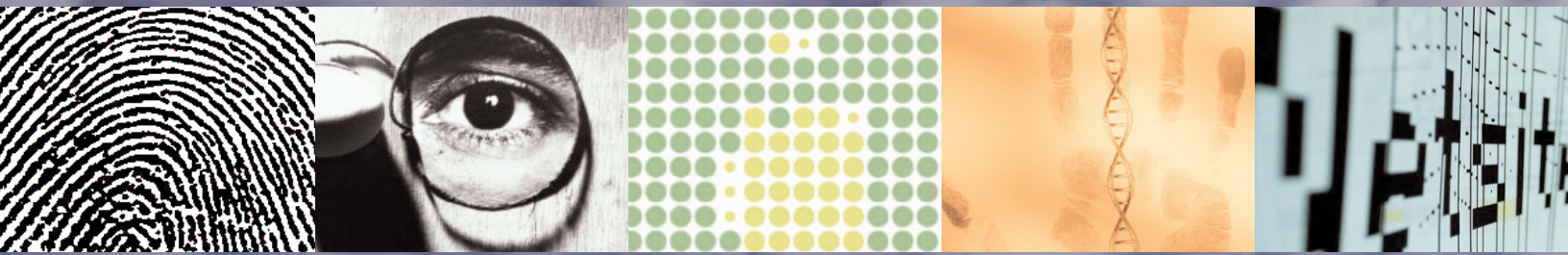
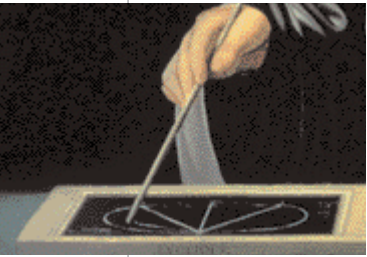


New Inventions / New Discoveries

COLUMBIA UNIVERSITY SCIENCE AND TECHNOLOGY VENTURES



Introduction



At Science and Technology Ventures (STV)—which serves to transfer inventions and innovative knowledge from Columbia University to outside organizations—measuring impact is important. But how do you measure impact?

Is it by the more than 600 patented technologies under management; the greater than 250 active license agreements; the 70 new companies created; or the more than \$1.75 billion in gross revenue generated for academia? What about other measurements—the ones that aren't quite as quantifiable? How do you measure the ability of a painter with waning eyesight to see clearly again due to Xalatan, a revolutionary glaucoma treatment? The joy of a couple who long struggled with infertility and now have a baby thanks to Serono S.A.'s breakthrough fertility drug, Gonal-F? Or the gratitude of a woman whose life was prolonged with the breast cancer medicine Trastuzumab?

Each of these life-enhancing products was built upon discoveries made at Columbia labs and ushered into industry by the technology transfer office. While these products have generated revenue for the University and for licensees, STV uses the more immeasurable impact that these innovations have had on society as its key benchmark for success.

“In many ways, the real importance of fundamental science is to uncover breakthroughs that can benefit the economy and people at large on a national and global basis,” says Dr. Michael J. Cleare, the

“Probably more than half the products in biotech as a whole came from discoveries in universities’ laboratories.”

**—Dr. Joseph M. Davie, former Senior Vice President,
Research, Biogen, Inc.**

executive director of STV. “The most important mission of the University technology transfer office is to provide a smooth and effective interface for the transfer of usable and useful technology that is developed within the University into the outside world to benefit society as a whole.”

Over the past 25 years, Columbia scientists have developed groundbreaking technologies that have been commercialized and have added inestimable value in enhancing people’s lives. Some of the greatest contributions have been in the health sciences field, where Columbia generates some 175 inventions annually. More than 30 pharmaceutical products based on Columbia technology are on the market today. These include major therapies such as Remicade, which has helped 634,000 people reduce the painful symptoms of ulcerative colitis, Crohn’s disease, and rheumatoid arthritis; Biogen Idec’s Avonex (interferon beta 1a), a once-a-week treatment taken by 100,000 people suffering with multiple sclerosis; and recombinant Alteplase, a clot-dissolving medication that helps to manage stroke—the number one cause of adult disability in the United States. Medical devices such as a revolutionary shoulder prosthesis and antimicrobial-coated catheters are also improving people’s lives every day.

Columbia’s physical scientists have also made great technological advances with inventions in video

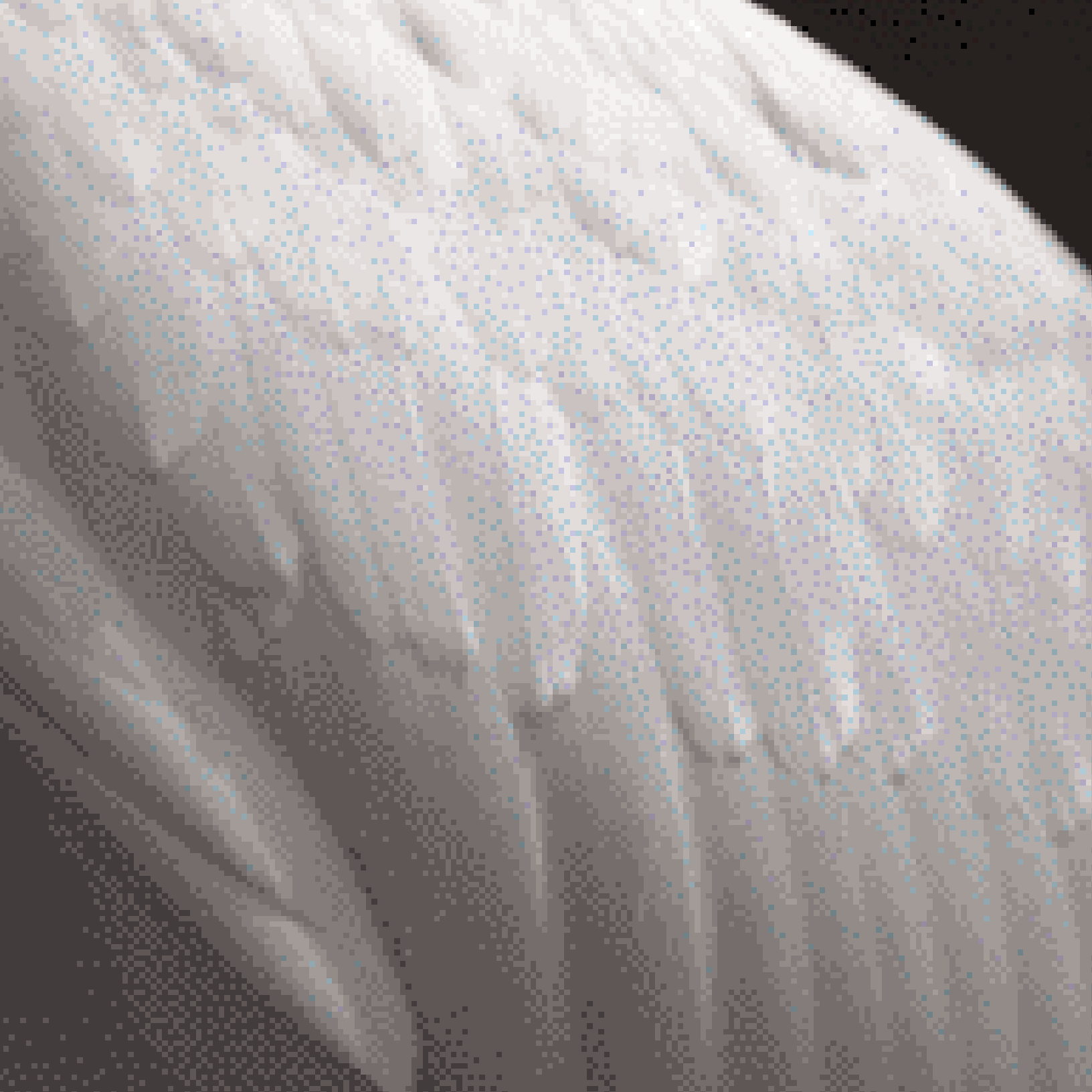
compression products (particularly for DVD players), flat panel liquid crystal displays (LCDs), blue and white light-emitting diodes (LEDs), Internet telephony, and Voice over Internet Protocol (VoIP) systems that have made it cheaper and easier to communicate with the other side of the world. In the computer sciences, Columbia research has yielded a variety of software packages that have provided the foundation for the development of emerging industries and made important advances in improving computer security.

Columbia scientists take great pride in seeing their academic pursuits translated into real world useful contributions. By reinvesting the revenue earned from their innovations, Columbia can look forward to continuing to expand the impact the University has on society in the future.

“It is of paramount importance that the office maintain good relationships with a wide range of industry contacts and that it also interface effectively with the investment community, particularly those involved with seed funding of new companies.”

—Dr. Michael J. Cleare, Executive Director, STV





The Virtuous Cycle and Columbia University

The products highlighted in this booklet represent a virtuous cycle of activity. Under successful circumstances, a series of returns on government-funded investment are given back to society in the form of life-saving or life-prolonging drugs and other products that enhance people's quality of life. The federal investment is also rewarded by economic development in terms of billions of dollars added to the GDP, increased tax revenues, and the creation of new jobs.

Since passage of the Bayh-Dole Act in 1980—which granted universities the rights to intellectual property developed with government funding—academic technology transfer has spurred overall economic growth by spawning new businesses, creating new industries, and opening new markets.

The results have been significant for Columbia as well. Revenues from successful products have flowed back to the University, not only to the inventors and researchers, but also to central funds, allowing Columbia to carry out discretionary projects such as the creation of new multidisciplinary research centers and the infrastructure to support them. A pertinent example is the prestigious Department of Biomedical Engineering, which was initiated using technology transfer funds. With the University reinvesting its earnings into research that furthers technological, scientific, and social advances, innovation at Columbia will continue to soar.



The Health Sciences

Since antiquity, doctors have recited the Oath of Hippocrates—swearing by Apollo Physician and Asclepius and Hygieia and Panacea—to treat patients with good intentions and ideal conduct. As modern society has called into question many of the oath’s principles (from praising pagan gods to forbidding surgery), the core promise—to care for the sick to the best of one’s ability, preserve patient privacy, and teach science to future generations—is still the foundation of modern medicine.

While we associate the healing process most directly with physicians in clinical offices, the path to good health begins with less frequently seen caregivers—scientists in sterile coats tucked away in laboratories—who are equally committed to the message of the oath and ultimately responsible for advancing health care.

In fact, a single discovery made in a lab can lead to dozens of life-enhancing drugs. Columbia is proud of its esteemed scientists who work tirelessly behind the scenes to develop treatments and cures. The following examples celebrate some of the inventions made at Columbia that have been successfully patented and licensed to pharmaceutical companies, resulting in royalties for the University. More importantly, these scientists and their research have bettered millions of lives, demonstrating that the principles of the Hippocratic Oath have transcended time.

COTRANSFORMATION: HELPING PHARMACEUTICAL COMPANIES TO

MANUFACTURE PRODUCTS

This scientific work, carried out by Columbia's Nobel Prize-winning scientist Richard Axel and colleagues Saul Silverstein, Michael Wigler (Cold Spring Harbor), and James Roberts, involves methods of inserting genes into the DNA of a cell. The discovery—known as cotransformation—has made it possible to turn cells into factories capable of producing a specific protein, allowing pharmaceutical companies to use human proteins rather than chemicals as the basis of drugs. Columbia has licensed these methods to more than 30 companies.

Products developed using the cotransformation process have yielded many billions of dollars in sales and have vastly improved the quality of hundreds of thousands of lives. Many products rely on the work of Dr. Axel and his colleagues: Biogen Idec's Avonex (interferon beta 1a) drug product for treating multiple sclerosis, Genzyme Corp.'s Cerezyme for Gaucher's disease, and recombinant

epoetin α , which has provided caregivers with important treatments for several manifestations of anemia.

ANTIMICROBIAL COATINGS: PROTECTING AGAINST INFECTIONS FROM IMPLANTED MEDICAL DEVICES

Columbia Department of Surgery's Shanta Modak and her collaborators developed a method that utilizes antimicrobial silver sulfadiazine and chlorhexidine in a polymeric matrix to help protect patients against bacterial infections that can occur with implanted medical devices. In 1987, Columbia licensed this technology to Daltex Medical Sciences, which sublicensed it to Arrow International, which has since sold more than 400,000 central venous catheters that employ Dr. Modak's invention.

CHIMERIC ANTIBODIES: A KEY INGREDIENT FOR BETTER-TOLERATED DRUGS

This technique, developed by former Columbia professor Sherie L. Morrison and Stanford University scientists Vernon Oi and Leonard Herzenberg,

offers a method for making "chimeric" antibodies—molecules with mouse and human components—that are better tolerated by the human immune system. The discovery has been licensed by numerous pharmaceutical companies and developed into many life-saving products such as the anti-blood clotting drug ReoPro, manufactured by Centocor, Inc., and marketed by Eli Lilly and Company, one of the first successful antibody medicines. The technique has also proven effective for developing several successful therapies for rheumatoid arthritis patients.

HOMOCYSTEINE: TESTING FOR CARDIOVASCULAR DISEASE

Discoveries made by Dr. John Lindenbaum, the late Columbia professor and past chairman of Medicine, and Drs. Robert Allen and Sally Stabler from the University of Colorado led to the development of an assay for quantifying the presence of homocysteine, an amino acid that, in elevated concentrations, can indicate an increased risk of heart disease. A number of companies, including

Bayer, have licensed the technology to perform assays that have helped innumerable patients receive necessary cardiovascular therapies.

LATANOPROST: A REVOLUTIONARY GLAUCOMA TREATMENT

Groundbreaking research conducted by Columbia University professor Laszlo Z. Bito revealed that prostaglandins (a family of chemicals produced by the body), when given in extremely small doses, can lower ocular pressure—and thereby successfully treat glaucoma, a disease that plagues two million Americans with vision loss and causes 120,000 of them to go blind annually. Dr. Bito's discovery led to the development of a synthetic version of the prostaglandin, Latanoprost, on which Pharmacia (now Pfizer) based the drug Xalatan—now the number one treatment for glaucoma.

SHOULDER PROSTHESIS: A COMPLETE WAY TO RESTORE SHOULDER JOINT FUNCTION

The groundbreaking ideas of an internationally recognized leader in shoulder surgery, Dr. Louis Bigliani,

chief of the Center for Shoulder, Elbow and Sports Medicine at Columbia University, led to Bigliani/Flatow The Complete Shoulder Solution, exclusively manufactured by orthopedic medical device company Zimmer. This prosthesis, developed by Dr. Bigliani and Dr. E. L. Flatow, a former Columbia professor, allows for the restoration of shoulder joint function for people who suffer from pain or disability from osteoarthritis (deterioration of the shoulder joint), rheumatoid arthritis (cartilage inflammation in the lining of the shoulder joint), traumatic arthritis (physical injury to the shoulder joint resulting in arthritis), and certain breaks in the shoulder bones. Thanks to the implant's revolutionary design, Bigliani/Flatow The Complete Shoulder Solution replicates the natural mobility, balance, and stability of the joint.



The Health Sciences | Marketplace

AVONEX (INTERFERON BETA 1A)

More than 100,000 people are currently taking advantage of Biogen Idec's once-a-week multiple sclerosis treatment Avonex (interferon beta 1a), which has been shown to slow the progression of physical disability, decrease the number of relapses, and reduce the number of active brain lesions.

BENEFIX

This Wyeth drug, which licensed Columbia's cotransformation patent, is used to stop or prevent bleeding in people with hemophilia B, or Christmas disease, a disorder marked by a lack of the blood-clotting protein factor IX. BeneFix is the number one prescribed factor IX product.

CEREZYME

This is used in the treatment of type 1 Gaucher's disease—an incurable genetic disease that is caused by a deficiency in an enzyme, resulting in anemia and other blood disorders, bone pain, and enlarged liver and spleen. This enzyme replacement drug by Genzyme allows

people with the disease to feel better and live nearly normal lives.

DORNASE α

Cystic fibrosis (CF) is a genetic disease that most commonly affects breathing and digestion and plagues 30,000 young people in the United States. Developed using the methods of cotransformation and launched by a leading U.S. biotechnology firm in 1994, dornase α was the first new therapeutic drug in more than 30 years for the management of CF. The treatment has broad viability to CF patients and is approved for use in CF patients from three months to four years old.

ETANERCEPT

Made by Wyeth using the principles of cotransformation, this protein blocker is a first-line therapy for moderate to severe rheumatoid arthritis and has shown to effectively improve physical function. It has also been successful at tackling psoriasis, an inflammatory skin condition that affects more than 4.5 million adults in the United States.

GONAL-F

One in 10 couples struggles with infertility. This medication is made by Serono S.A., which utilized cotransformation technology to improve protein yield. It is used to treat women who have not been able to become pregnant because of problems with ovulation and is sometimes used to stimulate the production of sperm in men. It is a proven and popular drug in many in vitro fertilization programs.

OMALIZUMAB

Produced by Novartis and other leading biotechnology firms, this is the first asthma treatment that works by blocking immunoglobulin E, an underlying cause of allergic asthma symptoms.

PALIVIZUMAB

Produced and distributed by a global leader in the development of vaccines and antiviral therapies, palivizumab prevents a lower respiratory tract disease caused by respiratory syncytial virus (RSV)—an illness that infects two-thirds of all infants during their first year and almost 100 percent of children by

the age of two. In the United States alone, RSV infection causes up to 125,000 hospitalizations annually.

RECOMBINANT ALTEPLASE

This clot-dissolving medication is the first therapy to be indicated for the management of stroke—the number one cause of adult disability in the United States. Recombinant alteplase is also approved for treating heart attacks and pulmonary embolisms, and is manufactured and distributed by a leading U.S. biotechnology firm.

RECOMBINANT EPOETIN α

Recombinant epoetin α , which works like the hormone erythropoietin, has provided caregivers with important treatments for several manifestations of anemia:

1. Patients on dialysis for chronic kidney disease often run low on red blood cells, causing anemia and chronic lethargy. A leading U.S. biotechnology firm provides recombinant epoetin α as a treatment for these patients, allowing them to return to their normal energy levels within weeks.

2. Anemia is also a side effect of many medications. Another leading biotechnology firm provides recombinant epoetin α as a therapy to alleviate anemia in cancer patients undergoing chemotherapy, HIV patients treated with AZT, and anemic patients scheduled for surgery and thus at risk for blood loss.

RECOMBIMATE RAHF

This drug is a genetically engineered factor VIII protein used for the prevention and control of bleeding episodes in people with hemophilia A.

REMICADE

Manufactured by Centocor, Inc. (a subsidiary of Johnson & Johnson), this advanced biologic agent, which employs Columbia's chimeric antibodies patent, targets specific proteins in the body's immune system to control inflammation and has helped more than 700,000 people reduce the painful and often debilitating symptoms of such diseases as psoriatic arthritis, ulcerative colitis, Crohn's disease, and rheumatoid arthritis.

REOPRO

This drug, manufactured by Centocor, Inc., and marketed by Eli Lilly and Company, which relies on a chimeric antibody fragment to stop platelets from sticking together, is used to reduce acute blood clot complications for patients undergoing percutaneous coronary intervention to open blocked arteries of the heart. ReoPro is a registered trademark of Eli Lilly and Company.

SEVELAMER HYDROCHLORIDE

Designed to reduce blood phosphorus in the 220,000 patients who are on dialysis due to end-stage renal disease, this drug has proven to be an integral part of dialysis patient care. Unlike other pharmaceuticals, it is free of complication-causing aluminum and calcium ions. Sevelamer hydrochloride is currently manufactured and distributed by a leading U.S. biotechnology firm.

SIMULECT

This Novartis-manufactured drug is used to prevent organ rejection in kidney transplant patients.

TENECTEPLASE

Made with cotransformation technology by a leading U.S. biotechnology firm, tenecteplase is approved for use in the treatment of acute myocardial infarction (heart attacks). Tenecteplase is the first "clot-buster" that can be administered for over five seconds in a single dose—offering physicians the fastest administration of a thrombolytic in the treatment of heart attack, leading to countless saved lives.

THYROGEN

This adjunctive diagnostic tool made by Genzyme offers a revolutionary way to allow patients to keep taking their thyroid hormones while they are being tested for thyroid cancer—one of the most treatable forms of cancer, but one that may reoccur and therefore warrants consistent monitoring. Thanks to this treatment, patients can avoid the debilitating effects of thyroid hormone withdrawal.

TRASTUZUMAB

One of the most promising cancer treatments, this monoclonal IgG antibody derived from recombinant

DNA is the only FDA-approved treatment for metastatic breast cancer patients whose tumors over-express the HER2 protein. Studies show that trastuzumab increases response rate to treatment, slows progression of metastatic breast disease, and increases overall survival.

XALATAN

Made by Pfizer, this once-a-day application is the number one prescribed treatment for glaucoma—a disease that causes vision loss for two million Americans annually.

“Of all human activities, science and engineering are the disciplines that enter most into our lives, that give us our means of living and permeate every fiber of the social fabric.”

—William Barclay Parsons (1859–1932), civil engineer; father of the New York City subway; founder of Parsons Brinckerhoff, a global engineering/construction company; first to stretch a railroad across China; Columbia graduate

While we celebrate our famous inventor forefathers—such as the Wright Brothers, Thomas Edison, and Alexander Graham Bell—we have come to take for granted the people advancing society through technology today. In our society, engineering is known as the “invisible” or “stealth” profession. Despite this perception, engineers are transforming our world and bettering our lives just as rapidly as they have in any other era.

Engineers as well as all of the physical scientists at Columbia have been on the cutting edge of important discoveries in chemistry, biology, and computer and materials science. The broad range of inventions—from methods used in pharmaceutical drug discovery processes, to ways to produce the optimal crystalline material, to technologies that allow us to communicate faster and more easily than ever—are yielding products that are making a difference in today’s society. From better flat panel display screens to environmentally friendly concrete building blocks, here’s a look at the modern marvels that have emerged from Columbia. As William Barclay Parsons would have said, they will come to permeate every fiber of the social fabric.





Portrait of Luca Pacioli, 1495, attributed to Jacopo de' Barbari, Museum of Capodimonte, Naples, Italy





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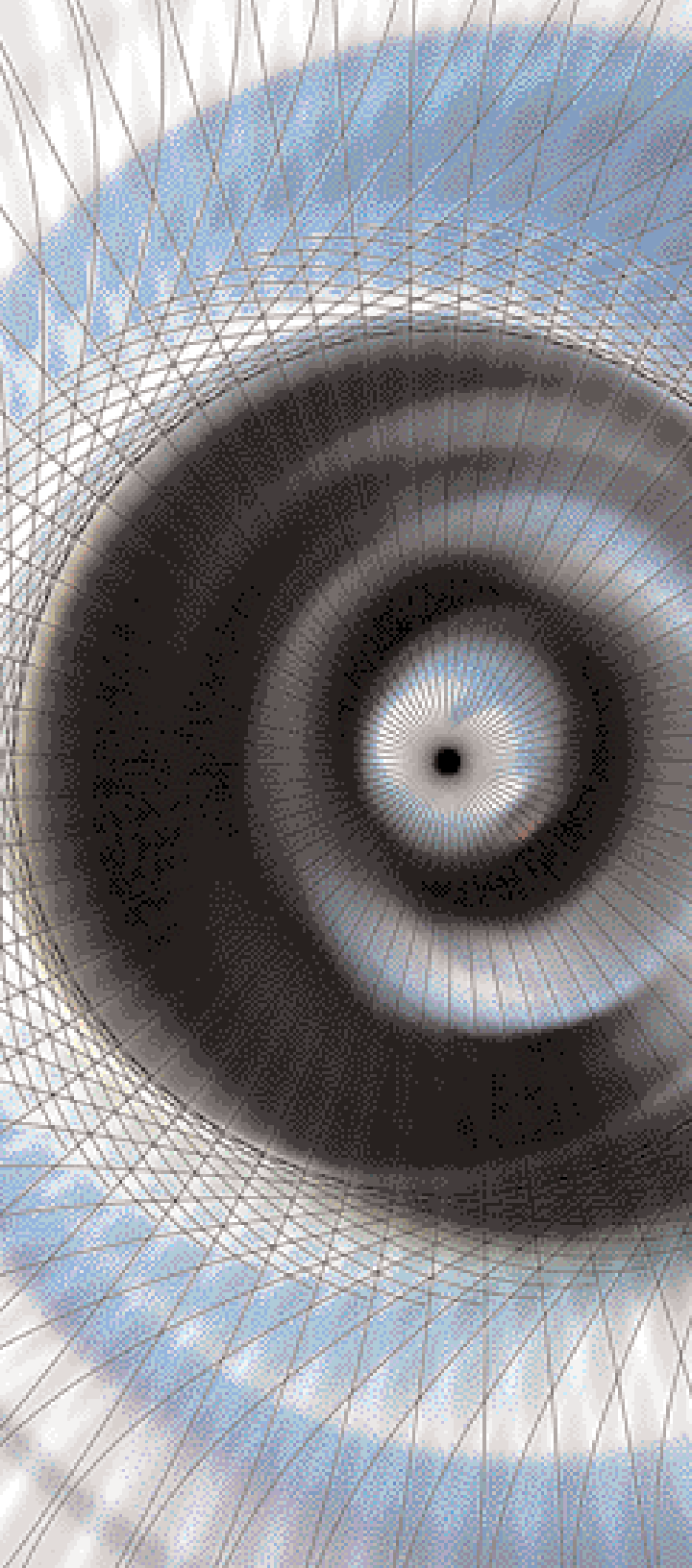
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BEAMPROP

Developed in Columbia labs by Dr. Robert Scarmozzino, a senior research scientist working with Dr. Richard Osgood, this software program has become the worldwide leading design tool in the area of photonics. Photonics, an emerging technology that uses light instead of electrons, is already being used in certain applications such as long distance telephone services that send light waves down a fiber optic cable. Industry watchers predict that in the future, photonic devices will replace more functions that are currently conducted by computer chips because they offer faster transmission and noise immunity. BeamPROP, one of the earliest tools in photonic computer-aided design, has provided the necessary foundation for the development of the industry. Dr. Scarmozzino co-founded RSoft Design Group in 1990 and licensed the technology from Columbia in 1993. The software has been commercially available since 1994 and is in use by leading researchers and development engineers in university and industrial environments worldwide.



BLUE LEDS

Columbia professor Gertrude Neumark is one of the world's foremost experts on doping wide-band semiconductors. This process is a critical step in the development of commercial blue semiconductor diode lasers and LEDs. Within engineering, research in this area is considered on a par with the quest for the Holy Grail.

Doping is the process of adding impurities to semiconductors in order to provide better conductivity. Dr. Neumark developed a unique process that is applicable to any wideband gap material. This approach resulted in the successful development of blue and green lasers and LEDs, using gallium nitride and related nitrides.

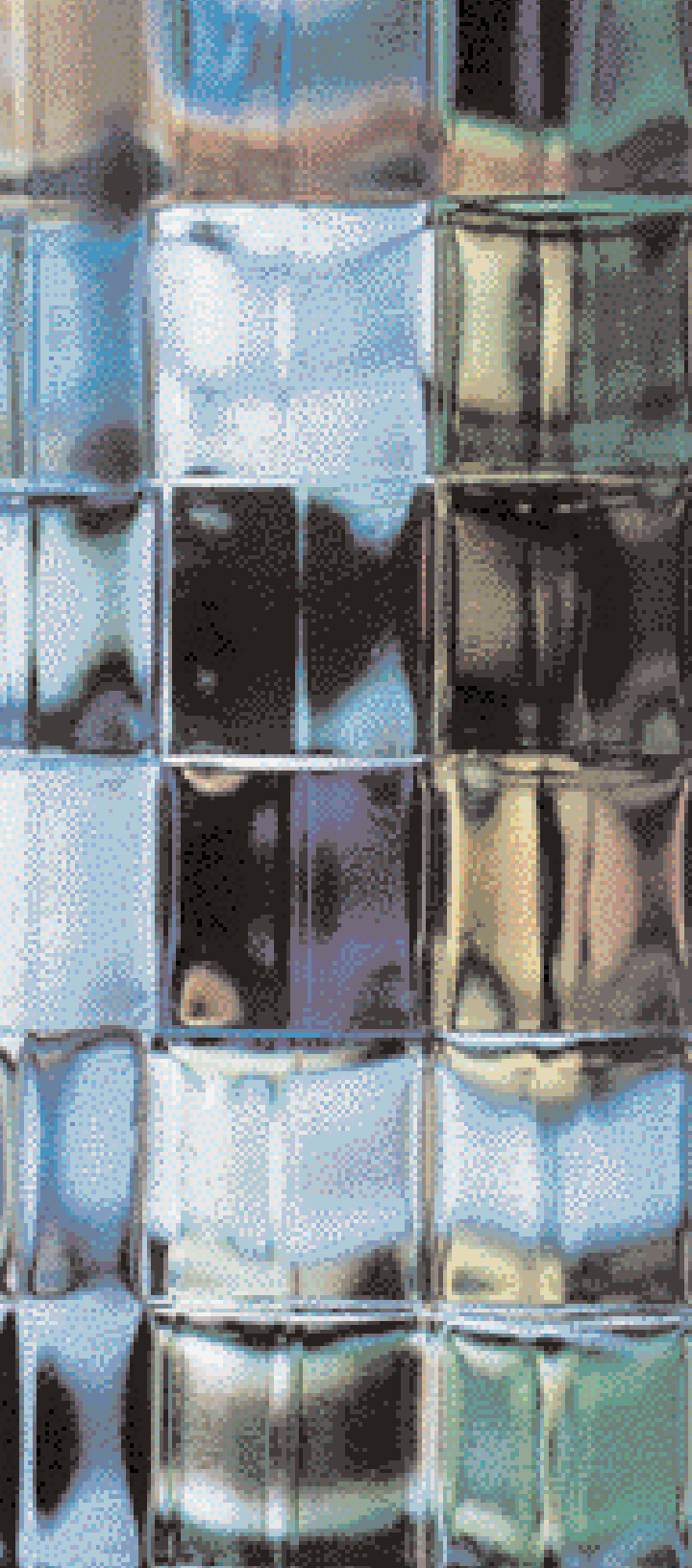
Her work on GaN semiconductor compounds represents one of the most important breakthroughs in electronics and optoelectronics of recent years. GaN-based LEDs have begun replacing traditional lightbulbs in traffic lights and are likely to gain an ever-increasing market share for many other lighting applications. GaN-based blue lasers allow data storage with much higher density than traditional red lasers. In addition, there are many less obvious applications in medical fields including diagnostics, among others.

Licensees include many of the industry giants, including most recently Toyoda Gosei.



COMPUTER SECURITY

Technologies developed at Columbia's Computer Science Department's Intrusion Detection Systems Lab have spawned several successful start-up companies designed to protect computer systems from dangerous virus and worm attacks. Revive Systems, Inc., a company that relies on the research of two Columbia computer scientists, Salvatore Stolfo and Angelos Keromytis, offers a radical new approach, fighting software threats by trapping intrusions, identifying the targeted software vulnerabilities, and automatically generating code to patch them. The result is a superior alternative to the products currently on the market, which require downloading a patch that can take several days—or worse, months. Dr. Stolfo has developed separate patent-pending technologies under research grants from the Defense Advanced Research Projects Agency (DARPA) and the U.S. Department of Homeland Security (DHS), which have been used to create another network security company, CounterStorm. Financial organizations, health care companies, media services, and government agencies worldwide rely on CounterStorm's products, which automatically stop attacks in seconds—and therefore prevent widespread and costly damage.

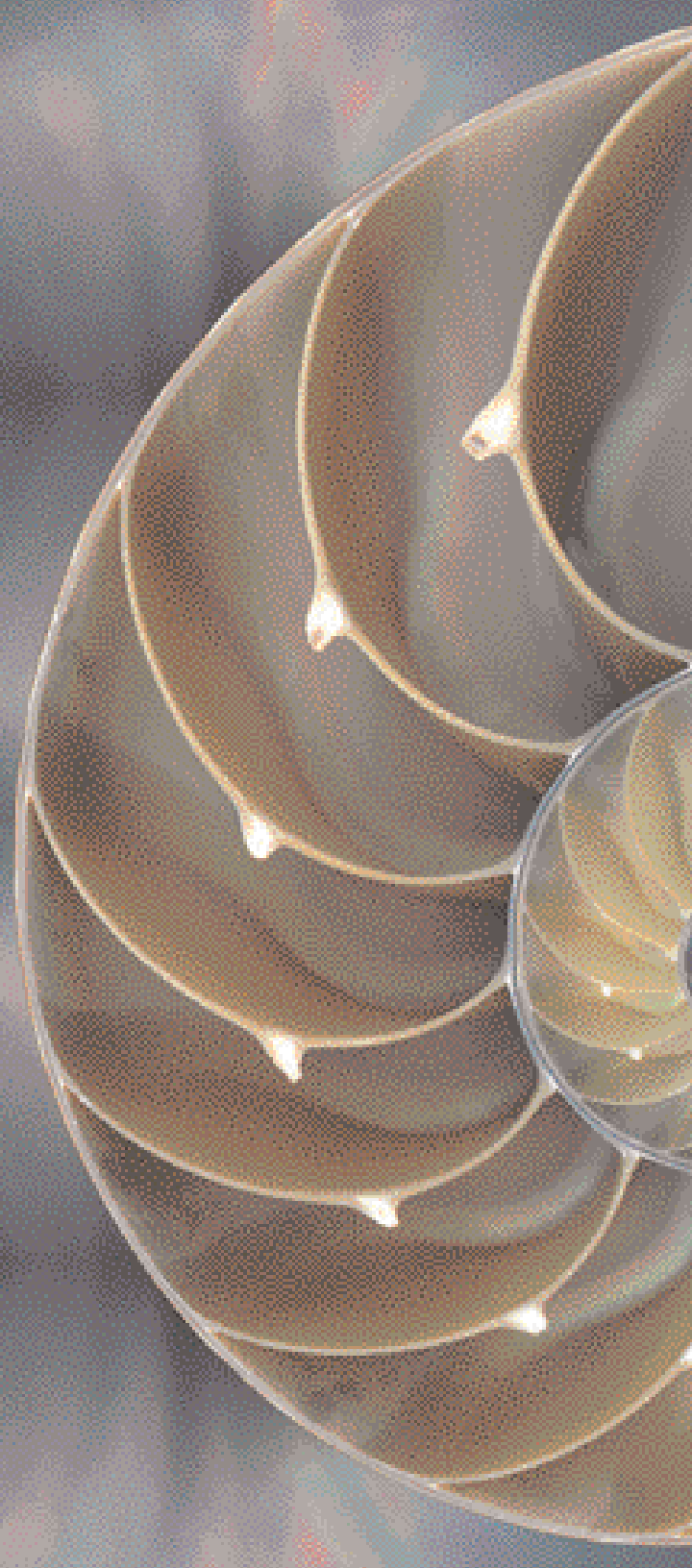


GLASS CONCRETE

The idea of using recycled postconsumer glass as an aggregate for concrete has been known for 30 years. Although the concept has long proved promising for its environmental advantages, destabilizing chemical reactions that occur between the glass and cement have made glass concrete unsuitable as a practical building material. That's changed, though, thanks to Drs. Semyon Shimanovich and Christian Meyer in Columbia's Department of Civil Engineering and Engineering Mechanics. They have created a new recipe that yields a more durable form of glass concrete. With the assistance of STV, the Columbia engineers are developing the commercial possibilities of their technology, which also provides a way for the product to be built in an economical manner. Wisconsin-based Wausau Tile Company is already producing terrazzo tiles and other glass concrete products under license from Columbia. The glass concrete can be produced with glass particles of different sizes and colors that can be matched with a suitably colored matrix as background—something that has given rise to ecologically and economically sound structures that are aesthetically pleasing as well.

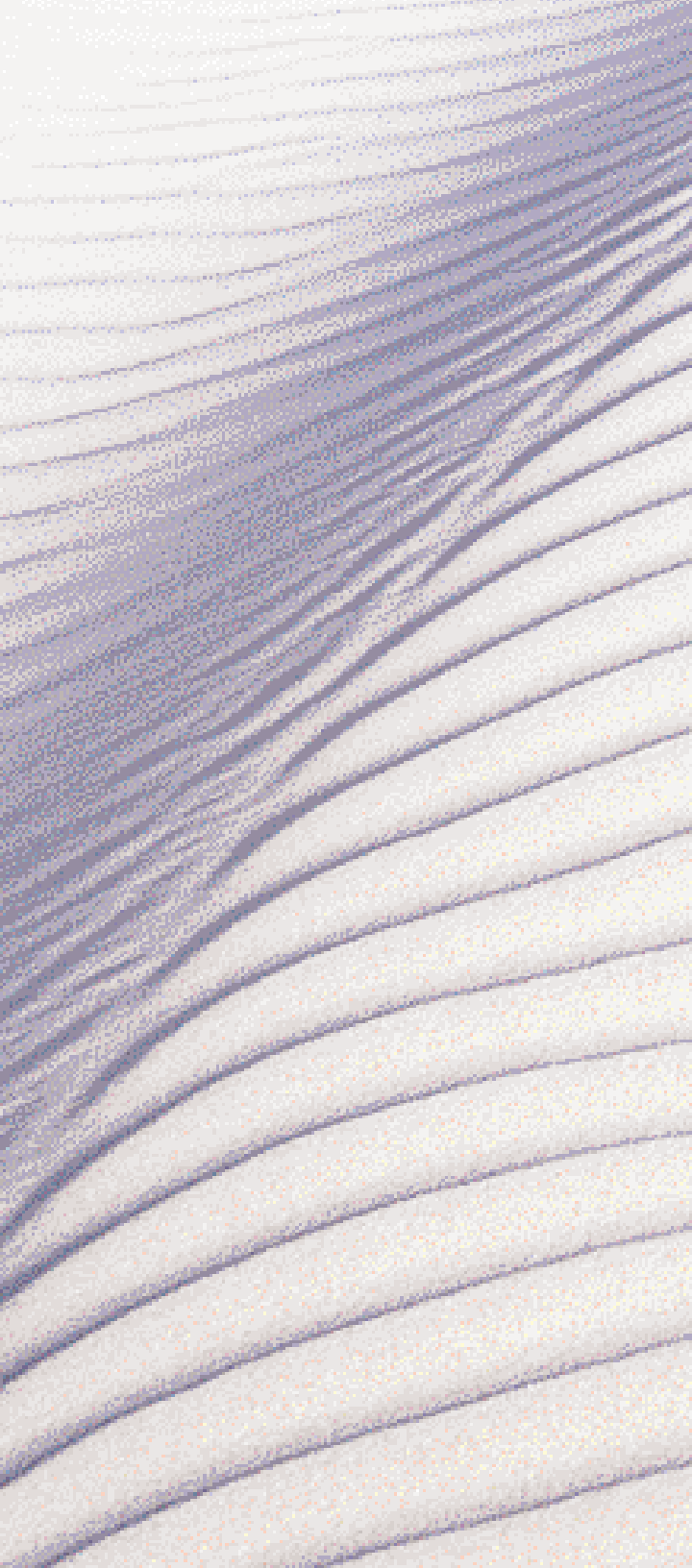
GREEN FLUORESCENT PROTEIN

A professor of biological sciences, Martin Chalfie revolutionized many aspects of biological research by introducing the technique of labeling cells in intact organisms with green fluorescent protein (GFP), a protein found in jellyfish that has an inherent fluorescence. Dr. Chalfie found that GFP could be used to indicate when genes are active. The advantage of GFP over other methods of monitoring gene activity is that no invasive techniques or additional chemical compounds are needed—only blue light. With this method, gene activation (and with modifications, gene inactivation) can be observed in living cells, so the processes can be followed in real time. It can be used as an indicator to distinguish marked cells from other cells. Dr. Chalfie's 1994 paper on the gene popularized GFP as a genetic marker and has become one of the 20 most-cited papers in the field of molecular biology and genetics. Today, GFP is widely used in pharmaceutical drug discovery processes. Elixir Pharmaceuticals, Inc., a metabolic disease drug discovery and development company, and Qbiogene, a provider of life sciences research products, have licensed the right to use GFP from Columbia University.



MACROMODEL

Clark Still, formerly a professor of chemistry at Columbia, developed MacroModel 20 years ago. The revolutionary molecular mechanics software program has become one of the most widely used computational chemistry applications—and continues to set the industry standard for classical molecular modeling. In 1998, the software company Schrödinger, which was co-founded by Columbia scientist Richard Friesner, acquired the exclusive rights to MacroModel technology. The integrated software system, which can model the basic properties of molecules to predict their size, shape, and stability, has been used to provide accurate, reliable, high-performance computational technology to quickly solve problems in pharmaceutical, biotechnology, and materials science research. The program's success is in its wide appeal: pharmaceutical companies use it to develop new drugs; dental schools use the program to explore properties of new materials for dental applications; the agriculture industry uses it to improve feed and fertilizer.



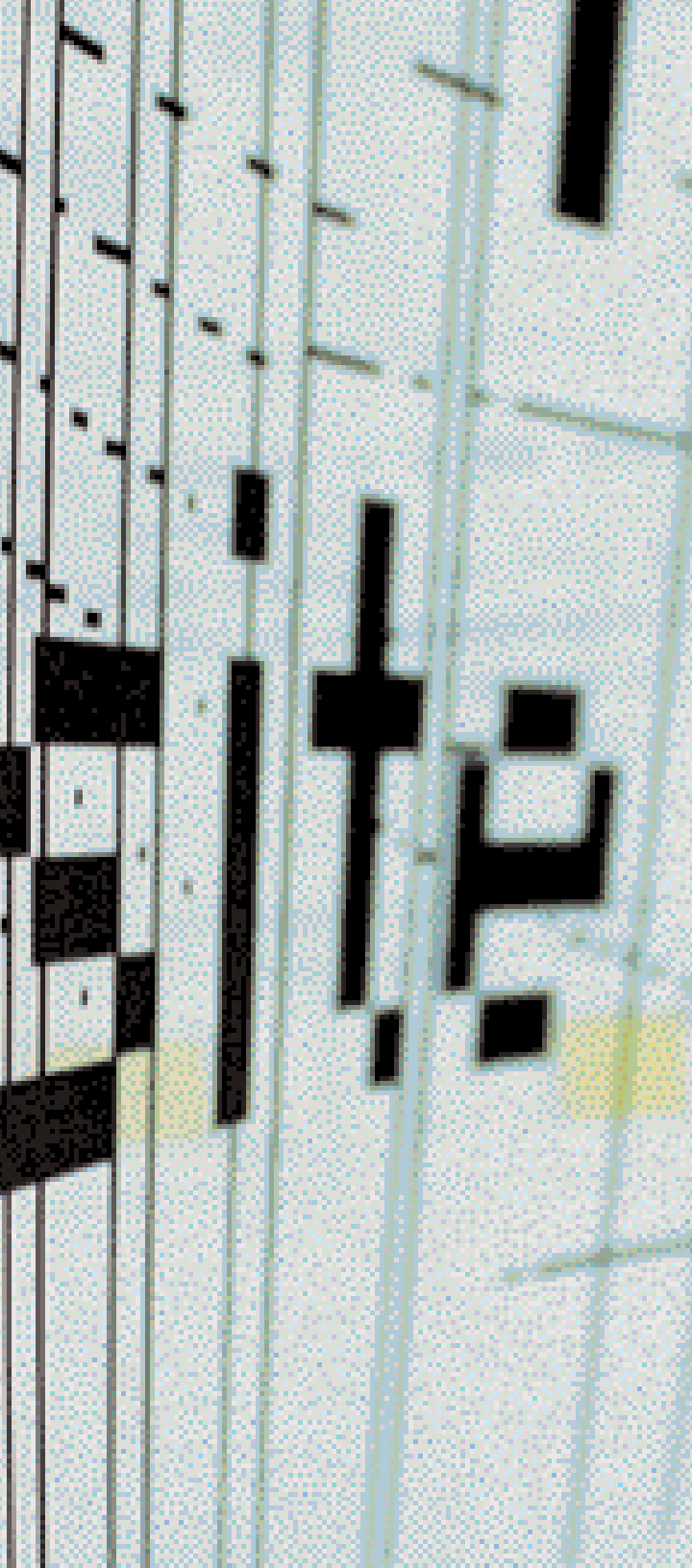
MPEG - 2

This groundbreaking research, conducted by a team that included Dimitris Anastassiou, Columbia University professor of electrical engineering, allows the transmission of high-quality video and audio over limited bandwidth. Columbia was the only academic institution involved in the development of the MPEG-2 algorithm. MPEG-2, which uses mathematical manipulations to compress and send high-quality video and audio signals over limited bandwidth channels and decompress them for display, appears in all current forms of digital transmission and has become the international television-coding standard. The success of getting this technology from laboratory to marketplace was the result of the University's collaboration with key industry partners including Fujitsu, General Instrument, and Mitsubishi Electric. The technology, which represents a market of billions of dollars, is currently being used in High Definition TV, DVD disks, Video on Demand, and personal computing. It will likely be used in the PCs and TVs of the future—products that will boast larger screens that depict tremendous detail.



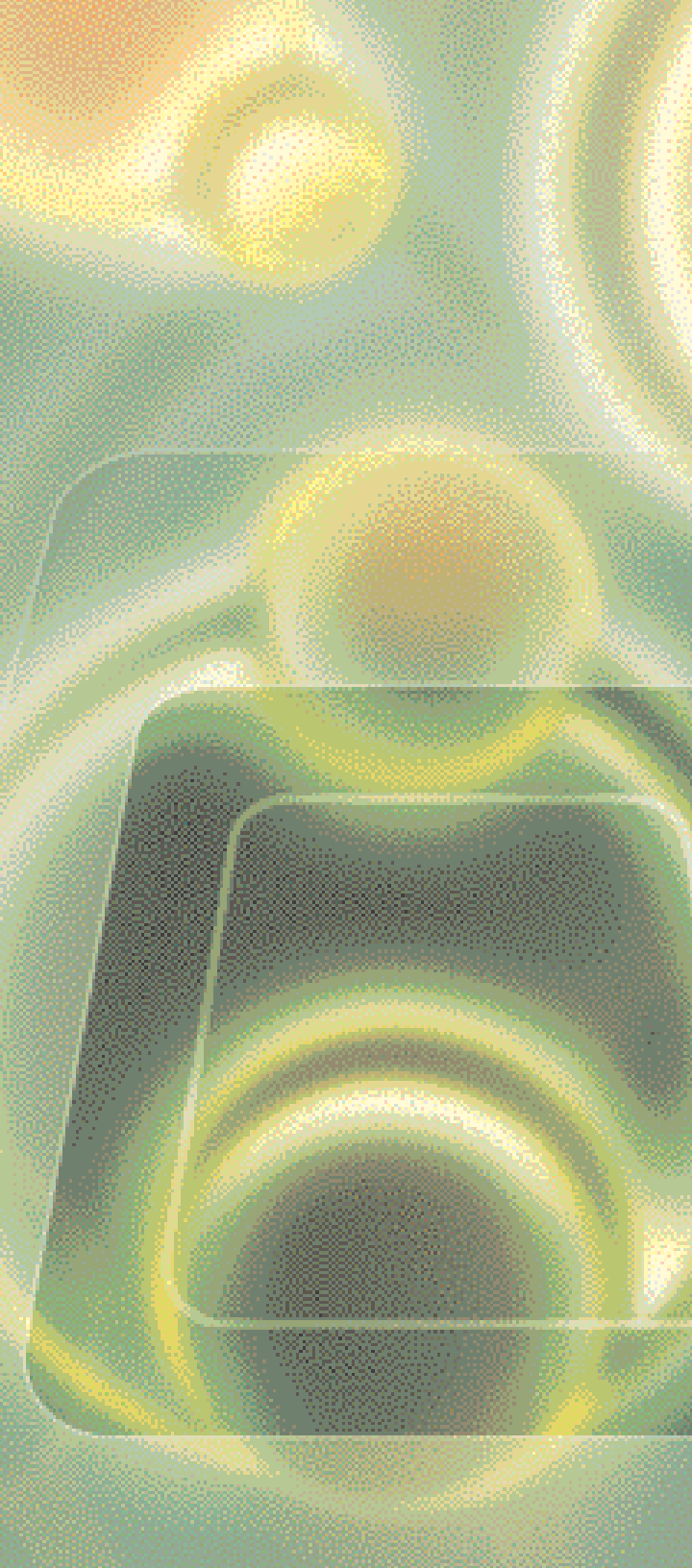
PHARMACOPEIA

This company—which discovers and develops novel drug candidates—relies on revolutionary combinatorial chemistry technology that was developed by former professor of chemistry Clark Still and Michael Wigler, adjunct professor. The Columbia-licensed technology, which is used to synthesize small-molecule libraries for drug discoveries, has allowed Princeton, N.J.-based Pharmacoepia Drug Discovery, Inc., to develop new compounds that may lead to promising treatments for immunological diseases including rheumatoid arthritis, asthma, and multiple sclerosis, and for transplant rejection. In addition to fostering multiple collaborations with biotech and pharmaceutical companies, such as Bristol-Myers Squibb and Schering-Plough Corporation, Pharmacoepia has also developed its own portfolio of compounds and currently boasts the largest such library in the world. The company, which went public in 1995 and is listed on the NASDAQ, has fostered economic development in the form of new jobs and valuable equity for its investors—making it a good example of the virtuous circle federal funding can generate.



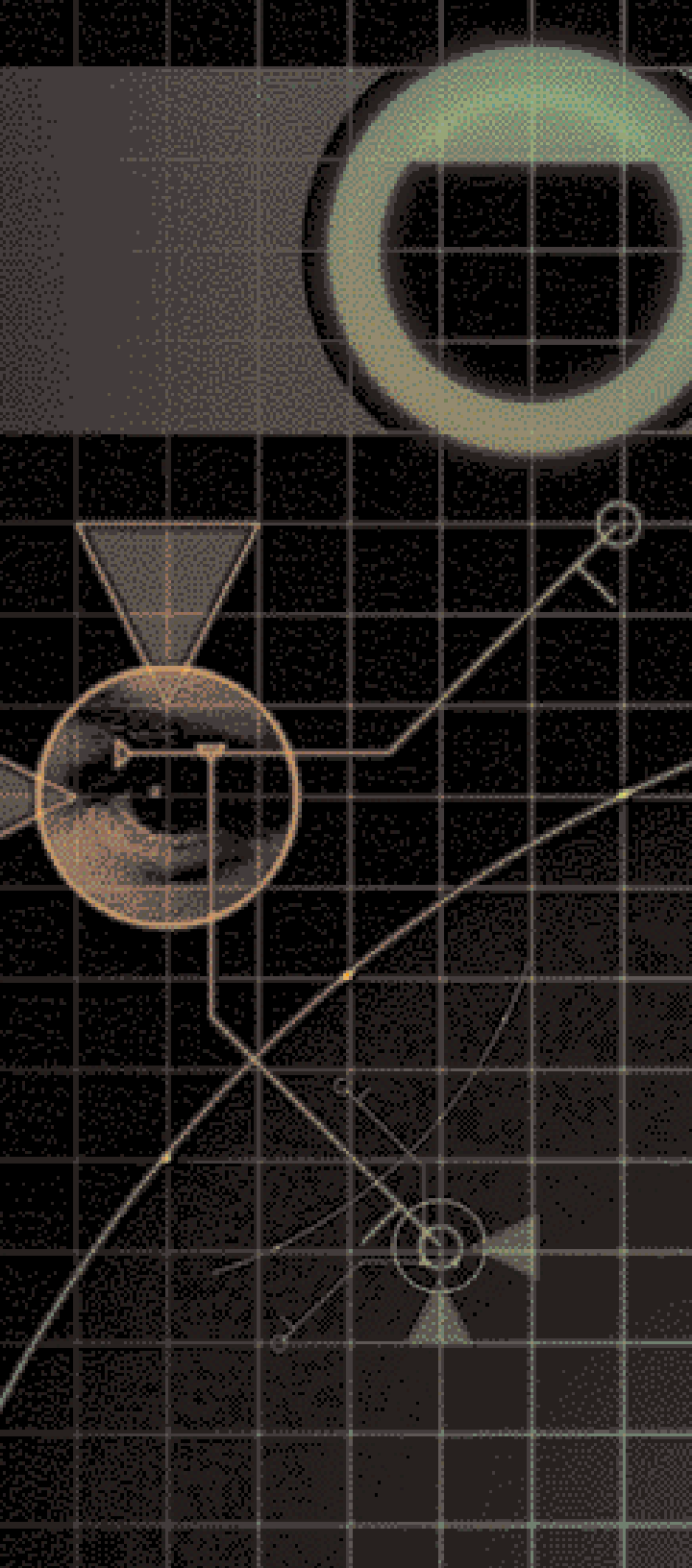
SESSION INITIATION PROTOCOL (SIP)

This technology, which establishes real-time interactive communication sessions over Internet protocol (IP) networks, was developed by world-class researcher and head of Columbia's Internet Real-Time Lab (IRT), Henning Schulzrinne. SIP, which is used for an array of applications—including audio, video, chat, instant messaging, and whiteboarding—has been accepted as a standard by the Internet Engineering Task Force and is gaining rapid acceptance from major equipment and service providers, enterprises, and software companies. One IP telephony software company, FirstHand Technologies (formerly SipQuest), was founded on this technology and has used it to develop several breakthrough products, including client software that runs on PDAs, smartphones, and emerging mobile devices for cellular and WiFi networks. (Dr. Schulzrinne serves as the chief scientific adviser of the company.) FirstHand Technologies is committed to expanding the use of SIP technologies through an exclusive licensing agreement with Columbia's IRT. With this unique partnership advancing a revolutionary technology, the next generation of telecommunications will allow people around the world to connect more cheaply and easily than ever before.



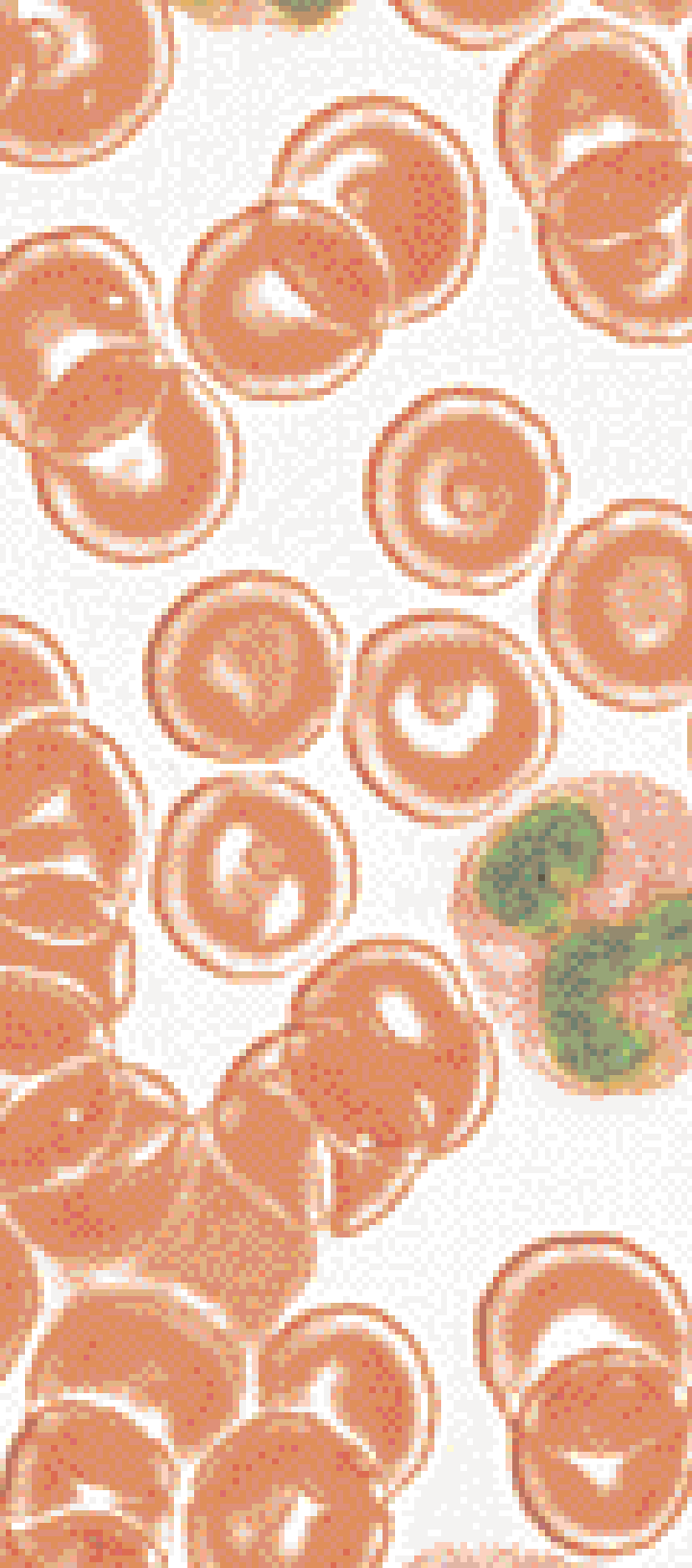
SLS

Patented by Columbia professor James Im, this discovery describes a process to produce the optimal crystalline material—something that can lead to lower cost and higher performance liquid crystal displays (LCDs). Dr. Im's method, called Sequential Lateral Solidification (SLS), is based on his fundamental breakthrough about how a substance is melted and solidified. The result is that silicon-based transistors can be put on inexpensive and transparent glass or plastic substrates, replacing the silicon wafers previously used. The new material can be used to create a variety of devices, from solar cells to thin film transistors for flat panel computer displays built on glass or on plastic sheets. (In theory, the discovery may eventually allow for an entire computer to be put on a sheet of glass or plastic.) Top display makers, including LG.Philips LCD Co., Ltd., and Samsung, have already licensed this technology. The innovation is also applicable to smart cards, image sensors, and three-dimensional integrated circuit devices.



SYSTEM MANAGEMENT ARTS (SMARTS)

Innovative software company SMARTS (now part of EMC Corporation) was a spin-off from Columbia's Distributed Computing and Communications (DCC) Lab. The company, the most financially successful IT start-up from Columbia to date, was co-founded by Yechiam Yemini, professor of computer science at Columbia. SMARTS, which was launched in 1993 with Columbia-licensed technology, rapidly grew to become one of the leading companies in network fault management. With this software solution, companies can easily detect and resolve the IT infrastructure problems that affect business services. Thousands of customers worldwide including a large number of Fortune 500 companies use the software, which has won numerous product awards, including being named to the Deloitte Technology Fast 500, *Inc.* magazine's Inc. 500, and *PC Week's* Analyst's Choice Award. In 2005, information storage and management leader EMC Corporation acquired SMARTS for \$260 million. SMARTS is a core piece of EMC's Resource Management offerings and is being integrated into the company's product suite for advanced storage management.



ZOLINZA

The technology behind ZOLINZA—a cancer therapy that aims to stop the growth of cancer cells by increasing the activity of some enzymes that are abnormally inactive—was developed in the laboratories of Ronald Breslow, Ph.D., at Columbia and Paul A. Marks, M.D., at Memorial Sloan-Kettering Cancer Center. In 2001, Drs. Breslow and Marks co-founded Aton Pharma, Inc., a privately held biopharmaceuticals company, to develop and commercialize ZOLINZA and other therapeutics for cancer. In February 2004, Merck & Co., Inc.—one of the world’s leading research-based pharmaceutical companies—acquired Aton as a wholly owned subsidiary. ZOLINZA, which carries the generic name vorinostat, has recently received FDA approval for the treatment of cutaneous T-cell lymphoma (CTCL), an aggressive form of non-Hodgkin’s lymphoma. The therapy is also being studied for the treatment of other types of cancer, including leukemia, multiple myeloma, advanced Hodgkin’s lymphoma, and solid tumors.





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