mean you can no longer enjoy a cookout. There are many ways to prepare grilled foods that also reducing the risk of forming carcinogens.

Reducing HCAs—conserve moisture while grilling and avoid cooking with high temperatures.

- Microwave food first to reduce grilling time
- Wrap food in foil with a few teaspoons of water to retain more moisture
- Marinate skinless chicken before grilling
- Eat more vegetables; HCAs do not form in vegetables and PAHs will not form unless they are charred
- Cook foods at a temperature high enough to avoid food poisoning but preserve moisture to avoid setting the creation of HCAs in motion

Reducing PAHs—avoid charring food and creating high flames on the grill.

- Use low or medium heat
- Use lean cuts of meat so less fat drips onto the flames
- Do not eat blackened parts of the meat
- Take skin off of chicken after grilling or use skinless

Still a Healthy Option

Despite the fact that small amounts of cancer causing agents have been identified in grilled food, grilling food is still an excellent low-fat cooking method. With outdoor grills becoming more and more sophisticated, cooking an entire meal on the grill is an excellent way to prepare

healthy food quickly and with less cleanup time. Grilling is also a quick way to prepare a meal for a large number of people, which brings us back to the beloved cookout. There is no doubt that “grilling out” will remain a treasured summertime activity. Summer just wouldn't be the same without it!

DID YOU KNOW?

When most people think of grilling food or hear the word "barbecue" they think of hamburgers, hot dogs and chicken. What most people don't know is that barbecuing and grilling are really two very different cooking styles with different types of food recommended for each style.

Grilling

Refers to cooking small, tender pieces of food very quickly directly over a hot fire. Any food that will sear and caramelize is a grilling food and includes chicken breasts, steak, hot dogs, and hamburgers. Even if barbecue sauce is basted onto the meat while it's on the grill, it is still not considered barbecuing.

Barbequing

Refers to cooking large, tough cuts of meat at a moderately low heat temperature and with a large amount of smoke. While cooking at a lower heat, tough connective tissues melt and meat fibers soften. Barbequing foods include ribs, whole chickens and beef briskets. Contrary to popular belief, a good barbeque is not all about the sauce. While a good sauce will enhance the barbeque, the true sign of success is the formation of a reddish smoke ring that appears while cooking the meat. If you see the ring, you know you are in for a treat!



Fisherbrand® Products

From an ISO 17025 A2LA accredited calibration laboratory

Traceable® 99M/59S Timer



Timer counts down from 99 minutes, 59 seconds in second increments with 3-button ease and big-digit visibility. Automatic memory resets the display to the last programmed time—ideal for repetitive tests. Alarm sounds for 30 seconds. Quartz-crystal accuracy is 0.01%. To assure accuracy an individually serial-numbered Traceable® Certificate is provided from an ISO 17025 calibration laboratory accredited by A2LA. It indicates traceability to standards provided by NIST (National Institute of Standards and Technology). Size is 2½ × 2½ × ½ inches. Weight is 2 ounces.

Cat. No. HS90861 Traceable® 99M/59S Timer \$12.25

Traceable® Snap-in Thermometer with Probe



Temperature range is -58 to 572°F and -50 to 300°C. Resolution is 0.1° from -20 to 200°; 1° outside this range. Accuracy is ±1°C between -20 and 100°C. To assure accuracy an individually serial-numbered Traceable® Certificate is provided from an ISO 17025 calibration laboratory accredited by A2LA. It indicates traceability to standards provided by NIST (National Institute of Standards and Technology). Size is 1½ inch height; 2⅞ inch width; ½-inch-depth. Probe diameter 0.14 inch; probe length (including handle) 2¾ inches; cable length 10 feet.

Cat. No. HS90862 Traceable® Snap-in Module with Probe \$19.95

Wireless Weather System



Weather System is a complete professional weather station. It's perfect for schools. Displays temperature, humidity, dew point, barometric pressure/pressure trend, weather forecast, wind direction/speed, windchill, rainfall amount, and clock/calendar. Sensors are wireless and cable-free. Supplied with sensors. Radio signal penetrates roofs and walls. Unit size is 8 × 7 × 5½ × 1 inches, display is 6¾ x 3¼ inches.

Cat. No. HS11130 Wireless Weather System \$550.95



Fisher Science Education

For customer service, call 1-800-955-1177.
To fax an order, use 1-800-9955-0740.
To order online: www.fisheredu.com



DIVERSIFIED WOODCRAFTS SCIENCE TABLES

What makes a great table? Diversified Woodcrafts knows.

- Corner braces made of 13 gauge steel keep the table from flexing when moved
- Chemical resistant finish protects the wood in the event of a spill
- Rubber leg boots are firmly attached and protect the legs from nicks and scratches
- Solid construction with tabletops attached through solid oak aprons for strength
- Top selling tables ship within 7 days!



SUPER-SIZED KIDS: THE EPIDEMIC OF CHILDHOOD OBESITY



The fastest growing health concern and the most common nutritional disease in America today is obesity. Next to smoking obesity is the second leading cause of preventable death in the U.S. More than 58 million American adults are overweight, 40 million are obese, and 3 million are morbidly obese. It's no surprise that this trend of excess has been passed to our children. In just one generation, childhood obesity has reached epidemic proportions. According to the American Obesity Association, over 30% of children and adolescents are overweight and more than 15% are obese.

More Weight = More Health Problems

Unfortunately, overweight and obese children are likely to face life-long battles with weight. Children who are obese at age 6 have a 50% likelihood of

becoming obese adults; those who are obese at age 13, face a 75% chance of life-long obesity. The health consequences for overweight children are numerous and overwhelming. Warning signs of chronic diseases that in past generations took years to develop are being seen in obese children as young as age four, including:

- Type 2 (adult-onset) diabetes
- High cholesterol/high blood pressure
- Sleep apnea
- Orthopedic complications
- Asthma
- Psychosocial effects

Sadly, if this current obesity trend continues, the life span of today's obese children will be shorter than their parent's.

What are the Causes?

No one factor can be identified as the cause for obesity in today's youth. Certainly genetics plays a role, but the obesity epidemic can't be blamed on genes alone. Weight gain in kids can be linked to the same causes in adults: eating too much and moving too little.

Physical inactivity: Today's kids are considered the most inactive generation in history. According to TV Free America, the average child now spends three hours each day in front of the television. It's no surprise that the kids who watch the most hours of TV have the highest rates

of obesity. Additionally, cuts in school physical education classes and extra-curricular programs and the lack of safe community recreational facilities reduce opportunities for regular fitness.

Excessive snacking: During their hours of TV viewing, children are bombarded with ads for high-calorie snacks and sugary soft drinks and tend to grab snacks to enjoy with their favorite TV shows.

Fast food diet—According to a 2004 Harvard study, every day more than 30% of U.S. children will eat fast food. On average these kids will consume 187 more calories and fewer nutrients than their peers.

Schools Can Be Part of the Healthy Solution

Numerous studies have shown a link between healthy diets and academic performance. Schools can play a vital role in helping to prevent childhood obesity by encouraging good eating habits, exercise, and healthy weights through school meals, gym classes and recess, health education, and school health services.

One proactive program developed to address childhood obesity and improve readiness to learn is the Action For Healthy Kids (AFHK). A public-private partnership, AFHK works with schools to help students learn and adopt lifelong healthy lifestyles, and includes over 40 national organizations and government agencies. Comprised of over 51 state teams and 5000 volunteers, AFHK helps to improve students' diets, increase their physical activity, and educate administrators, teachers, parents and the public about the role of good nutrition and physical activity in academic achievement.

As the part of their mission, AFHK developed a list of the top five actions schools can take to boost students' health, including:

Form a school health and advisory council. Develop a team of volunteers, including parents, students, medical and business professionals, administrators, law enforcement personnel, to help assess the school, develop plans, and implement programs to address nutrition and exercise in the school community.

Develop a comprehensive wellness policy. Under the Child Nutrition Reauthorization Act, all schools that participate in federal school meal programs are required to develop a local wellness plan with nutrition education and physical activity goals. This plan needs to address guidelines for all foods and beverages sold on school grounds, educating students on making good nutrition decisions, and training staff on healthy lifestyles.

Integrate physical activity and nutrition into the regular school day. Teachers can begin classes with fun physical activities such as marching or dancing. Additionally, they can incorporate information on nutrition, healthy lifestyles and exercise into lesson plans for reading, writing, math, science and other assignments.

Incorporate nutrition education and physical activity into after-school programs. For students involved in after-school programs, time should be allotted for fun physical activities and games that get students up and moving and provide a chance to increase physical skills. Healthy snacks should be made available as well as the opportunity to learn about healthy lifestyles.

Encourage staff to model healthy lifestyles. Teachers are powerful role models for students. A wellness program that educates and encourages staff to adopt healthy habits not only sets a good example for students, but benefits the school by improving morale, reducing absences, and lowering insurance costs for schools.

For more information, resources, and ideas on improving the health of students at your school, visit the AFHK Web sit at www.ActionForHealthyKids.org.

Fisher Science Education FE-Series Balances & FX-Series Balances

Toploading Balances

Analytical Balances

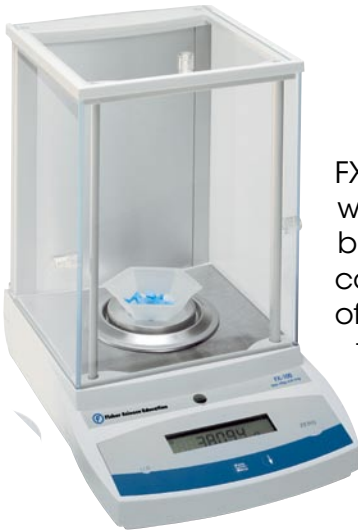


FE-Series Balances

The new FE-Series Balances are the perfect solution for academic environments. Eleven models offer capacities from 120g to 10,000g with readability from 0.001g.

Automatic Calibration, Fourteen Weigh Modes (including Newton) plus Percentage Weigh and Specific Gravity Applications. Stainless-Steel Weigh Pan, Sealed Keypad and Overload Protection. Optional RS-232 or USB Port.

MODEL	SPECIFICATIONS	CAT. NO.	PRICE
FE-123	120g x 0.001g	HS68705	519.95
FE-202	210g x 0.01g	HS68706	300.95
FE-402	410g x 0.01g	HS68709	356.95



FX-Series Balances

FX-Series Balances are ideal for those who demand quality on a limited budget. Built to last, FX-Series are constructed to withstand the rigors of educational use. Thirteen models to choose from with automatic calibration, multiple weigh modes, RS-232 and much more!

MODEL	SPECIFICATIONS	CAT. NO.	PRICE
FX-60	60g x 0.1mg	HS65229	1,392.95
FX-100	100g x 0.1mg	HS65230	1,490.95
FX-200	200g x 0.1mg	HS65231	1,824.95

Free Gift Offer!

Purchase any FE-Series Balance and receive a FREE Anti-Theft Kit!
Purchase any FX-Series Balance and choose from a FREE Anti-Theft Kit, In-Use Cover or Calibration Weight!



For complete listings of all models, please visit:
www.fisheredu.com
Product Search: "FE-Series" for FE-Series Balances
Product Search: "FX-Series" for FX-Series Balances

or call: 1-800-955-1177

Do your
homework
and you'll buy
an Ohaus.

- Industry-leading warranties and support
- The most comprehensive line of balances for grades K-12 and beyond
- More than just a balance company –
a true partner in education



www.ohaus.com



ENDURANCE

OHAUS TRIIPLE BEAM

Don't Settle for Imitations.



FINDING A GREAT SCIENCE FAIR PROJECT

The fundamental goal of a science fair is to encourage an interest in science. While the competitiveness can be quite demanding, the rewards, knowledge, and experience gained by the participants makes this yearly event an important part of science education.

Choosing a Project Topic

Students should pick a topic that they find interesting and have the resources to test. A good project is one that can be completed by the student with little or no help from parents or teachers and one that will foster an inquisitive interest about new topics and further studies.

Science fair enthusiasts can maximize their resources by using the Internet to research their topics. In fact, so many great Web sites exist to foster ideas and explain the scientific method that students and parents often wonder where to start. To get the most out of the science experience, students should only use these sites as a starting point and are strongly encouraged to ask their own questions.

Steps to Success

With significant advancements in electronics and computer modeling, science fair presentations need to demonstrate a student's ability to maximize resources while following the scientific method.

Preparing a project for the science fair can take from a few months up to an entire year. The topics may have become more complicated over the years, but the method of preparing and presenting the information has remained the same. The three steps that all students must follow are outlined below:

Step 1: Choose a Topic. This is the most creative and most overwhelming step for the student. During this time, students should also be determining how they plan to complete their project. While there are infinite possibilities of topics for study, access to the materials needed to complete the project is a crucial planning step that cannot be overlooked.

Step 2: Conduct the Experiment. Students are expected to use the scientific method and its four main steps: characterization, hypotheses, predictions, and experiments, to complete their projects. When experimenting, the project might fail in its goals, but the student will still be learning about science. Also, in understanding why an experiment didn't work, a student's interest in the topic is further developed.

Step 3: Making the Presentation. Science and literacy mix as students create a display board showing their background research, experimenting methods, and results. The information on the board should be comprehensive and designed to accompany a verbal presentation that will be given to the judges.

By rehearsing a presentation, students also gain experience in speaking in front of groups and conducting themselves in a professional manner.



The key to science's future?

The National Science Foundation reports that degrees awarded in science and math in the US have been declining since the early 1990s. Some believe that this decline can be improved with more focus on the creative aspects of science. Science fairs and clubs are excellent tools to connect students with science. As Dr. Shawn Carlson from the Society of Amateur Scientists (www.sas.org) commented,

"If your teenager told you that they wanted to be a musician, would you say, 'Great! You can learn everything you need to know in high school band?'"

Of course you wouldn't! You'd want to find an adult who shares your kid's passion—someone who knows where your kid is coming from, who's already gotten where your kid wants to go and who wants to teach your son or daughter how to get there.

SOME GREAT WEB SITES TO GET YOU STARTED:

For Students:

<http://www.ipl.org/div/kidspace/projectguide/>

<http://www.isd77.k12.mn.us/resources/cf/steps.html>

<http://www.scifair.org/>

For Teachers and Parents:

<http://www.sciserv.org/isef/>

<http://school.discovery.com/sciencefaircentral/dysc/>

<http://www.nsf.gov/index.jsp>

<http://www.sas.org/>

KEEP SCIENCE ON YOUR DESK EVERY DAY

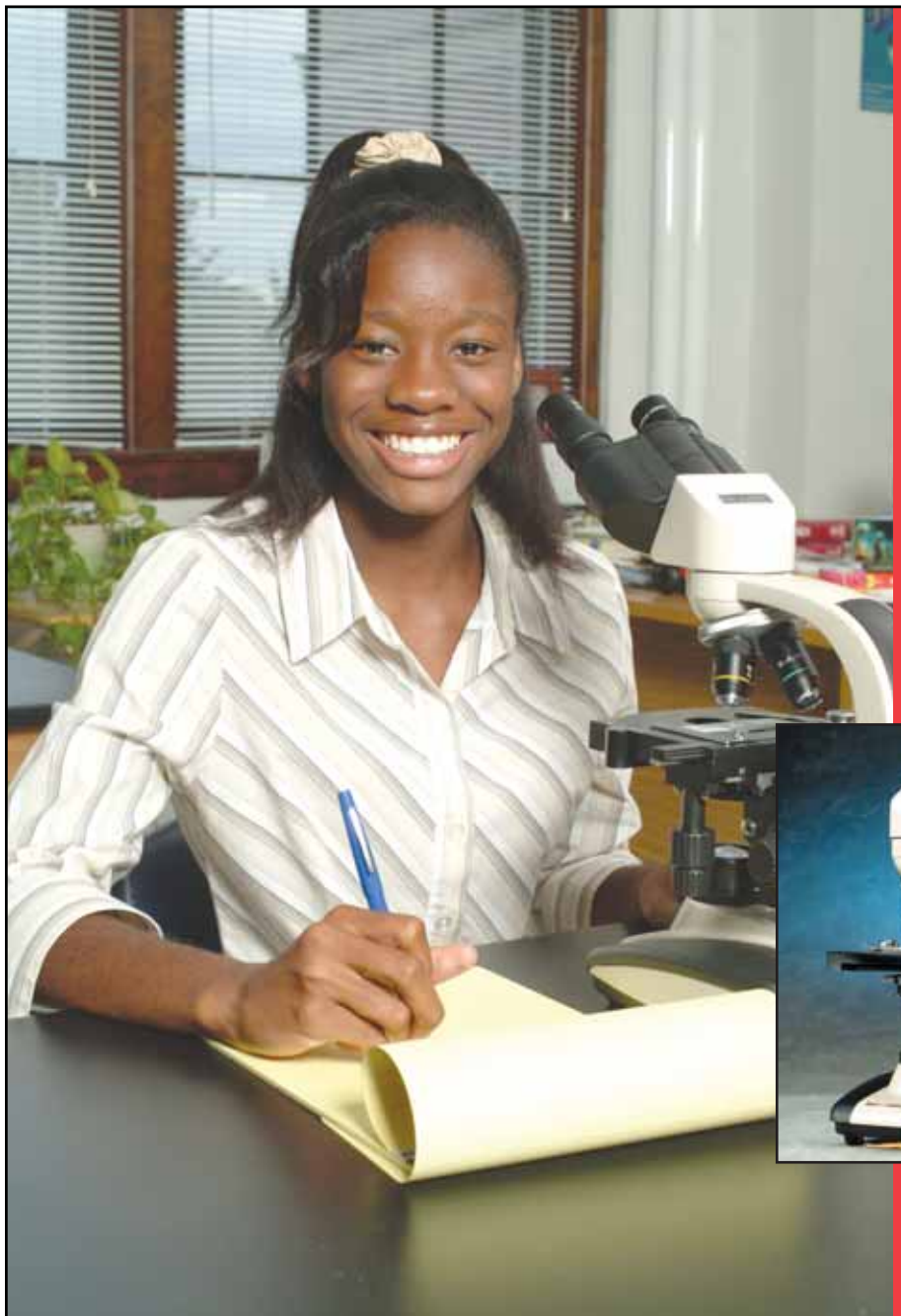
Our new Fisher Science Education Calendar provides a view of the entire month with ample space for notes.

- Months run from August 2006 to July 2007 to coordinate with your school year and allow for summer planning.
- Each month also features products from two of our prestigious suppliers—Ohaus and Ken-A-Vision
- Each weekday features an interesting scientific fact that occurred on that day in history. Use as a way to spark interest in the history of science or to prompt a discussion of the historical event with your class.



Get your calendar free with any order placed between now and October 31, 2006 while supplies last!

To request your calendar, include the catalog number **07CALENDAR** when placing your next order with Fisher Science Education.



How Do You Learn?

I am a visual learner. Ken-A-Vision® products allow me to visualize, capture and record my own world. Other Ken-A-Vision solutions allow me to capture movies and stills and share them with the rest of the class or store them for future use. Applied Vision™ Software makes all Ken-A-Vision's cameras the best solution.

For over 60 years Ken-A-Vision has focused on classroom learning with quality products backed by up to 10 year warranties and personal service.

Real World. Real Time. Real Learning.

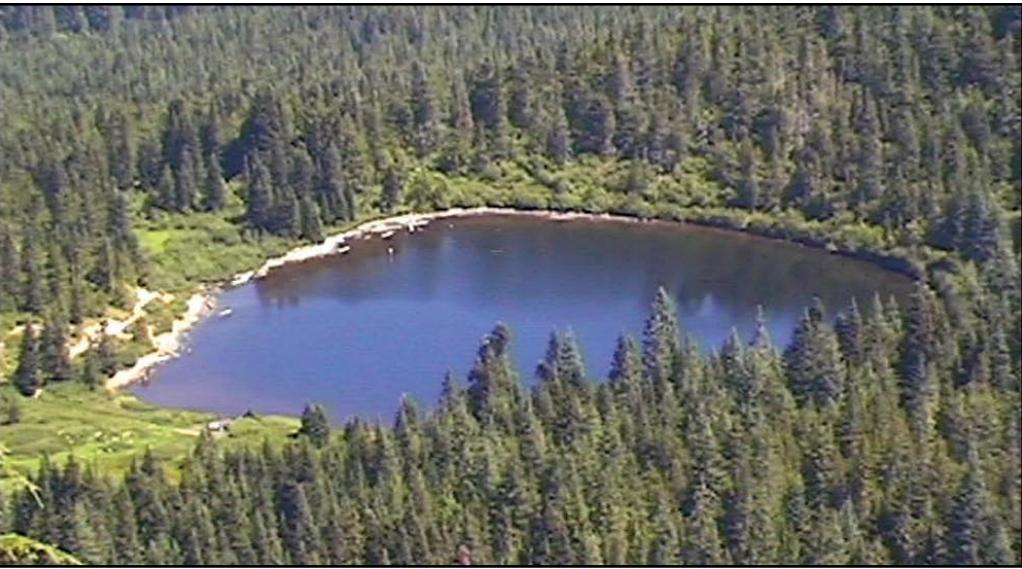
HS66900

618.95



ken-a-vision®
KNOWLEDGE THROUGH VISION

KEEPING OXYGEN ON THE RISE



Many aquatic animals are always on the move—they need dissolved oxygen to survive and they know its not distributed evenly, even in the same lake, pond, or ocean.

Oxygen dissolves into water by only two means. The first, and lesser, comes from photosynthesis by aquatic plants; however, plants also remove oxygen during respiration. This leaves the majority of dissolved oxygen to come from atmospheric diffusion where the air and water meet. Moving waters, such as rivers, benefit the most as they churn over rocks and roll downstream.

Water loses dissolved oxygen through many different means. Environmental changes decrease oxygen as the atmospheric pressure drops, temperatures rise, or salinity increases. All aquatic life depletes oxygen during respiration and, eventually, during decay. Still-standing water amplifies this problem because the decaying

matter sinks into water that has little atmospheric diffusion and is often too dark to support photosynthesis.

That leaves lakes, oceans, and other large bodies of water to rely upon wind, rain, and underwater currents to circulate oxygen-rich water throughout the different depths. The creation of currents strong enough to circulate though an entire lake is aided by seasonal changes.

For every season: stir, stir, stir

Seasonal changes oxygenate different layers of water. In autumn, frosts and cold winds lower the surface temperature, causing surface water to sink and warmer water from the bottom to rise. This internal current continues until the entire lake's temperature equals 39.2°F, the temperature at which water reaches its maximum density. Any water that is colder than 39.2°F will rise, as it is less dense.

Winter arrives and the non-rotating surface water begins to freeze. Aquatic life migrates to the warmer bottom waters. Decaying biological matter rotting on the lake bottom adds heat and helps keep the water from freezing so it is able to sustain life through the cold winter months.

Spring and summer bring warmer temperatures and warmer water. Warmed by the sun, the upper layer, called the epilimnion, will not sink; and it traps the cold layer of water below it. The lake begins to become stratified. Through conduction, the epilimnion expands deeper into the lower layer, or hypolimnion. Between these two layers, a buffer layer forms called the thermocline. The size of the thermocline will vary with the size and depth of the lake.

As weather conditions on the surface change, rain and wind cool the warm top layer and the water begins to sink. When it reaches the thermocline, it is warmed and starts to rise again, creating a current between the upper two layers, leaving the bottom waters undisturbed.

A rockin' thermocline

Strong winds can collect warmer waters on one side of the lake causing the thermocline layer to tilt and allowing cooler water to rise to the surface at the lee side of the lake. If the wind ceases suddenly, the thermocline swings back and forth until a balance can be reestablished.

For reservoirs and lakes where the bottom contours aren't symmetrical, a unique phenomenon occurs. If the thermocline tilts toward the dam, the hypoxic waters of the hypolimnion spread across very shallow areas. This produces oxygen-depleted "dead" areas that many animals abandon for deeper waters.

The rocking action creates a strong current that serves to oxygenate the lake, but also disrupts sediment from the lake bottom. When this kind of imbalance persists, the sediment builds up and can eventually result in a more shallow lake.

Conversely, the complete lack of wind will halt all circulation. The top few feet, regardless of the lake's size, become increasingly warm. As breezes return, a new current will cool that layer, but not disturb the rest of the lake. In ponds, many fish will migrate to this layer for the minimal fresh oxygen. However, fish use more oxygen as their internal temperature increases, so, until this new stratification is eliminated, they might also retreat deeper into the thermocline than usual.

Oceans as stratified waters

Similar to lakes, oceans have three layers of water and rely on currents to provide the oxygen needed to sustain life. Seasonal changes affect the ocean bottom as rivers and run-off during wet seasons supply more sediment and decaying matter.

For almost a century, the de-oxygenation of ocean waters has created large hypoxic zones that cannot support ocean life. These areas, often called dead zones, were identified as a concern in the late 1960s when some smaller ecosystems began to show hypoxic symptoms all year long.

In the Gulf of Mexico, this zone is seasonal, starting in the spring and lasting until late autumn. Many animals flee the area, leaving them more vulnerable to unfamiliar predators. Bottom-dwelling animals, however, do not possess the capabilities to flee as the area continues to grow. This year it is predicted that this zone will reach 6,700 square miles, or almost the size of New Jersey.

Researchers have linked the formation of this zone, and similar zones around the world, to fertilizer runoff. Increased nitrogen levels created by the runoff support an influx of algae that die and sink in the Mississippi delta, which flows into the Gulf of Mexico. The decay of these large algal blooms, plus the warmer waters, depletes oxygen in the area creating a dead zone.

continued on page 16.

Oakton pHTestr UltraBasic— Rugged and Waterproof



A rugged waterproof housing makes the Oakton pHTestr UltraBasic ideal for outdoor testing. A great low price makes it economical to provide your class with multiple units, making benchtop experiments go faster. And with push-button calibration and auto buffer, the pHTestr Ultrabasic makes it easy to get accurate results. Range/Resolution/Accuracy: -1.0 to 15.0/0.1/±0.2

DESCRIPTION	CAT. NO.	PRICE
pHTestr UltraBasic	HS90520	49.95

OAKTON



A MAMMOTH UNDERTAKING

Scientists sequence DNA from the extinct woolly mammoth

Two groups of scientists recently sequenced DNA extracted from well-preserved woolly mammoth specimens found in the Siberian permafrost. Both groups have made significant advances in the number of sequenceable base pairs (bp) analyzed from DNA that has been isolated from tissue samples of pre-Ice Age species. Previous efforts have encountered difficulties finding DNA that has not degraded after 10,000 years or more in the permafrost, and have produced sequences of only around 1,000 bp.

A team of researchers from Germany, the UK, and the US—led by Michael Hofreiter of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany—used multiplex PCR to analyze mitochondrial DNA isolated from just 200mg of mammoth bone. The result, reported in *Nature* in February 2006, was the successful amplification of 46 chunks of sequence, which were then pieced together to yield the complete 5,000 bp sequence of the woolly mammoth mitochondrial genome.

Meanwhile, scientists from the US and Canada—led by Hendrik Poinar at McMaster University in Hamilton, Canada and Ross MacPhee

at the American Museum of Natural History in New York City—have sequenced genomic DNA from a 27,000-year-old mammoth jawbone that contained nuclear DNA. As reported in *Science* in January 2006, the group has compiled about 13 million DNA base pairs. While only a relatively small portion of the entire genome, this portion of the genetic code is nearly 500 times longer than any woolly mammoth sequence previously identified. The researchers may be able to complete the sequencing of the entire genome in a year, using a state-of-the-art DNA sequencing machine at the Pennsylvania State University. The complete genome of an extinct animal has not been sequenced previously.

Evolutionary Investigations

Both teams of researchers have used their data to examine the evolutionary history of the woolly mammoth and their closest living relatives, the

Asian and African elephants. Based on their work with mitochondrial DNA, Hofreiter's group suggests that the mammoth is most closely related to the Asian elephant. Mitochondrial DNA is inherited through the maternal line, with small but regular changes, making it useful for studying lineages. The mitochondrial DNA data suggest that modern elephants and woolly mammoths share a common ancestor that split into separate species about 6 million years ago. The African elephants branched off first, while the Asian elephants and mammoths split into separate species about 440,000 years later, a relatively short period in evolutionary time.

By contrast, the Poinar-MacPhee group suggests that mammoths are more closely related to African elephants. The genomic data was 98.5% identical to nuclear data from an African elephant.

Genomic DNA represents a much larger portion of the genetic material contained in an organism than mitochondrial DNA, and can also be used as a predictor of species relatedness.

Clues to Extinction

Sequencing mammoth DNA may provide new insights into the cause of their extinction. Mammoths first arose in Africa about 1.6 million years ago, during the Pleistocene epoch, and eventually migrated to Europe, Siberia, and North America. Woolly mammoths are the best-known species of mammoth, and were extremely specialized to survive in the Arctic. The woolly mammoth likely first appeared in Siberia, and ultimately inhabited a vast northern range extending from Ireland to eastern North America. Most mammoths became extinct approximately 10,000 years ago, with a population surviving on Siberia's Wrangel Island until between 7,000 and 3,700 years ago.

Compared to other extinct, prehistoric animals, much is known about mammoths, since they were relatively abundant, well-preserved carcasses have been found, and they are prominent in primitive art.

However, the cause of the mammoths' extinction remains unknown. Around the time that mammoths became extinct, significant numbers of other large animals, such as the saber-toothed tiger, were also becoming extinct. The cause of these extinctions is a subject of much debate. Possible factors include climate change and hunting by humans.

MacPhee notes two unusual factors regarding this group of extinctions. First, unlike major extinction events, these extinctions were unevenly distributed across the globe, concentrated in the Americas, Australia, and many islands. Second, the extinctions typically occurred after humans arrived in an area for the first time.

MacPhee, in collaboration with virologist Preston Marx of the Aaron Diamond AIDS Research Center, has proposed the hyperdisease hypothesis: humans brought one or more virulent pathogens with them as they expanded into a new area, wiping out the native animals. By studying DNA samples taken from mammoths, scientists can search for foreign DNA that could belong to a pathogen that may have contributed to the mammoths' demise.

Even if foreign DNA is not found, other clues to the cause of the mammoths' extinction may be found in their DNA. Elephants and mammoths coexisted on Earth for four million years. Differences in the DNA may help to explain why the mammoths died out while elephants persist.

Russian scientists have created "Pleistocene Park," a restoration of the Ice Age landscape that was home to woolly mammoths. In the region where the park is located, temperatures range from highs of about 85°F in the summer to lows of -58°F in the winter. During the Pleistocene epoch, the vegetation in the region provided excellent grazing for woolly mammoths and other herbivores. As the Ice Age ended, the area became mossy tundra. Scientists hope that restoring the ecosystem may provide insight into the cause of the woolly mammoths' demise.



Extract DNA from strawberries



Excellent activity for transferring complex, abstract concepts into real observations. Each team of students will perform two extractions.

- Step-by-step instructions and teacher background information
- Illustrates the enormous length of the DNA molecule
- Class size: 32 students working in teams of four

Description:	DNA Extraction and Isolation Kit
Cat. No:	HS90182
Price:	72.50



An Ideal Outdoor Binocular

- REVOLUTIONARY SHOCKPROOF CONSTRUCTION
- DURABLE, WATERPROOF, AND NITROGEN FILLED
- GUARANTEED PRISM ALIGNMENT FOR LIFE
- 10X MAGNIFICATION AND 25MM OBJECTIVE LENS
- FIELD OF VIEW: 275 FT. AT 1000 YARDS
- WEIGHT: 18.0 OZ.

NOSHOCK BINOCULARS	HS90214	69.95
--------------------	---------	-------



NAVY BRUISED?

On July 3, 2004 more than 150 melon-headed whales congregated in the shallow waters of Hanalei Bay near Kauai, Hawaii. The stunning mass stranding of these deepwater whales was the largest ever recorded in Hawaii. Swift action by a team of government agencies, local biologists and volunteers organized a flotilla of kayaks that gently herded the wayward whales back to open sea.

Searching for clues, National Oceanic and Atmospheric Administration (NOAA) investigators ruled out environmental factors, such as weather conditions, food sources or predators, that might have attracted or driven the whale pod to the shallows. Focus shifted to human activities in the region. On July 2-3, the United States Navy had conducted active sonar transmissions in the vicinity as part of its Rim Of the Pacific (RIMPAC) exercises. In April 2006 NOAA concluded that the Navy's sonar drills were "a plausible, if not likely, contributing factor."

Since the mid-1980s, dozens of whale beaching incidents around the globe have been linked to naval sonar activity (see chart). While the Hanalei event resulted in the death of a single whale calf, others have ended more tragically. The question: Does sonar harm whales? The rancorous debate has put the Navy on the defensive against environmental groups seeking to protect whales from the alleged harmful effects of sonar.

Whales and echolocation

Nearly 90% of all whales, porpoises and dolphins are classified as toothed whales—odontocetes—a subset of the order Cetacea that includes smaller species like the bottlenose dolphin as well as larger whales such as the orca. Scientists believe that most odontocetes use a sophisticated sound transmission-and-retrieval system called echolocation to "see" the world around them.



When echolocating, a whale emits sounds from its forehead, focuses these sounds and receives the returning echoes through special sound conducting tissue in the lower jawbone. It is unknown precisely how the whale generates the sound, but research has proven that echolocation is incredibly sensitive: captive dolphins can distinguish a BB from a kernel of corn from a distance of 50 feet. In the dark ocean depths, echolocation allows whales to navigate, hunt, and gather information about their surroundings.

About Sonar

Sonar—Sound Navigation and Ranging—is used by navies around the world to detect submarines, mines and other underwater objects. The U.S. Navy utilizes two types of sonar, passive and active. Passive, or listen-only sonar, operates at 100-500Hz and is effective up to 100 miles for long-range sub detection.

Active sonar uses sound transmissions and is similar to whale echolocation. The active sonar implicated as harmful to marine animals is midfrequency sonar. Operating at 1-10kHz and effective up to 10 miles, this is the Navy's primary submarine hunting tool. It is the sonar you find in movies like *The Hunt for Red October* in which a submarine "pings" a noise that then bounces

off another object. The reflected sound provides information about the other object.

From the deep to the courts

Attempts to separate fact from conjecture about sonar's effect on whales are problematic.

Scientists and the Navy agree that sonar sound levels are intense and can remain at harmful levels for hundreds of miles from the source. From physical examinations of beached whale carcasses, biologists believe that sonar caused internal bleeding in the animals, particularly in their brains and eyes. On a larger scale, scientists are concerned about the impact of sonar on migratory routes of marine wildlife. The International Whaling Commission believes that the association between sonar and whale mortalities is "very convincing and appears overwhelming" and noted concerns that stranding reports may underestimate sonar harm because they do not account for whales that die at sea and are never found.

The Navy contends that much of the evidence linking naval activities to whale strandings is circumstantial or inconclusive. The Navy also argues that it takes reasonable precautions to protect marine animals and avoids known breeding or migratory areas. Skeptical environmental groups want the Navy to do more, and have taken to the courts to force the Navy's compliance.

Sonar's effects on whales made headlines in August 2003 when the National Resource Defense Council (NRDC) won a federal court victory to drastically curtail the Navy's use of low-frequency active sonar (LFA). The Navy agreed to limit use of LFA to designated areas subject to geographical and seasonal exclusions, excepting for times of war. Environmentalists lauded the agreement for striking a balance between national security and preservation of the environment.

Settling RIMPAC

In October, 2005 a coalition led by NRDC filed suit in federal court in Santa Monica, CA to force the Navy to develop a mitigation plan to protect marine animals from the harmful effects of sonar during military exercises.

In July 2006, the Navy and NRDC, et al reached an agreement to reduce the risks of mid-frequency sonar to whales and other marine life. Under the terms, the Navy will avoid using sonar in and within a 25-mile radius of the new Northwestern Hawaiian Islands Marine National Monument. The Navy also will use underwater microphones, aerial surveillance, and shipboard observers to detect marine life during future sonar drills associated with RIMPAC. Both sides expressed satisfaction with the settlement.

The Hanalei Bay stranding and similar incidents raise troubling questions. At a time when terrorism leads the daily news, how can a nation protect itself from potential enemies without harming the planet in the process? Do security interests supersede environmental concerns? What do you think?

Recent sonar-related whale strandings:

Canary Islands, July 2004: 14 whales beach during NATO exercises involving sonar

Hawaii, July 2004: 150 whales stranded off Kauai during RIMPAC exercises

U.S., January 2005: 39 whales die after U.S. Navy uses sonar in waters off North Carolina.

U.S., March 2005 : 80 dolphins beach as U.S. Navy sub trails sonar off Florida Keys; 30 die

Tasmania, October 2005: More than 110 pilot whales die; Australian Navy admits to using sonar

A WAVE OF FUN !!!

The Wave Channel for Water

Demonstrate and investigate the wave properties of water with 3B Scientific's new wave channel!

The unit has a Y-shaped channel made of plexiglass with two wave exciters which can be used both in-phase and out-of-phase. By adjusting the frequency you can generate waves with varying wavelengths. Waves can be either absorbed or reflected by inserting or removing the absorber at the end of the channel.

The Study of Wave Mechanics

- Reflection
- Dispersion
- Interference
- Frequency
- Wave length relations

DESCRIPTION	CAT. NO.	PRICE
Wave Channel	HS90356	1926.95
Power Supply 12V 0-2.5A	HS90363	304.95

3B Scientific® ...going one step further

You don't even have to leave the planet!

Variable Gravity Pendulum

Put some swing into your physics class....with the 3B Scientific® Variable Gravity Pendulum. This unique apparatus allows you to simulate the swing of a pendulum on the moon or any of the planets! Determine the period of oscillation as a function of rod length or vary the force of gravity by adjusting the plane of oscillation from 0. to 90 degrees from perpendicular.

- Easy to set up
- Virtually massless rod
- Variable plane of oscillation
- Fits most standard rods

Variable Gravity Pendulum	Cat. No. HS90352	\$388.95
Tripod Base	Cat. No. HS47810	\$12.75

American 3B Scientific® ...going one step further

continued from cover story.

It is the first commercial biorefinery that can accept a variety of wastes to convert into oil. The process is efficient enough that only 15% of the potential energy in the feedstock is used to power the plant. The remaining 85% is used for oil and fertilizer products. The oil produced is the grade that is used to power electrical utility generators. It can be sold directly to utilities, distilled further to convert it into vehicle-grade oil, or converted into hydrogen via a steam process.

Canine-friendly San Francisco, California is expanding their already exemplary bio-recycling programs to include one that turns dog waste into methane that can be used to heat homes and generate electricity. The technology isn't new, converting animal waste into energy was introduced 20 years ago in Europe and is used by dairy farms there and in the U.S. to harness the energy potential of livestock waste. San Francisco is believed to be the first U.S. city to explore turning pet waste into energy. And with a canine population of 120,000, this program promises to alleviate a huge waste problem. Up to 3.8% of the garbage collected residentially in San Francisco is in the form of animal feces.

Dog waste contains bacteria called methanogens, which feed themselves by breaking down carbon dioxide with the help of hydrogen. Methane gas, a biofuel, is produced as a byproduct of this digestion process and can be piped directly into any appliance powered by natural gas. Dog owners in San Francisco are excited about the program and are offering their support. The city's refuse company has plans to install special waste collection stations in the most popular dog parks in the city to support the program.

Although these new technologies are not going to provide the answer to all of our nation's energy concerns, the groundwork being laid by these pioneering companies is vital to the ongoing search for renewable energy sources that will reduce our dependence on foreign oil.

continued from page 13.

The balance of aquatic life in these areas has been changing rapidly. Jellyfish and other animals that can survive hypoxic areas are moving in, while brown shrimp have adapted to the environmental challenge by shrinking in overall size.

As with many environmental problems, there is no simple solution. While most scientists agree that acting quickly could possibly restore dead zones, the type of action required is uncertain. The Black Sea has made a dramatic recovery because of reduced fertilizer usage in the surrounding areas. Accomplishing the same type of reduction around the Mississippi River would require serious restrictions to both industrial farming and individual lawn care and would be difficult and expensive to effectively police.

Other possible solutions include protecting and increasing the number of wetlands further upriver. The large mass of still standing water in wetlands act as a kind of natural filter, allowing the nitrates to convert to gas and evaporate from the water, resulting in reduced nitrogen levels.

Controlling the drainage from unused crop fields would have similar effects. By blocking the drainpipes in the off-months, there would be less groundwater runoff between planting seasons.

Too much of a good thing?

Most current environmental debates focus on methods to increase the amount of oxygen in water because levels are low across the world. However, high levels of oxygen can also kill fish as it causes bubbles of air to form internally, although this is currently a rare phenomenon. As with most environmental studies, balance is the key. To that end, dissolved oxygen content can be considered an early warning indicator of an imbalanced ecosystem.

Set Learning in Motion!

The difference is clear – our best-selling Stirling and steam engines utilize plexiglass and heatproof quartz to enable your students to see all moveable parts. Incorporate one into your next discussion of heat and energy change and set your students' learning in motion!



The Stirling engine includes a motor-generator and can be operated as a thermal engine, heat pump, and/or a refrigerator.



On the steam engine, effortlessly remove the steam engine drive piston to study its inner workings.



- All parts are precision-machined and wear resistant
- Like all 3B products, they carry a three year warranty

DESCRIPTION	CAT. NO.	PRICE
Stirling Engine	HS90391	1219.95
Steam Engine	HS90389	1052.95



3B Scientific® ...going one step further



ALTERNATIVE FUELS COMPARISON

	Gasoline	No. 2 Diesel	Biodiesel (B20)	Compressed Natural Gas (CNG)	Ethanol (E85)	Liquefied Natural Gas (LNG)
Octane Number	86 to 94	8 to 15	~25	120+	100	120+
Main Fuel Source	Crude Oil	Crude Oil	Soy bean oil, waste cooking oil, animal fats, and rapeseed oil	Underground reserves	Corn, Grains, or agricultural waste	Underground reserves
Energy Content per Gallon	109,000 - 125,000 Btu	128,000 - 130,000 Btu	117,000 - 120,000 Btu (compared to diesel #2)	33,000 - 38,000 Btu @ 3000 psi; 38,000 - 44,000 @ 3600 psi	~ 80,000 Btu	~73,500 Btu
Energy Ratio Compared to Gasoline			1.1 to 1 or 90% (relative to diesel)	3.94 to 1 or 25% at 3000 psi; 3.0 to 1 @ 3600 psi	1.42 to 1 or 70%	1.55 to 1 or 66%
Environmental Impacts of Burning Fuel	Produces harmful emissions; however, gasoline and gasoline vehicles are rapidly improving and emissions are being reduced.	Produces harmful emissions; however, diesel and diesel vehicles are rapidly improving and emissions are being reduced especially with after-treatment devices.	Reduces particulate matter and global warming gas emissions compared to conventional diesel; however, NOx emissions may be increased.	CNG vehicles can demonstrate a reduction in ozone-forming emissions compared to some conventional fuels; however, HC emissions may be increased.	E-85 vehicles can demonstrate a 25% reduction in ozone-forming emissions compared to reformulated gasoline.	LNG vehicles can demonstrate a reduction in ozone-forming emissions compared to some conventional fuels; however, HC emissions may be increased.
Energy Security Impacts	Manufactured using imported oil, which is not a secure energy option.	Manufactured using imported oil, which is not a secure energy option.	Domestically produced and has a fossil energy ratio of 3.3 to 1, which means that its fossil energy inputs are similar to those of petroleum.	Domestically produced. The United States has vast natural gas reserves.	Domestically produced and it is renewable.	Domestically produced and it typically costs less than gasoline and diesel fuels.

Source: www.eere.energy.gov

Requires No Additional Chemicals



- Designed to demonstrate the practical use of a fuel cell with solar-produced hydrogen
- Reversible PEM fuel cell can be used as an electrolyzer or as a fuel cell

Demo kit demonstrates hydrogen fuel cell technology. The complete kit takes learning to the next level with supplies to meet a high school student's quantitative requirements.

Hydrogen Fuel Cell Model Cars

Description	Cat. No.	Price
Demo Kit	HS65853	194.95
Complete Kit	HS66135	261.95



There is a reason 90 year-olds do not crack under pressure.



PYREX® Glassware Confidence!

- ▶ Superior Quality
- ▶ Unmatched Consistency
- ▶ Dependable Service



CORNING

CHICAGO SCIENCE EXPEDITION: SHARING THE EXCITEMENT



Although it may appear in the record books, attracting the attention of the Guinness committee is not the motivation for creating the world's largest periodic table, due to be unveiled in Chicago on Sept. 22, 2006. Instead, the eight-story tall table, with elements filling most of the windows of the Daley Center, will be perhaps the most visible sign of Chicago's effort to brand itself as a "science city."

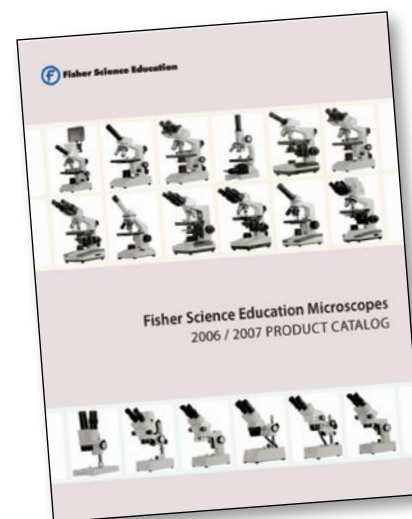
For two weeks this fall, the city will become a center for scientific discovery as parks, libraries, universities, and businesses present a wide assortment of exhibits, artistic events, and interactive activities, ranging from a Three Cosmic Tenors lecture to Starbucks Science Cafés.

The first-ever Chicago Science Expedition is being presented through collaboration between Chicago Public Schools (CPS), the City of Chicago, and

their commercial and cultural partners. Billed as "Two Weeks Worth of WOW!" the expedition will attempt to enhance the public's understanding of and appreciation for the economic and cultural contributions of technology and innovation.

To bring the fun into the classroom, teachers in over 100 schools will conduct activities in grades K-12 highlighting the achievements of prominent Chicago scientists, including paleontologist Paul Sereno, chemist Percy Julian, and physicist Enrico Fermi.

According to the CPS Office of Math and Science, community presentations have been designed to engage students of all ages in order to convey the importance of technology to everyday life, highlight the challenges and excitement of the world of science, and increase interest in science careers. Events will be held throughout the city from Sept. 22 through Oct. 8, 2006.



The New Fisher Science Education Microscope Catalog

HOT OFF THE PRESSES!

FEATURING THE FULL LINE OF MICROSCOPES OFFERED BY FISHER SCIENCE EDUCATION— COMPOUND AND STEREO MICROSCOPES FROM BASIC THROUGH UNIVERSITY GRADE.

- LARGE IMAGES SHOW SCOPE DETAILS
- COMPLETE SPECIFICATIONS LISTED FOR EACH MODEL
- ALSO LISTS REPLACEMENT PARTS AND RELATED PRODUCTS AND REFERENCES THE MICROSCOPES THEY PERTAIN TO

TO REQUEST A CATALOG, CONTACT YOUR SALES OR CUSTOMER SERVICE REPRESENTATIVE.
PHONE: 1-800-955-1177 FAX: 1-800-955-0740 WEB: WWW.FISHEREDU.COM

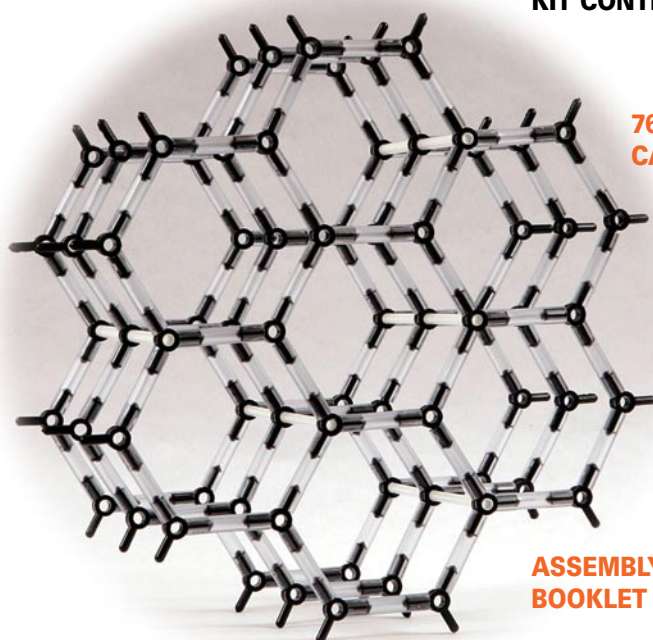
SNEAK PREVIEW
NEW FOR 2007!

GRAPHITE MODEL SET

Illustrates how graphite's layered structure accounts for its slippery property.

This durable model is great for comparisons with diamond structure to explain graphite's electrical conductivity.

KIT CONTENTS:



76 TRIGONAL PLANAR
CARBON ATOM CENTERS

92-1.25" PVC,
CLEAR BONDS

6 RIGID BONDS

ASSEMBLY INSTRUCTION
BOOKLET

GRAPHITE MODEL SET	HS94012	22.00
--------------------	---------	-------

For Low-Formalin or Formaldehyde-Free specimens, there are no safer names than Fisher Bio-Fresh® and Fisher-Free®

Amphibia, Anura, Frogs

Grassfrogs are the most popular specimen used for dissection because of their place in the phylogenetic structure, convenient size, and low cost.

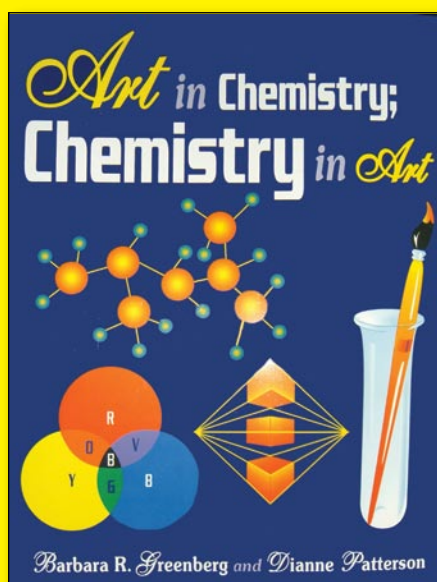
Choose from specimens:

- Fixed in formaldehyde, rinsed, and held in Fisher Bio-Fresh*
- 100% formaldehyde-free Fisher-Free* specimens, fixed and held in nontoxic solutions; excellent for classroom use



GRASS FROGS

Type	Cat. No.	List Price/Pack of 10
<i>Fisher Bio-Fresh 4.5-5.5"</i>		
Plain	HS1631S	43.70
Single	HS1617S	52.00
Triple	HS1615S	58.75
<i>Fisher-Free 4.5-5.5"</i>		
Plain	HS0930S	62.95
Double	HS0934S	69.85
Triple	HS0936S	75.45

SNEAK PREVIEW
NEW FOR 2007!

Art In Chemistry/Chemistry in Art

A complete curriculum in chemistry and art.

Written for middle school through community college level, this text is also suitable for Science Fairs and home schooling. With more than 60 hands-on activities and a number of fascinating demonstrations, it integrates chemistry and art, enabling students to see and understand how the science of chemistry is involved in the creation of art.

Topics include color, paint, supports and grounds, clay, sculpture and inorganic chemistry, jewelry, two and 3-D works of art, photography, art forgery, and chemical hazards. Includes alternative directions for some activities to accommodate multiple learning levels.

Grades 7-12

Art In Chemistry/Chemistry in Art

HS94043—51.50

SNEAK PREVIEW
NEW FOR 2007!

Travel across five continents for an up-close view of the astonishing variety and fascinating behavior of rainforest plants and trees, reptiles, birds, amphibians, insects and mammals.

Over the past 16 years, Thomas Marent, a self-taught photographer, has traveled all over the world photographing rainforests, from Peru and Ecuador to New Zealand and Papua New Guinea. In this, his first book, Thomas Marent brings the beauty and the drama of the world's rainforest to life with spectacular photography.

THOMAS MARENT

rainforest

- Includes 70-minute CD featuring the unique sounds of the rainforest
- Features personal anecdotes about how each photograph was taken
- Hardcover, 2006, 360 pages



Rainforest	HS94103	40.00
------------	---------	-------

VIDEO REVIEW



NOVA's *Cracking the Code of Life* DVD

An excellent documentary into the details and debates of human genetics.

Explaining complex definitions in terms that everyone can understand, this in-depth video investigates the Human Genome Project from its beginnings in 1990. This international consortium of labs took 13 years to sequence all 3 billion letters of our DNA. Threats of private and commercial labs finishing before them pushed their efforts forward and they finished their work two years ahead of schedule.

Join *Nightline* correspondent Robert Krulwich as he provides insight and lends some good-natured humor to this documentary. Visit families affected by genetic diseases that may one day be alleviated due to the work accomplished by the Human Genome Project. Video also explores legal matters, such as patents and privacy concerns.

Highly informative video promotes discussion of what breakthroughs might occur from understanding individual genetic codes. As technology continues to develop, we're forced to ponder what medical problems lie in our immediate future and what can be done to cure them.

HS94160 \$19.95

BOOK REVIEW



DNA Science:
A First Course

Second Edition
Cold Springs Harbor Laboratory Press,
hardcover, 2003, 575 pages

This highly successful textbook has sold over 50,000 copies and is now in its second edition. It combines narrative text on relevant historical information, a generous number of graphics, and easy-to-use practical laboratories.

The first eight chapters have been completely rewritten and revised to reflect the advances in molecular biology over the last several years. Updates include information and insights into the sequencing of the human genome and the impact that sequencing technologies are having on all the facets of our lives. Concepts and techniques of molecular biology have been revised to reflect the state of laboratory research today.

The laboratory experiments have been honed through years of actual classroom use, resulting in highly reliable methods and techniques of gene isolation and analysis that even inexperienced students and teachers can master.

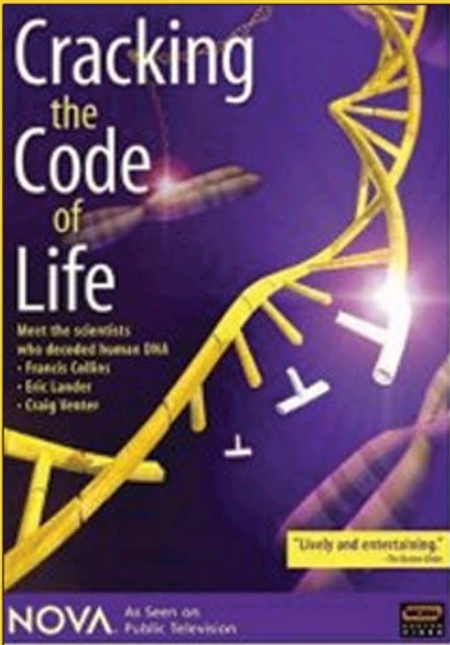
Preparation time is reduced through generous prelab notes for each experiment that detail necessary preparations and scheduling guidelines with flow charts and icons for easy navigation.

This popular textbook has undergone more than ten years of proven success in all levels of post-secondary education as well as advanced high school programs.

- Laboratories:**
Introduction—Lab Safety and Adherence to National Institutes of Health Guidelines
1. Measurements, Micropipetting, and Sterile Techniques
 2. Bacterial Culture Techniques
 3. DNA Restriction Analysis
 4. Effects of DNA Methylation on Restriction
 5. Rapid Colony Transformation of *E. coli* with Plasmid DNA
 6. Assay for an Antibiotic Resistance Enzyme
 7. Purification and Identification of Recombinant GFP
 8. Purification and Identification of Plasmid DNA
 9. Recombination of Antibiotic Resistance Genes
 10. Transformation of *E. coli* with Recombinant DNA
 11. Replica Plating to Identify Mixed *E. coli* Populations
 12. Purification and Identification of Recombinant DNA

HS90293 \$45.00

Go inside the amazing, complex world of the human genome



In 1990, an international consortium of labs created the Human Genome Project. The project's goal was to completely sequence human DNA by the year 2005. However, halfway through the project, a company called Celera announced they would finish the job in just two years.

Investigate the thrilling race to complete the Human Genome Project.

Debate the incredible impact that its discoveries will have on life in the 21st century.

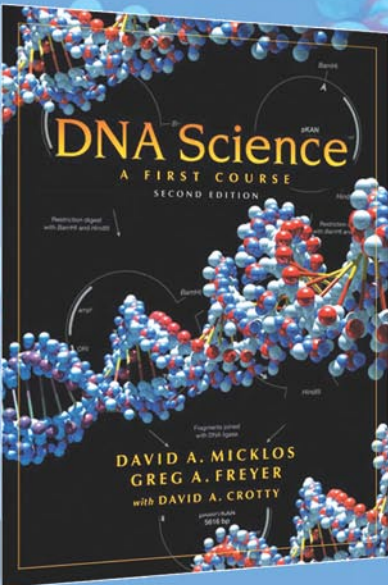
Running time: 120 min.

VHS	HS66246	20.35
DVD	HS94160	19.95

UP-TO-DATE CONCEPTS AND TECHNIQUES

Highly illustrated, narrative text is combined with easy-to-use, thoroughly reliable laboratory protocols. Honed by over 10 years of classroom use, this text can be successfully integrated into most biology courses.

- Collection of 12 rigorously tested and reliable lab experiments
- Covers basic techniques of gene isolation and analysis
- Flow charts and icons make protocols easy to follow
- Hardcover; Second edition, 2003; 575 pages



Description	Cat. No.	Price
DNA Science	HS90293	\$45.00

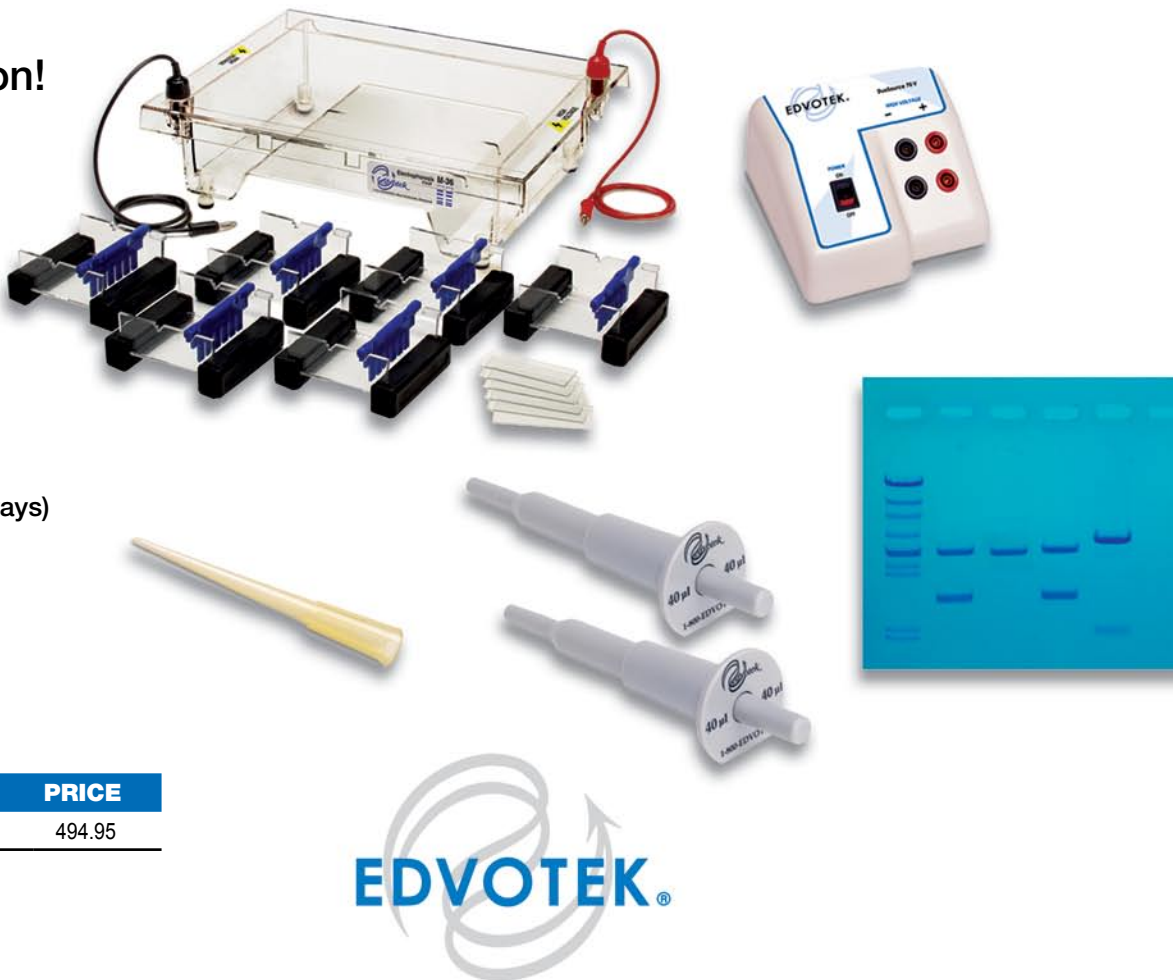
EDVOTEK® Classroom DNA Electrophoresis LabStation™

Finally, an affordable biotechnology solution!

The EDVOTEK® Classroom DNA Electrophoresis LabStation™ provides students with cutting-edge technology at a groundbreaking price. The LabStation™ consists of all the equipment and consumables for up to 24 students working in groups of four to perform DNA-based forensics. Each component of the LabStation™ has been carefully selected for the maximum in safety, quality, ease of use and value. The included electrophoresis unit features a lifetime warranty. See why science educators have come to depend on EDVOTEK® biotechnology education products for nearly two decades. All you have to do is just add water!

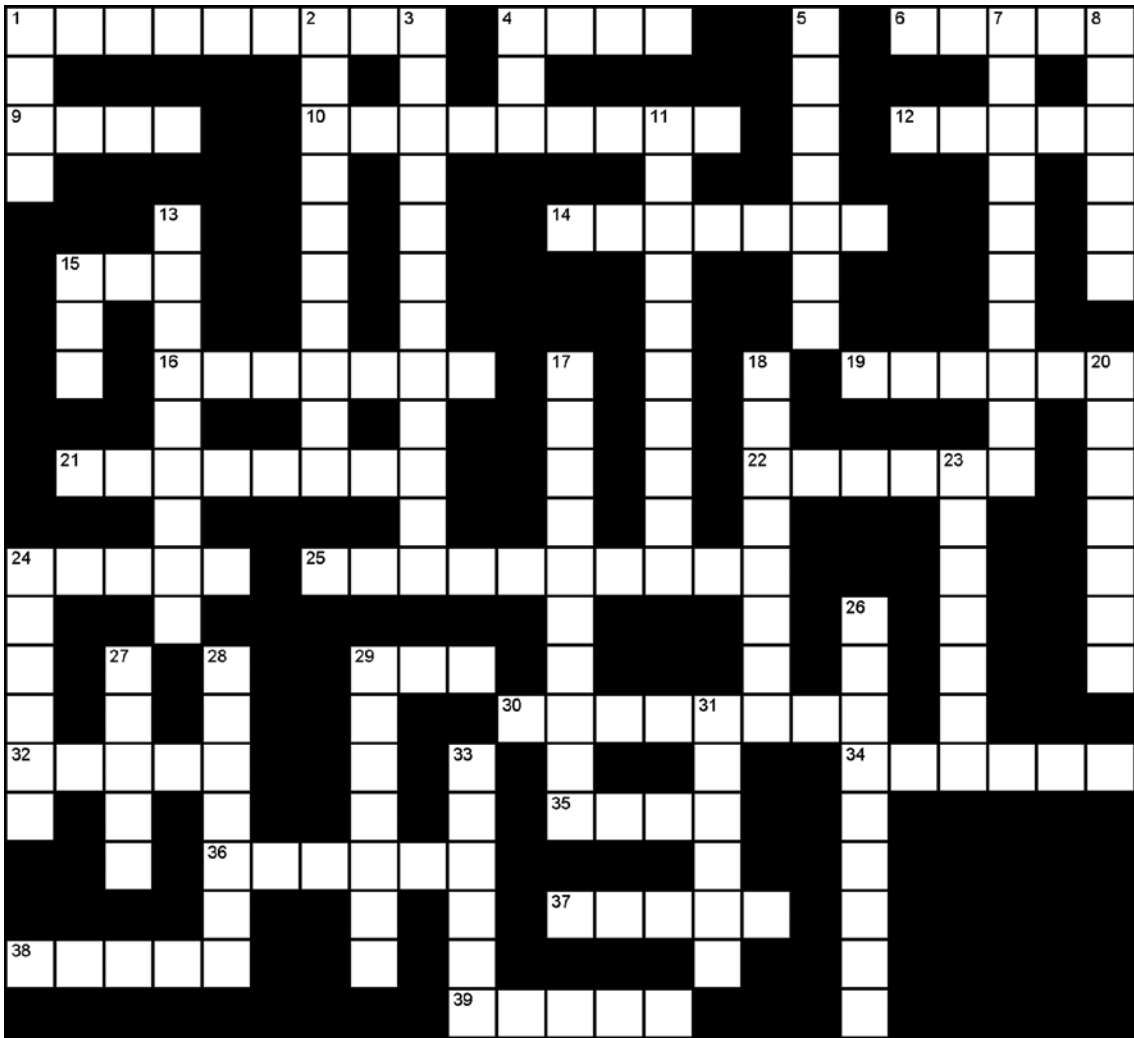
Contents:

- 1 M36 HexaGel Electrophoresis Apparatus (Six 7 x 7cm Gel Trays)
- 1 DuoSource™ Power Source (70V)
- 2 40µL Fixed Volume MiniPipets
- 2 Racks of Yellow MiniPipet Tips
- 1 Classroom DNA Fingerprinting Kit



DESCRIPTION	CAT. NO.	PRICE
Edvotek Classroom DNA Electrophoresis LabStation	HS68645	494.95

CROSSWORD PUZZLE



Answers can be found at www.fisheredu.com in the Literature section.

Across

1. Crime scene clues (p. 5)
4. Subcutaneous refers to something under this (p. 7)
6. Most creative and most overwhelming choice in science fairs (p. 12)
9. Branch of military service conducting sonar testing (p. 15)
10. Billionth of a meter (p. 4)
12. Long extensions of nerve cells (p. 7)
14. Dead zone water type (p. 13)
15. Post Mortem Interval, abbr. (p. 5)
16. 16th century painter, sculptor, and scientist (p. 2)
19. A complex neurobiological disorder typically diagnosed in early childhood (p. 6)
21. Categorized by atomic number in periodic table (p. 17)
22. Nerve cell (p. 7)
24. Interrupted breathing during sleep (p. 9)
25. Ethanol produced from cellulosic biomass (p. 1)
29. Deoxyribonucleic acid, abbr. (p. 19)
30. Science fair presentations mix science and this (p. 12)
32. Cooking meat like this avoids heterocyclic amines (HCAs) (p. 8)
34. Circulation in bodies of water adds this (p. 13)
35. Unspecialized cells (p. 7)
36. Site of first Wolly Mammoths (p. 14)
37. Linked to whale beachings around the world (p. 15)
38. Thrives on high nitrogen levels (p. 13)
39. Key ingredient to good barbecue (p. 8)

Down

1. Provides mitochondrial DNA to be analyzed with multiplex PCR (p. 14)
2. A new idea (p. 17)
3. U.S. city exploring using dog waste to produce methane (p. 1)
4. Scanning tunneling microscope (p. 4)
5. Preparation introduced into the body to prevent disease by stimulating antibodies (p. 6)
7. The process of imparting motion (p. 4)
8. Relating to the universe (p. 3)
11. A journey with a specific objective (p. 17)
13. A renewable energy source (p. 1)
15. Forms when meat is charred, abbr. (p. 8)