# 03

UNIVERSITY OF MICHIGAN ANNUAL REPORT TECHtransfer

Commercializing University discoveries for the public good is inevitably a process of

COLLABORATION.

It begins in University laboratories and centers of excellence.

It is moved forward by specialists in business, licensing, law, and marketing, by consultants and advisors, by university, industry and government partners, by networks of venture capital firms, and by business development experts.

Our deep appreciation to all those who play a vital role in transforming academic innovation and discovery into products, services and enterprises that benefit society.

# Message from the Executive Director

Fiscal year 2003 was a time of sustained growth and impressive gains for technology transfer at the University of Michigan. Thanks to steadily increasing interest and participation by our faculty and research scientists—supported by the expertise of our staff, external advisors and corporate partners—and a continued pipeline of world-class technology, our activity metrics showed impressive improvements despite the challenging national economy.

In FY03, we recorded an 8 percent increase in invention disclosures, a 23 percent increase in new agreements and a 60 percent increase in license revenues over the previous year. This achievement resulted from a continued commitment to responsive, professional service to our University and business communities.

Equally important—and tremendously exciting for everyone involved with tech transfer—a broad array of new UM-originated products and services are entering the marketplace. We were also pleased to see so many start-up companies, launched with our assistance, continue to evolve and prosper. In FY03, nine new business start-ups were launched based upon UM technology, joining the 27 other new ventures launched in the previous four years.

Much of this success can be attributed to our continued focus on collaboration—the keystone of technology transfer and the theme of this year's annual report. An excellent case in point is our new National Advisory Board. This group of talented individuals from various industry and geographic sectors is providing innovative strategies and resources that enhance our tech transfer capabilities.

As always, it has been a privilege to help further the mission of the University of Michigan by making new discoveries and their benefits available to the general public. We welcome the challenges of the year ahead and invite even broader collaboration with you—our University, community, and business partners.

Ken Nisbet

— Kenneth Nisbet
Executive Director
UM Tech Transfer

# Tech Transfer: Collaboration for IMPACT

In the past 20 years, technology transfer has helped transform leading-edge research into hundreds of products, services and business ventures. The resulting advances in health care, education, manufacturing, aerospace, energy, communications, environmental science, and other areas have had a direct and profound impact on the quality of life in the U.S. and across the globe.

If discovery is the engine that drives Tech Transfer, collaboration is the fuel.

The process of technology transfer is often long and complex. As professional facilitators, it is our task to provide relevant, effective support throughout every phase of that process—from initial inventor consultation, and the subsequent disclosure of a new idea or technology, to the drafting of commercialization plans, securing of patent or copyright protection, marketing of the technology, developing of prototypes, managing of investor relationships, and the negotiating of appropriate agreements.

Success depends in large measure on our ability to collaborate effectively—leveraging resources, forming alliances, constructing networks of expertise, and bringing together optimal combinations of people, technologies, talents, and resources.

In 2003, our efforts at collaboration took a multitude of forms, among them:

- Reaching out to faculty and research scientists in every unit of the University, from the life sciences and engineering to the liberal arts, bringing resources and options to their technology opportunities.
- Building a stellar National Advisory Board of executives and entrepreneurs to provide direction, guidance and vital points of access to the wider world.
- Developing solid community partnerships through local high-tech organizations, entrepreneur networks, and government and community entities.
- Enlisting talented graduate students in business, law, medicine, engineering, and information sciences to serve as consultants for our projects as part of our TechStart intern program.
- Bringing inventors and researchers into direct contact with entrepreneurs, venture capitalists, start-up specialists, and other commercial partners through events and programs such as Celebrate Invention, our annual University-wide inventors' recognition reception.
- Partnering with the State of Michigan to promote entrepreneurial initiatives and to provide stimulus for regional and statewide economic development.
- Leveraging the resources and expertise of peer universities through joint ventures such as the Michigan Universities Commercialization Initiative and the Midwest Research Universities Network, and with leadership positions in professional organizations such as the Association of University Technology Managers.
- Joining forces with the Zell-Lurie Institute for Entrepreneurial Studies and other University of Michigan units to expand and strengthen our services and provide educational opportunities for our talented students.

"We are finding new ways to engage, collaborate, and facilitate the interactions of the business community and the University. The resulting discoveries will benefit our state and our world."

— Mary Sue Coleman
President

"The depth and breadth of our world-class research program requires an equal commitment to technology transfer to achieve our goals as an institution."

— Fawwaz T. Ulaby
Vice President for Research

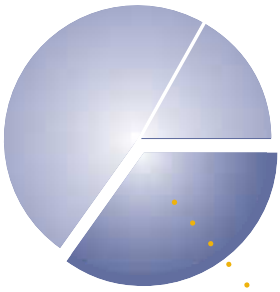
"In the last few years, we've seen steady increases in our metrics, in particular increased disclosures and license agreements. These improved metrics combined with our continued dedication to providing responsive, quality service to our inventors and business partners will set the stage for the future. We intend to continue our progress toward making the University of Michigan one of the top schools in the country in technology transfer."

—Robin Rasor
Director of Licensing
UM Tech Transfer

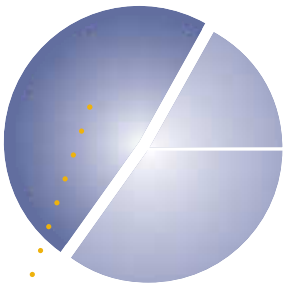
# The Year in REVIEW

Fueled by the innovation of UM researchers, Fiscal Year 2003 saw a continuation of positive trends in every area of technology transfer: invention disclosures, patents, license agreements, and start-up businesses. The University community can be proud of the new products and new business ventures that were launched in FY 2003, all of which are poised to make important contributions to the public good.

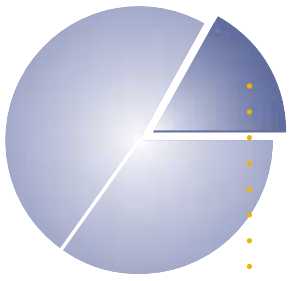
## 2003 INVENTION DISCLOSURES (by school and department)



| MEDICAL | | |
|---|---|---|
| Biological Chemistry | 6 | 6% |
| Internal Medicine | 22 | 23% |
| Microbiology/Immunology | 3 | 3% |
| Neurology | 4 | 4% |
| Opthalmology | 7 | 7% |
| Orthotics/Prosthetics | 3 | 3% |
| Pathology | 9 | 9% |
| Pediatrics | 5 | 5% |
| Pharmacology | 6 | 6% |
| Radiology | 7 | 7% |
| Surgery | 8 | 8% |
| Miscellaneous | 19 | 19% |
| *Total* | *99* | *100%* |



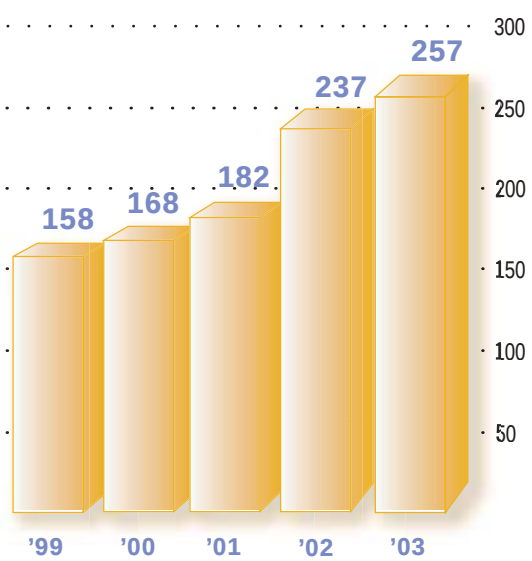
| ENGINEERING | | |
|---|---|---|
| Biomedical | 15 | 11% |
| Chemical | 10 | 7% |
| Civil/Environmental | 3 | 2% |
| EECS | 74 | 54% |
| Materials Science | 3 | 2% |
| Mechanical | 20 | 15% |
| Nuclear | 4 | 3% |
| Miscellaneous | 8 | 6% |
| *Total* | *137* | *100%* |



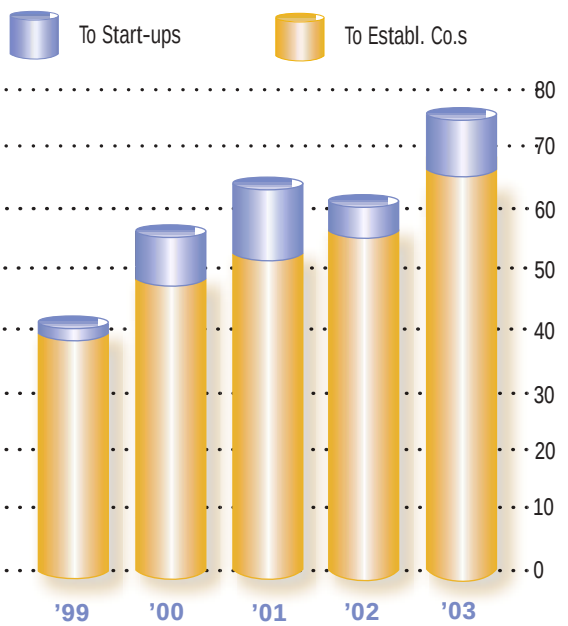
| OTHER | | |
|---|---|---|
| Dentistry | 4 | 8% |
| Pharmacy | 5 | 11% |
| Literature, Science & Arts | 25 | 52% |
| Miscellaneous | 14 | 29% |
| *Total* | *48* | *100%* |

**Disclosures with inventors from multiple colleges are credited to each college*

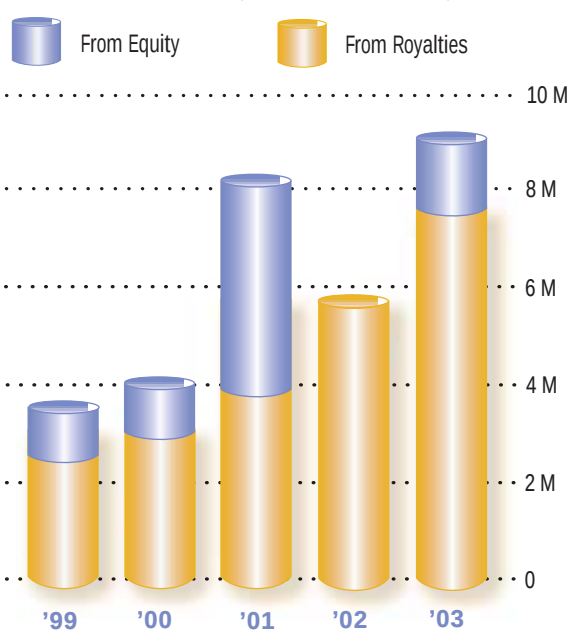
## INVENTION DISCLOSURES




## LICENSE AGREEMENTS




## LICENSE REVENUE (in millions of dollars)



# UM Tech Transfer
# FY 2003 Disclosures

Lightweight Strain-hardening Brittle Matrix Composites

Combinatorial Fluorescent Library Based on the Styryl Scaffold

Event History Calendar for the Social and Psychological Sciences

News in Essence

In an Instant: Fire Injury Prevention

Monoclonal Antibodies to HIP1 and HIP1r as a Cancer Marker

Protein MicroArrays Using a Fractionation of Cell Lysates

Genes and Signaling Pathways that Provide Proctection Against Noise Induced Hearing Loss

Carbon Nanotubes for Microanalytical Systems

Anti-cancer Screening Test for Inhibitors of HIP1 Function and Specific Inhibitors of HIP1 Function

Targeted Nanoparticles for Laser Induced Breakdown

Ultrasonic/Imaging Aspect

Direct Mapping Method for Multi-level Analytical Schemes

Multiple Component Crystalline Phases that Contain at Least One Pharmaceutical Component

Tmie Gene

Thiomolybdate Analogues and Uses Thereof

Targets for Tuberous Sclerosisi

Method and Apparatus for Querying on the Secondary Structure of Protein Data Sets

Method, Algorithm and System for Continuous Strain Distribution Measurement in Deformation Processes

Tissue Micro Array Profiler

PDE2 Inhibitors

A System/Method for Providing Computer Data Backup Without Administrative Overhead or User Involvement

A Pneumatic Human Power Conversion System

High Aspect Ratio Microheater for a Micro Analytical System

Pareto Front Gene Filtering (PFGF) Tool

Tissue-engineered Kidney in the Treatment of a Patient with Acute Renal Failure and Multi-organ Systems Failure

Methods for Identifying Therapeutically Useful Cytotoxic Agents

Ion-Cut Synthesis

Data Generator for the XML Benchmark

Diagnostic Test for Sepsis

Identification of the Gene Causing Nephronophthisis and Retinis Pigmentosa

Sprayable Strain-hardening Cementitious Composites

Design and Fabrication of Tunable Optoacoustic Detector

Collaborative PicoMap for the PocketPC

PicoMap for the PocketPC

YourURL for the PocketPC

Online Monitoring System and Method for a Short-Circuiting Gas Metal Welding Process

Method of Performing Biochemical Reactions

VocalSearch

Effects in Gliomas

Low Temperature Consolidation of Thick, Net-shape Bulk Articles from Alloys

Monoclonal Antibody specific for the von Willebrand Factor

Reconfigurable Inspection Machine to Measure Surface Finish in Cylinder Bores

Enhanced Fiber-optic Sensing Technique

Drowsy Cache

Vertigo

Novel Low Temperature NOx Reduction Catalyst

Static Progressive Forearm Rotation Orthosis

MDRTC (Michigan Diabetes Research and Training Center) Diabetes Model

Design for Crashworthiness of Automotive Body Structures

Wine Glass Disk Resonator

Glow Curve Method for Dose Timing Determination

Defribrillator Shock Electrogram

Secretion of Factors V & VIII

A MEMS Resonator Time Base In Silicon-on-insulator Technology for Embedded Processors

Novel Artificial Electro-ferromagnetic, Tunable Electromagnetic Band-gap, and Bi-anisotropic Composite Media

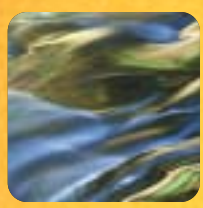
Novel Ionophores for Fluoride-selective Polymeric Membrand Electrodes

Interactive X-ray CT Reconstruction with Accurate and Efficient System Response Models

Efficient and Accurate Likelihood for Iterative Reconstruction Algorithms for X-ray computed Tomography

Fuel Processing Catalysts

Bathroom Environments for Aging Individuals with Alzhiemer's Disease, Other Forms of Dementia



Gene Transcripts

A Markov Chain Sequence Generator

Microfabricated Viscometer

Geopart: A Geometric Partitioner For 2-Weighted Placed Graphs

Recovery Of Epithelial Structure and Function During Administration of Parenteral Nutrition

Mitral Sling

Wafer-level Vacuum Packaging Technology for MEMS

Graphical display of History and Physical Data

Barttin Mutation, Gene and Uses

The Little Book of Profiling: Basic Information About Measuring and Interpreting Road Profiles

A Novel Gene and its Protein Product

Nav 1.2/Beta 1/Contacdin Cell Line

Image Reconstruction in Magnetic Resonance Imaging

Electromagnetic Metamaterial Substrate Fabrication by Lamination of Layers

Inline Elecrochemical Detection of DNA in Capillary Electrophoresis

A System for Clotting Time Blood Tests

Autoimmunity Treatments

Fast Up-regulation of BDNF mRNA

Method to Improve Factor VIII Secretion

DKAD Software

A Method and Portable Realtime Feedback System or Quantifying and Guiding Short and Long Term Resistance Weight Training and Other Exercise Activities

Reconfigurable Material Forming System - Dieless Forming System

A Multi-step Electromechanical Sigma-delta Converter for Micro-g Capacitive Accelerometers

Multiple Layer Metal Honeycomb Sandwich Structure for Improving Crush Energy Absorption Capability Under Combined Loading Conditions

Treatment of Crohn's Disease

Ultrasonic Imaging System of Intravascular Intervention

Thermally Activated Inline Microvalve

Instrumentation and Method for Measuring the Effect of Atmospheric Deflections

Combined Nanoimprinting and Photolithography for Micro and Nano Devices Fabrication

Device for Functional Imaging of the Prostate

Ultrafast Pulsed Laser Ablation

Method of Treating Allergen-Induced Airway Disease

Nanoscale Machining and Ablations Using Ultrafast Pulsed Lasers

A CMOS Voltage-to-Frequency Linearizing Preprocessor for Parallel Plate RF MEMS Varactors

Mailmove in IT

A Micromachined in-plane Silicon Accelerometer

An Interconnection Technique for MEMS Device Integration with Integrated Circuits

Genes Regulated in Common by Antidepressants of Different Classes

Method and Apparatus to Improve Noise Tolerance of Dynamic Circuits

Analysis of Respiratory Cycle-related EEG Changes in Sleep-disordered Breathing

A Novel Delivery System for Treatment of Brain (or other organs) Diseases/Disorders

Active Load Address Buffer: Mechanism for Input Replication to Detect Transient Faults in an SRT Processor

Refreshable Braille Display-based Integrated Microfluidic Control

Apparatus for Obstacle Traversion

PRIME (Proteome Research Information Management Environment)

Method for Fabrication of Shape-memory and Superelastic Open-cell Foamed Metal

Modification of Endovascular Coils

A Micromachined Pump for On-chip Vacuum

An Integrated Global Layout and Local Microstructure Topology Optimization Approach for Spinal Cage Design and Fabrication

Electrokinetic Micropump

Flossing Brush for Dental Implants

Compositions for Treating Gastrointestinal Infections

School Backpack with Back Support

CHAT: Choosing Healthplans All Together

Selective Sorbents for Desulfurization of Liquid Fuels

Pneumatically Powered Lower Limb Exoskeleton

Improvement to Denis Browne Splint

Low Noise Magnetron and Crossed-field Amplifier

Transient Fault Detection

MHPC-1

Rapid Screening of Crystal Polymorphs by Second Harmonic Generation

Activator of Mammalian Heat Shock Transcription Factor 1

MedHub Scheduling Program

Engineered Self-Organizing Cardiac Muscle

Chemical Address Tags for Modifying Drug Candidates

Dural Sealant

Diffusion of Molecules for Therapeutic Treatment

Coded Excitation with Spectrum Inversion

Frequency Shift Keying Demodulation Methods for Wireless Biomedical Implants

Atlastin Gene

EPIC Simulation Software

TURBO-REDUCE

Synthetic Thinned Array Radar (STARadar)

Synthetic Thinned Array (STAR) Communication Transmitter

Synthetic Thinned Array (STAR) Communications Receiver

Displacement of DNAPLs from Contaminated Aquifers

GLEAN 3 Simulation Software

Controlled Drug Delivery Recording and Stimulating Micro-electrode

A Novel Antioxidant

Transverse-Mode Micromechanical Square Plate Resonators

Single Resonator Micromechanical Disk Filters

Mechanically Coupled Micromechanical Resonator Array for Reduced Series Motional Resistance

Bridged Micromechanical Filter

Automatic Trimming Algorithms for Micromechanical Circuits

A Methodology for Cost-driven Lithographic Correction Using Off-the-shelf Synthesis Tools

Sequence of Novel NOD Proteins

Carbide and Nitride Supported Water Gas Shift Catalysts

Methanol Steam Reforming

Identification of Phosphorylated Tyrosines

Wafer Level Hermetic Micro Packaging

Sperm Isolation and Insemination Device

Hydrogen Storage

Compositions and Method of Use of Compounds Which Inhibit PKC

Chemical Address Tags Encoding Subcellular Localization Signals

Carbon-hydrogen Bond Activation

Inactivation Resistant Factor VIII

Three Dimensional Microassembly Structures for Micromachined Planar Microelectrode Arrays

A Non-invasive Method to Determine the Fat Content of Tissue In Vivo

Clog-resistent Billary Stent

Fiber Scanning Miroscope

Tumor Antigen that Induces an Immune Response in Colon Cancer

Synthesis and Biological Use of Nanoparticles

Novel Catalysts

Prevention of Intestinal Epithelial Apoptosis

Power Divider-Phase Shifter Circuit

Reconfigurable System with Integrated Inspection and Reconfigurable Machine Tools

High-Efficiency Neutron Detectors

Monoclonal Antibody Specific for Gene Product

Fiber laser-based EUV-lithography

SuperEGO Optimization Software

Method of Transferring Whole-layer Polymer Films from PDMS Stamp to Substrate

Polymer Inking as a Patterning Technique

Bioactive Batteries for Cellular and Sensing Applications

UMDIRECT Optimization Software

Smart Hood with Quick Release Latch and Lift

FMRI Simulator

Extensional Wine Glass Resonator

Predisposition of Tissue to Therapeutic Changes by Previous Ultrasound Exposure

Sera from Patients who Underwent Cryoablation of Breast Cancer

Method to Evaluate Metabolism of the Eye

Hormone Receptor Polymorphism in Obesity

Automated, Color-target-based Tracking System

Electrophysiology Report System (EPRS)

Robot for Fly Casting and Other Forms of Fishing

Application Protection Using Transient Authentication

A Reconfigurable Maintenance System for Distribution Scheduling

Active Filtration of Airborne Biological and Chemical Agents and Diesel Particulates

Overexpression of Receptor in Mouse Forebrain

Tool for the Treatment of Mayer-von Rokitansky-Kuster-Hauser's syndrome and Stenosis

Cell line

Method to Generate Tunable Lamb Waves

The Syndrome Finder

"COMPASS" software

A New Treatment for Orbital/Ocular Disease States and Autoimmune Diseases

Tyrosine Kinases

Spectral Flow Cytometry

Method and Apparatus for Osteoporosis Diagnosis

Selective Recognition of Bacterial Peptidoglycan

Detecting Receptor-G Protein Complexes

New Microthermal Siphon to Cool Electronic Chips

Processes to Fabricate Semiconductor Neutron Detectors

Accelerometer-Compensated Odometry

Synthetic Peptide Analogs as Selective Inhibitors of Thrombin

A Latching Thermopneumatic Microvalve for Ultra-low Power Applications

Pressure Tuned Scanning Fabry-Perot Interferometer

Mach-Zehnder Interferometer

Compositions and Methods Relating to Novel Compounds and Targets Thereof

Chemical and Bio-Sensors

Model-based Monitoring of Multi-tiered Applications

Selective In Vivo Expression Technology

Universal Radiologic Patient Position Marker

An Adaptive, Cache-Conscious Storage Technique for Improving the Performance of Database Query Processing Systems

An Algorithm for Accurately Searching Large Sequence Datasets

Switch For Continuous Air-Liquid Flows Using Electrowetting

New Cytotoxic and Antiproliferative Agents

Potential Therapy or Prevention Therapy for Osteoporosis

Horizontally Integrated Microwave Micromachined Cavity Filter

Treatment for Reduction of Thrombosis

Orphanin FQ Receptor

Degenerative Neurologic Disease

Chromosome-Specific cDNA Microarrays

Straight Talk

Micro Thermionic Power Generator

Synthesis of the Silicate Anion

Student-faculty Appointment Scheduling Program

Vibrating Capacitor Kelvin Probe for ph Measurement in Microfluidic Channels

Genomic Sequence, Genomic Organization, and Coding Sequence of the Gene Responsible for Autosomal Dominant Hereditary Spastic Paraplegia

Multi Resolution Imaging

Antimicrobials for Wounds and Infections

Catalyst for Low-temperature Autothermal Reforming of Gasoline

Human Bronchial Smooth Muscle Cell Lines

Novel Polymers

Treatment of Heart Failure

Six Sigma Online Multimedia Training Program

M5 Simulator System

Neurofibrosarcoma Cell Lines

Cell-Cross-linked Hydrogels

Genes Expressed by Cancer Cells

SPICE Format Parser

Human Bronchial Smooth Muscle Cell Lines

System for Combinatorial Synthesis and High Through-Put Screening of Compound Catalysts

Serum-Based Prognostic Marker for Lung Cancer

A Mechanism to Permit Analysis of Communication Content that Preserves Personal Privacy

UM/VABS—Variational Asymptotic Beam Section Code

Building Materials and Technology

Topologic Structure for Microfluidic Mixing

Oscillator to Control Fluid Flows

A Cell-free Method for Assembling Adenovirus Virions

Control of Nitric Oxide Release from NO Donors Contained Within Polymers

Molecular Diagnostic Chip-I for Recessive Retinitis Pigmentosa

Diabetes and Vascular Disease

Design and Synthesis of Dual Action HIV Reverse Transcriptase Inhibitors

Production of Recombinant Proteins in Eukaryotic Cells using Recombinant Adenovirus

Inhibition of Antigen/Protein Production in Ocular/Orbital Disease States and Autoimmune Diseases

# COLLABORATION AT WORK
## in the Market

Working in conjunction with fellow researchers at the University of California at Berkeley, Carnegie Mellon University, and McGill University, UM Professor of Engineering Daniel Koditschek developed RHex—a highly mobile hexapod robot capable of walking, swimming and climbing stairs. With potential applications ranging from search-and-rescue missions to children's toys, the unit has attracted interest, and funding, from the Department of Defense. UM Tech Transfer assisted in negotiating a joint inventorship agreement and worked with McGill University to develop business licensing plans.

This photo of RHex was taken at UM Tech Transfer's annual "Celebrate Invention" event, where it was one of eight UM technologies being demonstrated for inventors from around the University and members of the local community.

*Left:* A patient is administered the FluMist live-virus flu vaccine.
*Top Right:* UM School of Public Health Professor Dr. Hunein (John) Maassab conducting research in the lab in which he and his team discovered and perfected the live-virus vaccine.

Healthy Collaboration

# FLUMIST

Influenza has long been a matter of concern to public health officials, who have sought methods to promote more widespread protective inoculations among the general public. The Centers for Disease Control and Prevention estimate that 114,000 people in the United States are hospitalized and 20,000 people die every year because of influenza. Thus it's not surprising that a June 2003 decision by the Food and Drug Administration, granting regulatory approval for an influenza vaccine delivered in the form of a nasal spray, set off widespread excitement among health care practitioners, who are hoping that this easily accessible, painless option will encourage more people to protect themselves from the virus.

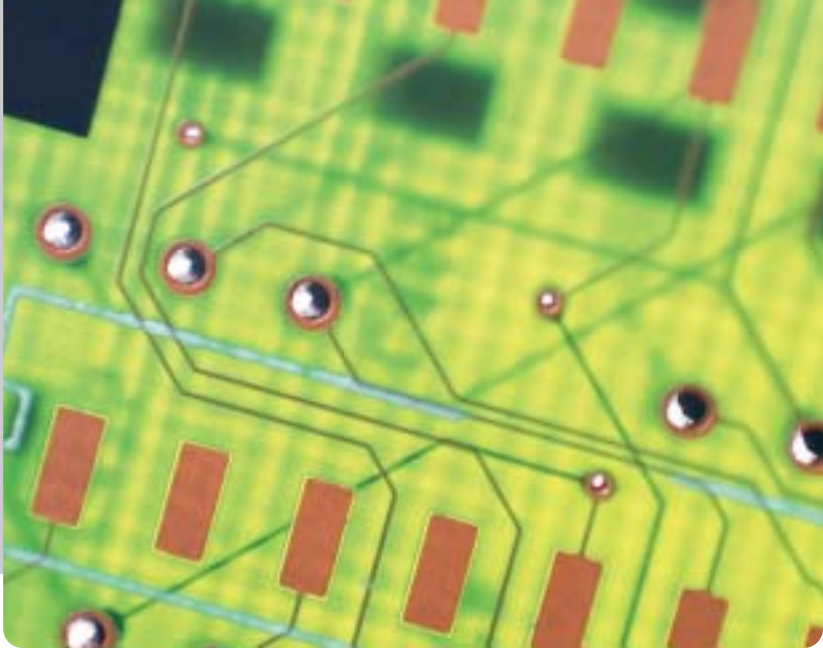
The inhaled vaccine, known as FluMist™, originated from research on live-virus vaccines begun by University of Michigan School of Public Health Epidemiology Professor Dr. Hunein F. Maassab and his colleagues in the1950s. FluMist uses a live, but weakened, virus, adapted for delivery via a nasal spray. This virus will grow in the lower temperatures found in the nasal passages but not the higher temperatures of the lungs, where naturally occurring influenza develops. Dr. Maassab was inspired by another pioneering UM researcher, Thomas Francis, Jr., developer of the first killed-virus flu vaccine, and mentor of Jonas Salk, who discovered the vaccine for polio.

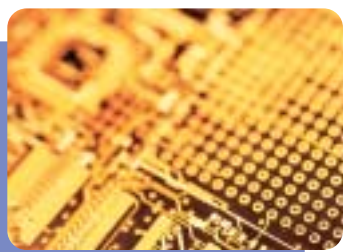
FluMist was originally licensed by the University of Michigan to Aviron, a start-up company which was then purchased by MedImmune Inc. in 2002. This success story illustrates the often-lengthy path required to transform promising research into a product that can be commercialized. It also demonstrates the need for a focused and trusting research-industry partnership, as has existed between the UM research team and the development team at Aviron and now MedImmune.

The FDA decison in June 2003 approved FluMist for treatment of healthy individuals between the ages of 5 and 49. MedImmune is co-marketing FluMist with Wyeth Pharmaceuticals and the companies anticipate that it should be available in time for the upcoming flu season.

# Entepreneurial Collaboration

## INTERLINK Networks





Recently introduced Secure.XS® software is finding an eager and growing market. As InterLink Networks CEO Michael Klein notes, "By transitioning to wireless, we were able to jump ahead of the pack. Because the Ann Arbor area is such a rich source of high-tech talent and funding, we could move from the back end of what had become a commodity business to the front end of a new and exciting market opportunity."

Computer networks have transformed the way we work and communicate. But as organizations worldwide have discovered, if local area networks (LANS) are powerful and efficient, they're also vulnerable to unauthorized access.

In the 1990s, the University of Michigan joined with Merit Network, Inc., a nonprofit corporation owned by Michigan's four-year public universities, to develop a security system for its network customers. The result was an innovative new tool for network authentication, authorization and accounting. In 2000, realizing the technology's broad commercial applications, UM Tech Transfer worked with Merit Network to launch an Ann Arbor-based start-up company known as Interlink Networks. The following year, Michael Klein, an experienced local entrepreneur, was recruited to expand the potential of Interlink's dial-up security access and authentication systems.

Klein, who had recently sold his own software firm, was attracted by a combination of factors: "It takes a lot of interconnecting pieces to build a successful company. With Interlink, all those pieces were in place. Proven, late-stage technology gave us market traction. We also had skilled technologists and strong investors. So it was really a question of building the management team, then positioning, marketing, selling, and moving the product line into the next generation."

And that's exactly what Klein and his associates have done in the past year. Under their leadership, Interlink recently entered the realm of wireless security, one of the fastest-growing markets in communications. Secure.XS®, the company's new wireless LAN security software, has already generated ten separate agreements with such equipment manufacturing giants as Hewlett-Packard and Siemens—and more deals are on the way.

## Expert Collaboration

# XEOTRON

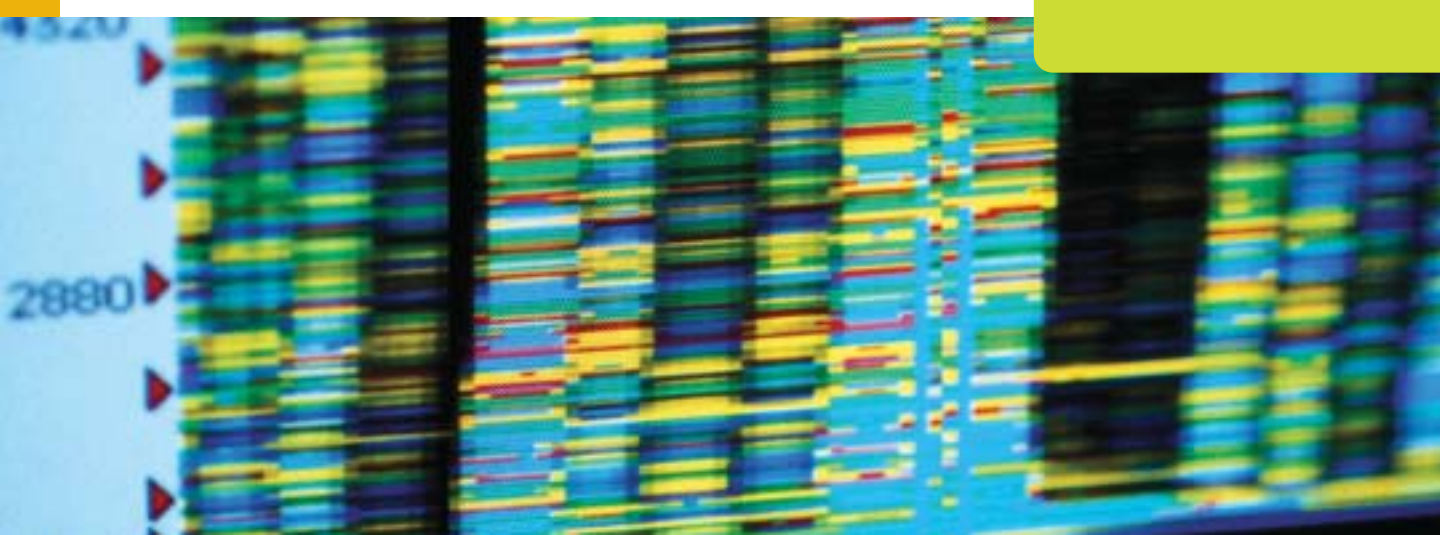
A DNA chip is a fingernail-sized device containing thousands of probes that, by detecting the presence or absence of specific gene sequences, can literally paint a genetic picture of living cells. UM Professor of Engineering Erdogan Gulari and his former student, research scientist Dr. Xiaochuan Zhou, teamed up with Professor Xiaolian Gao at the University of Houston to create a novel platform technology for use in the manufacture of DNA chips. The first marketable product to be based on their interdisciplinary effort is XeoChip®—advanced all-species DNA chips that offer genetic researchers distinct advantages in terms of quality, flexibility and speed.

Early in the research and development process, Zhou and Gulari began working with UM Tech Transfer on the protection and commercialization plans for the technology. It was there that they met Karen Studer-Rabeler of the UM Tech Transfer New Business Development (NBD) team. Acting as business formation consultants for tech transfer projects with the potential to become business start-ups, Studer-Rabeler and her NBD team provide assistance related to project management, business planning, mentoring, linkages to external resources, funding strategy, as well as other start-up facilitation services.

Through ongoing discussions, Studer-Rabeler explained the steps and issues involved in launching XeoChip technology, introduced the researchers to skilled executives, and pointed them to potential funding sources. "In this business, you have to have a champion," says consultant, and later Xeotron CEO, Martin Lindenberg. "With her can-do attitude, Karen was the ideal facilitator. She kept things moving forward, provided us with a road map and, at a crucial juncture, made use of the University's commercialization funds, which enabled my initial involvement in the process. Overall, UM Tech Transfer proved that, with the right guidance, even an inherently complicated process can proceed smoothly and successfully."

"Xeotron is a great example of how our business formation activities, coupled with business partners and resources, transformed a promising technology into a sensational business."

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



Inter-Institutional Collaboration

# Diagnostics for CYSTIC FIBROSIS

Cystic fibrosis is a debilitating hereditary disease that usually strikes its victims in early childhood. During the late 1980s, UM physician-geneticist Dr. Francis Collins, who currently directs the National Human Genome Research Institute, and Dr. Lap-Chee Tsui of Toronto's Hospital for Sick Children began a joint research project in hopes of devising a method for diagnosing and eventually treating the disorder. Within two years, the researchers successfully cloned and sequenced a gene encoding a protein known as the Cystic Fibrosis Transmembrane Regulator (CFTR). They then went on to discover that a mutant form of the CFTR gene, known as Delta 508, was the most common mutation causing the disease and was present in 90 percent of cystic fibrosis patients.

Following that discovery, the University of Michigan and the Hospital for Sick Children (HSC) filed a joint patent application for the gene and the protein derived from it. They also created an arrangement whereby the University of Michigan would oversee licensing activities in the U.S., the Hospital for Sick Children would take responsibility for all other licensees, and the two institutions would share royalties from these licenses.

Through the efforts of UM Tech Transfer and the Hospital for Sick Children, non-exclusive licenses have been granted to companies throughout North America and Europe. The decision to license non-exclusively has encouraged competition among diagnostic laboratories and enabled the test to be widely available at an affordable cost. While one firm is currently involved in clinical trials with a potential gene therapy product to treat affected individuals, the vast majority—14 thus far—are either performing in-house testing for individuals who wish to know their CF carrier status and/or for newborns if requested, or are developing standardized test kits that will eventually be sold to service laboratories.

"The multi-disciplinary collaboration that resulted in the formation of IntraLase is one of the key strengths of Michigan. We are recognizing that these examples of disciplines working together creatively to solve difficult problems are fertile ground for the development of technologies that may eventually seed other start-up companies."

—Elaine Brock
Director
Office of Technology
Transfer and Corporate
Research-Medical
UM Tech Transfer

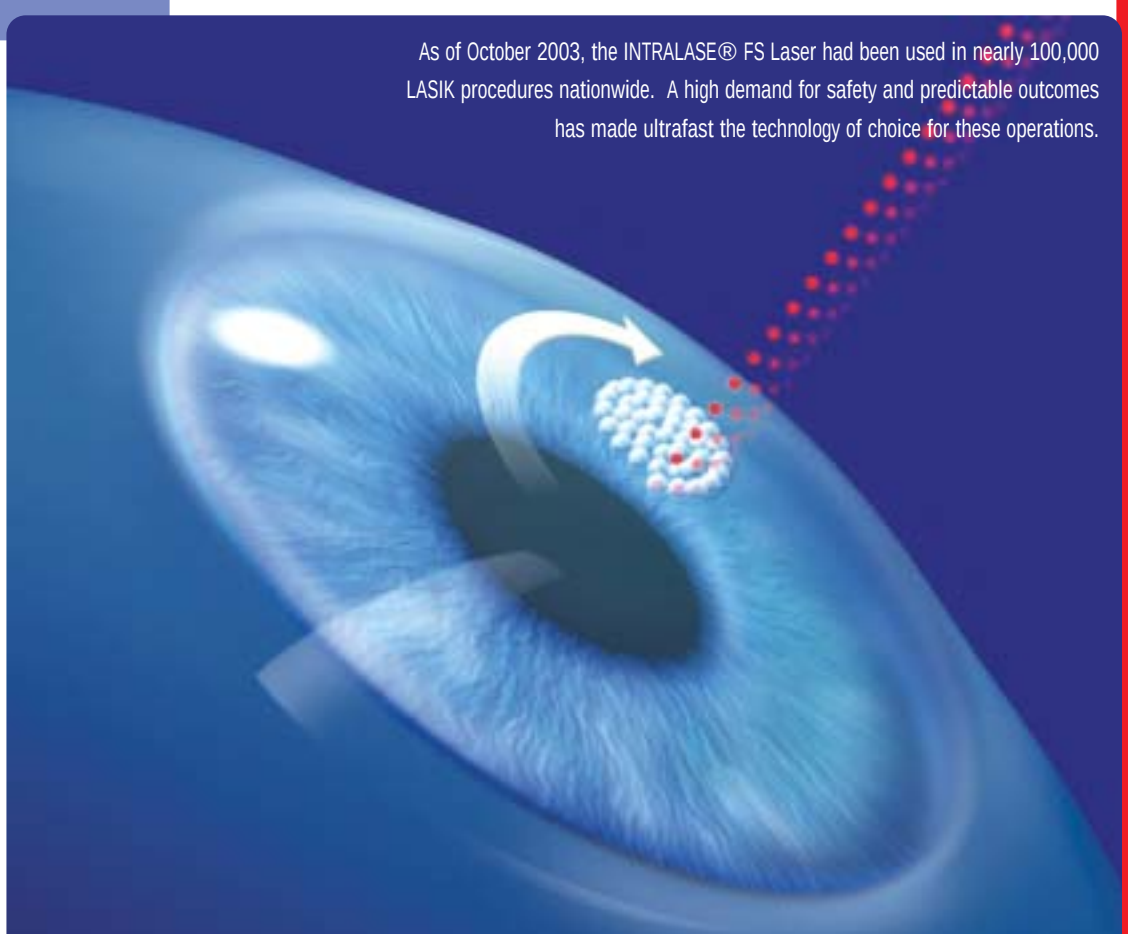
## Visionary Collaboration

# INTRALASE

"A computer driven, high precision scalpel for eye surgery" is how entrepreneur and UM Adjunct Professor of Ophthalmology Ronald M. Kurtz describes the INTRALASE® FS Laser. As the newest product available from IntraLase Corp., a company he co-founded in 1997 with then UM colleague Tibor Juhasz, PhD, the laser was introduced early last year for use in corneal transplants and vision correction procedures. The INTRALASE FS replaces a mechanical device known as a microkeratome, enabling ophthalmic surgeons to create a corneal flap—the first step in any LASIK procedure—with maximum accuracy and virtually no trauma to the outer surface of the cornea.

The technology behind the INTRALASE FS laser was the result of a close collaboration between researchers at the Center for Ultrafast Optical Sciences (CUOS) and physicians and researchers at the UM Kellogg Eye Center. The femto-second laser, pioneered at CUOS, provided significant benefits when applied to new techniques for laser eye surgery in collaborative work with the researchers of the Kellogg Eye Center. Other laser-enhanced ophthalmic applications are now in the process of being explored and tested.

As of October 2003, the INTRALASE® FS Laser had been used in nearly 100,000 LASIK procedures nationwide. A high demand for safety and predictable outcomes has made ultrafast the technology of choice for these operations.



# Integrated Sensing Systems (ISSYS)

These days, some of the biggest developments in engineering are also some of the smallest. Health care, communications, pharmaceuticals, manufacturing, and food processing are among the industries that are benefiting from remarkable advances in microelectromechanical engineering (MEMS). As a doctoral student at the UM College of Engineering, Dr. Nader Najafi was keenly aware of the vast potential of MEMS. He founded ISSYS in 1995 along with his brother and UM engineering professor Khalil Najafi and their former faculty advisor Kensall Wise. With the help of UM Tech Transfer, the company licensed eight patents for micro devices from the University of Michigan.

Today, ISSYS is well on its way to marketing a broad line of leading-edge microsystems. Animal studies have just been completed on prototype pressure sensors—wireless, battery-less, implantable micro devices for monitoring and treating congestive heart failure and hydrocephalus. Using its patented microtube technology, the company is refining portable multiple-drug delivery systems for treatment of AIDS, cancer, tuberculosis and other diseases. Its flow sensors are finding ready buyers in a wide range of industries. And the company is also doing a brisk business as a provider of fabrication and pre-production services.

Najafi is quick to credit the University's role in his company's success. "The University of Michigan has been—and continues to be—a fantastic partner," he says. "I view it as an ocean of opportunity for start-up companies."

"The wide range of market applications for MEMS technology is a testament to the success made possible by creatively applying superior university research results to unmet market needs, as ISSYS is ingeniously doing."

—Tim Faley
Former Director
Technology Transfer and Commercialization-Engineering
UM Tech Transfer

# High-Flying Collaboration

## SOAR Technology

The idea of machines endowed with human-like intelligence has been around for decades, but the concept is reaching new heights, literally, through the work of UM Professor of Engineering John Laird and his USC colleague Paul Rosenbloom. As students at Carnegie Mellon, the two engineers developed an early version of Soar, a computer language for modeling a full range of human mental processes. In the 1990s, the technology attracted sizable Department of Defense (DOD) research grants, many of which were channeled to the UM Artificial Intelligence (AI) Lab, where Laird served as director.

It was this government funding that enabled Laird, Rosenbloom, and a team of UM and USC engineering researchers to develop TacAirSoar, an agent-based simulation system. According to Soar Technology CEO James Rosbe, "TacAirSoar 'agents' are synthetic pilots that fly aircraft in simulations at the same level of skill as an expert human pilot, making human-like decisions on maneuvers, and communicating and reacting to changing events—adaptively and intelligently."

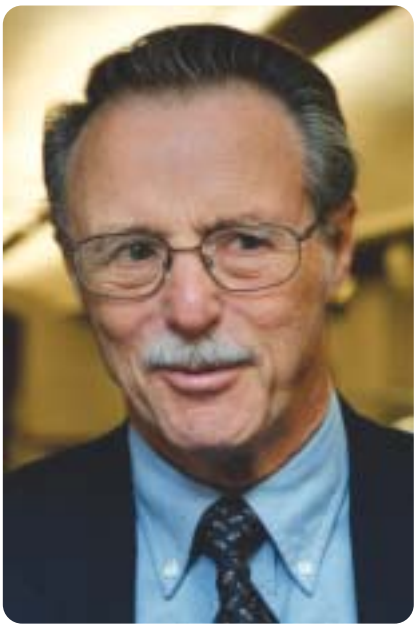
Soar Technology was established in 1998 to support and expand DOD applications of intelligent autonomous agent technology beyond what was possible within the University. Because of the terms of its government research funding, Soar Technology did not require a formal license for the DOD market. Even so, Tech Transfer assisted in a variety of ways: coaching the founders before and after start-up, providing an MBA student intern to conduct market research, and facilitating license negotiations.

Now, however, the company is beginning to broaden its focus to address non-DOD markets and, in 2003, became an official UM start-up, having licensed TacAirSoar and two other technologies from the UM AI Lab (EPIC and GLEAN, developed by Professor David Kieras). Rosbe notes that, with the technology access afforded by the UM license, the company plans to diversify into intelligent agent applications in medical research, health care and logistics.

TacAirSoar software for replicating expert pilot behavior is used for training and simulation exercises by the U.S. armed forces. For several years, the program has been incorporated into combat modeling exercises by the military, simulating special operations forces on the ground in contact with aircraft.

Life Time Collaboration

# Professor RAYMOND E. COUNSELL

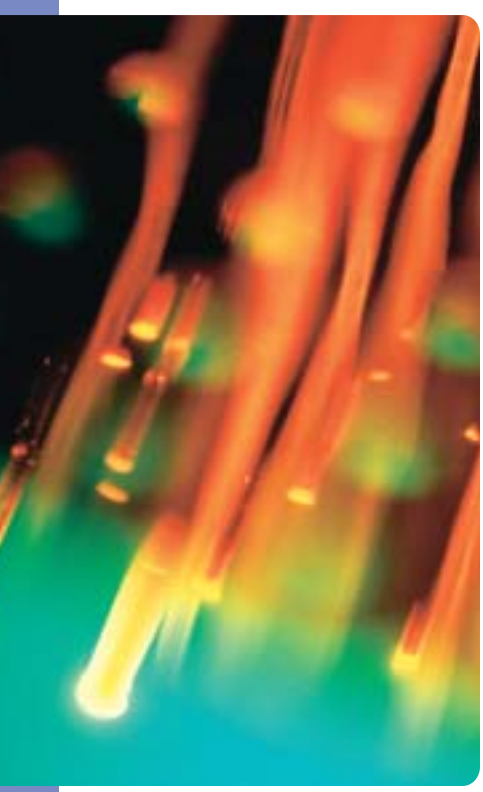


In the early 1960s, Ray Counsell was a senior scientist at Searle Laboratories, one of the major pharmaceutical companies of the time. His area of expertise, then as now, was medicinal chemistry with an emphasis on steroid hormone research. In 1963, Counsell was recruited to UM's fledgling Nuclear Medicine Department. The following year, he set up a campus laboratory funded by a seven-year grant from the American Cancer Society.

In prior decades, scientists had discovered that because of the thyroid gland's affinity for iodine, low levels of radioactive iodine made it possible to image the gland and detect problems. Fascinated by the possibilities, Counsell and his students set out to search for carrier molecules that would travel to specific sites in the body, deliver tracer amounts of radioactive material, and thus make it possible to detect deformities and tumors.

## Tracking Cancer to Its Source

One of Counsell's first major breakthroughs occurred in the 1970s, when he and his team synthesized a radio-iodinated form of cholesterol, otherwise known as a "probe," that concentrated effectively in the adrenal gland. The result of their success was the first-ever imaging procedure for diagnosing adrenal cancer.



It was in the 1980s, while doing background reading, that Counsell happened to note a peculiar phenomenon: when human tissues were analyzed, high concentrations of phospholipid ethers were typically found in tumor cells. Following up on this tantalizing lead, several of Counsell's doctoral students and post-doctoral fellows and faculty colleagues—among them Karen Meyers, Marc Longino, Terushi Haradahira, Anatoly Pinchuk, Kathleen Plotzke, Mark Rampy, Susan Schwendner, and Jamey Weichert—developed a series of probes, one of which was recently granted Investigational New Drug (IND) status by the FDA, thereby making it possible to begin initial clinical trials. Before year-end, the University of Michigan will begin using this agent in a clinical trial to determine uptake and elimination profiles in prostate cancer in patients, while the University of Wisconsin will conduct a similar trial for lung cancer.

Once again, Counsell's work as a teacher and mentor is proving instrumental in shaping the future of the new technology. The technology is being licensed to Cellectar, a company based in Wisconsin and co-founded by two of Counsell's former students and former UM faculty, Drs. Jamey Weichert and Marc Longino, both of whom are now working in the Radiology department at the University of Wisconsin.

## Taking the Next Step: Computed Tomography

As a result of their success in selectively targeting probes to specific organs, Counsell and his group shifted their attention from agents for nuclear medicine to the relatively new realm of computed tomography (CT), involving the use of tools such as CT scanners to diagnose problems in soft tissues. His students and colleagues went on to develop a family of probes, called polyiodinated triglycerides or ITG, capable of being incorporated into a lipid emulsion (LE) similar to that of a lipoprotein. Once the ITG-LE was taken up by lipoprotein receptors in the liver, the organ appeared as a bright image on a diagnostic scanner, making it much easier to spot tumors or other liver disease.

Recently, the ITG technology has been licensed to MetaProbe, a small biotechnology firm in San Diego, California, for commercial development. The company hopes to have a product on the market by 2008. As has often happened in Counsell's career, it is a former post-doctoral fellow—in this case Douglas Bakan, MetaProbe's vice president for business development—who is moving the technology into the market. "The team at MetaProbe is committed to developing Dr. Counsell's ideas for liver-selective imaging agents into a clinically relevant diagnostic tool for the radiology community. We anticipate that this novel approach to visualizing the hepatobiliary system will revolutionize both the type and the quality of information that can be obtained using CT imaging," said Dr. Bakan.

## Transitioning to the Market

For Ray Counsell, it has never been enough simply to make breakthrough discoveries. "For medicinal chemists," he notes, "the goal is always translational research. Simply defined, that means getting the ideas to market and getting new products and tools into the hands of physicians." He adds that it has been "a thrill" to have his former students so deeply involved in his work.

He also appreciates the increased efforts on the part of the University of Michigan to support technology transfer. "When I started at the UM," he recalls, "all the patents were handled by one person, who devoted 20 percent of his time to technology transfer. Today, the University is doing a great deal to facilitate the process of moving research into the marketplace."

UM President, Mary Sue Coleman (center), joined by UM Medical School Dean, Allen Lichter and UM Vice President for Research, Fawwaz Ulaby, meeting with UM Tech Transfer's National Advisory Board during the Board's first working session.

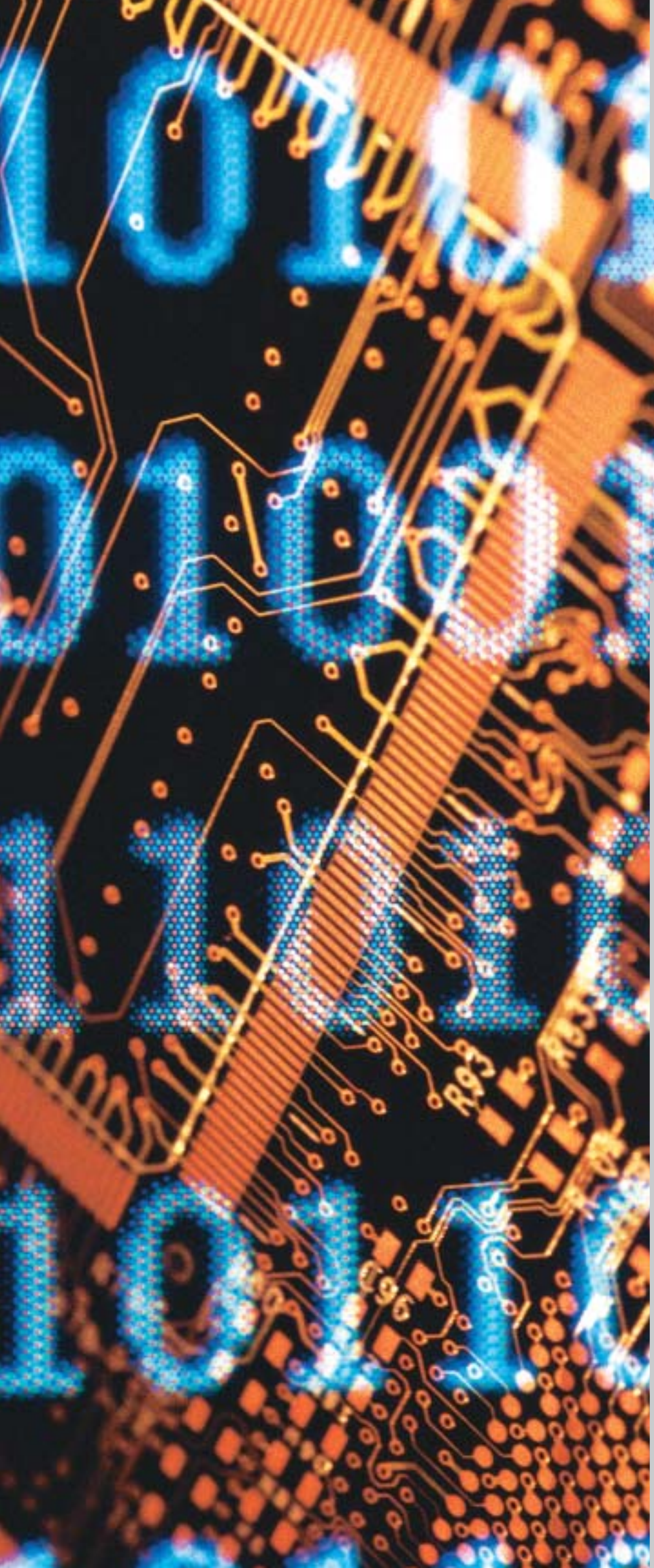
## Strategic Collaboration

# The Tech Transfer NATIONAL ADVISORY BOARD

In October of 2002, the newly formed Tech Transfer National Advisory Board (NAB) held its inaugural meeting in Ann Arbor. The 13 members of this group—recruited from the ranks of leading venture capitalists, successful entrepreneurs, corporate executives, and legal specialists—represent a broad range of industries, functions, regions, and professional expertise. Their mission: to provide both strategic guidance and strategic relationships for accelerating the University's progress in technology transfer.

During the initial meeting, Board members decided to actively assist UM Tech Transfer by forming four subcommittees that would focus on analysis of market opportunities, funding and resource strategies, enhanced marketing, and performance measurements. Following the group's second meeting in June of 2003, NAB Chair Rick Snyder noted that the Board had made significant progress on a number of fronts. "Every member is committed to our goals," he says. "These are people who believe absolutely that technology transfer is important to the University of Michigan, vital to the health of the region and the nation, and crucial to the public good."

NAB members include John Denniston, Tom Porter and Chuck Salley (top left), David Canter (above left), and Jan Garfinkle (left).



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TERI WILLEY
Managing Partner
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# Research Trends and FUTURE DIRECTIONS

"From 'smart therapeutics' capable of targeting cancer cells while sparing healthy tissues to nanoprobes for diagnostics and treatment at the cellular level, the work of UM researchers is awe-inspiring. Tech Transfer is privileged to play a key role in making so many important discoveries available and accessible to world markets."

—Marvin Parnes
Associate Vice President
for Research and
Executive Director of
Research Administration

In the realm of research, the University of Michigan enjoys a distinct advantage stemming from immense strength both within and across disciplines. The deep basic research underway in engineering, chemistry, medicine, pharmacy, computer science, and dozens of other fields is enriched by a university-wide emphasis on cross-disciplinary collaboration.

The remarkable diversity of research projects, and the varied expertise of research teams, has often made it difficult to describe intellectual property in terms of traditional fields of study. That has led UM Tech Transfer to augment its traditional marketing method with product portfolios—categorizing research by application rather than discipline. Already, this new approach has made it possible to support and market new technologies more effectively.

# Looking Ahead

Among the many domains of research that comprise the current list of product portfolios, tissue engineering and nanoscale technology demonstrate especially strong promise for technology transfer in the years ahead.

**Tissue engineering** involves the use of synthetic cells, organs, tissues, and molecules to replace or facilitate healing in specific body parts. Currently, more than 50 University of Michigan researchers—primarily in engineering, medicine, dentistry, and computer science—are engaged in this promising and relatively young field. During the past three years, their efforts have generated more than 100 invention disclosures and over 50 patents—and those numbers are growing.

Presently, at the University of Michigan researchers are using laboratory-grown materials to create scaffolds—also known as matrices—that can be used in artificial organs, bones and skin. Because the scaffolding is designed to behave as living tissue, cells bind to it, nutrients and blood vessels pass through it, and healing is accelerated. Other researchers are coating these same matrices with chemical and biological compounds to create artificial tissue capable of delivering drugs or genes to targeted sites in the human body.

In many ways, **nanoscience** represents a new frontier in research and one that is generating tremendous excitement and high expectations. Nanotechnology researchers manipulate matter at the molecular level for use in tiny electronic devices, microscopic machines, biological sensors, nanoprobes, lasers, and a host of other applications.

Between 1995 and 2002, UM investigators were awarded 88 grants to support research in nanoscience, and the University is currently making significant investments in nanoscale research and technology. Launched in 1998 the Center for Biologic Nanotechnology is a focal point for leading edge discoveries, particularly in the realm of nanoscale applications for health care.

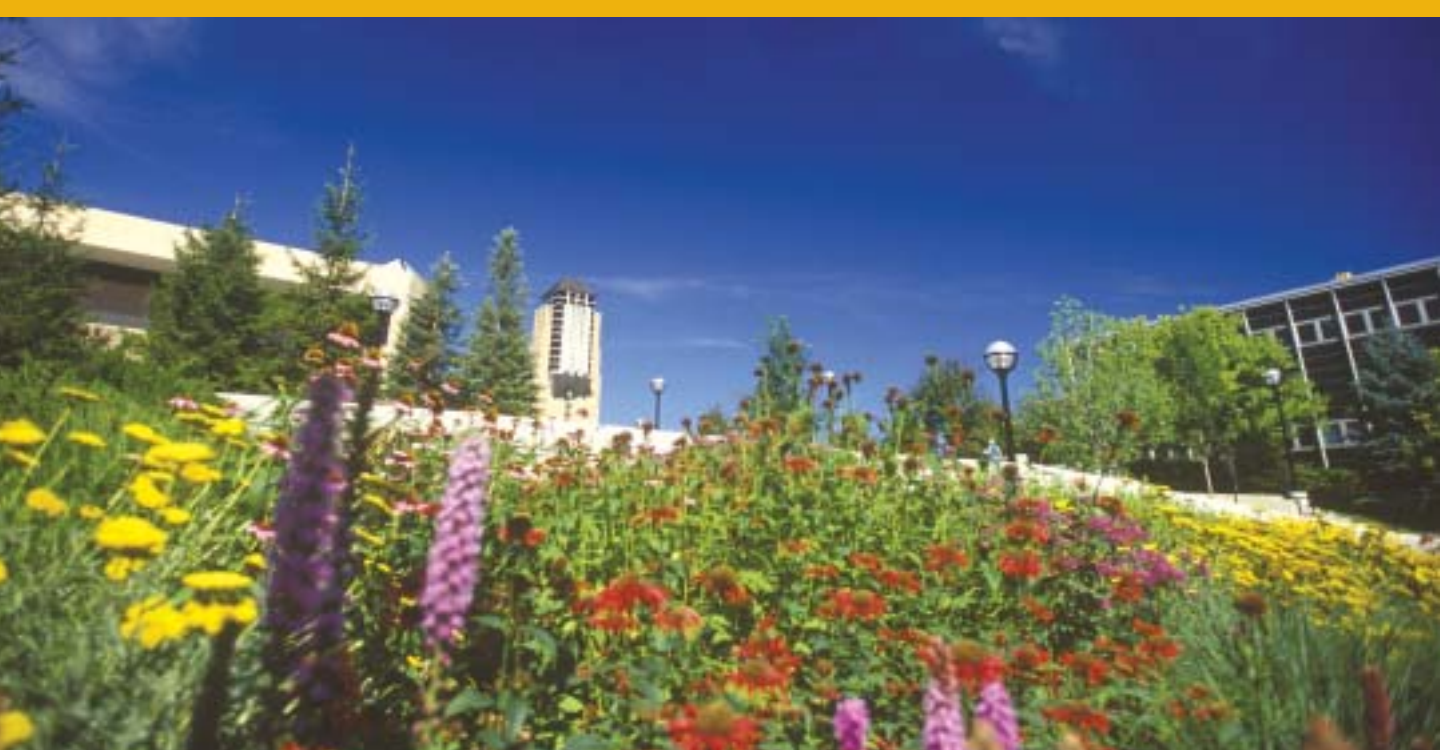
The University is presently studying ways in which research efforts in nanoscience and nanotechnology can best be supported and advanced. As a first step, the University is hosting "Frontiers in Nanoscience and Nanotechnology," an international symposium scheduled for November 14 and 15 of this year. Along with presentations by leading nanoscientists, a panel of expert evaluators will help assess UM's strengths and future prospects in nanoscale research.

# Community PARTNERSHIPS

Strengthening business resources and infrastructure enhances our ability to transfer technology to capable partners, increases opportunities for research and venues for student hands-on learning programs, and improves the overall quality of life. For all these reasons, UM Tech Transfer continues to participate actively in local, regional and national organizations that support economic growth.

## A University-Wide Commitment

Technology transfer offers the University of Michigan an important venue for fulfilling its three-fold mission of education, research and service. In a June 2003 presentation to an audience of several hundred entrepreneurs, venture capitalists, faculty members, and interested citizens, UM President Mary Sue Coleman discussed the University's role in economic development and emphasized the importance of creating a positive climate for technology transfer by increasing collaboration. As she noted, "The University of Michigan is committed to making the most of its potential in technology transfer. But we cannot do it alone. Advancing regional economic development requires more than funding. It requires new collaborative efforts among businesses, government partners, entrepreneurs, and community leaders."



# Providing Leadership and Support

During fiscal year 2003, UM Tech Transfer staff members participated, and often filled prominent positions, in regional technology, networking and business organizations, among them:

- Ann Arbor Chamber of Commerce: Tech Transfer is well represented and contributes to a variety of programs and special events.
- Ann Arbor IT Zone: a major educational and networking resource for entrepreneurs that supports new business development through forums, workshops, special programs, and mentoring.
- Association of University Technology Managers (AUTM): Tech Transfer is represented on the board of this premier association for university-based technology licensing professionals.
- BioMed Expo: a statewide networking event and annual showcase of biomedical research, education and commercialization.
- Great Lakes Entrepreneur's Quest (GLEC): an annual business plan competition to encourage technology entrepreneurship in Michigan.
- MichBio: Tech Transfer is represented on the board of this non-profit organization dedicated to accelerating the growth of life sciences in Michigan and improving the environment for biotechnology companies.
- The Michigan Economic Development Corporation (MEDC): the state of Michigan's economic development organization.
- Michigan Universities Commercialization Initiative (MUCI): a collaboration of UM, Michigan State University, Wayne State University, and the VanAndel Research Institute of Grand Rapids to accelerate the deployment of technology.
- Midwest Research Universities Network (MRUN): a working alliance of university business development professionals dedicated to facilitating technology commercialization, most notably through new venture creation.
- SmartZone Business Accelerator: a state-supported program for expanding technology-based business creation within the community.
- Washtenaw Development Council: local Ann Arbor / Ypsilanti economic development organization.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23. Jill Cooke
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