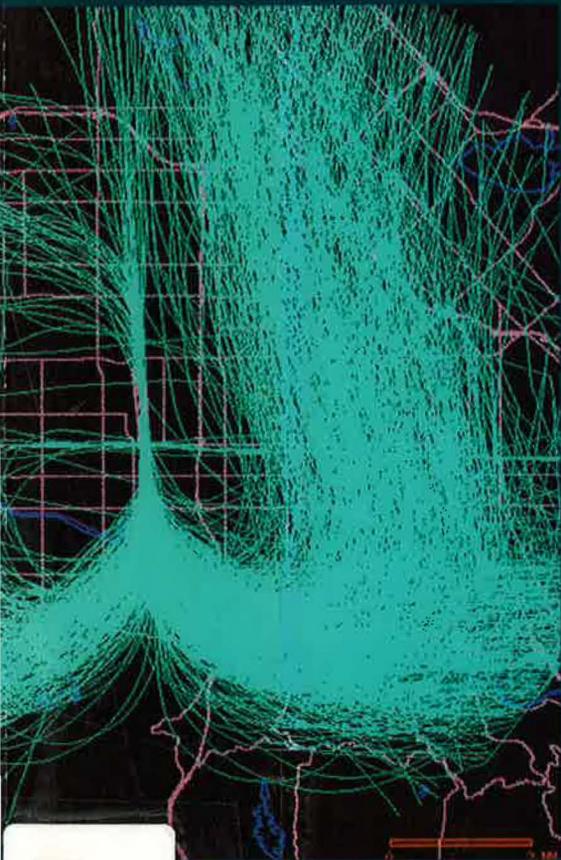




New Journal of **STUDENT RESEARCH ABSTRACTS**

2006



Van Nuys Airport • California State University, Northridge

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New Journal of **STUDENT RESEARCH ABSTRACTS**

Volume XI

2006

Published by Van Nuys Airport and California State University, Northridge

Editor

Steven B. Oppenheimer

California State University, Northridge

Sponsor

Van Nuys Airport



Van Nuys

Los Angeles World Airports

California State University
Northridge

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Credits

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Steven B. Oppenheimer, Ph.D. Director, Center for Cancer and Developmental Biology, and Trustees Outstanding Professor, the CSU System, California State University, Northridge.

Associate Editors

Helen Chun, Ph.D.

California State University, Dominguez Hills. Van Nuys Airport Public and Community Relations Staff, including Project Lead **Ashley Gomez**; and **Mindy F. Berman**.

Sponsor

Van Nuys Airport (VNY) – the world's busiest general aviation airport, owned and operated by Los Angeles World Airports – begins its sponsorship of the New Journal of Student Research Abstracts with this 2006 edition.

VNY Contributors

Selena Birk, Airport Manager; **Stacy Geere**, Public and Community Relations Director; Van Nuys Airport Tour Guides; **Jay Berkowitz**, Photographer; **Ashley Gomez**, Student Assistant; **Stephanie Webb**, Student Assistant. Journal design: **Alvalyn Lundgren/Alvalyn Creative**. Additional journal development support: **Mindy F. Berman Communications**.

California State University, Northridge Support

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Los Angeles Unified School District Collaboration

Dr. Todd Ullah, Director of Science; **Dan McDonnell**, Science Advisor; **Don Kawano**, Science Advisor.

Teacher Training Support

Maria Lopez Freeman, California Science Project; **Karen Humphrey** and **Linda Barton White**, Improving Teacher Quality Program; **Gery Simila, Gini Vandergon, Norm Herr** and **Steven Oppenheimer**, Training Leaders.

Recognition of Some of the Scientist Mentors

Larry Allen, Ph.D.; Lisa Banner, Ph.D.; Larry Baresi, Ph.D.; Edward Carroll, Ph.D.; Randy Cohen, Ph.D.; John Colicelli, Ph.D.; Mary Corcoran, Ph.D.; Cathy Coyle-Thompson, Ph.D.; Steve Dudgeon, Ph.D.; Robert Espinoza, Ph.D.; Richard Flagan, Ph.D.; Janet Kübler, Ph.D.; Jennifer Matos, Ph.D.; Aida Metzenberg, Ph.D.; Stan Metzenberg, Ph.D.; Steven Oppenheimer, Ph.D.; Polly Schiffman, Ph.D.; Ryoichi Seki, Ph.D.; Gerry Simila, Ph.D.; Mary Lee Sparling, Ph.D.; Mike Summers, Ph.D.; Paul Tomasek, Ph.D.; Virginia Vandergon, Ph.D.; Paul Wilson, Ph.D.; Maria Elena Zavala, Ph.D.; Peter Weigand, Ph.D.; George Dunne, Ph.D.; Kathie Marsaglia, Ph.D.; Vicki Pedone, Ph.D.; Greg Grether, Ph.D.; David Epel, Ph.D. (evaluation); Susie Hakansson, Ph.D. (evaluation); Norman Herr, Ph.D. (implementation).

New Journal of STUDENT RESEARCH ABSTRACTS Volume XI 2006

An Annual Journal for Young Investigators and Their Teachers

About the Editor

Steven B. Oppenheimer received the Ph.D. degree from Johns Hopkins University and is currently Professor of Biology and Director of the Center for Cancer and Developmental Biology at California State University, Northridge. He is author or co-author, mostly with his Cal State students, of about 200 publications, including 14 books and book editions; was awarded over \$16 million in research and science education grants serving as Principal Investigator; and served on National Institutes of Health and National Science Foundation grant review panels. He serves on the editorial board and is editor for the United States, Canada and South America of the international journal ACTA Histochemica, published by Elsevier. He is recipient of 26 distinguished teaching awards, distinguished research awards, outstanding professor awards and other honors from local, statewide and national organizations. In 1984, he was named statewide Trustees Outstanding Professor of the California State University system (the system's highest honor), and in 1992 he was elected Fellow of the American Association for the Advancement of Science (AAAS). The AAAS defines a Fellow as "a member whose efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished."

Editor's e-mail address: steven.oppenheimer@csu.edu.

About the Associate Editor

Helen H. Chun received her Ph.D. and was a postdoctoral researcher at the University of California, Los Angeles. She currently is an Assistant Professor in the Biology Department at California State University, Dominguez Hills. She is a researcher in the molecular biology of disease, specifically studying ataxia-telangiectasia and systemic lupus erythematosus.

About the Sponsor

Owned and operated by Los Angeles World Airports, **Van Nuys Airport (VNY)** ranks as the world's busiest general aviation airport, averaging nearly 500,000 takeoffs and landings annually. A facility dedicated to noncommercial air travel, VNY meets corporate, private and governmental aviation needs – in the process providing vital aviation services, enhancing efficiency at the region's commercial airports, creating jobs, promoting business, and serving as a valued San Fernando Valley community resource.

As part of its community involvement, VNY supports a wide array of education programs, and offers tours, presentations and other activities to help adults and youth alike learn about the exciting world of aviation in the San Fernando Valley and beyond.

Sponsor's website: www.lawa.org/vny.

About the Journal and Abstracts

The New Journal of Student Research Abstracts is published yearly on or about May 1 by Van Nuys Airport. Continued publication is always dependent on funding.

The journal is intended to serve as (1) a vehicle to honor young investigators and their teachers by showcasing their work, motivating them to continue their involvement in research science; (2) a sourcebook for both students and teachers who are looking for ideas for research projects, particularly in the areas of aviation and aerospace; and (3) a volume to disseminate student research discoveries.

Many abstracts included in the journal demonstrate good science, i.e. clear introductions describing hypothesis to be tested, methods, results and conclusion statements, and – most important – sufficient numbers of appropriate control and experimental samples and repetitions of experiments. Other abstracts do not display one or more of the principles of perfect science. The journal does not eliminate abstracts that do not demonstrate perfect science; the editor, however, reviews all abstracts and reserves the right not to publish those that are seriously flawed. The journal does not notify authors if their abstracts have been deleted.

Some of the abstracts are experimental plans instead of completed projects. This is especially true in the case of long-term, sophisticated research programs that require extensive set-up and planning. The journal encourages abstracts on the planning and progress of such projects.

Any opinions, findings and conclusions or recommendations are those of the individual authors of the abstracts presented in the journal, and do not necessarily reflect the views of Van Nuys Airport, California State University, Northridge, other contributing organizations and individuals, or the journal staff.

Submission of Abstracts

Any science teacher may submit student abstracts following the format used with the abstracts in this volume. After the title, followed by student author names and teacher name (teacher), school and school street address, city, state and zip code, abstracts should begin with the purpose of the study, followed by how it was done, and then the results and conclusions.

All abstracts must be typed in **11-point Arial font**, error-free. Messy abstracts and those not following proper format will be discarded. The journal is not responsible for any abstracts received or for publication errors. The journal does not acknowledge receipt of abstracts and never guarantees that they will be published or that the journal will be published in any given year.

Only teachers may submit their students' abstracts to the journal. Teachers should submit each abstract in **both hard copy and electronic format** – on either a floppy disc or CD-ROM. (**Note:** If it is absolutely not possible to submit an abstract electronically, teachers should just submit it in hard copy format.) Abstracts should be mailed along with a cover letter on school letterhead to Dr. Steven Oppenheimer, Editor, New Journal of Student Research Abstracts, Center for Cancer and Developmental Biology, California State University, Northridge, 18111 Nordhoff St., Northridge, CA 91330-8303.

The deadline for receipt of abstracts for each annual volume is Feb. 1, but an issue may be closed at an earlier date. Abstracts received by the end of the school year or those accepted after the volume fills will receive high priority for the next year's issue. Submitted abstracts are not returned to authors, so students and teachers are advised to keep a copy of all submitted materials. The only confirmation that abstracts will be published is if they appear in print.

Van Nuys Airport (VNY), the sponsor of the journal, will distribute a complimentary copy of the journal to teachers whose students' abstracts are published in that volume. VNY also will provide copies of the journal to others upon request, while supplies last. To request a copy, contact VNY Public and Community Relations at (818) 909-3529.

Each year, Van Nuys Airport will provide special recognition and awards to the best published aviation- or aerospace-related abstract (as selected by the journal editor) in three categories: elementary school (grades kindergarten through 5), middle school (grades 6 through 8) and high school (grades 9 through 12). We look forward to seeing students' outstanding research project submissions!

New Journal of **STUDENT RESEARCH ABSTRACTS**

Volume XI **2006**

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Los Angeles World Airports

Spring 2006

Dear Readers of *The New Journal of Student Research Abstracts*:

On behalf of Los Angeles World Airports (LAWA), it is my pleasure to welcome readers to the first issue of the New Journal of Student Research Abstracts sponsored by Van Nuys Airport (VNY) – one of four Southern California airports owned and operated by LAWA.

This venture highlights LAWA's continuing support for education of today's youth and development of tomorrow's leaders. Our efforts in this area include hosting free weeklong motivational programs for middle and high school students; matching airport employees with local students for mentoring; providing a school-to-career enrichment program; and making available paid internships for high school and college students.

Through these efforts, we hope to instill in students an interest in aviation in particular and science in general, helping to lay the foundation for a bright future for the students themselves and for all organizations, like LAWA, that will need an educated, dedicated workforce in decades to come.

Although we welcome all projects, we encourage students to submit aviation- and aerospace-related abstracts to future issues of this journal. Such projects, we believe, will provide students with insight into the fascinating world of aviation and help give wings to career dreams of helping all of us see the world in new ways.

Sincerely,

Lydia H. Kennard
Executive Director

1 North Hollywood Blvd., Suite 210, Van Nuys, California 91411 Telephone: 818-355-8529 Fax: 818-358-2963 Website: www.lawa.com



Van Nuys
Los Angeles World Airports

Spring 2006

Dear Readers of *The New Journal of Student Research Abstracts*:

Building on its long-standing commitment to supporting the science education of future leaders, Van Nuys Airport (VNY) proudly begins its sponsorship of the New Journal of Student Research Abstracts, coordinated by California State University, Northridge.

In meeting corporate, private and government aviation needs, VNY – the world's busiest general aviation airport – provides vital aviation services, as well as important contributions to the San Fernando Valley and greater Los Angeles region. In fact, according to an economic study, VNY contributes more than \$1 billion annually to the Southern California economy and supports over 10,000 jobs, while generating an annual earnings impact of \$273 million.

VNY also works closely with the local community to help prepare the students of today for the jobs of tomorrow, particularly in aviation-related fields. The airport's educational activities include working with its local adopted elementary school, hosting a weeklong motivational academy for high school students, helping provide aviation career scholarships, offering tours and presentations to school groups, and much more.

With its sponsorship of the New Journal of Student Research Abstracts, VNY aims to further encourage area youth to explore the exciting world of aviation, and to enable the ideas and aspirations of the next generation to take flight.

Sincerely,

Selena Birk
Van Nuys Airport Manager

15421 Sherman Way, Suite 210, Van Nuys, California 91411 Telephone: 818-355-8529 Fax: 818-358-2963 Website: www.lawa.com

California State University
Northridge

Office of the Dean

November 11, 2005

Dear Readers:

I was very excited to learn about the new partnership between Van Nuys Airport and the New Journal of Student Research Abstracts. Such sponsorship is critical to the journal's success and future expansion. As a scientist and Dean of the College of Science and Mathematics, I have a special interest in the success of the journal. It is a terrific way for our youth to engage in the scientific method. Publication is at the heart of the scientific method and has been key to the astonishing success of science in our society. The importance of publication cannot be over emphasized. The foresight of Van Nuys Airport to support this effort is remarkable and has my highest praise and thanks.

Publishing student abstracts has several major outcomes. I am certain that, as students see their results in print, more and more of them will elect to pursue careers in science, something which this country desperately needs if it is to stay competitive in the rapidly changing global economy. Also, the sharing of ideas which this journal provides, leads to a positive feedback cycle in which there are even better and more creative experiments done by future students. That is the way science works. And so, we can expect to see the quality of the learning experience as demonstrated in the abstracts continually grow. Finally, I am certain that when students who have never before taken an interest in science read the many fascinating studies reported in the journal, they will be drawn into conducting their own experiments. Hence, I see the journal as a powerful recruiting tool.

I look forward to reading many more abstracts from students in future editions of the journal. I feel confident that, with the recently announced support of the Van Nuys Airport, the journal has a long and bright future ahead of it.

Sincerely,



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Instructional Support Services Division

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Roy Romer
Superintendent of Schools

Robert Collins
Chief Instructional Officer

Dr. Lita Scragg
Assistant Superintendent

Dr. Todd Ullah
Director of Secondary Science

Letter of Support

January 23, 2006

Dear Journal Readers,

On behalf of Science Education in the Los Angeles Unified School District, I encourage all teachers to implement student research projects in your classes. The national security depends on producing innovative research scientists and student research at the K-12 level can interest youngsters in careers in research science. This journal showcases the beginning research efforts of students in public and private schools in the greater Los Angeles area. It is expected that this journal will be expanded to a national and international audience.

I would like to also announce a major advance in this direction by LAUSD. This year we will begin a new science fair program that, like this journal, showcases the work of the youngsters in our classes.

These are great times for Science at LAUSD! Congratulations to our outstanding teachers and students. "Science Matters!"...

Sincerely,



Athaur R. Ullah, Ed.D.
Director, Secondary Science Education
LAUSD

To find out more about VNY's community and education programs, visit www.lawa.org/vny or call (818) 909-3529. We hope to see you soon!

See Aviation in Action at Van Nuys Airport

With its average of nearly 500,000 takeoffs and landings annually, Van Nuys Airport (VNY) ranks as the world's busiest general aviation airport, meaning it handles all flights other than those for scheduled air carrier service or the military.

VNY also provides many opportunities for students, their teachers and families to learn more about the exciting world of aviation. Here's a look at what we have to offer. Let us know how we can assist you!

Public and Community Activities

Aviation Events: See unique aircraft and meet the pilots who fly them at VNY's free aviation events for the community. VNY's current annual event, called AirFest, showcases aviation's living history through rare historic and one-of-a-kind aircraft displays. By bringing a virtual traveling air museum to the airport, and also presenting exhibits, concessions, live entertainment and airfield bus tours, VNY makes AirFest an entertaining and educational event for the whole family.



Tours: Let your imagination soar with a close-up look at a wide variety of aircraft and a glimpse into the many activities of aviation companies and operations at VNY. For the youngest visitors (first grade and up), the award-winning tour program includes a visit with "Vinny," Southern California's first kid-friendly, hands-on educational airplane. Tours, offered free to school, civic and community groups, take place on weekdays and select Saturdays, with a minimum of 15 attendees per group. Reservations are required.

Public Observation Area: Watch aircraft take off and land from this area next to the airfield's east side while you listen to a live broadcast of air traffic controllers in the control tower. The observation area,

located off of Woodley Avenue at the end of Waterman Drive, also features historical and informational exhibits, picnic benches and a children's activity area. It is open daily from sunrise to sunset.

Presentations: Let VNY come to you through our Speakers Bureau, which offers presentations to schools and community organizations about the airport's rich history, aviation careers and many other topics. VNY also offers slide presentations to school groups and participates in student career fairs throughout the San Fernando Valley.

Educational Programs

ACE (Aviation Career Education) Academy: This free motivational program, offered for a week each summer, provides local high school students with a basic understanding of the aviation industry, plus general knowledge of VNY and Los Angeles International Airport. Participants are selected based on merit.

After-School Reading Program: VNY Public and Community Relations employees tutor local elementary students in reading, with an emphasis on aviation history. Teachers and counselors closely monitor the students' progress.

VNY Young Achievers: Through this program, VNY recognizes and rewards exceptional area middle school students who excel in academics, athletics, the arts or community service. The program culminates with an awards luncheon at the end of the school year. Parents, teachers and principals are invited to celebrate their students' success.

Los Angeles Unified School District Aircraft Mechanics School: Housed at VNY, this branch of the North Valley Occupational Center enables students to earn certification in general airframe and power plant mechanics. The program curriculum, approved and certified by the Federal Aviation Administration, consists of 45 subject areas to prepare students for a wide array of jobs in the aviation-aerospace industry.

To find out more about VNY's community and education programs, visit www.lawa.org/vny or call (818) 909-3529. We hope to see you soon! ♦

Discover the History of Van Nuys Airport: Where Progress Takes Flight

More than 100 years ago, on Dec. 17, 1903, Orville and Wilbur Wright made history when their Wright Flyer became the first aircraft to achieve sustained, powered flight.

This feat launched the modern era of aviation, which took off in Southern California just a quarter-century later with the establishment of the forerunners of both Los Angeles International Airport (LAX) and Van Nuys Airport (VNY). The growth of both airports in years to come helped make the Southern California region a major part of the aviation and aerospace industries in the 20th century.

LAX opened as Mines Field on Oct. 1, 1928, with the signing of a lease of 640 acres to use as an airport for the City of Los Angeles. Soon after – on Dec. 17, 1928, the 25th anniversary of the Wright Brothers' first flight – VNY was born as Metropolitan Airport through the establishment of a corporation by a small group of citizens.

VNY: The 1920s and 1930s

Located about 20 miles north of today's LAX, amid 80 acres of trees and farmland, Metropolitan Airport – with its initial biplane hangar fees of \$35 per month and landing fees of 50 cents – was a place where pioneering pilots who had faith in the future of aviation could fly their “new-fangled flying machines.”

In its early years, VNY served as the base for many record-breaking flights, including:

- A men's solo endurance record of 37 hours, by Herbert Fahy, in 1929.
- A women's endurance record of 42 hours, by Elinor Smith and Bobbi Trout, in 1929.
- A women's speed record of 196 mph, by Florence “Pancho” Barnes, in 1930.

Hollywood stars discovered the airport too, with Gene Autry, Cecil B. DeMille and Howard Hughes among the celebrities who flew there.

Although the Great Depression put an end to the corporation that established the airport, Hollywood film production, which like the stars themselves had found a home at the airport, helped save it. Filmmakers used the site for scenes from famous movies such as *Hell's Angels*, *Lost Horizon*, *Men With Wings* and *Storm Over the Andes*. To this day, producers of movies, TV shows, videos and commercials frequently turn to VNY to help

meet their filming needs. Just a few of the modern-day movies with scenes shot at VNY include *True Lies*, *Lethal Weapon*, *American Beauty* and *Pearl Harbor*.

VNY: The 1940s

With the outbreak of World War II in 1942, the U.S. government purchased Metropolitan Airport and converted it into a military base to help protect the West Coast. The military also purchased an additional 163 acres of land for the construction of the Van Nuys Army Airfield, using new runways to train hundreds of P-38 Lightning pilots.

The airport became a vital defense-manufacturing center during the war. In 1944, a joint venture between the U.S. Navy and Lockheed Corporation created an aircraft modification facility known as the Navy Lockheed Plant. And one day, the entertainment industry that had become so important to Metropolitan Airport discovered a young woman there on an aircraft assembly line. Her name? Marilyn Monroe.

In 1949, the City of Los Angeles purchased the airport from the U.S. War Assets Administration for the token fee of \$1, with the agreement that the California Air National Guard base continue to operate at the site. The name of the airport, which by then covered 400 acres, changed to San Fernando Valley Airport.

VNY: The 1950s and 1960s

In the 1950s, the Air National Guard entered the jet age by replacing its propeller fleet with F-86 jets, and also built newer, more permanent facilities at the airport. This base served as the launch point for several USO tours led by the legendary Bob Hope for American troops abroad.

During the decade, the airport also saw a great deal of growth in general aviation, and experienced its final name change (to Van Nuys Airport) in 1957. That same year, completion of the Sherman Way underpass enabled extension of the main runway from 6,000 to 8,000 feet.

In the 1960s, airport operations continued to increase, with aerospace companies and their space-age projects beginning to locate at the airport. VNY acquired new land to meet aviation and aerospace needs, and completed the 27-hole Woodley Golf Course on the clear zone at the south end of the airport in 1968. Also in 1968, VNY constructed the control tower it still uses today.

VNY: The 1970s and 1980s

By 1971, VNY had become the busiest general aviation airport in the nation. In 1975, the FlyAway Bus Terminal opened, providing nonstop bus service between the San Fernando Valley and LAX, and helping alleviate freeway and LAX parking congestion.

Several activities in the 1980s showcased VNY's commitment to working closely with the community. These included the implementation of a Noise Abatement and Curfew Ordinance governing aircraft operations, and the formation of the VNY Citizens Advisory Council to assist and promote closer, more direct interaction with community representatives on a variety of airport-related issues.

Also on the community front, in the mid-1980s VNY first participated in the Los Angeles Unified School District's Adopt-A-School Program, and began sponsoring its annual Santa Fly-In, which brings Santa Claus to elementary school students by helicopter. In 1988, the airport opened an observation site to allow the public to view airport operations firsthand.



VNY: The 1990s

The 1990s brought many more changes and developments to VNY, which continued to serve a vital role in Los Angeles. In 1990, the 146th Airlift Wing of the California Air National Guard relocated from VNY to the Channel Islands. In 1994, the area formerly occupied by the Guard served as a critical operating site for the American Red Cross as it prepared thousands of meals to aid victims of the devastating Northridge earthquake.

Business activity at the airport continued to grow and by 1999, an economic impact study indicated that the airport contributed about \$1.2 billion annually to the Southern California economy and supported more than 10,000 jobs.

VNY: 2000 and Beyond

Los Angeles World Airports, which owns and operates LAX, VNY and two other regional airports, took a major step forward to further address noise concerns related to VNY when it initiated a \$15-million residential sound-proofing program in 2000. The new millennium also saw the groundbreaking for the FlyAway Bus Terminal improvement project, and the start of a \$30-million bond project by the Los Angeles Fire Department to better serve and protect local communities by constructing permanent air operations and helicopter maintenance facilities on the former Air National Guard site at VNY.

Today, VNY sits on 730 acres, with more than 800 aircraft and 100-plus businesses based at the airport. Some of the business services provided include aircraft maintenance, fueling, aircraft parking/tiedown, charter service, flight and ground school instruction, aircraft manufacturing and avionics installation. VNY also provides facilities for fire, police, air ambulance, search and rescue, and news media aircraft that serve the region.

In the years to come – through its ongoing leadership in general aviation, business and community service – VNY will continue to play a crucial role in the Southern California economy, the regional approach to meeting passenger demand, and the entire nation's air transportation system. To learn more, visit www.lawa.org/vny. ♦

Let Your Imagination Soar: Careers in Aviation

When you think of careers in aviation, what comes to mind? Maybe a pilot? Or a flight attendant? While many people do work in these areas, aviation offers a lot of other exciting, fascinating career opportunities for all types of interests and backgrounds. So whether you'd like to work on an aircraft, in a workshop, in an office or on an airfield, you can find a great job in the innovative world of aviation.

Here's a look at some of the people who work at Van Nuys Airport (VNY) or for companies based at VNY. Check out if any of these careers interest you!

Norman Anderson, Director of Operations Skybird Aviation

Norman Anderson started Skybird Aviation, a private aviation company, about 30 years ago. Besides running the business and hiring employees, he's a captain of the impressive Gulfstream IV corporate jet, and gets to fly people all over the world.

Anderson loves that his career allows him to travel so much, see so many new places and meet people from around the globe. "It's very rewarding, exciting and adventurous," he says, though he adds that it's not a "9-to-5" job – he's away from home about 10 nights a month.

After becoming an aircraft mechanic and then an aircraft crew chief in the U.S. Navy, Anderson flew light aircraft as a flight instructor and pilot before entering the corporate aviation business. He says there are many schools that can prepare you for an aviation career. In fact, his son graduated from the North Valley Occupational Center Aircraft Mechanics School (operated by the Los Angeles Unified School District and located at VNY), became an aircraft mechanic, and then a pilot, and now works in corporate aviation.



Selena Birk, Manager Van Nuys Airport

Selena Birk manages VNY, the world's busiest general aviation airport. This means she coordinates all activities related to running the airport; implements policies, rules and regulations; and serves as a point of contact with local residential and business communities, as well as government officials.

After managing VNY for six years, she loves "the diverse experiences everyday, and working around people interested in aircraft, aviation and aerospace."

As a child, Birk used to watch planes take off at El Monte Airport. Her dad worked for an airline and her step-brother flew cargo aircraft. Her brother-in-law still flies as a commercial airline pilot and serves as a colonel in the U.S. Air Force. So, she says, she has "aviation in her blood, as well as a long-time interest."



If you're interested in the management side of aviation, she adds, "Go to college. Expose yourself to different aspects of aviation, become a pilot, work for an airline or Fixed Based Operator, learn about project management, property management, contracting, airport maintenance, law and public speaking."



Wayne Britton, Superintendent of Operations
Van Nuys Airport

A superintendent of operations at VNY, Wayne Britton ensures the safe and efficient operation of the airfield, which includes inspecting facilities and developing response procedures in case of aircraft emergencies. Before he joined the airport six years ago, he worked for more than 20 years for Pacific Southwest Airlines (PSA) and US Airways.

Britton, whose father served in the military and often took him to see planes take off and land as a child, says he loves the "fluid, fast-paced environment" of aviation, and calls it "an exciting career field."

Studying hard is important if you want to work in this industry, he says. "Aviation professionals are not born, they're educated," he explains. "Aviation is increasingly complex within a high-technology environment. Being an aviation professional requires more than just knowing how to fly."



John Ferguson, Pilot
Northrop Grumman

John Ferguson works as an international captain and Gulfstream specialist for Northrop Grumman, a global defense company headquartered in Los Angeles. He's been flying professionally for 17 years.

The best part about his career, he says, is "the flying, travel and responsibility." The biggest challenge is "having a life that integrates well with my career," because being a pilot can be trying for most families. But, he gives credit to his great wife for supporting what he does.

Ferguson got interested in aviation as a child, when his dad worked as an engineer for Lockheed Aircraft. He says that by the time he was 6 years old, he was completely fascinated with World War II aircraft. He never lost that fascination.

To get into aviation, Ferguson advises, "Stay focused in school and get good grades." He says to definitely finish high school, and recommends going to college.



Dale Gant, Pilot
Los Angeles Fire Department

Dale Gant flies helicopters for the Los Angeles Fire Department, where he's worked for 31 years. He makes water drops over brush fires, hoists stranded people from mountain areas and rivers, does air ambulance transports and trains new pilots.

"Every flight brings a different set of circumstances," he says. "What I do makes a difference in people's lives. I save lives and property."

Gant got interested in flying at a young age because both his dad and a family neighbor were pilots. He began working in aviation at age 15, washing and fueling planes. If you want to pursue a career like his, Gant says, start as soon as possible and get an education, because any college degree will help you in obtaining good jobs.

Jan Goforth, Tour Guide
Van Nuys Airport

In her job as a tour guide at VNY, Jan Goforth not only provides tours to the public, she also schedules and arranges speakers for groups, and handles any type of outreach to help educate the community about aviation and the airport.

"I get paid for doing something I absolutely love," says Goforth, who's also a private pilot. And she gets to relive memories from her childhood, when her mom brought her to VNY to watch planes arrive and depart. "I enjoy the opportunity to share my knowledge and enthusiasm with the public," she explains. "The airport provides various jobs and professions, but there is a special feeling of freedom when you watch an aircraft take off."

If you're interested in aviation, Goforth advises, "Involve yourself in your local airport. My particular job might not be available, but if you put yourself in the related surroundings, it might open the door – or hangar! – to what might interest you at the present time and give you new opportunities in the future."



George Jarvis, Police Officer
Los Angeles Airport Police

As a police officer for Los Angeles World Airports, George Jarvis patrols VNY to protect and secure the airport and aircraft from criminal threats. In addition to responding to security threats and helping catch criminals, he assists airport tenants with disputes, helps citizens with medical emergencies and educates visitors on federal and state laws.

"I have always been fond of aircraft," he says. "This job allows me to learn about aircraft's special abilities, and still interact with the international public." In fact, he points out that being willing and patient in assisting people is a very important asset in his job.

Jarvis worked as a police officer for 22 years at Los Angeles International Airport (LAX), and transferred to VNY a year ago. During his career with Los Angeles World Airports, which operates the largest dedicated airport police force in the nation, he's had the opportunity to work in many different assignments, including bike patrol, undercover crime control, training and more.

"Aviation security is unique to law enforcement and requires specialized training," Jarvis adds. "Students interested in a career of law enforcement in aviation should remain in school and obtain at least two years of college. To compete in promotional areas such as sergeant, lieutenant, captain and chief of police, degrees in business and public administration are desirable."





Glenn Smith, Lead Pilot
Los Angeles Fire Department

Like Dale Gant, Glenn Smith flies helicopters for the Los Angeles Fire Department, working as a lead pilot who supervises one of three shifts of pilots. For example, during brush fires, he flies the command helicopter and directs where water drops get made. He also oversees rescue operations involving the use of helicopters.

Smith, who has worked at the Fire Department for 27 years, has always liked aviation. He says, "I love the feeling of freedom that aviation gives you – the ability to fly above buildings and mountains, and see everything from a 'bird's eye' point of view."

Students who like the idea of learning how to fly, Smith says, should "concentrate on getting the most out of the schooling they are involved in now. Aviation requires a lot of studying, of laws and aerodynamic theories, and the study habits they develop now will aid them later in pursuing a career in aviation."



Robert "Duke" Tonry,
Executive Assistant/Director of Aeromedical Operations
Clay Lacy Aviation

Working as assistant to the president of private jet company Clay Lacy Aviation, Robert "Duke" Tonry handles all sorts of responsibilities, including the firm's community participation, marketing and publicity. Plus, he directs Clay Lacy's aeromedical activities, meaning emergency medical airlifts, patient transports and organ deliveries to hospitals.

Tonry learned the importance of aeromedical flights during his service in the U.S. Air Force, where he worked as a pilot and as a control officer for an Air Force Aeromedical Evacuation Team. During the Vietnam War, he helped transport injured soldiers back to the United States. He also served at the California Air National Guard base that used to operate out of Van Nuys Airport.

With aviation's role as "the tip of the sword in human civilization," Tonry says, students should consider the important role this industry plays in our lives. "All human effort is now influenced by aviation and its technology," he explains. "In 1800 the fastest a man could travel in 24 hours was about 25 miles. By 1900 the railroads allowed a man to travel 300 miles in 24 hours. By 2000 a man could travel 600 miles in one hour. Can you imagine how fast or far by 2100?"

Mike Wittman, CEO and Chief Meteorologist
Pacific Coast Forecasting

The CEO and chief meteorologist for Pacific Coast Forecasting, Mike Wittman runs the business and provides aviation companies with around-the-clock weather forecasts to help them plan flights, avoid severe weather and take advantage of tail winds to shorten flight times and save money on fuel.

“Real weather forecasting for real operations is much more interesting than meteorology for research,” says Wittman. “It’s exciting. Every day is different. Every storm is different.”

After joining the U.S. Navy, Wittman got offered a job there in weather aviation, and later earned a bachelor’s degree in geography. He says, “It’s impossible to quit now.” Today, his company also provides other aviation services, including making ground handling arrangements, obtaining permits for aircraft to land at and fly over certain areas, and handling customs notifications.

Wittman suggests that those interested in aviation meteorology either get a bachelor’s degree or learn about the subject in the military. He says a lot of newer employees have atmospheric science degrees, and then learn specifically about aviation on the job.



More Aviation Careers

There are plenty of other interesting jobs in aviation. Many of these jobs require (in addition to a high school diploma) a bachelor’s degree in a specialized field, with a master’s or doctoral degree preferred for others. Entry into many technical occupations involves two years of technical training after high school. Having computer skills can enhance most employment opportunities.

Here are some of the many additional opportunities (in alphabetical order) that aviation provides:

- **Aircraft interior designers and crafters:** Create comfortable, attractive aircraft interiors (designers) and design and manufacture cabinetry for aircraft (crafters).
- **Air traffic controllers:** Manage the safe and orderly flow of air traffic in the air and on the ground, and also give pilots taxiing and takeoff instructions.
- **Architects and civil engineers:** Design and supervise the construction of airports, including layout, buildings and upgrades/improvements.
- **Aviation mechanics:** Keep all types of aircraft safe by performing service, repair and overhaul of various aircraft components.
- **Baggage handlers:** Sort, load and unload thousands of pieces of luggage, mail and cargo.

- **Doctors, flight nurses and respiratory therapists:** Work with specially designed medical packs and mobile life-saving equipment that stabilizes patients being transported in the pressurized environment of an aircraft.
- **Electricians:** Install electrical wiring within an aircraft fuselage (the main body section that holds the crew and passengers or cargo). Also maintain runway approach lighting systems and emergency generators used to ensure an uninterrupted flow of electricity.
- **Electronics and environmental technicians:** Install, monitor, repair and maintain sophisticated air traffic control equipment, including radar communications, navigational aids and environmental systems.
- **Gardeners/landscapers:** Maintain airport landscaping and ornamental vegetation inside terminals.
- **Mapmakers (cartographers):** Draw and update aeronautical maps used to identify airport facilities, define airspace for airports and chart the aviation highways in the skies.
- **Nutritionists, caterers, cooks and chefs:** Design menus and prepare food, keeping in mind nutrition, portability and ease of serving both on flights and in airport terminal restaurants.
- **Painters:** Prepare runway/taxiway lines and airport identification signage.
- **Ticket/reservation agents:** Provide information about flight schedules and fares, plus make passenger reservations.

Besides all of these options, you also can consider military aviation, or a career in aerospace, which represents the future of aviation with new designs for air and space travel. The possibilities are endless!

To find out even more about aviation careers, here are some websites to check out:

- <http://wings.avkids.com/Careers>
- <http://www.avscholars.com>
- http://www.faa.gov/education_research/education

For more information about Van Nuys Airport, visit www.lawa.org/vny. To learn more about all of the airports owned and operated by Los Angeles World Airports, log onto www.lawa.org. Plus, check out the cool kids' website by going to www.lawa.org/LAWA.cfm and clicking on "Kid Website" on the left-hand side. ♦

Aviation Research Project Ideas

Here are a few ideas for future aviation and aerospace research projects, from www.juliantrubin.com/fairprojects/engineering/aviation.html:

Grades 4-6

- Determine how an airplane propeller's angle of pitch affects thrust.
- Find out which material is best for hot air balloons: nylon or polyester?
- Explore the effect of different designs of plane fuselage, nose, tail and wings on aerodynamic drag.
- Determine how gear combinations affect the revolutions of a helicopter's rotor blade.
- Find out the effect of differences in a rocket's motor on the rocket's performance.

Grades 7-9

- Determine the best nozzle angle for an airplane.
- Test the importance of angle of attack to flight.
- Determine how different wings and their surfaces affect their efficiency.
- Figure out which aerodynamic fuselage and wing design create the least amount of drag.
- Determine the effect of the thrust of a rocket on the height a rocket can go.

Grades 10-12

- Analyze the effects of varying aspect ratios on a toy glider's flight.
- Determine at what angle the lift of a wing is maximized.
- Research whether simplified methods of calculating the center of pressure are reliable indicators.
- Find out at which launch angle a rocket would be propelled the farthest.
- Develop a mathematical model to predict a rocket's trajectory.

Check out more project ideas and fun facts in the following websites:

- Aeronautics Learning Laboratory for Science, Technology and Research: www.allstar.fiu.edu
- Aviation for Kids Program on Business Aviation for Elementary School Students: www.avkids.com
- Federal Aviation Administration, Aviation and Space Education Outreach Program Kid's Corner: www.faa.gov/education/kidcornr.cfm
- NASA-Sponsored Educational Web Resources for High School Students: http://ohcm.gsfc.nasa.gov/job_student/NASA_Resources_High.htm#Activities
- Young Eagles Program of the Experimental Aircraft Association: www.youngeagles.org

For more information about Van Nuys Airport, visit www.lawa.org/vny.

How Do AIRPLANES FLY?



AIRPLANE FORCES

WEIGHT

Weight is the force created by gravity acting upon the mass of the airplane.

LIFT

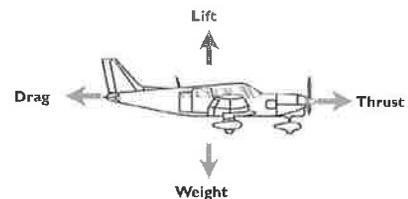
Lift is the partial vacuum created above the surface of an airplane's wing, causing the wing to be lifted upward. As the wing (airfoil) moves through the air, the curved shape of the upper surface is designed so the air flowing over the top of the wing travels faster than the air flowing beneath the surface of the wing. This higher velocity creates a lower pressure. Thus, lift is created when there is lower pressure on top and higher pressure on the bottom. When the lift is greater than the weight, the airplane is flying. The lighter the airplane, the less lift is required for flight.

THRUST

Thrust is the force produced by the airplane's engine. A jet engine produces thrust that pushes the airplane through the air. A front-mounted, engine-driven propeller actually pulls the airplane through the air. A rear-mounted, engine-driven propeller pushes the airplane through the air.

DRAG

Drag is the force that slows the forward movement of an airplane through the air. Drag counteracts thrust. If you put your hand out of the car window, there is more drag produced when your hand is vertical to the wind stream (palm forward) compared to when it is streamlined (palm down). This is drag. When thrust exceeds drag, the airplane will accelerate. The faster the airplane goes, the faster the air is moving over the wing, which creates more and more low pressure and results in more and more lift being created.



MAJOR AIRPLANE COMPONENTS

FUSELAGE

The body of the airplane to which all the other components are attached is called the fuselage.

COCKPIT

A cockpit is where the pilot sits and operates, or "flies," the airplane. It is the space in the fuselage containing the airplane controls and instruments.

WINGS

Wings are specifically designed airfoils that create lift, which is essential to flight.

AILERONS

Ailerons provide roll control and are the outermost movable sections of the airplane's wings.

They are controlled by the yoke and move in opposite directions to control the angle of bank of the airplane.

FLAPS

Flaps change the shape of the wing, increasing the "camber," or curvature, of the upper wing surface. Increased wing camber creates more lift at slower airspeeds, allowing the airplane to fly slower for takeoff and landing. Flaps are normally the innermost movable sections of the wings, work in unison and are not controlled by the yoke.

HORIZONTAL STABILIZER/HORIZONTAL TAIL

The horizontal stabilizer provides horizontal stability, meaning it keeps the airplane flying straight horizontally. It is the usually non-moving horizontal surface on the tail of the airplane upon which the elevators are mounted.

ELEVATOR

The elevator controls the pitch (nose up, nose down) movement of the airplane. The elevators are mounted on the rear of the horizontal stabilizer and are normally one piece that spans the width of the tail. When the pilot pulls back on the yoke, the trailing edge of the elevator moves up, the tail moves down and the nose pitches up. When the pilot pushes forward on the yoke, just the opposite occurs.

VERTICAL STABILIZER/VERTICAL TAIL

The vertical stabilizer provides directional stability, meaning it keeps the airplane flying straight vertically. It is the usually non-moving surface on the aft portion of the airplane upon which the rudder is mounted.

RUDDER

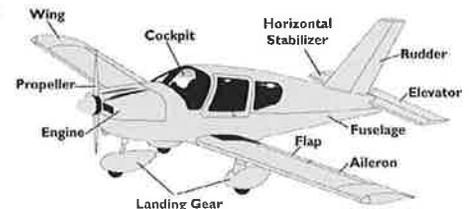
The rudder controls the yaw (nose left, nose right) movement of the airplane. The rudder is mounted on the rear of the vertical stabilizer and is normally one piece that spans the height of the tail.

LANDING GEAR

The landing gear is the structure consisting of the airplane wheels and the struts to which the wheels are attached. The landing gear supports the weight of the airplane during ground operations.

PROPELLER

Usually two-, three- and sometimes four-bladed, propellers are airfoils attached to the engine that spin rapidly, cutting into the air and "propelling" or "pulling" the airplane through the air. Most propellers are nose-mounted, but some are rear-mounted and are called "pusher-props" because they push instead of pull.



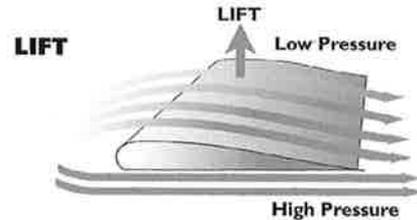


Van Nuys
Los Angeles
World Airports

AIRPLANE MOTIONS

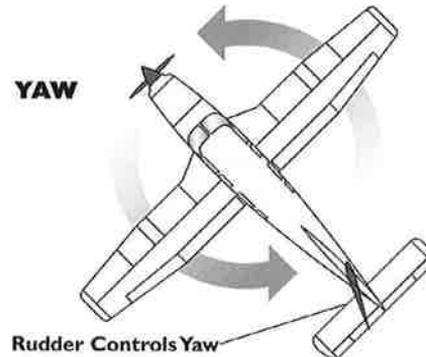
LIFT

The lift is caused by the shape of the wing. As the curved wing moves through the air, the air passing over the wing moves faster than the air passing beneath. Fast-moving air has a lower pressure, so slower, high-pressure air beneath the wing forces it upward. This force is called lift.



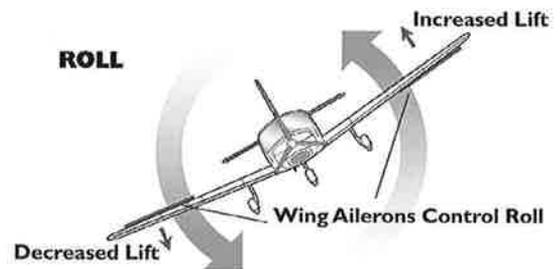
YAW

A yaw motion is a side-to-side movement of the nose of the airplane. To yaw left or right, the pilot pushes on the rudder pedals, which in turn deflect the rudder located on the vertical tail/stabilizer. The rudder is used to coordinate turns and maintain what is called "balanced" flight.



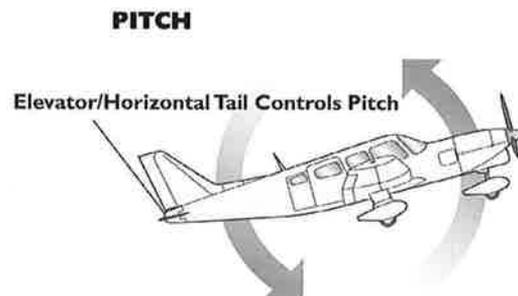
ROLL

To roll, the pilot rotates the yoke to the left or right, similar to the motion of an automobile steering wheel. The yoke controls the ailerons, which are movable control surfaces on each wing. Ailerons work in unison – up on one wing, down on the other. An aileron deflected upward decreases lift on that wing. The aileron deflected downward on the other wing increases lift and the resulting imbalance of forces creates a rolling motion in the direction of the wing with the upward deflected aileron. When a pilot rotates the yoke to the right, the right aileron goes up, the left aileron goes down and the airplane rolls to the right.



PITCH

To climb or descend, the pilot moves the yoke forward or aft to control the pitch or pitch attitude of the airplane. The fore and aft motion of the yoke controls the elevator. The pilot pulls back on the yoke to pitch the nose of the airplane up and pushes forward on the yoke to pitch the nose of the airplane down.



How to Organize a Science Fair

Benefits of Science Fairs

Science fairs help students practice knowledge that they have learned, expand their knowledge about subjects that interest them, solve problems and share their discoveries with others. Students also learn about the use and application of the scientific method through repeated experiments, evaluation/measurement of variables, theoretical and experimental analyses and finding ways to control them.

In addition, science fairs develop communication, writing, presentation and research skills and teach students how to take an open and creative approach to problem-solving. They learn that a successful project is based on a scientific approach and requires management and public speaking skills, as well as poise and independent and clear thinking abilities. Science fairs not only motivate students to learn math and science, and apply the scientific method, but also help them recognize and appreciate the importance of math and science in solving problems in everyday life. The fairs also provide an opportunity to acknowledge outstanding effort and achievement by students and teachers, plus create awareness among parents, teachers and students of the critical importance of social competencies, literacy and talent.

Organization and Planning

There are several steps to organizing and planning a successful science fair:

- 1. Obtain consensus from school administration and teachers on a general plan:** A team of teachers should be willing to support and contribute.
- 2. Select a date and place for the event:** Consider the date of the Los Angeles County Science Fair, availability of facilities and judges, and extent of student participation.
- 3. Appoint committees to oversee various aspects of the science fair** (logistics, publicity, setup, judging, advisory, mentoring, monitoring, take down, etc.) and to decide the nature of the science fair and resources required. It should be decided, for instance, if all students should participate with their individual projects or if group projects should be allowed, the acceptable format of project displays, if parental assistance should be sought, and even if neighborhood organizations and establishments should be asked to contribute.

4. Adopt a schedule based on the date of the fair, available space, degree of assistance from outside the school, number of students and teachers involved, number of projects expected and number of judges needed.

5. Establish milestones and convey them to the students.

6. Define project selection and judging criteria: A project should contain a title; a hypothesis or a question or statement; a complete list of materials/resources necessary to carry out the project; a well-defined design and procedure for experimentation; tables of data and a summary; plots and graphs showing the main results of experiments; explanations of anomalies in the data, if any; and a clear conclusion that corroborates the results. In addition, it is helpful to ask the students to keep a log book in which they take notes about each and every experience they have in implementing their project. It is also desirable to take pictures of the setup, apparatus and even the experimentation.

7. Convey guidelines to the teachers: This will help them explain to the students the topic/title selection process; how to determine what cause and effect relations to search for; how to identify controls or dependent and independent variables; how to look for variability in the process they are studying through repeated experimentation and by the application of various inputs and the study of their corresponding outputs; and how to best organize and present their projects. The scientific method should be understood by every teacher involved, so that they in turn are able to explain it to the students and ask everyone to carry out their projects accordingly.

8. Hold the science fair: Make sure the judges work on schedule and the students cooperate.

9. Tear down and clean up the facility and acknowledge participants (parents, students, teachers, etc.).

A science fair should be a fact-finding process for students. They should be able to plan, organize and implement, in a scientific way, activities directed toward the goal of answering a question they started with or proving/disproving the hypothesis they claimed to be true. All pertinent information should be made available to

parents and clearly explained to the teachers involved, who then should make sure to clearly explain it to the students.

The Scientific Method

Every experiment, no matter how well-planned and how precisely carried out every step of the way, will still have errors. For this reason, scientists always repeat each experiment several times, under "identical" conditions, observe the variability from one trial to the next and take the average of all trials as the acceptable value. If the variability of the measured data is significant, some statistics should be used indicating the mean value, the standard deviation and the variance of the measurement values.

Because of this, it is a good idea to teach students how to plan and execute experiments, including what to measure, what inputs to use and how many trials to perform per condition of the experiment. Having a well-planned and -executed experiment renders a good foundation for a well-planned and -executed science project. Even a simple project, such as the very popular elementary school "volcano" project, can be made into a real science project by designing experiments that evaluate things like the amount of chemicals vs. the height of the "eruption," or the kinds of chemicals and "eruption," etc. It is important to have an experiment in a science project; otherwise it will be a demonstration only.

The Science Fair

On the day of the science fair, all of the approved projects, with appropriate name tags and labels, should be placed on tables and arranged in accordance with agreed-upon settings and groupings. An adequate number of judges should be available to view and evaluate all of the projects displayed, in a timely manner. The judges should be aware of the criteria for judging, the schedule, the rubric and the amenities for their use.

Every student should be interviewed individually, and asked about his or her experiences and understanding of the theory and application of his or her project. Before the interviews, however, it is good practice to allow time for the judges to review the project displays one by one, in the absence of the students, to form a first impression of what the students have done, how much work has gone into each project, how neat and clear are the presented materials and how coherent and meaningful is the conclusion, based on the data shown. A five-minute

survey of a project (without the students present) by a judge could provide an overall impression of the subject matter, the scientific value and the relevance of the data. The judges should work based on clear directions and a well-written set of criteria by which to judge the projects.

The most practical way to judge school science fairs is to judge the projects of each individual grade level (or by category of project, rather than by grade level) by calling in several students at a time, interviewing them, sending them back to class and asking the next group to follow. After the interviews are over and all students have been questioned, the judges discuss the merits of the projects and try to select the ones with the highest ranking, according to the criteria they are following. It is sometimes deemed necessary to go back and re-evaluate projects, and even revisit and discuss some of the projects with students. This allows the judges to all agree on the final rankings and present the results to the science fair coordinator. Normally first-, second- and third-place winners are selected and an additional project is selected for honorable mention. It is even possible to select two or more projects that are of equal merit, by the consent of all judges, as first-, second- or third-place winners, or even for honorable mention.

Awarding Winners

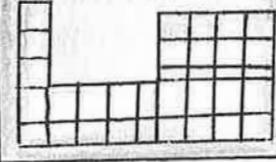
One effective way to encourage student participation in science fairs is to organize a special awards presentation ceremony and invite parents, relatives and peers to attend. The awards are presented by the principal or the organizer/coordinator of the fair, and all of the contributors to the fair's success are duly acknowledged. Those projects/students selected to participate in the Los Angeles County Science Fair are also given recognition and their names announced. Then the public is encouraged to view the projects and talk to the students.

The final phase of the fair is the removal of all of the projects, tables and chairs and the cleanup of the display hall. Moreover, thank you notes should be sent to all individuals, organizations and companies that helped put on and implement the science fair. Feedback should be sought from the judges, parents, teachers and the principal to try to improve the fair during the next season.

For more information on Pratt & Whitney Rocketdyne, visit www.Rocketdyne.com or contact Hagop Panossian at Hagop.Panossian@pwr.utc.com or (818) 586-9660. ♦

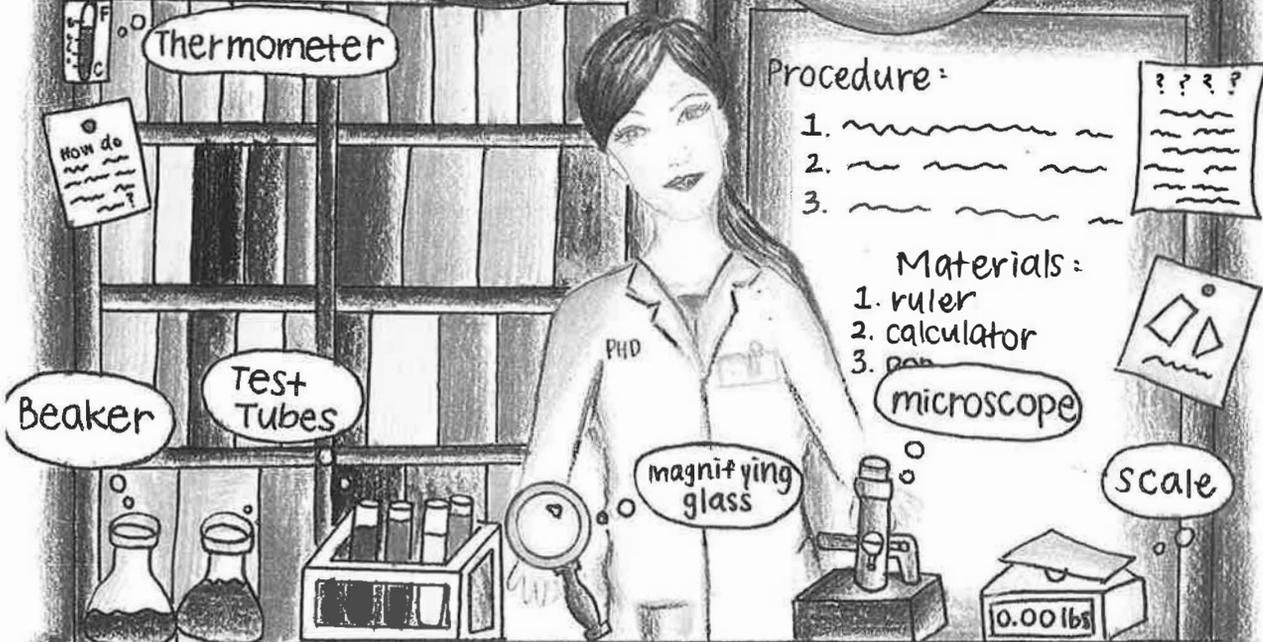
Periodic Table

Periodic Table of the Elements



1
Scientists are curious. They're always asking: How? Why? They have an inquiring mind.

2
They study things carefully with great detail. They also conduct nicely-planned experiments.



Thermometer

How do you do this?

Procedure:

1. ~~~~~
2. ~~~~~
3. ~~~~~

???

Materials:

1. ruler
2. calculator
3. pen



Beaker

Test Tubes

microscope

magnifying glass

scale



goggles



eyedropper

gloves



3
Scientists have a passion for learning. They have an open mind and look at situations from many angles.

4
They use their knowledge. Also, scientists think outside the box.

5
They use failure to improve future approaches to problem solving.

Student Artwork by Harene Kim
Lawrence Highly Gifted Magnet
Greg Zem, Teacher

Pani Kiaei, Lisa Kivman, Frank Asuncion, Maria Gaytan, Maribel Alvarez, Oliver Badali, Linda Esmaili, Jennifer Nnoli, Cathy Coyle-Thompson and Steven B. Oppenheimer

Center for Cancer and Developmental Biology
California State University, Northridge
18111 Nordoff St.
Northridge, CA 91330-8303

HPLC Isolation of Putative Sea Urchin Cell Adhesion Molecules

Using HPLC anion-exchange chromatography with a Bio Rad UNO Q1 column, proteins that caused exogastrulation in *Lytechinus pictus* sea urchin embryos were isolated from desalted calcium-magnesium-free sea water disaggregation supernatant. Exogastrulation is the process in which the advancing tip of the archenteron fails to adhere to the roof of the blastocoel and everts out of the embryo proper. The disaggregation supernatant was obtained by dissociating 24-32 hr old *L. pictus* embryos and fractionated on the UNO Q1 column. The fractions and controls with sea water only were added in quadruplicate to live sea urchin early gastrula embryos in a 96 well microplate, with about 10 embryos per well, incubated at 15 C for 24 hrs and observed live and after fixation with 10% formaldehyde. Two HPLC fractions (8/9 and 10/11) contained statistically significant exogastrulation inducing activity based on 4 replicates (p less than 0.05), compared with controls in sea water. Fraction 8/9 contained a single Coomassie brilliant blue-staining 35 kD band and fraction 10/11 contained 2 bands (35 kD and 150 kD) on Invitrogen pre-cast NuPAGE 4%-12% gradient Bis-TRIS gels. Other labs have isolated similar molecular weight proteins from different sea urchin species and stages. Our ability to obtain large quantities of the purified proteins and to quantitatively assay their effects on well defined adhesive interactions, may help elucidate the nature of molecular mechanisms involved in specific cellular interactions in a model system (supported by NIH NIGMS SCORE, RISE, MARC, ITQ program and the Joseph Drown Foundation). ♦

Gregory C. Zem, Maria Gaytan, Maribel Alvarez, Ludivina Vazquez, Brittany Low, Ashanti Franklin, Laarni Ricafort, Elena Katus, Hesam Hekmatjou, Johanna Perez, Marian Ranasinghe, Brently Dunivant, Evlin Adamian, Joo Yuen Lee, Marine Hakopyan, Lana Darghali, Jenilyn Datu, Jason Kim, Mai Nguyen, Carlos Flores, Jennifer Nnoli, Kara Jones, Patricia Rojas, Said Esfahani and Steven B. Oppenheimer

Center for Cancer and Developmental Biology
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Most Effective Saccharide Inhibitors of Immobilized Concanavalin A-cell Binding

This laboratory has been using a derivatized bead assay to study cell surface properties in many experimental systems. Here we test its efficacy in the yeast/concanavalin A (Con A) binding model to determine if immobilized Con A is inhibited by the same saccharides that inhibit free Con A binding. This system offers an excellent test case for the efficacy and validity of the derivatized bead assay. Con A binds to yeast because yeast are rich in cell surface mannose residues, a Con A preferential binding sugar. Here we examine the effects of 30 different sugars (0.05 M) on the binding of yeast to agarose beads derivatized with Con A, versus controls with no sugar, in a total of 3998 trials, with an average of over 133 replicates for each sugar. The most inhibitory sugars included D(+) melezitose, D(+) trehalose and maltotriose, the same sugars that effectively inhibit binding of free Con A. The results suggest that the bead assay is an effective approach to study the binding properties of cells, and most important, it is so rapid that hundreds of trials can be done in the time it would take to do one trial using conventional assays (supported by NIH NIGMS SCORE, RISE, MARC, the ITQ program, and the Joseph Drown Foundation). ♦

Pani Kiaei, Lisa Kivman, Frank Asuncion, Maria Gaytan, Maribel Alvarez, Oliver Badali, Linda Esmaili, Jennifer Nnoli, Cathy Coyle-Thompson and Steven B. Oppenheimer

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Sample University Abstract

Effects of Sea Urchin Hyalin on Gastrulation

The sea urchin hyaline layer is an extracellular matrix that develops soon after fertilization of *Strongylocentotus purpuratus* eggs. The major constituent of this layer is the fibrillar glycoprotein hyalin that is essential for maintenance, organization and adhesion of cells during morphogenesis. Here, hyalin was isolated from newly fertilized *S. purpuratus* embryos via disruption of the vitelline envelope with dithiothreitol, followed by removal of the hyaline layer from the embryo surface with ice-cold NaCl-KCl. Hyaline was collected as the supernatant from the settled embryos and its purity was assessed on 2 percent agarose gels. Twenty-five hr *S. purpuratus* embryos were incubated for 25 hrs at 15 C with normal sea water, hyalin/low calcium sea water, NaCl-KCl/low calcium sea water or low calcium sea water alone in 96 well microplates. The experiment was repeated 10 times. The hyalin-treated and control samples were observed live and formaldehyde fixed using a Zeiss Axiolab photomicroscope. Eighty-seven percent (average) of all the controls developed complete archenterons. In the hyalin treated samples 48 percent displayed no invagination, 49 percent showed incomplete, unattached archenterons, and 3 percent developed complete archenterons. Many studies, including this one, suggest that hyalin may be involved in gastrulation events such as initiation of invagination. The assay used here, because it allows precise qualification of the effects of substances on specific morphogenetic events, should help us understand exactly how molecules, such as hyalin, affect one specific event versus another (supported by NIH NIGMS SCORE, RISE, MARC, the ITQ program, and the Joseph Drown Foundation). ♦

April Abrena, Stephanie Acevedo, Lorena Avila, Romon Basa, Ricardo Carreon, Pariya Chanchaisri, Monique Chavez, Jeffrey Chiang, Kevin Covarrubias, Cecilia Diaz, Kevin Gabriel, Bianca Giovinazzo, Allie Guerra, Brittany Guidotti, Adrian Gurrola, Zachary Hill, Julie Jordan, Juan Juarez, Stephen Jungco, Viviana Kim, Denise Lainez, Nahani Lomeli, Carlos Martinez, Carla Meliton, Tatiana Nunez, Leslie Paredes, Larry Pompa, Isabel Quirarte, Rabya Raheem, Allyson Raymundo, Marie Ross, Ruby Saldivar, Abanoub Sidrak, Jazzae Smith, Erica Sommers, Andrew Tarabotto, Patsy Zamora and T. Miller (teacher)

Holmes International Middle School
9351 Paso Robles Ave.
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Does *Pseudosinella violenta*, an Eyeless Species of Collembola, Prefer Eating Red Colored Yeast or Yeast in its Natural Beige Color?

The purpose of this experiment is to determine if *Pseudosinella violenta*, an eyeless species of collembola, prefers eating red yeast or yeast in its natural beige color. In previous studies, collembola have been able to detect ultraviolet light. We hypothesized that collembola would not have preference to the color of food they ate. Collembola are microscopic hexapods that eat mold. In the laboratory they are fed yeast. In order to test our hypothesis we made homes for our collembola by mixing nine parts plaster of Paris, one part charcoal and water in nine petri dishes. We let them dry completely. We made the environments moist for the collembola by adding drops of water. We placed the yeast containing the red food coloring on one side of the petri dishes and the yeast in its natural beige color on the other side of the petri dishes. Fifteen to twenty collembola were placed into each petri dish. We used stereomicroscopes and hand lenses to observe the collembola each day for changes in the color of their guts. We counted the number of collembola with normal colored guts and the number of collembola with red colored guts for five days. We added all of our data from the five days and nine petri dishes. We found forty-seven percent of the collembola ate beige yeast and fifty-two percent ate the red yeast. Our hypothesis was correct because the collembola, *Pseudosinella violenta*, ate about the same amount of red colored yeast and beige colored yeast, showing little preference for yeast color. ♦

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Differences Between Normal and Cancer Cells

This investigation approached the question of differences between the normal cell and the cancerous cell's appearance, morphology, and growth under different conditions. Both types of cells were incubated under 37°C and 10% carbon dioxide under 1% and 10% serum. Over the next five days, the cells were counted using a Hemacytometer and appearances were compared after shooting pictures using a digital camera. The number of cells per milliliter was recorded. The experiment was repeated three times. The cancer-free cells grew at an average rate of 0.46×10^5 / ml under 1% serum and 1.2×10^5 / ml under 10% serum. The cancer cells grew at an average rate of 1.03×10^5 / ml under 1% serum and 3.41×10^5 / ml under 10% serum. The rounded, shiny cancer cells continued to stack upon each other after growing space ran out while the flattened, clear normal cells stopped growth up to a certain point. The results show that cell growth under 1% serum to 10% serum is greater and less controlled in a cancer cell than in cancer-free cells. ♦

Effects of Slope and Water on Soil Deposition

This experiment was developed for our participation in National Geology Week. This experiment observed the effects of slope and water erosion of soil. The experiment was conducted over several months with several erosion boards that were made with 1" grid lines on a white laminate bottom. The grid lines allowed for accurate mapping, detailing and accounting of the experimental effects. Slope was measured with the use of a compass and water was measured with the use of a graduated flask. The soil used was "Kiddies Fun Play Sand #1113," which is screened, filtered, dried and produced by Quikrite Products. A video was developed documenting the procedure and possible historic results. In all tests 11,000 ml of dry soil was used. Secondly, at 40 degrees of slope the soil broke form without added water; therefore, tests were not performed past a slope of 30 degrees. Lying flat (0 degrees) the soil was able to absorb an average of 13,467 mls of water before it broke form. Each test was performed six times with dry soil and the mean was then determined. Erosion is defined as the removal and transport of weathered material from one location to another. The addition of water was stopped when the soil broke original form. The amount of water used and the amount of soil movement was tabulated at 10, 20, 25 and 30 degrees of slope. At 10 degrees of slope the average amount of water needed was 10,034 mls and for an average area of soil displacement was an area of 72 squares (1" x 1" square). At 20 degrees of slope, an average of 8,105 mls of water was needed for an average area of soil displacement equal to 40 squares. At 25 degrees of slope, an average of 7,993 mls of water was needed for an average area of soil displacement equal to 48 squares. At 30 degrees of slope, an average of 6,105 mls of water was needed for an average area of soil displacement equal to 90 squares. These results did support our hypothesis that with the increase of slope, less water would be required for the soil to break form. When looking at the individual results of each test, an indeterminate result exists for support of our second hypothesis. Although the greater average area of soil displacement occurred at a greater degree of slope, there was a greater average area of soil displacement at 10 degrees than at either 20 or 25 degrees of slope; therefore our hypothesis that slope is also a determinate of soil deposition is inconclusive. Slope does play a part in erosion; however, the amount of soil displacement does not depend solely on slope (except at a critical inclination). The shape of soil displacement is also indeterminate in that it does not follow a consistent shape. This experiment does lead to further questions concerning the interaction of the combined effects of slope and water on soil displacement. There may also be properties in the soil that are inconsistent that prevent the soil from binding uniformly. This may result in the inconclusiveness of the effect of the slope on soil displacement. Several tests were performed on different soil types; however, the soils did not absorb water at greater degrees of slope, and displacement in the form of runoffs (rills and gullies) occurred with a greatly reduced amount of water. ♦

Phenotypic Expression as a Function of Different Substrate in *Brassica rapa*

The purpose of this study is to determine if there is a correlation between the substrate type that *Brassica rapa* is sowed into and any phenotypic expression. *Brassica rapa* are small mustard-like plants in the crucifer family. These petite plants cycle rapidly (~ 40 days) through their entire life cycle, allowing pollination and seed harvesting many times in one academic year. Three different substrates were identified for their ubiquitous nature. Perlite, potting soil, and a mixture of 1:1 of common clay soil and Perlite were sowed with 36 seeds of wild type *Brassica rapa*. The potting soil showed the best germination rate, 100% after 3 days. The clay mix and the Perlite showed a retarded rate of germination over a period of 3-5 days. While the Perlite sample eventually reached 100% germination, the clay mixture peaked at 60% germination. During the vegetative growth state (prior to development of reproductive structures) a striking phenotypic difference was observed. The internodal distance was reduced in Perlite, while very stunted in the clay mixture. This difference may be due to a lack of hormonal expression as a result of nutrient deficiency. The clay mixture and Perlite also showed signs of chlorosis though this observation was much more pronounced in the clay mixture. Continuing experiments will determine if there are other soils or soil mixtures that provide a more successful substrate than potting soil. ♦

What Are the Effects of Air Pressure and Type of Ground on a Basketball's Bounce?

This study showed the effects that air pressure and type of ground had on a basketball's bounce. Basketballs were dropped from a set height of 310 centimeters with 0.422, 0.563, 0.704, 0.844, and 0.985 kilograms per square centimeters of air pressure. Each ball with the same amount of air pressure was dropped onto the following types of ground: carpet, concrete, and wood. The same experiment was repeated with a different amount of air pressure on the three different types of ground. Each experiment was repeated three times. The basketball with 0.422 kg/cm² (kilograms per square centimeter) bounced an average of 154.8 cm on carpet, 167.7 cm on concrete, and 177.4 cm on wood. The basketball with 0.563 kg/cm² bounced an average 164.54 cm on carpet, 193.5 cm on concrete, and 187.1 cm on wood. The basketball with 0.704 kg/cm² bounced an average of 174.2 cm on carpet, 209.6 cm on concrete, and 199.9 cm on wood. The basketball with 0.844 kg/cm² bounced an average of 174.2 cm on carpet, 212.9 cm on concrete, and 212.9 cm on wood. The last basketball with 0.995 kg/cm² bounced an average of 180.6 cm on carpet, 219.4 cm on concrete, and 225.8 cm on wood. The results depicted that air pressure and type of ground change the height of a basketball's bounce. ♦

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A Bi-Direction Study on the Effects of Nutrition and Population Density in *Brassica rappa*

The purpose of this study was to evaluate the individual and combined effects of nutrition and population density and how they affect the phenotypic expression in *Brassica rappa*. Fertilizer pellets containing Nitrogen, Phosphorus, and Potassium were ground and then added to one-liter volumes to make the increasing concentrations of 1x, 2x, 3x, 4x, 8x and finally 16x. Fertilizer solution was added to each seedling in 2ml volumes at 5-day intervals. Four other trials were set up at the same time. Each trial used the same nutrition regime. Each trial differed in the amount of seedlings that were sowed and maintained throughout the entire experiment. The population densities varied from one plant canister in the first trial, to two plants per canister in the second trial, increasing the number of plants in each trial by a factor of two (2-4-8-16 plants per trial). Observations and measurements were taken daily. Among the observations two phenotypic expressions stood out. As the concentration of fertilizer was increased the expression anthocyanin was decreased. This effect was most pronounced when plant stocks were used that normally produce a large concentration of anthocyanin. The other phenotypic expression that was affected to a great degree was overall plant height. While it is not clear it seems that there is an upper and lower tolerance limit with an optimum of 8x. A new study is being designed to quantify the expression of anthocyanin in various plant tissues. ♦

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3368

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Abundance of the Lizardfish, *Synodus lucioiceps*, Off the Los Angeles Harbor

To determine in which month the lizardfish is most abundant and what impact water temperature has on its population dynamics, data collections were carried out off the LA Harbor on October 28, 2003. Data was collected using an otter trawl and a YSI to measure water temperature aboard the RV Yellowfin. The general method of these studies consisted of steering the Yellowfin out into the LA Harbor, deploying the otter trawl after determining the water temperature in the given region, and raising the net to tally the number of fish collected. To record the monthly abundance of fish, this experiment would have to be repeated each month and several times each month, so as to record the abundance in varying water temperatures. Data extended off the Oxy web site collections from an accumulation of statistics of the years 1998-2002 off Harbor #1 prove October to be the month with the greatest amount of fish. This data is significant in comparison to successive months in which few or no lizardfish were found. A statistical analysis of the collected data was carried out using a quadratic regression with the formula: $y = ax^4 + bx^3 + cx^2 + e$, if $a = -.1040$, $b = 2.4059$, $c = -16.9748$, $d = 40.2727$, and $e = -16.0101$. This yielded a fit of $R^2 = .8071$ to the curve. This indicated a strong correlation between the quadratic function on the month number and the number of fish found, depicting the probability that similar results will be obtained in successive experimentations. *Synodus lucioiceps* normally reside from Guaymus, Mexico, to San Francisco, California, but are not particularly common north of Pt. Conception. It can therefore be concluded that they prefer warmer water temperatures and reside in subtropical climates (from 34° - 22°N). ♦

Tolerance of Sunflower Seeds to Salt

This study was to see the possible effect that different salt water solutions had on the growth of sunflowers. Twenty seeds were first soaked in either the salt solution or distilled water for a day. In total: 120 seeds were soaked in water, which acted as the control. One hundred eighty seeds were soaked in different salt water solutions of .1%, .3%, and .4% salt. After soaking, the seeds were planted in groups of 20 in separate containers. The seeds were watered for 16 days with the solution with which they were soaked. The experiment was run three times with two controls for each percent of solution. For the control the height of the plants ranged from 1-14 cm, and the percent of germination was about 50%. For the .1% solution the range of height was 5-16 cm, and the percent of germination was also at 50%. At .3%, the range of height was .5-13 cm, and the percent of germination was 25%. At the .4% germination, the range of height was .5-9 cm, and 20% was the percent of germination. It can be concluded that the higher the percent of salt, the more stunted the growth of the sunflower seeds. ♦

Study of the Algae in the Sepulveda Basin Dam Region of the Los Angeles River

In this study, we examined the types of algae in the Los Angeles River. We took samples from four key locations going downstream. Site 1 was an area of the river in which the water consists of only street runoff, and Site 2 was an outlet from Lake Balboa which is fed by tertiary water treated by the Tillman Water Plant. Site 3 was just beyond the junction of water flowing from Site 1 and Site 2. Site 4 was about a quarter mile further downstream from Site 3. Samples were taken about once a week over a four month period from October 1995 to January 1996. Air temperature, water temperature, water flow volume, and overall weather conditions were taken each time we visited the river. The algae samples that we found consist of a single-celled, multi-celled and attached filamentous. Generally, we have found the largest quantities of algae at Site 1, where the river is wide and the water flow is slow. We found little to no algae at Site 2, where the water is in a cement channel and flows more swiftly. During December, we have found few samples of algae at Site 3, where the water flows more quickly due to the narrowness at that spot. Even though one would not expect to find algae at Site 3 because of the water's high velocity, we attribute our findings to rainfall in December. There is an abundance of algae at Site 4 because it's further downstream where the river widens, causing the water's speed to decrease. In the future, we plan to classify and scientifically quantify our algae samples. ♦

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3371

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Propeller Power

The purpose of this experiment was to find out how different things affect the flight of an airplane. First, we cut a jumbo straw in half, and we made holes near the top of both pieces of the straw using a hole puncher. Then we stacked two craft sticks, and sandwiched the two jumbo straws between the craft sticks, and we stapled the sticks together. Then we cut a regular straw with the same length as the craft sticks and passed it through the holes in both jumbo straws. We looped a rubber band through a paper clip, we twisted the rubber band a number of times, and we hooked the other end of the rubber band onto the propeller's hook. We attached the propeller on one end of the sticks, and using masking tape we attached the paper clip to the other end of the sticks. Finally, we threaded the fishing line through the top straw, and tied one end of the fishing line to the back of a chair, and attached the other end to another chair. We twisted the rubber band a few times and flew the plane. We learned from this experiment that the more we twisted the rubber band, the longer distance the propeller plane flew. We also learned the flight of the propeller plane was affected by how long the rubber band was and if the propeller was attached to the hook correctly. ♦

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3372

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The Effects of Different Size and Shape Parachute on Terminal Velocity

Terminal velocity is when a falling object is traveling at a high speed such that the frictional force on the parachute (drag force) exactly balances the force of gravity pulling the object. Static friction is the force before the parachute actually begins to move and kinetic is the force such that the parachute is in motion. At this point, its acceleration will be zero and it will be traveling at the highest speed possible under these conditions. The project studied the effects of different sizes and shapes of parachute on terminal velocity. The set-up required a Pasco Dynamics ring stand and was used with an Ultra Sonic Motion Detector that was taped on to the adjustable ring stand. The position vs. velocity graph was loaded under data logger. All the experiments involved fifty trials on each level. It was hypothesized that the regular shape would increase terminal velocity. In the first experiment the circle or regular shape was the control. The reason for this control was that it is used today as the shape for all parachutes and would give me a good outcome. The average mean of the trials was graphed on a line graph having a correlation of .997. The mean terminal velocity between the levels of different shapes was 1.19 and between the levels of different shapes was 1.34. The average standard deviation of terminal velocity was .086. The standard deviation showed us how much your correlation can fluctuate around our mean. It was hypothesized that the greater the surface area, then the lower the terminal velocity. The hypothesis was supported. ♦

The Effect of Wing Design on Distance of Flight, Speed of Flight, and Time of Flight on a Plane

The wing is a critical part of an airplane, in that it keeps the plane aloft. The design of the wing creates a low pressure system above the wing. This causes the plane to rise because the low pressure system creates lift, allowing the plane to fly. There are many corporations that are designing new wings and comparing their efficiency to current and more traditional types of wings. This investigation tested different designs of wings in order to determine how different wing designs affect flight time, speed, and distance. Three shapes of wings were tested: a right triangle, a rectangle, and an obtuse triangle. The two right triangles had dimensions of 16 cm on the edge that was attached to the fuselage, 20 cm on the hypotenuse, and 12 cm on the adjacent side. The two rectangular wings were 10x20 cm rectangles, with the 10 cm edge attached to the fuselage. The obtuse triangles had one side of 7 cm; the longest side was 20 cm, and the point of contact to the fuselage was 16 cm. The constants for this investigation were: test environment, fuselage, and shooting mechanism. The testing was done when each wing was joined to a standardized fuselage, and shot from a sling shot-like mechanism. There were 50 trials done for each variable. The right triangular wing stayed aloft the longest and traveled the furthest. The obtuse triangle wing flew the fastest. The statistical analysis done on the data was mean, variance, and t-test, which obtained the significance of the data. It turned out that all the data was significant except one of the speed trials. This was because there was too high of a standard deviation, creating too much room for error. It has not been concluded what caused this, and why this was the only data set that was insignificant. Overall, this investigation showed that each wing has its own advantages and disadvantages, depending on the purpose of the plane. ♦

Water Rocket

This experiment proves that all machines need energy to make them go. You will need: a plastic bottle, a rubber stopper, a bicycle pump, and an air valve. First, make a small hole through the rubber stopper with a pin or a skewer. Then push the air valve through the stopper. Then, pour water into the bottle until it is about one-third full. Push the stopper tightly into the neck of the bottle. Attach the bicycle pump to the air valve, ask an adult to hold the bottle, and start pumping. Caution: This rocket is very powerful and could hurt people seriously if it hits them. Always fly the rocket outdoors in a wide empty space well away from roads. Never fly the rocket near other people. Don't stand over the rocket as you pump it up. Keep off to the side. ♦

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The Aerodynamic Performance of Differently Shaped Objects in a Wind Tunnel

I tested the aerodynamicity of several differently shaped objects. The purpose of the experiment was to find the design on wheels that would offer the least amount of wind resistance. I hypothesized that the teardrop shape, with the point facing forward, would offer the least amount of drag, because the point would slice the onrushing airflow, and equally disperse it on all sides. I created a wind tunnel, with a cardboard box and a fan, several figures made from construction paper, a pulley system using yarn and a piece of cardboard, and a base resting on three wheels. The figures that I tested were a forward teardrop, a reversed teardrop, a rectangle, a cylinder, and a triangular figure. All figures had the same frontal area of 16 square inches. The forward teardrop and the triangle offered the least wind resistance, while the rectangle had the highest coefficient of drag. The cylinder and the backwards teardrop performed both equally and moderately well. It seems that the most aerodynamic figure has a pointed edge to separate the oncoming air flow. ♦

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3376

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Does Shape Affect Aerodynamics?

This experiment was a test to see if the shape of an object affected aerodynamics. Six sheets of aluminum foil, similar in size, were shaped differently. Three of them were folded in half with a flat bottom and a configured top, allowing air to be trapped. The remainder were shaped to allow air to flow through an opening in the middle of the sheet. A blow dryer was used for a count of two seconds to move the objects. In the initial trial the air source was twelve inches from the objects; the other trials had the blow dryer three inches away. The three with the flat bottoms were tested with the opening toward the air source, then with the opening away from it. The sheets that allowed the air to flow through had air blown through the opening, then to the side of the objects. The results showed that the most excellent shape was the one with the flat bottom and rounded top, with an opening three inches wide by 1 1/4 inches high and the closed end away from the air source of three inches from the object. The sheets that allowed the air to flow through them moved the least but did better in the trial where the air was blown against their sides. ♦

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3377

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How Fast Do Objects Accelerate to Earth?

This experiment involved measuring acceleration due to gravity. Calculated bundles of pennies were dropped from a predetermined height. The distance of the fall was noted. The rate (time) of the fall was recorded, with the use of a stopwatch. Eight drops were made for each bundle of pennies, 50 & 150 respectively. Four trials were recorded. It was determined that the smaller bundle had a faster rate of acceleration. Analysis was also done to calculate the rate of acceleration for each of the time trials. Once the times of the falls and the distance of the falls were found, the acceleration due to gravity was found using the following formula: $g=2d/t^2$ where g = acceleration, d = distance, t = time. The accepted value of g has been calculated as 980 cm/sec. This compared to our findings resulted in a 35.5% error rate. By increasing our predetermined height, the error rate would have been decreased. ♦

3378

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Airplanes Fly. But Why?

This involved the study of how airplanes fly. Two wooden blocks were glued together and a nail was placed on the top portion of the block on top. An airplane wing was then created by placing a strip of construction paper over a 3" piece of a broom handle. The "wing" was then attached to one side of a coat hanger and a couple of weights in the form of washers were placed on the other. The hanger was then wrapped around the nail so that the wing was a couple inches lower than parallel. A hair dryer and a fan were used to blow air over the wing. This experiment provided conclusive answers to the questions: How does the wing fly? Does the temperature have an effect on the lift of the wing? The results proved that the temperature had no effect on the lift of the wing and that the wing creates lift from the difference in air pressure caused by the speed difference in the air traveling over and beneath the wing. ♦

3379

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Practical Power of Wind Energy

The intention of this project was to quantify the maximum weight that could be elevated by a constant gust of wind energy. We hypothesized that a steadily applied amount of wind energy, which we quantified at 4.5m/s, put into a machine with a standard wind-surface area of 1084 cm², would respectively enable the amplification of a proportional weight of at least 500 grams upwards. The applications of this, however, would be to proportionalize our findings into larger scale, practical results. To analyze our hypothesis and investigate the principles of wind energy, we produced a simple machine. To one end of the apparatus was the weight under consideration, while the other terminus held varying parachutes (therefore varying areas) to which the steady amount of wind energy was applied. The device and its two termini were joined by three pulleys. After applying 4.5 m/s amount of wind force to lift each respective weight with each specific parachute, we plotted both the weight of the object and the amount of wind force needed to lift it 6 cm on the x- and y-axes, respectively. In conclusion, to lift the object, our graphs exhibited an increasing proportion (and need) of 1.8% of surface area per gram of the object. Our hypothesis was correct to a simplified extent; wind energy could be utilized to effectively lift, carry, and situate objects without the use of hydraulic lifts or fossil fuels. Of course, for practical industrial applications, proportions of weight and their needed energy amounts would have to increase significantly. ♦

3380

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Effects of Changing Angle of Attack on Airfoils

This study examined how changing the angle of attack for an airfoil affects the amount of lift and drag created. Three different airfoils were tested at different angles into a wind of 80 kilometers per hour. These were placed in a scale wind tunnel, and the wind was provided from a woodworking shop dust collector. Each angle of attack was tested four times on each airfoil: a Lissaman L7769, a Liebeck L1003, and a flat piece of wood, "the barn door." The results suggested that an angle of 15° is good for a human-powered aircraft (Lissaman) and an angle of 10° is best for a commercial jet (Liebeck). ♦

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Lifters—The Theory of Ionic Winds

Lifters are devices that can be made to fly using ion discharge between two electrodes to create an ionic wind that results in lift. Such devices do not have any moving parts and require a very high voltage power supply. This is possible and has been proven through the Beifield-Brown Theory. This theory states that if a craft is charged with a positive and negative electrode and the ionic wind is conducted through a good conductor, then the craft will thrust up with substantial force. But if there is a kink in the wire and the electrode connection is even slightly disrupted then the craft will not be able to fly. The craft must also be as light as possible unless there is enough thrust to lift additional weight. The results of this study were not successful, and the lifter did not fly as planned. The causes of this could be an added material in the aluminum foil, such as Teflon, or an insufficient power source. Another cause could be current leakage. ♦

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3382

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Study of Queenfish, *Seriphus Politus*, Populations in the L.A. Harbor

A study was conducted using data collected from the LA Harbor from January 29 to March 23, 2004, concerning the Queenfish, or *Seriphus politus*. The purpose of the study was to determine whether the following hypothesis is correct: If water temperature decreases in the L.A. Harbor, the population of the *S. politus* in the water will decrease. The data was collected using the SBE 25 Sealogger from Seabird Technologies. The results found by the study proved the hypothesis wrong and gave the two alternate solutions of either there being no correlation between the temperature of the water and the number of fish caught, or that the fish are caught at specific temperatures that can be predicted by a quartic (biquadrate: an algebraic equation of the fourth degree) curve derived from statistical analysis done on the collected data. ♦

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3383

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Predicting the Acid Content of the Microbial Lava Lamp® (MLL) Using Sugar Concentration as an Indicator

A product of the standard King and Tomasck, Microbial Lava Lamp® (MLL) is the production of carbon dioxide (CO_2) gas. The gas results from the respiration of yeast constrained in glass/algininate beads suspended in sugar water. We observed that not all CO_2 left the sugar water solution when the yeast beads reached the water's surface. Some of the gas, we surmised, remained in the solution to produce carbonic acid (H_2CO_3) with the water. We had no way to discern how much acid was produced. Nevertheless we hypothesized that, in general, the greater the concentration of sugar the greater the acidity of the solution since more CO_2 would be produced. We also realized the limitations of the hypothesis in that too much sugar would be counterproductive. We kept the relative range of our experiment from 5% to 20% sugar concentration. MLL bottles were prepared in intervals of 5% sugar concentration. Using the Oaktron PHTESTR® (model 3562420) we found that after several measurements in each bottle, the average pH fell 0.2 for every 50 grams of added sugar. This confirmed our hypothesis that the pH varies inversely with increasing sugar concentration. With more sugar, more CO_2 was produced to produce carbonic acid. ♦

3384

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Would Diving Affect the Human Heart Rate?

It is known that diving mammals undergo bradycardia (a decrease in heart rate) under water. I was interested to find out whether the human heart rate is affected under water. In this investigation I measured the heart rate of 10 different individuals at rest, while holding their breath and also while holding their breath with their faces in the water. I repeated the experiment several times. My experimental data showed that in all the individuals tested, heart rate decreased (60 beats/minute) when their faces were in the water as compared to the resting heart rate (76 beats/minute) and holding their breath (70 beats/minute). These results indicate that humans may undergo similar adaptive changes as diving mammals. ♦

3385

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Effect of the Environment on Sea Urchin Fertilization

Environmental factors influence marine life. Acid rain may alter the pH of the ocean and oil spills may destroy habitats. I was interested in finding out how oil spills and pH changes affect sea urchin fertilization. I used *Stongylocentrotus purpurants*. The sea urchins were injected with 0.5 ml of 0.55M potassium chloride in 3 points of a triangle into the body. The sea urchins were held upside down to check for gamete shedding. A white discharge indicated male and a yellowish/orange color indicated female. The male was put upside down on a small petri dish placed on ice. The female was also placed upside down and on top of a small beaker filled with artificial sea water (ASW) at pH 8.0. The eggs were washed 3 times in ASW, and 3 ml of pH 5, 7, 8 or 9 ASW was put into a small petri dish. One ml of eggs was added to the ASW in the petri dish and the eggs were closely observed under the microscope. A drop of diluted sperm was added and the time required for fertilization was recorded. Three fields were counted for the total number of eggs per field and the total number of eggs fertilized per field in a given amount of time. At pH 8, total fertilization was achieved within one minute and thirty seconds. At pH 7 and pH 9, the time required for fertilization was longer. At pH 5, very few or no eggs were fertilized within ten minutes. Similar results were observed at pH 3. My results indicate that at pH 8 the least amount of time is required for sea urchin fertilization. Fertilization is favored at neutral to alkaline pH over acidic pH. Adding 10W-40 or 10W-30 motor oil to ASW resulted in a decrease of 75% in the eggs that were fertilized. These results indicate that pH changes and oil spills in the ocean may be detrimental to marine life. ♦

3386

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The Effect of Temperature on the Heartbeat of Daphnia

Environmental temperature differences do not alter the heart rate in humans. We were interested to see whether temperature changes would alter the heart rate in daphnia. We placed the daphnia in a chamber and immersed it in water temperatures ranging from 4°C to 35°C and after 5 minutes of adaptation we counted the heart rate per minute. Each experiment was repeated at least 6 times. Our results show that there was a direct relationship between the heart rate of the daphnia and the water temperature.

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The Effects of UV Radiation on Fast Plants

Global warming may result in an increase in UV exposure. UV radiation is known to damage DNA. Therefore, it may be more harmful to growing and developing plants or organisms. To test this out I used Rapid Cycling Brassica Rapa or Fast Plants. I exposed the Fast Plant seeds and the germinated seeds to 30 to 60 minutes of UV light, respectively. My results showed that the germinated seeds were more sensitive to UV radiation than the seeds. At 10 days after planting the UV exposed seeds were 64% as tall as compared to the controls. The UV exposed germinating seeds on the other hand were only 45% as tall as the controls. At 15 days the control plants were 16 cm tall and blooming; the UV exposed seeds and plants were shorter and not blooming. These results indicate that UV radiation affects the growth and development of Fast Plants. ♦

Armando Castillo
and Nadita Pal (teacher)

3388

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A Study on Predator-Prey Relationships

In an ecosystem a predator-prey relationship is well known. There is competition between predators that share prey. They fight for food; the competition might be between two species as well. I was interested to find out what would happen if a Venus flytrap and a spider were in a small habitat sharing a prey (drosophila). I created a habitat, then added a Venus flytrap, spider and fruit fly. My predictions were that the Venus flytrap would consume the spider. I was wrong. The spider caught the drosophila. The same happened as I repeated the experiment. The more the spider built its web, the greater its chances were at capturing the fly. The fruit flies flew up and were always caught in the web. Since spider webs are found year round, the Venus flytrap would become extinct under these conditions. ♦

Bernard Cadiz and
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3389

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The Effect of Ultraviolet Radiation on Sea Urchin Development

The expanding hole and thinning of the ozone layer may result in UV radiation on land and marine life. It is known that UV radiation disrupts microtubule and cytoskeleton development. It may also stop cleavage and gastrulation in sea urchins. I was interested to find out which stages of development may be hampered by UV exposure. I used *Strongylocentrotus purpuratus*. Sea urchin eggs and sperms were prepared by injecting 0.5 ml of 0.55M potassium chloride in 3 points of a triangle into the body. A white discharge indicated male and a yellowish orange color indicated female. The male was put upside down on a small petri dish placed on ice. The female was also placed upside down on top of a small beaker filled with artificial sea water (ASW) at pH 8.0. The eggs were washed 3 times in ASW. A drop of diluted sperm was added to 1 ml of eggs in 3 ml of ASW. The fertilized egg was exposed to UV light for 5 minutes, 30 minutes and 60 minutes respectively, and put in an 18°C incubator. The development from a fertilized egg, blastula, gastrula and pluteus stages was observed over a 5-day period. The results show that UV exposure not only delays development but also increases mortality in sea urchins. ♦

3390

Jessica Gonzalez and T. Miller (teacher)

Will *Onychiruidae Encharpatus*, a Blind Species of Collembola, Prefer Active Dry Yeast Sweetened with Sugar or Regular Active Dry Yeast?

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My hypothesis was that collembola would eat yeast sweetened with sugar more than yeast without sugar. My procedure started with making the collembola's environment. I mixed one part charcoal with nine parts plaster of paris and water in four petri dishes. I let them dry for three days. Then, I made the collembola's food by first mixing one part yeast with a drop of water in a microcentrifuge tube. I put that on one side of all four petri dishes with a toothpick. Then, I mixed half yeast with half sugar with a toothpick in another microcentrifuge tube. I added a drop of water and a drop of green food coloring with an eyedropper. I placed that on the other side of the four petri dishes. I knew from a previous experiment that my collembola don't have a preference for the yeast with food coloring. I put ten collembola in each petri dish. I observed the collembola using a stereomicroscope for 22 days. I recorded data by counting the number of collembola with a green gut as opposed to the collembola with a beige gut. My results were that 60.9% of the collembola had normal colored guts and 39.1% had green guts. In conclusion, the collembola preferred the recognized taste of regular yeast more than the one sweetened with sugar. It turns out that my hypothesis was wrong. ♦

3391

David Kim and D. Shah (teacher)

Which Color of Light is Best for Faster Plant Growth?

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This experiment thoroughly examined the question of which color light leads to faster plant growth, leading to bigger plants. Aralias (the plants for this experiment) were placed under two lamps, each with the bulb covered with clear, colored film, so that the color of film is the color of light. Four Aralias were placed under red light, four under blue light, and four were placed outside, which was the control group. The Aralias under the lamps had lighting for 6 hours and all Aralias were watered whenever the soil felt dry. The results of growth were then measured and put into charts and graphs. The final measurements of the red group are 24.8 cm, 26.5 cm, 24.4 cm, and 28.2 cm. The blue group measurements are 20.5 cm, 22.2 cm, 19.6 cm, and 20.5 cm. The control group measurements are 17.3 cm, 16.5 cm, 17.7 cm, and 18.4 cm. The results suggest that under red light, plants grow quicker and taller. ♦

3392

Simon Ma and D. Shah (teacher)

The Probability of a Token Landing on Each Individual Estate in the Game of Monopoly

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This study examined the probability of a token landing on each individual estate in the game of Monopoly. The dice were rolled 223 times for a total of 40 trips around the game board. Probabilities ranged from approximately 0.9% to about 4%. The results suggested that Illinois Ave. is the estate that the token will land on the most times while playing the game of Monopoly. ♦

Jessamyn Sheldon
and D. Shah (teacher)

3393

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Effect of Colored Lights on Radish Growth

This project was conducted to find out how different colors affect radish growth. Bamboo skewers were placed in soil to support cellophane tents over the seeds. Sunlight and grow lamps provided light. The result was that plants grown in pale color lights grew taller and those in dark lights were smaller. In conclusion, lighter colors grew the tallest, healthiest plants, while dark colors grew smaller plants. ♦

Jeannine Garcia
and D. Shah (teacher)

3394

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Ants' Preferable Choice Between Sugar and Cheese

This study examined the question of what preferable choice ants would like better between sugar and cheese. The sugar and cheese were 152.4 millimeters apart from each other when the ants crawled to whatever food they desired. The amount of ants that crawled to the sugar and the ants that crawled to the cheese were observed and recorded. Each experiment was repeated 10 times. The ants favored sugar more when the food was 152.4 millimeters apart. When the distance was changed to 76.2 millimeters according to the variable, the ants' preference over the sugar and cheese was unaltered. The results suggest that granulated sugar is more likely ideal to ants than mozzarella cheese. ♦

Alice Kang and G. Zem (teacher)

3395

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Growth of Plants in Artificial Light or Sunlight

This study observes what environment a plant would grow better in, a plant that is grown in artificial light or a plant grown in sunlight? I first planted two seeds in two different cups with about one inch of soil above each seed. Next, I put one cup outside where the plant could receive sunlight and I put the other one inside next to a lamp where it could receive artificial light. Everyday after I planted the seed I would go out and water both plants equally, not too much when the soil looked damp but not too little either. To observe the growth of the two plants, I would record how many leaves each plant had and measure the length of the leaves every three days along with the plants. The results of this experiment stated that a plant is able to grow better in sunlight than in artificial light. ♦

Proving Galileo Correct

My topic is inertia and proving Galileo correct. Aristotle did not know about inertia, therefore he could not discover what Galileo discovered. Galileo discovered inertia, the tendency of an object to resist acceleration. Due to this Galileo could easily disprove Aristotle. To prove this Galileo rolled a ball down a slope and proved that a ball picks up equal amounts speed in equal intervals of time. He was the first to do this in 200 years since Aristotle. I redid this experiment and found that indeed Galileo was correct. I found speeds of three balls at three slopes. My data showed the same information that Galileo stated.

For my experiment I have done this test three different times with three different balls. The balls weighed 5.51 grams, 27.34 grams, and 54.7 grams. I thought that the heavier the ball and the steeper the slope the faster the ball would go. I used a ramp where I would be able to easily change the angle for the different tests. The ramp was a baseball net that I laid a piece of plywood on that I could easily adjust. I dropped the ball from the top of the ramp and timed how long it took the ball to get to the bottom. I ran the test five times with each ball on each slope to reduce the amount of human error. In the end I found out that the lighter the ball and the steeper the angle the faster that ball made it from one end to the other. This shows that a rolling ball will pick up equal amounts of speed in equal intervals. ♦

Are the Length and Height of a Bridge Related to the Amount of Weight It Can Hold?

This experiment examined the relationship between the length and the height of trusses of bridges and the amount of weight that they can hold before collapsing. Six different sized bridges, all based on the same basic truss design, were built out of popsicle sticks, rectangular pine dowels (5 mm x 10 mm), and were glued with a hot glue gun. The bridges were designated by number for the three different lengths and a letter for the two different heights. No. 1 bridges were 1'3" long, No. 2 bridges were 2'3" long and No. 3 bridges were 3'3" long. Letter A bridges had 4 1/2" tall trusses, and B bridges had 2 1/4" tall trusses. The bridges were spanned on two concrete blocks. Bricks were stacked onto the bridges until they collapsed. The conclusion made was that the lower, 2 1/4" truss failed with less weight than the 4 1/2" trussed bridges. Bridge 1A broke at 181.635 pounds, bridge 2A broke at 95.25 pounds, bridge 3A broke at 74.125 pounds, bridge 1B broke at 150.75 pounds, bridge 2B failed at 68.375 pounds and bridge 3B failed at 69.875 pounds. After graphing the length of the bridge and the amount of weight at which the bridges broke, there was a clear parallel curve between the shorter and deeper trussed bridges. The two longer bridges with the shorter trusses failed by torsion (overturning). Looking at the graph, it is obvious that the weights that caused this failure are not congruent with the projected point of failure. The error is approximately 12.4 pounds. This error could be fixed with several design changes in the truss and the length: width ratio of the bridges. After graphing the relationship of the weight of the bridges and the weight that caused a failure, there was a similar parallel relationship in this graph as in the length: weight ratio graph. ♦

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Projectile Motion

The problem that I was trying to solve with my Technion Project was whether an object dropped from a certain height will fall at the same speed as that same object but given kinetic energy parallel to the ground. This topic is referred to as Projectile Motion. The way I tried to prove my hypothesis was by measuring how long it would take for an object to fall from different heights. My object was a rubber bullet, and I would then take the rubber bullet and shoot it out of a fake gun, timing how long it takes to reach the ground. I timed these using a stopwatch, and measured the different heights (0.5m, 1m, 1.5m, 2m) using a meter stick. I did each height many times, so that my results would be more accurate. I found that when I did my experiment, the time taken for the bullets to hit the ground from the different heights was very similar to the times of the shot bullets, and they differed by only a couple hundredths of a second. I also measured how far each bullet went, so I could calculate the speed of the bullets, and show that they were traveling at a considerable speed. The calculated speed at which my gun shoots out the bullets is about 13 meters per second. After I got my results, I calculated analytically how long it should have taken for the dropped bullet to hit the ground. To calculate this time, I used the formula $h = \frac{1}{2}gt^2$ where h is the height, g is the gravity, and t is time. I found that they were very similar to the experimental data. I calculated the percentage error between the accepted/analytical value and the experimental one, and it was about 2 percent. This was enough to verify that my experimental values were reliable sources for conclusions. Since the dropped values were valid, and they were the same as the shot values, my hypothesis was correct.

My main source of information besides the Internet was the book *Lecture Notes on Physics* by Richard Feynman. This book had every formula that I needed, and provided me with a good understanding of my overall topic. This experiment would have been even more effective had I been able to use more precise equipment, higher heights, and faster guns so that I could show my hypothesis under more extreme conditions. ♦

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Do Emotions Affect How Much a Person Blinks?

The study examined eyes of a group of people who watched four scenes, two minutes long, in movies such as *Freaky Friday*, and *Harry Potter and the Chamber of Secrets*, which are both rated PG. The types of scenes included a blank scene, such as a blank tape, a funny, sad, scary, and romantic scene. Each person in the group would have the same environment such as the same lighting, background sound, etc. Recorded were how many times each person blinked in those two minutes of each scene. The results were that the most blinks were in the sad scene. For half of the subjects, the blink rate decreased during the scary scene. The funny and romantic scenes didn't lead to any conclusions about blinking. ♦

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Music's Effect on People's Heart Rate

This study tested how different types of music affected people's heart rate. There were nine volunteers gathered to be experimented on. This experiment included taking their normal heart rate and then their heart rate while listening to different samples of music that varied in tempo. An index finger was placed near the volunteers' wrist or neck to take their heart rate for 10 seconds. This was done during each song sample twice to assure accuracy. After the pulse for 10 seconds had been taken, it was then multiplied by 6 to get the final heart rate measurement for 1 minute. When beats in the songs got faster, so did the person's heart rate. The classical sample had the slowest tempo and it made most of the volunteers' heart rates go lower than their normal rate. The techno sample had the fastest tempo and it made many of the volunteers' heart rates race up drastically. After evaluating how each person's heart rate reacted to the different music samples, the final results suggested that as the tempo of the music that was listened to sped up or slowed down, so did the person's heart rate as it corresponded with the tempo. ♦

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Dyes

For my Technion project, I chose to test the color-fastness of chemical and natural dyes. I think this is important because chemical dyes have a chemical in them called PPD, which has been linked to illnesses such as bronchial asthma and dermatitis. If the natural dyes were to prove that they were just as color-fast as the chemical ones, then people wouldn't have to gamble with their health for the sake of vanity.

I thought that the chemical dye would be more color-fast than the natural dye and I proved to be right. I had many controls. Each bunch of hair used contained 60 hairs. For the chemical dyes 5 cc of dye was used for each "bunch." For the natural dyes, 20 ml of dye was used for each "bunch." To wash out the hair, 50 ml of water was used with 1 cc of soap and stirred together for 30 seconds. The mixture was then poured through a sieve and was repeated two more times. The chemical dyes stayed in the hair and didn't wash out until about the 8th wash. However, the natural dyes washed out after one wash.

For my equipment, I used a graduated cylinder, test tube, beaker, funnel, and small cups. There were also five different chemical dyes and an assortment of natural ingredients. I used seven websites and one book. The websites were about chemical hair dye, the anatomy of hair, and natural hair dye recipes. The book talked about cosmetic ingredients. My bar graph shows, by color, how many washes it took to take the color out of the chemical and natural dyes. In conclusion, I feel it would be a healthier choice to use natural dyes to color your hair, although it doesn't necessarily mean it is the most practical choice. Unfortunately, chemical dyes hold their color longer on the hair shafts and, therefore, work the best. ♦

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Effect of Sugar on the Growth and Germination of a Seed

The main goal, or objective, of this project was to test if sugar could act as a stimulant for plants, and make the plants grow faster. Glucose, or sugar, is naturally produced in plants during the process of photosynthesis. Giving a plant sugar could synthetically allow the plant to skip the process of creating food, or at least shorten the time required. The methods used in this experiment consisted of basically planting 6 sunflowers, and stimulating 3 of the plants with sugar. The average sunflower seed takes about 9-15 days to germinate and takes about 2-3 weeks to grow more than one pair of leaves. The plants watered with sugar germinated within 5-6 days and grew more than one pair of leaves within 2 weeks or less. The sugar did, in fact, allow the plants to grow faster, taller and more plentiful. This went with the hypothesis that stated the sugar would stimulate the plants. In conclusion, the sugar did play a role in feeding the plants synthetically. ♦

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What Sewing Machine Stitch is the Strongest Against Tearing?

This experiment examined what is the strongest of sewing stitches. It tested a 1 mm straight and zigzag stitch, and a 4 mm straight and zigzag stitch. Three tests were conducted for each stitch. It was hypothesized that the 1 mm straight stitch would perform the best. Force was applied to the stitch, in the form of stretching in a lateral position, to test the hypothesis. This was performed with water. The results proved the hypothesis accurate, making the 1 mm stitch the most durable of the tested stitches. ♦

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Effects of Water, Fluoride Gel, and Baking Soda on Decalcification of Teeth in Vinegar

This study examined what element worked best against decalcification of teeth in vinegar. The experiment took place over the same three days. The vinegar used in the experiments allowed simulation of the decay of teeth by natural food in a much shorter time frame. Each of three boiled eggs was put into 250 mL of vinegar as the control. Three other boiled eggs were each added to 250 mL of baking soda and 250 mL of vinegar. Three more boiled eggs well coated with fluoride were each put into 250 mL of vinegar. Finally, three boiled eggs were each put into 125 mL of vinegar and 125 mL of plain water. This experiment was done three times, and the results were the same in all of them. Baking soda protected the eggs the most, not letting them decay in the vinegar at all and the shells stayed as hard as they were before being added to the vinegar. The fluoride gel didn't protect the eggs well and the egg shells completely dissolved. The water partly protected the eggs, but half of the egg shells had dissolved. The results suggest that baking soda works better against decalcification of teeth in vinegar than the other elements tested. ♦

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How Mice Learn Best

This study examines the learning patterns and capability of *mus musculus*, the common house mouse. A maze was constructed, and nine mice were run through the maze. The mice were divided into three groups with three mice per group. In group A, or the learning group, each mouse was led through the maze by peanut butter on a cracker, then let through on its own. The three times were averaged to two minutes and 9.9 seconds. In group B, or the pre-taste group, the mice were allowed to nibble the peanut butter in the start box before beginning. There was peanut butter placed in the end box, and the mice were allowed to run to the end of the maze. Group B's average time was one minute and 34.55 seconds. Group C, or the observation group, was tested last. They were placed in a clear tank above the maze and allowed to watch as the other mice ran the maze. This group's average was one minute and 34.49 seconds. The end results are inconclusive, but suggest that mice do not remember complicated patterns such as the route through a maze. ♦

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Blood Pressure - What Affects It?

My project is based on blood pressure, and the varying factors in individuals' lives, which might affect blood pressure rates. I wanted to discover which factors affect it most, and in what ways. The variables that I used were age, weight, gender, stress, level of activity, and diet. I found some random people, took their blood pressure, and asked them about those aspects of their life. I then made data tables, which I used in order to compare blood pressure rates versus different aspects.

I used a certain piece of equipment to gather my data. The instrument used to measure blood pressure is a blood pressure gauge, or "sphygmomanometer." I used many sources to obtain my information. I used a couple different encyclopedias, a few websites, and two books on health problems. The blood pressure rates that I recorded during my experimentation ranged between 108/74mm Hg and 148/90mm Hg (systole/diastole). The average blood pressure rate is 120mm Hg/180mm Hg. I measured the blood pressure rates of people between the ages of 10 and 72, and weighing anywhere from 85 to 200 lbs. Rates were taken after the people were sitting down for 3 minutes. Data was graphed, and the factor that had the most direct variation with blood pressure rate was age.

Looking over my results again, I saw which factors mostly affected the blood pressure rate. Blood pressure increased as age increased for all of the people that I experimented on. Weight only mattered for some people, as their blood pressure rates got higher; for others, it remained the same. Men generally have higher blood pressure rates than women, and stress and higher levels of activity make blood pressure rates greater. Different diets did not seem to change blood pressure rates. Blood pressure is an important part of the way our body works, and it should be measured once in awhile to make sure we are healthy, and that we are not at a risk for any harm to our bodies. ♦

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Effects of Different Types of Music on Human Blood Pressure

This study examined whether different types of music could affect blood pressure in different ways. It uses rock music and classical music and examines the effects. Blood pressure was measured with an automatic wrist blood pressure monitor. Five people were tested in this experiment. A control blood pressure reading was taken, followed by a reading while listening to classical and while listening to rock. The results suggest that music does affect blood pressure, but that which type of music affects it in which way depends on the person. ♦

Angel Rodriguez
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3408

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Which Bandage Sticks to Human Skin the Longest?

This study examined the question of how long different kinds of brands can stick to human skin. Each bandage was stuck to the skin and every day the condition of the bandage was recorded. The total time the bandage stuck to the skin was also recorded and then the time lengths were averaged out. The results of the average showed that the Coralite Antibacterial bandage lasted the longest out of the four brands tested in this experiment. ♦

Yujin Park and D. Shah (teacher)

3409

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Segregation of Particles By Size By Shaking

This study examined the question of the possible segregation of particles by size. A mixture of red beans (0.8cm x 0.6cm x 0.5cm) and rice (0.6cm x 0.3cm x 0.2cm) was explored by shaking it in a jar (14cm high and 8cm in diameter) horizontally under gravity. As the number of shakes increased, the larger red beans gradually rose to the top, while the smaller rice grains settled down, eventually forming two separate layers. No appreciable segregation was observed for the mixture of pinto beans (1.3cm x 0.8cm x 0.5cm) and red beans, as they were similar in size. The results suggest that particles are subject to segregation by size when shaken, and that the larger particles settle at the top of the mixture. ♦

The Effects of Cigarette Smoke on Lettuce Plants

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This study examined the effects of cigarette smoke on Italian lettuce plants. Plants were grown in a large 2 gallon storage box, covered with a top attached to two plastic tubes. On one box the smoke from cigarettes was blown in, and left to settle overnight. The experimental group was exposed to smoke every day in the morning and at night, and the control was left alone. They were watered every two days, as well as measured. The plants were measured over a period of 28 days, and the results tallied over 14. The results suggest that despite the smoke, the experimental set lasted longer and grew healthier than the control, even though they may not have been able to be eaten. ♦

Does the Type of Bread Affect How Quickly Mold Grows?

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My experiment shows if the type of bread can affect mold growth. Such as, if potato bread gets mold, will the mold grow quicker or slower than on 100% grain bread? I think out of the four breads that I have (potato, 100% grain, English toasting, and buttermilk), the buttermilk will form mold last and the English toasting bread first. Molds tend to grow on food only if it is damp. That is why bread can easily form mold because it is porous and can suck up moisture. This allows the mold to grow on the damp patch. ♦

Straw Bridges

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The purpose of this experiment was to discover which bridge between the beam, arch, and suspension bridges could hold the most weight. During the experiment I examined each bridge's strengths and weaknesses and how forces affect the stability of each bridge. Based on the amount of weight each bridge could hold, I calculated the amount of weight real beam, arch, and suspension bridges could hold. I started with three hypotheses: The suspension bridge would hold much more weight than the arch and beam bridges, with the arch bridge holding more than the beam bridge; the longer a bridge, the more it could hold; and support beneath a bridge is important. I received most of my definitive information from <http://www.howstuffworks.com/search.php?terms=bridges>. To test each bridge, I made a model of each type of bridge using fifty straws and pins. I added weight to each bridge until it fell off. Three-quarter inch washers were used for weight, with each washer weighing one-tenth of one pound. Each end of each bridge was placed on a chair with each chair being exactly fourteen inches from one another. I tried eliminating all possible variables to obtain the most accurate calculations possible. As hypothesized, the suspension bridge held much more weight than the other two bridges, with the arch bridge coming in second. The range of weight was ten pounds to 2.8 pounds. My hypothesis, the longer a bridge is the more weight it can hold, was incorrect because it is easier for the center of the bridge to bend. Both the suspension bridge and arch bridge had much support beneath them while the beam bridge had none. The suspension bridge had the most support, which explains why each bridge finished with the amount of weight it did. The two forces that act on bridges are compression, which pushes down on the bridge, and tension, which stretches the bridge; these two forces are more concentrated at the center of the bridge. The more a bridge can reduce these forces, the more stability it has and it can hold more weight. ♦

Jasmine Gabae
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Loss of Hearing

For my Technion project, I decided to do something that would interest me very much. I decided to find the relationship between the coming of age and the loss of hearing (known as Presbycusis). I have always wondered why it is so much more common for elderly to have hearing loss than everyone else. My hypothesis is that: the more one ages, the more the level of their hearing decreases due to nerve damage. So, I did some research on the topic, and with the help of a certified audiologist, I did some testing on five elderly patients and one middle age patient. I tested three male and three female elderly subjects between the ages of sixty-five and ninety (which I observed at an elderly day care center), in addition to the middle age working patient. I tested both the right and the left ear of each patient at a time. I tested these patients several times at different frequencies in order to observe them and determine which frequencies they can hear and react to. I tested these patients at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz and 8000 Hz. The intensity of the pure tone sound (the ringing noise the patients are supposed to react to if they are able to hear it) was measured in dBHL units. As an assistant to the audiologist, it was my duty to find the threshold point in each individual (the level at which the tone is so soft that it can only be perceived fifty percent of the time it is presented). In order to find the threshold I had repeatedly given different amounts of intensities to each patient until I could find the exact point at which the patient could identify the sound. In order to show that they heard the pure tone (the sound), they would push a buzzer to confirm that they were able to hear the tone (whether clear or faint). This process would be done until the exact threshold was found and confirmed three times. ♦

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Energy and Velocity

I am working on a project in which I will find the relationship between energy and velocity on the roller coaster "Superman the Escape" at Six Flags Magic Mountain. I hypothesize that the faster the train moves the greater kinetic energy it creates. And also, the higher the train has traveled, potential energy increases. I will also be researching the details and effects of weightlessness. Why does it come? What is it? When does it come? I don't really know what weightlessness is. I just know that when I went on this ride, I felt weird, and I found out that I was weightless during that time.

I got an information paper from Magic Mountain, which gave me data about acceleration, height, and track length. These values helped me with my calculations to find the velocity for every second. Since the time was not listed, I brought my stopwatch with me to Magic Mountain and timed the ride when I rode it. I had all my data to make a graph of velocity. Once I made that graph, I was able to make the energy graph. I also researched weightlessness from various sources.

I was able to make my graphs, and the highest point of potential energy is at the highest point at which the train is not moving. My hypothesis about this was correct. I stated that the higher the train travels, the higher potential energy. And at the highest point, it's the highest potential energy. I was also correct about kinetic energy. I found out that weightlessness comes when an object falls from rest onto the earth's surface, or when gravity is the only force acting upon it. ♦

Sunblock

Scientific research has proven that ultraviolet rays severely damage the human epidermis. In analyzing this conclusion, I conducted an experiment to see if an acne face wash and sunblock make a significant difference in reducing UV waves. My hypothesis was that skin which has been cleansed with Neutrogena Acne Wash, without the use of sunblock, would be damaged the fastest because the chemicals in the wash would damage the quality of the skin; and without sunblock the UV rays would be more attracted to the skin. In carrying out my experiment, I used cowhide (leather) because it reacts similarly to UV radiation as human skin. I cut three pieces of leather. I washed two pieces with Neutrogena Acne Wash; I left one piece with soap, and I put sunblock spray of SPF 30 on the other. I did nothing to the last piece. For a period of twelve days, I re-enacted this procedure and placed the leather in the sun under a glass cover and over a piece of foil. Over these twelve days, all the pieces of skin changed textures from being inflexible to flexible and wrinkled, and the skin with sunblock changed color.

Sources (Physical Science textbook) claim that glass shields the epidermis from UV radiation, so I experimented to see if this was true. I proved this statement false because within the twelve days or sixty-seven hours the skin was under the sun, its appearance and texture changed; therefore UV rays penetrated the glass. For this procedure, I used: pieces of cowhide, acne wash (1.03 g per piece, except one), tap water, foil and a glass cover. In order to measure the amount of UV radiation being absorbed, I did another test with UV sheets and different amounts of face wash and water to see if the wash absorbs or shuns UV radiation. In this test, I used acne wash, a plastic sample holder, a graduated cylinder, a coffee stick, a medicine drop squeezer, water (10 mL), a protective cover (with transparent sheets), solar-graphics paper, a scale, and a metallic tray. In conclusion, I have concluded that the acne wash maintains or protects the epidermis from harm when a reasonable amount is used. ♦

The In-Seed Story

My report is plants' seeds. My hypothesis was: did every seed have stored food, seed coat, embryo and cotyledon? My theme was right and wrong. Not every seed had every three important parts like the corn and the bean. But there were similar seeds to prove my hypothesis. It was a bit difficult to open the seeds and use a hand lens to examine them. My conclusion was that a seed couldn't survive without water, soil and sunlight. But a seed can survive with a stored food, seed coat, embryo, and cotyledon even if it doesn't have any that a seed should have. ♦

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Pressure on Human Body

The pressure on Mt. Everest and how it affects the human body is a very complicated subject that has finally been solved. The other subject dealing with pressure is how pressure changes according to the altitude that one measures the pressure. My hypothesis is that my measurement for pressure at sea level will be the greatest amount, and as I reach higher altitudes, the pressure level will decrease. Another part of my hypothesis is that the pressure on Mt. Everest negatively affects the human body and it is deadly for a human to be on Mt. Everest without an oxygen tank. The method that I chose is the most effective. My method was that I would measure the pressure at different altitudes in the city of LA and then create an equation with the data I got. My second method, referring back to Mt. Everest, was that I had the theoretical equation of pressure and I solved for the pressure of Mt. Everest using the theoretical equation. My results were very expected and I got the numerical values that I anticipated. I performed my experiment over and over. Doing this, I would be able to receive a mean for the pressure at each altitude. The control I had was that I set the correct altitude on the altimeter according to what the altitude was at the area where I was recording my data. I used the encyclopedia *Encarta* to receive some of my data on the pressure of Mt. Everest and several concepts about pressure. I also used websites like Google, answers.com, and howstuffworks.com to get much of my data. These sources were very helpful and reliable and were the basis of my project. The ranges of altitudes that I performed my experiment in were between sea level and 5710 feet. My pressure that I received for that range of altitude ranged from 25.1 in/Hg to 29.857 in/Hg. These values were calculated at about 75°F weather. My conclusion is that my hypothesis was completely correct in what I thought was going to be the outcome of my research. ♦

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Sunscreens

Is SPF 45 sunscreen really three times stronger than SPF 15 sunscreen? Does it last three times longer? I hypothesized that a sunscreen with SPF 45 is three times as strong as a sunscreen with SPF 15. If I used SPF 45 I would only have to apply it once instead of applying SPF 15 three times in a period of 5 hours. Sunscreens provide protection against UVA and UVB rays by creating an additional layer the sun has to penetrate before reaching the skin. The sun gives off many different frequencies of electromagnetic waves. Two of these frequencies are: UVA (ultraviolet-A), which are lower frequency electromagnetic waves, and UVB (ultraviolet-B), which are higher frequency electromagnetic waves. UVA rays penetrate the skin deeply and cause skin wrinkling and some skin cancers. UVB rays are considered the main cause of skin cancer.

To test whether SPF 45 is three times stronger than SPF 15, I created an experiment in which I used apples as a substitute for my own skin. Apples have similar characteristics as human skin: cells full of water, vitamins, and sensitivity to prolonged exposure to the sun. Also, it is more accurate to measure the difference in SPF on an apple (calculating % change in mass) than on human skin (seeing the difference of color). To determine the difference in strength of sunscreen, I coated the slices of apples with the same amounts of sunscreen and calculated the percent change in mass. In this experiment I used one apple with SPF 15, one apple with SPF 45, and one apple with no sunscreen on it. The equipment I used in this experiment is the electronic scale (measured in grams), 3 granny smith apples (approximately the same size), different color thread (red, green, blue), paper clips, hanger, knife, cutting board and apple corer. The apple without sunscreen is used to make sure that the sunscreen is not responsible for causing any water loss. By having three samples it will show that the apple slices with the sunscreen on them might

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do the opposite effect of preventing water loss and might speed up the process. After examining and comparing the apples, their data conclusions were found.

I expected SPF 45 to be three times stronger than SPF 15. Since the % change in mass for the SPF 15 apple was -21% I would expect the SPF 45 apple slice to have a % change in mass of -7%. However, its % change in mass was almost double that, - 13%. This demonstrates that SPF 45 is not quite twice as strong as SPF 15. Sunscreen does prevent water loss in apples. The control apple slice lost 33% of its initial mass, which is far more than the apple slice with SPF 15. ♦

3419

Yama Fazli and D. Shah (teacher)

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Mold Growth on Cheese Over Time

This research observed mold growth on various types of cheeses. Five different types of cheeses were dunked in water and left outside until the growth of mold was noticeable. This method was repeated 3 times over the course of 4 weeks. Feta (the quickest) on average took 96 hours to grow mold, while Rancho Cacique (the slowest) took 184 hours to grow mold on average. The results suggest that Feta cheese is most likely to grow mold first, then Blue, Cheddar, Mozzarella, and lastly Rancho Cacique. Inclusively, Rancho Cacique would be the most favorable cheese to take with you on an outing. ♦

3420

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Earthquakes' Effects on Ants

This experiment tests the ants' intelligence and what the ants do during and after an earthquake. The ants must be put into an environment that looks like their home. That would make their behavior more natural. Artificial earthquakes must be made. The results were amazing. The ants refused to leave the den, until there was no more hope for the den. In conclusion, the ants are very devoted to their home and are smart enough to know when it's time to abandon their home. ♦

Natasha Yashar
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3421

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Resonance of Piano Notes

My Technion project is measuring the abstractions of resonance in each piano key. This experiment takes much thinking and processing in order for the project to be legitimate and clear. My hypothesis is that the resonance and the wavelength of any piano note are reversely related to each other. The lower notes have a bigger wavelength and smaller resonance whereas the higher keys have smaller wavelengths and bigger resonance. I had to collect data which included measuring the length of each piano string A0, A4, A7, and D1, D4, D7 octave notes (there are seven octaves on the piano for each key C, D, E, F, G, A, B - the number indicates which octave it is on the piano) with a tape measure. Some values for the measurements of strings A0 were 1105 mm and A7 was 59 mm. I purposely measured different extremes of numbers to show the change in measurement and vibration. There were some variables I had to control such as making sure the tape measure was measuring the exact key in the right place because it could move out of place. In order to find the resonance, or vibration, of each key, I had to use a machine called Sanderson Accu-Tuner II, which can tell you the value for the vibration once the specific key is pressed down on the piano. For example, the measurement for D1 was 38.89 Hz and D7: 2488.96 Hz to show the difference in vibration when you go up and down the piano. I used a tuning hammer to see the change in tension for the lower strings and the higher strings on the piano and came to find that the more tension there is on the note, the faster the vibrations were; but the lower the tension was, the lower and smaller the vibration was. Some book sources such as *Physical Science Second Edition* have helped me understand the fundamentals of resonance and strings. ♦

Ryan Weiss
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3422

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Why Curve Balls Curve

My project was on the topic "Why curve balls curve." I believe that curve balls curve because of the combined force of the pitcher throwing the ball and the force created on the ball. The force created on the ball is made by the spin of the ball. When the ball spins, on one side there is an increased velocity on the air currents passing by. This is because the ball is spinning in the direction of the air currents. The other side has the opposite effect. Since the velocity of the air currents is speeded up on one side and reduced on the other, the amount of pressure is different on both sides according to Bernoulli's principle. This force pushes the ball sideways while the force from the pitcher pushes it forward. I believe that the combination of these forces the ball to curve.

I have conducted an experiment in which I tested Bernoulli's principle. When air was blown in between two hanging ping-pong balls, they went in toward each other instead of away like most people would have expected. Also, I tried to figure out how much a curve ball would curve using math. I used the velocity of the ball, the rotations of the ball per second, the air pressure, the difference in pressure on the sides of the ball, the distance to home plate, and the time it takes the ball to go from the pitcher's mound to home plate. After my calculation, I concluded that a ball traveling 40 meters per second, rotating 30 times per second, and with air pressure at about 1.2 kg/m^3 would curve 0.289 meters (the rest of the units can be found with these units). Two sources that I used are www.exploratorium.edu/baseball/curve.html and www.grc.nasa.gov/WWW/K-12/TRC/Aeronautics/Ping_Pong_Curve.html. There are a lot of physics behind the mysterious curveball. ♦

How Long Bandages Stick to Human Skin

Bandages are adhesive tape-like bands used to cover a minor wound. There are chemicals, which a bandage contains, that allow it to stick to human skin for the longest duration of time. This experiment tests which type of bandage can stick to the human skin for the longest duration of time. This experiment shows that out of 7 different types of bandages, the plastic type sticks the longest. There must be something with the plastic that allows it to stay on longer than the rest of the bandages, which seem to be made out of a soft cloth-like substance. The plastic type is obviously plastic. Apparently, it is not only the chemical substance that makes the bandage adhere, but it also depends on what type of bandage is being used, as the material that the bandage is made out of plays a role in keeping it on longer. All bandages have the same chemical substance that acts like "glue" on human skin. Thus, it really is the material that the bandage is made out of. The results show that since the plastic type is the longest lasting, then plastic helps bandages stick to the human skin longer than the regular cloth kind. ♦

Effects of Miracle-Gro Soil on Pansies and Spinach

This study examined the question of whether or not Miracle-Gro soil affects plant growth. The two types of plants chosen to be the test subjects were pansies (*viola x wittrockiana*) and spinach (*spinacia oleracea*). Six pansies and six spinach were planted in Miracle-Gro soil, while another six pansies and six spinach were planted in organic soil. Over four weeks, the heights of the plants were measured and recorded. Miracle-Gro soil seemed to have the best effect on plants because the averages of the plants grown in Miracle-Gro were slightly higher than those in organic soil. ♦

Effects of Vitamin C on Marigolds

This experiment examined how marigolds react when they are treated with vitamin C. The marigolds were left on a windowsill each day. The experimental marigolds were watered with a vitamin C and water mixture. The control marigolds were watered with spring water. All marigolds were watered every 36 hours for 2 weeks. The marigolds watered with vitamin C germinated later than those watered with spring water. They also grew a lot less. The results suggest that marigolds should be watered with spring water for best growth results. ♦

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Do Violas Grow Best Under Sunlight, a Grow Bulb, or a Light Bulb?

This study examined whether certain plants grew better under different kinds of light. The plant *Sorbet Purple Duet Viola* was used under sunlight, a grow bulb, and a light bulb. Three plants were tested under the same lights. Each plant was watered 1/6 of a cup a day, and was kept under the lights for varying amounts of time, lasting until sunrise to sunset. Results concluded that plants under light bulbs grew the best. ♦

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Effect of Gibberellic Acid on the Growth Rate of Dwarf Peas

This study examined whether growth hormones (gibberellic acid) affect the growth rate of dwarf peas. Dwarf pea plants were sprayed with or without a solution of gibberellic acid. The experiment was repeated three times. Application of gibberellic acid slightly increased the growth rate of the treated peas, and also increased the number of leaves on each plant. The results suggest that gibberellic acid could be used to enhance crop production. ♦

Ariela Pier and
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3428

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Hair Relaxing

Hair relaxing is a technique of permanently straightening hair, which many women choose to do. I always wondered if people with curlier and thicker hair needed a longer time period to straighten their hair. I also wondered if people with curlier hair needed a stronger relaxing cream in order to make their hair as straight as someone with thinner hair. My hypothesis was that the people with the thickest hair do need to have the cream in their hair for a longer amount of time, and people with curlier hair do need to use a stronger cream. After much testing, I found that both my hypotheses were correct.

In order to prove my first hypothesis, I started off by measuring the thickness of the women's hair (in cm) using a tape measure. The thickness ranged from about 8 cm to 20 cm. Then, using a ruler, I measured (in cm) the amount of curls that were in 5 cm of their hair. This ranged from about 1 curl to 5 curls. Once I knew the hair's thickness, Edison, the hairstylist, applied the relaxing cream. Using a stopwatch, I timed how long the cream was in the women's hair (in min) before it became straight. The process took between 12 and 18 minutes. When I did this experiment, I realized the women with the thicker and curlier hair had to have the cream on for a longer amount of time.

To prove my second hypothesis, I simply observed the cream strength that Edison used on the different women since I already knew the curliness of their hair. As I suspected, the women with the curliest hair had to use a relaxing cream with a strength of 5, while the women with straighter hair had to use a relaxing cream with a strength of 1. ♦

Improving Microphone Sensitivity

The goal of the project was to understand how to improve the sensitivity of a microphone using parabolic reflectors. My hypothesis was that when the sound is reflected by a concave parabolic surface, the sound is amplified. In order to conduct the experiment I used a bowl as a parabola and I drilled a hole in it in order to pass the microphone through, attaching wire hangers at three different equidistant points on the rim, keeping the microphone firmly in place. The apparatus was hung four feet away from the computer speakers. The same sound file was played twice, once for each recording to ensure an identical source on each test. The sound recorder of the computer was used to capture the sound signal generated by the microphone. The software spectrum analyzer (Virtins Sound Card Spectrum Analyzer Version 1.1) was used in Oscilloscope mode to convert the sound signals to equivalent electrical signals measured in mV. My results were that with the side of a paraboloid shape reflector one is able to capture a higher amount of sound energy generated by the source. Paraboloids are the best curved surfaces to capture sound waves from distant sources. By reflecting the sound signals to a paraboloid's focal point, one is able to amplify and detect faint sounds which normally would not be audible. This is precisely what one does instinctively when cupping the hand behind the ear.

My hypothesis was proved correct and the results were as expected. If I had more time to go more in depth in my research I would have used multiple paraboloids to examine the effect of the size of the parabola as measured by its diameter on its amplification ability. ♦

Purification of Dirty Water

Today, fresh water is the main source of drinking water, but unfortunately fresh water sources are limited and not readily available in certain areas. Only 0.5% of the world's total water is fresh water, 97.5% of the earth is seawater, and 2% is other. It is becoming increasingly important for us to treat the water we have, including wastewater and dirty water, because seawater is often too expensive to treat and we are running out of other essential sources.

There are several ways to purify water but the method I tried was a cloth filter. I took several bottles of tap water and added a drop of red, green, or blue food coloring. I then passed each water sample through the cloth filter and took pictures of the water before and after it passed the filter in order to determine how much of the water was cleaned. I used a program called the WhatColor to help me determine the RGB (red, green, blue) values of the final experiment. For example, when I measured the red water before I had values of about 181 red, 82 green, and 45 blue and after I got values of 150 red, 139 green, and 139 blue. These values show that the experiment was a great success because the after values were very similar to the background wall. The wall was about 141 red, 145 blue, and 145 green, meaning that all the colors were very similar and 44% gray. The color of the after values was about 45% gray, therefore proving that the water was nearly clear.

Although the values came out to be pretty precise (according to color), I was not able to measure the turbidity (dirtiness) of the water and purify it to the point where it was drinkable. One easy way to kill bacteria, viruses and some chemicals is by simply boiling water. When water reaches 100 degrees Celsius, it begins to boil and then evaporates because the water molecules move faster in heat and go from liquid to vapor. In order to make the water pure, we must condense the vapor by cooling it. Boiling is one of the best and cheapest ways to clean water, and one of the easiest to do in emergency situations. ♦

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3431

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Botox

My project was on Botox and its chemical effect. I believed that through analyzing two different patients week by week, I would discover a difference in each patient's results. I would perform tests on each patient to see the condition of their skin. From that, I would see how Botox treats the skin and enhances it. From this, I would discover what elements Botox depends on. I concluded that Botox injections depend on the depth of the wrinkle and the thickness of the muscle.

I mostly used my patients as my "control," because I would weekly observe how their skin would change. I analyzed and compared their skin with tongs and a ruler. I was able to get hold of Botox injectors, and from them I would see how many units were being injected, and the number of milliliters used. I measured the percentage of change weekly, and calculated the difference between each week.

From this project I have learned that Botox does not deal with the skin. It deals with the muscle, and therefore, the muscle changes the appearance of the skin. I was not well equipped with "high-tech" materials, so I had to be creative with all that I had. Since Botox shows the results almost immediately, I wish I was able to see the patients daily, and I would therefore have had more accurate data. ♦

Chokkaku Otobe-Ando and
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3432

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Comparison of Memory Between Young and Old People

This study questioned which age group could remember things the best. Five facts were read aloud to the person and they then tried to remember all the facts. After testing three age groups to see whether or not they could remember all of the facts, it was concluded that students could remember the facts the best, which suggests students have the best memory. ♦

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3433

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Populations of Humpback Whales Endangered

Starting with the 17th century and until about the middle of the 20th century, the population of the *Megaptera noveangliae* was greatly affected by whaling and was on the brink of extinction. Among other countries, Japan and Russia stood out in the exploitation of humpback whales. Because of these countries' resentment to comply with the sanctions imposed against whaling by the International Whaling Committee, the efforts to raise the *M. noveangliae* population are still in jeopardy. If the strict restrictions that have been sanctioned against whaling and ocean pollution are withdrawn, then the rate of reproduction will not suffice and the *M. noveangliae* population will eventually become extinct. The method of tracking the growth of the population of humpback whales is either through aerial and naval sighting, or through the use of electronic tracking devices. The estimated pre-exploitation number of humpbacks was around 250,000. They were nearly wiped out until they were protected in the early '70s, which marked the beginning of the recuperation of the humpback whale population; however, the population is still in danger because the rate of reproduction is insufficient to make up for the number of whales killed, and if whaling is resumed, they will most likely become extinct. ♦

Explosion of the Sun

The sun is not only where we get our natural light from, it is also a star. As time goes by, it will eventually die, causing destruction in the solar system. My hypothesis was, if the sun were to explode, then the entire solar system would be destroyed, including all nine planets. The sun is a lightweight star, therefore it is smaller in comparison to heavyweight stars such as the pistol star. The stages of a lightweight star begin with the star being made up of gas and dust. Next, it will enter the phase called the main sequence in which the star begins to lose its mass. From the main sequence, the lightweight star then becomes a red giant, where the surface will expand and become gigantic because of the loss of hydrogen and energy that cools the star down. Finally, the sun (and other lightweight stars) will become a white dwarf. A white dwarf is a small, hot, massive object due to the fusion between elements, causing a gravitational collapse and causing the star to shrink and become warmer (this proves it will take a few hundred thousand years). Studies have shown that the sun's atmosphere will expand, and the sun itself will collapse in about 4 billion years.

I have been using sources from the internet, and definitions from my science text book in order to get the basic understanding of the project (and no, I have not been looking into the sun). Since this is mainly a theoretical project, I have not been able to use many pieces of equipment, but I have been looking through a telescope at the stars and observing the color and form. I am still continuing to see what the outcome will be when the sun becomes a white dwarf, and how life on earth will disappear. ♦

How Volcanoes Affect Weather and Nature

Everyone has heard of what they can do, some can survive to tell the tale, and others research to find more about this magnificent, but malevolent, natural disaster: the volcano. Volcanoes are an extremely interesting part of mother nature and I am very curious about this topic. I am mostly concerned about how the eruptions affect the weather, and how they affect nature surrounding the volcano. From an educated guess I have reason to believe that the temperature will get slightly colder and nature will eventually suffer from the eruption. I observed two similar plants, one outside in 80 degrees Fahrenheit and the other in a dark room at room temperature. Over the course of a week I was measuring the growth of the two plants that started equally at 30 cm long. By these numbers, hopefully, I will be able to find out the mystery of this experiment. At the end of seven days, there is a difference of three centimeters between the two plants. A volcanic eruption does affect the temperature and the nature surrounding the explosion. In the experiment I found out that an outside environment is microscopically better for a plant's survival than a colder and shadier area. Some flaws in the experiment could be not exact temperatures of a real life eruption. Also, the measures could be slightly off. These are some of the possible errors that could have occurred. However, due to the resources, the experiment was a success. ♦

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Weight Needed to Sink a Ship

For my Technion project I chose to conduct an experiment in order to figure out how much weight it would take to sink a massive cruise ship, in this case, Royal Caribbean's Adventure of the Seas (for information on the Adventure of the Seas see: http://www.Royalcaribbean.com/findacruise/ships/class/ship/home.do?jsessionid=000sahh04zG_qxUpDTDCV3nfko:v2mocbr0?br=R&shipClassCode=VY&shipCode=AD).

Before starting this project my hypothesis was that the combined weight of passengers and luggage would be much less than the amount of weight needed to sink the ship. I figured that because of this, the ship could hold many more people than its stated capacity of 3,114 passengers. The main goal of my project was to see if the combined amount of passengers and luggage is close to the amount of weight needed to sink the ship. After doing the experiments I have realized that there is much more weight on board that makes the maximum capacity of passengers on board so few for this huge ship. Some of the things that have substantial weight on the ship are furniture, food, safety devices, etc. In order for me to figure out about how much weight it would take to sink the Adventure of the Seas, I needed to do an experiment using smaller boats and set up a proportion to the cruise ship. I took two toy boats of different sizes and put different amounts of weight on top of them in the water and learned how much weight it took for the small boats to sink. I then set up a proportion that was the weight of the small ship over the amount of weight that sunk it, to the weight of the cruise liner over the variable x . I solved the proportion and arrived with my answer, which is about 1,380,000,000 pounds. The control for this project was the set amount of weight that I put onto each small boat. My range of values for sinking the small boats was 4.5 pounds to 5 pounds. This Technion project took time, effort, and patience but what it gave me was knowledge, experience, and understanding. ♦

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Tooth Decay

Tooth decay is a major complication in your mouth that may lead to many other diseases and/or complications. Tooth decay is the gradual breakdown of the tooth, beginning with the enamel surface and eventually progressing to the inner pulp. Tooth decay, though, is very much preventable, yet it is easily exacerbated if you do not take care of your teeth and do not maintain healthy oral hygiene. The effects of promotion and prevention of tooth decay take a period of time. In this experiment you will not see any improvement or deterioration because of the short time span taking place. For this experiment I needed a scale, various teeth, cups to put the teeth and solution in, dietary sugar, toothpaste with fluoride, and a ruler to measure the height and width of each tooth. I called three different general dentists and an oral surgeon to provide me with teeth. After numerous contacts, finally Dr. Maranon was able to provide me with teeth he had extracted. A major difficulty was getting the right scale as teeth are very light and household scales could not appropriately weigh the teeth. At first I used my kitchen scale, but it was not sensitive enough and didn't show the tooth mass because teeth are so light. I then borrowed a scale from Encino/Tarzana Regional Medical Center which was sensitive enough to measure the tooth mass. Clearly, I overcame various conflicts to conduct this experiment. I used a book source, many websites, and I interviewed Dr. Al Mindel, a dentist, to gather my information. The mass of most of the teeth was 0.25 grams, the height was 2 cm, and the width was 1 cm. Throughout this project I learned about the causes, effects, and everything about tooth decay. Decay formation is not a short term phenomenon, which is why nothing changed over my ten day experiment. Each individual can promote or prevent tooth decay, and it is important to maintain healthy oral hygiene so no other complications will occur. ♦

What Affects Cricket Chirping?

I have been researching the frequency of cricket chirping. My hypothesis is do crickets of different sizes react and chirp the same in different circumstances? First, I got crickets that were 0.5 in long and some that were 0.25 in, and tested out three of each size, in different temperatures and in the night and day. First, I used the crickets, and put them in a cricket tank. I had the heat lamp and thermometer to measure the temperature. I also used a stopwatch to properly calculate my results and used a camera to take pictures and a video camera to film the sequence. I learned after researching 3 different sets of crickets that crickets do not chirp during the day. I also learned that the 0.25 in crickets chirp about 1 to 2 more times in a 15 sec interval than their 0.5 in counterparts in the same temperature. I have concluded that crickets only chirp at night, and that the smaller the cricket, the more often the cricket chirps. I also concluded that the warmer the climate, the more often the crickets chirp. Actually, every degree warmer the temperature is, the cricket chirps approximately 1 more time. The ranges in my information were about 1 chirp for the cricket size, at a certain temperature. For example, my largest range was an average of 1 chirp per the 4 times at night I experimented. It was the 0.5 in cricket at 70 degrees, which ranged from 29.75 chirps per 15 sec interval to 28.75 chirps per 15 sec interval. I got my information from *Encarta* CD-ROM, encyclopedia.com, www.wellesley.edu/activities/homepage/web/species/acrickets.html, and www.insecta-inspecta.com/crickets/field.html. ♦

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Kush Gaur and D. Shah (teacher)

How Does High Temperature Affect the Magnetic Force of a Magnet?

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This study examined the question of different temperatures affecting the strength of Neodymium Iron Boron magnets. The Neodymium magnets were put at different temperatures, and the distance of attraction was measured between the "regular" magnet and the Neodymium magnet and recorded. Six different temperatures were tested at 5 trials each. This experiment was repeated twice. The results show if temperature increases on a magnet, then the magnet's strength will decrease. ♦

3440

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Swing of a Pendulum

The purpose of my experiment was to create a formula to predict how long it would take for a pendulum to swing one period (a swing back and forth). My hypothesis was that the original pendulum formula only works for small angles, less than 30°.

In order to do this, I chose 3 different lengths of fishing string, 12, 15 and 18 inches, and at the bottom of each string I attached a 2 ounce weight. I then measured the time it took for the pendulum to swing 3 periods. I did this 3 times for each string length at varying angles from 30° to 90°. Then I took the average of the 3 swing periods. I then divided that by three to get the average time per swing. Then I plugged in the numbers into the original formula, $T=2\pi\sqrt{L/g}$, to get the predicted time according to the original formula. I noticed that my average time per swing was different from the predicted time according to the original formula. So I created my own formula, which I call the new formula (FN). In order to figure out the new formula for large angles, I multiplied the unknown "x" by the original formula, $T_5=x(2\pi\sqrt{L/g})$. I then plugged in "x" into the new formula to discover the predicted time per swing according to the new formula. The predicted time in the new formula matched the actual time on the stopwatch. As the string got longer, the swing became slower. As the angle got larger, the swing became slower.

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I controlled the number of swings, the angles I chose for each string length, the weight at the end of the pendulum, and gravity. Although I had 3 different string lengths, I experimented with the same angles on each length of string and always swung it 3 times. And, of course, gravity was controlled. ♦

Jordan Ross and
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3441

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The Chemistry of Bleach

I set out to determine the effect of changes in concentration and pH on bleach effectiveness, hypothesizing that pH changes will have a greater impact than dilution. The oxygen in bleach removes stains by eliminating chromophore parts, which cause color. Clorox Bleach (pH 12.43) was diluted with water in ratios of 1:1, 1:2, 1:4, 1:8, 1:16 and 1:32 in 1 mL samples, or was titrated with hydrochloric acid (pH 1.49) to produce solutions with pH ranging from 12.43 to 3.10. pH was measured using a pH meter. Blue, green and yellow dyes were pipetted (10 μ l) onto a white paper towel, allowed to dry and subsequently treated with pure bleach or no bleach (controls), and with diluted and pH titrated solutions. Towels were scanned into a computer, images loaded into Photoshop Elements and each dye spot analyzed for luminosity (arbitrary units, AU). Data was entered into an Excel spreadsheet and graphed for each color and an average color, for both dilutions and pH titrated solutions. The relation between luminosity and bleach dilution was represented by 2nd-order polynomial trendlines (R^2 values >0.9) for all colors. The relation between luminosity and bleach pH was represented best by a 3rd-order polynomial trendline (R^2 values .796 - .849) with a threshold effect at pH <8 . Bleach had similar maximal effects on all colors, though the baseline luminosity was greatest in the yellow dye (190 AU), lowest in the blue dye (127 AU) and intermediate in the green dye (163 AU). These experiments conclude that titration of bleach pH to <8 has a much greater reduction in bleach effectiveness than dilution up to a ratio of 1:32. ♦

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3442

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E. Coli in Burgers

The nature of my project is E. coli in hamburger meat. I took pieces of burger meat in three different stages (raw, medium, well-done) and placed them into lactose broth, which is the perfect environment for coliform bacteria to grow. My hypothesis was that the raw meat would be most positive for E. coli and the well-done meat would have the least because the well-done meat had been cooked at a high temperature for a long time, killing off most of the bacteria. My results proved my hypothesis to some degree. The test tubes with the raw meat clearly had a strong presence of E. coli while the well-done had very little. The part that I didn't predict, however, was that the well-done and the medium were about the same, in terms of the presence of the bacteria. The conclusion I drew from these results were that raw meat, even when it is stored properly, is potentially the home to deadly bacterium and should be sanitized or cooked before eaten. Since this project had the potential to be very dangerous, I was very careful about the condition in which the test tubes were kept. I didn't want the fumes from the bacteria to leak out and I also didn't want other bacteria to contaminate my samples, so each test tube was equipped with a spill proof lid that I did not remove after the inoculation. There were several sources that I used to achieve my background information. I used books such as *The World of Biology* as well as *The New Encyclopedia Britannica*. I also used several sources from the Internet. This project taught me many things about biology and inspired me to continue investigating into the world of science. ♦

Overview of the Worldwide Population of Minke Whales, *Balaenoptera*

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The study was conducted on minke whales around the world and the effects of whaling upon their population. As minke whales are the single source of game for commercial whaling, they are hunted by the masses in countries such as Japan and Norway. These countries constantly exceed the quota for whales set by the International Whaling Commission (IWC). Data collected from the IWC records led to the hypothesis: If the hunting of minke whales does not stop soon, then the species will die out and become extinct. Population samples were collected via track lines used by boats in areas around the ice pack. The data was sampled during the summer in the Antarctic region, a place where minke whales gather to feast after mating. The information on the whales shows that the population of the *B. Acutostrata* generally decreased as the years passed by. Due to the actions of major whaling nations, the number of whales has gone down, but not significantly enough to affect the entire population greatly. The hypothesis was revised, as there have been sightings of an abundance of minke whales all over the world; however, if the minke continue to be hunted in numbers over the set quota, there will be a significant decline in population. ♦

Technion Project

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I have always been intrigued by the unusual characteristics of polymers, and I have wondered about what makes them such versatile and useful materials. When I played with "silly putty," I was amazed by the fact that it could be repeatedly shaped, tied, stretched, flattened, and rolled.

In general, a polymer is a naturally occurring or synthetic compound consisting of large molecules made up of a linked series of repeated, simple monomers. In this project I had a chance to prepare three polymers and study some properties that make polymers so unique, such as elasticity, dehydration and thermoplasticity.

Elasticity is a characteristic allowing resumption of former size and shape after being stretched. Thermoplasticity means that the elasticity of some polymers is affected by temperature. Dehydration of the polymer is evaporation of water.

In order to measure the elasticity of the polymers commonly known as slime and silly putty, I dropped them from a height of 30.48 centimeters, and then measured how high they bounced. I conducted these motion measurements three times: once after I chilled them in the refrigerator, then after they got back to room temperature of 25°C, then at a hot temperature after allowing my samples to sit in the sun. I used the following equipment: graduated cylinders to measure volume in millimeters, Pasteur pipettes, beakers, Erlenmeyer flasks, ruler to measure the bouncing distance in centimeters, and an analytical balance to measure the mass of borax and the mass of PVA in grams.

Materials used: water, borax, Elmer's white glue, talcum powder, food coloring, PVC, sebacoyl chloride, cyclohexane, hexamethylenediamine, sodium hydroxide, strofoam cups, wood stirring stick, plastic bag, glass vials and plastic vials.

In the following tables are the results, in centimeters, for slime and silly putty after each was released by me in a still position from a height of 30.48 centimeters.

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Bouncing Data			
	Room temperature	Cold temperature	Hot temperature
	10.16 centimeters	11.43 centimeters	0 centimeters
SLIME	12.7 centimeters	10.4 centimeters	0 centimeters
	9.7 centimeters	11.7 centimeters	0 centimeters
	7.6 centimeters	9.9 centimeters	.25 centimeters
	7.1 centimeters	11.2 centimeters	0 centimeters
	Room temperature	Cold temperature	Hot temperature
	0 centimeters	0 centimeters	0 centimeters
SILLY PUTTY	.25 centimeters	.25 centimeters	0 centimeters
	1.3 centimeters	0 centimeters	.25 centimeters
	0 centimeters	0 centimeters	0 centimeters
	.51 centimeters	.51 centimeters	0 centimeters

The results differentiate the two polymers. Their elasticity is affected by temperature. Slime is more elastic than silly putty. Chilling the slime did not affect its elasticity but warming it up decreased it considerably. This behavior is also related to their molecular composition and structure. In the future, I intend to investigate these various natural polymers in order to collect data relevant to their role and/or connection to living organisms.

Reference: Center for Applied Research in Education and Harold Hart, Leslie E. Craine, *Organic Chemistry Laboratory Manual 9th Edition*. ♦

James Noble and D. Shah (teacher)

3445

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Effect of Concave Mirrors on Light Beams

This study examined the effects of concave mirrors on light beams. A laser and a flashlight were shined into a concave mirror. The angles of incidence changed and rotated around the mirror. The angles were 40 degrees, 70 degrees, 100 degrees, and 120 degrees. They were bent upward into a wall. This showed that the concave mirror, bending inward like a cave, bent the light. The control was a light beam at 90 degrees. The result of this was no visible light. The end of the experiment showed that a concave mirror bends light beams, not just reflects them. ♦

Jason Garcia and D. Shah (teacher)

3446

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What Type of Juice Cleans Pennies the Best?

This study was to prove which kind of juice was best when cleaning pennies. Many pennies were taken and placed in juice for 5 minutes. They were then removed and wiped. The experiment shows that the tomato juice was most effective for cleaning pennies. ♦

How Different Liquids Covering the Stomata Affect the Plant's Growth

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This study was conducted to see if covering the stomata of the plant, *Primula malecooides*, with different liquids would affect the plant's growth in any way. Five plants of relatively the same health were placed in the same environment and cared for in exactly the same way, regarding things like time in presence of sunlight and the amount of water given (100ml, once a day at 6 pm). Each plant's stomata was covered with a different type of liquid: water, vinegar, hairspray, and oil. These liquids were brushed on the underside of the leaves with a small paintbrush. The control plant was covered with nothing. The plants were monitored over 5-day periods and their growth recorded everyday. The experiment was repeated three times. The plants covered with water, oil, and hairspray did not seem to differ from the control plant in any significant way. These plants grew between 0-1/2 centimeters during the 5-day period, the same growth rate as the control, and there were no dramatic changes in health of the foliage or stalk. However, the plants covered with vinegar had drastic outcomes. Within a day of applying the coating, the leaves had reduced in size because they were all withered, shriveled, and drooping. All three experiments yielded the same results. These results show that in affecting the plant's growth, the texture of the liquid does not matter so much as the chemical composition of it for the reason that oil is obviously thicker than vinegar, yet the vinegar had a much quicker and harsher effect on the plant. ♦

How Do Electromagnetics Work?

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This study examined the electromagnet and how it works. An electromagnet was built using one D cell type alkaline battery, a DPDT 0.5 amp direct current "knife" switch, an 8d size nail, masking tape, and bare copper wire. First, the bare copper wire was wound tightly around the nail fifty times. The wire at the top of the nail was taped down to the negative end of the battery using masking tape. The wire at the bottom of the nail was connected to the screw terminal of the "knife" switch. Another short piece of bare copper wire was connected to the remaining screw terminal of the "knife" switch and its other end was taped to the positive end of the battery. When the "knife" switch was turned on, the nail picked up two paper clips, each having an average mass of 0.5 grams. Then the copper wire was wound ten more times around the nail. The nail picked up three 0.5 gram paper clips. Then the battery was removed and the two copper wire ends of the nail were connected to the two screw terminals on the "knife" switch. No paper clips were picked up by the nail. Also, some pieces of the copper wire were disconnected from different places on the electromagnet. Again, no paper clips were picked up by the nail. Each experiment was repeated 3 times. The results suggest that the solenoid around the nail plays a role in increasing an electromagnet's magnetism, a source of energy (the battery) must be provided for it to work, and the copper wire carries the electric current through the whole structure. ♦

What's More Dense?

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My report is about "What's more dense?" If the substance does not mix with the water will it float? The hypothesis to this question is a substance can float in any kind of liquid. You can put a clear large container into the following items: cups of syrup, water, and oil. Buoyancy is the force that makes things float. The three liquids float on top of one another because they have different densities. The syrup is the densest. The oil is the least dense. The water's density is in between the syrup and oil. The data collected is that most of the heavy objects sink to the bottom. The syrup can carry the heavier of the objects, the oil can carry the lighter of the objects, and the water can take the least of them all. ♦

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3450

The Effect of Depth on the Number of *Genyonemus Lineatus* in the Los Angeles Harbor

The number of white croaker, *Genyonemus lineatus*, was compared at different depths in the Los Angeles Harbor between the months of January 2004 and May 2004. The hypothesis that was tested stated that if the depth of the water at the Harbor Pier increased, then the amount of white croakers being captured will increase to a certain point, and then descend. During the experiment, the RV Vantuna, Otter trawl and collecting bin were used. When the study was completed, the hypothesis was found to be correct. As the depth of the water increased, so did the population of white croaker. However, when the depth reached 11.1 meters, the amount of white croaker found was at its peak. After 11.1 meters, as the depth increased, the amount of white croaker began to decrease. According to the data, the fewest number of *G. lineatus* were found at the most shallow water. The second fewest were found at the deepest water. As the depth increased, the number of *G. lineatus* increased to a certain point then began to decrease. The greatest number were caught at 11.1 meters. Most of the *G. lineatus* were caught between 11.0 – 11.5 meters. This concludes that the hypothesis stated was correct. ♦

Hannah Cohen and D. Shah (teacher)

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3451

Hermit Crab Preference Among Grape Purple, Hot Pink, and Banana Yellow Sand

This experiment involved the preferences among the colors grape purple, hot pink, and banana yellow sand. The tank that the experiment was conducted in was divided in half. Each half was identical to the other except the sand on each half of the tank was a different color. The number of crabs on each side was written down, determining the preference of that one night. The totals were added up and preferences were obvious. Hermit crabs seem to prefer grape purple to banana yellow and hot pink. They also seem to prefer hot pink to banana yellow. ♦

Jeffrey Gorman and
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3452

Bridge Stability

In 1940, the Tacoma Narrows Bridge collapsed because of 45 MPH winds. Ironically, higher winds made a small wave on the bridge but it did not break. A slow wind collapsed the bridge since the wind hit the resonant frequency of the bridge. At the pinnacle of the oscillations, one side of the bridge was 28 feet higher than the other side. Then the center cable snapped and the bridge lost its support.

After researching this phenomenon, I tested my bridge against the wind. I built a rope bridge out of popsicle sticks flimsy enough to cause oscillation. I put a sheet of tissue paper behind it because originally the wind just went through the gaps between the popsicle sticks. At 1.76 MPH the bridge slowly resonated, then started violently twisting. This shows it's capable of resonating with small forces, such as the fan. However, I was unable to hit the resonant frequency by tapping it. I used a force meter to measure the force of the taps that make my bridge resonate.

I was looking to get the same amount of resonance for each bridge weight, but with each increase in weight, more taps were needed. The first time I tested it at 3 TPS (all taps were at .98 Newtons). Then I doubled the weight, using

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pre-measured coins, to achieve the same resonance—tapping it 6 taps per second. Point (6, 50) is off the line because of human error. The next graph that I made was almost linear. I stripped the bridge of all its weights, until it was 37.5 grams and tapped it at 3 TPS. As I doubled the weight, I needed to double the force to achieve the same resonance.

In conclusion, I have found that if you double the weight of my bridge, then you must double the amount of taps per second, or force, to achieve the same amount of resonance each time. ♦

3453

Ram Dixit and D. Shah (teacher)

Trajectory Profile of Ping-Pong Ball Shot from a Catapult

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The present study examined the relationship between the trajectory angle and the distance a projectile traveled when the force applied to the projectile was kept constant. The projectile was launched using a wooden catapult that was powered by using a heavy-duty rubber band. The angle of the catapult was varied using a template with predefined angle inclinations. A standard ping-pong ball was used as the projectile and force was applied using a heavy-duty rubber band. Trajectory angles were varied from 0° to 90°, in 15° increments. The distance traveled by the projectile in centimeters was measured in triplicate for each angle. Complementary trajectory angles such as 30° and 60°, 15° and 75°, and 0° and 90° traveled similar distances. However, the trajectory angle of 45° produced the longest distance traveled. ♦

3454

Victoria Turner and D. Shah (teacher)

Connection Between Hot Sauce Spiciness and Acidity

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This experiment investigated the existence of links between spiciness and acidity in hot sauces. The pH value of each sauce was tested with pH strips 3 times on sauces with Scoville Unit (SU) (measurement of spiciness) levels of 2,000 (Jim Beam); 1,850 (Tabasco Green); 5,900 (Pyromania); 2,140 (Tabasco Red); and 90,000 (Mad Dog). Jim Beam had an acidity level of 5, 5 and 6; Tabasco Green had 5, 6, 5; Pyromania had a constant 6; Tabasco Red had a constant 5; and Mad Dog had 6, 5, 5. This study suggests that spiciness in hot sauce is unrelated to the acidity of the sauces. ♦

3455

Loren Brindze and
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Music Theory

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Is music truly universal? Are there any major physical and theoretical differences between music of different religions? This project is a comparison between Eastern (Indian) and Western (European) classical music. My original assumption is that because the two sounded different, not only would there be a theoretical (relational) difference, but also a physical difference in frequencies used and wave patterns. To prove this, I recorded single notes on both sitar and piano five times, took an average of these frequencies in Hz and compared them to a calculated control group of frequencies. I also analyzed the wave shapes through an oscilloscope application. Finally I researched music theory online. For the control, I took an already calculated frequency measurement C (261.6 Hz) and multiplied it

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in increments of the 12th root of 2 to find the rest of the notes in the scale. When analyzing wave patterns, I found a drastic difference in the piano's simple pure sound, and the sitar's complex harmonic combinations. However, the physical frequency difference in the two was an almost inaudible difference. My values varied from 260 Hz all the way to 1550 Hz and came up with the wave equations from so simple as $y=A\sin(kx)$ to the complicated wave structure of $y=A\sin(4kx)+B\sin(3kx)+C\sin(2kx)$ where k is the period, or cycle, and A , B , and C are the amplitudes. Finally I researched music theory and found that the main difference between Indian and Western classical music is that the prior is based more on complex melody structure and individual relations, while the latter is based mostly on complex harmonic structures. In conclusion, I found my original hypothesis to be incorrect, and that the frequencies and tones used in both music are the same. It is the relations between the tones and harmonics where the real difference occurs. ♦

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3456

Dissolving Different Forms of Tylenol

Tylenol is an over-the-counter drug used to help relieve pain and reduce fever. Once swallowed, stomach acid dissolves the pill, which then absorbs into the body. Five forms of Extra-Strength Tylenol (Tablet, Caplet, Cool Caplet, Geltab, and Rapid Release Gelcap) were examined in simulated stomach acid to test which pill dissolved the fastest. The experiment consisted of placing one Tylenol pill into a beaker of 100 mL of vinegar, while stirring the solution with a glass rod. The dissolution process was timed until the solution achieved saturation. Each form of Tylenol was tested three times at room temperature (20°C). These findings were then averaged. Variables of volume and temperature were explored using the same procedure. Volume was tested in 200 mL. Temperature was tested in 100 mL at normal body temperature (37°C) and high fever (40°C), with heat continuously applied using a hot plate. *Chemistry Concepts and Applications*, by John S. Phillips, and www.tylenol.com were particularly helpful sources.

Uncoated tablets dissolved the fastest in all experiments, from 54 seconds at 20°C to 34 seconds at 40°C. Geltabs consistently dissolved the slowest, taking 581 seconds at 20°C to 194 seconds at 40°C. As the temperature increased from 20°C to 40°C, Geltabs had the greatest increase in dissolution rate, dissolving 67% faster. Rapid Release Gelcaps did not live up to their name, dissolving in 257 seconds at 20°C and 113 seconds at 40°C. Caplets and Cool Caplets, with their thin non-gelatin coating, did not dissolve as fast as tablets nor as slow as Rapid Release or Geltabs. Thus, coatings, especially gelatin ones, slow down the dissolution process.

Vinegar was not strong enough to dissolve the pills; it created a mixture of small uniform particles. Greater amounts of vinegar did not improve dissolution; however, higher temperatures dissolved more of the pill and at a faster rate. Since the gastric fluid in the stomach contains hydrochloric acid, it is suggested that an acid stronger than vinegar would completely dissolve Tylenol. Further research could determine if this is because stronger acids completely separate in solutions. ♦

Bubble Physics

My research question was, will it make a difference to the diameter of the bubble if you add substances to the solution or blow the bubbles on different surfaces? The method used to prove this question was with a bubble solution that I added different substances into, Karo light corn syrup and Woolite laundry detergent. I also performed each bubble solution 6 times on 2 different surfaces, a plastic and a metal surface. In the end I concluded that the bubbles on the plastic surface tended to be larger and those on the metal surface tended to be smaller. I used a metal and a plastic surface, Joy soap, glycerine soap, water, a cup, a straw, Woolite laundry detergent, Karo corn syrup, measuring spoons, measuring cups and a ruler. My controlled solution was 1/3 cup of water, 1 cup of Joy soap and 1 tablespoon of glycerine soap. The one website that I used the most was the Exploratorium. It gave me all sorts of good information on bubbles from color to solutions. My data values ranged from 16.5 cm to 18.6 cm on the metal surface and from 17.2 cm to 20.9 cm on the plastic surface. I measured the "residue" left by the bubble after it popped. For instance if I was blowing a bubble, on any surface, and it then popped I would measure the residue left with my ruler, in centimeters. This residue that was left is the diameter of the bubble. With these measurements taken and my experiments performed, I have concluded that the type of substance that you put in the solution does not make as much of a difference in the diameter of the bubble than what type of surface that you do it on. ♦

Speed of Light

I worked on a project involving how a microwave can help you measure the speed of light. I didn't think the method I had found would work because 20 seconds wouldn't be enough time to melt the marshmallows. I also doubted the success because I didn't know how high the power should be. Making it too high would melt the marshmallows too much, and making it too low wouldn't melt them enough. After some adjustments to the instructions, the experiment was a success. I performed the experiment five times, and each time, the results were very similar, the average of which was almost exactly what I had hoped it would be. Sometimes there were more or fewer marshmallows in the plate, but that didn't affect the outcome. I concluded that the power of the microwave didn't matter and if done correctly, the length of the melted spots would be the correct wavelength. For this project, all I needed was a ruler, three bags of marshmallows, and a casserole plate. Ideas on About.com and other physics websites gave me some ideas on how to perform the experiment, but then after trying it, as I mentioned, I had to adjust the time that the marshmallows would be in the microwave. Some values I got for the length of the melted spots were 12 meters and 13 meters. If these values were the wavelength, then the speed of light would be equal to 2.94×10^8 m/s and 3.19×10^8 m/s, which is awfully close to 3.0×10^8 m/s. ♦

Effects of Cryogenic Treatment on Magnets

This study examines the possible effects on the strength of a magnet put into cryogenic treatment. Several sets of different magnets consisting of ten neodymium, six ceramic, two alnico and six hand-made electromagnets were tested with two tests at room temperature and the results were recorded. One test measured the number of paper clips that a magnet can pick up; the other test measured the distance in millimeters at which a magnet can attract a paper clip. Then half of each set of magnets underwent cryogenic treatment, where the temperature was reduced to about -360 degrees. All of the magnets were then tested again and the results were recorded. The magnets were tested four times each before cryogenic treatment and four times each after treatment in the two different tests.

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The results of the tests showed that there was little or no significant difference in the treated and untreated magnets or gave results that showed little or no significant difference to the same magnets before or after treatment. On average the treated neodymium magnets picked up 3 or more paper clips than the untreated set and 5 paper clips more on the same set after treatment than before. The other magnets all picked up fewer paper clips after treatment with ranges on average from 1 to 9 paper clips fewer. In the millimeter test the neodymium, ceramic and alnico magnets pulled on average from .42 mm to 3.2 farther after the treatment. The electromagnets pulled less. ♦

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3460

Do Cell Phone Models Produce the Same Amount of Electromagnetic Forces (EMF)?

The purpose of this experiment was to find whether certain cell phones emitted the same amount of electromagnetic forces (EMF). To find the EMF emitted, an EMF sensor from EXTECH instruments model #480823 was used. Every cell phone was tested for EMF in the environment without the cell phone, with the cell phone off, with it on, and with it receiving a call. Using the average of all the EMF measurements for each phone, the average obtained was compared with other phones' averages to find the highest and the lowest EMF emitted. The phone that produced the most EMF waves was 53.275 mGauss, which was emitted from the V-300 Nokia that came out in May 1998. The lowest EMF producing phone, however, was a newer phone, Treo 30650, that was released in July 2003. This phone emitted 3.875 mGauss. The results suggest older models such as the V-300 Nokia produce more EMF than newer phones. ♦

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3461

Effects of Ions on Boiling Point

Pure water, which consists of hydrogen and oxygen atoms, has a boiling point of 100.0 degrees Celsius. In this experiment the effects of sodium and chlorine ions on the boiling point in a solution is observed. The boiling point of a solution will increase as the percent weight of salt in a solution is increased.

Five different solutions were tested and observed. The first solution, as the control, was pure distilled water. A total of four salt solutions with different concentrations of salt were prepared using distilled water and NaCl. The weight of the salt in each four salt solutions varied from 0.0 grams to 223.0 grams, adding 58.0 grams each trial. The salt was dissolved in distilled water and boiled in a 1.0 quart cooking pot. The temperature of the boiling point was measured using a thermometer. The percent weight mass and molarity of each solution were calculated.

Data and results:

Formula for weight percent: $[\text{Mass of solute (g)}/\text{Volume of solution (ml)}] \times 100$

$$[58.0 \text{ (g) NaCl}/1000 \text{ (ml) H}_2\text{O}] \times 100 = 5.8\%$$

Formula for molarity (M): moles of solute/1 liter of solution

$$1.0 \text{ moles of solute (NaCl)}/1 \text{ liter of solution} = 1.0 \text{ (M)}$$

$$(\text{Moles of solute (NaCl)} = 58.0 \text{ gr}/57.443 \text{ gr} = .0 \text{ mole})$$

Trial	% NaCl in solution	Moles of NaCl	(M)	Boiling point (Co)
1	0	0	0	100.0
2	5.8	1.0	1.0	100.5
3	11.6	2.0	2.0	101.1
4	17.4	3.0	3.0	101.6
5	23.2	4.0	4.0	102.2

Conclusion: Dissolving NaCl in water raised the boiling point of the solution; hence it requires more heat (energy) to break down bonds between the atoms in solution. The ions (Na+) & (Cl-) will form covalent bonds with hydrogen and oxygen atoms. The boiling point of pure water was increased by about one half degree Celsius for every 58 grams of salt added to one liter of distilled water. ♦

Effects of Different Amounts of Vinegar and Baking Soda on the Production of Carbon Dioxide in the Chemical Reaction

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This experiment observed the effects of more vinegar than baking soda in the acid base reaction between the two. In each set of experiments, different combinations of baking soda and vinegar (the total being a specified amount) were combined in a graduated cylinder. The carbon dioxide produced was then measured and recorded. In the first set of experiments, the total baking soda and vinegar was 10 cc/mL and 9 different combinations were tested. In the second set of experiments, the total baking soda and vinegar was 20 cc/mL and 19 different combinations were tested. The results showed that more vinegar than baking soda does increase carbon dioxide production and that vinegar to baking soda ratios between 4:1 to 3:17 produce the most carbon dioxide. ♦

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Effects of Temperature on Battery Life

This experiment tested the hypothesis that temperature affects battery life while the battery is in use. A data logger was connected to an AA battery after initial launch from the computer. This apparatus was then placed into either room temperature, the refrigerator, or the freezer. The data logger automatically recorded the voltage of the battery every second. The data logger was disconnected from the battery and reconnected to the computer to upload the data. This provided a program for the data logger to compile the data points into tables and graphs, as well as allowing for the information of the data into the Microsoft Excel program to construct custom graphs. The experiment control is battery at room temperature. The results of the experiment demonstrate that battery life decays as the temperature decreases. ♦

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Metal Density and X-Ray Effects

X-rays are a form of electromagnetic light with high energy, high frequency, and short wavelengths. These qualities allow X-rays to see through the human skin, to our bones. William Roentgen discovered X-rays accidentally while performing an experiment that included electron beams in a glass discharge tube. X-rays have also been extremely beneficial to the medical world, allowing doctors to see into the body without physically opening it up. The question that I wanted to answer was which metals are X-ray resistant, and if their density affects how resistant they are. My hypothesis was that all of the metals would be at least somewhat resistant, and that the higher the density of the material, the more resistant it is to X-rays. In order to find this, I first took five X-ray pictures, of five different metals, at 540 KVP (the amount of energy). All of the pictures were taken over a gold ring, except for a picture of gold by itself. The gold ring was used as a control for the experiment. I then took a second set of five pictures, but at 70 KVP, in order to make my results more accurate. I then looked up each of the metal's densities (gold, lead, silver, aluminum, and copper). At 50 KVP, my hypothesis was correct. At 70 KVP, however, I found that gold was less resistant than lead, and yet gold had a larger density. Gold's density is 19.3 g/cm^3 and lead's density is 11.34 g/cm^3 . This disproved my hypothesis, showing that density does not have to do with the X-ray resistance of a metal. Another startling find was that aluminum was not resistant at all to X-rays, and you could completely see through it, even at 50 KVP, the lower energy level. ♦

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Water Quality

Non-organic farmers heavily use nitrates, phosphates, and other chemicals to feed their plants as growth hormones. These chemicals harmfully affect the soil, nearby bodies of water, living creatures in the ocean, land, and humans. I tested nitrate, phosphate, and bacteria levels of the L.A. River, Balboa Lake, and Arrowhead bottled water. I specifically chose the L.A. River because I drew a sample of it next to a sod company. The L.A. River flows into the Balboa Lake, and the Arrowhead unopened bottle is my third sample, acting as my control.

I looked at drops of water from all three sources under a microscope to find an approximate ratio of 1:5:35 parts per million pieces of bacteria (Arrowhead: Balboa Lake: L.A. River). I tested for nitrates using a kit and filling ampoules with water diluted with nitrate powder. After shaking the ampoule, letting it sit, then comparing it to a color test, I observed the nitrate levels (parts per million) 0.6:0.9:5, L.A. River: Arrowhead bottled water, Balboa Lake. I tested for phosphorus filling ampoules with water diluted with two phosphate drops. After shaking it, the color test worked the same way. The ratio of the phosphate levels (parts per million) follow 0:0.4:1.0, Arrowhead: L.A. River: Balboa Lake.

I have concluded that the sod company was directly related to the high amount of nitrates and phosphorus present in the L.A. River and Balboa Lake. Balboa Lake most likely had higher amounts of nitrates because the L.A. River flows through it, so it would be an accumulation of nitrates delivered from the sod company floating downstream. The high phosphate levels, I believe, are also directly received from the sod company next to it. High phosphate levels, however, may be from natural aquatic animal habitats. In addition, because nitrates are highly mobile elements that are overused, their mobility through water may be the reason why they are extremely abundant in some places, and not that abundant in water close to them. Phosphates are stable elements, so it is harder to considerably change the amount of phosphates in a liquid as quickly as nitrates. Finally, I have proven that when sod companies and conventional farmers put chemicals on their plants, they can easily move through soil and water, which is harmful to ecosystems.

All information derived has been from internet websites, magazines, other scientists' research data, and my experiments with labs and numbers. ♦

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Aerodynamics

Aerodynamics (noun) — the science which studies the movement of gases and the way solid bodies, such as aircraft, move through them. The purpose of the aerodynamics in this Techron project is to distinguish the difference of aerodynamics on different objects based on their size, shape, and form. I believe that more wind will pass through objects which have a smaller shape and form, rather than a big cumbersome object which will allow less air to pass through it. To prove this theory, I created a wind tunnel and placed one glider at a time in the wind tunnel. I calculated the velocity of each of the two objects by measuring the distance and the time it takes the air to flow from one part of the box to the end. Dry ice was used to measure the speed of the wind. I evaluated both gliders and ended up with what I first thought would happen. The glider made of a thick newspaper allowed less wind to pass through, and the glider made of a single sheet of printer paper allowed more air to pass through. To

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create the wind tunnel I used a variety of different cutting materials and daily appliances. These included a ruler, scissors, a saw, coil, plastic sheet covers, glue, hooks, exacto-knife and pliers. The controls I had were only due to materials I used. I could have had a better wind tunnel made of metal rather than cardboard, which is less sturdy, but it hardly made any difference. The websites that helped me the most were the ones that had pictures and different examples of wind tunnels. I worked off this website to come up with and create my own wind tunnel: <http://sln.fi.edu/flights/first/makesimple/index.html>. The data I gathered had huge ranges depending on the set speed I placed on the fan and depending on which object I tested. My values for the time varied from .53 seconds to 2.04 seconds. All in all, this project not only taught me about aspects of science, but of organization, time management and effort. ♦

3467

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The Effects of Boiled Water, Microwaved Water, Distilled Water, Mineral Water, Tea, Tap Water, Tap Water Plus Vitamin C and Calcium, Milk, Rain and Mountain Spring Brand Water on Growing Garlic

This study examined which of the waters allowed garlic to grow fastest. Garlic was put into water and growth was recorded daily. Water was replaced when needed. Studies suggest that rain water makes garlic grow faster. ♦

3468

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Egg Drop

Eggs are very delicate. They crack very easily. But why and when do they crack? Is it because of the velocity that they are traveling at when they hit something or is it because of the density of the material that they hit? If we alter the state of the egg by freezing it, will the egg still break upon impact? Is there a way to drop an egg at the same velocity that it would normally crack and yet still keep it intact? If we can answer these questions, we will understand the fundamental concepts of how gravity affects objects in freefall and how we can modify those effects.

I dropped eggs onto many different surfaces from different angles, different heights, and at different temperatures in order to discover whether the eggs would be broken no matter what. In order to assure that I was able to drop the eggs on the correct angle, I taped a string to the egg and cut it. After I determined which surfaces the eggs would break on, I began wondering what velocity at which the eggs traveled. I calculated the time that it took for the egg to hit the ground using $d=v_0t + at^2$. Then I took the time and plugged it into $v=v_0 + at$. I then knew the velocity at which the egg fell. But how many pounds of force are there on an unprotected egg? I took the acceleration and multiplied it by the mass of the egg, $9.81 \text{ m/s}^2 \cdot 0.059 \text{ kg} = .49\text{N} = 0.11$ pounds of force. I got these equations from my Physical Science textbook and from an email correspondence with a science teacher, Mr. Cooperman. I wanted to figure out a way to drop the egg from the same heights and still have the egg sustain its form. My first idea, a parachute, failed. My second idea, to place the egg in a container, also failed. But when I placed the egg in a container and filled the container with water, success was evident. ♦

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Antiperspirants

Do antiperspirant deodorants really help to reduce a person's amount of perspiration? Are antiperspirants more effective than regular deodorants? I believe that antiperspirants are more effective and will help reduce the amount of a person's sweat. In my experiment I have learned that deodorants do not necessarily decrease the sweat, but just give off a fragrance to hide the repulsive smell of sweat. For three days my sister went to the gym and used three different deodorants. High Endurance antiperspirant for men, Secret antiperspirant deodorant for women, and Dove deodorant for women were used in the experiment. Everyday I would weigh my sister's clothing, which was a tank top and shorts, before and after she worked out. I subtracted the difference on how much her clothes weighed after she sweat in them, and from the weight before. At the gym my sister spent one hour on the elliptical machine and I anticipated that she would sweat less when wearing the antiperspirant deodorants and more when using just the regular deodorant. My hypothesis was correct. The High Endurance men's antiperspirant deodorant helped prevent her from sweating more than Secret antiperspirant deodorant for women, because men are expected to sweat more. Therefore, antiperspirant deodorants, especially men's, contain salts to reduce the flow of sweat from the skin. These salts dissolve in sweat and leave a thick coating of gel over the sweat glands. The coating that is left reduces the amount of sweat on the skin for a number of hours after the user applies the antiperspirant. Also, these salts provide the safest and most effective way to control sweat. ♦

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3470

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Effect of Acid on Calcium

This experiment examined the question of what acid does to calcium. Eggs were put in vinegar, lemon juice, tea, and water. Vinegar and lemon juice represented acetic acid. Tea represented tannic acid. Water was the control. Each experiment was repeated three times. Vinegar quickly dissolved the calcium, the eggshell, in 6, then 10, then 8 minutes. The lemon juice dissolved the eggshell into a powder-like material in 12, then 15, then 13.5 minutes. The tea as tannic acid didn't have any effect on the calcium, except to stain it. The results suggest that while acetic acids dissolve calcium, acids like tannic are just too weak to do anything to calcium. ♦

Aracely Curiel
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3471

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The Study of Which Melts Faster: Frozen Water or Fresh Water?

This study examined the question of whether frozen fresh water or frozen salt water melted faster. One hundred twenty five milliliters of fresh water and one hundred twenty five milliliters of salt water were frozen. They were put out and timed to see how long they took to melt. This was repeated three times. The salt water melted almost two hours faster than the fresh water. So then salt water melts faster than fresh water. ♦

3472

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The Type of Bubble Gum that Blows the Biggest Bubble

The experiment designated which type of bubble gum can blow the biggest bubble out of 5 possible different types of bubble gum. Each person chewed each bubble gum for 3 minutes. Then, a bubble was blown as large as possible, and the measurements (in centimeters) were recorded. Each bubble gum had a 20% chance of having the largest bubble. The type of bubble gum with the firmest substance is more likely to hold a larger amount of air. This is because a flimsy substance is too thin, and could easily pop from overexposure to air, whereas a firmer substance, kind of like a balloon, could hold a more massive amount of air. ♦

3473

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Stain Away

For my science project, the question is which laundry detergent takes out stains the best? My hypothesis is Wisk will work better than the store brand, which is the Albertson's brand. I made three different stains, put the stains on the T-Shirts, and washed each stain out twice. One was washed in Wisk, the other in the store brand. My conclusion is that Wisk will work better than the store brand. ♦

3474

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Effect of Cloud Cover on Night Temperature

This experiment and study searched for an effect that cloud cover had on night temperatures. The night sky was observed twice, once at sunset, and again 2 hours later, while recording temperature and the average percentage of cloud cover. This process was repeated for a week. When the temperature was 62-66 degrees Fahrenheit, the cloud coverage was about 10-20%. When the temperature was 56-61 degrees Fahrenheit, the cloud coverage was 3-5%. When the temperature reached below 56 degrees Fahrenheit, there were no clouds seen in the sky. Due to the night clouds creating a thermal layer over the earth, the clouds retain the heat and toss it back down to the ground, making the night warmer. As you can see, higher cloud coverage produces higher night temperatures. ♦

What Brand of Paper Towels Absorbs the Most Water?

This study was to see what brand of paper towels is the best by testing which brand absorbs the most water. Five brands of paper towels were used: Bounty, Brawny, Scott, Viva, and Sparkle. A measuring cup was filled with 250 milliliters of water. A folded paper towel was placed in the measuring cup and taken out after thirty seconds. What was left of the 250 milliliters determined how much the paper towel absorbed. It was repeated three times for each brand. The average amount absorbed was found for each brand. The worst paper towel was Sparkle, which absorbed the average of 55 milliliters. The next worst was Scott, which absorbed the average 58.3 milliliters. The third best was Brawny, with the average of 73.3 milliliters. Second was Viva, with the average of 75 milliliters. The best paper towel was Bounty, with the average of 83.3 milliliters. ♦

Effects of Aerosols and Mists on Plants

The purpose of this study was to examine the effects of specific aerosols and mists on plants. Three plants were each assigned a different aerosol or mist. The three aerosols used were the following: air freshener, hair spray, and one teaspoon of sugar mixed into 8 oz. of water. The name of the plants tested on is Dwarf Rose Snapdragon. Everyday they would be sprayed by their designated aerosol or mist, and data was recorded showing the progress of these plants. This experiment was conducted six times over a period of three weeks. Every week, there were two batches of plants that received the same spray. The sprays were the only differentiating factor between them. The different aerosols and mists did not create much of a difference between the growth rates of the plants; however, the appearance of the plants did change slightly. The plant receiving the sugar water seemed at times to shrivel, the plant receiving the hairspray seemed to become waxy in texture, and the plant receiving the air freshener seemed to fair quite well. The results of the plants receiving the sugar water and the air freshener seemed to be quite similar. Based on these experiments, the results suggest that these particular plants, Dwarf Rose Snapdragons, do not get affected or respond much to aerosols and mists used. ♦

Will the Energy Within a Battery Deplete Faster in Different Temperatures?

This experiment is to test the battery's power in different temperatures, and also to find out which battery will last the longest in different temperatures. This experiment will also reveal if any batteries are affected by the temperature at all. All the batteries, both batteries at room temperature and at 39 degrees Fahrenheit, will be placed in a flashlight and used until their energy supply has been exhausted. Starting from when the flashlight is first turned on, the battery brand will be recorded down and timed until the battery runs out of energy. The time and battery brand will be recorded on a piece of paper. Battery brands that will be tested in this experiment are Duracell, Energizer, Ultra Last, Eveready, Toshiba, Rayovac and Panasonic. All batteries lasted longer at a temperature of 39 degrees Fahrenheit. Energizer was found to last the longest both in room temperature and in freezing temperature. From this experiment, I conclude that temperatures around 39 degrees can actually preserve the energy of a battery rather than deplete it faster. ♦

Exercise

Exercise plays a significant role in daily life, but it is always limited by certain body factors. Exercise is any activity involving force with a certain muscle. Limiting factors are the things that limit a person's exercise effort. In this experiment I am going to figure out which factors limit a deconditioned person's exercise effort and how that compares to a conditioned person. I believe that the most common limiting factor is respiratory rate, but the time it takes to reach the limit will depend on the person's physical condition.

In this experiment I used a treadmill for the subject to perform the work, an oxymeter to measure the subject's pulse and oxygen saturation, and a stopwatch to calculate the subject's breathing rate. I took the patient's heart rate, breathing rate, and oxygen saturation four times throughout this experiment – at the beginning, at a light jog, at their limiting point, and at the end. Subjects were four 15 year old males. Two were conditioned, taking PE or playing a sport, and two were deconditioned, not taking PE nor playing a sport.

Here is one aspect of data from my experiment. One deconditioned patient had a heart rate of 55 beats/min at rest, but 180 beats/min at his limiting point. The conditioned patient had a heart rate of 60 beats/min at rest and 90 beats/min at his limiting point. Another big difference was that one deconditioned patient reached his limiting point at 7 minutes 20 seconds, while one conditioned patient reached his at 12 minutes 30 seconds.

My data indicates that conditioned people are more fit than deconditioned people. The limiting factors were obvious from the drastic changes in specific parameters. The most common limiting factor was the lungs' inability to deliver enough oxygen to the blood due to rapid, inefficient breathing and low oxygen saturation. I answered the research question, but more time and test subjects might yield additional clarification. ♦

The Effects of a UV Light on the Activity of a Hermit Crab

The purpose of this study determined the activity levels of hermit crabs when exposed to ultraviolet rays. Three hermit crabs were individually placed in the terrarium at night. This eliminated any exposure to natural light. The only artificial light present was the ultraviolet light that was placed directly over the terrarium. Hermit crab #1's distance was 23½ cm; #2's was nearly triple #1's at 62 cm; and #3's was the lowest at 13½ cm. In test two, however, hermit crab #1 traveled at 25 cm; #2 traveled literally double #1's first try at 47 cm; and #3 traveled 56 cm — more than four times its original distance! These results suggest that exposure to UV light may increase a hermit crab's activity level. However, these results do not necessarily prove that hermit crabs' activity levels change drastically when exposed to UV light. ♦

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How Weight Affects the Flight of a Rocket

This experiment was done to find out how weight would affect the pattern of the flight. The data focused mainly on the height and launches were conducted near Ridgecrest, CA. Data was collected using an altitude calculation gun. The rocket fell in approximately the same pattern each time, changing only in height. The first difference between no weight added and one ounce weight added was forty-five feet. The second difference between one ounce weight and two ounces weight was an additional twenty-eight feet. The height varied between weights, distinctly decreasing when the weight is increased and the same engine type is used. ♦

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3481

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Dry Ice

What is dry ice? What could be to many people just a fun thing to look at is actually a very useful tool. For my Technion project I am researching dry ice's cooling effects on water. I will calculate the cooling rate of dry ice to water. I will find how much the water is cooled per minute. My hypothesis was that the dry ice would cool the water alot faster in the beginning than it would in the end. I was totally accurate, and what made me right is the process of sublimation. Sublimation is the process in which the ice changes phases straight from a solid to a gas and skips the liquid phase. I did my research by putting various pieces of dry ice (which I weighed and recorded the weight myself) into a beaker, stirred the water and at the same time recorded the temperature of the water every 30 seconds. To get authentic and sufficient data, I repeated this process numerous times. After 5 times, I plugged my three best tests into Excel and here they are: Test 1, Test 2, Test 3. After I had all my research and I had all the data I made a simple equation to find the cooling rate per minute. The equation is the following: $Q = (\Delta T/W)/5$. This simple equation is the key to finding my rate. After plugging all three labs into this equation I averaged all the numbers together to get: $0.13^{\circ}\text{F}/\text{gram} \times \text{min}$. I found that dry ice is a very sufficient tool when used correctly to cool water; it does the job quick and right. I could not have completed my project with out the help of these two websites. They helped me to understand the basis of dry ice and what it can be used for: <http://www.occc.com/abc/dry-ice.htm> and <http://www.dryiceinfo.com/>. While doing this project I noticed that my numbers were all close to each other. In my three main tests the final numbers only vary by 0.02. This proves the authenticity of my lab and I am very proud of it. This whole project taught me alot about dry ice and mainly how to do a project timely and well, and most of all I had fun. ♦

3482

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Effects of Games on Blood Pressure

This experiment took a look at the question of games having some effect upon pulse rate. Six humans were tested by sitting, running and playing different types of games: Role-playing, First Player shooter, and another role playing game, this time alot more calming with not much excitement, but much satisfaction. Those 6 humans were tested at 30 minute intervals in which after we checked the number of heartbeats per minute. The results were recorded and they were tested again. After results were recorded twice, the data gathered showed that games do increase pulse rates, but different games increase the pulse in different ways. ♦

3483

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Hydrodynamic Resistance: The Effects of Water Flow on Certain Geometric Shapes

This science project focused on how certain geometric shapes would behave in moving water. There were eight different geometric shapes: a rectangle, a 120 degree triangle, a 90 degree, 60 degree, 40 degree, an ogive, a half circle, and a half ellipse. A water sluice was constructed and the shapes were placed in it with a steady stream of water. Each shape was tested three times with a spring scale measuring the resistance in grams. The average of each test was recorded afterwards. The original data was converted to Newtons as the standard unit of force. This unit of force was then used for the measure of pressure on the leading surface of each shape. The unit of pressure used was the Newton per square meter. Tables and graphs were used to illustrate the results, which showed that the smooth, slanted surfaces (such as the 40 degree triangle) had the least amount of pressure, and therefore, the least resistance. On the other hand, shapes like the rectangle measured the greatest amount of pressure and therefore, the most resistance. ♦

3484

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Does *Pseudosinella violenta* Lay Their Eggs Next To or On a Food Source?

The purpose of my experiment is to determine if the collembola parents help their offspring by laying their eggs near a food source or on a food source. My hypothesis is that the collembola parents will lay their eggs near a food source. I took two plastic containers and placed plaster of paris, charcoal, and water in them. I stirred it and let it dry for a week. I then placed 10 collembola in one dish and 12 collembola in the other dish. I put yeast in each of the dishes for the collembola to eat. I observed the collembola, fed and watered them once a week for 6 weeks. I collected data by counting the number of eggs next to yeast and not next to yeast. The total of collembola eggs near or on a food source was 75 eggs. The collembola eggs that were not near a food source were 39 eggs. This data shows 65.8% of the eggs were on or near a food source and 34.2% were not near a food source. In conclusion, my hypothesis is correct that the collembola prefer laying their eggs near a food source. ♦

Renz Basa, Natalie Camacho, Pedro Campo, Jessica Carmichael, Victor Carson, Julio Constantino, Alan Contreras, Barbara Cruz, Sirak Doganyan, Raul Duarte, Steven Espinoza, Janelle Gabb, Guillermo Galvez, Diego Garcia, Amanda Gonzalez, Carla Herrera, Anh-Vi Hoang, Ricardo Huizar, Laura Jimenez, Daniel Lopez, Justine Nocera, Gerlyn Nunez, Christopher Perez, Erick Perez, Paul Reynoso, Joshua Rodgers, Denise Rodriguez, Joshua Sanchez, Victoria Santana, Michelle Szebenyi, Alexandra Tallas, Douglas Tejada, John Villalobos, Sergio Zepeda and T. Miller (teacher)

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3485

Does Miracle-Gro, a Powdered Fertilizer, Harm an Adult Species of Collembola Called *Pseudosinella violenta*?

The purpose of this experiment was to determine if Miracle-Gro would harm *Pseudosinella violenta*, an eyeless species of collembola. Collembola are small arthropods that live in leaf litter and soil. To test our hypothesis, we first made homes for the collembola using 9 parts plaster of paris, one part charcoal, and water mixed in petri dishes. Their homes were allowed to dry completely. We made the Miracle-Gro according to the directions. Yeast was placed in each dish for food for the collembola. Each petri dish was labeled as control or experiment. The control dishes were moistened with drops of water. The experiment dishes were moistened with drops of the liquid Miracle-Gro. Equal numbers of collembola were placed in the petri dishes. The experiment lasted 19 days. The collembola were observed 9 times using hand lenses and stereomicroscopes. Live collembola and dead collembola were counted as data. After the research was completed the results were tallied from all the petri dishes. In the control, 67 percent of the collembola survived. In the Miracle-Gro experiment dishes 47 percent of the collembola survived. Our hypothesis was correct; the Miracle-Gro powdered fertilizer harmed the collembola. ♦

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3486

Greenhouse Gases and Greenhouse Effect

I believe that if we reduce the amount of man-made greenhouse gases, we can prevent the Earth's temperature from rising from its stable, natural temperature. A greenhouse gas is an atmospheric gas that contributes to the greenhouse effect, and is capable of absorbing infrared radiation or heat. The greenhouse effect is very essential to the balance of temperature on Earth. Greenhouse gases allow sunlight to enter the atmosphere. When sunlight hits the Earth's surface, some of it gets reflected back to space as infrared radiation, or heat. Greenhouse gases trap some of the heat inside the Earth's atmosphere. Most greenhouse gases are natural, but ever since the Industrial Revolution, human-made greenhouse gases have thrown off the balance of temperature, and more heat is coming into the atmosphere than going out.

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In order to prove my hypothesis, I must use an experiment. In this experiment, I used a car and two thermometers. I used the car to represent the Earth and its atmosphere, the seats as a representative for the Earth's surface, the car's windows to represent the greenhouse gases, and the sun. The windows are similar to greenhouse gases because they both allow the sunlight to enter the atmosphere, and then trap the heat inside. I took data with the window at certain heights to compare and show how different amounts of greenhouse gases will result in different temperatures. Then I used thermometers to measure the temperature outside the car, which represents the Earth's average temperature without greenhouse gases, and the temperature inside the car, which represents the change in temperature due to greenhouse gases. I tried this experiment with three different window heights (each height twice) and then graphed the data on Excel. After comparing the data, one could see that the more the windows are up, or the greater amount of greenhouse gases there are, the higher the temperature will rise from the natural temperature with no man-made greenhouse gases. This experiment shows that if we continue to emit man-made greenhouse gases at the current rate, the temperature will increase greatly from the natural temperature without man-made greenhouse gases. ♦

3487

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Does Vigoro, a Powdered Fertilizer, Harm an Adult Species of Collembola Called *Lepedocyrtus northridge*?

The purpose of this experiment was to determine if Vigoro, a powdered fertilizer, harms a species of collembola called *Lepedocyrtus northridge*. Collembola are invertebrates that can be as small as a few millimeters in length. They live in soil environments. We hypothesized that Vigoro will harm collembola. In order to test our hypothesis we made homes for the collembola by mixing 9 parts plaster of Paris, one part charcoal, and water in 14 petri dishes. Each petri dish was labeled with the name of the group and whether it was the control or experiment. We made the Vigoro fertilizer as the directions described. In half the petri dishes we moistened the environment with the Vigoro liquid fertilizer. We used water in the control in the remaining petri dishes. Equal numbers of collembola were placed in the control and the experiment dishes. We added yeast to feed the collembola. We carefully observed the collembola using magnifying glasses and stereomicroscopes for 19 days. Once we added up the class data 77 percent of the collembola were found alive in the control. In the environment with the fertilizer 57 percent of the collembola were found alive. Our hypothesis was correct because fewer collembola were found alive in the Vigoro fertilizer. ♦

Hot Air Balloons

The Technion project this year truly allowed me to broaden my scientific horizons and explore an aspect of science which I was truly concerned about and for which I had a genuine interest. Through graphs, experiments, research, the study of history (in my field), and calculations, I was able to successfully map out patterns in nature, which I discovered in the fields of buoyancy and density. By testing balloons and buoyancy achieved through heat, I was able to relate my experiment and personal experiences to the ideas and functions associated with hot air balloons. Also, by researching and testing the properties of density, I was able to make a connection to the field of submarines and get an idea of how they work.

My procedure was simple; I used marbles and counted an amount needed for each bottle (of different sizes), which I used to compare the ratio of marbles to the amount of fill capacity of each bottle (in mL). This way I was able to find out how many marbles would sink a squared inch of the marble, plastic of the bottle, and the air under the same conditions and I formed an equation for this ratio. From this equation, I hypothesize that I will be able to successfully construct a submarine with working conditions that could control its rising and sinking functions through alterations in buoyancy and density.

I tried to apply the same technique to the idea and construction of the hot air balloon. I tested the theory and function of hot air balloons by testing regular party balloons under heat (100 degrees Celsius) by applying it to direct boiling water for a varied amount of times (original, 1 minute, 2 minutes, and 3 minutes) and recording the diameters and calculated areas of the circles drawn by the outlines of the different balloons. This produced a fairly efficient graph and rendered an almost 99% R squared value. From this equation I was able to derive other values and by doing so, I discovered there to be asymptotes to the graph and undefined values on the graph, meaning that the diameter can only reach a certain amount for the specific brand of balloon which I probed.

Overall, my tests were all efficient and all produced helpful information, which I was later able to apply to different situations and derive useful equations/charts, which helped me visualize and conceptualize my results/data. ♦

The Worldwide Population Decline of *Sebastes marinus* from 1950 to 2003

If people continue to over fish *Sebastes marinus* at the current rate, then the species could face extinction in the future. This study examines commercial fishing data from 1950 to 2003. Catch data of deep water commercial fishing vessels was compiled from NOAA. These fish are caught with trawls, hooks, and lines. Depth finder instrumentation was required to locate the deep-water environments of the fish. In the 1950s about 200 million pounds of *Sebastes marinus* was caught in the ocean. However, by the year 2003, this number decreased by about 199 million. In the 1950s *Sebastes marinus* was a very popular fish. However, over fishing caused the *Sebastes marinus* to decrease in population greatly. Even though in recent years the population has started to increase very slightly, it will take many years for it to become what it was in the 1950s. *Sebastes marinus* is a very slow reproducing species. The fact that it is a very slow reproducing species contributes to its decrease in population and therefore, humans should be extremely cautious in commercially fishing this species. ♦

Study of the Minke Whale *Balaenoptera acutorostrata* Populations Worldwide

Although not classified as a species on the verge of extinction, the minke whale population is decreasing at a slightly higher rate than it should be, as more and more countries manage to avoid quotas set by the International Whaling Commission (IWC). The hypothesis stating that if countries continue to disobey the IWC's guidelines concerning the issues of whaling, then the minke whales will slowly decrease in population worldwide, would be entirely correct if the IWC guidelines are not enforced the way they should be in the near future. To estimate minke whale population, numerous vessels (some of which belong to the IWC) were sent out into areas where minke number are usually high, in the region of Antarctica. To conduct their experiment, the research teams used what are called underwater hydrophones to detect the passing acoustics of the minkes without causing any harm to the species. The gathered data sheets from the vessels that kept track of these whales are then used to create an estimated population. It was before the 1980s that the IWC and Ocean Managements came up with increases in population. Today the estimated minke whale population is about 750,000. The pre-whaling estimate before the 1980s was 850,000, showing a 100,000 decrease in minke population.

It was during the 1980s that the IWC established new whaling guidelines to better protect the minke whales, as well as the larger and scarcer species of baleen whales. Ironically, the minke whale population began to decrease at this time. Countries like Japan and Norway are responsible for the decrease since these countries have begun to ignore the IWC and harvest the minke whales, regardless of the set guidelines. Japan captures approximately 500 minke whales a year. The minke captures made by Norway show increasing numbers of minkes have been captured from 1993 to 1998. The relatively slow reproduction rate of the minke whale is one of the major factors in the reason their population is slowly decreasing. The minke whales cannot keep up with the gradually increasing rate of whale harvests. If the government and the IWC continue to turn their back on these harvests, the minkes will most likely suffer the same fate as the other baleen species in the future. ♦

Effects of Lemon Juice, Vinegar, Baking Soda and Tomato Juice on the Growth of Mold on Bread

This experiment observed the effects of lemon juice, vinegar, baking soda, and tomato juice on mold growth on white bread. In the experiment, 10 mL of lemon juice, vinegar, baking soda, water, and tomato juice each were added to 8 pieces of 4x4 cm white bread and kept at 27°C. Two pieces of bread, with nothing added, served as the control. The experiment was done three times. Bread with baking soda was the first to develop visible mold, and by the end of 21 days, the mold was 4 cm in diameter. Bread with vinegar added developed no visible mold. Bread with the lemon juice developed mold 3 cm in diameter. Bread with tomato juice developed 3.5x3 cm of mold. Bread with nothing added (the control) developed mold that was 1 cm in diameter. The results of the experiment suggest that baking soda has factors that help accelerate the process of mold growth, while vinegar has factors that most likely slow down the process of mold growth. ♦

The Cleaning of Acidic Juices on Copper Pennies

This study examined the possible interference of acid when cleaning pennies with fruit juice. Water (control), grapefruit, orange, pineapple, lime and lemon juice cleaned off copper pennies. The control was water and the variable was the change of fruit juice. Each experiment was repeated three times. Each substance was measured by a pH meter, in order to measure the acidity of each substance. The results suggest that the acidity of fruit juice plays a role in the cleaning of pennies. This role is: the fruit juice with the most acidity will clean copper best. ♦

Chemical and Radiation Damage

We always hear that radiation can cause severe damage to a human and that one should try to stay far from it. I tested this statement, but on plants. I used UV light, X-ray radiation and sunlight for the source of radiation. My hypothesis was that higher radiation results in a shorter life span of a plant. The plant exposed to ultra-violet light will shrivel and have a shorter life span than the plant exposed to sunlight, yet a longer life span than the plant exposed to X-rays. For my equipment I used three pots of peace lilies, water, UV light, an X-ray machine and sunlight. My procedure for this project went as so: expose each plant to either an X-ray radiation of 70 kVp, UV light and sunlight, then observe one leaf over a time span of four days, recording its color, height and survival. My control group was the group with plants exposed to the sun's radiation and the experimental group consisted of the plants exposed to UV light and X-rays. After gathering data and analyzing it, I concluded that by using minimum radiation in a short amount of time, the plants were not visibly affected by the electromagnetic spectrum. I then came up with a new idea: are the household chemical effects on a plant more significant than the electromagnetic effect from low-level radiation?

My hypothesis was that the plant exposed to bleach will suffer the most – drastically changing in color, size and shape. The plant exposed to vinegar will also suffer (but not as much as from bleach), while the plant exposed to oil will not have any negative short-term effects. I then needed a new set of equipment: table vinegar, vegetable oil, "Chlorox" regular bleach, and three peace lilies. The procedure for this experiment went as so: add two teaspoons of each chemical element over one specific leaf each day for three days, recording its color, size and observations on its survival every day. Calculate the final survival rate for each leaf mixed with a chemical element. After gathering the data and analyzing it, I found that I had proved my hypothesis to be true. The only difference was in the plant exposed to oil – it wilted to the side from its original upright position on the last day. My final conclusion was that chemical effects on a plant are more harmful than low-level doses of radiation. My data ranges showed that each approximately ended up with a linear trend line. To conduct this experiment effectively, I looked to the web, my class knowledge, help from a doctor and my science book, to learn the foundation of my experiment. ♦

Comparing Oil-Base Varnish and Water-Base Varnish on Brazilian Cherry Wood

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This study examined and compared the two varnishes, oil-base and water-base, in order to identify the strongest one. Brazilian Cherry Wood, coated four times with a different type of varnish, was damaged with sandpaper and a three pound stone weight. After this test was repeated three times, the results suggested that oil-base varnish is stronger and more durable than water-base varnish. ♦

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Jumping

Muscles are made of cells called fibers. A collection of these fibers looks like a cylinder inside of a human body. There are mainly three different types of muscles in a human body. But the ones that are the most common in the human body are the skeletal muscles. I think that if a human stands and waits on his or her tippy toes for a certain amount of time, then his or her jumping altitude will increase, depending on how long he or she stands and waits. I have continuously heard this rumor and wanted to see if it was true. As a result, I decided to test my hypothesis. I made a chart that had four different columns with a certain time. The time was how long I would stand on my tippy toes before testing my jumping height. My four time groups were, of course, zero seconds, thirty seconds, sixty seconds and ninety seconds. I experimented not once but two times, to make sure that my observations were more precise. The result was that my experiment went well. My hypothesis was correct and so was the rumor. It turned out to be that standing longer on my tippy toes made my jumping a little better.

My experiment did not use a lot of equipment, but everything I used was essential to my experiment. I first needed to find something to jump next to and measure the height of the jump against. Since I like basketball, I decided to use my basketball rim. I put it at the measure of ten feet because I could have easily jumped and touched the rim of a nine and a half foot high basket. To mark how high I jumped, I used a Sharpie marker. Every time I jumped, I tried to mark a spot on the net of the basket. When I actually got a mark, I went on a ladder and measured how many inches below ten feet my mark was. My jump without any tippy toes warm up was marked to about nine feet, five inches and a half. Every thirty seconds or more standing on tippy toes made my altitude of jumping higher by about one to one and a half inches. Overall, my experiment turned out to be better than I thought, even though my tiles outside got full of Sharpie markings. ♦

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Lenses and Light

My topic was about how the different thickness of a lens affects its strength and focal length. My hypothesis was, "If convex lenses are used to focus an image, then the thicker the lens, the shorter the focal length." I measured using a metric ruler on stands and a pointer for each object: candle, lens(es), and the card. That way I was able to measure distances between each object. My control was the use of no lens and the short distance it had to have to be sharp. I repeated measurements numerous times and only kept the sharpest results and the most repetitious. To some point, my results were inaccurate because I changed the distance between the candle and the lens. But nonetheless, they still proved my hypothesis correct, that they are strong and need shorter distances if they are thicker. ♦

Connor Fordham and
D. Shah (teacher)

3497

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Optimum Bicycling Cadence

This study investigated optimum bicycling cadence, and its dependence on slope of the road and duration of the effort. Test intervals of 3 to 10 minutes were ridden on an indoor trainer by two cyclists, and on roads with 1% and 6% slopes by one of the cyclists. Sets of intervals were ridden at a target speed, each in a different gear, to measure the effects of cadence on heart rate and perceived effort level. Multiple sets were ridden on different days in varying order and averaged to eliminate warm up and fatigue problems. Additional calibration intervals at different speeds provided a basis for linear fits of heart rate and effort level vs. speed, which were used to align test interval results to the target speed. Power was calculated for road trials based on slope and wind resistance determined from a coast-down experiment. These calculated power values agreed with power measured on the trainer (produced at the same heart rate). Heart rate was found to decrease with cadence, and was lowest at the lowest cadence tested (~60 rpm). On the other hand, effort level was nearly maximum at ~60 rpm, but minimum at cadences of 73 to 80 rpm. These results did not vary with duration of the effort, but conditions during the 6% slope tests made the dependence on slope inconclusive. More testing is needed in a more controlled environment. Effort level was found to be a better indicator of optimum cadence than heart rate was. ♦

Emily Wong and D. Shah (teacher)

3498

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Effects of Sterilization on Pea Plant Growth

This study examined the question of which type of soil pea plants grew better in – sterile, sterile with nitrogen fertilizers, or untreated soil. Results showed that the plants grown in sterile soil with nitrogen fertilizers added were less healthy and stayed considerably smaller than those planted in sterile soil. The peas planted in untreated soil showed the poorest growth, with the least germination and very weak and diseased development. The results suggest that sterilizing the soil benefits pea plant growth, but that adding fertilizer may not always be beneficial for plant growth. ♦

Claudine Yee and D. Shah (teacher)

3499

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Blood Pressure Response After Different Types of Exercise

This study examined the question of how blood pressure responds to different types of exercise. Subjects exercise by squeezing a handgrip 10 times and walking on a treadmill for 6 minutes. On average, it took 4 minutes for the blood pressure to go down on the handgrip and $3\frac{1}{8}$ minutes for the treadmill. The results suggest that the treadmill makes blood pressure drop more rapidly after exercise. ♦

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The Effects of Listening to Mozart on Spatial Perception

This study examined the effects of listening to Mozart on spatial perception. Each child was given a math test with 20 problems to their intelligence level in a quiet environment. Then, after listening to a Mozart violin sonata for exactly 10 minutes, they took another test, similar to the test before. The experiment was repeated 3 times. The first test (without Mozart) achieved scores with an average of 84% the first time and the second time. The third time, the average score of 87% was achieved. The children that listened to Mozart before the test achieved better scores. The first time, the score of 92% was achieved, the second, 93%, the third, 93%. The average percent difference for the 1st time was 8%, the 2nd time was 9% and the 3rd time was 6%. The results suggest that listening to Mozart before a test can result in an average of an 8% higher score. ♦

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Effects of Different Amounts of Sunlight Given to Bean Sprouts

This project observed how various amounts of sunlight given to bean sprout seeds can change their growth. One handful of bean sprout seeds was placed in 3 different jars containing holes on the bottom. Each jar of bean sprouts was watered with 13° C. sink water, and length of growth for each jar was recorded in centimeters, for a period of 8 days. Each experiment was repeated 3 times. Average length growth of height in the control group (indoors) was 6.15 cm. Outdoor sprouts were averaging 1.65 cm. Sprouts in the closet that received no light averaged 7.73 cm. Results suggest that bean sprouts grown in a closet receiving no light will grow longest. ♦

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Efficiency of Support Placements on Popsicle Stick Bridges

This study examines how the placement of supports affects how much weight a bridge can support. Each bridge was placed in the center of two wicker cubes. The variable used was 21,164 grams placed horizontally. The experiment was conducted twice on identical bridges of three different types: no supports, supports on the bottom, and supports on the top. The first bridge collapsed after 6,804 grams. The bottom-heavy bridge collapsed after 9,979 grams. The top-heavy bridge collapsed after 21,164 grams. These results suggest that the top-heavy support bridge is the most efficient weight-bearing bridge. ♦

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How Much Electricity Does Various Fruit Generate and Does That Amount Change With Different Temperatures?

This project measured how much electricity various fruit gave off at room temperature and at a refrigerated temperature. The electricity was measured by sticking a zinc screw in one side of the fruit and a piece of copper in the other side. By taking a multimeter and putting the negative probe on the zinc screw and the positive probe on the piece of copper, the multimeter gave a reading as to how much electricity was in that piece of fruit at room temperature. After placing the fruit in a refrigerator and letting it sit for 24 hours, the chilled fruit was measured for the amount of electricity it generated by using the multimeter.

The results of this project showed that it does not matter how small or large the fruit is that determines the amount of electricity it generates. One of the factors that contributed to the amount of electricity in a piece of fruit was the level of acidity in the fruit. The more acidic the juice was, the more ions were in the fruit. These ions made a current, which made it easier for the electricity to flow through the fruit, increasing the amount of electricity the fruit could generate. Another factor that contributed to the amount of electricity in a fruit was whether the fruit was at room temperature or refrigerated. In six of the twelve fruits tested, the measurements showed that the fruits generated more electricity when they were chilled than when they were at room temperature. This is probably due to the fact that the ions were frozen in place, instead of moving around like when the fruits were at room temperature. This would cause the electricity to move even easier through the fruit, resulting in an even larger output of energy. ♦

Cheyenne Tran and G. Zem (teacher)

3504

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How Do Other Substances Affect the Process of Evaporation?

When water is mixed with different types of substances does it evaporate at the same rate or do the substances have some sort of impact? An effective experiment is to actually mix substances with water and observe it to see the evaporation rate of different liquids. Some choices may be oil that is stirred into the water, oil that is not stirred into the water, coke, orange juice, coffee, tea, lemonade, salad dressing, lemon juice, and an environment, just water, to have something to compare the results of the others to. To achieve the best results, it is recommended to put the same amount of water and substance in each container. Setting the containers in an area where they will have access to sunlight will help speed up the evaporation process. After keeping results for an extended amount of time, it will show the effects of the different substances relating to evaporation. As a result you may find that darker substances evaporate faster, most likely because they are able to absorb more energy/heat to speed the molecules to evaporate. Other results that can be concluded are that sweeter substances evaporate faster; mold develops even in water; evaporation even occurs when it rains and the atmosphere is humid; and that there is a difference with oil when the oil is mixed and when it's not. ♦

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Effect That Handwashing Has on a Person's Health

This study examined the sanitary procedures of students aged from eleven to fourteen. This study had set out to find if there is any connection to the amount of times students wash their hands a day to how often the specific person gets sick. Out of fifty students, twenty five male and twenty five female, two (4%) had washed their hands two or fewer times in a day, and had gotten ill a week ago, and a month ago. Six students (12%) washed their hands three times a day, and had become ill in November, four had gotten sick a month ago, and one person had gotten sick a week ago. Twelve (24%) students washed their hands four times a day, and had been sick in the amount of time ranging from last week to six months ago. Fifteen (30%) people washed their hands five times a day and they had been sick in the range between one week and one year, causing a different result than expected. Six (12%) students washed their hands six times a day and are either currently ill, or were ill three months ago. Eleven (22%) students washed their hands more than seven times a day, the average being ten, and were sick a week ago, a month or two ago, seven months ago, or one year ago. These results suggest that there is not an exact connection between hand washing and how often the said person gets sick; it could be that the people have an unhealthy immune system or that this is irrelevant to one's health. Maybe the assumption that hand washing automatically improves health by getting rid of bacteria is false. There has to be a further elongated study to prove this theory by using more people because when this research was conducted, it was cold and flu season; therefore the results were biased. If this was done throughout the whole year and possibly one or two extra years, you would then be able to determine the effect that hand washing will have on a person's health. ♦

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Blackout: Solar Eclipse

This experiment examined the question of the cause of solar eclipses. The experiment was conducted as follows: First, the eye was introduced to the viewing of a tree that was in plain view in sunlight without any obstructions. Second, the eye was covered, partially by a circular coin, representing the moon. The changes in the view of the tree were noted, and these changes were compared to the conditions in that of a partial solar eclipse. Third, the coin was moved in front of the eye, gradually, until the tree was completely out of view, representing a full and/or complete solar eclipse. In this experiment the tree represents the sun; the dime, the moon; and the eye, the earth. This experiment shows that, though the moon is smaller than the sun, when positioned in front of the earth, it blocks light, and therefore blocks the light of the sun when positioned in such a way. This is because the sun is so much farther away than the moon is, allowing the moon to pass in front of the sun; and while crossing the path of view, it also blocks the path that the sun's light travels upon reaching us here on earth. This process, the blocking of the sun's light by the moon, is called a solar eclipse. ♦

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The Effect of a Different Wing Structure on Paper Airplanes

In this experiment, eight pairs of airplanes were folded (two of one kind) totaling to sixteen planes. The second plane of each pair had the wing tip folded upward. This was to test whether, by changing the wing structure, a plane could achieve a better flight time. Each plane was flown ten times in a 40-foot square area. Every plane was timed on its flight time and recorded. After every plane was flown and recorded, the average of the ten trials was calculated and written down. From the average time, the planes were concluded to have either failed or succeeded. Four out of the eight experimental planes failed and four out of the eight succeeded. The total success rate was fifty percent. From the results, it can be concluded that planes with large wing areas shouldn't have their wings altered. However, from the experiment, it can also be concluded that the path each plane flew was much more straight with the wing tips folded upward. ♦

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The Effects of Age and Gender on Short-term Memory

The aim of this investigation was to study the effects of short-term memory on different age groups and gender. In this trial, a grid containing 20 simple black-and-white pictures was shown to both genders of each age group. Each subject was given 15 seconds to study the grid pictures. When the grid was taken away, the subject was asked to list the names of objects he or she could recall. The results were recorded and examined. I experimented on 48 different subjects, 3 male and 3 female from each age group. Subjects in their 40s and 50s were able to recall five to ten objects. Subjects in their 30s to 40s were able to recall eight to twelve objects. Subjects in their 20s to 30s were also able to recall eight to twelve objects. Subjects in elementary were able to recall about five to seven objects. Subjects in kindergarten were able to recall one to three objects. According to my data, it was clearly shown that the number of objects a person could recall depended immensely on their age. As for the children of age in kindergarten to elementary, their brains are not fully developed in order for them to retain enough information. That is why they were able to only recall one to three objects. As for the middle age group, which included subjects from junior high to high school and the age 20 to 50, most of their brains are developed and can process information a lot more. This is the age group which is most active, and therefore can remember many objects. Adults and seniors are either slowly entering or already in the stage where their brain cells are slowly dying. This prevents them from obtaining as much information compared to the young ones. Aging affects their memory by changing the way their brain stores information and by making it harder to recall stored information. The brain capacity decreases as the age increases. ♦

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The Calculation of Time of Which Brand Name Bubblegum Lasted the Longest

The study examined the question of which brand name bubblegum lasted the longest. Bubblicious contained the most sugar, and then the following were Double Bubble, Juicy Fruit, Winter Fresh, Eclipse, and Trident. Each gram of sugar makes each gum last longer in minutes and seconds. Sugar-free brand name bubblegum such as Trident and Eclipse lasted the least because it has the least sugar. The results suggested that Bubblicious had the longest lasting flavor because it contained the most amount of sugar, and Trident was the least lasting bubblegum. ♦

Zach Simmons and
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Smog Pollution

My hypothesis is the Los Angeles smog problem is a result of the city's exposure to constant heat and ultraviolet light from the sun, which worsens the effects of car exhaust on living and non-living organisms. Two airtight containers were used in order to create environments in which the car exhaust and the different specimens could react. Placed in both containers were identical objects including newspaper, printer paper, rubber bands, an apple, a strawberry, and a plant. Also in both containers was a set amount of car exhaust, produced by the same automobile and piped into the containers for the same amount of time (about 10 seconds each). Both containers were then sealed tight with all the specimens inside. In addition, both containers were exposed to a plant light, for proper simulation of the sun, so that the living organisms could grow properly. To block any ultraviolet light that may have been emitted from the light, an Ultraviolet Screen Protector, which blocks 99% of UV light, was placed directly on top of the container which was directly below the light. One container, though, was exposed to unblocked ultraviolet light to test whether UV light would damage the specimens in that container more so than the other in addition to the car exhaust. To make sure that the other container would not be exposed to ultraviolet light several dividers were put in between the two containers. Also, the temperature surrounding the containers was always 64 degrees Fahrenheit or above, which allowed for photochemical smog to occur. To ensure that carbon monoxide was being produced from the car whose exhaust was used in the experiment, a carbon monoxide detector was used beforehand.

The specimens were put into their airtight environment on Sunday, May 9th, and were given seven days to react with the car exhaust. The first few days, differences between the two tanks were not obvious, but as time progressed, differences between the two were drastic, especially in the living organisms. By Wednesday, the 4th day, there were differences between the two apples and the two strawberries. The apple with UV exposure had deteriorated to a much greater extent than its counterpart, getting several wrinkles and browning spots. The strawberry with UV exposure also deteriorated to a greater extent than the strawberry in the other container, growing a black fungus (after having a white fungus), while the other strawberries were still white. Also, being that the strawberries were very similar in weight to start with, we can establish from their weight differences in the end, that the strawberry with UV exposure had 1/8 oz. more fungus than the other strawberry. The other strawberry did have fungus on it by Thursday, but even then it did not match the amount of fungus on the other strawberry. By Friday, there was a drastic difference in the plants as well. The plant that had received UV light had begun to shrink while the other plant was still growing. There were not drastic differences between the non-living objects including the rubber bands, paper, and newspaper, except for differences between elasticity of the rubber bands, in which the one with UV exposure was less than the other. ♦

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Terminal Velocity

My Technion project is about skydiving, and more specifically, terminal velocity. There are two forces acting upon the diver when he/she jumps out of a plane - gravity and air resistance (the force opposite gravity). It is proportional to the speed and surface area of the diver. (Miami University, Physics 101. Spring 2002. *Physics of Skydiving*. Retrieved April 10, 2005 from <http://www.users.muohio.edu/mcgratra/physics/html>.)

After some time, the two opposite forces are equal and the diver reaches terminal velocity, stopping acceleration. If the net force of an object is zero, the velocity of that object does not change. (Gewirtz, Herman & Wolf, Jonathan S. 2004. *SAT II Physics* [8th ed.]. New York: Barron's Educational Series, Inc.) My project looked into the time it takes for any object to reach its terminal velocity. My hypothesis was that all objects with the same surface area, even of different masses, should reach terminal velocity after the same amount of time. I digitally recorded two objects of different mass but same surface area and split up the videos by frame to determine when they reached terminal velocity. When I dropped one piece of cardboard, it reached its terminal velocity after 1 to 1.2 seconds. With two pieces taped together, they did not reach their terminal velocity and were still accelerating when they hit the ground. Therefore, my hypothesis was disproved and the less massive object reaches terminal velocity faster.

My mistake was that I confused the force of gravity for the acceleration of gravity. My hypothesis did not work because the acceleration is still the same on the heavier object, but the force of gravity is greater. Therefore, it would take longer for the force of air resistance to equal the larger force of gravity and longer for it to reach its terminal velocity. If I were to do this experiment with more precision, I might want to record the drops with a tape measure next to the falling object so I get the actual values instead of a proportion. However, I was able to get accurate enough data to disprove my hypothesis in the end. ♦

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Forces Generated on Rides

Physics is known to be involved almost everywhere in our daily lives. Physics involves velocity, forces, distance, time, work and much more. My project is on the forces of a ride called "Spin-Out" at Six Flags Magic Mountain theme park. The ride is as follows...People line up against the wall of a circular room and when ready, the room begins to spin at an accelerating velocity. When the ride gets to a fast enough velocity, the floor lowers beneath you; however, you stay against the wall. The question I was specifically trying to answer was, "What are the forces involved in the ride to make the person stay up?" My initial answer to this question or hypothesis was that there are forces involved in keeping the person up against the wall and up from the ground. These forces I later came to realize were centripetal force, which is the force that pulls an object outwards from the center when spinning at a certain rate. I also found out that frictional force was involved, which is the resistance of movement between two surfaces against gravity to keep the person up, while centripetal force keeps the person out.

The calculations part of this project required much work. I needed to conduct a procedure. This procedure involved measurements of time and length. I measured how long the ride took (90 s) and how long it took for the ride to spin once (.5 s) with a stopwatch. I used a simple measuring tape to measure the diameter (4.2672 m). One more

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thing I measured was my own weight (120 lbs). I then calculated my mass by dividing my weight by 2.205 lbs, because there are 2.205 lbs in every kg. All of the measurements were done manually at Magic Mountain. The only other tool I used was my calculator to make calculations. I used many sources for my project, including books, Internet sources, and encyclopedia, for instance, *Van Nostrand's Scientific Encyclopedia*. All of these sources were very helpful in understanding the physical elements of this project.

My hypothesis, although broad, was right. There are forces that act upon the person to keep him/her up. These forces are frictional and centripetal. However, the centripetal force is perpendicular to the frictional force, so there must be a force that the frictional force is fighting against. That force is gravity. The centripetal force is keeping you out, while the frictional force is keeping you up. Basically the frictional and centripetal forces are working together to keep the person from falling. All of this data was very important for my project and had a vast impact on both my calculations and my understanding of the elements. ♦

3513

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Salt Affects Boiling Point

Many people say that by adding salt to certain foods you obtain a higher boiling point, therefore resulting in faster food production. I predicted that the salt would be a contributing factor to the temperature at which the water boiled.

For my control value, I boiled water without salt and recorded its highest boiling temperature. Next, I measured the same amount of water but with different salt contents to see how helpful salt is in raising the boiling temperature of the water. The different amounts of salts are the variables. I repeated this process three different times on three different days to make sure that the outside weather would not influence the water temperature at all.

When I completed the experiment, I found that the salt raised the boiling temperature about 9 degrees. The first time I performed the experiment, I found that there was almost no variation in the boiling temperature at all. Because of this, I tried to use larger sampling amounts and to my satisfaction, I found that it was more difficult to see the results with a smaller amount of resources. This experiment taught me to never give up and if I do not succeed on the first try, not to be discouraged but to keep on trying. ♦

3514

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Do You Spin Longer With Your Arms In or Out?

This study examined if you spin longer with your arms in or your arms out. Four people were tested in four different spins: the Scratch Spin, Sit Spin, Camel Spin, and Layback Spin. Each spin was repeated four times with their arms out, and four times with their arms in. All of the people spun longer with their arms in, in the Scratch Spin, Sit Spin, and Layback Spin. However, in the Camel Spin, the spinners spun longer with their arms out. ♦

Fertilization of Sea Urchins

The purpose is to synthetically fertilize a sea urchin specimen and manipulate the rate of fertilization by introducing vegetable oil. Male sea urchin sperm was applied to a microscope slide containing a female egg suspended in seawater. The sperm and egg cells were extracted from the male and female specimens, respectively, by injecting potassium chloride to the bottom orifice of each specimen, which induces spawning. The sperm and egg cells were then stored in separate beakers. An eyedropper was used to apply each type of cell to a droplet of seawater on a microscope slide. The slide was then put under a microscope and observed. A drop of sperm cells was then added to the slide containing egg cells and seawater, the duration of the fertilization process was observed, and the times at which the fertilization process initiated and completed were recorded. In order to change the duration of the fertilization process, the experiment was repeated again, this time with vegetable oil as a substitute for the seawater. It was concluded that fertilization in sea urchins can be achieved synthetically, and the rate of fertilization slowed when the process takes place in vegetable oil in comparison to seawater. Observations of the fertilization process, when viewed under a microscope, reveal the way the sperm and egg interact with each other, and the similarities to other animals, such as humans for example, where the sperm "swims" to the egg. Once the sperm meets the egg, it is enclosed with a membrane that prevents other sperms from entering. Recorded data indicates the average fertilization rate of sea urchins in seawater is 58 seconds. The average rate in vegetable oil is 73.3 seconds. From the data it may be conjectured that ocean pollutants, such as those resulting from petroleum oil spills, also slow and perhaps stop natural occurring fertilization of sea urchins in the ocean. ♦

Phototropism in Mealworms

The purpose is to find out what effect light has on mealworms and what response they give. Six mealworms are put in a cardboard box with the top cut off. Half of the box is covered on the top with foil and tape. The organisms are then observed extensively for the next 20 minutes to see which habitat they prefer more, dark or light.

Results: Our study reveals that after 5 minutes, there were 2 mealworms in the light side and 4 in the dark side. After 10 minutes, there was 1 in the light side and 5 in the dark side. After 15 minutes, there was 1 mealworm in the light side of the box and 5 in the dark side. After 20 minutes, all of the mealworms had migrated over to the dark side of the cardboard box. From the study, it can be inferred that the mealworms slowly began to crawl toward the dark side and at the end of the experiment, all of the mealworms were at the dark side of the box. We inferred that because the mealworms liked the natural dark habitat better than the light one, they probably grow, develop and transform into beetles faster in a dark environment. Another conclusion made by us was that living things adapt and react to their environment by trying to keep their external environment. This conclusion was made when the mealworms, instead of embracing their non-natural habitat, tried to keep their old environment or an environment similar to their past. In performing this experiment, we understood one of the characteristics of all living things: they react to their ever-changing environment and try to keep their external habitat reasonably constant, mimicking their internal homeostasis. ♦

3517

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A World of Bacteria

The purpose of the experiment is to show just how large a role bacterium plays. The process of making yogurt requires cultured bacteria to set and cultivate in a heated area, with high temperatures for hours at a time. By way of binary fission, and the asexual process, the bacterium multiply. With hundreds multiplying every fifteen minutes, it's not even countable as to what the resulting number of bacterium would be after eight hours of binary fission. Through each experiment, this will be shown. If there are different types of food and natural ingredients available, then there are also different types of bacteria present in each. ♦

3518

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Nicotine, Ozone and Pollution

As a group we conducted three separate experiments to research the effect of nicotine, pollution and ozone on plants and bacteria. The first experiment consisted of growing bacteria in petri dishes in three different environments. Then each dish was contaminated with different amounts of liquid nicotine. The second experiment consisted of soaking plant seeds in nicotine or feeding the plants with different amounts of water and nicotine. The third experiment was a study of polluting sprouted plants with cigarette smoke and ozone. All three experiments show that nicotine, cigarette smoke and ozone affect the growth of living plants and bacteria. ♦

3519

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The Effect of Frostbite on Growth

The purpose of this experiment was to test the effects of frostbite on the growth of seeds. By exposing the seeds to dry ice, which is -70 degrees Celsius, for one, two and three days, I created varying degrees of frostbite on the seeds. I tested corn, radish, bean and sunflower seeds by exposing them to the dry ice for varying days. Then I put them in the freezer for one week to preserve the burns. Afterwards, I put the three day, two day, one day, and control seeds into petri dishes lined with damp paper towels. Each day, I added 3 mL of water to the dishes and observed their growth. I found that the seeds that were exposed to ice for one day, not the ones that had no frostbite, sprouted the fastest. ♦

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Killer Dandelions

Throughout history, various types of plants and herbs have been used for medical reasons. Dandelions, for example, were known for being nutritious and tasty; the greens made a great salad and the flowers a decent wine. Researchers are testing an investigational liquid dietary supplement that contains the nutrient found in dandelions, obligofructosaccarides, to see if it makes our bodies more resistant to diseases, particularly in the immune system. In this experiment, dandelion capsules and dandelion roots were tested to see if they had the same bacteria fighting results as penicillin, a common antibiotic. One drop of the liquid bacteria was spread over a petri dish, and on each dish were placed four small filter paper disks. Each disk was soaked in either water, penicillin, dandelion capsule, or dandelion root solutions and allowed to incubate. The results obtained by observing the bacterial growth demonstrated that, although the roots had no effect, the dandelion capsules showed some significant change, but neither could surpass the fighting power of penicillin. ♦

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Under Pressure

The purpose of my experiment was to determine the effect of decreasing air on the growth of plants. For my experiment, I grew peas in six different ball jars. The jars were divided into four different groups of six. Each of the jars contained different amounts of air. I vacuumed out 250 cc of air in one jar, 220 cc in another, followed by 190 cc, 160 cc, 130 cc and 100 cc. There was one in each group of three. I also examined the effect of fungi and yeast on the growth of plants. Two out of the three sets contained one of these variables.

My results show decreasing air pressure has a limited effect on the growth of pea plants. *Aspergillus niger* and yeast also played a limited role in the growth of the pea plants. In the control group and the fungi group, the plants decreased in height as they decreased in air pressure. In the yeast group, the plants increased in height as they decreased in air pressure. ♦

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Glowing Plant

Will performing a DNA transformation lab with bacteria from a jellyfish containing fluorescent DNA and a common tobacco plant give the plant the ability to glow? The purpose of my experiment has been to do a bacterial transformation and translation with the bacteria, *Vibro fischeri* (a form of *E. coli*) that has a fluorescent DNA component, then put the translated bacteria into a tobacco plant so the plant will have the capacity to glow. I have done the bacterial transformation of *E. coli*; however, it dawned on me that there is no way to transfer the bacteria into the plant with what I had primarily done. I then planted the tobacco plant, *Callus*, so that I would be able to take the egg cells of the plant and perform a transformation on those simultaneously with the *E. coli* bacteria so that they will have the glowing capacity. Then I would be able to join the egg cells with sperm cells from the same tobacco plant, and then plant the seeds so that the plant that grows will be able to glow. However, I was not as successful as I thought I would be because the tobacco plant did not grow and I was not able to extract the egg and sperm cells as I had planned. The primary bacterial transformations were successful, but I did not obtain the proper results from my experiment. ♦

Agar Overlay Recovery Method

A method of recovering sublethally injured bacteria was developed. The procedure known as *Agar Overlay Recovery Method* uses nonselective agar underlaid, with a selective and differential medium overlaid. In one petri dish, a selective agar, Viola Red Bile Agar, will be poured in first. This underlay will then be followed by the bacteria in *Escherichia coli*. In another petri dish, a nonselective agar media, Trypticase Soy Agar, will be poured in first. Then it is also implanted with a population of sublethally injured bacteria from *Escherichia coli*. Both petri dishes will be incubated. During this incubation, the bacterial repair processes occur and any injured bacteria will start to grow. After a short repair incubation period over a few hours, the second petri dish with the Trypticase Soy Agar underlay will be removed from the incubator. Into this petri dish both a selective and differential agar, Violet Red Bile Agar, is poured and incubated once again. This will provide an environment so that any nontarget organisms will not grow. At the end of this experiment, I was able to prove that the *Agar Overlay Recovery Method*, which was used in the second petri dish, is more effective than just direct selective planting procedures, which was done in the first petri dish. ♦

Oil Eating Bacteria

Bioremediation is a harmless process that allows for restoration and cleanup of contaminated land and water bodies. It is done by oil eating bacteria, which convert the oil into harmless organic components. In my experiment, I recreated this phenomenon by using motor, mineral, and canola oils. In order to study bioremediation, I created twelve agar plates and separated them into three groups of four. Each group held a control, hot, cold and room temperature plate. Later, I placed my bacteria into each plate and deposited five drops of the appropriate oil into each group. Then I placed each plate in its proper location. I marked the growth of my bacteria by seeing if the bacteria grew over the droplets of oil I placed in each plate. All twelve of my plates had significant growth. The plates labeled hot and control had the most growth, while the plates labeled cold had the least. Overall, my experiment was successful because bioremediation took place over all of my plates. ♦

What's Up Top?

Roof shillings are pieces of construction that are essential to the finishing products of rooftops. I decided to test three different asphalt roof shillings against the three most common forces of Mother Nature. Each of the shillings was tested against acid rain, high winds and fire. When the test was completed, I examined the effects that the natural forces had on each of the shillings. When tested against acid rain, the shingles showed dramatic discoloration. When tested against high winds, the shingles seemed lighter in weight than their original weight. And when tested against fire, the shingles proved to be fire resistant. ♦

Escalators or Elevators?

Are escalators or elevators more efficient for use in malls or large complexes? It was hypothesized that escalators would be found to be more efficient. Preliminary measurements were taken at a local mall utilizing both escalators and elevators. Using a stopwatch and tally sheet, the number of patrons accommodated by an escalator in 3 minutes was recorded. This measurement was taken three times, an average was calculated, and the measurement was reduced to people accommodated per minute. The same procedure was used for three elevators in the building. The elevator measurements ranged from 27-32 people/3 minutes; the escalator measurements ranged from 43-48 people/3 minutes.

The data calculated was: elevator – 10 people/min; escalator – 15 people/min. The velocity of both escalator and elevator was measured using a stopwatch to time the length of a trip from one floor to the next. Each machine's single-floor journey was made and measured three times, and an average was taken. (The distance from one floor to the next was approximately 12 feet, though the final measurement was converted to inches/sec.) The data found was: elevator = 10 inches/sec; escalator = 7.308 inches/sec. When the velocity and the people/min results are multiplied, the result is an approximation of how many people utilize each machine for one trip between adjoining floors. Those results are: elevator – 2 people/floor; escalator – 5 people/floor. Thus the preliminary ratio of escalator efficiency to elevator efficiency is 5:2 or 2.083:1. It appears here that the escalator is about twice as efficient as the elevator.

The work and force exerted on escalator and elevator were calculated after the preliminary values, to verify or disprove those preliminary results. Since $F=MA$, an average mass of the elevator was approximated by converting an average weight of 8 occupants to kg and adding that to an average accepted value of an empty elevator car (the result was approximately 752 kg). The average acceleration of an elevator (found from a reputable source: Murphy, Hollon and Sitzewitz, Smoot. *Physics Principles and Problems*. New York: Merrill Publishing Co., 1986) is 11.902 m/s² (including acceleration of gravity). Thus the force exerted by the elevator mechanism is 8.95×10^4 N. Conversely, an escalator moves at a constant velocity and thus has no acceleration. Thus the only force exerted by the escalator is one to cancel the effects of gravity on a person's weight. Taking an average adult's weight as 150 lbs and converting this weight to N, it was found that the minimal force exerted by an elevator is 6.67×10^4 N. Thus the ratio of force used by an elevator to that used by an escalator is 13.4:1. An elevator uses over 13 times as many Newtons as an escalator to function. The work exerted on each machine confirms this ratio. The displacement is equal to the number of floors in the building (8) which converts 29.961 m. Elevator = 2.619×10^5 J; escalator = 1.952×10^4 J. The ratio of work performed by an elevator to that performed by an escalator is once again 13.4:1.

Judging by the preliminary ratios and the more complicated later ratios, it seems clear that escalators are overall far more efficient than elevators. However, elevators still serve an important purpose in accommodating the disabled and those with strollers or large packages. ♦

Effects of Pre-Soaking Beans in Different Liquids

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The basic idea of this project is to see if soaking beans in liquids really affects germination. In the experiment, the unsoaked beans were the control group, and all the other beans' growth was compared to the progress of the control group. Since each bean's growth is quite variable, the average of several beans for each group is taken. After the averages are compared, remarkable differences are discovered. After the experiments proved that soaking beans in liquids before planting does affect germination, the next topic is to see which liquid affects the beans the most. After more experiments, it's been proven that beans soaked in hydrogen peroxide begin growing first, but beans soaked in tap water grow to be the finest plants.

Meanwhile, beans that are soaked in tea do remarkably worse than unsoaked beans. Beans soaked in tea begin developing last and grow the least. Soaking beans in tea stunts growth. These experiments and results show that in the end, soaking liquids do affect germination, but the liquids picked to soak beans in have to be carefully chosen. The best liquid to use would be easily obtainable tap water. ♦

Michelle Chow and
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Harmful Trees?

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As I was reading a *Science News* in the library one day, I came across an article that seemed to disprove the universal truth I had been taught since the first grade: that all trees are good because they "help" the environment. I decided this would be an exceptional experiment to perform because it was fascinating, unprecedented, and one that could definitely be learned from. My arrangement for the project was that I would, like the scientists who studied trees in Finland did, monitor the growth of certain pine trees and, after a certain period of time, measure the air omitted by the trees to detect any nitrogen oxides. Though the experiment in the *Science News* article was done with *Sylvestrus pinus* pines, my project was done by experimenting on three types of pine trees: the Dwarf pine, the Japanese pine and the Redwood pine. I bought the trees and planted them in clear plastic containers and allowed them to grow inside. After a couple of weeks, I measured the air from each container using nitrogen oxide measurement tubes to reach a conclusion. After measuring the gas concentration, I found that the Japanese pines were the only trees that showed that nitrogen oxides were omitted into the plastic containers. Both Redwood and Dwarf pines did have a color change in the red reagent, but I believe the orange color was the result of the acidity of the pine trees. ♦

Kristen Estrada and
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3529

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Mega Maggots

For my project, I would like to see how maggots work in a fixed environment, rather than just in the dirt in any given place. I would like to determine whether or not plants would grow and develop better and more rapidly in an environment that was inhabited by animals like fly larvae, and eventually full grown flies, which survive by regurgitating their nutrients into the soil once they have digested them. Also, since a plant's growth can be limited by drought, and maggots (which are eventually flies) dwell and grow in moist areas, the plants should be able to benefit from the flies' environment. I suppose that the nutrients and secretions they deposit into the soil will add to the growth and healthiness of the plants. If indeed the nutrients from the food that flies regurgitate do enrich the soil and work in a positive way for the seeds that have been planted, the plants should grow better. Through this experiment, I should observe more rapid results and positive growth spurts in the plants. ♦

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3530

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Sea Urchin Lab

In this lab, I want to find out how long it takes for an egg and a sperm from sea urchins to fertilize. I also want to find out if I add any kind of substance, like sugar water, to the egg and sperm, will it speed up the process or slow down the process in which it fertilizes? What are sea urchins? Where do they live? What is their scientific name? How do they reproduce? What types are there? What do they look like? I did six different tests of which three were just the sperm and egg together and the other three were with sugar water. My hypothesis is that sugar water will speed up the process of fertilization.

Results: Sea urchins are members of a large group of marine invertebrates in the *Phylum echinodermata*. They live in Alaska, Washington, Oregon, California and Maine. They can only survive in seawater for long periods of time. They have many scientific names. Some of the names are *Diadema Paucispinum*, *Echinothrix Diadema*, and *Echinothrix Calamaris*. The sea urchins reproduce by releasing eggs and sperm, then they fertilize. There are red, purple and green sea urchins. There are many different sea urchins but usually they are spiky and round. My hypothesis is that sugar water will speed up the process of fertilization. The three tests that I did with just the sperm and egg, the times on which they fertilized were 33 seconds, 49 seconds and 40 seconds. For the other three tests in which I added the sugar water, the times were 52 seconds, 69 seconds and 66 seconds. I learned from my data that the rate in which fertilization occurs is faster without the sugar water substance. My hypothesis was wrong. I thought that if I had added sugar water it would speed up the fertilization process; however, it did not. ♦

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3531

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Age of Which Growth Rate of Female Fingernails is Highest

This study examines the question of the rate of one's nail growth. There were six subjects in this experiment. Their ages varied from 0-60. The ages of the subjects were broken up into decades, with one representative for each. In this experiment, the nails of the subjects were painted and measured. This experiment was repeated three times for a period of 16 days each. The results suggest that the nails of the younger people grew the fastest. This experiment lacked distinction among the results. ♦

Laser Hair Removal

Who is a better candidate for laser hair removal? My hypothesis for this experiment was that people with lighter skin and darker hair have a better chance to get rid of their unwanted hair using the laser hair removal system. I assumed this because the laser beam would react stronger to dark pigments of hair. Since each skin type has a different pigment, a different treatment (and perhaps a different hair removal device) is necessary. There are different hair removal laser machines. Each of them has different pulses, power and spot sizes. There are four types of lasers that are mostly used at the clinics: the Ruby, Alexandrite, Diode and Nd: YAG laser. These four lasers have a range between 694 – 1064 nanometers.

In order to do this experiment, I tested two different skin types with two types of lasers. I tested two people with dark and insensitive skin and two people with light and sensitive skin. The two people with dark skin types were treated with the Nd: YAG laser. The two people with light skin types were treated with the Alexandrite laser. Each person is different in response to the treatment. Therefore, for optimum treatment, one needs different laser hair removal machines that will penetrate the skin with the correct wavelengths and a safe fluency so that the skin is not damaged. The results of my experiment proved my hypothesis correct. By the end of the month, the two people with darker skin had a little bit more hair coming through the surface of their skin than the people with the lighter skin pigment. ♦

Pollinators

The purpose of my experiment was to see if pollen eruption would occur better under circumstances other than water. To find this, I did 4 different trials on 10 different types of flower pollen. The first trial was testing the pollen in distilled water to see how long it would take for the pollen to erupt. The second trial was to see if pollen would erupt in a shorter amount of time in distilled water after the pollen had been humidified. The third trial was to see if pollen would erupt when 10% salt solution was added. And the fourth trial was to see if pollen would erupt in 10% sugar solution. With each of these trials, I collected the data of the times of eruptions, the humidity levels, or that there was no eruption at all. Each of these trials was not as accurate as possible because of the limited time that I had to observe the experiment. The results I obtained after looking over my data were that eruption of pollen was best in distilled water and it did not erupt in any other solution. Eruption with distilled water did not occur after the pollen had been humidified, though. Out of the 10 flowers tested, only one flower had pollen erupt after it had been humidified. In the case of the third and fourth trial, there were no eruptions after the 10% salt and 10% sugar were added to each of the pollen samples. From these results, I concluded that pollen would erupt the best in distilled water, that there was a 1-10 ratio of eruption after the pollen has been humidified, and that there was no eruption when 10% salt and 10% sugar were added.

PCR, Polymerase Chain Reaction, is the well-known method of replicating and multiplying DNA patterns of bacteria and organisms. I decided that I would try to replicate and compare the different DNA patterns of different flowers. I used PCR to multiply the DNA patterns and visually analyzed them on an agarose gel. Unfortunately, after carefully following all of the procedures for the PCR method, my photograph of the agarose gel did not show anything. The pictures did not show any sign of DNA patterns at all. The buffer loader did not even come out in the pictures. Sadly, my experiment was not successful, but I am proud of my hard work and dedication. ♦

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Effect of Auxin Powder on Radish Seeds

The purpose of this project was to figure out how the plant hormone, Auxin, affected the root growth of the plant. My hypothesis was that the plants that I added Auxin to would grow faster, longer, and healthier than the plants that didn't have Auxin powder added to them. I worked through my experiment from the date of February 4, 2005 to the date of March 10, 2005. To test this hypothesis and prove it correctly through an experiment, I got ten clear containers and filled them up with soil. I added one ounce of Auxin powder to five containers, making sure to read all the safety measures. Then, I filled each container by placing four groups of two radish seeds on the sides around the container. After I had gone through all procedures, I began to record data and observations every other day for about five weeks. At the close of these five weeks, my hypothesis had turned out to be correct. This is due to the fact that the length of the roots that received the Auxin powder came out to be around 6.5 millimeters, and the length of the roots that hadn't received Auxin powder came out to be around 3.4 millimeters. For that reason, my experiment proves that the radish seeds' roots in the Auxin powder do grow faster and longer than the radish seeds' roots with no Auxin powder. ♦

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3535

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Which Type of Soil Can Hold the Most Water: Potting Soil, Clay, Sand, or Marbles?

The problem was which type of soil can hold the most water: Potting soil, clay, sand, or marbles? My hypothesis was that sand could hold more water. First, I had to make a table by putting a window screen over four wooden blocks. Then, I placed four plastic cans with their bottoms and tops removed on the screen. I placed the same amount of potting soil, clay, sand, and marbles into each container. Next, four paper bowls were placed on the bottom of the table under the four containers and then I poured 124 milliliters of water into the four plastic containers. The water that was not absorbed fell in the four paper bowls. Recording the amount of water that fell into the bowls and then subtracting by the amount of water that was used took data from this experiment. This experiment was performed four times. Sand held the most water, holding an average of 36 milliliters of water. Therefore, my hypothesis was correct. ♦

Effect of Chewing on Teeth

I investigated the effect of chewing on our teeth. At the beginning of this project, I thought that chewing would have great impact on our teeth. But I found that the enamel on the outside of our teeth is very strong and well protects the dentin from outside forces.

I first wanted to find how much our teeth decrease over a year, and then a lifetime. I found that teeth lose 3.5×10^{-6} m/year, and 2.38×10^{-4} m/lifetime. This is not very much considering that just the enamel is .0033 meters thick. I then wanted to find the force of a tooth. I originally wanted to find it using the formula $F=ma$, but decided to find it using an experiment instead. I had my family bite into a piece of apple the height of the space between their teeth, 2 cm (measured with a ruler) at 30 times less their usual speed. I then took the average of their values, 1.125 cm, and multiplied it by 30, giving me 33.75 Newtons as the force of a tooth. I also wanted to find out the work done and pressure of a tooth. I used the formulas $W=\text{force} \times \text{distance}$ and $P=\text{force}/\text{area}$. I found the work as .3375 kg x m/s and the pressure as .3375 N/m.

What I found most interesting was finding how much energy it took to rub off a layer of tooth. I found this by multiplying the pressure (N/m) by the volume (m). This value was very small, so it doesn't take a lot to rub off a layer, but there are so many layers of enamel molecules that it doesn't really matter when you do. I also found that you cannot lose weight by chewing.

This project was interesting to me because I'd always wondered how teeth are so resilient over the years. This enabled me to find out to what lengths our body goes to keep our teeth strong. ♦

Effect of Pendulum Length on the Time to Reach a Stationary Equilibrium

This study was used to find if the length of the pendulum affected the time to reach a stationary equilibrium. The pendulum would be dropped from a 30° swing and would be shortened 50 cm twice, starting from 1.5 meters. In the test for accuracy, the pendulum timer was stopped at ± 4 cm amplitude. The time to reach a stationary equilibrium would be recorded for each measurement. The results showed that the time for the pendulum to reach ± 4 cm amplitude changed between each length. The period changed as well. The longer the pendulum, the longer the time to reach ± 4 cm amplitude. ♦

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Mass and Velocity

This project used model trains as an example of why objects with a greater mass have a greater velocity. My hypothesis was that there is a logical way to prove this, and through a series of testing and plugging the data into formulas, get a reasonable explanation. To perform this experiment, I used one train car, and tested how long it took to ride down a six-foot piece of track, sloped at a twenty-five degree angle. After testing the car three times to ensure that no outliers would be used for the data, I added a new one-ounce weight to the same car and compared their values. After also doing this three times, the process was repeated by adding two weights, three weights, and four weights. To measure this data, I used a stopwatch and halfway through the testing I stopped and waited one day before resuming. This ensured that there was no air conditioning or other outside force acting on the train car besides gravity. Overall, the data that was collected worked to prove the hypothesis. Data ranged from around three seconds for the empty car, to two and three-quarters of a second for the car with four weights. The train car got to a point where it was so heavy that the time it took to finally get accelerated down the track did not compensate for the faster velocity when it reached full acceleration. The one setback of this data was the fact that I could not get a track that was over six feet. With a six-foot piece of track, the train car did not have enough time to fully accelerate and thus, the data did not quite show my hypothesis in certain places. To help me form my hypothesis, I researched this topic online and in my textbook. The one equation that did help logically prove my hypothesis was momentum=mass times velocity. From that, I could clearly see that the mass of the object had a definite impact on its momentum and final velocity. Overall, I achieved my goal of logically proving why objects with greater masses have higher velocities. ♦

Alan Janoyan and
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3539

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The Effects of DDT on *Genyonemus lineatus* in the Los Angeles Harbor

The white croaker fish, *Genyonemus lineatus*, can be found in the Los Angeles Harbor. Occidental University trawl data in the months of November 2002, January 2003, February 2003, December 2003, January 2004 and March 2004 were analyzed. Several different fish were caught by otter trawl off the RV Vantuna, including the white croaker. When the data is observed it shows the slow reduction of white croaker fish in the LA Harbor in the past 2 years. If sediment caps aren't placed on the sediments of the LA Harbor, then the population of the white croaker fish will continue to decrease.

Since the DDT molecule, Dichloro-Diphenyl-Trichloroethane, has built up in the harbor's water and the sediment beneath it, fish such as the white croaker are at risk of decreasing in population. The DDT inside the LA Harbor is subject to biological magnification through the food web. The biological half-life of the DDT ranges from 26 days to 15 years, during which time it builds up inside the fish. The build up causes the white croakers to die. If the white croaker is eaten with the DDT it contains, then the people eating it will be at risk for diseases such as cancer. The Occidental data shows that from January 2003 to March 2004 there was a 60% decrease in white croakers being caught by otter trawl. A possible reason is the LA Harbor has been contaminated with high amounts of DDT, which kills fish. The way to prevent the DDT from entering the food web is through caps that are put in the water to cover the sediments beneath the clean water. If the high amount of DDT is not under control soon, then there will be a decrease in white croaker population in the LA Harbor. Signs are set up in the city of Los Angeles warning fishermen not to eat white croaker fish because of the risk of factors caused by DDT, and this is true for other cities such as San Francisco and Palos Verdes. In conclusion the caps that control the DDT level need to be put in the LA Harbor to save the lives of the fish and to get the people eating the fish out of danger. ♦

Time on an Inclined Plane

With a hypotenuse of a ramp and a given height, is it possible to find out how long it will take a ball, placed at the top of the ramp starting at rest, to reach the bottom? Yes, I believe it is possible. A ramp of varying heights was used with a ping-pong ball. With an adjusted formula for time, I compared my times to those that were supposed to come out. With an error of approximately 3%, the results were fairly accurate. Friction and/or faulty measurements could be the reason for errors.

The ramp was constructed of heavy cardboard, that which would not yield to the mass of a ping-pong ball. The ping-pong ball was a standard and did not change. A physics website was used to confirm that the acceleration on an inclined plane equals the acceleration of gravity multiplied by the sine of the angle of elevation. My data ranges from 3.01 seconds to .54 seconds depending on the height of the ramp. For the example, the length of the ramp was .57 meters and the height was .007 meters. The time for the ball to reach the bottom was 3.01 seconds.

My conclusion is that on a frictionless ramp, the time for a ball to reach the bottom equals the square root of twice the distance squared divided by the acceleration of gravity multiplied by the height of the ramp. When there is friction, the friction must be accounted for. This was the reason for my 3% error. The height and distance of the ramp are related to the time it takes for the ball to reach the bottom. ♦

Water Quality

As humans do, aquatic flora and fauna need oxygen to live. When water moves past the gills (or alternate breathing system) of aquatic life, tiny bubbles of oxygen enter their bloodstreams called dissolved oxygen. This is known as respiration (the process of breathing), essential to most life forms. The production of oxygen comes from photosynthesis during the hours of daylight and is consumed during respiration and decomposition. Photosynthesis takes place only during hours of daylight, while decomposition and respiration are processes that do not discern between day and night. During hours of darkness, no oxygen is being produced while decomposition and respiration of the plants are taking place. By the morning, in areas of plant overgrowth, the large amount of plant life has used much of the oxygen in a body of water for decomposition or respiration. This often results in "dead zones" where the level of DO has dropped so significantly, there is not enough oxygen for living organisms to survive. This can result in massive "fish kills," a condition where fish float ashore after dying as a result of low oxygen levels. Plant overgrowth is typically fueled by a high level of nutrients (which include nitrates, nitrites, and phosphorus) which come from a variety of sources, including excessive dumping of animal waste, sewage, lawn fertilizers, badly maintained septic tanks, agricultural waste, runoff from urban storm drains, and treated water with high levels of nutrients from composted materials.

I conducted tests at two locations: Solstice and Las Virgenes Creeks. Solstice Creek is used as a standard of the parameters that a stream should have because it is still, overall, an undisturbed tributary. Consequently, Solstice Creek served as the control or reference point, while Las Virgenes Creek was the experimental creek. Both creeks had acceptable levels of dissolved oxygen at the time of testing; however, the Las Virgenes DO level came with other questionable data, affirming the initial assumption of an imbalance. I converted, through several equations, the DO level from mg/L to percent saturation. My data ranged from about 8 mg/L to about 12 mg/L, both considered healthy levels. However, further examination reveals that Las Virgenes Creek may not be as healthy as it seems on the surface (consult the conclusion). My primary source was Heal the Bay, an organization with which I worked very closely throughout the project, using their equipment, laboratory, and infinite expertise. Other sources included Waterontheweb.org, a division of NSF (National Science Foundation), and lastly the EPA (Environmental Protection Agency). ♦

Problems in the Global Warming Theory

Global warming has been a major subject in popular science, but the statements made by most scientists about global warming are based on inconclusive data, or conclusive data that is misinterpreted. From certain graphs acquired from NASA, it has been seen that many factors affect global warming. One of these factors is the Milankovitch Cycle, which is a cycle of warming and cooling of the global temperatures. Carbon dioxide is a well known and publicized factor in global warming but Daly has data showing otherwise. Sunspots, another factor, cause most "spikes" in these readings. In fact, sunspots are the main reason for spikes in graphical reading. Carbon dioxide and the Milankovitch Cycle are the cause of the slow rise in global warming according to the comparison of Daly's and NASA's graphs.

The problem with the study of global warming is that the ways these graphs are studied, most of the time, conclude the scientist's original hypothesis to be true. In conclusion, global warming is a subject that remains inconclusive until political "emotion" on the subject would not affect the conclusion of the studies.

The original temperature data in this report was collected from various weather stations from Arctic and Antarctic regions. Sunspot and the Milankovitch data for the graphs were collected from ice cores from measuring the chemical "scent" of the cores. Current sunspot data was collected from counting sunspots from telescopes.

The reason why most graphs appear that the world is getting warmer or colder is because the graphs show only a century's worth of data and they are sometimes squeezed to create the illusion that the world is getting warmer or stretched to show that it getting colder.

The problem with the current global warming theory is that its radical statements cause people to make radical decisions. Like the Kyoto bill, which wastes the world economy on \$117 billion for lowering global temperature by 0.001213876 °C by 2050 (Junk Science), when in fact the world is about to enter another ice age according to the Milankovitch Cycle. Instead of controlling the weather, we must adapt to it. Also, all of the world's money should be spent on cleaning up the environment, not changing its mixture compound. ♦

Which Citrus Fruit is the Best Electrolyte?

This experiment was conducted to determine which citrus fruit would generate the highest electrical current. Grapefruits, lemons, limes, oranges, and tangerines were tested. Copper and zinc electrodes, connected to a voltmeter, were inserted into either side of each of the five citrus fruits. The electrodes could not come into contact with each other. The citrus fruit juice passed the electrical current to the metals, which were then read by the voltmeter. The mass, diameter, and voltage of each fruit were recorded. The experiment for all fruits was repeated 3 times, with the lemon and grapefruits being tested 4 times. The resulting voltage range was from .67 - .804 volts. The grapefruit produced the highest voltage and the tangerine the lowest. These results suggested that the grapefruit was the best electrolyte. ♦

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The Effect of Lemon Juice on Apples

The objective of this experiment was to find out if lemon juice affected how long an apple would stay fresh in a room temperature location. Two groups of apples were used in the experiment: 20 apples were dipped in lemon juice and 20 apples weren't dipped in lemon juice. After the apples were left for 48 hours, the 20 apples that were dipped in lemon juice still looked healthy, if not so juicy. However, the 20 apples that weren't dipped in lemon juice looked brown and nearly rotten. The results suggest that the lemon juice has something to do with slowing down the process of browning or oxidation, and keeps the apple fresh and healthy longer. ♦

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Elastic Collision

This study discusses the involvement of energy and momentum in an elastic collision demonstrated with different sports balls dropped from a specific height onto a solid surface. A bowling ball, a tennis ball, a basketball, a baseball, and a golf ball were some of the balls taken one meter above the ground and dropped onto a cement floor. Each ball was dropped three times. Each ball's bounce height was recorded. When balls were held one meter above the ground, each ball possessed gravitational potential energy. When each ball hits the ground, kinetic energy is transferred to the ground, and then into sound. This is all possible because the ground gives an equal force to what the ball exerted, making the ball bounce. Out of these experiments the tennis ball's bounce height was a higher distance than the rest. ♦

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Which Filter Works Best?

In this project, I tested different filters in how effective they are in removing chlorine and decreasing acidity. The filters I tested included a reverse osmosis filter, a gravel filter, and a carbon filter. First, I tested unfiltered tap water, which had a chlorine level of 0.8 and a pH of 7.6. The tap water that went through the reverse osmosis filter had no chlorine and pH level of 7.0. The carbon filter had no chlorine and a pH level of 7.4. The gravel filter had a chlorine level of 0.6 and a pH level of 7.6. This proved that the reverse osmosis filter works the best at removing chlorine and reducing acidity. ♦

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Fertilization of Sea Urchin Egg Affected by UV Lights

The purpose of this experiment is to be able to fertilize *Strongylocentrotus purpuratus*, known as the Purple Sea Urchin, eggs. This experiment is also going to test if ultraviolet light affects the rate at which this fertilization occurs.

In order to create a control, a simple timing of egg and sperm fertilization under a light microscope was used. Once the fertilization was completed, the time was recorded and this was repeated several times to ensure the test. New sperm and egg are then separated onto two separate petri dishes to ensure no pre-fertilization. An ultraviolet light that has specifically 290-320 nm is placed directly over the dishes without coming in contact with them. Once the egg and sperm are exposed to the ultraviolet light for 35 seconds, they are then fertilized under the microscope and time is recorded. The exposure of sperm and egg to UV light is then repeated several times as before. This again is repeated with different exposure times of 60 seconds and then 180 seconds. The times are recorded and then compared.

Different amounts of ultraviolet light did affect the rate of fertilization. Our results showed us that ultraviolet lights make fertilization quicker depending on how much time the sperm and eggs are exposed for. Our times for the complete fertilization process were (in average seconds) 68.6 seconds, 43.3 seconds, 31.6 seconds, and 40 seconds from the exposure times of none, 35 seconds, 60 seconds and 180 seconds of ultraviolet light, respectively. Once the time exceeds a certain point, the fertilization begins to slow down again. Since the exposure that was the quickest to fertilize was the middle range, this might be a factor of why the *Strongylocentrotus purpuratus* lives in the average depth of the Pacific Ocean. This would help the fertilized egg's chance of surviving. ♦

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3548

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Black Grouper, *Mycteroperca bonaci*, Population Studies in West Coast Florida

The Black Grouper species, *Mycteroperca bonaci*, has decreased in population over the years. This observation is based on data collected by fishermen in West Coast, Florida, between the years of 1986 and 2003. In the study, the fishermen used a stout cod-line, or a Kirby Limerick hook, which they attached bait to. They also used nets because the grouper fish travel in big groups, and therefore it is easy to catch many at the same time. If limits are set for the amount of Black Grouper fish that can be caught, and if coral mining, damage caused by boats and anchors are controlled, then the Black Grouper population can be stabilized. Between the years of 1986 to 2003, fishermen in West Coast Florida caught a total of 11,974,387 pounds of Black Grouper. In 1986, a total of 1,304,281 pounds of Black Grouper were caught; in 1991, 873,449 pounds were caught; in 2003, only 452,329 pounds were caught. This represents approximately a 65% decline in the number of pounds of Black Grouper fish caught in West Coast Florida in 2003 versus 1986. This shows that the population has decreased in the Florida, West Coast region over the years. Population stabilization is possible, but due to the slow reproductive characteristic of the fish, it will take a number of years to occur even with adopting strict conservation efforts. ♦

3549

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Effect of Creatine Monohydrate on *Lumbriculus variegatus* (Water Worms)

This study examined the effects of creatine monohydrate on the locomotor performance of *Lumbriculus variegatus*. Worms were put into water or creatine monohydrate for 24 hours. Each worm was tested three times for one minute. Worms in the creatine traveled about 58% more than the worms in water. ♦

3550

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Working Memory

This science project's purpose was to see whether gender affected working memory. Working memory is a function that we use everyday. It involves remembering telephone numbers, lists, names, etc. A poster with 12-15 pictures was shown to four girls and boys, all the same age (15 in this case) for two minutes only. They were then to write down the pictures that they remembered. They were given about three minutes to do so. The results were averaged out. The girls' average was 11 of the correct images and the boys' average was 14 of the correct images. In the end, the boys' working memory worked better than the girls' working memory. Gender does affect working memory even though there is only a slight difference between both genders' averages. ♦

3551

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Is There a Difference in the Bone Density of Women in Rural Areas vs. Women in Urban Areas in India?

This study tested to see the difference in bone density in Indian women who came from urban areas and from rural areas. A test was conducted on the participants using a clinical bone sonometer, which measures and shows the bone density of the participants using their heel. We tested 100 women who live in urban areas and 100 women in rural areas who were 40 years old and above. Out of the 100 urban participants, 45 women/45% had a normal bone density while 55 women/55% had a lower-than-normal bone density. Out of those 45 women who had normal bone density, 25 women/56% were between the ages of 40 and 54 while the other 20 women/44% were over 55 years of age. However, out of those 55 women who had a lower-than-normal bone density, 31 women/56% were between the ages of 40 and 54 while the other 24 women/44% were older than 55 years of age. These are the results of the 100 women who lived in urban parts of India.

Out of the 100 participants who lived in rural areas in India, 49 women/49% had a normal bone density while 51 women/51% had a lower-than-normal bone density. From those 49 women, 35 women/71% were between the ages of 40 and 54 while 14 women/29% were older than 55 years of age. However, of those 51 women who had a lower-than-normal bone density, 25 women/49% were between the ages of 40 and 54 while 26 women/51% were older than 55 years of age. These are the results of the 100 women who lived in rural parts of India.

The results of this experiment have led to two conclusions. First, women who live in rural areas may have less incidence of osteoporosis due to normal bone density measurements. Second, the women in the age group of 40-54 years in the urban areas, when compared to the rural areas, may have a higher incidence of osteoporosis (low bone density measurements). ♦

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3552

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Effect of Secondhand Smoke on Basil Plants (*Ocimum basilium*)

This experiment examined the effect of secondhand smoke on basil plants (*Ocimum basilium*). Two groups of 6 plants each were started from seed. Observations and measurements were recorded for a period of 2 weeks. The control group was treated the same as the experiment group except that the experiment plants were exposed to the smoke of 2 camel unfiltered cigarettes for 1 hour daily. The experiment group sprouted 2 to 3 days later and did not grow as tall as the control group. The smoke had killed the experimental group at approximately 2 weeks. The control group stayed alive and healthy. The secondhand smoke did affect the growth of the basil plants (*Ocimum basilium*). ♦

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3553

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How Different Colored Light Affects Plant Growth

Research has shown that the color of light shining on a plant affects its growth patterns. A greater proportion of deep red light makes plants grow taller, and a greater portion of lighter red makes them grow shorter and bushier. The effects of five colors of light on the growth of common green beans were investigated. The colors used were transparent, yellow, red, green, and purple. Plants were grown for six weeks and measured at the tallest part of the stem to determine plant height. The results showed that the beans grew tallest under yellow light, followed by purple, transparent, green and red. Previous research was partially confirmed, in that plants in purple light grew taller than those in all the other colors but yellow. However, the shortest plants should have been green rather than red. Other factors that should be considered in future studies include type of plant, temperature, fertility of soil, and angle of light. ♦

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3554

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The Effects of Water in Oil

This study was to try and prove whether water would mix in/sink with vegetable oil or extra virgin olive oil within a six week time period. Two clear containers were filled with oil. One was filled with vegetable oil and the other with extra virgin olive oil. Equal parts of dyed water were added on top of the oil (any color that stands out, preferably red). Store at room temperature and mark the sides where the oil and water are separated. Then watch that line to see if the water soaked up any oil. This can be told if the dyed water went over the marked line. Be careful moving it because this might disrupt the process and/or outcome of the experiment. The results of this were that the water did not soak up any oil after a six week period. ♦

Evaporation

In my project, I am trying to prove how temperature and surface area affect the rate of evaporation. Evaporation is the process in which water transforms from a liquid into a gas. To begin my project, I gathered some background information on evaporation from different websites and the encyclopedia. I learned that evaporation occurs because among the molecules near the surface of the liquid, there will always be some molecules with enough heat energy to overcome the cohesion of the others around them and escape. For my experiment I placed 210 ml of water in a plate and cup, the plate having more surface area (62.8 cm), and the cup having a circumference of 23.6 cm, and let it sit in room temperature (72°F). After 3 days, I measured the volume of the water, and calculated the amount of water that had evaporated. Next I did the same thing but placed the cup and the plate in the refrigerator (35°F). In the warmer temperature, 20 ml had evaporated from the cup and 90 ml had evaporated from the plate. In the colder temperature, 5 ml had evaporated from the cup and 65 ml had evaporated from the plate. More water evaporated from the plate because it has more surface area and more water molecules are exposed to the air. More water evaporated in the warmer temperature because it has faster molecules and more of them will escape more easily. I concluded that the more surface area and the higher temperature there is, the quicker water will evaporate. Other than the cup, plate, and water, I used a measuring cup and measuring tape for my experiment. The measuring cup was to measure the volume of the water before and after evaporation, and the measuring tape was to measure the diameter of the plate and cup so I could calculate the circumference to prove the surface area part of my project. ♦

Does Miracle-Gro Powdered Fertilizer Lower the Reproductive Rate of a Species of Collembola Called *Pseudosinella violenta*?

The purpose of the experiment was to determine if Miracle-Gro, a liquid fertilizer, lowers the reproductive rate of collembola, *Pseudosinella violenta*. Our hypothesis was that the reproduction rate would be lowered by the Miracle-Gro. Collembola are hexapods that eat mold. We made habitats for the collembola using plaster of Paris, charcoal, and water in petri dishes. We made the Miracle-Gro according to the directions and watered half the petri dishes with the Miracle-Gro fertilizer. The other half of the petri dishes were watered with water and labeled the control. We placed grains of yeast into the petri dishes for the collembola to eat. Equal numbers of collembola were placed in the control and in the experiment. We used stereomicroscopes and hand lenses to observe and collect data 9 times in 19 days. We combined all the data and found 45 percent of the adult collembola survived in the Miracle-Gro fertilizer and 76 percent of the collembola survived in the control. No juveniles were found in the experiment, although 10 juveniles were found in the control. In conclusion, our hypothesis was correct: the reproduction rates of collembola were lowered by the use of the Miracle-Gro. ♦

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Freezing Effects

Through this experiment I was hoping to prove that by freezing both fruits and vegetables the mass would change in each object along with a change in their appearance. I started with two cups, an electric scale and a number of different fruits and vegetables, each having separate physical and chemical attributes. The data collected was the mass before frozen, the mass after and the time it took to freeze. Before starting the freezing process I massed each sample. Then I placed them into a cup half filled with liquid nitrogen, calculated the time and then massed it again. After about a minute or so in the liquid nitrogen most had frozen but there was no drastic change in their mass, though many changed dramatically in appearance. After performing this experiment I realized that there were many things that may have gone wrong or that could have changed data. The amount of other particles in the area that could have tilted the scale is a main part of the experiment that may have gone wrong. Besides the variables, the experiment completely surprised me and was very interesting to perform. I expected the liquid nitrogen to have a greater effect on the fruits and vegetables than it did. Most of the mass weights decreased rather than increased to my surprise. All in all, the research was a success and I discovered that liquid nitrogen just freezes things, causing them to be either more brittle or stronger. ♦

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Investigation of Thorium Radiation

This study investigates the characteristics of alpha, beta, and gamma radiation emanating from radioactive thorium-232 and its associated decay products. Camping lantern mantles were utilized as a source of thorium. The alpha activity of lantern mantles ranged from 0.012 to 0.03 microcuries and the beta activity ranged from 0.089 to 0.144 microcuries. The gamma exposure rate on contact ranged from 30 to 43 microroentgens per hour. The effect of increased distance from the source on the radiation levels was investigated. The radiation levels decreased exponentially with distance. Alpha radiation became non-detectable within 3 inches. Beta radiation became non-detectable within 32 inches. Gamma radiation became non-detectable over 12 inches. The effect of shielding materials (paper and water) in reducing exposure levels was investigated. Alpha radiation was effectively shielded with only 1 sheet of paper. Beta radiation decreased exponentially, requiring 30 sheets of paper for a 90% decrease, and 150 sheets to be shielded completely. Gamma exposure decreased linearly, requiring 150 sheets for a 90% decrease. With water shielding, gamma exposure was reduced 90% with 2 inches of water and 100% with 3.5 inches of water. All data reported above was background subtracted. Typical background gamma exposure levels during this investigation were 2,818 +/- 490 cpm (13.1 +/- 2.8 microroentgens per hour). Typical background alpha and beta levels were 1.0 +/- 1.3 cpm and 56 +/- 19 cpm respectively. ♦

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Does Vigoro, a Powdered Fertilizer, Harm an Adult Species of Collembola Called *Lepidocyrtus northridge*?

The purpose of this experiment was to determine if Vigoro, a powdered fertilizer, lowers the rate of reproduction of the adult *Lepidocyrtus northridge*. We hypothesized that the fertilizer would lower the reproduction rate. Collembola are macroscopic invertebrates that have a head, thorax, and abdomen. To test out the hypothesis we made the Vigoro according to the directions, one tablespoon per gallon of water. Then we made homes for the collembola by mixing 9 parts plaster of Paris, 1 part charcoal, and water in 14 petri dishes. We let them dry completely. In half of the petri dishes we placed drops of Vigoro to moisten the environment. In the other half of the petri dishes, the control, we placed drops of water to moisten the environment. The class divided into groups of three or four to care for our experiment. Each petri dish was labeled with group names and control or experiment. Yeast was placed in the environment to feed the collembola. We placed equal numbers of adult collembola into each of the petri dishes. We observed the collembola 8 times in 19 days. On the last day we used hand lenses and stereomicroscopes to count the number of juveniles in the petri dishes. We combined all the data from the groups. In the Vigoro we had 72 live juveniles. In the control we had 237 live juveniles. The results prove our hypothesis is correct. The liquid fertilizer, Vigoro, lowered the rate of reproduction for *Lepidocyrtus northridge*. ♦

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Bacteria in Tap Water

For my 2004 Technion Research Project I chose to research tap water. I was always interested in tap water, especially after hearing reports about how bottled water is not what it seems to be. I have always been fascinated with the cleanliness of tap water. Some areas I have been to have tap water that tastes great, while others have tap water that isn't safe to drink. So, for my project, I collected water samples from around California and tested their cleanliness by their bacteria contents.

At 4pm on the test date, all the water samples looked the same. After placing the tablets into each sample, an orange ring developed at the bottom of every cup, and particles started to drift to the surface. All the samples had about the same dissolving speed for their tablets. After watching for the first ten minutes, I realized that the Tarzana and Irvine samples had the fewest particles gathered at the surface, and Encino had the most. After letting the samples sit for another hour, I observed the following: the Irvine sample had the fewest particles at the surface, but had a cloudier look to it. The Encino sample was the darkest orange. The San Francisco sample had the most particles gathered at the surface. The Northridge sample had the biggest particles gathered at the surface. The Irvine sample also had the most dissolved tablets. After another four hours, I gathered the following: the filters did

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almost nothing and not enough data could be collected; however, the tablet tests had interesting results. The Tarzana water sample looked clean, but had particles spread out on the surface. The San Francisco sample also looked clean and had many particles floating on the surface that were bunched together. The Northridge sample and the Encino sample looked the same as the Tarzana sample. The Irvine sample looked extremely cloudy and had many particles gathered on the surface. Now, as for the filter tests, every sample looked the same and did not change throughout the whole test. However, I did observe that the Tarzana sample had the most bubbles gathered on the filter. The final observation I made was that the amount of bacteria in the purified water sample does not even compare to the tap water samples; the purified water has almost no particles in it, and had a much faster dissolving speed. After making these observations, I realized part of my hypothesis was wrong; the water samples from L.A. were the cleanest, while the water samples from around California were dirtiest.

To measure the actual bacteria of each sample I did the following: first I measured the area of the circular base of the cup (all bacteria cultures were at the bottom of the cup). Next I measured the area of one of the cultures of bacteria and multiplied it by however many cultures there were. Next I took the total bacteria number for each sample and divided it by the total area and multiplied that by 100 to get a percent. The following is what I collected:

Irvine: 19.625 cm² total bacteria (also the area of the cup's circular base; the bacteria covered the whole circle). This is 100% bacteria covering the base.

Tarzana: 1.57 cm² total bacteria. 8% of the base was covered with bacteria.

San Francisco: 56.52 mm² total bacteria. 28.8% of the base was covered with bacteria.

Northridge: 100.48 mm² total bacteria. 51.2% of the base was covered with bacteria.

Encino: 100.48 mm² total bacteria. 51.2% of the base was covered with bacteria.

Purified Water: bacteria particles barely visible. Less than 3.14 mm² total bacteria. Less than 1.6% of the base was covered with bacteria. ♦

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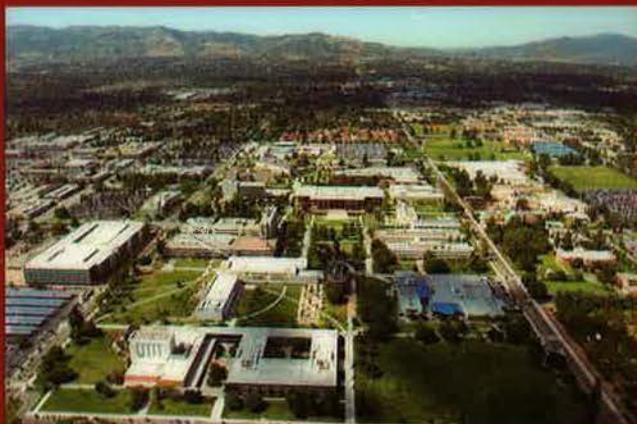
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