四、德州大學 OTC 資料

office of Technology Commercialization The UNIVERSITY OF TEXAS AT AUSTIN

The 8 Steps of Technology Commercialization



The discoveries and inventions are formally disclosed by the inventors submitting a confidential Invention Disclosure form to OTC. (See www.otc.utexas.edu/Inventor Forms.jsp.)

Disclosing an

invention

Market assessment

OTC assesses a disclosed invention and develops a preliminary commercialization strategy. Based on this assessment, OTC determines whether to assert the university's rights in the disclosed invention. The assessment and determination is performed in conjunction with inventors, outside counsel, and/or advisors as appropriate.

Patenting and other legal protection

If the university's rights are asserted in an invention that appears suitable for patenting, OTC will engage outside counsel to pursue patent protection for the invention. When appropriate, the university may utilize copyright, trade secret, or trademark rights to commercialize university inventions or works of authorship.

Research

Observations and experiments during research activities often lead to discoveries and inventions that may have commercial applicability.

Prospecting

OTC proactively approaches companies, entrepreneurs, and investors who have been identified as potentially suitable partners to bring the technology to market. OTC also showcases available technologies online and at appropriate conferences. In addition, faculty publications, presentations, or academic renown may result in third-party licensing interest.

After the deal

The path to commercial markets will vary, depending on the nature of the invention, the market it is addressing, and the invention's stage of development. Under the terms of the agreement, the commercialization partner provides regular progress reports to the university on its commercialization activities. The inventors may continue to be involved in development activities with the commercialization partner.

The deal

When the university and the commercialization partner are ready to move forward, OTC prepares legal agreements to reflect the business terms negotiated. When the agreements are signed by both parties, the startup or licensee has the right—and obligation—to commercialize the invention. Compensation to the university varies from agreement to agreement and may involve fixed fees, milestone fees, royalties, equity, and other forms of consideration. Compensation is shared with inventors in accordance with university policy.

Due diligence and negotiation

Marketing activities may result in one or more parties requesting an in-depth examination of the technology. This can involve signing a non-disclosure agreement and additional discussions with the inventors. Interested prospects will present a plan for commercialization and negotiate business terms with OTC.

OTC Quick Facts

office of Technology Commercialization

THE UNIVERSITY OF TEXAS AT AUSTIN

Our mission

As one of the nation's premier public research institutions, The University of Texas at Austin is the originator of many novel and useful discoveries each year. The Office of Technology Commercialization (OTC) helps university employees protect and commercialize new and useful inventions that are potentially patentable or copyrightable. In support of the university's mission, OTC:

- **Educates** the UT community about the patenting and commercialization process
- **Protects, markets and licenses** UT inventions and software to industry, entrepreneurs, and the equity community
- Assists in the formation of startup ventures
- Promotes UT-industry collaborations and relationships





Selected successes: medicine, energy, engineering

Practice-changing glucose monitor	Licensed to Abbott Diabetes Care
First approved tamper-proof oxycontin	Licensed to Abbott GmbH
Seminal IP for lithium-ion battery	Licensed to HydroQuébéc, others
High-resolution, low-cost imprint lithography	Licensed to Molecular Imprints
Industry-standard vibration analysis software	Licensed to CDH GmbH

Working with OTC

Who's who at OTC? www.otc.utexas.edu/StaffBios.jsp

How do I disclose a new invention? www.otc.utexas.edu/InventorForms.jsp

What is the licensing process at UT Austin? www.otc.utexas.edu/IndustryComm.jsp

Where can I download a non-disclosure form? www.otc.utexas.edu/IndustryForms.jsp

Other questions? Please contact us at: info@otc.utexas.edu







COMMUNITY PROFILE

The Research Valley

Committed to Excellence in Providing Solutions for Industry-Academia Collaborations





HOWDY!

Charles (Chuck) Martinez Vice President - Innovation Services The Research Valley Partnership, Inc.







- A public-private economic development corporation
- Teamed with Texas A&M, Cities, County, State and Private Sector
- Confidential assistance and custom research to support site selection
- Coordinate tax, infrastructure and business incentives; workforce training; and value-added services to help companies establish, expand and launch in The Research Valley





*









Innovation

- Business Advisory & Specialty Services
- University and Technology Transfer
- Access to Capital (Texas ETF, Aggie Angel Network, RVAN)
- Virtual and Physical Incubator Space (International Gateway)
- New Venture & Promotion Services

*

Innovation economic development is about the conversion of knowledge to a new venture – the commercialization of applied research. It is about building an ecosystem.

We define innovation as bringing value to the Research Valley through facilitating emerging science and technology new ventures that lead to jobs, investment and expanded research in a global market place.





Innovation Capital of Texas



On the Horizon...

- Regional Center for Innovation & Commercialization
 Texas Emerging Technology Fund
- Texas A&M Clean Energy Incubator
 State Energy Conservation Office/Texas A&M Energy Institute
- Center for Advancement of Non-Metallic Materials for the Energy Sector (CANES)

Texas A&M APPEAL Consortium/Texas Emerging Technology Fund

Research Valley Innovation Center 2.0 Prescience International

Prescience International

+ 📀 🛞

International

GATEWAY

RESEARCH VALLEY

INTERNATIONAL ECONOMIC DEVELOPMENT COUNCIL

ONOMIC DEVELOPMENT



- Helps businesses rapidly and inexpensively enter the U.S. marketplace
- Our 'soft landing' services streamline legal and logistical complexities so companies can focus on their customers and partners
- Provide access to a "global innovation network" of academic, business and government partners





ESEARCH

How We Do It

The Research Valley International Gateway (RVIG) enables international businesses to pursue new U.S. opportunities through a set of initial customized services.

U.S. Corporate Formation Services

- The International Gateway will form a Texasbased C-corporation with bylaws
- The International Gateway will get you a company a federal tax ID number
- The International Gateway will serve as your Registered Agent
- The International Gateway address will be registered as your company's legal U.S. address







Business Virtualization Services

- Clients are provided a business phone number that can be forwarded to their mobile phones or guest office phones while visiting the U.S.
- Web-based phone voicemail system can be accessed from anywhere in the world
- Client business mail will be opened, scanned and emailed to wherever they are
- 24-hour access to executive office suite space and conference room with computers, Wi-Fi hotspot, phone system, printing, and networked whiteboard are available via reservation

Current Pricing

One-time initial payment of \$5,000 (USD) and \$500 (USD) monthly fee.



Additional Services (Additional Cost)

Other professional services can be facilitated upon request through varied partners and the Research Valley Innovation Center.

- Language training and translation
- Business plan development
- Domestic market research and entry assistance
- Fundraising assistance
- Intellectual property protection and tech transfer commercialization strategies
- Help with import/export laws
- Help obtaining business and driver's licenses
- Immigration and visa assistance
- Housing and commercial real estate assistance
- Legal counsel
- Accounting, tax and banking services
- Talent recruitment
- Assistance in setting up meetings with target clients

We're committed to facilitating a U.S. presence as well as providing flexible, affordable access to value-added services for international businesses.







CENTER



We're Ready to Discuss Collaborations & Partnering

Charles Martinez

Vice President of Innovation Services

The Research Valley Partnership 1500 Research Parkway, Suite 270 College Station, Texas 77845

Phone 800.449.4012 Mobile 979.575.4112 cmartinez@researchvalley.org









The Role of Commercialization in Research

The Texas A&M University System Office of Technology Commercialization



Saurabh Biswas, Ph.D. Director, New Ventures saurabh_biswas@tamus.edu 979-458-2640

The Texas A&M University System (TAMUS)



STATE AGENCIES

THE TEXAS A&M UNIVERSITY SYSTEM

Texas A&M AgriLife Research

Texas A&M AgriLife Extension Service

Texas A&M Engineering Experiment Station

Texas A&M Engineering Extension Service

Texas A&M Forest Service

Texas A&M Transportation Institute

Texas A&M Veterinary Medical Diagnostic Laboratory



A statewide network of eleven universities, seven state agencies, and a comprehensive health science center

- Educates more than 120,000 students and reaches another 22 million people through service each year
- Includes 28,000 faculty and staff, ~\$3.3B annual budget, research expenditures >\$772 million annually
- Traditional strengths in engineering, veterinary medicine, agriculture
- Commercialization of technology can be considered in tenure decisions
- History and culture of dedicated service to the United States

The Texas A&M University System (TAMUS)

THE TEXAS A&M UNIVERSITY SYSTEM



STATE AGENCIES

Texas A&M AgriLife Research Texas A&M AgriLife Extension Service Texas A&M Engineering Experiment Station Texas A&M Engineering Extension Service Texas A&M Forest Service Texas A&M Transportation Institute Texas A&M Veterinary Medical Diagnostic Laboratory

TEXAS A&M

- Ranked 3rd in research expenditures among universities without medical schools, behind only MIT and UC-Berkeley
- 6th largest university in the nation in enrollment

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- 2,500+ faculty, including recipients of the Nobel Prize, National Medal of Science, and Wolff Prize and members of the National Academy of Engineering, National Academy of Sciences, and National Institutes of Medicine
- Triple federal designations as a land-, sea-, and space-grant institution
- Operates research centers in Mexico, Costa Rica, and Italy and branch campuses in Galveston and Doha, Qatar
- Maintains 122 formal agreements for collaborative research with 39 countries and research programs on all seven continents



Dwight Look College of Engineering

- 11,179 engineering students (22% of University total)
 - 8,329 Undergraduate Students
 - 2,850 Graduate Students

THE TEXAS A&M UNIVERSITY SYSTEM

- 3rd largest undergraduate engineering program in the U.S.
- 6th largest graduate program in the U.S.
- 109 National Merit Scholars (62% of university total)
- 2nd highest research expenditures in the U.S.



12 Engineering Departments

THE TEXAS A&M UNIVERSITY SYSTEM



Texas A&M Engineering Experiment Station (TEES)

- Engineering technology transfer for the State of Texas
- Unique engineering research laboratories and centers
- Education and workforce development
- Complex industry partnerships



Offshore Technology Research Center



Nuclear Science Center

TEEX Mission

THE TEXAS A&M UNIVERSITY SYSTEM

The Texas A&M Engineering Extension Service develops a skilled and trained workforce that enhances public safety, security, and economic growth of the state and the nation through training, technical assistance, and emergency response.





Expertise

- Firefighting & Emergency Services
- Homeland Security
- Urban Search & Rescue
- Law Enforcement
- Public Works & Safety
- Economic and Product Development

THE TEXAS A&M UNIVERSITY SYSTEM

Average Annual Figures

Total Trained/Served- 180,000 TEEX' Total Contact Hours: 2.9 Million International Service: 70 Countries Total Classes: 5,500



The Texas A&M University System (TAMUS)

THE TEXAS A&M UNIVERSITY SYSTEM



STATE AGENCIES

Texas A&M AgriLife Research Texas A&M AgriLife Extension Service Texas A&M Engineering Experiment Station Texas A&M Engineering Extension Service Texas A&M Forest Service Texas A&M Transportation Institute Texas A&M Veterinary Medical Diagnostic Laboratory

Texas Transportation Institute

Lives Saved

•Roadside safety devices; crash cushions, breakaway signs, guardrail treatments (10,000 + lives saved worldwide)

•Safer pavement surfaces that provide high and long lasting friction, reduce splash and spray, and reduce traffic noise

Time Saved

•Advanced intelligent transportation systems and active traffic management resulting in more efficient travel

•Annual Urban Mobility Report: definitive source for national and state congestion relief priorities

Resources Saved

Reducing costs of roadway construction

 Developing "game changing" innovations in freight movement that will dramatically improve freight reliability, while moving large numbers of trucks from the highways

Students Supported

•TTI is a major producer of new talent for the transportation industry, training about 200 students each year.



THE TEXAS A&M CENTER FOR INNOVATION

in Advanced Development & Manufacturing



The New Reality of Emerging Diseases

THE TEXAS A&M UNIVERSITY SYSTEM

The Natural Threat

Emergence of new, virulent pathogens (50 appeared since 1973)





H5N1







Transportation assures rapid global spread of emerging diseases



The U.S. has Launched a New National Biosecurity Initiative

THE TEXAS A&M UNIVERSITY SYSTEM



"And we are launching a new initiative that will give us the capacity to respond **faster and more effectively** to bioterrorism or an infectious disease a plan that will counter threats at home and strengthen public health abroad."

> President Barack Obama State of the Union January 2010



"Our Nation must have the **nimble**, **flexible capacity** to produce MCMs rapidly in the face of any attack or threat, known or unknown, including a novel, previously unrecognized, naturally occurring emerging infectious disease."

U.S. Department of Health and Human Services The Public Health Emergency Medical Countermeasures Enterprise Review August 2010

The U.S. has Launched a New National Biosecurity Initiative

THE TEXAS A&M UNIVERSITY SYSTEM



President Barack Obama State of the Union January 2010 U.S. Department of Health and Human Services The Public Health Emergency Medical Countermeasures Enterprise Review August 2010 U.S. Department of Health and Human Services Request for Solutions (March 30, 2011)

THE TEXAS A&M UNIVERSITY SYSTEM



Objectives

 Develop a national response capability to manufacture pandemic influenza vaccines for the U.S. population

(50 million doses in 4 months: implies new cell-based or recombinant vaccine; Global pharmaceutical partner must be "anchor tenant")

- Manufacture biothreat vaccines and medical countermeasures for the U.S. Strategic National Stockpile (SNS) (CBRN: Current requirements are for 17 products)
- Lead the development of new vaccines and countermeasures from ~Pre-IND through licensure (animal models, pivotal animal studies, clinical trials, regulatory submissions, etc.)
- Train the U.S. workforce in all aspects of vaccine and MCM development

TAMUS is the Prime Contractor / System Integrator Final Proposal Team

THE TEXAS A&M UNIVERSITY SYSTEM

INTEGRATED BIOPHARMACEUTICAL COMPANIES

GlaxoSmithKline Biologicals (Belgium)

ACADEMIC INSTITUTIONS

- Baylor College of Medicine (Texas)
 - Sabin Vaccine Institute
 Vaccine Research Unit
 - Texas Children's Hospital
 - UTMB-Galveston National Laboratory
 - University of Florida
- Blinn College (Texas)

BIOPROCESS TECHNOLOGY PROVIDERS

- Sartorius (Germany)
- GE Healthcare (Sweden) deltaDOT (UK)

TAMUS COMPONENTS

- Texas A&M University
- Texas A&M Health Sciences Center
- Texas Engineering Experiment Station (TEES)
- Texas Engineering Extension Service (TEEX)
- Texas Veterinary Medical Diagnostic Laboratory (TVMDL)
- Texas A&M Research Foundation (TAMRF)

NON-PROFIT RESEARCH INSTITUTES

- Lovelace Biomedical and Environmental Research Institute (New Mexico)
- Texas Biomedical Research Institute (Texas)
- Mary Crowley Research Center (Texas)

COMMERCIAL PARTNERS

- Kalon Biotherapeutics (Texas)
- Lonza Houston (Texas)
- PPD, Inc. (North Carolina)
 NDA Partners (California)
- NDA Partners (California)
 Caliber Biotherapeutics (Texas)
- The Beck Group (Dallas)
- Vaughn Construction (Houston)

Why is TAMUS the Prime?

Translational Life Sciences Initiatives Anticipated CIADM Requirements

THE TEXAS A&M UNIVERSITY SYSTEM

- Focused on intermediate and advanced development of vaccines, therapeutics, devices, and diagnostics
- Integrated, multidisciplinary, innovation-driven enterprise



Establishment of US Domestic Capacity - Infrastructure

THE TEXAS A&M UNIVERSITY SYSTEM



Caliber Biotherapeutics

The Texas A&M System Mission

 The mission of The Texas A&M University System is to provide education, conduct research, *commercialize technology*, offer training, and deliver services for the people of Texas and beyond through its universities, state agencies, and health science center.

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THE TEXAS A&M UNIVERSITY SYS

Interpreting the Commercialization Mission

- Why do universities have commercialization offices?
 - Help researchers get patents?
 - Make money off of patents?
 - Fulfill a part of the university's service mission?
 - Create economic impact?
- What is the goal?

Why – A TAMUS Answer

- Help our researchers and Members achieve their core missions of research, education, and public service
- Leverage Intellectual Property to create value
 - Entice industry partnerships
 - License/equity income

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Income Streams for Research Organizations

The Texas A&M University System

- Increased research funding
 - Industry, state, and federal research

– Do these stakeholders care about commercialization?

- Retention and attraction of key faculty
 - Commercialization support
- Royalty returns to stakeholders
 - Generally small, blockbuster exceptions
- Equity returns to stakeholders
 - Generally small, blockbuster exceptions

Typical Commercialization Metrics

THE TEXAS A&M UNIVERSITY SYSTEM

FY 2012	
Invention Disclosures	212
Patents Filed	72
Patents Issued	39
New License Agreements	66
License Revenue	\$12.5 million
Patent Expense Reimbursements	\$1.2 million

But it's about more than these metrics

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Other Impact in FY 2012

THE TEXAS A&M UNIVERSITY SYSTEM

- \$30 million in research funding from licensees
- \$150 million in sales of TAMUS licensed products
- 2000 jobs created by TAMUS licensees
- 65 start up companies since 1995
 - Cumulative license revenue \$3.8 million
 - Cumulative sponsored research \$10 million
 - Retained equity value of \$20 million+

Medical Technology Commercialization

THE TEXAS A&M UNIVERSITY SYSTEM

- Drugs and devices pose a special challenge for commercialization
 - Very early stage of development
 - High failure rate in trials
 - Very expensive to commercialize
- Few discoveries move directly to big pharma or device companies

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The Cost High and the Time is Long

THE TEXAS A&M UNIVERSITY SYSTEM



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- Creating companies
 - to move early stage technologies forward
 - to get a greater return on early stage technologies
- In the past, reliance on entrepreneurial faculty to initiate these
- Currently, have a dedicated team that focuses on formation of start-ups

What Are Spin-Out Opportunities?

- Goldilocks technologies
 - Not developed enough to attract licensees
 - Developed enough to attract angels
- Next steps usually involve further research at the university
- Value add step is relatively inexpensive
- Large market fundable, exit strategy

Example Spin-Out

The Texas A&M University System

- MacuClear Dr. George Chiou
 - Treatment for Age Related Macular Degeneration
 - Formed with a \$50,000 investment
 - Has raised more than \$8.3 million
 - Now in Phase III human trials.
 - Has funded more than \$1 million in research with the inventor
 - University equity stake valued at \$10M+

Example Spin-Out

- Global BioDiagnostics Dr. Jeffery Cirillo
 - Point of care diagnostic for tuberculosis
 - Company formed with \$50,000 investment
 - Has raised more than \$4.7 million
 - Two years from product sales
 - Has funded more than \$500,000 in research with the inventor
 - Valuable university equity stake

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How can you get involved?

THE TEXAS A&M UNIVERSITY SYSTEM

- Companies need CEOs
- Companies need advisors and board members
- Companies need money to move forward – Aggie Angel Network
- Companies need strategic international partners for global commercialization efforts



- System Members meet their goals in research, education, and public service
- With this goal, economic development, increased research funding, and industry partnerships are outcomes

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 "Our goal is not only to discover knowledge, but to apply it,"

Former Chairman Bill Jones Board of Regents





Office of Technology Commercialization

Making Connections

LICENSING AND INTELLECTUAL PROPERTY MANAGEMENT ALLIANCES A NEW VENTURES A APPLIED RESEARCH

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The Texas A&M University System is committed to making its workplaces and services accessible to all, without regard to race, color, religion, sex, national origin, disability, age or veteran status.

OTC1201.0112



² \blacktriangle Making Connections: Office of Technology Commercialization



Brett Cornwell, Associate Vice Chancellor for Commercialization

OTC Facts (since being founded in 1992)

- Successfully negotiated 931 licenses and 125 option agreements with 774 companies
- Worked with 3,297 inventors to review and assess 2,967 disclosed technologies and discoveries
- Obtained 1,083 issued patents on 463 A&M System inventions
- Partnered with 39 co-developers of new intellectual property
- Supported entrepreneurship by licensing A&M System technologies to 61 start-up companies
- Enabled licensees to deliver more than 470 new products and services to the marketplace
- Generated licensing revenue exceeding \$90 million

Everything's Connected

The Office of Technology Commercialization (OTC) helps others form productive, sometimes profitable business relationships. In a nutshell, we're about making connections.

Of course, OTC's core job involves licensing the A&M System faculty's ideas and technologies to the private sector. Like similar departments at other institutions of higher learning, we work with inventors to identify and disclose discoveries, protect and patent inventions, and market and ultimately license their discoveries to companies. But unlike those other universities, that's not where our mission ends.

Our New Ventures Division creates new companies and connects them with private investment to help faculty inventors develop and commercialize their discoveries. We form alliances of interested stakeholders, secure seed funding, create corporations and present private-sector partners with wholly formed businesses ready for investment. Think of us as the hyphen in "public-private partnerships."

Clear Vision for the Future

Here's a great example of the value we bring to the table. Texas A&M Health Science Center College of Medicine's Dr. George Chiou created and patented MC-1101, a new treatment for age-related macular degeneration (AMD). Following discovery, more funding was needed to develop the treatment to a point where the pharmaceutical industry would be interested. OTC built a business model, engaged a CEO (industry expert Philip G. Ralston, Jr.), and created a company formed in partnership between the A&M System and the Texas A&M Health Science Center College of Medicine. Our goal? To raise the research dollars needed to take MC-1101 to the next stage.

With \$50,000 in seed money, MacuCLEAR (http://www.macuclear. com/) — the start-up company OTC spun out in 2006 to further develop MC-1101 — has generated nearly \$1 million in privately sponsored research specifically earmarked for continued development at Texas A&M Health Science Center College of Medicine. Clinical trials are ongoing. Given that, by 2020, three million Americans will suffer vision loss from AMD, the potential return on this investment goes well beyond dollars. While we hope that MacuCLEAR ultimately leads to an approved treatment for AMD, this venture has already proven incredibly successful by returning \$20 in support of Texas A&M research for every \$1 initially invested.

Developing Locally, Reaching Globally

And that's just one of our initiatives. We're working in agriculture, engineering, health care — practically every industry you could name. In August 2010, OTC signed an agreement with the Wallonia Foreign Trade and Investment Agency (AWEX) of Belgium. This agreement allocates 2 million euros from the Walloon government to support Walloon commercialization connections with the A&M System. In fact, the Belgian company AMOS, a leading scientific telescope manufacturer, intends to locate its first U.S. office in College Station, Texas, because of the connections between AWEX, the community and the A&M System.

Protecting, marketing and licensing technologies. Developing alternative research funding sources. Building business relationships across the public-private spectrum. This is what we're doing at the Office of Technology Commercialization.

With that said, I'd like to welcome you to our overview brochure. Its primary purpose is to help us make a connection with you, our stakeholders and clients . . . our partners in the future.

So — how can we help you make your vision a reality? \blacktriangle

By pairing Texas A&M AgriLife researchers with private companies striving to make their knowledge and innovation available to the public, the Office of Technology Commercialization is on the leading edge of product and process development and also brings in new funding through the licensing of intellectual property. Photo courtesy Texas AgriLife Communications.

4 A Making Connections: Office of Technology Commercialization

Making a Difference in the World

"Licensing is more than the legal process of conveying rights to ideas," says Peter Schuerman, director of OTC's Licensing and Intellectual Property Management (LIPM) division. "It's about fulfilling the vision of our researchers. It's about making a difference."

All research is valuable in some way, but some research can only improve our quality of life when commercialized. LIPM takes its direction from the A&M System's mission, which makes commercialization of research results a priority. LIPM staff help protect the intellectual property rights of A&M System researchers while connecting them with outside parties willing to invest in the innovations.

"Many new discoveries will never benefit the world unless the right steps are taken," explains Schuerman. "For these discoveries, we must protect intellectual property and convey rights to commercial partners so they can fulfill the vision that inspired the research."

Over the past year, LIPM has achieved a new level of transparency within the A&M System. Schuerman and his staff hold regular meetings with key A&M System members to review the current portfolio of licensable discoveries and update stakeholders on how their investments are performing. "Rather than wait for a researcher to bring us a discovery, we engage with them as they perform their work. We prioritize opportunities within the System so we can focus our efforts more effectively," states Schuerman.



LIPM uses an opportunityassessment matrix to categorize prospective licensing opportunities in terms of their potential return and the likelihood of their being adopted by industry. For OTC, "return" includes achieving a positive impact for the A&M System in terms of financial benefit (e.g., licensing revenue or research funding returned to the university). For example, externally funded research expenditures exceeded \$772 million for the A&M System last year, and OTC was a part of making that happen. But "return" goes beyond the financial — it also means creating societal benefits for Texas and beyond.

While some new discoveries are ready to license from the beginning, others require careful cultivation before they can be adopted by industry. Forming corporate alliances at the appropriate time can, for example, accelerate a technology's maturation process. Some discoveries are referred to OTC's New Ventures Division for the formation of a startup company dedicated to furthering their development.

"We don't see intellectual property as simply something to sell," explains Schuerman. "We approach it as something we invest with a company

IP and Licensing Impact	2007	2008	2009	2010	2011	TOTAL
New Invention Disclosures	166	226	196	207	284	1079
Patents Filed – U.S. and Foreign	115	105	102	67	63	452
U.S. Patents Issued	27	23	16	30	16	112
License Agreements	49	39	55	36	49	228
License Revenue	\$7,564,230	\$11,668,106	\$8,137,757	\$8,275,711	\$8,479,625	\$44,125,429

in order to achieve a return. We ask the question, how can we make the most of this opportunity for the researcher, our partners, the A&M System and the public?"

LIPM will continue reaching out to the A&M System's research community to better understand researchers' goals for their individual programs and create commercialization strategies that help the researchers reach these goals.

"We're in this for the long haul," says Schuerman. "We build long-term relationships between our researchers and licensees and potential sponsors for their research. We provide the "Licensing is about fulfilling the vision of our researchers. It's about making a difference."

> Peter Schuerman, Ph.D., Licensing and Intellectual Property Management

opportunity for A&M System member innovators to see their ideas and discoveries have a measurably positive impact on the world. That's why we're here." ▲
New Licenses

L icensing of A&M System intellectual property is the way OTC enables private companies to leverage the inventions of A&M System researchers. It's the core function of OTC. Licensing generates cash returns for A&M System members and researchers, but most importantly it impacts all taxpayers by turning research projects into products that improve citizens' lives.

"Rather than wait for a researcher to bring us a discovery, we engage with them as they perform their work."

Peter Schuerman, Ph.D., Licensing and Intellectual Property Management

Advanced Cooling Technologies, Inc.

Advanced Cooling Technologies, Inc., (ACT) specializes in advanced thermal technology development and custom thermal product manufacturing. ACT is commercializing the Momentum-Driven Vortex Phase Separator (MDVPS) invented by Dr. Frederick Best, Dr. R. Cable Kurwitz and Dr. Ryoji Oinuma of the Texas Engineering Experiment Station. MDVPSs facilitate directcontact heat and mass transfer in a small-sized system with no moving parts or seals, allowing improved reliability, resistance to acceleration loads and reduced maintenance requirements. Advanced applications include geothermal uses, air conditioning, humidity control, purification,



Laboratory model showing sustained vortex from tangential inlet.

vapor compression and two-phase thermal bus architecture.

Location: Lancaster, Pennsylvania System Member: Texas Engineering Experiment Station

Ceres, Inc.

Bigger is better when it comes to producing biomass, the raw material used to make biofuels. Today ethanol production uses grain, like corn, but the plants themselves may hold the greatest potential for biofuel production. Ceres, Inc., in conjunction with Texas AgriLife Research, has used sorghum inbreds created by Dr. William Rooney in its development and commercialization of energy sorghum hybrids. These hybrids produce high yields of biomass, are naturally drought tolerant, and can be commercially productive for rain-fed agriculture. The first-generation products can grow to 15 to 20 feet under favorable conditions and could produce more than 1,000 gallons of liquid fuel per acre, more than two times that produced by the current process using grain.

Location: Thousand Oaks, California System Member: Texas AgriLife Research



Energy sorghum hybrids are drought tolerant and produce twice as much liquid biofuel per acre as corn and other grains.

MedAutomate Diagnostics, Inc.

Quick diagnosis can sometimes make the difference between life and death. When a person has a cardiac arrest or traumatic brain injury, the body releases certain biomarkers into the bloodstream. The handheld MedAutomate Device uses nanotechnology to quickly measure the biomarkers in a patient's blood in the field. Using the device, a physician can more accurately diagnose the patient's condition and potentially save brain or heart tissue from further damage. To develop this device, the company licensed technology from the laboratories of Dr. Jun Kameoka in the Department of Electrical Engineering and Dr. Gerard Coté in the Department of Biomedical Engineering related to enhanced detection of biomolecules by surfaceenhanced Raman spectroscopy.



MedAutomate Diagnostics President Alice Sesay-Bodie, with Dr. Gerard Coté and Dr. Jun Kameoka.

MedAutomate Diagnostics, Inc., plans to expand the technology to detect other biomarkers.

Location: Denton, Texas **System Member:** Texas Engineering Experiment Station



Dr. Tzachi Samocha at the AgriLife Research Mariculture Laboratory in Flour Bluff is developing sustainable biosecure and costeffective shrimp farming practices through intensive nursery raceway systems.

Royal Caridea, LLC

Large, fresh shrimp are always in demand at upscale restaurants. Live shrimp are costly to ship, so they are usually transported refrigerated or frozen. To address these opportunities, Royal Caridea, LLC, has exclusively licensed rights from the A&M System for a shrimpfarming technology developed by Texas AgriLife Research's Dr. Addison Lawrence at the Port Aransas Mariculture Research Facility.

This technology holds the potential to open a whole new market for live shrimp. Known as Super-intensive Raceway Shrimp-Farming, the invention enables the construction and operation of biosecure, closed-system, indoor shrimp farms in areas not traditionally utilized for shrimp production, such as metropolitan areas away from traditional coastal shrimp production regions. With production closer to market, opportunities are created to lower distribution costs and make shipping logistics more efficient.

Location: Port Aransas, Texas System Member: Texas AgriLife Research

SDL Citadel, LLC

In recent years, the electricity industry has decentralized, due in part to small-scale electrical production and storage methods becoming more cost effective. SDL Citadel is a minority-owned and operated renewable energy company that aims to capture a significant share of this distributed electrical utility market. Established in 2008, SDL Citadel works to integrate green technologies into a seamless process that enhances environmental protection, produces renewable energy and stimulates job growth. SDL Citadel is commercializing a novel biomass gasification system, developed by Dr. Sergio Capareda, that can be used to generate synthesis gas and provide sitespecific electricity generation at significantly reduced cost. Moreover, this novel biomass gasification system uses urban municipal solid waste, a renewable waste product, as its feedstock for conversion into electrical power.

Location: Dallas, Texas System Member: Texas AgriLife Research



Texas A&M biological and agricultural engineering professor Dr. Sergio Capareda developed a biomass gasification system that can convert municipal solid waste into electrical power. SDL Citadel, LLC, is commercializing this system.

L icensing is the transaction that moves intellectual property from the A&M System to private companies. However, OTC and A&M System members strive for more than a single transaction with a company. We strive for ongoing alliances to help drive the next great invention and provide market insight for researchers across the A&M System. The following examples show the power of long-term relationships that stem from a desire to commercialize A&M System technology.

Texas Engineering Experiment Station (TEES) and Gamesa: Wind Power

Texas A&M and Gamesa Technology Corp. are working together to install a new generation of wind turbines at West Texas A&M University. This effort is coordinated jointly by Energy Engineering Institute (EEI) — a center within TEES — and the Alternative Energy Institute of the A&M System. A&M System and Gamesa officials have initiated a long-term agreement to conduct ongoing research and testing for Gamesa's energy-related projects.

TEES and Vestas: Wind Power

Vestas, the world's leading supplier of wind-power solutions, has delivered more than 40,000 wind turbines in 65 countries. The company has made vital contributions to development of the Texas A&M Wind Energy Center, part of TEES. The center's mission is to cultivate wind-related research within the A&M System. The center promotes its unique capabilities across the wind-energy spectrum, from nanostructured materials for next-generation blades and civil infrastructure to turbomachinery, power, aeroelasticity studies, computational fluid dynamics, wind forecasting, logistics, testing and evaluation, and other areas critical to the wind-power industry.



In 1991, the patented ET2000[®] guardrail end treatment was developed. Over 540,000 units have been shipped throughout the United States and around the world.

TTI and Trinity: Highway Safety Technologies

The Texas Transportation Institute (TTI) has a long history of working with Trinity Industries, Inc., and Trinity Highway Products, LLC, to develop and bring innovative highway safety technology to market. The best-known products are devices to protect drivers whose errant vehicles leave the roadway. The ET series of energy-absorbing end terminals (ET-2000, ET-Plus® and Euro-ET[®]) offer protection in guardrail-end collisions. The reusable HEART® crash cushion is applicable for unvielding objects such as concrete barriers and bridge columns. The co-developed Cable Barrier Safety System (CASS®) prevents drivers from crossing over medians into oncoming highway traffic. TTI estimates that the successful commercialization of these safety technologies has saved tens of thousands of lives in Texas, the United States and other parts of the world.

TEES and StarRotor: Advanced Compressors and Expanders

Founded in 2001 to commercialize technology from Texas A&M University and TEES, StarRotor Corporation began from a novel idea to use gerotors (a unit with an inner rotor and outer involute that creates suction and/or compression) to process gases. This idea by Dr. Mark Holtzapple and Andrew Rabroker is the technical

foundation for StarRotor compressors, air conditioners, expanders and engines. StarRotor continues to develop these technologies in its facilities in Bryan, Texas.

StarRotor engines are designed to require significantly less fuel than conventional internal combustion



The StarRotor engine, developed by chemical engineering professor Mark Holtzapple, is a more efficient car engine that has the potential to be three times more efficient than the conventional internal combustion engine.

engines and provide advantages of higher performance and lower pollution. StarRotor expanders are positioned to help recover waste energy from sources that are currently uneconomical. StarRotor compressors are more efficient than conventional reciprocating and axial machines, and can be configured to be hermetic. Air conditioning systems that utilize StarRotor components have the potential to save electricity and protect the environment by eliminating harmful refrigerants.



The Freight Shuttle consists of electrically powered vehicles that travel on a specialized, derailment-proof guideway similar to the "people movers" operating at some major airports and cities. The major benefits include the low operational costs and the promise of congestion relief.

TTI and Freight Shuttle International: Cargo Transportation

TTI's Freight Shuttle System (FSS) is positioned to revolutionize the way containerized freight is transported by reducing congestion, emissions and delivery delays, while significantly increasing efficiency and security. The FSS system is comprised of individual cargo transport vehicles propelled by linear induction electric motors. These vehicles travel on specialized, derailment-proof, steel or concrete guideways. Along highways, the FSS may operate on an elevated guideway in order to efficiently utilize right-of-way. At ports, the FSS will facilitate efficient inspection of cargo containers at Homeland Security scanning stations without delays.

Featured Alliances: Advanced Fuel Development



TEES and Terrabon

Terrabon, Inc., is cooperating with TEES in a facility in Bryan, Texas, to demonstrate a Texas A&M process that transforms biomass into liquid fuels. It will test the MixAlco technology developed by Dr. Mark T. Holtzapple and Research Engineer Cesar B. Granda.

The MixAlco technology uses naturally occurring soil organisms to digest biomass such as non-crop plant material, manure and garbage. The process transforms biomass into mixed alcohols that can be blended into gasoline. With additional processes, the alcohols can be converted into gasoline that is nearly identical to that derived from crude oil.



Holtzapple has also developed a process of converting biomass trees, grass, manure, sewage sludge, garbage, agricultural residues and non-food energy crops — into fuel.



Chemical engineering professor Ken Hall has patented a method for refining natural gas that will enable taking advantage of existing natural gas deposits.

TEES and Synfuels

Using a process conceived by Dr. Kenneth R. Hall of TEES, Synfuels International, Inc., of Dallas, Texas, has developed what it calls the industry's first commercially viable process for converting stranded natural gas into easily transportable liquid fuels. Cooperation between TEES and Synfuels has produced an efficient, environmentally friendly process that could create millions of barrels of new petroleum products — including a clean-burning pipeline or tanker-ready liquid — from existing natural gas deposits.

The process could make use of currently untapped deposits of natural gas and prevent "flaring," inefficiently burning natural gas into the atmosphere during the refining process — something that is both wasteful and bad for the environment.

AgriLife and General Atomics: Algae Production Systems for Advanced Biofuels

Currently, biofuels come from terrestrial crops, but another source — microalgae — can produce significantly more biofuel per acre than any other potential source. AgriLife Research and General Atomics have received significant funding from the Governor's Texas Emerging Technology Fund and the U.S. Department of Defense to develop production systems for microalgae capable of producing biodiesel and biojet fuel.

General Atomics and AgriLife Research have identified specific strains of microalgae that possess high oil-producing potential and high-value protein co-products for animal feed. These strains are being evaluated at the AgriLife Research algae test bed located on the AgriLife Research Station in Pecos, Texas. For more information, visit http://algaeforfuel.agrilife.org.



Developing techniques for separating algae from water is one of six research components of the Algae for Fuel program.



AgriLife and Chevron: Cane and Oilseed Crops for Biofuels Production

Researchers are taking a new look at U.S. crops for biofuel production. Texas AgriLife Research is collaborating with Chevron Technology Ventures, a division of Chevron U.S.A., Inc., on two projects for the development of a bioenergy industry. The first project focuses on the breeding and production of oilseeds such as safflower, camelina, peanut, jatropha and flax. Researchers will also perform a life-cycle analysis and monitor the environmental impact of an oilseeds industry on production agriculture. The second research project focuses on the breeding and production of energy cane and energy cane hybrids for the lignocellulosic bioenergy industry. This project includes the identification of molecular markers, such as lignin content, to assist and promote breeding of these novel crops.



AgriLife and Licensees: Small Grains

Texas AgriLife Research developed TAM 401, the latest of a long line of successful wheat varieties. TAM 401 is an early maturing, semi-dwarf, hard red winter wheat variety. Syngenta Cereals, formerly known as AgriPro Wheat, has licensed this wheat variety, which has good stress tolerance and is adapted to all wheat-growing areas in Texas and other areas. TAM 401 has excellent grain yield potential, good resistance to foliar diseases and acceptable hard red winter wheat end-use quality. This variety is also an awnless wheat, which means it does not have the bristle-like awns found on most wheat, making it better for multipurpose production uses such as cattle grazing, grain production and hay production. It's estimated that over 100,000 acres are grown annually.



St. Augustine grass.

AgriLife and Licensees: Turfgrass

Not only does green grass appeal to us visually, but it serves an important environmental role, such as in soil stabilization, water conservation and pollutant filtration. The turfgrass programs at Texas AgriLife Research have developed many varieties and types of both warm- and cool-season grasses. Warm-season grasses include vegetatively propagated zoysiagrasses and St. Augustine varieties used throughout the southern United States in home lawns, commercial properties, golf courses and sports fields. Commercial production for resale of A&M System warmseason grasses are grown on over 2,500 acres across the southern

U.S. and internationally. Coolseason grasses include Texas *x* Kentucky bluegrass hybrids, creeping bentgrasses and turf-type annual ryegrasses. The scientists of Texas AgriLife Research and Texas Extension have helped solve turfgrass-related problems for years, using reliable research, extensive outreach educational programs, and statewide and county extension activities. Producers like King Ranch Turf and New Life Turf are working to bring these grasses to consumers.

AgriLife and Licensees: Peanuts

Researchers in the peanut-breeding programs at Texas AgriLife Research have concentrated their efforts on developing high-oleic peanut varieties in the runner and Spanish market classes for the southwest peanut production



Peanuts on the vine.

area of the United States. A high oleic acid-to-linoleic acid ratio in the peanut imparts desirable traits after it is roasted, such as longer shelf life for products. These peanuts also impart health benefits from more mono- and polyunsaturated fat in the diet. Two recently released high-oleic varieties are also resistant to many peanut diseases without sacrificing yield potential or quality.

These varieties are available through licensees in Texas and Oklahoma, including Golden Peanut Company, Birdsong Peanut Company, Clint Williams Peanut Company and Wilco Peanut Company.



AgriLife and Licensees: Potatoes

Robert Campbell, president of Cal-Ore Seed, Inc., and manager of Discovery Gardens, joined forces with Texas A&M potato breeder Dr. J. Creighton Miller to produce a superior russet potato for the American table. In 2001, they chose the variety TX1523-1Ru/Y, an early emerging potato with improved consistency, color and taste. The potato is now marketed in the United States and Canada under the name Sierra Gold.



AgriLife and Southern Gardens and Texas Citrus Board: Disease-Resistant Citrus

In early 2007, Texas AgriLife Research tested potential canker- and greening-disease-resistant citrus trees. Because the plants show promising results, Southern Gardens has begun a field trial of these trees in its Hendry County, Florida, citrus groves to see if they are commercially viable. Citrus greening disease is possibly the most serious disease of the citrus tree. Strains resistant to it could make a huge impact on the U.S. citrus industry. Texas citrus growers alone produce approximately 27,000 acres of citrus every year.



AgriLife and Ceres: Bioenergy Sorghum

Sorghum is a crop traditionally utilized in many different ways: animal feed, ethanol, molasses, syrup and beer. Sorghum, however, has the ability to become a cornerstone of the bioenergy industry by utilizing the grain, stalk, juice and leaves through clever manipulation in plant breeding. Ceres, Inc., has teamed with Texas AgriLife Research to produce an energy sorghum for maximal biofuel production via a variety of different processes.

Ceres and AgriLife Research are working together to expand their sorghum breeding efforts, cutting years off the development timeline and defining specific unique product types. Commercial quantities of the initial hybrids are now on the market and are available to supply the first cellulosic biorefineries now being planned.

Texas A&M and TIPS

Texas A&M University and the Texas A&M Institute for Preclinical Studies (TIPS) have worked together to fulfill TIPS's educational mission to provide advanced training to graduate and professional students in biotechnology. Texas A&M and TIPS also support degree programs that train students about regulatory issues within the field. Students gain valuable multidisciplinary training while helping TIPS provide research and services in drug and device development, preclinical studies and biomedical imaging.



MRI diffusion tensor image of the brain of a pig. Tracts represent neural fibers within the brain and allow researchers to understand how the brain is interconnected.

Texas A&M University Health Science Center (TAMHSC) through IRM and REPAIR Technologies, Inc.

The goal of the Institute of Regenerative Medicine (IRM) at TAMHSC is to bridge the gap between basic science and clinical use — bringing regenerative medicine and experimental cell therapeutics into real-world applications. IRM is working with REPAIR Technologies, Inc., to use stem cell research to create products that can help repair or regenerate tissues damaged by aging or disease. In particular, adult mesenchymal stem cells (MSCs) show promise in



reducing tissue inflammation and injury. Dr. Darwin Prockop first discovered adult MSC progenitors, stem cells that can make different tissue types. Using this research, IRM and REPAIR are working to bring regenerative medicine to the general public.

Dr. Darwin J. Prockop, director of Texas A&M Health Science Center College of Medicine Institute for Regenerative Medicine at Scott & White in Temple, conducts research using adult stem/progenitor cells.

TEES and CorInnova

TEES and CorInnova are working together to develop and market innovative devices to treat congestive heart failure. Dr. John C. Criscione, associate professor at Texas A&M, develops heart-assist technologies in the lab, and CorInnova transfers those important innovations to the marketplace. In 2009, Dr. Criscione received the Bryan Rotary Club/ Research Valley Commercialization Rising Star Award for his work in accelerating the commercialization of Texas A&M heart technologies.



Biomedical engineering associate professor John Criscione develops heart assist technologies by studying how mechanics — the study of force and motion in matter — applies to the biology of the heart.



Dr. Magnus Höök, director of the Center for Infectious and Inflammatory Diseases at the Texas A&M Health Science Center Institute of Biosciences and Technology in Houston, conducts research on the molecular pathogenesis of infections and inflammatory diseases. His lab is working to translate findings into new or improved strategies to prevent and treat infectious diseases.

TAMHSC and Extracellular Matrix Technologies (ECM Technologies), LLC

Designer collagens are proteins produced from bacteria that can be used in medical applications such as surgical mesh coating for hernia repair, adhesion prevention and other uses. Second-generation products could even be used with grafts, stents and patches. ECM Technologies, LLC, began with the core technology developed by Dr. Magnus Höök. ECM, the Texas A&M Health Science Center, Texas A&M University and the Baylor College of Medicine further developed the novel regenerative technology and fast-tracked it, working to put lifesaving products into the hands of practitioners. ECM's designer collagens have the potential to direct cell behavior, a desirable trait for many medical device implants.



3D visualization of Golgi-stained cell.

TEES and 3Scan

3Scan, headed by a former visiting student at Texas A&M University, is marketing an innovative technology developed and patented by the late Professor Dr. Bruce H. McCormick of TEES. The technology enables high-resolution, high-throughput imaging of large volumes of biological specimens. The submicrometer-resolution data can serve a variety of tasks, including neuroscience research, drug delivery and diagnostics. In addition to being cost effective and time saving, the technology dramatically changes the kinds of quantitative analysis possible for academia, biotech industries, pharmaceutical companies, pathology, histology, forensics and other disciplines.



In his lab, Dr. George C.Y. Chiou emphasizes research and clinical applications, including the development of drug therapies, to improve ocular health. He founded MacuCLEAR from his continuing work on treatments for age-related macular degeneration.

TAMHSC and MacuCLEAR

With \$1.7 million from private investors, TAMHSC and MacuCLEAR are developing therapeutic eye drops for agerelated macular degeneration AMD. Based on the research of Dr. George C.Y. Chiou of TAMHSC, the drug will be tested and submitted to the Food and Drug Administration.

AMD, which gradually destroys sharp, central vision, is the most common cause of vision loss in people over age 65. One form of AMD currently has no cure, while the second form requires invasive treatments that slow the progression of the disease but do not restore central vision. The relatively inexpensive eye drops being developed by MacuCLEAR increase choroidal blood flow in the eye, effectively preventing and reversing damage.

New Ventures Division



The Texas Center for Applied Technology (TCAT), a center under the Texas Engineering Experiment Station, works with industry to develop, implement, test, and field systems that integrate other technologies and products. Shown here is a renewable energy micro-grid system used in the Texas-Mexico border region to provide electrical service to non-grid connected communities called "colonias." Funded by the Texas State Energy Conservation Office and the Department of Energy, TCAT worked with Xtreme Power, Inc., of Kyle, Texas, to integrate the technologies needed to build the systems and to deploy them near Laredo, Texas. These systems are also applicable to provide emergency electrical service during disaster recovery or other contingency operations.

Matching Innovation with Opportunity

Unlike most universities, OTC forms companies and provides initial seed capital, hires a CEO, sits on the board of directors, and creates a corporation that is an opportunity for private capital investment. OTC doesn't start companies because we want to; we start companies because we have to.

New venture opportunities arise not only because the technology offers a chance for a large return in the marketplace, but also because the technology may not be ready for licensing due to lack of development. Using start-up companies as a way to attract funding to complete the transition of an invention into a product not only offers the opportunity for long-term return, but also brings short-term research opportunities to A&M System members. And more importantly, a start-up company may be the only viable path forward for a critical innovation. In rare but significant cases, some innovations bring something totally new to the table. Often what makes these discoveries valuable also makes them a challenge to commercialize. OTC's New Ventures Division can really make a difference in these cases.

"A researcher within the A&M System can only take his or her discovery so far in the laboratory," explains Saurabh Biswas, a business development manager in OTC's New Ventures Division. "But that may not be far enough for a corporation to license it because it may not yet be ready for the market."

Sometimes called the "valley of death," this phase between discovery and commercialization can be the most dangerous for discoveries with real market potential. Without funding to further develop the innovations, they can wither and die on the vine.

OTC's New Ventures Division works with A&M System researchers to create (or spin out) companies around new ideas or technologies. The new company then seeks funding from private investors to help build the bridge between the researcher's laboratory and a corporation's willingness to adopt a product for the marketplace.

"In a way, that new idea or technology is very much like a child put up for adoption," explains Biswas. "New Ventures can become the fostercare provider that nurtures the child until we find the right home for it."

Given the breadth of research within the A&M System, New Ventures fosters ideas across all business sectors, from biotechnology to agriculture to the oil industry. Fortunately, these "foster children" enter the private sector with a little help. The A&M System might elect to provide a modest amount of start-



Dr. Darwin J. Prockop at his offices in Temple. His research involves adult stem/progenitor cells from bone marrow known as mesenchymal stem cells, multipotent stromal cells or MSCs. The cells have the remarkable ability to home to injured tissues and repair them by a variety of mechanisms.

"In a way, that new idea or technology is very much like a child put up for adoption. New Ventures can become the foster-care provider that nurtures the child until we can find the right home for it."

> Saurabh Biswas, Ph.D. New Ventures Division

Benefits of Working with OTC's New Ventures Division

- Work with creative, flexible individuals focused on best routes to commercialization
- Help find research dollars to grow your discoveries
- Help attract high-tech businesses to the community
- Make a difference in the world

up capital to help a new spin-out company. This seed capital helps the company secure much more substantial private funding, which frequently immediately returns to the A&M System in the form of research dollars aimed at further developing the discovery.

The spin-out company becomes a sponsor for new Research and Develop within the A&M System, which can receive an immediate return on its seed investment. And the company and its private investors enjoy the benefits of further developing the technology within a world-class research institution, typically by the very research team that created it in the first place. Work by New Ventures can also positively impact the Bryan/College Station community when private-sector partners choose to locate near the birthplace of the innovation.

"The most important aspect of the companies we create is their ability to secure private funding to further develop these discoveries into commercially viable and valuable technologies," Biswas says. "More to the point, with the help of New Ventures, our researchers can make their mark on the world."

Helping the Medicine Go Down Easier

Ever heard the saying, "Sometimes the cure is worse than the disease"? When it comes to treating colorectal cancer, that's a very real concern.

"Chemotherapy, which is very effective in treating colorectal cancer, creates toxins in humans and animals often causing severe, debilitating diarrhea," explains Richard Scruggs, president and CEO of Salient Pharmaceuticals.

The problem is not limited to chemotherapy. Patients receiving radiation and antibiotics — as well as those suffering from infectious disease and many autoimmune diseases — often experience nausea, vomiting, cramping and diarrhea. These symptoms can lead to modification, and in some cases suspension, of the primary therapy. The thread common to these conditions is acute gastroenteritis resulting from gut injury and a storm of inflammatory cytokines. Cells produce these proteins in response to disease or infection, but too much cytokine production can actually create disease.

Formed in 2007, Salient is developing CASAD[™], an allnatural therapy for the prevention and treatment of severe diarrhea. CASAD is currently in Phase II human clinical trials specifically

aimed at assessing its capacity for mitigating the diarrheal side effects of chemotherapy. It is also the subject of a Phase II trial studying its applicability in infectious disease therapy.

So, how does it work? CASAD absorbs diarrhea-causing toxins in the intestinal tract to reduce the body's natural reaction to chemotherapy, infectious disease and other conditions. For example, CASAD has proven effective in absorbing Toxins A and B elicited by *Clostridium difficile*, one of the most common infectious diseases with a high incidence of diarrhea. In an *in vivo* study involving 23 cancer-bearing dogs, CASAD stopped intractable diarrhea within 48-72 hours in 65 percent of the animals.

"This is a platform technology," says Scruggs. "Easing the treatment burden on colorectal cancer patients is only the first of many potential advances in improving patient health." Salient believes that speeding gut injury healing and quieting the cytokine storm will reduce gastroenteritis, improve the odds for the primary therapy's success and enhance the patient's quality of life.

"This is a platform technology. Easing the treatment burden on colorectal cancer patients is only the first of many potential advances in in improving patient health."

Richard Scruggs, President and CEO Salient Pharmaceuticals CASAD could also potentially shorten hospital stays (thereby reducing treatment costs for both the patient and the health care industry as a whole) and, ultimately, help restore patient

health. Worldwide, diarrhea is the number one cause of death in children. The CASAD technology has the potential for ameliorating this sad truth, from possibly easing the side effects associated with eating tainted food in countries where few nutritional options exist to enabling the successful application of numerous medical treatments.



Founded: 2007



Time Line for CASAD Development

- **2009:** Launched Phase II human clinical trial for chemotherapy-induced diarrhea
- **2010:** Launched Phase II human clinical trials for Clostridium difficile
- 2011: Phase II clinical trials complete; Pursue Alliance/Licensing or Acquisition opportunities
- **2012:** Expand indications; Conduct additional Phase II/III human clinical trials

"We provide the opportunity for A&M innovators to see their ideas and discoveries have a measurably positive impact on the world. That's why we're here."

> Peter Schuerman, Ph.D., Licensing and Intellectual Property Management

A key advantage that companies have when they work with A&M System members is that they can not only access some of the best scientists and research capabilities in the world, but can also access real-world testing facilities operated by A&M System members. Not only can companies license novel fireretardant chemicals from our researchers, they can also test those products at the Texas Engineering Extension Service (TEEX) fire field. Not only can novel biologic drugs be licensed from A&M System researchers, they can also be manufactured for trials at the National Center for Therapeutics Manufacturing. This practical, translational research across a broad array of technical areas is a unique resource that companies can access by developing relationships with A&M System members.

Texas AgriLife Research and Extension Center Irrigation Facility

The Texas AgriLife Research and Extension Center Irrigation Technology Center provides information about efficient irrigation and water conservation while coordinating irrigation research and extension programs. The Center offers continuing education classes to industry professionals and provides potential evapotranspiration (PET) data and weather summaries from 28 Texas stations. The Center's research and education services help districts operate efficiently, improving their management systems and evaluating the need for district rehabilitation projects. The Center has created a simulation of the waterdistribution network — based on geographic information systems — so that districts can plan, manage and optimize the way they serve their customers.

Indre Pemberton, a research associate with Texas AgriLife Research, downloads data from an automated weather station. The data from the station, which is located at the Texas AgriLife Research & Extension Center at Overton, is used to calculate potential evapotranspiration or PET. Such information is used by irrigators to precisely prescribe how much irrigation water should be applied. Data are also daily posted on the Center's Web site at http://etweather.tamu.edu/. Photo courtesy of Texas AgriLife Research.





CT study of a pig. Soft tissue (muscle and fat) has been electronically removed so the lungs can be evaluated for a suspected case of pneumonia.

Texas A&M Institute for Preclinical Studies

TIPS focuses on providing research and core services in device development, preclinical studies and biomedical imaging. Using a multidisciplinary approach and including graduate and professional students, TIPS improves the effectiveness and efficiency of drug and device development from the early stages through clinical trials. Their projects include testing new magnetic resonance imaging gadolinium contrast agents and implanted medical devices and therapeutics. The Institute has performed its first open-heart bypass surgery to implant a new cardiac device and continues research into osteosarcoma, hemorrhagic shock, cancer and other diseases.

Applied Research

Successful testing of an "in-house" designed wedge barrier paves way for overcoming systemic problems of many commercially-available systems. The D-T Barrier completely stopped a 15,000-pound medium duty truck that impacted it at 50.5 mph. The truck's cargo bed did not travel beyond the barrier's leading edge signifying the D-T Barrier met DS requirements for vehicle anti-ram performance. Photo courtesy of Richard Badillo, TTI.

TTI Roadside Safety and Physical Security Division

Along with helping to save lives by reducing injuries and fatalities from traffic crashes, research results produced by TTI's Roadside Safety and Physical Security Division also help protect U.S. embassies and other key strategic resources from physical attack. TTI researchers identify, analyze and develop both roadside safety solutions and barriers to protect against vehicular assaults on structures. Using clinical analysis, computer simulation and crash testing, the institute has develop roadside safety equipment such as guardrail end treatments, concrete barriers, median cable barriers, crash cushions and breakaway sign couplings. Rapidly deployable bollards, drop arms and wedge barriers have also been successfully developed and tested for the U.S. Department of State and various private sponso The Texas A&M University System has the ability to partner with industry and municipalities to license, test, develop, and deploy technologies to improve infrastructure capabilities. Shown is a 50,000 gallon per day Advanced Vapor Compression Desalination water treatment pilot plant for the City of Laredo developed by Terrabon, Inc., under license from The Texas A&M University System. The project was managed by The Texas Center for Applied Technology, a center under the Texas Engineering Experiment Station.

TEES TCAT

The Texas Engineering Experiment Station TCAT provides innovative engineering solutions to solve real-world problems. TCAT's core competencies incorporate basic and applied research, development and prototyping, and application. For example, TCAT has developed groundbreaking technology and methods to desalinate and purify water, turn cafeteria scraps into gasoline, isolate and correct leaks in aircraft fuel systems, and optimize warehouse and business operations. The center helps develop commercial products, build prototypes and conduct realtime, real-scenario performance testing. The Texas Engineering Extension Service's Disaster City® often serves as a test bed for new technology. Since 2005, the National Institute of Standards and Technology (NIST) has conducted annual robot evaluation exercises at Disaster City to evaluate emerging robotic capabilities for use by emergency responders. Ground-, air and sea-based robots are provided realistic disaster scenarios and situations allowing evaluation of their real-world capabilities. Photo courtesy of TEEX (www.teex.org).

TEEX Product Development Center (PDC)

The Texas Engineering Extension Service PDC brings inventors, researchers and subject matter experts together with businesses and manufacturers to promote economic growth. As part of the U.S. Department of Homeland Security program, the center has developed partnerships to assess, test and evaluate products for emergency responders, as well as commercialized products developed by NASA researchers. Center projects include mobile command units for emergency responders, a prototype seatbelt knife and the Sentry 500 Mobile Utility System.



Janie Hurley, OTC Senior Licensing Manager

"One of the things I like about my job is the variety. We work with all of the A&M System members, but I also talk to external parties like industry, scientists and patent lawyers. When I was deciding what career path I wanted to pursue, I saw that variety as something that would always keep me interested. OTC encouraged me to stay. I believe in the work we're doing, which makes it easy to promote to outside parties."

> Janie Hurley, OTC Senior Licensing Manager

OTC must be about more than license income; it must impact the mission of A&M System members. Key to the mission of any university is education and opportunities for students. OTC works with students and brings the real-world problems of technology commercialization into the classroom through courses and student competitions. This immerses students in the challenging problem of identifying market applications for technologies that may have been developed with no market application in mind. It also connects OTC to the greatest asset in the A&M System, the students.

System technologies and spin-off companies are the basis of the Master of Business Administration Technology Transfer Challenge. OTC staff teach classes on technology commercialization and give guest lectures on intellectual property and commercialization. OTC works with students through assistantships and internships for class credit. Commercialization isn't separate and apart from the core missions of research and education. It's a tool leveraged to enrich the education and research opportunities for students and faculty.

The Key to Retaining Top Students: Keep It Interesting

As part of its goal to build and expand a world-renowned faculty, Texas A&M University recognizes the value of retaining its top students in its Vision 2020 initiative. Janie Hurley is one of those highachieving students. She began her career at the Office of Technology Commercialization as a graduate assistant in 1997.

"I received my B.A. in biomedical sciences at Texas A&M and was studying for my MBA," says Hurley. "Like most of my fellow students, I'd planned to get a job in the private sector."

But in 1999, Hurley saw an opportunity that she couldn't pass up. Her time as a graduate assistant had fired her curiosity, drawing her into the work of OTC.

"At the time, it was a small office," says Hurley, "and I learned every aspect of the job of a licensing associate — working on contracts, doing market research, talking with scientists about the technology, writing abstracts. I found it fascinating. We had so many different types of cutting-edge programs and projects. I was so interested that I decided to stay at the A&M System and become a licensing associate full time."

Her time as a biomedical student was well spent as she worked in the agriculture and life sciences area at OTC, which looks to improving plant varieties and inventions. She quickly went from a licensing associate to a licensing manager, and then to her current position as a senior licensing manager. In 2009, she won the Outstanding Employee Service Award.

"One of the things I like about my job is the variety," says Hurley. "We work with all of the A&M System members, but I also talk to external parties like industry, scientists and patent lawyers. When I was deciding what career path I wanted to pursue, I saw that variety as something that would always keep me interested. OTC encouraged me to stay. I believe in the work we're doing, which makes it easy to promote to outside parties."

Hurley has continued the practice of keeping Texas A&M's best and brightest at the University. She mentors the licensing managers and students and works with student competitions by providing technologies for MBA students to commercialize in their business plans.

"Staying at the A&M System and OTC has been a good career choice for me," says Hurley. "Fostering research that has application in the real world is rewarding work, and every day brings me something new." ▲



Global Initiatives

A Shrinking World of Growing Opportunity

A Final Word from Brett Cornwell The world isn't as big as it used to be. Business destinations that once took days or weeks to travel to are mere hours away. In fact, business travel itself is no longer necessary in many cases thanks to the Internet and virtual meetings. As the world has shrunk, the global economy has become more complex. That term global economy no longer describes a loose collection of national economies tied together by international trade. As trade barriers fall and more traditionally nationalistic interests give way to global financial opportunity, countries are becoming ever more interdependent on one another for their economic vitality.

A World-Class Institution with a Global Vision

Through its Born Big initiative, The Texas A&M University System recognizes this brave new world. Specifically, the A&M System embraces a broader perspective, recognizing that research solutions to real-world problems might be born locally. Problems like global poverty, widespread hunger and the need for basic health care beg for great minds to help solve them.

To make those solutions a reality, OTC develops relationships with international universities, governments and service providers that connect local opportunities, resources and research and development capabilities with innovative minds at the A&M System and financial support from American industry. When we commercialize a promising technology at OTC, we do so with the goal of implementing that solution wherever — and everywhere — it's relevant.

Matching Opportunity with Innovation

The A&M System is a global leader in areas such as agriculture and food products, petroleum research, bio-fuels and rural health. These areas of commercialization match up well with the economies of partners like Mexico, India, China, Russia, Portugal, Qatar, South Korea, Australia and Belgium. We're convinced there are many mutually beneficial alliances out there, just waiting to be forged.

For example, many developing countries are growing faster - and offer greater growth opportunities to small companies and local entrepreneurs - than their moredeveloped sister nations. These fast-growing economies allow start-up companies to compete with less direct competitive reaction than slowergrowing economies do. This also means that new capital is pushing the developing economy. Start-ups based on high-quality technology and aided by the resources of a strong private-sector partner can access that capital and compete favorably while developing the marketplace itself.

T exas, in general, and the region around Texas A&M University specifically, have grown faster and with more strength than the U.S. economy. In fact, our local region continues to grow exponentially in its ability to attract venture capital and entrepreneurs. This makes Texas A&M and the local community ideal for fostering global alliances that can successfully commercialize A&M innovations in the world marketplace.

With the A&M System's vision guiding it, OTC — through several startup companies described in this annual report, including MacuCLEAR, Salient Pharmaceuticals and PHluorescent Technology, has begun exploring these international opportunities. Below we describe how Global Biodiagnostics mig make a difference in your small part of the globe. As you read about that, ask yourself if there's a way you can partner with the A&M System to help shape a better future for yourself and your world.

Global BioDiagnostics: The World Is in Our Hands

You've seen the documentaries. Images that make even the toughest viewers wince.

Young children in Africa with distended bellies from malnutrition. Elderly women, emaciated and dying on cots in India. The after effects of natural disasters — destruction, disease and death.

While we can't prevent the natural disasters, we can lessen the tragedy that follows in their wake. Innovative research at the Texas A&M Health Science Center's College of Medicine and effective implementation of that research around the globe are keys to making that happen. Traditionally, problems like health care development costs have challenged groups like the World Health Organization (WHO). Global BioDiagnostics (GBD) is

working to change that for tuberculosis (TB), a preventable disease.

"We're working with the WHO, the Foundation for Innovative New Diagnostics and Doctors Without Borders, among

others, to innovate cost-effective solutions to the TB health care crisis around the world," explains CEO Michael T. Norman. "We tailor our solutions to local needs by developing products and processes that fit well in a given market — India, Africa or wherever they're needed." The WHO estimates that someone dies from TB every 15 seconds; that's 2.1 million people every year.

Smear microscopy, the primary screening test for TB, requires large numbers of bacteria to render a positive diagnosis. Bacteriological culturing, the "gold standard" for diagnosis, can detect as few as 10 bacteria but takes 3 to 6 weeks to complete diagnosis.

Based on a groundbreaking innovation from Dr. Jeffery Cirillo in the Texas A&M Health Science Center College of Medicine, GBD is developing a rapid TB Diagnostic Assay that has the potential to be the first ever easy-to-use, low-cost TB diagnostic that can be deployed in the Point of Care setting. This new diagnostic process has the potential

to make a huge

diagnostic market.

More to the point,

it has the potential

impact in the

\$900 million

global TB

to help save

millions of lives

by more quickly

"In 50 years, I want our grandchildren to look back at what we've done at GBD and say, simply but truthfully, 'They helped save millions of lives, especially among the world's poorest people."

> Michael T. Norman, CEO Global BioDiagnostics

> > diagnosing TB, leading to better TB treatment.

What makes GBD unique is its game-changing approach to developing its products. Traditionally, large companies develop drug therapies and diagnostics in the United States and Europe, then attempt to sell them worldwide. But



Founded: 2009

Time Line for the Rapid TB Diagnostic Assay

- **2011:** Complete in-vitro trials and assay optimization
- **2012:** Complete pre-clinical trials and validate assay design and durability
- 2013: Complete WHO regulatory trials; begin first commercial sales
- 2014: Cash-flow positive

The World Health Organization estimates that someone on Earth dies of tuberculosis every 15 seconds; that's 2.1 million people every year.

GBD is commercializing a diagnostic tool that has the potential to help save many of those lives.

one size doesn't fit all when it comes to worldwide diseases. The "global market" is really a collection of smaller markets, each with its own unique set of needs. Guided by the WHO's best practices and insight into the global market, GBD finds consumer-driven solutions that are easy to use and affordable for local practitioners and patients.

For a man so oriented to the practical needs of the global diagnostics market, Norman has a philosophical take on GBD's legacy: "In 50 years, I want our grandchildren to look back at what we've done at GBD and say, simply but truthfully, 'They helped save millions of lives, especially among the world's poorest people."

26 ▲ Making Connections: Office of Technology Commercialization

The Texas A&M University System

Office of Technology Commercialization

800 Raymond Stotzer Parkway, Suite 2020 College Station, Texas 77845 979/847-8682 Fax 979/845-1402 otc.tamu.edu

Annual Report on Extramural Funding and Technology Commercialization

Rathindra Bose, VC/VP for Research and Technology Transfer



DOR Guiding Principles

"For I dipped into the future, far as human eye could see, Saw the Vision of the world, and all the wonder that would be." - Tennyson

> "Knowing is not enough; we must apply. Willing is not enough; we must do." – Goethe

Top American Research Universities

- 1. Total Research Expenditures
- 2. Federal Research Expenditures
- 3. National Academy Membership
- 4. Faculty Awards
- 5. Doctorates Awarded
- 6. Postdoctoral Appointees
- 7. National Merit and Achievement Scholars
- 8. Endowment Assets
- 9. Annual Giving
- 10. SAT Scores

UNIVERSITY of HOUSTON RESEARCH

How are we doing?

• Significant increase in Federal Awards

(\$69.4m in FY12, \$49.8m in FY08)

Nationally Ranked No. 38, National Academy Members
(12 NAS/NAE members associated with UH)



- Nationally Ranked No. 53, Doctorates Awarded
- **Eight NSF CAREER Award Recipients in FY12**
- Nationally Ranked No. 34, Royalty Revenue

(Ranked No. 11 among U.S. public institutions, Ranked No. 1, in ROI among Texas institutions)

Summary of Accomplishments-2012

Proposals Submitted: \$500.9 million (1172 Projects) Awards Received : \$106.9 million (786 Projects) Royalty/Licensing Revenue: \$12.5 million Active U.S. Patents: 152 Pending Patents: 159 Fulbright Scholars: 3 **NSF CAREER Awardees: 8**



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Five-Year Extramural Awards and Expenditures



UH SYSTEM

Total Research Expenditures, as reported to NSF



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Funding Trend from For-Profit Entities (UH)



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Royalty Income: Five-year Trend (UH)



UH Energy Enterprise: An Overview



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Funding for Energy Projects

Total UH Energy Awards FY 2009 to FY 2012, by cluster: \$122.91 million



UH Energy Awards



Workforce Training

UH is developing a center for energy education and training, with funding by the Department of Energy, Electric Power Research Institute, Texas Workforce Commission, and University of Houston.



UH Health Enterprise: An Overview



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Funding for Health/Life Sciences Projects

FY 2009 to FY 2012



Health/Life Sciences Awards

Total UH Health/Life Sciences Awards FY 2012: \$31.6 Million





"I do not believe that the wireless waves I have discovered will have any practical application."

Heinrich Hertz,
discoverer of radio waves

Protect IP!

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UH Intellectual Property by Commercial Sectors



Energy-Related UH Intellectual Property



Superconducting Wires & Cables-Dr. V. Selvamanickam

Thin film superconducting wire for energy applications

- > Thin film superconducting wire can carry 300 times more current than copper wires
- High power wind turbines & off shore platforms.
- Magnetic Energy Storage with rapid charging & discharging
- > More efficient electrical equipment with long duration
- Radiation Shielding in space craft



Improved performance, lower cost superconductor wire manufacturing



High Efficiency Energy Applications

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High Efficiency Solar Cells-Dr. Alex Freundlich

Markets Needs and Applications:

Direct replacement to existing tandem devices without need for retooling/changing manufacturing standards

Space Photovoltaics

- Market 100% III-V tandem devices, current devices 33% efficient with active device thicknesses>16 microns.
- Market size \$2-3 B



Technology Enables Thinner (4-5 fold thinner) and more efficient (>40%) devices: mission enabling panel size reduction

Terrestrial Concentrator PV

- Market uses currently 75% III-V tandems devices
- Market Size ~<0.1% of the current \$100B PV market. Expected to reach >\$10B by the 2020.



Technology enables more Efficient devices (>50%) with cost comparable or lower than existing technologies. Significant BOS cost reduction.

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Anti-Epileptic Drug- Dr. Harold Kohn



Veronica Crowe, an epilepsy patient who has been seizure-free using lacosamide monotherapy.



LACOSAMIDE (Vimpat[®])

Approved in 34 countries for adjunctive therapy for partial-onset seizures in adults.

Current trials:

- (1) pediatric partial-onset seizures
- (2) monotherapy for partial-onset seizures
- (3) generalized seizures

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Breast Cancer Monitoring Device- Drs. A. Brazdeikis and Q. Pankhurst



sensor + magnetic tracer



UCL/UH – Spin-off Endomagnetics Ltd.



Globally, 1.25 million new cases of breast cancer are diagnosed each year, and the rate is increasing by nearly 20,000 cases year on year. The SentiMag – a new surgical instrument for use in the treatment of breast cancer

New technology is now available in EU

Multi-target Cancer Therapy-Dr. R. Bose



Carboplatin (a leading drug in the market) administered by IP (60 mg/kg) to tumor inflicted SCID mice (left) and after 9th day post 2nd IP (center and right)



Control on day 1

10mg/kg active p1 Post 2nd IP injection 15mg/kg active p1 Post 2nd IP injection

Excellent efficacy against ovarian, lung, and head & neck cancers with minimal toxicity!

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Strategic Goal

\$200 Million Research Expenditure by 2020

Increase federal funding

(highly competitive endeavors)

- Center grants
- Multi-disciplinary grants
- Applied/Translational Research

Increase funding from forprofit entities

Increase Royalty income

Invest in STEM fields

- recruit excellent faculty
- provide ample start-up
- build core facility

Create adequate infrastructure Aggressively commercialize technology

Meet Houston regional needs
Where should we invest?

An example of unprecedented returns: The Human Genomic Project



Economic Impact of the Human Genome Project

How \$3.8 billion investment drove \$796 billion in economic impact, created 310,000 jobs and launched the genomic revolution

Prepared by Battelle Technology Partnership Practice May 2011

The \$3.8 billion spent on the HGP may well represent the best single investment ever made in science.

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Recent Investment



New Facilities



Science & Engineering Research Center



Health & Biomedical Sciences Center

Planning Phase: Pharmacy Science Multidisciplinary Research & Engineering Building



How Engineering College is doing.

National Academy Members

(9 NAE members in the College of Engineering)





















- Six NSF CAREER Award recipients in FY12
- No. 1 in Federal Funding among colleges

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Stellar Recruit



Dr. Bonnie J. Dunbar

- **Retired Astronaut**
- NAE Member
- Director, UH STEM Center

Multidisciplinary Research and Engineering Building

A NEW BUILDING is urgently needed to address the shortage of quality research laboratory space in Engineering and foster collaboration across campus, minimize investments in multiple and redundant instrumentation facilities, house core facilities in a neutral location, and to sustain and enhance research growth.



Proposed Activities in New Building

Core Facility includes

High performance computational facility High-end multi-dimensional imaging facility Proteomics and genomics facility State-of-the-art mass spectrometry facility High-field NMR spectrometer

Engineering Facility includes

Research laboratories for Engineering faculty Hands-on laboratory experience for graduate and undergraduate students

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Building Basics

- 120,000 GSF
- 4-story
 - 37% lab space
 - 15% office/tech space
 - 4% common space
 - 6% shell space
 - 38% building support



