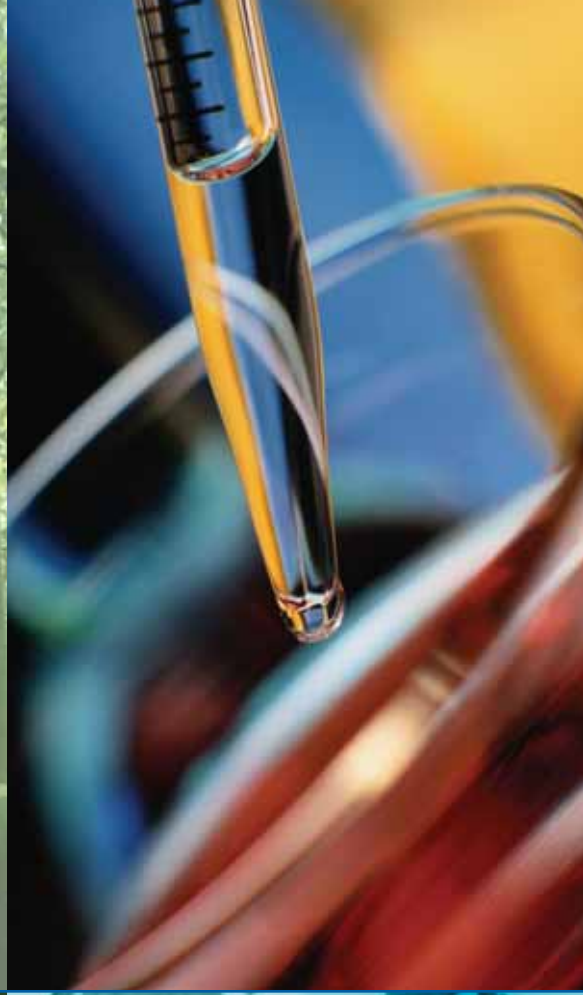
Technology Transfer Works: 100 Cases From Research to Realization



Reports From The Field

AUTM

2006 Edition

www.betterworldproject.net

Technology Transfer Works: 100 Cases From Research to Realization

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Part of The Better World Project

www.betterworldproject.net

The Better World Project

The Association of University Technology Managers launched the Better World Project in 2005 to promote public understanding of how academic research and technology transfer have changed our way of life and made the world a better place. The project draws from more than a decade's worth of case studies and news from AUTM members — the professionals who make academic technology transfer happen.

The first edition of the project focuses on products derived from U.S. and Canadian academic research. Future reports will include stories and perspectives from around the globe that convey the benefits of academic research in human terms.

Materials and Support

The Better World Project includes:

- *The Better World Report*: In-depth articles about 25 innovations derived from academic research that have changed the world
- *Reports From the Field:* 100 technology transfer success stories, from research to realization
- *Better World Project Online:* A searchable database to help you find stories of interest to you and your community

The Better World Project materials are available in print and electronic forms. Visit The Better World Project Web site or contact AUTM headquarters for details.

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The Association of University Technology Managers

AUTM is a nonprofit professional association with membership of more than 3,500 intellectual property managers and business executives from nearly 50 countries. The association's mission is to advance the field of technology transfer, and enhance the ability to bring academic and nonprofit research to people around the world. AUTM members represent more than 350 universities, research institutions, teaching hospitals and government agencies as well as hundreds of companies involved with managing and licensing innovations derived from academic and nonprofit research.

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Reports From the Field wouldn't exist if not for the directors of institutions' technology transfer offices and their staffs, who diligently gathered and submitted these stories and others. AUTM recognizes this dedication — which is never part of technology transfer professionals' job descriptions, but represents a considerable extra effort and labor of love — and expresses gratitude for their considerable contributions.

Editor and Staff: *Reports From the Field* was edited by Marcie Valerio of The Sherwood Group Inc., a nonprofit association management firm serving science, technology and healthcare specialty fields. AUTM's management staff and the Communications Department at The Sherwood Group provide strategic, editorial and design support for The Better World Project.

Contents

Welcome to a Better World

We have a story we want to tell. In fact, we have hundreds of them.

The stories are about people whose lives have changed for the better. They are stories about the world around us, and how it is becoming a healthier and safer place.

The Association of University Technology Managers has been in the business of building a better world for a long time. AUTM members manage the transfer of discoveries resulting from academic research to companies that transform these intricate technologies into viable products for the world far beyond the boundaries of the campus.

Many of these products have become household names: Allegra, Restasis, Honeycrisp apples, Caltrate Colon Health, nicotine patches and the Hepatitis B vaccine, for example. Others with names such as HibTITER, C-plate technology, stub-loaded helix antenna and somatic embryogenesis may not be as well known but have affected all of us profoundly — saving lives, improving well-being and contributing to a stronger economy.

Too often, the stories behind these innovations have been forgotten or lost in the passage of years, or simply never told. No one ever sat down and explained how these products for a better world came to be in the context of the human experience. Yet the stories are immensely human, from the first spark of wonder and discovery to the final product that, for some people, can change everything. Without the tireless work and commitment of academic researchers on campuses across the globe, there would be no products and no stories to tell.

This inaugural *Reports From the Field* publication contains 100 good stories from the United States and Canada, but they're just the beginning. There are many more to tell. In the coming years, The Better World Project — an overarching program that includes *Reports From the Field, The Better World Report* and Better World Project Online — will continue to capture and tell the stories of products that have improved the health, safety and welfare of people worldwide.

In fact, AUTM already is planning the next edition, which will feature more stories from the United States and Canada as well as other countries where AUTM members are sharing news about products that originated in their research institutions and now are available to the public. *Reports From the Field* is about academic research — no matter where it occurs on the face of the Earth. It's about people who are passionate about their research and helping others, even if it takes years of sustained effort.

The scope of this endeavor will expand greatly, but the goal of every edition will remain constant: to illustrate how academic research and technology transfer have changed our way of life and made a better world.

Pink Beauty Potentilla Beautifies Gardens Around the Globe

University of Manitoba

Decades of plant breeding and proofing at the University of Manitoba went into the development of the popular Pink Beauty Potentilla. Since its introduction in 1994, the cultivar has taken the gardening and landscaping business by storm in North America, Europe, Japan and Australia.

In the wild, potentilla is a circumpolar plant that grows in northern temperate zones. Through the years, botanists have domesticated these wild cultivars to produce well-adapted yellow-, cream- and white-flowered potentilla shrubs. Pink, however, proved elusive.

In the 1980s, university plant researchers led by professor Louis Lenz were taking an active role in developing plant hybrids by studying genetics. Lenz and his students began to study the pigments that determine flower color — carotenoids for yellow, flavenoids for white, anthocyanins for pink — and their response to various climates. The researchers found that anthocyanins diminish as the temperature increases, so they began breeding plants that could retain anthocyanins in various light and soil conditions.

After more than 20 years and 1,600 different plants varieties, Lenz and his students produced Pink Beauty: a compact, drought tolerant, long-blooming plant with semi-double pink flowers that grows well in a range of soils and climates. The Pink Beauty was the University of Manitoba's first domestic plant licensed to commercial nurseries and has served as a model for other plant varieties that have since reached the market.

Plant Root Simulator Probe Leads to Significant Increases in Crop Yields

University of Saskatchewan

To produce bountiful harvests, farmers need a precise understanding of the soils functional ability to supply the nutrients plants need. In the 1990s, a farmer and professor in the University of Saskatchewan's Department of Soil Science began searching for ways to measure this soil nutrient supplying power.

Jeff Schoenau, Ph.D., P.Ag., created a plant root simulator probe, now called the PRS™ Probe, that can mimic the surface of plant roots and absorb many types of nutrients including nitrate, ammonium, phosphate, sulphate, potassium, calcium, magnesium and many other minor elements. The PRS™ Probe is much more comprehensive than traditional soil tests and can help farmers — as well as horticulturalists, environmental scientists and foresters — improve growing conditions in any soil climate and condition.

Western Ag Innovations, a startup company based in Saskatoon, Saskatchewan, Canada, dedicated to developing technologies that sustain soils, the food supply and a healthy environment, licensed the PRS Probe technology from the University of Saskatchewan and developed it into a final product available today in numerous countries around the world. Though the tests and advanced crop nutrition planning software are a bit more expensive than traditional soil testing methods, the 20 percent increase in crop yields far outweighs the cost.

In its first six years on the market, the PRS™ Probe improved yields on 3.4 million acres of farmland in western Canada alone, with an estimated economic impact of almost CAD$60 million. And in 2004, the Western Ag and the University of Saskatchewan won the Synergy Award for Innovation from Science and Engineering Research Canada. Read more about the PRS Probe at www.westernag.ca.

Agriculture

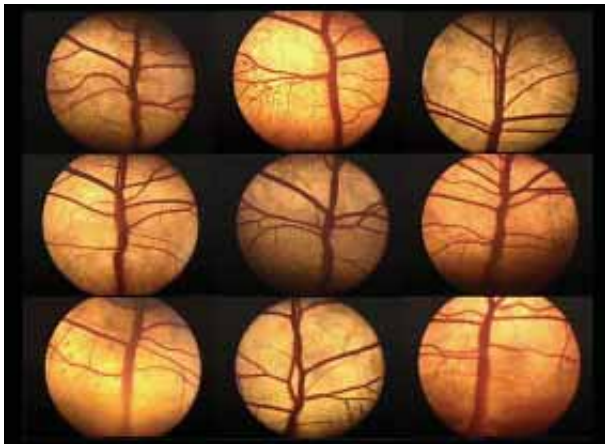
OptiReader — Safeguarding the Food Chain by Tracking Food Animals

Colorado State University

Animal health and food safety go hand in hand. Now, a new technology makes it easier to keep track of animals such as cattle, pigs and sheep as they're raised, shipped and prepared for market.

The OptiReader™ — a combination handheld computer and digital video camera — takes an image of retinal vascular patterns, which are unique to each animal. The camera records each animal's pattern and sends it to a handheld computer, which can transmit the information to a Web-based database. This process provides a method for verifying source, location and ownership of live animals.

It also makes it easy to track diseased animals because the OptiReader automatically encrypts global positioning satellite information every time it takes an ocular image. Handlers can quickly locate them and the animals they've come in contact with to limit the spread of disease, economic loss and possibility of unfit meat products reaching the market.



Unique retinal vascular patterns.
Photo courtesy of Optibrand Ltd.

OptiReader is manufactured by Optibrand, a Fort Collins, Colo., startup company that licensed the technology from Colorado State University in the late 1990s and secured private funding to develop it into a market-ready product. More information is at www.optibrand.com.

Clearfield Rice Fields Yield More Grain, Fewer Weeds

Louisiana State University Agricultural Center

Rice is among the most widely consumed grains in the world, and controlling weed infestation is especially difficult in the damp conditions that crops require. But the fight against rice-field intruders — especially the red rice weed, which affects nearly half of U.S. rice acreage — made strides in the 1990s after a professor at the Louisiana State University Agricultural Center discovered a type of rice with a natural resistance to the imidazolinone family of herbicides.

Photo courtesy of Horizon Ag LLC

Tim Croughan, Ph.D., isolated this and other resistant rice lines by using enhanced plant-breeding and whole-plant selection methods. This process, which in no way resembles genetic modification, is similar to methods that rice breeders have used for the last 50 years to develop many of the rice varieties in supermarkets today. The result of Croughan's research is Clearfield rice.

Now, farmers can use imidazolinone-based herbicides on Clearfield rice crops to dramatically reduce weed infestation and increase crop yield. Four resistant rice lines are available to farmers, and LSU is working with BASF to introduce additional varieties to ensure crop sustainability. Read more at www.orygen.net/clearfield_rice/index.htm.

Decades of Breeding Yields the Popular Honeycrisp Apple

University of Minnesota

One of North America's favorite apple varieties is the result of more than 20 years of plant breeding at the University of Minnesota. The Honeycrisp apple's roots are in a 1960 cross of Macoun and Honeygold apple trees.

The original seedling was planted in 1962 at the university's Horticultural Research Center, but as with all plant breeding programs, determining whether a hybrid is successful often can take decades. Researchers were seeking hardy cultivars with high fruit quality. Not until 1974 did researchers select the plant for further evaluation in Minnesota and New York.

Scientists continued to refine the tree and by the late 1980s, it produced an apple with highly acclaimed flavor and crispiness as well as long-term storage of up to seven months. The university launched a widespread nonexclusive licensing program that allowed nurseries to propagate and sell apple trees to orchards that then produce and sell Honeycrisp apples.

Since the first tree sold in 1991, nurseries and orchards have bought more than 3 million trees. The Honeycrisp is even credited with helping the apple industry break out of a slump. Because the price of apples in grocery stores had dropped to record lows, growers had to sell the fruit at below cost, and some orchards went out of business. But demand for Honeycrisp apples grew, and farmers had a new apple that they could sell at a premium.

Photo courtesy of the New York Apple Association

Harsh Winters, Pests and Disease Are No Match for Hybrid Hollies and Dogwoods

Rutgers University

Indigenous hollies and dogwoods have graced gardens and woodlands across the northeastern United States for centuries. But adverse climatic conditions, pests and disease are an increasing threat and have decimated the species in some areas. Elwin Orton, Ph.D., has been working since 1960 to develop hybrids that can beautify Northeast landscapes under the harshest of circumstances.

A researcher and professor in Rutgers' Department of Plant Biology and Pathology, Orton has run a plant-breeding program for more than four decades that combines native Northeast cultivars with hardy species from around the world. The result is new aesthetically superior plants with increased winter hardiness, resistance to insect and disease pests, and compact growth habits that require little maintenance.

Rutgers has licensed 13 patented species to propagators, who have used them to help revitalize the nursery industry in several northeastern states, and Orton has numerous other hybrids in various stages of development. In addition to securing the future of these plants in the environment, the breeding program has earned millions of dollars for companies in green industries including production nurserymen, garden center operators and landscape architects. To learn more about Orton's program and plants now available, visit agproducts.rutgers.edu.

Biotechnology

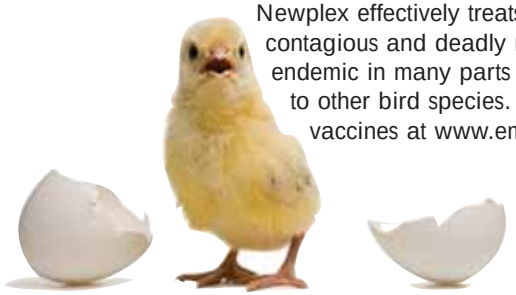
VNF Vaccines Treat Avian Diseases Even Before Eggs Hatch

University of Arkansas, Fayetteville

Poultry are susceptible to many diseases that can affect not just a single bird, but an entire flock. Yet vaccinating entire flocks against disease can be arduous, not to mention loud and messy. A new technology that started with research in 1976 at the University of Arkansas gives chicken farmers the ability to vaccinate birds even before they hatch.

Combining the viral neutralizing factor antibody, which was identified at the College of Agricultural, Food and Life Sciences, with a vaccine virus provides lifelong immunization in a single step, reducing or eliminating multiple vaccinations that poultry farmers must administer each year. The university licensed the VNF factor technology to Embrex, which developed Bursaplex® and Newplex™, then applied for and received U.S. Department of Agriculture approval for the vaccines.

Bursaplex prevents infectious bursal disease, also known as Gumboro disease, which can kill up to 40 percent of infected birds and severely compromise the immune systems of survivors. The product is the world's only single-dose vaccine designed to protect poultry from IBD when maternal antibodies are present. Newplex effectively treats Newcastle disease, a highly contagious and deadly respiratory virus that is endemic in many parts of the world and can spread to other bird species. Read more about the vaccines at www.embrex.com.



CMV Promoter Leads to Treatments for Chronic and Life-Threatening Diseases

University of Iowa

Medical treatments are constantly progressing, but the work of Mark Stinski, Ph.D., a professor in the University of Iowa's Department of Microbiology, helped to transform the modern approach to therapeutics and vaccines. Stinski's laboratory was the first to clone the human cytomegalovirus genome into noninfectious DNA segments, which led to his discovery of the usefulness of the cytomegalovirus promoter as a tool to make various therapeutics and vaccines.

The CMV promoter is crucial in the production of protein-based drugs such as Rituxin and Zevalin®, for treatment of non-Hodgkin's lymphoma; Synagis®, for the treatment of respiratory syncetial virus; ReFacto®, for the treatment of factor V deficiency in hemophilia; and Zenapax®, for the prevention of acute organ rejection after a transplant.

"It has resulted in effective treatments for children with serious viral infections, patients with lymphoma and individuals with serious bleeding disorders," says Michael Apicella, M.D., UI's head of microbiology. "Additional effective agents using the promoter will be available in the near future."

Stinski's CMV promoter is generally held to be the most effective promoter of its kind and may prove useful in a range of gene therapy applications. Researchers worldwide also routinely use it in genetic and cellular research studies. The University of Iowa Research Foundation manages the licensure of the CMV promoter patents, and has entered more than 100 nonexclusive license agreements with companies around the world. The foundation does not seek compensation for research uses of the CMV promoter.

Biotechnology

BeadArray Makes Possible a New Level of Genetic Understanding

Tufts University

Advances in understanding how genes affect health will underpin the future of medicine. The BeadArray™ technology is the core of several tools that help scientists analyze genetic variation and function as well as how genes synthesize proteins, which direct all cellular function.

Developed in the Tufts University lab of professor David Walt, Ph.D., the BeadArray technology was licensed to startup company Illumina Inc. in 1998. The San Diego-based company then developed testing systems used in a variety of life-sciences applications. The BeadArray technology portfolio achieves a level of array miniaturization that allows for a new scale of experimentation.

An array is a collection of miniaturized test sites arranged on a surface that permits many tests, or assays, to be performed in parallel. By arranging the analytical devices into a multi-sample Array of Arrays™ format, scientists can process thousands or even millions of assays simultaneously, which makes it possible to determine variation in genetic sequences, show genes that are active in a particular cell or group of cells, and detect whether a protein is present and how it interacts with others.

One of the most widely known projects that relies on the technology platform is the International HapMap Project, launched in 2002 with the aim to speed the discovery of genes related to common illnesses such as asthma, cancer, diabetes and heart disease. The technology platform is capable of a range of other applications, too — from screening large chemical-compound libraries for promising drug candidates to testing thousands of water samples for the presence of pollutants.

The BeadArray technology has had an impact on the economic front, too. In less than seven years, the company has grown to 300 employees, and promises to continue expanding at a healthy pace. Read more about Illumina and the BeadArray technology platform at www.illumina.com.

Economical Bioreactor Supports Genetic Research and Medical Advances

University of Maryland, Baltimore County

The sequencing of the human genome has been an enormous task, but what lies ahead will be even more challenging. A logical and necessary next step is to discover what turns genes on and what proteins they express. Advanced fermentation and cell-culturing technologies will play a critical role in this research, which ultimately will yield highly effective molecular-level medical treatments.

Traditionally, scientists used simple glass or plastic vessels to conduct experiments at this phase, but this equipment offers limited control and process data, and compromises accuracy. A more precise equipment option is a small bioreactor, but their expense is difficult for many laboratories to absorb.

Then researchers at the University of Maryland, Baltimore County and the University of Maryland Biotechnology Institute developed Cellstation™, a high-throughput bioreactor designed to speed the discovery and process-development stages of fermentation and cell culture-based medical products. Through the use of non-invasive sensing techniques, multiple-well platform architecture and reliance on low-cost disposables, the Cellstation enables highly parallel bioprocessing that yields an order of magnitude increase in performance compared with other products. The approach relies on simple peel-and-stick sensor patches that researchers add to any vessel and monitor non-invasively from outside the vessel.

The institutions licensed the technology to Baltimore-based Fluorometrix Corp. in 2001, and the company introduced the first Cellstation product in 2004. Read more at www.fluorometrix.com.

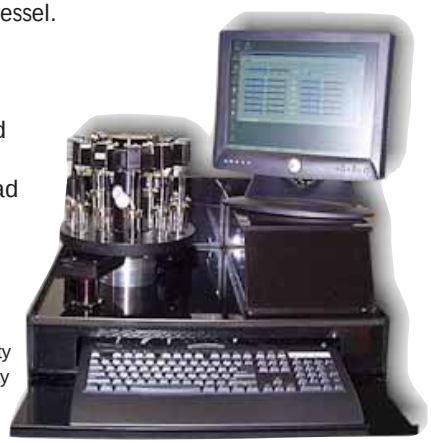


Photo courtesy of the University of Maryland, Baltimore County

Biotechnology

Specialized Agar Improves Reliability and Efficiency of Salmonella Detection

University of Maryland, College Park

More than 40,000 cases of human salmonella poisoning are reported in the United States each year, according to the U.S. Centers for Disease Control and Prevention, and approximately 600 people die annually of acute salmonellosis. Salmonella contamination can occur at many stages between the barnyard and the dining table; poultry feed and water, hatchery and farm conditions, and processing plants have all been cited as contamination culprits.

The World Health Organization states that eradication of the bacterium is unrealistic, so containment is the best defense. A growing medium, or agar, developed at the Virginia-Maryland Regional College of Veterinary Medicine is an important tool for early detection, which can lead to improved food quality and lower numbers of salmonella cases among humans and animals.

Russell Miller and Edward Mallinson, Ph.D., developed a unique plating medium for isolating salmonella. Tests show that the medium detects salmonella three times faster than other agars. Therefore, time and labor required to confirm suspect salmonella colonies have dropped dramatically, and testing efficiency has increased proportionately. These advantages apply to a range of testing situations including human and veterinary medical analysis, food microbiology, research and quality control.

BD Diagnostic Systems, based in Sparks, Md., licensed the medium from the University of Maryland, College Park in 2001 and introduced a diagnostic tool in 2002. Since then, facilities around the world have used it to control outbreaks among poultry, ensure processing plants are sanitary and improve food safety.

Computer-Based Testing System Advances Life Sciences Research

University of Oregon

In 1987, a group of chemists and physicists at the University of Oregon — Dale E. Tronrud, Ph.D., L.F. Ten Eyck, Ph.D., and Brian Matthews. Ph.D. — created software that allowed researchers to generate improved three-dimensional depictions of proteins and other large molecules. Their innovation, dubbed the TNT Refinement Package after the pioneering TNT software that Ten Eyck developed in the 1970s, was based on a simple yet highly adaptable approach to computer-based testing of the numerous assumptions that underlie every model of chemical structure.

The TNT Refinement Package proved to be not only versatile, but also quicker and easier to use. It was also computationally fast — up to 20 times faster than other programs of its type. Because of these advantages, biochemists and biophysicists around the world widely adopted the TNT Refinement Package, using it to refine models of protein structures and their interaction with small chemicals including potential new medicines.

More than 15 years after its creation, the TNT Refinement Package remains a tool-of-choice for life science researchers across the United States and around the world, including more than 30 multi-national corporations whose names constitute a Who's Who compendium of life-science industry leaders. Read more at www.uoxray.uoregon.edu/dale/papers/enzyme/enzyme.html.

Biotechnology / Chemical

Proteome Technology Opens the Door for New Cancer Treatments

West Virginia University

Integrated microfluidic technology developed at West Virginia University rapidly separates, isolates and concentrates cellular-level protein samples for analysis and identification, a crucial step in treating numerous illnesses. This study of protein — called proteomics, a term coined to make an analogy with genomics, the study of genes — is a highly complicated science. In fact, it's even more complicated than genomics because the genome is rather constant, but the proteome differs from cell to cell and is constantly changing through its biochemical interactions with the genome and the environment.

WVU's Integrated microfluidic system is the platform technology for startup company Protea Biosciences Inc., based in Morgantown, W.Va. Protea's mission is to apply the technology to the discovery of new, disease-specific protein targets that researchers can use to develop new pharmaceuticals and biomarkers that aid in the treatment of cancer and other diseases.

The technology is capable of targeting specific proteins within a sample, separating proteins based on electrophoretic mobility, fractionating complex mixtures of proteins to collect discrete fractions with reduced band broadening and creating databases of protein samples derived from normal and disease-specific tissue extracts.

Since 2003, the company has been working with Novartis Pharmaceuticals Corp., a leader in cancer research, to identify new protein biomarkers present in the blood samples of cancer patients. The goal is to give physicians a tool to detect specific cancers earlier, predict their aggressiveness and design new treatments methods. More information is at www.proteabio.com.

Additive Reduces Weed-Control Costs and Cuts Herbicide Use in Half

North Dakota State University

Farmers can have all the weed control for half the price thanks to Quad 7™, an additive that increases the pH level of spray solutions to increase solubility and efficacy of certain herbicides, especially those used on corn, soybean and sugarbeet crops. That means farmers can use less herbicide to achieve the same weed-free crop results — a feat that cuts weed-control budgets in half and releases far fewer chemicals into the environment.

Quad 7 is the culmination of 36 years of agronomy research at North Dakota State University led by John Nalewaja, Ph.D. Professor Nalewaja's specialty was weed control, and he became interested in the use of additives, or adjuvants, designed to increase the effectiveness of existing herbicides. Because herbicides must stick to weeds to kill them, previous methods to enhance sticking included mixing petroleum-based oils with herbicides. One of Nalewaja's first discoveries was that oils from the seeds of plants such as flax and sunflower were superior to petroleum oils when mixed with certain herbicides. He then discovered that methlyated seed oils had even better performance.

The patented invention on which the product Quad 7 is based, however, does not require the use of any oils. A non-ionic surfactant, such as an alcohol, keeps the herbicide on weeds; and adjusting the pH of the herbicide spray to be more basic, or alkaline, increases its solubility so that it is chemically more effective. An additional benefit of the alkaline pH is that the herbicide does not precipitate out of solution, a particular problem when using a nozzle to produce a fine spray. The patent, issued in 1997, was exclusively licensed to AGSCO, which introduced Quad 7 into the marketplace in the spring of 1998.

Chemical / Computer Science

Nontoxic Oxsilan Makes Metal Finishing Safer

University of Cincinnati

Oxsilan®, which keeps metals from rusting before they can be painted or finished, received accolades from *R&D Magazine* as one of the 100 most technologically significant new products of 1999. And the praise is well deserved — the product is a cost-effective alternative to conventional, carcinogenic chromate-based toxic metal pretreatment systems.

Rust can weaken metal, making it unsuitable for manufacturing processes such as painting. Rinsing metals in a chromium-containing bath is a common way to prevent rust and promote adhesion, but the chromate bath is highly toxic. Another option is to coat metals with a thin layer of plastic, or polymer, which requires a multistep process and often leaves the surface unsuitable for subsequent coatings.

Professor Wim van Ooij, Ph.D., from the University of Cincinnati's Department of Chemical and Materials Engineering, College of Engineering, resolved all of these problems when he invented a coating method using vinyl silanes that is nontoxic, can be applied from a single solution and works as an adhesion promoter for additional coatings including paint and rubber. Oxsilan provides protection against rust and other forms of corrosion such as pitting, stress-corrosion cracking, corrosion-fatigue cracking and hydrogen cracking. The patented process works with or without paint systems on cold-rolled steel, stainless steel, aluminum alloys, galvanized steel, brass, copper, magnesium, tin and nickel.

Non-toxic Oxsilan is used in the aerospace industry to treat metals before finishing.

The University of Cincinnati licensed the invention to Brent International, which was subsequently acquired by Chemtall GmbH. The company has expanded the product to include a range of compositions and ingredients for different metals and types of corrosion, and is marketing Oxsilan for use in the automobile and aerospace industries. Additional applications include coating microelectronics and treating the cords in steel-belted radial tires.

Viewing Large Monitors and Screens Now Is Easier on the Eyes

University of Akron

New surface plate technology developed at the University of Akron promises to make viewing computer monitors, television screens and other consumer products easier on users' eyes.

The technology, called C-plate technology, is a polymer film that reduces distortion when viewing flat-panel monitors from wide angles. Frank Harris, Ph.D., and Stephen Cheng, Ph.D., of the University of Akron's College of Polymer Science and Polymer Engineering, invented the technology by developing polymers, then processing those polymers into consistent sheets that are sandwiched in layers to build large, flat-panel monitors in devices such as televisions and computers. The technology received support from NASA and the U.S. National Science Foundation, and the University of Akron received a patent for it in 1996.

In 2002, the university licensed the technology to Nitto Denko of Osaka, Japan, one of the world's leading producers of flat-panel displays. The deal included a research agreement for ongoing development. Nitto Denko has the largest worldwide market share for optical films for specialized industrial and medical applications and is incorporating the technology into the company's large display monitors. Thousand Oaks, Calif.-based Rockwell Scientific Co. also licensed the technology in 2004 for use in LCD projection televisions.

Preserving Alaskan Permafrost to Improve Highway Safety

University of Alaska

Alaska's harsh climate often has adverse effects on man-made infrastructure such as roads, buildings, railways or pipelines. Most drivers in interior Alaska have first-hand experience of the challenges created by harsh climatic conditions and permafrost.

Simply put, roadways and permafrost don't coexist comfortably, at least not in the large portion of Alaska with ice-rich permafrost. Vegetation clearing and constructing roadway embankments often produce local warming of the ground surface. The warming, in turn, interferes with the thermal state of the underlying permafrost and causes thawing. If the permafrost has high ice content, a common occurrence in many of Alaska's permafrost areas, then thawing results in roadway buckling and heaving. The distorted roadways are hazardous to the driving public and dramatically increase maintenance costs.

A new embankment design developed by the University of Alaska Fairbank's Mechanical Engineering Department creates air-circulation patterns that push warm air away from permafrost underlying the roadbed and pulls cold air toward the bottom. Circulating cold winter air directly through the embankment shoulder creates a large cooling effect that chills permafrost and preserves its frozen state year-round.

A new construction technique keeps Alaskan roads from crumbling.
Photo courtesy of the University of Alaska

Basaltic Termite Barrier Forms a Layer Impenetrable to Hungry Termites

University of Hawaii

The Basaltic Termite Barrier, a four- to eight-inch layer of crushed basalt, forms an extremely effective, nontoxic, environmentally friendly, natural barrier against the Formosan subterranean termite. The principle behind BTB is simple: The granules in the barrier must be small enough to pack well so that there aren't any gaps the termites can squeeze through, big enough to make it impossible for termites to move them, and too hard for them to chew.

Builders can lay BTB under a building foundation before construction begins, or homeowners can retrofit existing buildings by digging a trench around the house and filling it with BTB. The barrier eliminates the need for fumigating houses or chemically treating soils around buildings and significantly reduces chances for termite infestation and damage by subterranean termites.

Invented by Minoru Tamashiro, Ph.D., an entomologist at the University of Hawaii, BTB is an inexpensive and permanent alternative to chemical treatment. It is an important tool in combating the estimated $5 billion in damage that termites cause in the U.S. each year. Read more at www2.hawaii.edu/~entomol/research/r_btb.htm.

Construction / Education

Polywood: an Inexpensive, Environmentally Safe Alternative to Treated Wood

Rutgers University

In July 1985, under the mentorship of the late Malcolm G. McLaren, Ph.D., director of Rutgers' Institute for Engineered Materials, professor Darrell R. Morrow, Ph.D., opened the Center for Plastics Recycling Research to develop marketable recycled products. Joined in 1988 by Thomas J. Nosker, Ph.D., Richard W. Renfree, Ph.D., and Kenneth-Van Ness, Ph.D., graduates of Rutgers' Mechanics and Material Science Department, the team began focusing on creating a strong, durable plastic lumber for use in general construction applications.

By 1989, the center's experimentation focused on increasing the stiffness of plastic lumber. Traditionally, plastic lumber has been made from high-density polyethylene, or HDPE, the plastic used to produce milk jugs and the largest part of the waste stream. Because it lacked stiffness and had a thermal expansion coefficient much greater than softwoods, researchers needed to strengthen the material. The next material from the center was a composite of HDPE and polystyrene, the plastic used to produce coffee cups, food containers and serving trays. By using a melt-and-extrusion process, researchers created a unique microstructure that produced a plastic wood with a high stress-transfer and strength coefficient. Because of its stiffness and durability, the plastic wood is ideal for making railroad ties, bridge arches, telephone poles and substructures that don't splinter, warp, corrode or mildew.

Unlike treated wood usually used for these purposes, plastic lumber is nontoxic — it does not leach or bleed arsenic, heavy metals or chemicals into the soil and does not require specialized disposal. For their invention, researchers received the 2001 Thomas Alva Edison Patent Award from the Research and Development Council of New Jersey.

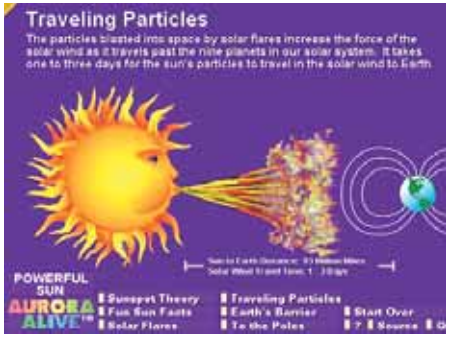
Polywood doesn't rot or damage environmentally sensitive areas.
Photo courtesy of Polywood Inc.

Polywood Inc., an Edison, N.J.-based startup company, licensed the technology in 1996 and makes decking, banister spindles, stairways, outdoor furniture and other products out of Polywood™. Today, Rutgers' AMIPP Advanced Polymer Center is researching the further development of advanced materials based on immiscible polymer blends. These new materials will branch out into structural and functional uses such as packaging, semipermeable membranes, and thermoformed automotive and appliance components.

Program Uses Aurora Borealis to Teach Physics and Math to Native Alaskans

University of Alaska

Developed at the University of Alaska Fairbanks by Kathy Bertram, Geophysical Institute Education Outreach supervisor, Aurora Alive® meets the unique educational needs of native Alaskan students by providing science and math instruction that is culturally sensitive, relevant to village life, scientifically accurate and standard-driven. The curriculum is available through a multimedia CD-ROM and more than 50 associated tactile lessons.



Aurora Alive blends native Alaskan traditions with western research.
Photo courtesy of the University of Alaska

Since the program's inception in 1997, more than 2,500 students and 110 teachers in about 50 Alaska villages have used the program, which is now available worldwide. Aurora Alive blends native Alaskan "ways of knowing" with western research by teaching the physics and mathematics of the aurora borealis, or northern lights, as a dynamic, natural phenomenon. The aurora is an ideal educational topic because all native students, families and elders in rural Alaska communities have observed the phenomenon for generations.

To make the program even more culturally responsive and widely useable, the Aurora Alive CD-ROM will soon be available in Inupiak and Athabascan, two native Alaskan languages that students can use while learning the program in school. A grant from the U.S. Department of Education funded development of Aurora Alive. Additional funding From DOE provides related professional development opportunities, allowing educators to earn university credits for program participation.

In addition to benefiting thousands of native Alaskans, Aurora Alive has reached the general public on an international level. Hundreds of individuals across North America have purchased the CD-ROM, and the program has been featured in exhibits at the Smithsonian Institution and the University of Alaska. It also was recently translated into Japanese. More information is at www.auroraalive.com.

Curricula Trains Outreach Staff to Help Parents Raise Healthy Babies

Florida State University

The Florida State University Center for Prevention and Early Intervention Policy, under the leadership of Mimi Graham, Ed.D., has developed, copyrighted and widely distributed the Partners for a Healthy Baby curricular series. These guides were developed to help nurses, home visitors and other outreach staff help expectant families have and cope with a new baby to ensure a happy, healthy childhood.

Photo courtesy of Florida State University

Practical applications of research are integrated throughout the curricula in strategies families can use for promoting a healthy pregnancy, early bonding and nurturing relationships. The program also discusses caring for a new baby, nutrition, health and safety, recognizing early warning signs of health and developmental problems, and supporting and enriching the child's development. Career development and financial issues are covered, too.

Magazine-style handouts summarize critical points in each trimester of pregnancy and each month of the child's development through the age of 3. Topics include enriching family relationships, enhancing fatherhood, nurturing self-esteem, supporting early language and literacy development, childproofing the environment, choosing quality child care, providing appropriate guidance for young children, the importance of routines for young children and dealing with temper tantrums.

The purpose is to help home visitors effectively communicate these issues and help families provide the social, emotional, intellectual and physical support young children need to thrive. The handouts reflect ethnically diverse families and are published in English and Spanish.

Programs such as Early Head Start, Healthy Start and Healthy Families use the series, as do hospitals and school boards across the United States. Additional curricula focus on fatherhood and self-esteem. More information is at www.cpeip.fsu.edu/index.cfm.

Quiz Center Makes it Easy to Generate, Give and Grade Quizzes

University of Hawaii

Quiz Center is an online assessment program composed of separate quiz tools that offer a number of features. The technology is free, and more than 100,000 teachers around the world access and use it through the Discovery Channel's Web site at school.discovery.com/quizcenter/quizcenter.html.

Teachers can use Quiz Center to create, administer and grade quizzes online. Without any Web development background whatsoever, users can make online quizzes that provide instant feedback to teachers and students. The software also allows teachers to attach photographs, graphics, sound files, foreign languages and links to different Internet sites and resource documents. Quiz Center makes it easy to generate quizzes, correct quizzes automatically and have students take open-book tests from home; it also helps with privacy protection and file management.

Tom Wright and Richard Shadian perfected Quiz Center in the late-1990s at the Maui Research and Technology Center under the auspices of the Maui Educational Technology Research and Development Center, a program of the University of Hawaii Office of Technology Transfer and Economic Development. Quiz Center uses a common gateway interface script written in Perl, called CorrectQuiz, that compares the student's answers to an answer key stored on the server and reports which answers are right or wrong. A script called QuizMail e-mails the answers to the student and CorrectMail e-mails the answers to the teacher.

Because Quiz Center is written in HTML code, users must access the software though the Internet. Hundreds of institutions also have purchased Quiz Server, the licensed version of Quiz Center software, for internal use on institutional Web servers.

Education

Hands-On Curriculum Teaches Day-to-Day Application of Quantum Mechanics

Kansas State University

Society is relying more and more on devices such as computers, cellular phones and laser scanners. The physical phenomena responsible for many of these applications and the fundamental physics principles that explain these phenomena are associated with a branch of physics called quantum mechanics or quantum physics.

To encourage students to study this science and contribute to advancements in electronic devices, Kansas State University's Physics Education Research Group, supported in part by the U.S. National Science Foundation, has introduced Visual Quantum Mechanics. VQM is a series of teaching/learning units on CD-ROM that introduces quantum physics to students between 14 and 19 years of age who have little science or math background and a low interest in science.

The curriculum utilizes visualization techniques to replace higher level mathematics, integrates the learning of quantum physics into the traditional physics curriculum, applies a learning strategy in which students actively construct knowledge and uses computer visualization to illustrate the application of quantum principles to physical phenomena and modern technology.

Instructional units integrate interactive computer programs with inexpensive materials and written documents in an activity-based environment. Each VQM instructional unit stresses a qualitative knowledge of a few concepts. The prerequisites for each unit are kept to a minimum so teachers and students can integrate the study of contemporary topics with the traditional physics curriculum. VQM offers a way for students to construct knowledge of contemporary science in an activity-based environment and, thus, is consistent with National Science Education Standards. Read more at web.phys.ksu.edu/vqm.

Career Discovery Helps Students Identify Educational and Career Goals

Creighton University

When the director of Creighton University's Career Center developed a unique, innovative, interest-driven career-exploration resource, he thought it was a tool that Creighton students could use to jump-start their career-exploration process. His vision grew when CareerXplorer International LLP licensed the technology, which now is assisting students in more than 100 locations across the United States.

Photo courtesy of Creighton University

The Career Discovery system is a card-based system that encourages self-analysis and self-discovery, and empowers students from middle school through college to explore careers based on their interests. The system offers a simple, self-directed method for students to learn how their interests can be applied to a variety of real-world occupational and academic options.

Each Career Discovery system contains multicolored interest and self-assessment cards. Interest cards cover a range of diverse interests, from agriculture, computers, religion, math and law enforcement to advertising, languages, music, photography and construction. Students can pick the areas that most interest them, and the cards show places to work, numerous job titles, appropriate educational pathways and Web sites where they can research further. Self-assessment cards allow students to identify their skills, values and personal characteristics, and select those that they feel are most important.

The cards are portable, so students can bring them to parents and counselors when discussing educational and career plans. They also can display the cards on an acrylic wall unit — a visual that can empower students to follow their hopes and dreams. Additional information is at www.careerxplorer.com.

Neurological Experts Develop Breakthrough Language and Reading Program

Rutgers University / University of California

The Fast ForWord® family of products grew out of more than 30 years of research at Rutgers University and the University of California, San Francisco. These scientifically validated software programs help individuals — particularly children with language and reading problems — make significant improvements in their cognitive skills, leading to improvements in reading achievement.

Since the mid-1970s the UCSF group, led by Michael Merznich, Ph.D., and William Jenkins, Ph.D., had been studying how people learn. During many years of research the UCSF team of neuroscientists established scientifically validated training programs for the human brain analogous to neurological pushups. Meanwhile, the Rutgers team, led by Paula Tallal, Ph.D., and Steve Miller, Ph.D., specialists in the neurobiological basis of language, had been studying children with language difficulties. They hypothesized that children with language problems don't process sounds quickly enough.

Between 1993 and 1995 the two teams collaborated to produce and test a training program aimed at improving the cognitive skills of memory, attention, processing and sequencing, including increasing the speed at which children recognize sounds. Their work was published in 1996 and demonstrated that, on average, children who use the Fast ForWord Language product for 100 minutes a day, five days a week, for four to eight consecutive weeks make one- to two-year gains in reading skills.

Studies show that children who use the Fast ForWord program make significant gains in reading skills.
Photos courtesy of Scientific Learning Corp.

No established companies were interested in building a business based on this work, so in 1996 UCSF and Rutgers licensed the technology to startup company Scientific Learning Corp., which was charged with making the product available to the public. Venture funding followed and in the first year of operation, the company hired a staff of 30.

Progress was rapid. The company conducted an initial field trial in 1996, made the first Fast ForWord product available to certified speech and language professionals in early 1997 and less than two years after founding, in March 1998, made Fast ForWord products available to students in public schools across the U.S.

The company is now publicly traded, has developed a full family of related products, and employs more than 150 people. More than 575,000 individuals have used the Fast ForWord products at more than 3,700 schools and 5,000 clinics. Read more at www.scilearn.com.

Education / Electronics

Programs Encourage Adolescent Athletes to Develop Good Nutritional Habits

Oregon Health & Science University

In the early 1990s the U.S. National Institute on Drug Abuse began encouraging researchers to find new ways to encourage healthy diets and lifestyles among adolescent athletes. Research at the Oregon Health and Science University has yielded two new team-based programs for adolescent athletes.

Athletes Training and Learning to Avoid Steroids, or ATLAS, is an innovative, team-centered program to reduce the use of anabolic steroids, drugs, alcohol and performance-enhancing supplements while promoting healthy nutrition and exercise in adolescent male athletes. The program, funded by the National Institute on Drug Abuse, received the Model Program Award from the Center for Substance Abuse Prevention, U.S. Department Health and Human Services, in May 2000, and one of only nine Exemplary Awards from the United States Department of Education in January 2001.

Athletes Targeting Healthy Exercise and Nutrition Alternatives, or ATHENA, targets female athletes in middle and high school to reduce eating disorders, and the use of body shaping and other drugs, and promotes healthy nutrition and exercise. Both programs are highly scripted to be delivered through coaches and student peers.

Studies show that one year after intervention, ATLAS-trained students decreased use of steroids, performance-enhancing supplements, alcohol and other drugs. They also retained an understanding of the dangers of drug use, improved nutritional intake and reported increased athletic competence. ATHENA, which was released more recently, also has proved to be effective in short-term studies.

Team-centered programs are widely accepted to be an effective format for non-stigmatizing gender-specific health promotion, and prevention of drug use and other health-harming behaviors. ATLAS and ATHENA consist of 45-minute sessions delivered to a group of students and integrated into their usual sport-training activities. The programs do not require additional class time or facilities and can create healthy habits that produce lifelong benefits. Read more about ATLAS at www.ohsu.edu/hpsm/atlas.html, and ATHENA at www.ohsu.edu/hpsm/athena.html.

Exploring the Seas With Sonar Technology

Florida Atlantic University

Florida Atlantic University professor Steven G. Schock, Ph.D., has been conducting acoustic imaging and sonar research for more than 15 years. His latest project, chirp sonar, is a digital, wideband FM sonar that gets its name from the sound it makes, similar to a bird's chirp. The sonar device emits the sound as it's towed just above the ocean floor and maps images according to echoes reflected off buried targets. The U.S. military, which has funded Schock's research through the Office of Naval Research, is interested in using the technology to locate buried underwater mines.

"Traditionally, they have used dolphins," says Schock, adding that chirp sonar is a more exacting way to find mines, which can be difficult to pinpoint because of shifting ocean currents and the migrating waves of sand along the ocean bottom.

EdgeTech, a maker of marine instruments and devices that measure moisture and humidity, wants to use chirp sonar for commercial application. "There is a need to identify where pipes and cables are buried," says EdgeTech President Rick Jablonski. The company has worked with FAU's Department of Ocean Engineering for a decade and in 2002, EdgeTech licensed the chirp sonar device to find buried objects. The deal led to the development and 2004 launch of a side-scan sonar system and survey-quality sonars for small autonomous underwater vehicles.

The partnership between EdgeTech and FAU goes beyond licensing agreements. For the past five years, EdgeTech has donated products, services and underwater equipment to FAU for continued research and makes its facility in Boca Raton, Fla., available at no cost to FAU ocean engineering researchers. Graduate students also benefit from the relationship. As EdgeTech grows, the company is hiring FAU students and graduates and provides internships and continued education to EdgeTech employees. For more information about EdgeTech, visit www.edgetech.com.

This wideband FM sonar device emits a chirping sound to map images.
Photo courtesy of EdgeTech Marine

Photosensitive Glass Changes Light Properties to Create Holograms

University of Central Florida

For Leon Glebov, Ph.D., and Larissa Glebova holographic imaging boils down to one of the most common yet powerful materials on the earth — glass. The Glebovs, scientists at the University of Central Florida College of Optics & Photonics, developed a new method of writing microscopic holograms or pathways into glass that can direct light to perform specific functions.

The invention came after years of research at the renowned Vavilov State Optical Institute of St. Petersburg, Russia, and refined at UCF. The hologram provides a pathway and direction for the light beams that pass through it and, in the case of the Globovs' work, can actually change some of the properties of the light. Holograms also have applications in a variety of commercial uses including cutting, welding and drilling processes in the automotive, aerospace and ship industries.

Most consumers recognize holograms as the reflective logos on credit cards, but few realize the amount of data contained in those images. Holograms are full of information about the size, shape and brightness of the object being recorded. Laser light records the data, and incoming light unlocks the image for the viewer. Holograms make it possible to control laser beams and store large amounts of data and have archival potential superior to compact discs and photographic film.

Glebov applied to UCF's Technology Incubator and received office space for his new company, originally called Light Processing Technologies Inc. and recently renamed OptiGrate Inc. He entered into a partnership with UCF for an exclusive license of the core technology. Since its founding in 1999, the UCF Technology Incubator — a collaboration of UCF, Orange County, the City of Orlando, the Florida High Tech Corridor Council and the Metro Orlando Economic Development Commission — has helped more than 870 emerging technology companies create more than $1.5 billion in revenue and approximately 600 jobs.

Read about the UCF Technology Incubator at www.incubator.ucf.edu, and OptiGrate Inc. at www.optigrate.com.

Crystal Layering Breakthrough Makes Blue LEDs Possible

Boston University/Boston Medical Center

Light emitting diodes, or LEDs, appeared about 40 years ago when researchers first figured out how to squeeze light out of compound semiconductor crystals. When electricity flows through these crystals, they emit photons of light at a certain wavelength, depending on the composition of the crystal.

Early LEDs were made with a compound called gallium arsenide, and they produced only weak red and green glows suitable for clock and calculator displays. But about a decade ago, engineers invented a crystal made of aluminum gallium indium phosphide that produced a brighter red light.

Producing light with shorter wavelengths requires compound semiconductors with higher band gaps such as gallium nitride, which yields blue light. The problem with producing LEDs from gallium nitride is that the artificial substrates on which photo-emitting layers are deposited have a different crystal lattice spacing than gallium nitride, making it impossible to grow single crystal layers of gallium nitride on the sapphire.

Ted Moustakas at Boston University's Photonics Center solved this problem by developing the buffer-layer process, a two-step method for depositing a bridging layer of gallium and nitrogen atoms onto silicon, sapphire and other substrates. In August 1991, Moustakas published a paper detailing the buffer-layer process; it remains the only known way to make blue LEDs.

As Moustakas was reporting his early successes with gallium nitride, Shuji Nakamura, an engineer at Nichia Chemical Industries Ltd., then a small family-owned chemical company in Japan, was racing to perfect the technique as well. Several months after Moustakas' publication Nakamura published similar results in a different journal, then built the first working blue LED.

In 2001, Boston University licensed the buffer-layer patent to Durham, N.C.-based Cree Inc., a North Carolina State University startup company. Cree, Boston University and Nichia Chemical Industries entered into a patent cross-license agreement in 2002. Today, both companies sell LEDs to customers who use them in full-color displays in cellular phones, handheld personal organizers, arena display boards and traffic lights.

Electronics

Hollow Optical Fibers Yield Powerful Lasers and Telecommunication Systems

Massachusetts Institute of Technology

Researchers at Massachusetts Institute of Technology's Research Laboratory of Electronics and Center for Materials Science and Engineering developed a photonic band-gap fiber that has a hollow core surrounded by a highly confining reflective surface. The fiber conducts an intense stream of laser light that would melt traditional fiber-making materials.

Dubbed "the perfect mirror" when originally invented in 1998, the hollow-core optical fibers use omnidirectional reflection to confine light, allowing — for the first time — waveguiding of light in air at a wide range of wavelengths. The fibers offer inherent design flexibility and can be tailored for specific wavelengths and applications such as long haul telecommunications, medical and industrial high-power beam delivery, spectroscopy, sensing and more.

In 2000, MIT licensed the technology to Cambridge, Mass.-based startup company OmniGuide Inc., founded in part by inventors Yoel Fink, Ph.D., John Joannopoulos, Ph.D., and Edwin L. Thomas, Ph.D. The company has since built upon the founders' work, and the OmniGuide fibers now are appropriate for applications such as enhancing the use of infrared lasers in medicine, which allows improved delivery of infrared beams from the laser source to treated tissue; delivering high-power carbon dioxide, or CO2 laser beams in industrial materials processing, which decreases the cost of CO2 lasers for cutting, welding and other activities; and developing new operating systems for optical communications, which reduces or even eliminates the need for optical amplifiers and further increases the network's transmission range or capacity. Read more at www.omni-guide.com.

Mini-Microphone Improves Cell Phone Clarity and Reduces Background Noise

Carnegie Mellon University

When Kaigham "Ken" Gabriel, Ph.D., became director of Carnegie Mellon University's Microelectromechanical Systems Laboratory in the late 1990s, he and his team of researchers began working to take the field of acoustics and binaural hearing — or how humans use two ears to process acoustic signals and suppress background noise — to a new level. His goal: to make an acoustic system on a chip. And his success has raised the bar for cellular phone and hearing aid acoustic standards.

This chip holds the functionality of a microphone with microelectronics and software. Photo courtesy of Akustica Inc.

Gabriel and his students focused on modernizing microphones and speakers in cellular phones by creating membranes that react to sound much like a traditional microphone — with the voice creating variations in air pressure that hit the membrane, moving it. The membrane's motion is converted into electrical signals that correspond with pitch and loudness.

When the research project matured, Carnegie Mellon licensed the technology to Gabriel, who joined entrepreneur Jim H. Rock to create Akustica Inc. The Pittsburgh startup company combined the functionality of microphones with microelectronics and software onto a single chip. This system-on-chip technology uses standard semiconductor processes to fabricate acoustic membranes and other sensor structures in the same chip with analog and digital circuitry. Each individual membrane can target specific audio frequencies with better sensitivity than previous miniature microphones.

The microphone chips also suppress background noise to produce sound with greater fidelity. Ongoing research is refining Akustica chips that enable a range of products — including mobile electronics, personal computers, digital media, medical products and automobiles — to interact more intuitively with users. Details are at www.akustica.com.

Electronics / Environment

Customized Digital Hearing Breaks Sounds Into Frequency Bands

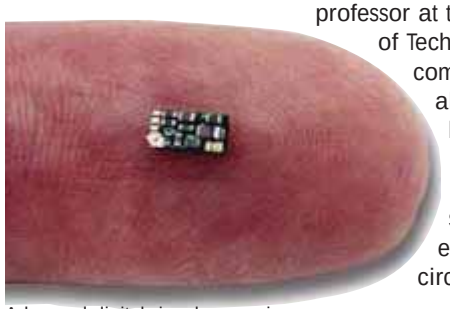
Brigham Young University

Professors Doug Chabries and Richard Christiansen of the Electrical and Computer Engineering Department at Brigham Young University developed a new digital hearing aid that doctors can customize according to patients' specific hearing needs. The device also reduces background noises that can interfere with the ability to hear and participate in conversations.

The hearing aid uses advanced digital signal-processing algorithms that incorporate mathematical models of human physiological hearing mechanisms. This unique digital hearing aid, marketed by Salt Lake City-based startup company Sonic Innovations as Natura®, allows sound to be broken into nine frequency bands. A healthcare professional can customize the frequency bands to compensate for specific impairments. This custom fit allows a more natural hearing experience.

The device focuses on consonant sounds that begin words, which helps the ear distinguish similar sounding words such as sat from fat or kit from hit. The latest version of the product contains a new computer chip that actively suppresses background noise, such as road noise on the freeway or the noise in a crowded restaurant, to allow the user to focus on important sounds such as the human voice.

The BYU professors teamed with Thomas Stockham, Ph.D., formerly from the University of Utah, and Carver Mead, Ph.D., a professor at the California Institute of Technology, to create a tiny computer chip to run the algorithm. Stockham is listed in the World Book Encyclopedia as the father of digital sound, and Mead is an expert in integrated circuit design who was instrumental in miniaturizing the size of the circuit.



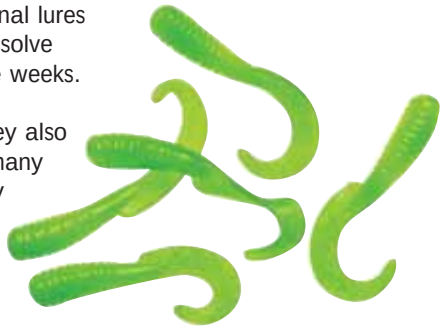
Advanced digital signal processing algorithms fit on a tiny chip.
Photo courtesy of Sonic Innovations

Sonic Innovations licensed the BYU technology in 1994. Since then, more than 200,000 people have purchased the devices, and the company employs 200 people. Read more at www.sonici.com.

Food-Rich Fishing Lure Is Environmentally Safe, and Fish Eat Them Up

Auburn University

Auburn University professors teamed with experienced anglers and after more than two years of laboratory research and field testing, they created a new fishing lure that's made entirely of consumable fish food. Because it contains no plastic, FoodSource® lures are safer for the environment than traditional lures and, if not eaten first, dissolve completely in about three weeks.



Tail grub lures made from protein sources that fish normally eat.
Photo courtesy of FoodSource Lure Corp.

According to reviews, they also are more effective than many plastic lures because they smell and taste like something fish want to eat. When the Auburn research team — which included Jean Weese, Ph.D., and Leonard Bell, Ph.D., from the Department of Nutrition and Food Science, and Russell Wright, Ph.D., of the Department of Fisheries and Allied Aquacultures — concluded their research, Auburn licensed the product to Birmingham, Ala.-based FoodSource Lures Corp. In 2003, the company began developing several different shapes, colors and scents to attract various types of fish.

FoodSource lures have earned praise for their environmental sensitivity and high-protein content. The process to make FoodSource lures is completely nontoxic and, unlike many soft plastic lures, FoodSource lures do not contain carcinogens. Anglers also don't have to worry if wildlife — or the family dog — gets into the bait box. In fact, the lures are even more nutritional than real earthworms and grubs. Some state wildlife commissions have even designated the lures to be natural bait, which means anglers don't need to have a fishing license to use them.

Continuing research shows that the FoodSource lures could be appropriate for additional products including a bait for an oral rabies vaccine for raccoons and other wildlife. Read more at www.fslures.com.

Environment

Building Healthy Forests With Early-Stage Propagation

University of Saskatchewan

Forestry is among the world's largest industries, and has a significant impact on people's lives around the world. One of the industry's greatest challenges is increasing the efficiency of land areas designated for commercial forestry to improve productivity and discourage illegal poaching of protected forests. Another challenge is complying with, and hopefully exceeding, environmental standards that provide guidelines for reforestation, production in environmentally sensitive areas and long-term sustainable forest management.

A crucial step toward increased efficiency is growing stronger trees. With many plant species, horticulturalists can create new varieties by taking cuttings from plants with desirable characteristics and encouraging them to root. This propagation method has yielded scores of different orchids, roses, grapevines, fruit trees and other plants. But it doesn't work well with most forest trees because the cuttings are less likely to take root.

Researchers at the University of Saskatchewan developed a technology called somatic embryogenesis, or SE, a more complex propagation process that relies on the splitting of one embryo into two or more identical embryos. This method allows scientists to grow two or more plants that have the same genetic makeup. In other words, the result is the same as growing new plants from cuttings, but the propagation occurs at an earlier stage in the plant's lifecycle.

SE offers several economic benefits to the forestry industry including enhanced propagation of desirable trees and the ability to grow seedlings year-round. The University of Saskatchewan licensed the patent-protected technology to CellFor Inc., based in Vancouver, British Columbia, Canada. In 2003 the company began working with timberland managers to plant loblolly pine seedlings grown from fast growing, disease resistant varieties in southeastern U.S. states including Georgia and Mississippi.

The company maintains more than 3,000 unique genetic lines and has an extensive network of field trials aimed at testing and further refinements. The technology allows CellFor to produce seedlings that grow faster, generate a higher yield, and produce superior wood, while reducing production costs and enhancing resistance to disease and pests. Read more about SE at www.cellfor.com.

Permeable Reactive Barriers Improve Groundwater Before it Reaches the Surface

University of Waterloo

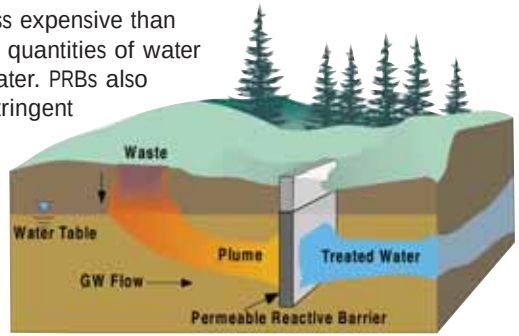
Groundwater pollution — frequently caused by farming and industrial activity, and exacerbated by growing populations — is becoming a major problem in urban and rural areas alike. Treatment systems for contaminated groundwater developed at the University of Waterloo could make an enormous contribution toward providing safe drinking water for people around the world.

The inventors, David Blowes, Ph.D., Carol Ptacek, Ph.D., William Robertson, Ph.D., Ryan Wilson, Ph.D., and Douglas Mackay, Ph.D., worked for more than 10 years to perfect technologies that can remove nitrates and phosphates from farming and cattle runoff as well as metal contamination such as arsenic, copper, chromium and uranium from mining. The water treatment system also can reduce volatile organic compounds and methyl tert-butyl ether, or MTBE, a flammable gasoline additive.

These patented permeable reactive barrier wall technologies, or PRBs, are relatively simple says Scott Inwood, technology transfer manager at the University of Waterloo. A typical installation involves selecting and placing a material that reacts with specific pollutants into an excavated trench or chamber and positioning it to intercept the path of the contaminated groundwater plume. The PRB acts as a filter that breaks down contaminants as the groundwater flows through the barrier. Environmental scientists select different reactive materials depending on the target contaminants that need to be treated, making the PRBs useful in a variety of applications.

According to a 2001 report by the U.S. Environmental Protection Agency, these systems are two to five times less expensive than pump-and-treat technologies that remove large quantities of water from the ground and replace it with treated water. PRBs also have proven to be more effective in meeting stringent regulatory criteria. And because they are buried underground, PRBs do not create eyesores or surface damage that could reduce property values.

Government agencies are now field-testing the PRB technology at five sites in Canada and the United States, and so far 12 commercial entities in the U.S., Canada and Europe have licensed the technology.



PRBs use diffusion tubes or reactive materials to remove pollutants from groundwater.
Source: U.S. Environmental Protection Agency

Underwater Spectrometer Identifies Water Composition in Real Time

University of South Florida

A technology developed by researchers at the University of South Florida's College of Marine Science has changed the way scientists perform underwater applications such as pollution analysis, petroleum sniffing and hydrate exploration.

David Fries, Ph.D., Tim Short and Robert Byrne, Ph.D., contributed to the creation of In-Spectr®, the world's first commercially available portable mass spectrometer. Instead of waiting days to get results from an offsite laboratory, researchers can submerge the tool at the site of research to continuously collect samples.

The device uses a multi-channel peristaltic pump and a quadropole mass filtering system to produce readings in real time, delivering immediate results. Scientists use the machine to measure volatile organics and dissolved gases present in parts-per-billion thresholds that are beyond current U.S. Environmental Protection Agency requirements.

USF licensed the technology to Applied Microsystems Ltd., based in Sidney, British Columbia, Canada. The company is dedicated to helping scientists involved with oceanographic research, water treatment, environmental protection and marine survey analyze the property and contents of water in which they work.

Ongoing research is investigating how advanced versions of the mass spectrometer can help detect dangerous gasses and other compounds in harsh environments such as outer space, ocean caverns, volcanoes and battlefields.

Environment

Idaho Facility Uses Ion-Exchange Process to Revolutionize Waste Water Treatment

University of Idaho

Municipalities and industrial plants across the United States are finding themselves between a rock and hard place. They'll need to spend millions of dollars to improve their water treatment systems to comply with new clean water regulations, but the existing technology to upgrade water treatment systems is not highly effective.

Much of their dilemma revolves around regulations to reduce nutrients such as phosphorus in discharged water by as much as 95 percent. Phosphorus, a vital nutrient in all living things, can be harmful when excessive amounts are in lakes and streams. Too much phosphorus causes rampant algae growth, which further diminishes the quality of water and can kill fish and other organisms.

Conventional water treatment systems may be capable of reducing phosphorous levels to as low as 500 parts per billion. But in certain parts of the country, such as the Spokane River in the Northwest, new phosphorous reduction regulations allow for only 50 parts per billion — far below the water cleaning capabilities of conventional systems.

Luckily, a new water treatment technology called BluePRO™ has entered the marketplace. The BluePRO filtration system is based on the research of Professor Greg Möller, Ph.D., and Remy Newcombe, Ph.D. The two conducted initial work on the technology at the University of Idaho, under the sponsorship of the U.S. Environmental Protection Agency and other U.S. government agencies. In 2003, Blue Water Technologies Inc., based in Hayden, Idaho, was founded to commercialize the technology; it also obtained the license to the technology underlying BluePRO.

Interior of the new wastewater research facility in Hayden, Idaho. Photo courtesy of Blue Water Technologies Inc.

The system uses sand coated with iron oxide to absorb phosphorus and other undesirable properties in wastewater as it flows through large tanks. The sand sinks from the top of the tank toward the bottom, and the iron oxide detaches and absorbs the phosphorus. Next, the water, sand and iron oxide are separated by density, and the clean water is pumped out.

Depending on the size of the community involved, use of the highly effective BluePRO system can cost as little as $12 per household annually for about 20 years. Read more at www.blueh2o.net.

Getting Coal Ash out of the Landfill and Into Building Materials

Michigan Technological University

Fly ash, a byproduct of operating coal-fired power plants, has gone into landfills for decades. But a process developed by Michigan Technological University's Institute of Materials Processing converts the ash into a valuable mineral filler product.

The patented purification procedure, called a wet benefication process, consists of five steps: forming a slurry mixture of fly ash and water; skimming fly ash that has a density less than the liquid; putting the slurry through a magnetic field to separate magnetic particles; separating the unburned carbon from the remaining slurry; and collecting the remaining silicate spheres and silicates. The process removes contaminants such as carbon, barium, iron oxide and other trace elements, and produces a fly ash product for use in concrete, plastics, ceramics and other applications. Carbon removed during the process also can be reused as a sorbent to remove mercury from power plant emissions.

In 1996 Michigan Technological University licensed the fly ash benefication technology to a Texas-based industrial minerals company that sells quality-controlled fly ash, as well as concrete and other products made with fly ash, to companies across North America. The materials are approved by state department of transportation agencies and recommended by the U.S. Environmental Protection Agency.

Researchers at the company also maintain a relationship with Michigan Technological University scientists to continue finding new uses for industrial byproducts. Together, they're working to reduce solid waste and promote environmental responsibility.

Saving Forests and Creating a New Cash Crop in the Middle East and Asia

University of Minnesota

The high demand for agarwood — wood soaked with a resin produced by a small portion of Aquilaria trees in southeast Asia and Indonesia — nearly decimated the species. The trees produce the resin only when injured and, before researchers stepped in, usually when the trees were 50 or more years old.

Agarwood and the resin within are highly prized in the Middle East and Asia, particularly in Islamic and Buddhist cultures, where the wood and resin are used for perfumes, ceremonial incense, traditional medicine and other uses. Unfortunately, determining whether a particular Aquilaria tree contains agarwood is nearly impossible, so harvesters were falling and cutting up Aquilaria trees until they were on the verge of extinction in much of their natural range.

Robert Blanchette, Ph.D., of the University of Minnesota and a nonprofit organization based in the Netherlands called The Rainforest Project have jointly developed an easy and inexpensive method to induce agarwood formation in trees that are only 3–6 years old. Now, instead of cutting down trees found in the forest, farmers can grow plantations of Aquilaria trees, induce the production of agarwood in those trees, and sell them as a new cash crop.

This practice benefits the regional farmers and their local economies, takes pressure off the native populations of Aquilaria trees, and ensures a long-term supply of agarwood for cultural and religious uses that have been practiced for centuries. The University of Minnesota has licensed the technology to The Rainforest Project, which is leading distribution efforts beginning in southeast Asia.

System Helps Scientists Link Water Quality to Ecological Health

North Carolina State University

North Carolina State University has an extensive program to study the ecology of North Carolina's extensive river, estuary and coastal areas. To better understand whether water quality is involved in adverse events such as fish kills, toxic algae blooms and industrial-waste contamination, researchers need water quality data quickly.

So a research team headed by JoAnn Burkholder, Ph.D., director of NCSU's Center for Applied Aquatic Ecology, invented a device that automatically monitors water-quality parameters and transmits data to the research station in real time. The system also can detect unusual events and, in response, change the way it operates. The advantage of this system is that it provides more and better data at a lower cost than other devices now on the market.

Other applications include monitoring the safety of drinking water and bodies of water including oceans, reservoirs, estuaries, lakes, public water-treatment facilities and hydropower operations as well as detecting water-quality changes associated with contamination through unintentional pollution or bioterrorism.

The technology has been licensed to YSI Inc., which makes a line of data-collection modules that are compatible with the NCSU profiler system. YSI introduced products based on NCSU research in August 2004.

Environment

The Greener Cleaner: an Alternative to Toxic Dry-Cleaning Methods

University of North Carolina, Chapel Hill

Photo courtesy of Hangers Cleaners

Dry-cleaners traditionally have relied on the toxic chemical perchloroethylene, or perc, in their cleaning process. Because the U.S. Environmental Protection Agency classifies this groundwater contaminant and probable carcinogen — and the lint and filters generated by the dry-cleaning process — as hazardous materials, dry-cleaners face zoning restrictions, regulatory oversight, high insurance rates and taxes associated with hazardous-waste disposal.

In 1995, Joseph DeSimone, Ph.D., professor of chemistry at the University of North Carolina at Chapel Hill and of chemical engineering at North Carolina State University, discovered an effective, environmentally safe replacement for the traditional method of dry-cleaning clothes. DeSimone's technology, the innovation behind the commercial entity called Hangers Cleaners®, uses liquid carbon dioxide, or CO_2 to clean clothes, eliminating the need for toxic chemicals.

The Hangers Cleaners method uses a patented MICO$_2$ machine that resembles a front-loading washing machine. When the operator places clothes in the wash wheel, the machine seals the door, pumps in a patented combination of liquid CO_2 and detergent and agitates the clothes while the liquid circulates through a dual-filtration system that captures dirt, lint, loose fibers and solids. A carbon filter removes dyes and odors.

When the cycle is finished, the machine pumps out any remaining CO_2 and spins the clothes to remove excess liquid. Hangers Cleaners shop owners can reuse up to 98 percent of the remaining cleaning solution, and throw away the dirt and residue caught in the filter. The method is odorless and uses cooler temperatures than traditional dry cleaning, thereby reducing problems such as shrinking, stain setting and fading. Because CO_2 is gentle on fabric, it produces less lint and can extend the life of garments. Consumers get clean, fresh clothes — and a safer environment.

The growth of Micell Technologies Inc., a UNC-Chapel Hill startup company that obtained licensing rights in 1996, reflects the success of the Hangers Cleaners technology. The company began offering franchises in 1998 and by 2005 had more than 60 franchises across North America. Micell has received numerous awards recognizing the revolutionary nature of the technology including the 1998 R&D 100 Award, recognizing Hangers Cleaners as one of the most technologically significant products of that year, and North Carolina's 2001 Governor's Award for Entrepreneurial Excellence.

Finding New Ways to Derive Nutrients From Whole Grains

University of Alberta

Scientists have known for years that fractionating cereal grains yields valuable nutritional products. But until recently, the process of breaking up the grains was so costly that the end products were prohibitively expensive for general consumption.

Then, University of Alberta agriculture researchers Thava Vasanthan, Ph.D., and Feral Temelli, Ph.D., developed a new process for fractionating cereal grains. Perhaps the most important product derived from this new technique is beta-glucan, a naturally occurring dietary fiber that can be found in the cell walls of oat and barley.

Many researchers believe that beta-glucan has a number of human health benefits including the ability to reduce serum cholesterol and activate immune response through macrophage immune cells, which may prompt various therapeutic effects. Researchers also anticipate that beta-glucan may soon help diabetics manage blood-sugar levels.

Previously, demand for purified beta-glucan was limited because of its high cost. The expense also was a burden for scientists who wanted to research purified beta-glucan. Because the new fractionation technique was created with the specific goal of cost-effectiveness, scientists can perfect beta-glucan applications and investigate uses for other byproducts such as starch concentrate.

In July 2002, the University of Alberta's technology transfer unit, a program of TEC Edmonton, collaborated with Canadian technology investment firms AVAC Ltd. and Foragen Technologies Management Inc. to launch Cevena Bioproducts Inc. The company has commercialized this beneficial new fractionation technique and delivers nutritional products from oat and barley crops under the commercial name Viscofiber®. The company has since received a second round of financing and is developing partnerships with other organizations interested in using purified beta-glucan in nutritional markets. Read more at www.cevena.com.

Beta-glucan retains its structure, providing increased viscosity that yields health benefits. Photo courtesy of the University of Alberta

Resistant Starch Technology Makes Low-Carb, High-Fiber Foods

Kansas State University

With millions of people counting and cutting simple carbohydrates, there's an enormous push to develop and market low-carb, high-fiber food products. Kansas State University professor Paul Seib and graduate student Kyungsoo Woo developed a resistant starch technology that makes plant-based starches resistant to being broken down during digestion by the enzyme amylase. In many types of foods, the resistant starch enhances fiber content and can be used to reduce carbohydrate levels.

Any product that uses flour can be made with these resistant starches including breads, buns, crackers, cookies, chips and pastas. When incorporated into food products, the new starches have two potential health benefits. Some of the starch is slowly digested, which results in a sustained, low elevation of blood sugar. Scientists report that low glycemic load to the blood is associated with delayed hunger and a reduced incidence of type II diabetes — a condition affecting nearly 18 million people in the U.S. alone. Secondly, the portion of the starch that totally resists digestion is fermented in the large intestine and may lower the incidence of colon cancer. In food products, the resistant starches contribute to a diet with fewer calories and more fiber.

The university licensed the technology to MGP Ingredients Inc., which has expanded production capacity in anticipation of filling the demand for ingredients that increase fiber and decrease carbohydrate levels. In October 2003, the company released a specialty wheat-based resistant starch, Fibersym 70™. It also produces a potato-based resistant starch, Fibersym 80™.

More information about the Kansas State University Research Foundation is at www.ksu.edu/tech.transfer, and details about Fibersym 70 wheat starches are at www.midwestgrain.com.

Health Services

Turning Quitters Into Winners: The Nicotine Patch Success Story

University of California

During a casual conversation in 1981 between brothers Jed and Daniel Rose, the topic of work came up. Little did they know that their discussion would lead to a major medical discovery that would save thousands of lives.

At the time, Jed Rose was a faculty member of the University of California, Los Angeles School of Medicine and founder of UCLA's Nicotine Research Program, and his brother Dr. Daniel Rose was a physician with a successful private practice in Healdsburg, Calif. They talked about separating nicotine from sensory factors like taste or inhaling tobacco smoke and whether some sort of skin patch — similar to treatments used for motion sickness — might assist people trying to kick the habit.

Working together with his brother and Murray Jarvik, Ph.D., then head of UCLA's Psychopharmacology Laboratory, Jed Rose determined that using a polyethylene nicotine patch could indeed help reduce nicotine cravings. After years of experimentation, the team developed a skin patch that would transmit low doses of nicotine into the bloodstream through a subject's skin at a rate corresponding to that of smoking. The trio of researchers obtained the first of three patents on the technology in May 1990.

Swiss pharmaceutical company Ciba-Geigy licensed the new nicotine patch technology from the University of California and, after gaining approval from the U.S. Food and Drug Administration, launched the Habitrol® patch as a prescription drug in 1991. It wasn't long before other prescription-based transdermal nicotine patches entered the marketplace as well. But it was the FDA's approval of over-the-counter nicotine-replacement therapies in the mid-1990s that caused the use of nicotine patches to grow dramatically — as much as 92 percent. An over-the-counter version of Habitrol became available in 1999.

Numerous studies indicate that nicotine patches roughly double the rate of successful quit attempts. And by helping thousands of smokers quit every year, nicotine patches generate tremendous social benefits — saving lives as well as a portion of the million of dollars spent on smoking-related medical care each year. Read the complete story about Habitrol in The Better World Project online database, available at www.autm.net/betterworldproject.

Pawpaw Tree Extract Fights Head Lice Naturally

Purdue University

Up to 25 million people in the U.S. including 10 million children, become infested each year with *Pediculus humanus capitis*, or head lice. The primary symptom is persistent itching, particularly around the ears, back of the neck and crown, and if untreated secondary bacterial infections can occur. But the greatest harm associated with head lice may result from the well-meaning but unwise use of toxic shampoos to eliminate the pests.

In September 2000, California banned the use of Lindane, an organo-chlorinated pesticide in the same chemical family as DDT. This common treatment of head lice can cause numerous side effects and may promote seizures. Numerous other products in the marketplace have drawn criticism, too, especially now that studies have shown head lice are becoming resistant to many existing products including pyrethrin-based pesticides.

During his more than 25 years of research at Purdue University, Jerry McLaughlin, Ph.D., identified compounds in the bark of the pawpaw tree, called annonaceous acetogenins, that are particularly effective for treating pesticide-resistant pests. McLaughlin devised a method for extracting and concentrating the compounds, then standardizing them using a bioassay. This process ensures the end product has a consistent concentration of annonaceous acetogenins.

Extensive research revealed that the compounds are capable of controlling a variety of insects and pests, so McLaughlin next focused on efficacy. The three stages of head lice infestation consist of nits, or eggs, that attach to human hair shafts; nymph lice that appear seven to 10 days later; and mature lice that feed and lay eggs on the scalp. McLaughlin's studies indicated that the pawpaw product works by targeting the nymphs and adults, and by loosening nits so they comb out easily before hatching.

Once research was complete, Purdue licensed the technology to Nature's Sunshine Products Inc., a Provo, Utah-based company that specializes in herbal products and nutritional supplements. Clinical studies of PawPaw Lice Remover Shampoo, which became available in 2001, indicated that the product is nearly 100 percent effective in removing head lice and their nits when used according to label instructions.

Health Services

Digital Medicine Takes a Step Forward With New DICOM Workstation

Louisiana State University

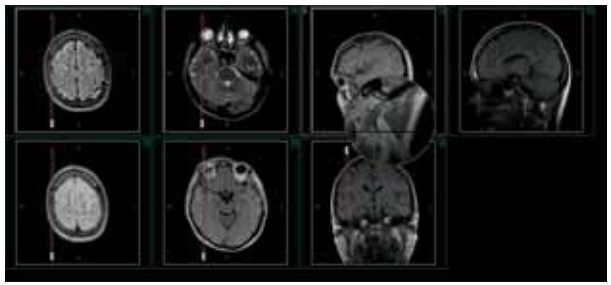
Digital imaging in communications and medicine, or DICOM, is by far the most universal standard in digital medicine. It provides all the necessary means for diagnostically correct representation of medical data. DICOM is not an image or file format, but primarily is a TCP/IP-based networking protocol designed to store and transmit medical data. In effect, it governs all areas of digital medicine.

In 1998, the Louisiana State University Health Sciences Center and Louisiana State University A&M Department of Computer Science launched a joint project to develop an efficient DICOM-compatible radiologist workstation. The project brought together an outstanding group of computer and medical researchers, with a goal to improve the current state of digital medicine.

Three years later, the first version of the patented DICOM workstation was released, making it the first lightweight, personal computer-based, Web-accessible picture archiving and communication system, or PACS. The universities licensed the technology to startup company Universal PACS, or UniPACS, based in Baton Rouge, La.

In August 2004, UniPACS was used for the first time to connect two hospitals — Kenner Regional Medical Center in Kenner, La., and Charity Hospital in New Orleans — into a single PACS network. Unlike the PACS from other manufacturers, the UniPACS software has extremely minimal hardware requirements, which permits it to run on any relatively modern PC, at home or work, and with any type of Internet connection.

This efficient, accessible and affordable technology has substantially improved the quality of medical services in the field of digital medicine — and played an enormous role in providing medical assistance after Hurricane Katrina. UniPACS became the main tool in recovering radiology services in Louisiana after many original installations and systems were lost. Medical experts used the technology to build a highly efficient distributed teleradiology network that connected many displaced radiologists with hospitals and patients. Read more at www.unipacs.com, or contact Dr. Oleg Pianykh at contact@unipacs.com.



UniPACS was crucial in recovering radiology services after Hurricane Katrina.
Photo courtesy of Louisiana State University Health Sciences Center

Using Calcium to Battle Colorectal Cancer

Dartmouth College

The American Cancer Society reported an estimated 145,000 new cases of colorectal cancer in 2005 in the U.S. alone, and more than 56,000 fatalities — the second leading cause of cancer death in the United States. To combat this disease, researchers around the world have been researching causes and treatments as well as prevention.

Animal studies and human epidemiological studies have led many scientists including John Baron, Ph.D., a professor of medicine at Dartmouth Medical School, to believe that calcium supplements help prevent the formation of adenomas, or polyps, in the colon, which can progress to colorectal cancer. The National Cancer Institute agreed to test the hypothesis through a multicenter randomized, double-blind, placebo-controlled trial that lasted more than four years at six Dartmouth-led medical schools and involved 930 patients with previous history of polyps.

Each day, patients received 1,200 milligrams elemental calcium as calcium carbonate through Wyeth Healthcare's Caltrate supplement. The patients underwent two colonoscopies to inspect the effect of the supplement on the large bowel. Overall, patients who received the supplement showed a 19 percent decrease in the incidence of recurrence of adenoma and a 24 percent decrease in the number of adenomas overall. Dartmouth received a patent on the findings of the study.

Wyeth licensed to the patent and in 2002 launched two products: Caltrate Colon Health and Solgar's Calcium 600.

Health Services

Industry and University Research Improve Radiation Detection Accuracy

Oklahoma State University

Research by Oklahoma State University physicists has led to the development of a new method to measure radiation involving the use of sapphire crystals. This unique optical process protects people who work in hospitals, medical and dental offices, university and national laboratories, nuclear power plants and other industries from the hazards of workplace radiation by measuring accumulated radiation in personal radiation badges.

Photo courtesy of Landauer Inc.

The badges not only measure radiation with greater sensitivity and provide more information than other devices on the market, but also are more durable and less sensitive to environmental effects. Landauer Inc., of Glenwood, Ill., the world's largest maker of personal radiation dosimeters and the largest provider of dosimetry services, licensed the technology from Oklahoma State University in 1998 and sells the new badges under the trade name Luxel®.

Landauer refined the technology, and now the badges use a specially formulated aluminum oxide crystalline detector material surrounded by filters to detect exposure. To take readings, lab workers stimulate the aluminum oxide materials with frequencies of laser light, and the material glows in proportion to the amount of radiation exposure. The luminescence measured is applied to an algorithm that relies on the response ratios between different filter positions in the device to discriminate between beta and photon radiation fields and determine exposure results.

Landauer maintains a close relationship with OSU, collaborating with researchers to explore ways to implement new technologies. Visit www.osldosimetry.com/luxel to learn more about the Luxel technology.

Technology Leads to Improvements in the Quality of Nursing Home Care

Brown University

Ensuring residents of long-term care facilities receive high-quality care — and staff and managers can work effectively and provide the best environment possible — requires powerful organization and data-management tools.

Vincent Mor, Ph.D., worked with a team of three other academic experts in the field of long-term care to develop software and online tools to measure and improve clinical outcomes, ensure regulatory compliance, manage risk and facilitate accuracy in reimbursement. Their credentials are evidence of the program's thoroughness. Mor is chair of the Department of Community Health at the Brown University School of Medicine and formerly served as the director of the Brown University Center for Gerontology and Health Care Research. His partners in the project were Barry Fogel, M.D., and Lewis Lipsitz, M.D., geriatricians and professors at Harvard Medical School, and John Morris, Ph.D., a senior researcher at Boston's Hebrew Rehabilitation Center for Aged.

Together they launched a company called LTCQ Inc., based in Lexington, Mass., to provide information-based services that enable providers, payers, insurers, regulators, suppliers and consumers to measure quality and understand the requirements for quality improvement. LTCQ offers tools that measure and provide feed back about data integrity, clinical quality, risk assessment and management, and education and training.

In the past 10 years LTCQ's healthcare business has grown to serve more than 1,000 nursing facilities including three of the nation's largest chains, numerous regional chains and many private facilities. Four years ago LTCQ began working with insurance providers to apply the company's quantitative methods for assessing long-term care facilities, which has led to the development of an extensive database of risk exposure, unique models of liability-claims risk, and a set of Web-based risk management tools. Today, insurers who have access to this information frequently offer lower premiums to facilities that use LTCQ assessment tools. Read more at www.ltcq.com.

Information Services

Graduate Student Takes Classroom Learning to the Business World

University of South Dakota

Using the skills that he learned in a graduate-level computer science classes at the University of South Dakota, Matt Smart built a business on a project that he began with classmates. In spring 2004, technology that Smart licensed from the university became the primary offering of his startup company, Smart Software Solutions Inc.

The Pierre, S.D.-based company creates and hosts Web-based information management systems for businesses of all sizes. The company's primary technology, called DataSafe, organizes and archives vital business files so every employee has access to the same files via the Internet, which ensures the information that employees see is current and accurate. The technology allows small- and medium-size businesses to organize and unify their files in the same way as government organizations and large corporations, but at a fraction of the cost.

Smart Software Solutions' first customer was Sioux Valley Regional Health Services. Smart's company created a customized data-management system that consolidates data from nearly 100 medical facilities across the Midwest. The system includes a fully functional encryption and security system as well as a customizable data-querying tool.

The company is continuing to market the system to healthcare providers as well as other business with multiple locations such as real estate offices. Smart also is pursuing further development of the software in collaboration with the University of South Dakota researchers through the U.S. Small Business Innovation Research program and other grant opportunities, which will enhance local economic development and employment opportunity. Read more about Smart Software Solutions at www.smartsoftwareinc.com.

Lightning Detection Technology Drives Nationwide Network

University of Arizona

In the 1970s, a team of scientists at the University of Arizona made significant strides in the study and detection of lightning, and the development of equipment to assist their research. Team leader E. Philip Krider, Ph.D., who now teaches physical meteorology and atmospheric electrics at the university, along with Burt Pifer, Ph.D., and Martin Iman, Ph.D., developed the first gated wideband magnetic-direction finders.

In 1976, Krider formed Lightning Location and Protection and reached an agreement with the university for the exclusive right to manufacture products based on his research. LLP eventually became part of Vaisala, which operates the National Lightning Detection Network with equipment based on Krider's findings. The NLDN protects people and businesses across the U.S. by providing up-to-date real-time information about lightning activity in their local areas.

The NLDN uses 100 ground-based remote sensors to detect electromagnetic signals that indicate cloud-to-ground lightning strikes, which occur 20 to 25 million times per year in the United States. The sensors then send data to a satellite-based communication network that alerts users worldwide. Lightning detection data has a range of critical applications, and its users include air traffic controllers, transportation regulators, meteorologists, electric utility companies, forestry officials and others who need to be aware of the potential for violent weather. NLDN users can receive severe-weather data in 10 seconds; Doppler radar data takes as long as six minutes to process.

Officials in 40 countries use products derived from Krider's research, and the licensing agreement between the university and LLP has provided support for ongoing research at the University of Arizona's licensing program for the past 20 years. Krider is now working on using lightning detection to predict forthcoming monsoons based on a link between lightning and rainfall. Read more about Krider's research at www.atmo.arizona.edu/faculty/research/lightning.

Information Services / Machinery

Helix Antenna Brings Wi-Fi to Hotels and Coffee Shops Around the World

Virginia Polytechnic Institute

When you use a wireless Internet connection in an airport, hotel or other public or remote location, you just might be receiving the signal thanks to an invention born at Virginia Polytechnic Institute.

Professor Warren Stutzman, Ph.D., and his doctoral student Mike Barts of the Virginia Tech Antenna Group began investigating small helix antenna in the mid-1990s. Their work led to the refinement of existing models and, a decade later, the team's stub-loaded helix antenna, or SLH, has gone global. In 2004, SLH products experienced a dramatic and increased demand in the market and are now being used in countless countries on every continent.

Though conventional communications antennas use linear polarization, the helix, which resembles a bedspring, produces circular polarization and, thus, possesses a higher gain for its size. The popularity of unlicensed wireless connectivity, or Wi-Fi, has stimulated demand for SLH products, bringing signals to users who want to access the Internet almost anywhere. SLH provides the possibility of affordable, high-speed wireless broadband connections to suburban and rural areas, where other standard operators such as DSL and cable will not go because of economic or technical limitations.

The stub-loaded helix antenna makes is easy for airports, hotels or other public or remote locations offer wireless Internet access. Photo courtesy of Virginia Tech Intellectual Properties

SLH allows for more complete penetration into buildings such as hotels, hospitals and schools. One customer was able to provide a network for most of a downtown area, with Wi-Fi coverage scattered across a range of buildings, cafes, retail outlets and city centers.

Other current client applications range from testing the SLH in the development of an unmanned aircraft communicating wirelessly with a ground station, to successfully demonstrating wireless voice of IP coverage for an eight-kilometer stretch of highway. The test was completed as part of a U.S. Department of Homeland Security grant, and the implementation will begin with a first responders' network — police, fire, ambulance and border patrol. The SLH antenna technology is licensed to FRC Component Products Inc.

Getting Three-Dimensional Images With Atomic Force Microscopes

Stanford University and University of California

Typically when people think of microscopes, they think of optical or electron microscopes, which create a magnified image of an object by focusing electromagnetic radiation, such as photons or electrons, on its surface. Optical and electron microscopes generate two-dimensional magnified images of an object's surface, with a magnification as great as 1000X for an optical microscope, and 100,000X for an electron microscope.

Though these are powerful tools, they usually supply images only in the plane horizontal to the surface of the object, not vertical dimensions of an object's surface, the height and depth of the surface features. The atomic force microscope, or AFM, scans the surface of objects and uses sophisticated electronics to interpret atomic force and create three-dimensional images at magnifications of up to 1,000,000X.

Inventors Calvin Quate, Ph.D., of Stanford University, and Christoph Gerber, Ph.D., and Nobel Prize winner Gerd Binnig, Ph.D., of the IBM Research Laboratory in Zurich, introduced AFM to the scientific community in 1986. Since then, University of California researchers have refined the technology to create the most sophisticated AFMs now available.

The first AFMs were somewhat limiting because they could scan only tiny areas, usually less than 30 microns wide, and scientists couldn't use optical microscopes during scanning to view the object being studied. To resolve these issues, UC scientists developed a device that uses an optical assembly mounted on the scanning mechanism to guide the laser light, emitted from a separate source, during scanning. They also created multipurpose sensors that can detect optical, thermal, magnetic, electrical and other signals from the surface of objects; and an engineered electrode called a nanofabricated carbon-based detector, or NACAD, that allows scientists to study elastic properties of submicrometer-sized secretory granules.

These advances have helped establish AFM as a vital tool in a range of applications from analyzing semiconductors to viewing dynamic events in living cells and revealing subtle details of biological processes.

New Process Makes Diamond-Coated Tools Even More Durable

University of Western Ontario

Diamond coating doesn't make industrial tools last forever, but it does enable them to cut and bore much longer than conventional tungsten carbide tools. "Something like graphite is not difficult to machine, but is so abrasive that the normal, widely used tungsten carbide tools wear out fairly quickly," says Joe Brennan, president of CVD Diamond Corp. in London. "Diamond is the hardest material known, so adding diamond coating to tungsten carbide results in very superior wear properties."

The company began as a research project at the University of Western Ontario in 1993. Professor Leo Lau, Ph.D., and research engineer Bill Sun, Ph.D., developed a chemical vapor deposition, or CVD, process that produces very adherent diamond films. The patented and cost-effective CVD process removes carbon atoms from methane gas and deposits the remaining molecules onto surfaces as diamond. The continuous polycrystalline film, which is highly homogeneous, is ideal for making diamond-coated tools.

So Lau and Sun requested and received funding from Materials and Manufacturing Ontario to investigate using the technology in tool-making and by 1995 were producing tools that in experimental work lasted at least 20 percent longer than state-of-the-art diamond-coated tools that had just entered the market. With assistance from the Canadian Office of Industry Liaison and Materials and Manufacturing Ontario, the researchers developed a business plan and found investors to launch CVD Diamond Corp.

CVD Diamond's tools entered the marketplace in 2001. The extremely high thermal conductivity of the thin diamond coating removes heat from the cutting edge to increase effectiveness and durability. In fact, studies show that tools made with the CVD process last 10 to 20 times longer than tungsten carbide tools.

"The University of Western Ontario's Office of Industry Liaison staff played a significant role in cooperation with the spin-off. Having the university there was and is important," Brennan says. The ongoing relationship with the university includes optimization of cutting-tool geometry and the diamond-coating procedure. "We will be going back to supplement our know-how with university expertise in the future," he says.

Using Vehicle Engines to Power Military Radar Systems

Mississippi State University

The U.S. military's ability to maneuver in remote regions is getting a boost from power electronics technology developed by researchers at Mississippi State University's Center for Advanced Vehicular Systems. Scientists Marshall Molen, Ph.D., and Mike Mazzola, Ph.D., have harnessed the internal combustion engine of high-mobility vehicles such as the humvee to generate electricity for powering onboard radar systems in rugged combat environments.

The MSU researchers successfully demonstrated a system that replaces the low-voltage alternator of a vehicle's internal combustion engines with one that has much greater current capacity. Then, they installed an electronics interface to power the U.S. Army's Sentinel radar system. This small module, called the VPS-10K, replaces a 10-kilowatt diesel generator that military vehicles must tow by trailer. By eliminating the need to tow power, soldiers can travel more safely through off-road terrain.

The VPS-10K has a peak power output of 10 kilowatts and produces voltage outputs at 50 hertz for international applications, 60 hertz for domestic applications and 400 Hertz for aircraft and radar applications. It also has an independent speed-control system to vary the vehicle's motor speed in accordance with the electrical load that it needs to generate.

The VPS-10K is small enough to mount inside or outside a humvee.
Photo courtesy of Diversified Technology Inc.

The university licensed the Tactical Mobile Power Technology in 2005 to Diversified Technology Inc. of Ridgeland, Miss., which will finalize and ruggedize the technology. The company provides numerous types of computing products and systems for the communications and telecom, commercial and industrial control, and military markets. It also has developed strategic partnerships with research and development universities to bring new technology development and employment opportunities to Mississippi.

Read more about the Center for Advanced Vehicular Systems at www.cavs.msstate.edu and Tactical Mobile Power Technology at www.dtims.com/markets/government.html.

Machinery / Medicine

Technology Enables Improved Microchip Manufacturing

Brown University

In the manufacture of microchips, an important element of quality control is the measurement of the thickness, evenness and density of the many layers of metal film applied to production wafers. Errors must be quickly identified, as they can result in high costs for the manufacturer.

Technology developed at Brown University by Humphrey Maris, professor of physics, and his colleagues, was the first technique capable of measuring these layers directly on the wafer and with a precision of better than 1 percent.

Called the picosecond ultrasonic laser sonar method, or PULSE™, it is the basis for the MetaPulse™ line of instruments manufactured and sold by New Jersey-based Rudolph Technologies. The company designs, develops, manufactures and supports high-performance process control metrology and defect inspection equipment used by semiconductor device manufacturers. Rudolph has developed a family of proprietary systems for thin-film measurements and maintains operations in facilities worldwide.

The PULSE system generates and detects sound in opaque films with pulses of light, a non-contact and non-destructive measurement technique that monitors the reflection of laser-induced ultrasound. It can measure the thickness of six or more layers as well as film density, roughness, adhesion and contamination. This technology is widely accepted and used for on-line quality control in most fabricating plants.

AU MEDS Helps Hospitals Reduce Medicine Administration Errors

Auburn University

More than 40 years of collaborative research led by professor Kenneth Barker, Ph.D., of Auburn University's Department of Pharmacy Care Systems, had produced AU MEDS®, the gold standard observation-based medication error-detection system developed at AU's Harrison School of Pharmacy. The system is endorsed by leading patient-safety advocates because it provides hospitals with a proven tool to quickly and accurately identify and measure medication administration errors.

Each day, undetected medication errors harm thousands of hospital patients. To improve patient safety, a growing number of hospitals are buying, using and relying on the AU MEDS system, which combines intensive training, information and support to help hospitals reduce medication errors in real time.

AU MEDS has three primary components: a special training program that helps hospital employees detect and classify errors, proprietary software for data analysis, and ongoing quality-control support services. The hospital uses a profile to identify a nurse who will be trained in the observation method. After onsite training, the nurse observes medication administrations during peak workload periods in selected nursing units. These bedside observations are recorded and compared to the patients' charts to identify any discrepancies between the observed administration and the physician's orders. The nurse then enters the review into the AU MEDS software and meets with the observed nurse to discuss any discrepancies and solicit assistance in eliminating circumstances that might have caused the error. Regularly scheduled operational and business reviews with a team of experts ensures standards and practices don't decline over time.

AU Meds can reduce medication errors in hospitals. Photo courtesy of MedAccuracy

MedAccuracy LLC retained an exclusive license for AU MEDS, and oversees its implementation in hospitals across the United States. Read more at www.medaccuracy.com.

Doctors Rely on CALM System to Provide Appropriate Care for Women in Labor

McGill University

Emily Hamilton, M.D., is taking some of the guesswork out of delivering babies. The McGill University obstetrics and gynecology professor was teaching at Montreal's Jewish General Hospital when it occurred to her that doctors and nurses could better evaluate the progress of delivery if they knew how their patients compared with others.

"Students were asking simple questions like, 'How do you know when labor is slow?' " Hamilton says. Doctors were relying on a small study of women conducted in the 1950s for information about delivering babies, yet a number of medical developments, such as epidurals, greatly influence the average length of labor. When Hamilton looked at the big picture, she saw that the power of computing combined with large-scale studies could tell physicians and nurses what comprises a normal labor for different women.

Her revelation occurred in the early 1990s, and today the Computer-Assisted Labor Monitoring, or CALM™, system is installed in numerous North American hospitals. Hamilton's studies show that the technology can reduce Cesarean sections. Fewer Cesareans mean less pain and quicker recuperation for women and less time required by surgeons. The CALM system tells medical personnel when a labor that appears long may, in fact, be progressing normally. After inputting information about the patient, a simple-to-read graph appears on the screen. The graph shows three lines: the woman's progression of labor, and the high and low limits of statistically normal progression, based on data from other women with similar clinical characteristics. Doctors can quickly and easily update the touch-sensitive screen.

In addition to her position on the McGill faculty, Hamilton now serves as vice president for medical research and scientific advisory board chair for LMS Medical Systems Ltd., which distributes and monitors CALM in North American facilities. The company is based in Montreal, and Hamilton continues to hire engineering and computer science graduates from McGill and Université de Montréal as the company expands. Read more at www.lmsmedical.com.

A screen capture of the CALM software shows data comparisons.
Image courtesy of LMS Medical Systems

Ultraviolet Irradiation System Is Ready for Use Against Bioterrorism

National Jewish Medical and Research Center

An ultraviolet air treatment system used to control lung disease is now in the hands of first responders across the United States to combat potential bioterrorist attacks. Researchers at the National Jewish Medical and Research Center, a leader in the field of respiratory and pulmonary studies, originally developed the ultraviolet germicidal irradiation system to battle tuberculosis.

Michael Dee Iseman, M.D., Dale R. Morgan, Richard P. Palestro and Donald P. Rosier created the system, which received a U.S. patent in 2002. The system uses ultraviolet light in conjunction with a filtrated air exchange system to destroy airborne pathogens and pulmonary bacteria.

Tuberculosis is the leading cause of death among infectious diseases worldwide, and the UV system allows healthcare professionals to control spread of the disease in potentially communicable settings. This same technology has now been adapted to help contain harmful air particles and bacteria in cases of biological contamination.

The National Jewish Medical and Research Center has partnered with Biotech Systems, a company dedicated to raising the standards for quality and rapid deployment in case of biological, chemical or radiological contamination. This partnership has allowed the sale of the UV system in portable trailer form to communities nationwide, so that it can kill harmful bacteria and pathogens related to bioterrorist strikes.

Medical

Dental Work Is Strong and Natural Looking Thanks to New Composite

University of Connecticut

Ideally, materials used to make dental crowns and bridges should be strong, look natural, last a long time and be easy for the dentist or dental laboratory to mold and fit. Metal is strong and lasts a long time, but it is not the color of teeth and needs to be processed to the desired shape by a dental laboratory. Polymer devices are more natural looking, but can be somewhat weak and not terribly durable.

FibreKor has been used in millions of orthodontic retainers, bridges, crowns, space maintainers and splints.

Jon Goldberg, Ph.D., and Charles Burstone, D.D.S., of the University of Connecticut Health Center worked together to find a better substance. The materials scientist and orthodontist, respectively, invented a fiber-reinforced composite material that can form the substructure for a new bridge or crown. The next step is coating this base with an existing plastic restorative material to make an artificial tooth that is strong and natural looking.

The composite, patented in the late 1980s, has glass fibers embedded inside a polymer matrix and is so easy to work with that dentists can make some devices in their offices during patient visits. University officials licensed the material to Pentron, a small company in Wallingford, Conn., in 1996. Pentron began introducing fiber-reinforced composite materials to the dental market in early 1997.

The first product, FibreKor®, is a replacement for metals in the fabrication of dental appliances including crowns and bridges. Two additional products appeared shortly thereafter: Splint-It® holds groups of teeth together to compensate for a lack of gum or bone support, and FibreKor Post is an alternative to traditional metal posts that support crowns that patients receive after root canals. Since 1997, FibreKor materials have been used in millions of orthodontic retainers, bridges, crowns, space maintainers and splints.

Nonprofit Drug Company Creates Nontoxic Therapies for Chagas' Disease

University of Washington and Yale University

Chagas' disease is a chronic infection caused by the protozoan parasite *Trypanosoma cruzi*. The disease is a major public health problem in Central and South America. The Centers for Disease Control and Prevention estimate that 16 million to 18 million people suffer from the disease, with an estimated 200,000 new cases occurring each year.

Nearly one-third of those infected will develop chronic complications such as digestive or heart problems later in life. Chagas' disease is the leading cause of heart failure in Latin America. Existing medications for Chagas' disease are effective in the acute stage of disease only; however, in this early stage, symptoms are evident in only 1 percent of cases, so victims rarely seek treatment.

Once the infection is established and becomes a chronic condition, current medications provide no benefit. But new medications and treatments for Chagas' disease and other tropical diseases are on the horizon. Scientists at the University of Washington and Yale University have synthesized new compounds that laboratory tests show to be highly effective against *Trypanosoma cruzi*, but nontoxic to human cells.

Though University of Washington TechTransfer Invention Licensing and Yale's Office of Cooperative Research work primarily to patent and license their respective institutions' inventions to industry, the offices also complete technology transfers to nonprofit agencies as part of their mission to contribute to the public good.

The Rhodnius prolixus, or kissing bug, spreads Chagas' disease when it bites.
Photo by Sinclair Stammers; courtesy of the World Health Organizations and the Special Programme for Research and Training in Tropical Diseases

In 2003, the University of Washington and Yale exclusively licensed the patent rights on new compounds to the Institute for OneWorld Health, a nonprofit pharmaceutical company. One of the organization's main objectives is to search out promising new drug candidates for neglected diseases that affect millions in developing countries, then develop and distribute effective medications to these people, who otherwise would have little access to new treatments.

Gene Therapy Produces Treatments That Help People Breathe Easier

University of Florida

Research at the University of Florida that led to the founding of a startup company called Applied Genetic Technologies Corp. may soon help people around the world breathe easier. AGTC, based in Alachua, Fla., is now conducting clinical trials in conjunction with UF to develop a gene therapy treatment for alpha-1 antitrypsin deficiency.

Alpha-1 antitrypsin is a protein that protects human tissues from damage caused by neutrophil elastase, an enzyme released by white blood cells fighting inflammation and infection. When the liver doesn't produce enough alpha-1 antitrypsin, neutrophil elastase destroys sensitive tissue, most commonly in the lungs, causing early-onset emphysema in adults as well as life-threatening liver disease in children. Alpha-1 antitrypsin deficiency is one of the most common serious hereditary disorders in the world, with an estimated patient population of 200,000 in North America and Europe. Doctors predict the rate of symptomatic patients will increase 4 percent every year.

AGTC's treatment for alpha-1 antitrypsin deficiency uses adeno-associated virus technology as a vehicle to deliver normal human genes to patients so their bodies can produce the missing protein. Researchers are working to develop a treatment that would be administered only once to stabilize deterioration of lung function in patients with chronic symptoms. For newly diagnosed patients, treatment could prevent lung abnormalities, allowing symptom-free, normal life spans.

After receiving seed grants from the Alpha-1 Foundation, a nonprofit group dedicated to supporting researchers working to find a cure for alpha-1 antitrypsin deficiency, AGTC received investments of more than $15 million, which will finance clinical trials at UF's Powell Gene Therapy Center as well as ongoing development.

The company also is researching how to use adeno-associated virus technology to ease symptoms of other diseases. AGTC is working with UF on a treatment for Pompe's disease, an inherited enzyme deficiency that causes muscles to atrophy; and with UF, the University of Pennsylvania and Cornell University on a treatment for Leber's Congenital Amoroso, an inherited deficiency that causes blindness. Doctors currently have no treatment options for these devastating diseases. Read more at www.agtc.com.

Restasis — a New Treatment for Dry Eye

University of Georgia

In 2004, the University of Georgia Research Foundation Inc. began receiving royalties on sales of a newly approved human drug, Restasis™, sold by Allergan Inc. Before this first therapeutic product for treatment of dry-eye became available, patients with dry-eye could use only artificial teardrop products.

Restasis contains cyclosporine, an immunosuppressant that decreases tear duct inflammation and allows tear ducts to produce natural tears. Natural tears are important for eye health because they contain many compounds that artificial teardrops don't. This invention was developed in 1984 in the College of Veterinary Medicine to address a problem in certain breeds of dogs. The veterinary product, Opptimune™ was licensed to an inventor-led company called KB Visions Inc. and subsequently introduced to the market by Schering Plough in 1988. The U.S. Food and Drug Administration approved Restasis for human use in December 2002, and first sales occurred in April 2003.

The University of Georgia is proud to be the source of this medical invention, which has earned royalties that represent a very significant increase in licensing income for the Research Foundation. To date, the Foundation has received more than $28 million in licensing royalties from the veterinary and human applications of this technology, and has used a portion of the funds for research in the College of Veterinary Medicine. The remainder has been deposited in the University of Georgia Research Foundation's general research fund, and will provide research grants to faculty and startup funding for new faculty.

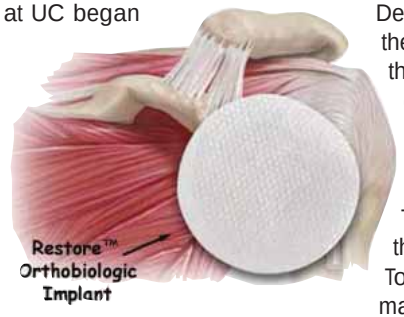
Medical

Computer-Aided Detection Finds Cancer Sooner

University of Chicago

Medical physicists in the Department of Radiology at the University of Chicago have been working for more than 30 years to develop computer applications that spot and characterize abnormalities on medical images. The researchers began making breakthroughs in the late 1980s, when computational power finally allowed practical applications to real images.

Technology transfer professionals at UC began patenting the technological advances, and in the mid-1990s the university partnered with a serial entrepreneur who formed the startup company R2 Technology Inc., based in Sunnyvale, Calif. The company introduced the ImageChecker® system based on UC research and received approval from the U.S. Food and Drug Administration in 1998 for a computer-aided detection system for use with mammograms. The technology doesn't replace mammograms, but brings tiny irregularities in the images to the attention of radiologists. In 2005 hospitals around the world used ImageChecker to assist with interpreting more than 8 million women's mammograms.



The Restore implant encourages rotator cuff tendons to heal.
Photo courtesy of DePuy Orthobiologics

According to a study published in the October 2005 issue of the *American Journal of Roentgenology*, using CAD to read mammograms increased detection rates for small, invasive breast cancers by 164 percent, and overall breast cancer detection rates increased by about 16 percent. The study, which was conducted in a South Carolina hospital, used ImageChecker.

R2 Technology also has introduced a CAD system for detecting lung abnormalities. Early studies show a 23 percent increase in the identification of lung cancer and other lung abnormalities. The company is continuing work with UC researchers to develop a CAD system for detecting intestinal polyps and colorectal cancer.

To learn more about the breast cancer detection study, go to www.ajronline.org and click on the archived October 2005 issue. Read more about ImageChecker at www.r2tech.com.

Biomaterials Replace and Repair Damaged Tissues

Purdue University

In the late 1980s, a team of Purdue University inventors developed techniques for working with natural tissue substrates to develop novel extracellular matrices. This technology led to the development of advanced biomaterials for repair and replacement of damaged and diseased tissues.

In 1991, the technology caught the attention of Richard R. Tarr of DePuy Orthopaedics Inc., based in Warsaw, Ind. Purdue licensed the technology to DePuy Orthopaedics, and collaborated with the company for the next few years to develop a product that gives surgeons a new alternative for treating rotator cuff injuries: Restore®, a biopatch made from extracellular matrix, currently derived from pig small intestines.

The rotator cuff is a group of four muscles and their tendons that wraps around the front, back, and top of the shoulder joint. Together the rotator cuff muscles help guide the shoulder through many motions and lend stability to the joint. U.S. doctors perform more than 300,000 rotator cuff surgeries each year.

The Restore® Orthobiologic Implant received approval from the U.S. Food and Drug Administration in 2000 for use in rotator cuff repair. Since then, doctors have used it to provide a strong, resorbable framework that encourages rotator cuff tendons to heal. The implant is a patch the size of a silver dollar with a dimpled structure like a paper towel, but much stronger. It acts as a natural agent to assist the healing process, serving as a scaffold and gradually disappearing as new tissue grows.

In 1995, Cook Biotech Inc., a startup based in West Lafayette, Ind., licensed the technology for development of products for other medical applications. The technology is sold under the brand names Oasis®, Surgisis® and Stratasis® to treat a range of conditions including management of dermal wounds and burns, reinforcement of many types of weakened tissue and treatment of urinary incontinence. Many new applications of the technology are under development.

To strengthen lost or damaged tissue, surgeons traditionally have relied on autografts or allografts-tissue grafts from a patient's own body or a donor's body, or synthetic materials. These new materials provide a biocompatible alternative to these traditional materials. It is a naturally occurring, complex matrix that is easy to handle yet strong enough to hold sutures and provide support for weakened tissue.

Validation Materials Help Advance Genetic Research

Maine Medical Center

In the late 1990s Clark Rundell, Ph.D., led efforts at the Maine Medical Center's newly created molecular pathology laboratory to implement new genetic testing methods for identifying causes of inherited diseases such as cystic fibrosis. The field of genetic research was growing rapidly at the time, as was the rate at which scientists were discovering disease-causing genes. Though genetic diagnostic technologies were booming, the development of molecular validation materials — controls that ensure tests are working properly — were not keeping pace.

So Rundell, who then was MMC's director of chemistry, invented and patented a process to stabilize specific DNA constructs for use as controls in molecular-based diagnostic tests. DNA constructs are sequences of nucleic acid that combine aspects of more than one DNA source. Joan Gordon, a senior technologist and research associate at the Maine Medical Center, then developed protocols based on the process to manufacture an FDA-cleared quality control for infectious disease tests.

Rundell and Gordon applied for and received a Small Business Innovation Research award in 2000, and formed a startup company called Maine Molecular Quality Controls Inc. Since then, the company has worked to develop cost-effective molecular validation materials used in tests to identify genetic mutations, focusing first on cystic fibrosis mutation detection. MMQCI also has received funding from the National Institutes of Health and Maine Technology Institute.

The validation technology now helps scientists across the United States make strides in genetic research. Read more at www.mmqci.com.

Test Diagnoses Herpes Quickly and Accurately

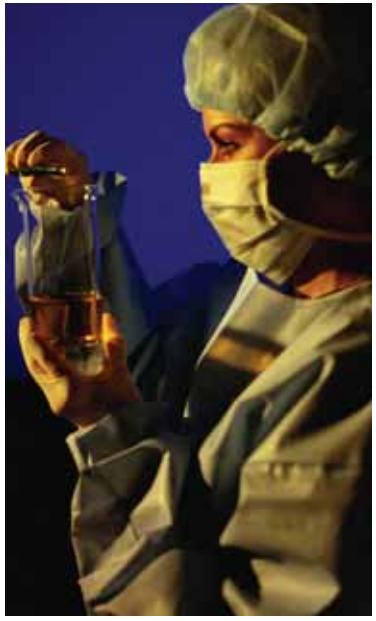
Washington University in St. Louis

The herpes simplex virus is the most widespread sexually transmitted disease in the United States. More than 20 percent of U.S. adults live with herpes simplex type II, or genital herpes. Incidences of the virus have increased more than 30 percent since the late 1970s, according to the National Institute of Allergy and Infectious Diseases.

Researchers at Washington University in St. Louis developed a test for type I and type II herpes, which has led to quicker, more accurate diagnoses. In the early 1990s, a team led by Paul D. Olivo, M.D., Ph.D., created the assay, which uses a provided cell line to signal the presence of the herpes virus.

These cells act as reporters when they come into contact with a culture. If the sample contains HSV, the reporter cells turn blue. When the test is complete, typically within 24 hours, technicians read results with an inverted light microscope. The test is quicker than most other viral culture tests, provides a positive/negative reading and can differentiate between the two types of the virus.

In 1995 the university granted Athens, Ohio-based Diagnostic Hybrids Inc. an exclusive license to market the test. DHI sells the product as the ELVIS (enzyme-linked virus inducible system) HSV test system, mainly to commercial laboratories. The system's quick diagnoses help allow patients get access to treatment faster, and can help prevent the spread of the virus by alerting patients to their positive status sooner.



Medical

Three-Dimensional X-Ray Device Increases Mammogram Accuracy and Comfort

Wake Forest University School of Medicine

The application of a revolutionary method of three-dimensional imaging has resulted in a quicker, more comfortable and more accurate mammogram. The methodology — called tuned-aperture computer technology, or TACT® — constructs three-dimensional breast images from two-dimensional images taken at random angles and distances.

Photo courtesy of GE Healthcare

By reducing the need for each image to be taken from precisely the same position, a patient's position no longer needs to be reassessed and adjusted between each image. The need for less repositioning and less breast compression decreases the number of retakes, makes the procedure quicker and provides the patient with a more comfortable experience.

The TACT technology — developed by Richard Webber, D.D.S., at the Wake Forest University School of Medicine — allows physicians to view breast tissue in single layers, avoiding obstructions caused by dense breast tissue and implants, and yielding images with a superior resolution compared with those produced by traditional breast imaging. By separating the tissue into individual layers, TACT allows for an easier assessment of biopsy depth.

Webber began his research in the mid-1980s and developed the first TACT algorithms in 1990. Relying on the algorithms, Webber was able to construct a reference system to decipher the projection geometry of images taken from arbitrary and random positions. Application of the TACT technology for mammography begins with taking digital images of the breast from several different angles and storing these images in a computer.

The reference system then reconstructs the projection geometry that produced the images to splice all the two-dimensional images together, resulting in a series of three-dimensional images of the breast.

In 1997, the university licensed certain medical applications of the technology to Instrumentarium Corp., based in Helsinki, Finland. The company, an internationally recognized leader in breast imaging devices and diagnostic breast care instruments, incorporated the TACT technology into its Delta 16 TACT® and Delta 32 TACT® imaging machines.

Reciprocating Syringe Is More Stable and Safe Than Traditional Models

University of New Mexico

As a medical resident back in the 1980s, Wilmer Sibbitt, M.D., remembers being frustrated with the way syringes worked, and wondering why someone didn't develop a safer, more practical device. As a rheumatologist at University of New Mexico Hospital, his frustration persisted. Then in the late 1990s, he decided to take matters into his own hands.

"The problem with a traditional syringe is that it requires two-hands to operate it," he says. This creates an unstable needle, and increases the risk of complications. Sibbitt solved this problem by inventing a reciprocating syringe, which requires only one hand to operate. "The reciprocating mechanism is a simple design," Sibbitt says. "But, it's also counter-intuitive. When people see how the syringe works, it takes a moment to understand," he says.

"My design is based on understanding how the human hand works," Sibbitt says. "It takes advantage of the intrinsic strengths of the hand, rather than its weakness." According to Sibbitt, the hand's grasping motion is weak when extended, so pulling the plunger back on a syringe is difficult, and usually requires two hands. Sibbitt's syringe, marketed under the name Procedur™, doesn't require this action. Instead, medical professionals push the plunger to inject and extract fluid.

Clinicians can withdraw and inject fluids simultaneously with the Procedur reciprocating syringe.
Photo courtesy of University of New Mexico

After developing a prototype, Sibbitt asked fellow physicians at UNMH to try out the syringe and they found it much easier to use. To further develop and market this device — and others that are on the way — Sibbitt worked with UNM's Science and Technology Corp. STC helped him identify a business partner, and together they started Avanca Medical Devices. The company has been selling the syringe since it received approval from the U.S. Food and Drug Administration in January 2005.

New Technology Improves Knee Replacement Results

Hospital for Special Surgery

More than one billion knee-replacement surgeries are performed worldwide each year. The procedure is a significant medical advance, but not all patients with knee damage require a full-knee implant. Realizing this, doctors at the Hospital for Special Surgery in New York City began research to create a cutting-edge partial-knee implant device that requires less invasive surgery and speeds recovery time.

A wide variety of prosthetic devices for replacing knees are available. Many are bicondylar, which replace both knee joint condyles — the rounded prominences at the end of the femur. Medical professionals often refer to a bicondylar replacement procedure as total knee replacement. But in situations where only one condyle of the knee is damaged, doctors can replace only the damaged part and save the healthy bone. Unicondylar knee-replacement devices make this procedure possible.

Unicondylar devices offer several advantages. They allow surgeons to use a minimally invasive surgical approach, permitting shorter hospital stays and faster healing times with reduced discomfort. The devices are particularly well suited for younger, more active patients, who are more likely to have limited damage and need the use of their knees for longer periods of time.

The Uni Knee partial-knee implant requires less invasive surgery and speeds recovery time.

But some previous unicondylar implants have been prone to misalignment or dislocation. Scientists at HSS and Switzerland-based device company Mathys-Medical developed a unicondylar knee replacement device with a unique, self-aligning design developed to resolve both problems. After HSS and Mathys jointly filed for patent protection, the hospital granted an exclusive license allowing Mathys to make the device available on a broad scale. In 2005 Mathys began selling the new unicondylar knee implants in Europe under the name balanSys™ UNI. Mathys and HSS now are working together to identify a partner to distribute the device in the United States.

Vaccine Saves Hundreds of Children's Lives Each Year

University of Rochester

For decades, *Haemophilus influenzae* type b, or HIB, was the most common cause of meningitis in children, as well as the most common cause of acquired mental retardation and acquired deafness in children. Then, researchers at the University of Rochester developed a new vaccine that has nearly eradicated the illness.

Scientists developed a conjugate vaccine, called HibTITER®, that has decreased the number of illnesses caused by this bacteria from 20,000 to about 200 cases each year. A conjugate vaccine makes the treatment more effective by linking it to a protein that spurs an infant's immune system to fight an infection especially vigorously.

After successful initial tests in the early 1980s the team, led by David Smith, M.D., went into business and created a company called Praxis to make the vaccine. The HIB vaccine was approved by the U.S. Food and Drug Administration in 1990, and was the first vaccine in 20 years to be recommended by the FDA for universal use in children. The approach also laid the foundation for additional vaccines against two additional infectious agents, pneumococcus and meningitis.

"During my training in the 1970s, you could walk into any pediatric ward anytime and guarantee that there would be at least one child with invasive *Haemophilus influenzae,*" says Richard Insel, M.D., formerly of the University of Rochester, who was part of the team that worked on the original vaccine. "Now, there are so few cases, a doctor will go years without ever seeing a case." Doctors have administered the vaccine to more than 50 million children, and estimate that it has saved the lives of approximately 1,000 children every year and protects thousands more from permanent brain injury each year.

Photo courtesy of Wyeth Pharmaceuticals

Medical

Minimally Invasive Technique Encourages Bone Growth Instead of Bone Grafts

Cleveland Clinic Foundation

Stem cell technology developed by an orthopaedic surgeon at The Cleveland Clinic has provided the basis for a new technique to treat back pain. The technology, called Cellect™ uses a needle to collect bone marrow cells from the hip area, then processes the cells so they can be grafted onto the spine.

This new treatment can result in significantly fewer complications than traditional bone harvesting that until 2003 was required for spinal fusion surgery, a procedure performed on more than 300,000 people each year in the United States. In traditional bone harvesting, surgeons remove bone material from a patient's hip through a three- to five-inch incision. Studies have shown that complications arise more than 30 percent of procedures, and 27 percent of patients continue to feel pain in the hip area as long as two years after surgery.

In the new procedure, a surgeon uses an aspiration needle to extract bone marrow through a tiny incision. Specialists place the marrow into a patented system that creates a graft with an increased proportion of progenitor cells, or bone forming cells, onto a special matrix. Surgeons then insert the graft into the spinal area, and new bone tissue grows to provide additional stability and reduce back pain.

George Muschler, M.D., a staff physician, surgeon and researcher in the Cleveland Clinic's Departments of Orthopaedic Surgery and Biomedical Engineering, and Orthopaedic Research Center, developed the technology. When DePuy Spine, a Johnson & Johnson company, introduced the Cellect device in 2003, surgeons for the first time could selectively control or increase the population of bone forming cells in regions that require new bone tissue for improved health.

In the future the Cellect technology may have applications for trauma surgeries, orthopaedic reconstructive surgeries, plastic surgeries, maxillo-facial surgeries, and ear nose and throat surgeries.

Technology Improves Performance of Hip and Knee Implants

Clemson University

As one of the world's pioneering biomedical programs, Clemson University's Department of Bioengineering is internationally recognized for significant contributions in the field of biomaterials engineering. In 1963 — long before biotech became a household word — Clemson faculty members began tackling the challenge of creating and improving materials specifically for use in medical devices.

The fruit of their efforts includes the founding of the Society for Biomaterials, the world's largest professional organization dedicated to the advancement of materials used in medical and surgical devices, which in turn has fostered similar societies in Europe, Canada, Japan and southeast Asia. This history has produced a research focus centered on the interaction between biomaterials and the human body.

In the early 1980s, a team led by Clemson researcher Joon Park, Ph.D., created a technique to improve the adhesion, or chemical bond, between orthopedic implants and bone tissue. In the technique, the prosthesis being implanted has a polymer precoat applied on the entire surface that is affixed to the bone by cement. The process dramatically improves the performance of hip and knee prostheses, and studies have shown it to be two to three times stronger than conventional techniques.

Zimmer, Inc. — a company specializing in the design, manufacture and distribution of orthopedic implants and at the time a division of pharmaceutical giant Bristol-Myers Squibb Co. — licensed the rights to put the invention on the market. As a result of Zimmer's success, in the 20-year span following the license nearly half of all hip-replacement surgeries incorporated the "Clemson hip" technology.

In addition to fulfilling Clemson University's primary mission of teaching, research and extended public service, Clemson has been able to further the development of other research programs with the revenue generated from the intellectual property income.

Diagnostic Test Determines Correct Dosage of Chemotherapeutics

St. Jude Children's Research Hospital

In 1998 St. Jude Children's Research Hospital announced results of a study tracking the treatment of childhood acute lymphoblastic leukemia, or ALL, which revealed a five-year event-free survival rate in 80 percent of patients. Inspired by these results, St. Jude drafted a protocol setting a goal of a 100 percent survival rate.

In taking a substantial step toward achieving this goal, St. Jude developed a diagnostic test to determine the appropriate dosage of thiopurines for patients according to their genetic profiles. Thiopurines are a family of chemotherapeutics commonly used to treat ALL, arthritis and inflammatory bowel disease, and as an immunosuppressant following organ transplant.

The test — one of the first clinical applications of pharmacogenomics, the science of using genetic testing to predict the safety, toxicity and efficacy of drugs in individual patients or groups of patients — is based on genetics research that began in 1995 by William Evans, who holds a doctorate in pharmacy and now serves as director of St. Jude Children's Research Hospital.

Evans' research focused on genetic polymorphisms identified in the thiopurine S-methyltransferase, or TPMT, gene and the impact these single nucleotide polymorphisms, or SNPs, had on the effect of the TPMT enzyme, which controls the ability to metabolize and eliminate thiopurines. He discovered that three TPMT SNPs were responsible for more than 90 percent of decreased or deficient TPMT enzyme activity. Patients with diminished enzyme activity caused by these inherited polymorphisms have a decreased ability to metabolize thiopurine and experience severe toxicity when they receive the treatment with standard doses.

Testing enables clinicians to identify patients with TPMT SNPs and tailor dosages of thiopurines to the patient's individual genetic needs. Evans conducted additional research to show that patients with decreased and deficient TPMT activity receive substantially the same benefit from reduced dosages of thiopurines without experiencing side effects associated with toxicity to the drug.

St. Jude exclusively licensed the patented TPMT technology to PPGx Inc., which since has been acquired by DNA Sciences Laboratories Inc., of Freemont, Calif. The company has sublicensed the technology to Prometheus and both companies now offer a clinical test based on Evans' TPMT research.

Through a series of licenses, acquisitions and sublicenses, a commercial diagnostic test for the TPMT SNPs identified by Evans is now available through Prometheus Laboratories and Specialty Labs.

Photo courtesy of St. Jude Children's Research Hospital

Medical

New Cholesterol Tests Predict Heart Disease in the Silent Majority

The Texas A&M University System

Texas A&M University researchers have invented a more precise and comprehensive cholesterol test that allows doctors to identify health risks that traditional screens miss. The blood-screening process separates lipids in the blood to create a detailed cholesterol profile that helps doctors identify patients at risk for heart disease.

Ronald Macfarlane, Ph.D., and fellow researchers in Texas A&M University's Department of Chemistry, pioneered the process as part of ongoing studies of advanced analytical techniques that can help doctors diagnose early warning signs for coronary heart disease, which, according to the American Heart Association, kills more than 2,600 U.S. residents a day.

The process goes beyond standard measurements of good and bad cholesterol levels using lipoprotein fingerprinting. The test displays results in a detailed graph that shows lipoproteins in bands at their specific densities. Doctors can use the results to precisely analyze a patient's overall risk profile and monitor the effectiveness of a diet or treatment regimen.

The purpose of the test is to identify problems in the 50 percent of patients who are at risk for developing cardiovascular disease, but whose standard lipid tests don't detect any danger. High LDL cholesterol is a major cause of coronary heart disease, according to the National Cholesterol Education Program. With early detection — the key to slowing the development of heart disease in later life — advanced cholesterol screening can be a valuable tool and is gaining acceptance among medical insurers.

Texas A&M licensed the technology to startup company LipidLabs Inc., a diagnostic laboratory based in The Woodlands, Texas. SpectraCell Laboratories Inc. acquired the technology from LipidLabs in January 2006. The Houston-based clinical laboratory serves physicians nationwide by providing a patented assessment of a patient's nutritional status. SpectraCell's national sales team will market the reasonably priced advanced cholesterol test, which provides accurate and specific data that helps guide clinical judgments and patient therapy to prevent heart disease.

Yeast Research Leads to Hepatitis B Vaccine

University of Washington

Professor Benjamin Hall, former chair of the University of Washington Department of Genetics, was among the first researchers who asked: "What is a yeast promoter?" He began researching in 1963 and found an answer that now helps protect millions of people from Hepatitis B and was a major contribution to the establishment of the biotechnology industry.

Hepatitis B is a common, highly contagious blood-borne virus; doctors report 200,000 new infections and 4,000 deaths per year in the U.S. Worldwide there may be 300 million carriers. The virus is fatal for about a quarter of those chronically infected because it can lead to cirrhosis of the liver and liver cancer.

By the mid-1970s major pharmaceutical companies had developed Hepatitis B vaccines derived from the blood of human carriers. However, blood-derived products were associated with a risk of contracting the disease, and the limited supply of plasma also made it impossible to manufacture enough vaccine for everyone who needed it. But the new technology of genetic engineering provided a solution for these problems.

Hall didn't originally set out to invent a Hepatitis B vaccine. His research group was interested in the genetics of baker's yeast, or Saccharomyces cerevisiae. They were studying promoters, signals in or near the DNA of a gene that control the conversion of that gene into a protein. After Hall and post-doctoral fellow Gustav Ammerer determined which part of a yeast gene contained the promoter, they began studying whether the promoter could spur a non-yeast gene in yeast to become a protein.

By collaborating with scientists from Genentech, they were successful in causing yeast to express human interferon, a protein that cells produce when invaded by viruses to induce healthy cells to manufacture an enzyme that counters the infection. Next Hall decided to try this method with the surface antigen protein from human Hepatitis B virus. After the research began it took only two months for the experiments to succeed.

This and related protein expression technologies are licensed to about 25 organizations including several of the world's largest pharmaceutical and biotechnology companies. Since its introduction, more than 1 billion doses have been administered. Doctors routinely give yeast-made Hepatitis B vaccine to newborns in the U.S., Europe and China, and eradication of Hepatitis B worldwide is now considered possible.

Medical / Nanotechnology

TRICKS Gives Doctors New Insights Into Vascular Disease

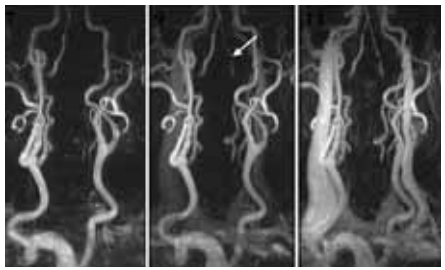
University of Wisconsin-Madison

Every year, between 8 and 10 million people are affected by peripheral vascular disease. Doctors commonly use magnetic resonance imaging to diagnose the problem but until 2003, visualization during the MRI process was limited because the technology — which works like a camera taking multiple shots — might miss damaged blood vessels or fail to show when the flow in an artery had backed up and started going in the wrong direction.

A team of University of Wisconsin-Madison researchers led by professor Charles Mistretta resolved this problem with the invention of time-resolved imaging of contrast kinetics, or TRICKS™. The visualization-enhancement technology acts more like a video camera, recording all the events in an MRI exam, so doctors can be sure they've captured the exact image they need for diagnosis.

The system provides three-dimensional images much faster than previous imaging systems, improving patients' comfort and doctors' efficiency. "TRICKS has helped us see what arteries are affected, how bad the arteries are, and if the patient needs vascular surgery," says Kevin DeMarco, M.D., an associate professor in the Department of Radiology at Michigan State University. "TRICKS also helps us see the very small arteries in the calf and foot, even down to three millimeters."

After receiving a patent for TRICKS in 1996, the Wisconsin Alumni Research Foundation licensed the technology to GE Healthcare of Waukesha, Wis. Today, TRICKS has been incorporated into several lines of imaging devices used by radiologists around the world. The rapid, safe and noninvasive TRICKS technology means better diagnosis of blood clots and circulatory problems, which translates to fewer surgeries for individuals suffering from some forms of vascular disease.



Nanotechnology Research Company Making Great Strides

University of Wyoming

Nanotechnology is the study of matter smaller than microscopic size, typically between .1 and 100 nanometers. (A nanometer is one millionth of a millimeter). Because the physical properties of materials are different when their size is so small, the aim of the technology is to allow the manipulation of material at a near molecular level. Nanoscale substances already are used in biomedical, electronic, pharmaceutical, energy, catalytic and materials applications. Products from computer hard drives to car bumpers to tennis balls feature nanotechnology-based improvements.

Researchers founded Nanotechnology Discovery Corp. in 2003 to make nanotechnology-related materials, products and intellectual property available commercially. NDC has a research partnership with the University of Wyoming and Daniel Buttry, Ph.D., former head of the university's chemistry department and current faculty member, serves on NDC's board of directors. This partnership has been beneficial for the university, a leader in the study of nanotechnology, and has helped Laramie, Wyo.-based NDC remain at the forefront of the field.

NDC's product development efforts focus on fuel cell and rechargeable battery technologies, using patented high-throughput screening. This technology allows researchers to conduct numerous nanomaterials experiments simultaneously using specialized laboratory hardware. Within the field of nanotechnology, this technique allows the rapid search of for new chemical formulations.

The United States Department of Defense awarded the company $2.5 million in 2005 to produce a new class of fuel cells powered by high-energy materials like propellants and explosives. The technologies created with this program will produce portable power devices for soldiers and miniature power supply for use with munitions programs. NDC's work with fuel and battery materials aims to create products with high economic impact on the consumer market.

Pharmaceuticals

Scientists Create Customized Antibodies to Neutralize Drugs' Effects on the Brain

University of Arkansas for Medical Sciences

A decade of research at the University of Arkansas for Medical Sciences has led to a process to customize antibodies and block the effects of PCP and methamphetamine on the brain. The treatment is so promising that in early 2005 a startup company launched in the UAMS Arkansas BioVentures business incubator received a $3 million grant from the National Institute on Drug Abuse to obtain approval from the U.S. Food and Drug Administration and conduct clinical trials.

Pre-clinical studies show that monoclonal antibodies can absorb PCP and methamphetamine from the blood stream. These antibodies bind the toxins and allow them to be removed from the body before crossing the blood-brain barrier and causing brain damage. Preliminary trials also show that using the antibodies for ongoing treatment can help patients overcome dependence on the drugs.

The treatment was invented by Michael Owens, Ph.D., director of the UAMS Center for Alcohol and Drug Abuse and a professor in the Department of Pharmacology and Toxicology in the UAMS College of Medicine. In addition to this role, Owens is now the chief scientific officer of startup company Little Rock, Ark.-based InterveXion Therapeutics LLC, which received an exclusive license for the technology from UAMS. Other founding partners include Brooks Gentry, M.D., associate professor of anesthesiology and pharmacology at UAMS, and Ralph Henry, Ph.D., associate professor of biological sciences at the University of Arkansas, Fayetteville.

Michael Owens, Ph.D.
Photo courtesy of the University of Arkansas for Medical Sciences

A unique aspect of the company's treatment approach is that the antibodies are produced in modified plants grown in a greenhouse. Scientists remove and purify the antibodies for use in an injectable form. In the body they act to neutralize the drugs' adverse effects, just like a natural antibody protects against other diseases.

According to the U.S. Department of Health, more than 12 million people have tried methamphetamine and 7 million have tried PCP in their lifetimes. More than 135,000 sought treatment for addiction to these drugs in 2003 — double the number or people who sought treatment in 2000. Read more about this developing treatment at www.intervexion.com.

Topical Gel Treats AIDS-Related Cancer

Salk Institute for Biological Studies

AIDS-related Kaposi's sarcoma is a cancer typically found in men diagnosed with AIDS. The disease is the most common malignancy among AIDS patients, affecting between 30,000 and 50,000 patients in the United States and Western Europe. Kaposi's sarcoma most often appears on the skin, in the mouth and on lymph nodes. Widespread, progressive skin lesions are a common symptom.

In the mid-1980s Ronald Evans, Ph.D., of the Salk Institute for Biological Studies, began researching materials that bind to cells, then activate nuclear receptors within those cells. Evans, a world-renowned expert on this kind of cellular research, discovered previously unknown receptors and hormones. Study of nuclear receptors has become key in pharmaceutical research because many hormones work by binding to nuclear receptors, and a class of pharmaceuticals also bind to these receptors.

In 1988, a startup biotechnology company called Ligand Theraputics Inc. (originally named Progenx) obtained an exclusive license to use and further Evans' research. After years of study and clinical trials, the company formed a partnership with the pharmaceutical company Allergan that led to the development of the drug Panretin®.

The U.S. Food and Drug Administration approved Panretin for the topical treatment of AIDS-related Kaposi's sarcoma in 1999. A self-administered and non-invasive gel, the drug treats skin lesions directly. Though not intended for patients with internal growths, Panretin provides an alternative to costly, time-consuming treatment programs that must be administered by healthcare professionals.

Pharmaceuticals

Breakthrough Treatment Could Save Vision for Millions

University of Colorado

Age-related macular degeneration is the leading cause of severe vision impairment in people over the age of 55. Neovascular AMD, which comprises the majority of these cases, affects nearly 2 million people in the United States alone, with another 200,000 new cases diagnosed each year. But a new treatment can help patients with AMD avoid irreversible vision loss.

Neovascular AMD, also called wet AMD, occurs when abnormal blood vessels that grow under the center of the retina leak blood, creating scar tissue. Over time the tissue damages the macula, a part of the retina that enables central vision, and once destroyed these light-sensitive cells cannot be regenerated and the patient suffers central blindness.

Macugen® treats the disease at its origin by inhibiting a protein that overstimulates the growth of new blood vessels. The compound was identified through a patented process invented by University of Colorado Professor Larry Gold, Ph.D., and Craig Tuerk, Ph.D., in the 1980s. The process — called systematic evolution of ligands by exponential enrichment and systematic evolution process, or SELEX — allows scientists to design short strands of RNA that can bind to specific molecular sites for more specific therapeutic effects.

EyeTech Pharmaceuticals Inc., now part of Melville, N.Y.-based OSI Pharmaceuticals, acquired rights in 2000 to refine the compound and seek approval. In 2002, the company partnered with Pfizer and received approval from the U.S. Food and Drug Administration in December 2004. Macugen has since been approved for use in Canada, Europe and Brazil, and is under review in 12 other countries.

The treatment has the potential to save the vision of millions of people worldwide who suffer from macular degeneration. Scientists at OSI-EyeTech also are researching how to use Macugen in treating blindness caused by diabetes and circulatory problems in the eye. Read more about AMD and Macugen at www.macugen.com.

Allegra Relieves Allergy Symptoms for People Around the World

Georgetown University

For decades the only prescription medications available to treat the symptoms of seasonal allergies left patients feeling groggy and sluggish. Then, the U.S. Food and Drug Administration approved Seldane in 1985.

For a few years Seldane, the brand name for the drug terfenadine, was considered safe and effective, but doctors found that taking it with other medications could cause a buildup of terfenadine in the blood, and that could lead to serious — or even fatal — abnormalities in heart rhythm. Raymond Woosley, M.D., Ph.D., was one of the doctors called in to find a solution. At the time, he was chair of Georgetown University's Department of Pharmacology.

Woosley's research in the late 1980s and early 1990s pinpointed the interaction problems with terfenadine, but he didn't stop there. His studies also showed that fexofenadine, one of the components that Seldane breaks down into in the body, could provide the same benefits of Seldane without the risk of arrhythmia. The drug is now available as Allegra® and is one of the most widely prescribed antihistamines in the world. After it received approval from the U.S. Food and Drug Administration in 1996 and Allegra-D®, an extended-release formulation, received approval in 1997, the agency took Seldane off the market.

Photo courtesy of Sanofi Aventis

Pharmaceuticals

Improving Treatment for Crohn's Disease and Other Inflammatory Bowel Diseases

Washington University in St. Louis

Crohn's disease is a serious chronic inflammatory disease of the gastrointestinal tract that affects more than 1.5 million people worldwide, including approximately 500,000 people in the United States. Researchers Brian Dieckgraefe and Josh Korzenik of Washington University in St. Louis found a way to improve the health and quality of life for this vast population of sufferers. As part of the process, they also found an important new use for an existing compound.

The university researchers embarked on a counterintuitive approach to finding a treatment for Crohn's disease — a disease generally characterized by over-active immune responses — by investigating compounds that actually enhance the innate immune response. The existing biological compound granulocyte-monocyte colony stimulating factor, or GM-CSF, also known by the trade name Leukine®, is one of the immune-enhancing compounds the researchers found to be effective in treating Crohn's Disease. In the past, GM-CSF, a growth factor that helps fight infection and disease by enhancing cells of the immune system, was used primarily in patients undergoing chemotherapy for leukemia.

Photo courtesy of Berlex Laboratories Inc.

In July 2002, the university licensed its patent for treating inflammatory bowel disease with GM-CSF and granulocyte colony stimulating factor, or G-CSF to Berlex Laboratories Inc. The pharmaceutical firm continues to conduct clinical trials to evaluate Leukine's efficacy in treating Crohn's disease, and scientists are hopeful that the compound will soon receive approval from the U.S. Food and Drug Administration to relieve painful symptoms for thousands of people who suffer from the chronic disease.

Cotransformation Process Advances Treatment for Numerous Diseases

Columbia University

Among the most important pharmaceutical achievements of the past 30 years is the cotransformation process invented in the late 1970s at Columbia University by Professors Richard Axel, M.D., Saul Silverstein, Ph.D., and Michael Wigler, Ph.D. In cotransformation, scientists insert foreign DNA into a host cell to produce proteins that can target specific disease-causing molecules.

As a pioneering recombinant DNA technology, the process has led to numerous important therapeutic products such as:

- Activase®, used to treat heart attack, ischemic stroke and pulmonary
- Avonex® and Rebif®, treatments for relapsing forms of multiple sclerosis
- BeneFix® and Recombinate®, to reduce bleeding in patients with hemophilia
- Cerezyme®, which helps control type 1 Gaucher's disease
- ENBREL® and Humira®, for rheumatoid arthritis
- Epogen®, a treatment for anemia, hemophilia and cystic fibrosi
- Thyrogen®, a diagnostic test for thyroid cancer
- Xolair®, used to help control asthma in adults and adolescents
- Simulect®, to prevent kidney transplant rejection
- Rituxan®, used to treat B-cell non-Hodgkins lymphoma

These therapeutics and many others under development help doctors treat diseases on a molecular level, and wouldn't be possible without cotransformation. University officials say the process emerged naturally from basic academic study that emphasized the importance of research on everyday life and constantly challenged scientific frontiers.

Pharmaceuticals / Safety

Specialized Cells Deliver Missing Enzyme That Causes Fabry Disease

New York University's Mount Sinai School of Medicine

Lysosomal storage disorders are rare, inherited diseases, each caused by a specific genetic defect that results in the absence of an important enzyme necessary for the breakdown of certain substances. Fabry disease is one of 40 such disorders, afflicting about 1 in 40,000 males.

The cause of Fabry disease is a genetic disorder that compromises the production of an enzyme called alpha-galactosidase A, or Gal A, which breaks down a substance called globotriaosylceramide, or GL-3. In the absence of Gal A, GL-3 builds up in the body, particularly in the walls of blood vessels and other tissues. The accumulation of GL-3 damages organ systems over time, and young Fabry patients suffer from frequent pain, gastrointestinal problems, a characteristic skin rash, and the inability to sweat. Fabry patients live an average of 40 years, and death is usually caused by liver failure or vascular disease of the heart or brain.

In 1970, Robert Desnick, M.D., Ph.D., professor and chair of Human Genetics at Mount Sinai School of Medicine, administered Gal A intravenously to three Fabry patients. This treatment successfully reduced their levels of circulating GL-3, which gave hope that the disease could be treated by replacing the missing enzyme. But purifying a single dose took months, stalling progress on the development of a practical therapy.

The breakthrough came in 1992, when Desnick and his Mount Sinai collaborators, Yiannis Ioannou, Ph.D., and David Bishop, Ph.D., demonstrated the feasibility of engineering cells that make and secrete large amounts of Gal A. The enzyme could be purified easily from such a culture, and an enzyme replacement therapy for Fabry disease was in sight.

After several years of searching for an industry partner to license the resulting patented treatment and fund clinical development of the product, Mount Sinai reached an agreement with Genzyme Corp. in 1999. The resulting therapeutic, called Fabrazyme®, was approved in Europe in 2001 and in the United States in 2003. Doctors in more than 50 countries now prescribe the treatment, and Fabry patients are living longer, more comfortable lives.

Seat Sensors Protect Children From Airbag Injuries

Massachusetts Institute of Technology

Airbags save lives in car accidents. However, airbags can cause injury to children when they are seated in the front passenger seat — the average height of a child may place their head within range of a deploying airbag.

In an attempt to prevent front airbag injuries to children, the National Highway Traffic and Safety Administration issued a mandate: By 2006 all vehicles are required to detect and classify the occupant in the front passenger seat and make a decision to suppress or to deploy the airbag. According to NHTSA regulation FMVSS-208, an airbag should deploy for an adult and suppress for all children, with or without a child seat restraint.

One technology solution automakers can use to meet this requirement is electric field, or E-field, imaging, developed by Neil Gershenfeld, Ph.D., of the Massachusetts Institute of Technology. E-field can detect and classify the presence, position and mass of the occupant sitting in the front seat of a vehicle.

Before researchers began developing E-field to improve airbag safety, it was instrumental in illusionists Penn and Teller's spirit chair act. They amazed audiences when Penn sat in the spirit chair and gestured wildly with both hands and feet to evoke sounds of drums, trumpets, cymbals and other musical instruments from synthesizers. No wires linked Penn's hands or feet to the synthesizers producing the sounds, yet they sensed his every movement. In reality, the chair held no magic, but used electric fields that sent signals from the body to the instruments.

Image courtesy of ELESYS North America Inc.

In the fall of 1996, Phil Rittmueller, vice president of Elesys North America Inc., then an engineer for NEC Technologies Inc., saw the electric-field technology demonstrated at MIT's Media Lab. Rittmueller and Gershenfeld immediately saw the potential for vehicle airbag-related uses, resulting in the joint development of the technology that is the basis of a product called SeatSentry™.

Safety

Critter Crawl Provides Safe Passage for Small Animals

University of Montana

Many small animals, including skunks, ferrets, deer mice, marmots, voles, and porcupines, get flattened on highways that fragment their habitat. In response to this problem, Kerry Foresman, a University of Montana biology professor, and Cory Claussen, an employee of Roscoe Steel & Culvert Co. of Missoula, invented the Critter Crossing™.

The Critter Crossing is shelf suspended inside a culvert to allow animals to move easily and safely under a highway, even when the culvert contains water. The shelf floor is metal mesh with holes smaller than one inch to allow small animals to cross comfortably. It is also equipped with a side tube to provide covered protection for mouse-sized critters.

The shelf is removable, so it doesn't impede water movement during floods or high-water events, and can be retrofitted into existing culverts. Kerry Foresman, an animal behaviorist who researched why small animals wouldn't cross highways, conducted a study to measure the success of the culvert shelves using a variety of high-tech devices such as heat and motion-sensing cameras and tracking plates.

After some design modifications, he successfully documented several animals wandering the shelves. UM's patent for the culvert shelf was approved in 2005, and four culvert shelves are now in use beneath U.S. Highway 93 in Montana's Bitterroot Valley. UM licensed the invention to Roscoe Steel, which made the shelves, and the company will market and manufacture critter crawls. Roscoe is in the process of trademarking the name "critter crawl" and is developing a marketing plan.

Steven Patrick, general manager of Roscoe's Missoula, Mont., operations, envisions marketing them to Native American reservations and places with high volumes of smaller animals, such as the Carolinas and Florida. Read more at www.umt.edu/urelations/MainHall/0405/critter.htm and www.roscoebridges.com/prod_critter_crossing.html.

System Quickly Breaks Down Ice Into Hydrogen and Oxygen

Dartmouth College

Ice buildup on aircraft, runways, roads, bridges, sidewalks and power lines routinely wreak havoc with air, ground and sea transportation as well as communication, manufacturing and energy-distribution systems. Air transportation is particularly vulnerable; icy buildups on planes as thin as a few thousandths of an inch can alter aerodynamics, leading to loss of control and catastrophic accidents. Since 1970, investigators around the world have blamed ice for more than 35 serious commercial aircraft crashes.

The traditional weapon in fighting ice accumulation on grounded planes is a warm bath of antifreeze sprayed onto planes' wings and tail assemblies right before takeoff. The method is time-consuming and expensive — up to $3,000 per application. Once a plane is flying, there is no defense against additional ice buildup from freezing rain or fog. During the past three decades, companies and federal agencies have spent millions of dollars to find reliable, practical and economical methods to protect aircraft from ice.

Researchers at Dartmouth College have created a technology that can keep aircraft — and even airports — ice-free. A team of Dartmouth engineers led by Professor Victor F. Petrenko, Ph.D., developed a method that uses low-voltage current to prevent or quickly dispense ice on aircraft surfaces. Petrenko's invention uses electrodes that are embedded in a coating applied directly to surfaces, including windows. The current thwarts formation of ice through the process of electrolysis, which breaks down moisture into hydrogen and oxygen.

Patrenko's technology removes ice from structures such as the Uddevalla bridge in Sweden.
Photo courtesy of Dartmouth College

In January 2000 Dartmouth granted BFGoodrich Co. an exclusive license to market Petrenko's invention for aerospace and marine applications. Later that year, *Discover* magazine named Petrenko's airplane deicer winner of the magazine's annual Discover Award for Technological Innovation in the aerospace category. Hailed as a breakthrough ice-protection technology for the airline industry by governmental and corporate officials alike, Petrenko's achievement has implications that stretch far beyond aviation.

Dartmouth has issued licenses to other firms anxious to apply the technique in a variety of ways including land-based vehicles and outdoor facilities. Petrenko and Dartmouth also launched startup company Ice Engineering LLC in 2001. The company uses the technology in skis, footwear, power lines and refrigeration equipment. Read more at www.iceengineering.com.

Smarter Guardrails Decrease Fatalities on U.S. Roads

The Texas A&M University System

More than one in four deaths on U.S. roads are a result of collisions with roadside objects such as guardrails, according to the Insurance Institute for Highway Safety. Researchers at Texas A&M University's Texas Transportation Institute found that impacts with guardrails accounted for 4,047 traffic accidents in Texas in 1989 alone.

Years ago when vehicles crashed into the end of a guardrail, the rail would act as a spear through the vehicle. In later models a rail with ends that sloped down into the ground ended the spearing problem, but unfortunately a new problem arose — vaulting and rolling. Then, TTI researchers developed a guardrail end treatment that has significantly reduced traffic fatalities.

The ET2000 was designed to make collisions with guardrail ends survivable. When a car hits this device, the energy of the moving vehicle is absorbed as the rail is pushed through an extruder, which flattens the rail, bends it and forces it away from the vehicle. As the railing curls away from the vehicle toward the roadside, energy is absorbed, bringing the vehicle to a safe stop.

Tests at TTI facilities showed that the guardrail slows an errant vehicle to a safe and stable stop when it hits the guardrail head-on; the vehicle's kinetic energy is absorbed by the force required to flatten the guardrail. The safety record of the ET-2000 has proven to be a tremendous public benefit in saving lives along the nation's highways.

Sharpening Our View of the World

University of New Brunswick

New-generation satellites such as IKONOS, QuickBird, and SPOT 5 can capture high-resolution, clear monochromatic images and lower resolution, not-so-clear color images. However, researchers interpreting the images need clear color photos to extract the most accurate information. Given this, specialists developed several ways to fuse the clear black-and-white and not-so-clear color images to produce clear color images. Results, however, were inconsistent; colors were often distorted and the overall quality depended on the skill of the person doing the job.

Then Yun Zhang, Ph.D., of the Department of Geodesy and Geomatics Engineering at the University of New Brunswick developed software that dramatically improved the fusion quality of satellite images. His pan-sharpening algorithm and software automatically fuse low-resolution color and high-resolution black-and-white images, to generate high-resolution color pictures showing clear depictions of geographical features.

The breakthrough received immediate attention, and in 2002 UNB reached an agreement with PCI Geomatics, based in Richmond Hill, Ontario, Canada, to include the algorithm in the company's software for remote sensing, photogrammetry, spatial analysis, and cartography. The company began offering products with the pan-sharpening technology in February 2003. UNB also signed an agreement in 2004 permitting Longmont, Colorado-based DigitalGlobe to incorporate the algorithm into its production line to produce pan-sharpened QuickBird images, which are now commercially available color satellite images with the highest resolution in the world. Google Maps uses the pan-sharpened QuickBird images to show details of selected areas and cities.

Photo courtesy of PCI Geomatics

Zhang continues his study of image processing technologies at UNB, and in 2005 received the Talbert Abrams Grand Award from the American Society of Photogrammetry and Remote Sensing. The award is one of the most prestigious and recognized prizes presented to researchers in the mapping and remote sensing community today.

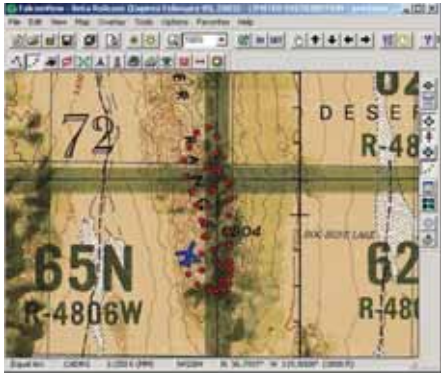
Software

Mapping Software Takes Birds-Eye View to a New Level

Georgia Institute of Technology

When the U.S. Department of Defense sought advanced mapping, charting and display technologies, one of the institutions it tapped was Georgia Tech. Researchers there developed FalconView™, a Windows-based system that now is an integral part of the U.S. military's flight planning programs.

FalconView supports many types of displays, but pilots primarily use aeronautical charts, satellite images and elevation maps. The software also can show overlays with any map background. When first launched, only U.S. Air Force F-16 pilots used the software but programmers have since adapted it for a variety of aircraft and now more than 20,000 pilots in every branch of the U.S. armed forces rely on it.



Falconview mapping software improves the functionality of satellite images and can show overlays with any map background.
Image courtesy of Georgia Institute of Technology

In recent years, several European nations began using a special version approved for export, and Non-military U.S. agencies such as the Federal Aviation Administration and the U.S. Customs Service are conducting tests to determine how to best use FalconView in their work. The software also is applicable and has been licensed in a wide range of non-combat mapping activities including fire-fighting, whale tracking, drug enforcement and emergency response.

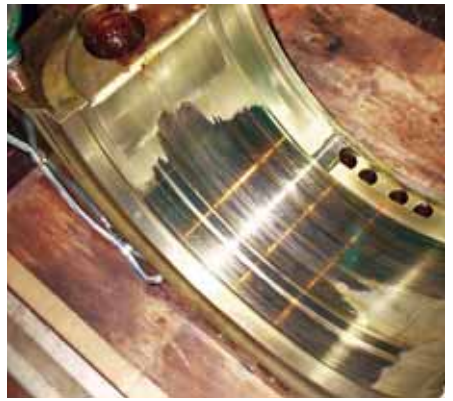
Fault Analysis Technology Predicts Machinery Failure

University of Chicago/Argonne National Laboratory

A partnership between the University of Chicago and Argonne National Laboratory has yielded a commercially available technology that can predict machinery failure before it happens. Argonne scientists developed Equipment Condition Monitoring, a type of fault-analysis software, in the early 1990s to predict pump failures at a nuclear reactor in Idaho. The software uses a statistical approach that models the typical operation of machinery and detects even the smallest deviations, which often are warnings of impending failure.

The University of Chicago's Office of Technology and Intellectual Property assesses the potential of advances made at the University and Argonne, which is a U.S. Department of Energy lab that UC manages. Argonne is one of the nation's largest energy research centers, with more than 200 ongoing projects and partnerships with more than 600 companies since 1990.

The university's technology office realized that Equipment Condition Monitoring could benefit numerous types of manufacturing operations and formed SmartSignal Corp. in 1995 to market the software. SmartSignal has grown consistently since then, and its client list includes Delta Airlines, Caterpillar, General Motors and myriad power companies. Delta relies on the software to check all of the airline's commercial jet engines.



Detecting damage to a turbine-driven generator.
Photo courtesy of SmartSignal

SmartSignal's technology is broadly applicable, and is used in many forms of commercial travel. By fixing small, otherwise unnoticeable problems, SmartSignal helps avert potentially disastrous failures later. Seeing the software's important role in safety and efficiency, the U.S. Department of Defense and National Transportation Safety Board have forged partnerships with SmartSignal. For more information, visit www.smartsignal.com.

Managers' Ingenuity Yields Sponsored Programs Database

Western Kentucky University

A unique administrative need at Western Kentucky University led to a fruitful collaboration between Regina Allen, an operations specialist in the Office of Sponsored Programs, and Jeffrey Alan Jones, a senior programmer and consultant in the Microcomputing Center.

Using commonly available commercial software, the creators devised a relational database, complete with a single form interface that managers can use to manipulate, manage and calculate proposal and award data. The database can link and track data, calculate totals, generate reports and provide other information of interest to managers.

Available non-exclusively to any academic, research or clinical facility that engages in sponsored programs administration, the product was born from necessity and cost nothing but the creators' ingenuity and effort. It was introduced to the market in summer 2002 strictly by word of mouth, and to date has netted more than $25,000 for WKU.

World's Smartest Music Teacher Creates Custom Practice Routines

Carnegie Mellon University

Music students have suffered through practice time long enough. With a software program called SmartMusic®, many of the 2 million students in the United States who begin playing instruments in school band and orchestra programs each year will never learn to fear the phrase "practice time."

Based on a system developed by Carnegie Mellon researcher Roger Dannenberg, Ph.D., SmartMusic is a revolutionary learning and assessment practice tool for band, orchestra and choir musicians. The software, which retails for less than $100, provides accompaniment, loops difficult passages and listens to musicians as they sing or play, providing feedback and adjusting tempo in real time.

Dannenberg specializes in harmonizing the strengths of music teachers, students and technology in a live setting, even if the musicians improvise. "When you have a computer and a human working together, you can create music that neither could make by themselves," says Dannenberg, an avid trumpeter and member of CMU's faculty since 1982. SmartMusic works because students practice more and learn faster when they can play with accompaniments, hear recordings of themselves and get help with notes and rhythms.

SmartMusic displays music on a computer screen, plays accompaniments and listens to what students play through a computer microphone. Students can click on a note to see a picture of their instrument with the appropriate fingering. If a student wants an assessment, SmartMusic displays red and green notes to show students what pitches or rhythms they played wrong and how to play them correctly. SmartMusic also can score the student's performance and e-mail it to the teacher.

CME originally licensed SmartMusic to Coda Music Technology Inc. in 1992, and in 2003 finalized another arrangement with MakeMusic! Inc., which began bundling the software with its best-selling Hal Leonard books for beginning music students. SmartMusic received another boost when it received an endorsement from Grammy-winning music education advocate Wynton Marsalis. Read more about SmartMusic at www.smartmusic.com.

Software / Technology

University Research Raises the Bar on Internet and Cellular Phone Quality

Université de Sherbrooke

Algebraic-code-excited linear prediction, or ACELP®, is a voice-compression technology that has become the standard for digital and mobile telephony. The technology developed at Canada's Université de Sherbrooke provides more than 500 million Internet browsers and 2 billion mobile phone users with crisp, clear audio.

The work of inventors Jean-Pierre Adoul, Claude Laflamme, Redwan Salami, Bruno Bessette, Roch Lefebvre and Milan Jelinek of the university's Speech and Audio Compression Research Group — supported largely by strategic partners Sipro Lab Telecom and startup company VoiceAge Corp. — has led to more than 400 patents, which are included in 15 major international telecommunications standards.

Since the technology was introduced in the mid-1990s, Sipro Lab Telecom and VoiceAge, both based in Montreal, accelerated market adoption by providing users a simplified way to access to the technology. The result: ACELP has become a de facto standard for voice over the Internet wireless telephony. Companies such as Microsoft, RealNetworks and Apple have integrated it into Windows Media Player, RealPlayer and QuickTime Player; and ACELP technology is used in 93 percent of wireless phones worldwide.

Sipro Lab and VoiceAge also manage patents to provide companies with convenient, fair, reasonable and nondiscriminatory access to a portfolio of worldwide patents under a single license agreement. The companies have diversified their offerings to include music and different audio types as well as voice — making it ideal for mixed-content audio, streaming video and subscription services.

So far, more than 180 licenses have been granted to companies around the world, including Nokia, NEC, Dialogic, Oki, Matsushita Electric, Hitachi, Mitsubishi Electric, TDF, Mindspeed, Scientific Atlanta and Audible. Read more at www.voiceage.com and www.sipro.com.

Inspection Robot Makes Searching for Car Bombs Safer and More Efficient

Utah State University

Car bombs are an all-too-common threat in war zones. Inspecting cars for undercarriage bombs can be a dangerous job because visual inspections and trained dogs are not completely accurate and require inspectors to stand near suspicious vehicles.

Researchers at Utah State University found a way to inspect full parking lots of vehicles: a four-inch tall, three-wheeled robot called ODIS, short for OmniDirectional Inspection System. A remote control operator directs the low-profile, high-mobility robot by joystick to inspect the underbelly of cars. The robot can turn quickly and travel in any direction, much like a helicopter, and is armed with a camera that allows for a fast and complete inspection for explosives or contraband.

The ODIS robots were developed by Utah State University College of Engineering's Center for Self-Organizing Intelligent Systems, or CSOIS, with funding from the U.S. Army Tank Automotive Command and Utah State University. The idea for the project was launched in 2000 and — because of its ability to prevent misuse and transport of hazardous materials — became a high priority after the terrorist attacks of Sept. 11, 2001.

The collaboration brought students, academic researchers and industry professionals together to focus on a single idea, eventually producing the hardware and software for the robot that was licensed to Windber, Pa.-based Kuchera Defense Systems. The robots improve security at checkpoints in Iraq and Afghanistan, and at parking areas in Washington, D.C., and have been credited with saving a number of lives.

Technology / Veterinary Science

Dual-Frequency Sonar Improves Vision in Murky, Turbid Waters

University of Washington

Scientists at the University of Washington developed a high-definition sonar technology that sets a new standard for underwater imaging. The dual-frequency identification sonar, or DIDSON™, provides dynamic images of such high quality that in turbid water, many researchers actually prefer it to optical systems.

Invented by Edward Belcher, William Hanot and Joe Burch of the university's Applied Physics Laboratory, the highly sensitive DIDSON devices use high-frequency sound waves and acoustic lenses to visualize underwater objects in detail. And unlike traditional sonar, which provides information only about object distance and displays data as a series of peaks, DIDSON provides near-video quality images of fish, mines, ships and other underwater objects.

The DIDSON device.
Photo courtesy of Ocean Marine Industries Inc.

DIDSON equipment can create images of objects 80 feet away and at depths of up to 3000 meters. At the same time, it yields images so clear that scientists can differentiate fish species by their size, shape and swimming patterns. In fact, the Army Corps of Engineers and Alaska Department of Fish and Game have used the sonar technology to monitor and protect fish. The technology has numerous other applications, too, including leak and flow detection, search and evidence recovery, ship inspection, underwater vehicle navigation and checking underwater structures such as bridge footings, cables, and pipelines.

UW licensed the technology to the inventors, who in 2003 launched a startup company called Sound Metrics Corp., based in Kenmore, Wash. The company markets and sells equipment to organizations around the world. Read more and watch video of DIDSON images at www.didson.com.

Tests Allow Veterinarians to Determine Dogs' and Cats' Blood Types

Kansas State University Research Foundation

Blood-typing pets has become an important issue in veterinary medicine. Animals can receive blood transfusions and, as with humans, it is essential to transfuse a compatible blood type. Blood typing also is important when mating cats, which have two major blood types, A and B. If a female cat with blood type B mates with a male cat with blood type A, some of the kittens may die from a reaction with the mother's antibodies.

Blood-typing cats and dogs hasn't always been easy or accurate. In the early 1990s Joseph Smith, D.V.M., Ph.D., a Kansas State University professor in the Diagnostic Medicine/Pathology Department of the College of Veterinary Medicine, and Gordon Andrews, D.V.M., Ph.D., associate professor in the same department, invented accurate, quick, economical in-office methods for blood-typing cats and dogs. These technologies allow veterinarians to type cats and dogs during regular office visits, and keep the information on file for future use.

Smith and Andrews worked with technology transfer professionals at the Kansas State University Research Foundation, and in 1992 received a patent for the feline blood typing method. An agreement finalized in 1995 permitted DMS Laboratories Inc., based in Flemington, N.J., to sell canine and feline blood typing products to veterinarians.

After Smith's death in 1998, Andrews continued research and improved the feline blood typing technology in 2001. The feline and canine products are now available in 28 countries. Read more at www.rapidvet.com.

Veterinary Science / Other

Hair Today, Gone Tomorrow: New Cat Foods Reduce Hair Balls

University of Wisconsin-Madison

Mark Cook, animal scientist at the University of Wisconsin-Madison, and researchers at the Nestlé Purina PetCare Co. have devised a way to help dissolve hairballs by using natural agents that break up, or emulsify, fats. Cook and his collaborators, Beth Drake, Leonard Girsch and Janet Jackson, conceived the idea after discovering that hairballs can contain up to 30 percent fat.

A patent was issued jointly to the Wisconsin Alumni Research Foundation, a nonprofit agency that manages intellectual property for UW-Madison, and Nestlé Purina in May 2003. Nestlé Purina holds an exclusive license to the technology and has incorporated it into new Purina ONE® hairball-control cat food formulas that are now on store shelves. This technology may improve the lives of thousands of felines and their owners.

Photo courtesy of Purina

Hairballs are a natural outcome of a cat's grooming rituals. During ongoing conversations with Nestlé Purina scientists about a variety of pet care issues, Cook says the subject of hairballs kept coming up. "They kept asking me about them," he says. "So I finally said, 'Well, what is a hairball?' They all laughed and said, 'It's hair.' So I said, 'Put 20 of them in a box and ship them to me.' "

After a simple analysis of the water, fat, protein and ash content of the hairballs revealed their fatty nature, the team quickly hit upon the idea of using a detergent to break up the fat and disintegrate the balls. Cook first tested a common dishwashing detergent. When that worked, he moved on to a food-grade fat emulsifier, a solution of which trimmed the size of hairballs by more than 50 percent. In the new hairball formula, an edible emulsifier called soy lecithin helps break down existing hairballs, allowing them to pass more easily through a cat's digestive tract, and minimizes the formation of new ones.

Birth Control for Cockroaches Relieves Pest Problems

Virginia Polytechnic Institute

Cleary Roach Terminals™, developed by a researcher at Virginia Tech, is a safe and natural alternative to chemical pesticides. The active composition in the cockroach bait is a nutritional metabolism disrupter and is a combination of xanthine and oxypurinol.

Xanthine is found in coffee, potatoes and many other foods; oxypurinol prevents the formation of uric acid. Humans don't need uric acid, but cockroaches require it for reproduction and development. Virginia Tech's Heather Wren, a research scientist in the Department of Entomology, studied the cockroaches' dependence on uric acid, and discovered how to interfere with this metabolism.

The Roach Terminal™ eliminates cockroaches within weeks by stopping the production of viable eggs, even after only a few days' exposure to the bait. Experiments and trials proved the compound works — eliminating even cockroaches resistant to a suite of insecticides — and can be more effective than other commercial baits.

The product is environmentally friendly because it contains no harmful residues, and was approved for commercial sale by the EPA as a reduced-risk pesticide. The composition of the bait is stable, and remains active and palatable to cockroaches for years.

Dominion BioScience, an early-stage biopesticide company located in the Virginia Tech Corporate Research Center, originally licensed the product from the university. Today, the technology is licensed to Cleary Chemical Co.

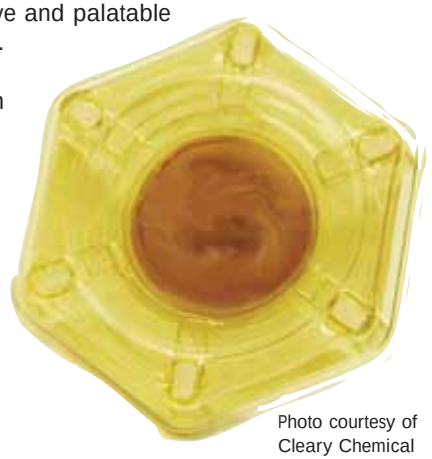


Photo courtesy of Cleary Chemical

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Technology Transfer Works

The 100 cases in this compelling book illustrate the public benefits attained through technology transfer. *Technology Transfer Works: 100 Cases From Research to Realization* is a must-read for professionals in research, management, technology transfer or economic development as well as anyone who has wondered: "Where did that come from?"

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FoodSource Lures	University of Akron
Habitrol Nicotine Patch	University of Arizona
Hepatitis B Vaccine	University of California
HibTITER Flu Vaccine	University of Calif./Stanford University
Honeycrisp Apple	University of Georgia
National Lightning Detection Network	University of Hawaii
Permeable Reactive Barrier	University of Minnesota
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