04

Annual Report

UNIVERSITY OF MICHIGAN

TECHtransfer

year ending June 30, 2004

at the point of impact

Message from the Executive Director

Tech transfer is no longer a spectator sport at the University of Michigan. In 2001, we set aggressive goals to achieve excellence in our technology transfer activities. We recognized that achieving success would require, not only excellent performance and effort from our tech transfer staff, but also the active support and participation of our faculty and researchers, our University leadership, and our business, government, entrepreneurial, and community partners. Today, thanks to all these stakeholders, technology transfer at the University of Michigan is on-task and on-target, making a tangible impact in the world.

In fiscal year 2004, we recorded a 11% increase in invention disclosures, negotiated 73 new license and option agreements, launched 13 new business start-ups and received $11.7 million in license revenues that is being reinvested in research and education.

However, to fully appreciate the impact that UM technology transfer is exerting in the wider world, it's necessary to look beyond the numbers.

A surge of innovative products—several of which are featured in this publication—made their way into the market, with the potential to improve the quality of life for everyone. Exciting new start-ups founded in the last few years have begun to hit their stride, generating jobs, revenue and additional resources. With our active assistance, the local high-tech community continues to grow and coalesce, creating employment and opportunity for our state and region.

We are proud to be part of the ongoing mission of the University of Michigan, grateful to our many partners both internal and external, and privileged to be helping UM researchers contribute to the public good. University of Michigan Tech Transfer is making an impact as never before and, with the help of our many enthusiastic and capable partners, we have every intention of increasing that impact in the years to come.

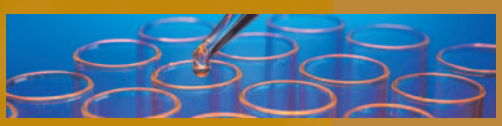
Ken Nisbet

Kenneth Nisbet
Executive Director
UM Tech Transfer
University of Michigan

about TECHtransfer

FROM RESEARCH LABS
TO WORLD MARKETS

Components of the
Tech Transfer Process:



THE MISSION of UM Tech Transfer is to effectively transfer University technologies to the market so as to generate benefits for the University, the community, and the general public.

The University of Michigan's continued pursuit of excellence in research inevitably leads to discoveries of great value to society—discoveries that address a broad range of problems and needs. Since 1983, when our first technology transfer office was established, hundreds of inventions and research findings have made their way to waiting and eager markets in the form of new products, services and business ventures.

Full-Spectrum Support

UM Tech Transfer is a service unit comprised of specialists in licensing, business development and law, all with wide experience in transferring technology. Our goal is to provide faculty researchers with expertise and guidance throughout the entire technology transfer process—from initial consultations, assessments and disclosures to full-blown commercialization plans, patent protection, marketing, development of prototypes and licensing. Through our TechStart student intern program, we provide access to graduate-student consultants with backgrounds in business, engineering, law, medicine, and information management. And to facilitate start-ups, our New Business Development team works actively to build relationships with investors and other commercial partners.

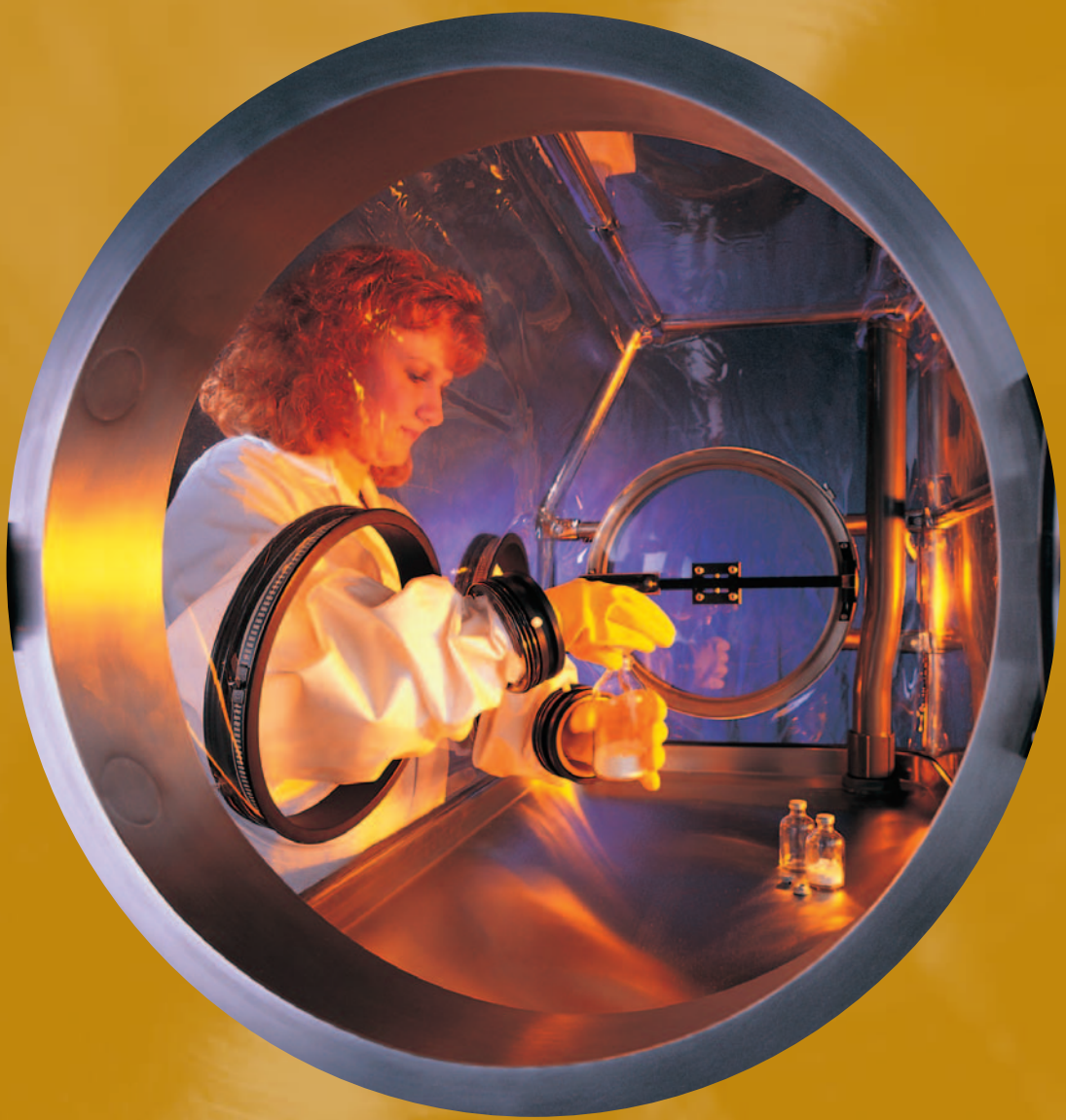
Far-Reaching Impact

UM Tech Transfer supports and furthers the University's mission by:

- Increasing the likelihood that new discoveries and innovations will lead to useful products, processes and services that benefit society.
- Facilitating new research collaborations and resource exchanges with industry, thereby providing unique opportunities for faculty and students.
- Increasing the flow of research dollars and resources to the academic community.
- Providing incentives for faculty to deepen and broaden the scope of their research.
- Helping to attract and retain highly qualified faculty and graduate students.
- Enriching the educational experience through student internships and work-study opportunities.
- Leveraging business partnerships to stimulate local and regional economic development.
- Enhancing the reputation and stature of the University.

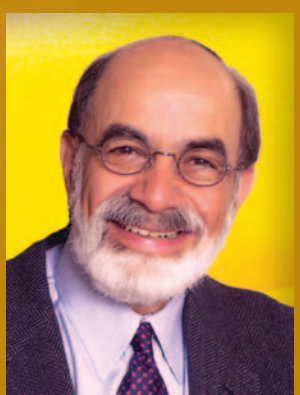
"Public universities are playing a critical role in restoring our economy, providing the state of Michigan with the energy and resources that will fuel a strong and productive future. Every year, we present the state with thousands of new graduates, an expansive array of public cultural events, and life-saving health care. Moreover, because our research universities attract over a billion dollars of federal research funding each year, we also add a substantial number of jobs to Michigan's economy, along with the innovations produced by our research… We must recognize that the economic engine of the 21st century runs on ideas. Our university laboratories, the minds of our exceptional faculty, and our outstanding young graduates supply the raw material we need."

—Mary Sue Coleman
President
University of Michigan



"Our goal is to move University of Michigan technologies into the world,where they can create positive change. It is particularly rewarding when that commercialization process takes place close to home. As we launch more companies in our region and work with increasing numbers of existing companies, we help make this a thriving entrepreneurial center, one which offers more career options for our graduates, more research options for our faculty, and more commercialization options for our technologies."

—Fawwaz T. Ulaby
Vice President for Research
University of Michigan



"Our UM Tech Transfer team is focused on being the best at serving our research community and our business partners, and we're seeing positive results. From low power semiconductor clocking systems to the BEXXAR® therapeutic regimen, a treatment for non-Hodgkin's lymphoma, products resulting from UM research are making a difference in the world."

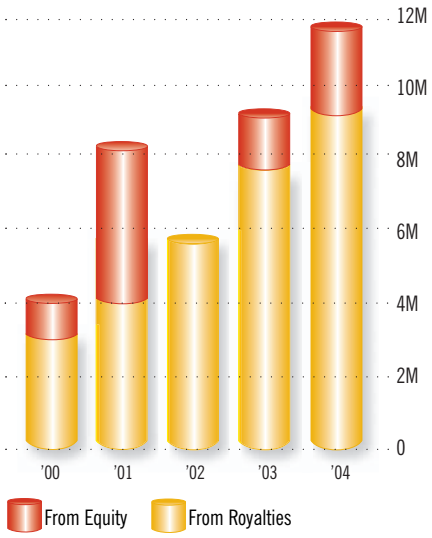
—Robin Rasor
Director of Licensing
UM Tech Transfer

FY 2004 results

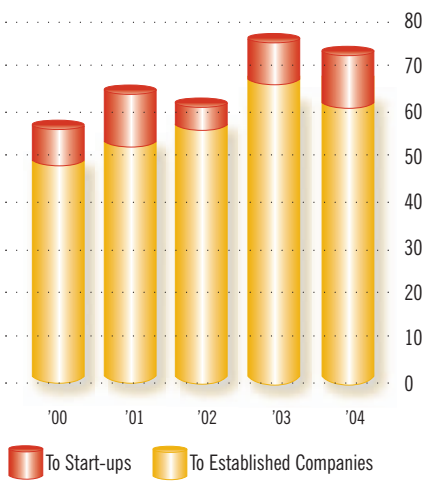
Fueled by the innovation of UM researchers, Fiscal Year 2004 saw a continuation of positive trends in every area of technology transfer: disclosures, patents, license agreements, and start-up businesses. The University community can be especially proud of the 13 new business ventures that were launched in FY 2004, all of which are making important contributions to our region and beyond.

THE YEAR IN REVIEW

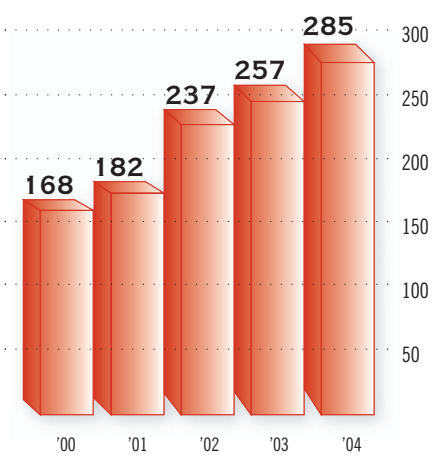
License Revenue (in millions of dollars)



License Agreements



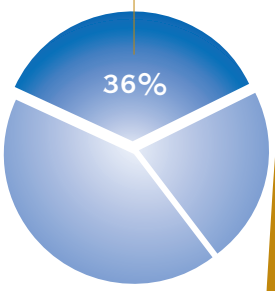
Invention Disclosures



2004 Invention Disclosures

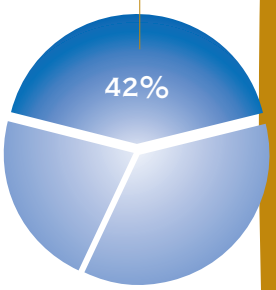
Medical

Cardiology	4	4%
Internal Medicine	43	43%
Mental Health	3	3%
Ophthalmology	5	5%
Pathology	8	8%
Pediatrics	4	4%
Physiology	3	3%
Psychiatry	3	3%
Rad/Onc	3	3%
Radiology	10	10%
Other	16	16%
Total	*102*	*100%*



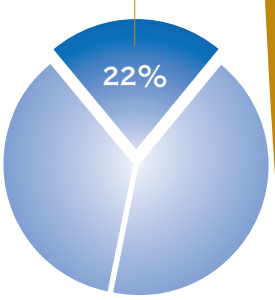
Engineering

Biomedical	7	6%
Center for Professional Development	1	1%
Chemical	7	6%
Civil/Environmental	4	3%
EECS	79	67%
Materials Sciences	5	4%
Mechanical	12	10%
Navel/Marine	1	1%
Nuclear	2	2%
Total	*118*	*100%*



Other

Art & Design	2	3%
Athletics	1	2%
Center for Performing Arts	1	2%
Dentistry	9	15%
Epidemiology	1	2%
Literature, Science & Art	27	44%
Media Union	1	2%
Pharmacy	11	18%
Recreational Sports	2	3%
School of Information	3	5%
Social Work	1	2%
Transportation Research	1	2%
Total	*60*	*100%*



The Start-Up Class of 2004

Ablation Frontiers
Cardiac therapeutic devices

Ascenta Therapeutics
Cancer therapeutics

Cellectar
Medical imaging and therapeutic agents

Dentigenix
Therapies to regenerate dental tissue

GMP Immunotherapeutics
Drug treatments for immunologic disorders

MC3 Biomaterials
Nitric oxide releasing polymers for medical devices

Mobius
Semiconductor technology focused on mixed-signal integration

NanoCure
Nanotechnology for drug delivery and imaging

Neural Intervention Technologies
Intravascular treatment for brain vessel defects

NeuroNexus
Implantable, microscale neural probes

OncoImmune
Drugs for MS, Cancer and Tuberous Sclerosis

Opteos
Electro-optic probe for test and measurement

Southern Industries
Laser welding of zinc coated materials

FY 2004 disclosures

Disclosures listed by Department of Lead Inventors

Anesthesiology

Augmenting the Effect of Inhaled Nitric Oxide for Cardiac Transplantation and Device Implantation in the Preventing of Pulmonary Hypertension
Medication Administration Machine

Art & Design

UM Library Images
Vital Sigh Sensing Blanket Y System for Health Purposes

Athletics

Camp/ Clinic/ Seminar Registration Software

Biologic & Material Science

Method of Applying Thin Hydrogel Coating to Teeth
Artificial Salivary Gland
Combined Polymeric Scaffold Delivery of Condensed DNA, Protein, and Stem Cells
Treatment of Periodontal Disease
Cell Transplantation Therapy for Neurodegenerative Diseases and Nerve Injury

Biological Chemistry

Treatment of Peutz-Jeghers Syndrome and Wolff-Parkinson-White Syndrome

Biomedical Engineering

Engineering of Functional Tendon
Intracranial Neural Interface System
Method for Detecting a Loss of Balance and/or Fall
Biodegradable/Bioresorbable Tissue Augmentation/ Reconstruction Devices
System for Measurement of Object Motion
Passive and Active Probes
Protein Patterning on SiO2 and Glass via Nano Imprint Lithography

Biophysics Research Division

Radiosensitizer Concentrated by Cancer Cells

Cancer Center

Brochure Boss—A Brochure Ordering System

Cardiology

Ablation Catheters & Methods of Use
Novel Sheath and Needle System for Intracardiac Transeptal Catheterization
Helical and Linear Ablation Catheters and Methods for Linear, Curvilinear and Coronary Sinus Ablation and/or Isolation
Leads for Pacing Within the Coronary Sinus of Other Vasculature
Compositions and Methods for Mammalian Dental Regeneration
Manufacture of Synthetic Dental Enamel

Cell & Develop. Bio.

MAS/MSS(MIL Authentication System/MIL Scheduling System)

Center for Biologic Nanotechnology

Multi-functional Engineered Nano-devices

Center for Performing Arts

MIDI-Encoded Musical Themes

Center for Professional Development

Michigan Engineering Online (MEonline)

Chemical Engineering

Selective Sorbents for Purification of Hydrocarbons
Denitrogenation Of Liquid Fuels
Process for Synthesis of Isopropenylphenol
Synthesis of Large Monodisperse PMMA Particles
Fluidic Devices and Method for Multiplex Chemical and Biochemical Reactions
Gold Water Gas Shift Catalysts

Chemistry

Compositions and Methods Relating to Novel Compounds and Targets Thereof
Biocatalytic Generation of Nitric Oxide
Excitation Ratiometric Fluorescent Biosensor for Zinc Ion at Picomolar Levels
Method and Compositions for Regulation of Aging
Porous Metal-Organic Polyhedra
Process for the Alkoxylation of Organic Compounds in the Presence of Novel Framework Materials
Process for the Epoxidation of an Organic Compound
Shaped Bodies Containing Metal-organic Frameworks
Process for Producing Polyalkylene Carbonates
Process for Preparing Hydrogen Peroxide from the Elements
Method of Storing, Up-taking, Releasing of Gases by Novel Framework Materials
Photoinitiated, Variable Control Nitric Oxide Release
Conductometric Immunomagnetic Sensors
Kinetic Based Screening for Therapeutic Inhibitors
Porous Organic Frameworks
Crystalline Polymorphs of Sulfamethoxazole
Methods and Compositions for Benzodiazepine and Related Compounds
Treatment of Autoimmune Disease and Cancer
Gas Storage System
Process for the Alkoxylation of Monools
Process for Preparing an Organometallic Framework Material
Compounds and Methods for Modulating Retinoid-induced Hyperplasia
Small Molecule Transcriptional Domains

Civil & Environmental Engineering

Multicomponent Droplet Packaging Into Single Microchannel
Flow (Gen)Omics
Method of Improving Fiber Composite Ductility
High Early Strength Fiber Reinforced Cementitious Composites

Clinical Pathology Laboratories

Antibody

Computer Science

TriCorder System, A PDA-Based Laboratory

Dental School

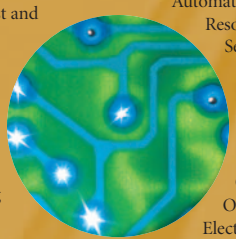
CXCR4 Antagonists and Methods of Their Use

Dermatology

The Leaders Trust Trademark

EECS

Broadband Amplifier And Communication System
Multi-Stage Optical Amplifier And Broadband Communication System
Micro Gas Chromatograph
Vertigo–Perspectives Based Algorithms
Vertigo–Performance Counter
Vertigo–Perspectives Based Algorithms
Systematic and Random Error detection and Recovery Within Processing Stages of an Integrated Circuit
Memory System Having Fast and Slow Data Reading Mechanisms
Method For Designing a Pupil Filter to Shape a Focus, Apparatus For Generating Cylindrical Polarization, and Apparatus For Integrating Pupil Filtration And Cylindrical Polarization Generation
Data Retention Latch Provision Within Integrated Circuits
Mixing-Bandits Team Scheduling Algorithms
Resonator Notching for Low Velocity Access
Software for the Synthesis of MEMS Devices
Shatter-Proof Microprobes
Method and System of Pattern Replication
A Battery-operated Wavelength-tunable Optical Source for Fluorescent Detection of Bio-chemicals
Compact, Modular Assembly and Packaging of Multi-Substrate Microsystems
Cooties on the PocketPC
Cells for the PalmOS and the PocketPC
iKWL for the PalmOS
Intermedia Widget for the PalmOS
Locker for the PalmOS
Pocket Learning Environment on the PocketPC
Sketchy on the PocketPC
PRESTO! for the PocketPC and PalmOS
Desktop Manager for the PocketPC
Fling-It for the PocketPC
A Compact Large Voltage Compliance High Output Impedance Programmable Current Source for Biomedical Implantable Microstimulators
Antenna Stent
A Hermetic, Vacuum Capable, Encapsulation Technique
A Predistortion Linearizer for Power Amplifiers
Razor 1
Method of Backtracking Intrusions
Micromachining with Focused Femtosecond Lasers
An Electromagnetic MicroPower Generator for Low-Frequency Environmental Vibrations
Lorentz Force Assisted Switch
Hollow Disk Micromechanical Resonator
Meta-Substrates for Novel Wireless Antenna Applications
Method and Apparatus for Ion Lithography
Micromechanical Resonator
A Mold and Transfer Technique for Lead-Free Fluxless Soldering
Micromachined Arrays of Thermal Probes
Compact X-ray Source
Stateful Distributed Interposition
Application of Mid-infrared Light Sources
A Framework for Supporting QoS-dependent Applications and Appliances in Access Networks
Low Voltage High Contact Force RF-MEMS Switch
TIMBER: A Native XML Database System
Microelectromechanical High Voltage Generator
Micromachined Geiger Counter
Scan-chain Enabled Low-power Flip-flop with Gate Enable
Automatic Tuning System for Resonant Clock Generator
Self-consistent Schrodinger-Poisson Solver for Quasi-bound Quantum States
Optical Logic Gate
Optical Router with Optical Switching
Electric Hearing Device
Low Voltage Gain-compensated Switched-capacitors Integrators
Energy Recovering Boost Logic
Q-Control at RF Frequency in Micromechanical Mixer-Filters
Electro-Magnetic Cuff Flow Sensor
Active Gain Equalization
Laser Diode Pump Sources
Method for the Laser Cooling of Solids
Mode Scalable Optical Fibers for High Power Fiber Lasers
Bulk-conductivity Insulated Gate Field-effect Transistor
ListMaker for the PalmOS
Chemation for the PalmOS
PicoWrite for the PalmOS
Skills Arena for the GamBoy Advance
Electrochemically Generated Oxygen Microgradients for Cell Culture
Method for Establishing Air-isolated Connections
Frequency Tuning of Vibrating Micro Mechanical Resonators Via Laser Trimming
Process for the Generation of Attosecond Pulses of Electrons and Applications to the Production of Coherent and Incoherent X-rays
A Spin-on UV-curable Resist for Micro and Nanolithography
Chirp Confocal System
Noise-adapting Edge-preserving Regularization for X-ray Reconstruction



Epidemiology

Library on a Slide

Family Medicine

"I M Well" Essential Food Pyramid
ClinfoTracker

Hematology/Oncology

BRGI Antibody

Human Genetics

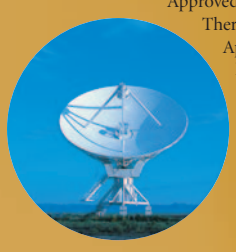
Effects on Blood Sugar in Diabetics
Humanized Androgen Receptor Target Mouse (HART mouse)

Industrial and Manufacturing Systems Engineering

Computer-controlled Universal Hand-force Analysis System

Internal Medicine

Antimicrobial Nanoemulsion Compositions And Methods
Prevention and Treatment of MHC-Associated Diseases
Monoclonal Antibodies Against a Cancer Marker
Small Molecule Antagonists of BCL-2 Family Proteins
Therapeutic Utility of PKB/Akt Inhibitors for Fibrotic Diseases
System and Method for Measuring Mechanical Properties of Vascular Structures
Modulators of Protein Kinase B/AKT and Methods of Their Use
Modified Mice
The Purification of Hematopoietic Stem Cells
Apoptosis Promoting Agents
Conformationally Constructed Apoptosis Promoting Agents
Compounds that Promote Apoptosis
Classes of Acids as Apoptosis Promoting Agents
Analogues that Promote Apoptosis
Cancer Stem Cells and Notch
Compounds that Promote Apoptosis
Small Molecules that Promote Apoptosis in Cancer Cells
Combination Therapy
Kit for Measuring Biochemical Marker for Hypertension
Treatment of Head and Neck Cancer
Lysosomal Phospholipase A2 for Surfactant Metabolism
Method of Treatment of Tumors
Endogenous Lithium Clearance
Biomarker of Breast Cancer and Novel Target for Anticancer Drug Design
Prevention and Treatment of MHS-Associated Diseases
Treatment of Human Cancer and Other Conditions
Methylation Sensitive T Cell Genes in Lupus and Aging
Synthesis of UDP-Glucose
Improved Tumorigenic Derivatives of Human Cancer Cell Lines and Method of Their Use
Treatment of Cancer
X-Score: A Computer Program for computing Protein-ligand Binding Affinities 8
The PDBind Database: A Web-based database of Binding Affinities and Structures of Protein-ligand Complexes
Antibody
Pathway Inhibitors in the Treatment of Lupus
Treatment of Lupus
Lupus Biomarkers
Web-based Chemical Structural Database and Tools of FDA Approved Drugs
ThermoSole
Apoptosis Promoting Agents



Immunotherapeutic Method for Treating Multiple Myeloma
Dendritic Cell Vaccine for Helicobacter Pylori Infection
Mediation of Plasmid DNA Transfection In Vivo

Materials Science & Engineering

Monocrystalline Alloys with Controlled Partitioning
Mixed Metal Oxide Particles
Materials for Lighting Applications
Imprinting of Supported and Free-standing 3-D Micro or Nano Structures
Liquid Feed Flame Spray Modification of Nanoparticles

Mathematics

Software for Fast Evaluation of the Coulomb Potential

MCIT—Medical Center Information Techno

Organ Transplantation Information System (OTIS)
C.O.M.E.T. (CDR Oracle Metadata and Explain Tool)

Mechanical Engineering

Integrated, Proportional Controlled, and Naturally Compliant Universal Joint Actuator with Controllable Stiffness
Method for Cost-effective Fabrication of Fuel Cell Bipolar Plates
Recellularized Small Diameter Engineered Tissue for Vascular Grafts
Frequency-banded Layered Structures for Shock/Vibration Control
Structures With Discrete Embeds for Frequency-Banded Vibration and Wave Motion Control
Productivity Analysis of Manufacturing Systems
Intelligent Prosthetic Foot for Controlled Energy Storage and Release
Reconfigurable Protein Patterning
Reconfigurable Cargo Extension for Vehicles
Thermal Modulation and Monitoring for Gas Chromatography
Alloy Based Laser Welding
Interactive Architectural Layout Design Optimization Software

Media Union

"3d Double-wide"–A live 3d Web Video Streaming Process

Medicinal Chemistry

Antiviral Drugs
Long Chain Aliphatic Keto-Acids

Mental Health Research Institute

Conditionally Transformed and Genetically Modified Cell Lines with Novel Properties Associated with Muscle Development and Physiology
Ligand-regulated transgene expression
Quantitative Assay for Muscle Cell Fusion

Molecular, Cell & Developmental Biology

Method of Producing Geraniol

Naval Architecture & Marine Engineering

Blast and Impact Resistant Materials and Structures

Neurology

Myofibrillogenesis Regulator 1 (MR-1) Gene

Nuclear Engineering

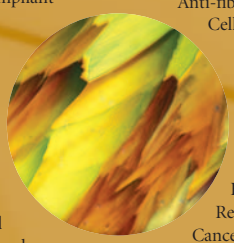
Low Noise Magnetron and Crossed-field Amplifier by Azimuthally Varying Axial Magnetic Field
A Very High Resolution Small Animal SPECT System

Ophthalmology

Anti-Metastatic Compounds
Capsulorrhexis Knife
Eye Drop Bottle–One Drop, Easy Delivery System
Method to Diagnose and Monitor the Status of Pregnant Women
Monoclonal and Polyclonal Antibodies

Pathology

Urine Biomarker for Prostate Cancer
Cancer Microarray Compendium and Data-Mining Platform
Proteomic Alterations in Prostate and Breast Cancer Progression
Cytokine Microarray Immunoassay
Profiling of the Humoral Immune Response to Prostate Cancer
Anti-fibrotic Agent
Cells and Vectors



Pediatric Hematology

Methods of Affecting Stem Cell Commitment and Osteogenesis
Collagen Interactions with Human Prostate Cancer Cells
Regulation of Human Prostate Cancer Cells

Pediatrics & Communicable Diseases

PLAY Project Level I Workshop CD Rom

Periodontics

Combinatorial Gene Therapy for Bone Regeneration

Pharmaceutical Sciences

Pharmaceutical Co-crystal Compositions
Measurements of Equivalent Anti-Xa Activity of Heparin Species

Pharmacology

Inhibitors of RhoGEFs
Inhibitors and Activators of Endothelial NO-Synthase

Pharmacy

Methods for Stabilizing Biologically Active Agents Encapsulated in Biodegradable Controlled-Release Polymers
Methods for Encapsulation of Biomacromolecules in Polymers
Optimization of Stability and Release of Bovine Serum Albumin Encapsulated in Base-neutralized PLGA Millicylinders
Nucleic Acids and Polypeptides Involved in the Production of Cryptophycin
Effects on the Controlled Release of Proteins

Pharmacy Services

PharmDoc.Net

Physics

Quantum Entanglement Between an Atom and a Photon Through Spontaneous Emission

Physiology

Inhibitors and Uses Thereof
Cheompreventive and Adjuvant Chemotherapeutic Drug
Cardiac Molecular Inotrope for Heart Failure and Ischemia

Psychiatry

Genes Differentially Expressed in Mood Disorders
Genes Differentially Expressed in Schizophrenia
Receptor Antibody

Radiation Oncology

Peptides Which Bind to Irradiated Pancreatic Cancer Cells
Method and Composition for Inducing Apoptosis in Cancer Cells

Radiology

High Resolution X-ray Breast Imaging
High-shear Ball Mill for Multiphase Chemical Reactions
Breast Cancer Detective
Transendothelial Transfection System
A Novel Device for the Endovascular Treatment of Intracranial Aneurysms
Multi-modality Image Analysis for Computer-aided Characterization of Breast Masses
Novel Pharmaceutical for the Evaluation of Small Bowel Strictures
Gating of Cardiac X-ray CT Scans from Projections
Liquid Coupled Ultrasound Probe Holder for Combined Mammography Ultrasound Imaging System
Noninvasive Detection of Early Therapeutic Response in Brain Tumors

Recreational Sports Department

Membership Editor
Dr. Scheduler Platinum Edition Suite

School of Information

Method for Identification of Patent Thickets
Method of Determining the Economic Relationship Between Patents
A Mechanism for Making Communications Markets With Application to the Spam Problem

Social Work

ImageXchange

Surgery

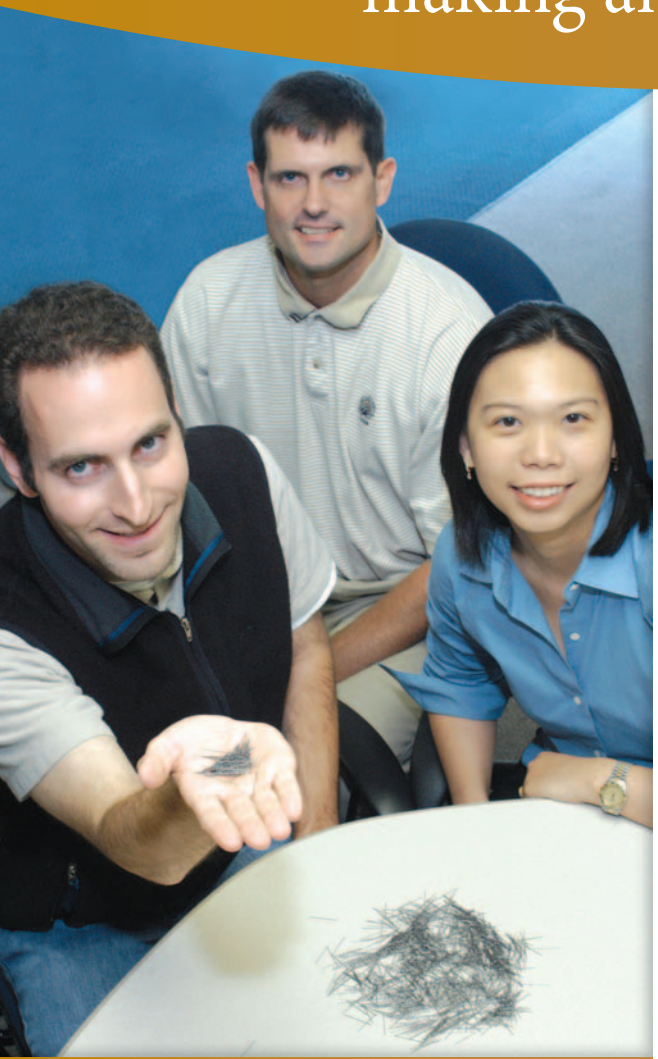
Method and Composition for Preventing Total Parenteral Nutrition-associated Changes to the Intestinal Immune System

UMTRI

Tolerance Modification Process and Software

Urology

Immortalized Normal Human Prostate Epithelial Cells



From left to right: Luke Pinkerton, CTO, Polytorx; Mike Mettler, CEO, Polytorx; and Dr. Kulsiri Chandrangsu, Senior Engineer, Polytorx

In more than 300 structural tests, Helix™ has outperformed straight steel fibers and other concrete additives. The secret lies in the triangular, screw-shaped design, which provides superior strength and flexibility, mixes with concrete quickly and easily, and allows suppliers to reduce their overall material costs.

"Polytorx is a great example of how, with a dedicated scientist, community resources, and creative local entrepreneurs, we were able to launch a superb new technology."

—Dan Broderick
Director,
Engineering–OTTC
UM Tech Transfer

POLYTORX

Making an Impact on Infrastructure

For at least 2,000 years, human beings have used concrete to build roads, bridges and a multitude of other structures. But as engineers are quick to point out, concrete is brittle and prone to fail catastrophically under tensile loading. Which is why suppliers often add reinforcing materials to make concrete behave more like steel.

In the early-1990s, UM Civil Engineering Professor Antoine E. Naaman began experimenting with new shapes of fibers for concrete reinforcement. By 1997, when civil engineering graduate student Luke Pinkerton joined Naaman's lab as part of a work-study assignment, the research team had developed a screw-like steel form with better anchoring properties than traditional reinforcement materials. Ultimately, Naaman and his team devised Helix™—a toothpick-sized, triangular-shaped, twisted steel fiber proven to increase the tensile strength of concrete by a factor of five.

In 2002, a few years after the Helix™ technology was awarded a first patent, Pinkerton enrolled in an MBA program at Georgia Tech with the idea of helping his faculty mentor build a business around the new technology. During the year that followed, Pinkerton's business plan won two major competitions. In the summer of 2003, the engineer-turned-businessman found himself back in Ann Arbor with a scholarship to the Ann Arbor IT Zone Boot Camp program. There, he met investor Bill Orabone, who worked closely with Naaman, Pinkerton and the Tech Transfer staff to launch a company known as Polytorx in June of 2003. Interns from UM Tech Transfer's TechStart program provided business research expertise to help the start-up through its first, formative months.

Sales of Helix™ are climbing rapidly. "Numerous pilot programs are underway to test Helix™ in municipal and commercial applications," Pinkerton says. "Also, a phase-II, $600,000 Small Business Innovation Research (SBIR) grant from the federal government will enable us to work with University of Michigan scientists to develop new, highly targeted applications."

"As an attending physician, I realized that if you can't write an order in a patient's chart for a specific therapy or intervention, you're powerless. UM Tech Transfer enabled us to bridge that gap. By allowing our ideas to flow from labs to companies, they opened the possibility for improving medical care in ways that simply weren't possible before."

—Dr. Gary J. Nabel

As a University of Michigan research scientist, physician Elizabeth G. Nabel specialized in vascular biology. Her husband and medical colleague Dr. Gary J. Nabel focused on virology and immunology. As Elizabeth recalls, "In the mid-1980s, it occurred to us that we could merge these two technologies in our research." They did. And it wasn't long before the Nabels had combined catheter technology and gene delivery technology into a unique protocol for treating heart disorders such as atherosclerosis, arrhythmia, heart failure, and instent restenosis—the scarring and subsequent blocking of blood vessels following stenting and angioplasty. Their subsequent experiments offered proof of concept that recombinant genes could be delivered directly to the walls of blood vessels using existing angioplasty catheters and stents, the devices used to prop open coronary arteries.

CARDIOGENE THERAPEUTICS

Making an Impact on Heart Disease

By the 1990s, the Nabels were collaborating with Harvard physician and scientist Dr. Jeffrey M. Leiden, a former UM colleague. In 1994, working closely with UM Tech Transfer, the three researchers founded CardioGene. Ultimately, the company's technology platform grew to include proprietary delivery systems, devices and vectors-biological transport mechanisms for local delivery of therapeutic genes. In June, 1998, CardioGene was acquired by Boston Scientific Corporation (BSC), a leader in the medical device industry.

In 1999, the Nabels left Ann Arbor for appointments with the NIH in Bethesda, Maryland. Both of them look back on their work with UM Tech Transfer as a "remarkable experience" in which they learned to bridge the gap between lab and clinic.

Neural Intervention Technologies President and CEO Thomas Collet and company co-founder and Chief Scientific Officer, Dr. Daryl Kipke

Neural Intervention Technologies

Making an Impact on Neurovascular Disease

Neural Intervention Technologies (NIT) is poised to make a major impact on the health care industry with its line of ALGEL™ products. In addition to stroke-fighting properties, the formula co-invented by NIT Chief Medical Officer Dr. Cameron McDougall could have applications for cancer therapy and the treatment of fibroid diseases.

Each year, millions of people suffer strokes that result in debility or death. Approximately 80 percent are ischemic strokes, caused by lack of blood flow to the brain. But as many as 150,000 additional cases annually involve hemorrhaging stroke, in which neurovascular lesions and other defects lead to a rupture of blood vessels. The fatality rate for hemorrhaging stroke is extraordinarily high—and millions of people are at risk.

In the past, treatments for "the other stroke" have involved dangerous surgical procedures or toxic substances for repairing lesions. But that could change with the introduction of a non-toxic, biocompatible product called ALGEL™ which blocks the flow of blood to vessel defects and promotes healing of dangerous lesions. The ALGEL™ technology was initially developed at Arizona State University and further refined at the University of Michigan by biomedical engineers Tim Becker and Daryl Kipke. In 2001, with the assistance of UM Tech Transfer, Drs. Becker and Kipke joined forces to found Neural Intervention Technologies (NIT), Inc.

According to serial entrepreneur and NIT President and CEO Thomas A. Collet, the organization has been built on collaboration. "There's ALGEL™ itself," he explains, "and the fact that we're bundling technology from Arizona State and the University of Michigan. But there's also the strong support we've received from UM Tech Transfer in everything from licensing to assistance with reimbursement and regulatory planning."

Recently, NIT and UM received a joint $2.2 million award for clinical development from the Michigan Life Sciences Corridor. The company has also received two Phase I Small Business Innovation Research (SBIR) grants.

"Our New Business Development team works with promising concepts such as Neural Intervention Technologies to provide hands-on business and project planning, and connections to resources and talent."

—Karen Studer-Rabeler
Associate Director of New Business Development
UM Tech Transfer

OPTRIX™

Making an Impact on the Built Environment

Every inventor has a story about the moment of discovery. For UM College of Architecture graduate Abhinand Lath *(pictured right)*, that moment occurred in the winter of 2003 while he was working on his master's thesis, attempting to show how poetic ideas can be translated into materials. As he recalls, "I was reading a Japanese poem about a woman walking through a bamboo forest, and how her movements made the delicate stalks sway, creating ten thousand generations of shadows. Something clicked. The next morning, I woke up with the idea of moving pieces of shadow to unexpected places."

Lath, who also holds an undergraduate degree in electrical engineering, discussed his brainstorm with Doug Kelbaugh, Dean of the College of Architecture and Urban Planning, and immediately received a summer research grant. Initially, Lath achieved the desired shifting-light effect by embedding fibers in concrete, then began using pieces of plexiglass or acrylic. Over the summer, the process evolved into OpTrix™, an interwoven matrix of reactive fiber optic strands that move light from one area to another.

In the spring of 2004, Lath won a competition for new ideas sponsored by *Metropolis* magazine. He also earned the opportunity to display OpTrix™ at an exhibition of experimental design held at the International Contemporary Furniture Fair, where he received an award for Best New Talent. Currently, he's working with UM Tech Transfer staff members to determine the optimal course of action. "Ultimately, I'd like to focus on designing buildings," he says. "But right now, I want to get this technology out into the world, whether through a license, a start-up, or some combination."

"OpTrix™ is a concept, a technology, that can take many forms," explains inventor and UM alumnus Abhinand Lath. "It can be a fabric, a building material, almost any surface." Consequently, the applications are broad and range from security and highway safety products to architecture, furniture, signage, automotive design, and household and office products.

—Abhinand Lath

"NanoBio is an impressive example of how the University of Michigan's basic research translates into economic development. Work that initially was focused on arcane infectious diseases now has been applied to every day problems ranging from cold sores to nail fungus. Added to the renewed need for anti-bioterror therapeutics, this company will be on the cutting edge of antimicrobial development for the foreseeable future."

—James R. Baker, Jr.
CEO/CSO, NanoBio Corporation

"Patenting is a crucial element of what we do. Working closely with our inventors and patent law firms, we're constantly striving for efficiency and effectiveness. This enhances the market attraction of many of our licensing opportunities, since patents are a critical asset for opportunities such as NanoBio."

—Rick Brandon
Assistant General Counsel
UM Tech Transfer

Forget the old adage about thinking big in order to succeed. For the past five years, UM researcher and physician James R. Baker, Jr. *(pictured left)* has been thinking small—very, very small—and making huge advances in medical science. As a nanoscientist, Dr. Baker works in a dimension so infinitesimal that most of us can scarcely even imagine it. At one billionth of a meter in size, nanoparticles can move into cells without being recognized, implant genes, deliver medications or, in the case of Dr. Baker's inventions, destroy pathogens ranging from anthrax to herpes.

Since 1999, Dr. Baker, an allergist and immunologist by training who now directs the UM Center for Biological Nanotechnology, has received more than $11.5 million in research grants from the U.S. Department of Defense to develop nanoemulsions. When these synthetic materials—comprised largely of soybean oil, detergents and purified water—contact the membrane of a bacteria, fungus or virus, they disrupt the structure, destroying the pathogen in the process. Yet these same nanoemulsions, when applied to the human skin, appear to be non-toxic.

NANOBIO® CORPORATION

Making an Impact on the Future of Health Care

Dr. Baker worked closely with UM Tech Transfer specialists to patent hundreds of different formulations for his invention. In 2000, the lure of this amazing technology was powerful enough to draw Ann Arbor businessman and financier Mike Nold out of retirement and into the post of CFO at NanoBio® Corporation, a start-up company that holds exclusive rights for licensing the nanoemulsion technology from the University of Michigan.

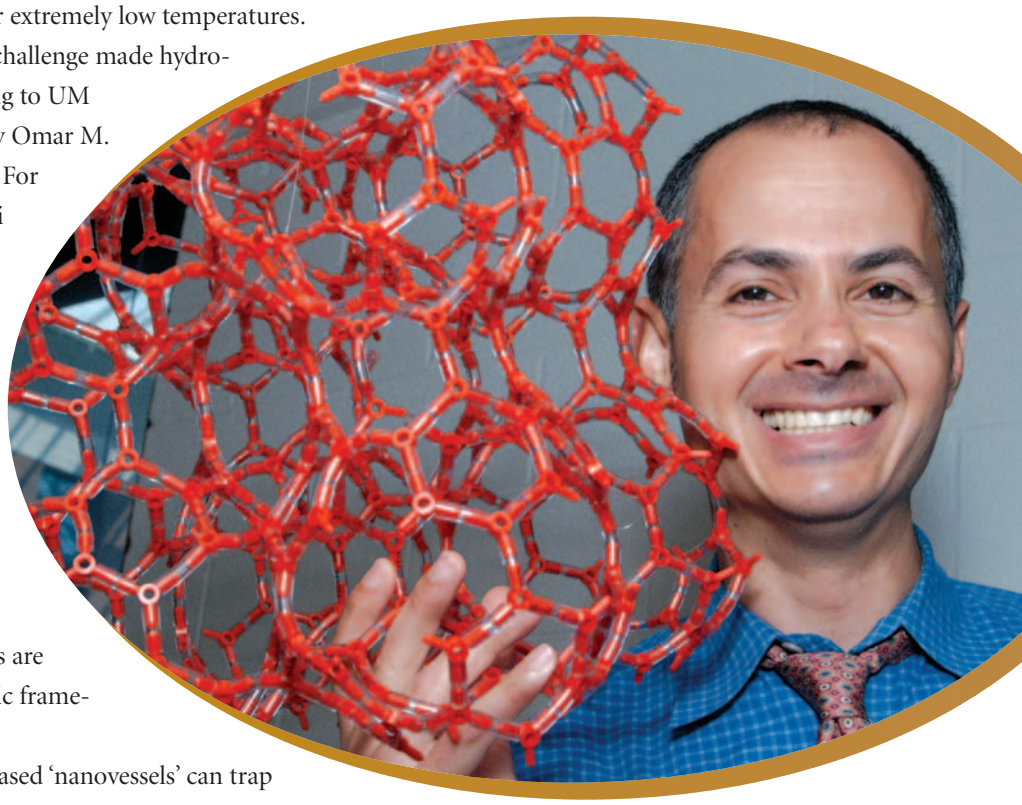
Currently, the company has eight pharmaceuticals in the pipeline. Two rounds of angel funding were oversubscribed, and the first round of venture funding is expected to generate as much as $20 million.

Professor Omar M. Yaghi

Making an Impact on Fuel Cell Technology

Hydrogen could well be the ultimate fuel—a plentiful, clean-burning, planet-healthy alternative to oil. But first, numerous obstacles must be overcome. Heading the list of challenges is storage. Currently, storing hydrogen in sufficient quantities for use in vehicles or electronic devices requires either dangerously high pressures or extremely low temperatures.

That particular challenge made hydrogen especially appealing to UM Professor of Chemistry Omar M. Yaghi *(pictured right)*. For the past 14 years, Yaghi has been producing structures from molecular building blocks—essentially stitching together highly porous molecules of organic and inorganic materials to create containers on a nanometer scale. The resulting new materials are known as metal organic frameworks, or MOFs.



"These crystal-based 'nanovessels' can trap and store small and large molecules or cause them to react within the pores of the structure," Yaghi explains. "By custom-designing the walls of these storage vessels to attract hydrogen, we're able to stack molecules and make it practical to store the element in large volumes." He notes that one key factor has been the ability to develop strategies for creating greater surface area of materials. "Using the metaphor of a parking structure," he says, "we've created more parking spaces for molecules. One gram of MOF contains the surface area of 17 tennis courts, or approximately 5,000 square meters."

With the assistance of UM Tech Transfer, Yaghi and his research team have patented designs and production protocols for hundreds of materials. Currently, BASF is producing MOFs in kilogram quantities. Other license agreements are being forged with automotive companies. And while much of the research is funded by the U.S. Department of Energy, major corporations are also stepping forward to provide financial support.

Abundantly available in nature, hydrogen gas when broken down produces only water as its byproduct. In the process of looking for a more efficient way to transport this clean energy source, Yaghi and his fellow researchers have literally forged a new branch of chemistry known as reticular synthesis, focused on the designed construction of highly porous metal-organic frameworks.

Tony Fadell, leader of the team that created the iPod® and Vice President of Engineering for Apple's iPod® Division, recalls how, back in 1989, as a student, Soloway gave him the freedom and encouragement to build an entire media lab from scratch. "With Elliot, you learn by doing," says Fadell. "And he has a passion and enthusiasm that's infectious."

Elliot Soloway

Making an Impact on Education

"Technology isn't about gadgets. Technology is an opportunity to do something different in the classroom, something effective."
—Elliot Soloway

There's a quiet revolution taking place in classrooms from New York to Norway. Thousands of K-12 students are trading in their textbooks for handheld computers loaded with software programs that are both powerful and fun to use. Thanks in large part to these new educational tools, students are not only enjoying the learning process as never before but also excelling in national standardized tests. In fact, scores in math and science are jumping by as much as 15 percent. Surprising? Not to UM computer scientist and Arthur F. Thurnau Professor Elliot Soloway *(pictured above),* who helped set the revolution in motion and—along with his students—developed the software that's powering the handheld movement.

The Evolution of an Educator: Computer scientist. Inventor. Mentor. Consultant. Software designer. Businessman. Elliot Soloway is all of these things. But the role he relishes most—the one that defines him and inspires him—is that of educator.

It hasn't always been that way. Back in the 1980s, as a junior faculty member at Yale University, Soloway devoted himself to research in artificial intelligence (AI). But in 1988, the year he was recruited to the University of Michigan, everything changed. "As a new faculty person and a new parent, it suddenly dawned on me that instead of making machines smarter, I should be using my time to make kids smarter. So I stopped doing AI and started working in schools, trying to make technology an effective tool in the classroom. Then I discovered that schools don't want technology. They want curriculum."

That rude awakening led Soloway to UM School of Education Professor Phyllis Blumenfeld, who became his collaborator in creating educational tools to promote inquiry-based learning in middle school science. By 1990, Soloway and Blumenfeld were working with Professors Joseph Krajcik, a specialist in science education, and Ronald Marx, an educational psychologist. Following a spate of National Science Foundation grants and the launch of successful software programs, the four core faculty established HI-CE, the Center for Highly Interactive Computing in Education, a research collaborative that continues to attract faculty from around the University.

Reaching Out to the Digital Generation: "Kids today are digital-age kids," says Soloway. "Technology is an integral part of their lives. And we have astonishing data from 28 middle schools in Detroit proving that technology is the hook, the way to engage digital-age kids in science." To make learning more appealing, Soloway and his colleagues began promoting handheld computers as the most task-appropriate classroom learning tools, based on their size, cost and power. With generous funding from NSF, Microsoft, Intel, and Apple, they developed nearly two dozen educational software programs.

In 2000, guided by UM Tech Transfer, the HI-CE faculty formed a start-up called GoKnow, Inc. for the purpose of licensing its software and introducing its technology to as many schools as possible. As Soloway explains, "No one understands our products better than we do. So, with the help of UM Tech Transfer, we decided to create our own business and our own distribution channels."

Helping Students Learn How To Fly: Soloway's goal, always, has been to give students the tools and freedom they need to make their own discoveries. As third-grade teacher Janine Kopera emphasizes, "He understands how students learn, and he places that knowledge at the core of his work."

It's a pedagogical model that Soloway uses in his own university courses as well, preferring to let his students "learn how to fly." Beginning in the summer of 2001, Soloway—who holds appointments in the School of Education, the College of Engineering and the School of Information—enlisted undergraduates in the task of creating software for grades K-12. One of those students, Adam Wieczorek, observes that Soloway has "a rare gift for understanding how technology can be applied in the real world." This freewheeling approach has led to the development of an entire suite of productivity tools for handheld computers.

Of course, the point of all this immense creativity has been to move technology out of academic research settings and into real-world classrooms. "I'm grateful for the opportunity we've had to launch our own business," says Soloway. "We now have customers in England, Norway, Canada, and Mexico as well as the U.S."

A Teacher—First, Last and Always: Despite his successful venture into the business world, Elliot Soloway's real love is education, and it shows. Two years ago, he won the University's Golden Apple Award for Teaching, and this year he was named Teacher of the Year by the Electrical Engineering and Computer Science Honor Society. "I've found my calling," he declares. Ph.D. student Katy Luchini Colbry couldn't agree more, describing Soloway as "an outstanding teacher at the forefront of ed-tech research, who offers a combination of computer science, education and classroom work that's simply not available elsewhere."

And what will Elliot Soloway be doing in the near future? "I want to give something back," he says, "in gratitude for my own excellent public school education. A lot of my work will continue to be focused in Detroit schools. That's both a privilege and a painful experience. The kids in Detroit don't have a lot of hope. But when you see them dancing with the technology, you see that there is hope. And where there's hope, there's life. And where there's life, there's opportunity. For me, technology is a vehicle for building hope and opportunity."

"The Regenerative Medicine Conference was important for the University of Michigan because it brought a wide array of industry leaders onto campus to meet with our scientists and lay the groundwork for future commercialization of a targeted cluster of UM technologies. What we heard from these visitors was that our strength at UM wasn't just our great scientists, but also the interdisciplinary nature of our research.

—Marvin Parnes

UM Associate Vice President for Research and Executive Director of Research Administration

Emerging Trends and Future Directions: Regenerative Medicine

The University of Michigan has a long history of scientific achievement in the area of regenerative medicine, the use of special materials and techniques to repair tissue and organs. In large part, UM's leadership in this emerging realm is driven by a diverse group of researchers at the College of Engineering, the School of Dentistry and the Medical School. During the past several decades, these university laboratories have continued to produce medical advances in areas as disparate as stem cells, nanotechnology, gene therapies, tissue engineering, and synthetic bone replacements.

Translating Scientific Potential Into Clinical Practice

Among leading universities, UM's regenerative medicine research program is unique, primarily because Michigan faculty have not only created an impressive toolbox of technologies but have translated those technologies into clinical practice, both through investigator-sponsored trials and spin-off companies.

Examples of Current Toolbox Technologies:

- Innovative combinations of stem cell manipulation and nanotechnology, including implantable bio-artificial organs using nanofabrication and stem cell technology
- Localized gene therapy approaches to tissue regeneration
- Synthetic materials for use as bio-scaffolds and matrices in orthopedic applications and implants, as well as for drug delivery
- Bone regeneration approaches using synthetic materials

Translation into human clinical practice:

UM research findings are developed into "candidate" products through a phased process that begins with cell culture applications and moves to product refinement in clinical trials. Specialized facilities such as the Human Applications Lab, part of the General Clinical Research Center (GCRC), give the University a rare ability to manufacture regenerative medicine materials on-site for clinical development.

The Technology Showcase

UM scientists and technology transfer specialists are being challenged to accelerate the movement of beneficial new technologies from university labs to world markets. On May 6, 2004, UM Tech Transfer took a major step in that direction by hosting the Technology Showcase, an event designed to jump-start the entry of regenerative medical technology into the market.

During the day-long symposium, prominent inventors from the University of Michigan presented their discoveries and supporting data to industry representatives, entrepreneurs, and venture capitalists from throughout the region. The response was extremely positive. According to Thomas Collet, CEO of Neural Intervention Technologies, the Technology Showcase accomplished even more than planners anticipated. "There was a wonderful array of technology on display, all very advanced, innovative and highly integrated," he notes. "Those in the business community who participated discovered that UM was indeed a leader in the field, thanks to its strong interdisciplinary focus."

"The University of Michigan has been a valuable partner in the quest to make our state one of the best in the nation with regard to high-tech careers and business creation. UM Tech Transfer is a powerful engine driving positive change for our state economy."

—David C. Hollister Director, Michigan Dept. of Labor & Economic Growth

"UM Tech Transfer's summer internship program, TechStart, not only allowed me to gain hands-on entrepreneurial experience but gave me an opportunity to network within Ann Arbor's high-tech and business communities."

—Anish Parikh MS, Aerospace Engineering, University of Michigan

Creating a Thriving High-Tech Region

The University of Michigan plays a leadership role in sustaining—and enhancing—the economic vitality of southeastern Michigan and beyond. As an integral part of this effort, UM Tech Transfer continues to focus its resources and energies in ways that expand the region's economic potential to improve the quality of life for our students and faculty, our community and the general public.

Connecting technology solutions with business needs

UM Tech Transfer professionals view themselves not as gatekeepers but as guides. By providing expert, highly responsive service, our staff members make UM technology the solution of choice for businesses everywhere, with a particular emphasis on our regional business partners.

Creating New Businesses

An in-house team of business start-up specialists makes it possible for UM Tech Transfer to expand and accelerate the launch of new businesses from UM technologies. Offering hands-on assistance and links to local and national resources, our staff members help maximize the potential of new start-ups, most of which locate within southeastern Michigan.

Developing and Retaining Talent

Our TechStart program brings together graduate student interns from across the University to assist in the commercialization of UM technologies. TechStart provides our start-ups with superb business planning and consulting services while the students learn firsthand how businesses are launched and funded. TechStart is just one example of how UM Tech Transfer partners with the UM Business School's Zell-Lurie Institute for Entrepreneurial Studies.

Leveraging our UM Alumni Network

UM has one of the largest alumni networks in the world, with graduates holding leadership positions in every industry. UM Tech Transfer leverages this tremendous asset in a variety of ways—tapping alumni expertise for everything from technology projects and events to the Tech Transfer National Advisory Board.

Building Regional and National Bridges

UM Tech Transfer team members sit on the boards of the Ann Arbor IT Zone, the Ann Arbor Area Chamber of Commerce, MichBio, the Association of University Technology Managers, the Washtenaw Development Council, the Zell-Lurie Institute for Entrepreneurial Studies, the New Enterprise Forum, and many other regional and national organizations. Our volunteer efforts help to grow the local business community while accessing world-class resources.

Marketing our Advantages

By aggressively promoting tech transfer opportunities and participating in national conferences and events, we complement other regional marketing initiatives designed to attract resources and communicate opportunities. One outstanding example is Ann Arbor TechKnow Forums, an exciting new series highlighting technology usage in key industry sectors. These events were spearheaded by the University of Michigan with widespread community support, all focused on building and marketing our regional technology community.

"As a member of UM Tech Transfer's National Advisory Board, I've been given an opportunity to give something back to my University. Having a chance to work with my fellow board members to provide hands-on assistance to the University's technology transfer efforts has been very rewarding."

—John Denniston Partner and COO, Kleiner Perkins Caufield & Byers

"In the University, we have a tireless partner for our business acceleration efforts. The quality of the opportunities and the proactive support we have seen from UM Tech Transfer have been big factors in our recent success."

—Chuck Salley Executive Director, Ann Arbor Ypsilanti SmartZone Business Accelerator

UM Tech Transfer Team:

1. Dennis Linder
2. Julie Condit
3. Jill Cooke
4. Sally Ingalls
5. Sandra Moing
6. Debbie Watkins
7. Linda Hamlin
8. Karen Studer-Rabeler
9. Janet Vandagriff
10. Rick Brandon
11. Mark Maynard
12. Robin Rasor
13. Doug Hockstad
14. Tina Bissell
15. Ken Nisbet
16. David Oslon
17. David Ritchie
18. Matt Bell
19. Mike Sharer
20. Brice Nelson
21. John Cunningham
22. Mike Hallman

Not pictured:
Dan Broderick
Susan Moreau
Greg Choiniere

Editor: Linda W. Fitzgerald

Contributing Editor: Mark Maynard

Photography: Philip Dattilo, Peter Smith

Designer: Office of Marketing Communications, Kathy Horn

Project Managers: Mark Maynard; Office of Marketing Communications, Cynthia Camburn

UNIVERSITY OF MICHIGAN TECH TRANSFER

Office of Technology Transfer
University of Michigan
2071 Wolverine Tower
3003 South State Street
Ann Arbor, MI 48109-1280
Phone: (734) 763-0614
Fax: (734) 936-1330

Satellite Office: Engineering
CoE–OTTC
143 Chrysler Center
2121 Bonisteel Boulevard
Ann Arbor, MI 48109-2092
Phone: (734) 647-7080
Fax: (734) 647-7075

Website: www.techtransfer.umich.edu

TECH

UNIVERSITY OF MICHIGAN