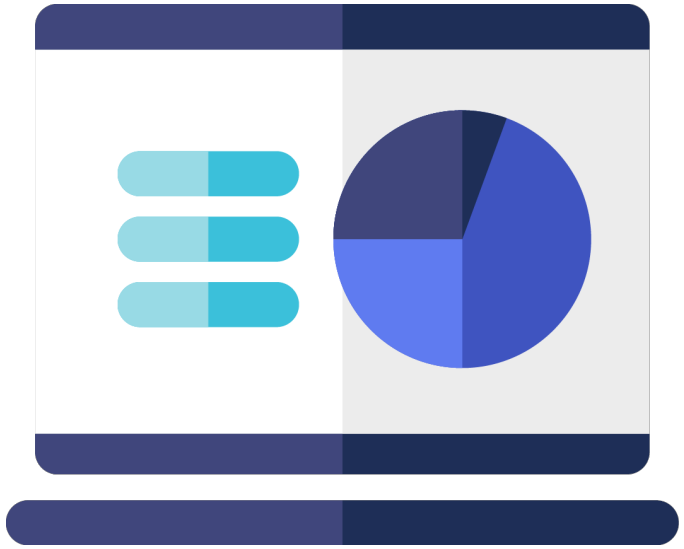


Gathering Data for Commercial Applications

Gina McMillen, DVM, PhD
Director, Office of Technology Development

Annie Smith, MBA
Growth Fund Coordinator, Office of Technology Development

Innovation to Impact | November 2017

Overview

- The Data Disconnect
- Data for Patent Claims
- Commercially-Relevant Data
- Funding To Bridge the Data Disconnect

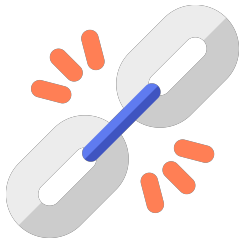
The Data Disconnect



ACADEMIA

Focused on gathering data to support **fundamental knowledge advancement**

Grant applications • Discovery
Publications • Patents





INDUSTRY

Looking for solutions to **well-defined problems with commercial potential**

Product Development
Commercially-relevant data • Patents

What Drives Science May Not Drive Business

The Data Disconnect



GOAL

Transition innovation from research lab to industry for development into products & services for broader impact



REWARDS

- Publications
- Funding
- Prestige
- License revenue

Successful Innovation

Understand your innovation and where it fits in the market

- Are you a new solution to an existing problem?
- What is your innovation most likely to be used for?
- What already exists?
  - Does it solve the problem?
  - Do you solve the problem better, cheaper, or faster?
  - Is your solution feasible?
- What are other potential uses of the innovation?
- Who is already in the space? Who may enter soon?
- What is the intellectual property in this space?



Exploring the product-market fit can guide data generation

Data for Patent Claims

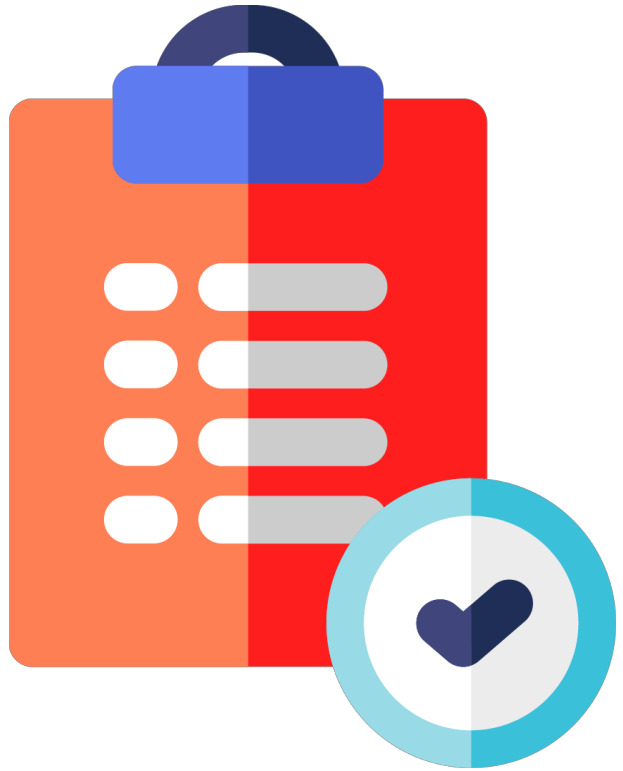
Depends on what you want to claim

"the claimed invention must be enabled so that any person skilled in the art can make and use the invention without undue experimentation" 35 U.S.C. 112(a)

- Description of how to **make** the invention
- Description of how to **use** the invention

Breadth of data determines the breadth of claims

- The devil is in the details
- Working examples for all embodiments
- Goal is a broadly enabled invention



Chris Corbett, Ph.D., Director of Intellectual Property is a resource

Commercially-Relevant Data

MRSA Treatment with β-lactams

Tech ID: 15NOR033

Technology Type/Class: Therapeutic/Drug Repurposing and Rescue
Mechanism/Modality: Inhibition of Wall Teichoic Acid Functionality
Application: MRSA, Antibiotics, Superbugs

Technology Background

Methicillin-resistant *Staphylococcus aureus* (MRSA) poses a serious threat to human health. Re-sensitization of MRSA to traditional antibiotic therapies may be preferred to the long-term and high cost of bringing new antibiotics to market. The β-lactam class of antibiotics bind to the active site of penicillin binding protein (PBP), thereby preventing bacterial cell wall crosslinks and facilitating death through cellular rupture. However, MRSA produces an alternative, PBP2a, that β-lactam antibiotics are unable to disable, thus essential cell-wall crosslinking is maintained. Compounds that disable PBP2a remain elusive. But targeting the PBP2a co-factor, wall teichoic acid (WTA), restores anti-MRSA properties to β-lactam antibiotics.

Technology Summary

This technology is based on a novel composition comprising β-lactam antibiotics and branched poly(ethylenimine) (BPEI) having efficacy against MRSA. *In vitro* and *in vivo* antimicrobial synergy of BPEI with common antibiotics (e.g., oxacillin, ampicillin, amoxicillin, meropenem) is shown against CA-MRSA and HA-MRSA strains. Examples are: MRSA USA300, MRSA 252, MRSA ST239, and MRSA USA 400. Results suggest that BPEI interrupts function of cell wall teichoic acid and PBP2a, thereby disabling the resistance mechanism. BPEI cytotoxicity has been assessed in murine fibroblast cells and human primary kidney epithelial cells. The *in vivo* half-life has been measured using a validated bioanalytical method.

In vitro study (Foxley et al., 2016) has demonstrated:

- BPEI binds to the cell wall where it can interrupt the function of teichoic acids, inactivate PBP2a, and restore β-lactam antibiotic activity.
- BPEI, administered in concert with ampicillin, resensitizes MRSA to ampicillin with a MIC of 1 μg/mL (superior to that of vancomycin MIC of 3.7 μg/mL).

In vivo study (unpublished) has demonstrated:

- 96% reduction in the MRSA bacterial load at dose of 2 mg/kg. Further dose testing is underway to achieve 99-99.9% reduction.

Differentiation Factor

Allows FDA-approved β-lactam antibiotics to regain their efficacy against MRSA



This technology brings dozens of off-patent antibiotics back under IP protection to gain a market advantage.

Development Stage: Research
IP Status: PCT/US2016/037799
Lead Inventor: Charles V. Rice, PhD

Engagement Contact: Meredith E. Wilkerson, PhD
Office of Technology Development
(405) 271-7725
meredith-wilkerson@ouhsc.edu

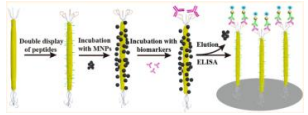
Magnetic Virus-Based Diagnostic

Tech ID: 15NOR043

Technology Type/Class: Diagnostic/Platform
Mechanism/Modality: Nanotechnology
Applications: Biomarker Identification, Analytical Platform

Technology Summary

This technology utilizes the filamentous fd phage as an analytical platform for sample enrichment and enhanced detection of serum biomarkers by ELISA. Two peptides (targeting peptide for capture of serum antibody and magnetic nanoparticle binding peptide for sample enrichment) are co-displayed on the viral nanofiber, facilitating enrichment of the phage-captured antibody complex via exposure to a magnetic field. The result is increased sensitivity and time efficiency. The technology has been demonstrated using 68 serum samples from *C. albicans*-infected cancer patients and 144 serum samples from healthy controls.



Construction of viral nanofibers: Two functional peptides are genetically displayed on a single filamentous fd phage. The resultant phage is decorated with magnetic nanoparticles and then captures the biomarker from the sera. The phage-bound biomarker is then magnetically enriched and biochemically detected (Wang et al., 2015. ACS Nano. 9(4):4475-83).

Differentiation Factor

- Quicker results and increased sensitivity compared to traditional blood culture and antigen-based methods (**6 hours vs. 5 days; and 1.1 pg/mL vs. 89.56 pg/mL**, respectively).
- Biomarkers are magnetically enriched first and then biochemically analyzed. Other methods are unable to enrich the captured biomarkers.
- Specific peptide can be designed for various biomarkers.

Development Stage: Research

IP Status: PCT/US2016/026031

Lead Inventor: Chuanbin Mao, PhD

Engagement Contact: Meredith E. Wilkerson, PhD
Office of Technology Development
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PPARα agonists for DR and AMD

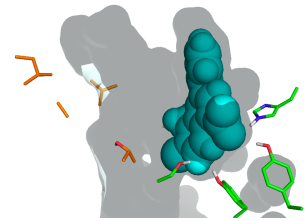
Tech ID: 16HSC043 / IP Status: PCT/US2017/030053

Technology Type/Class: Small molecule lead
Mechanism/Modality: PPARα agonism
Applications: Therpeutic lead for macular degeneration and edema

Technology Summary

PPARα agonism has demonstrated promise as a therapeutically viable option to address the major pathological features of macular degeneration and edema. To date, fenofibrate is the only PPARα agonist known to cross the blood-ocular barrier and provide protective effects against macular edema and neovascularization. Fenofibrate however, suffers from low ocular distribution, lack of target selectivity, and dose limiting toxicity, which will limit its use as an ocular therapy.

Researchers at OU have identifed a novel, structurally unique, and selective PPARα agonist. *PPARα* knockout experiments in mouse models confirm that PPARα expression is required for activity. Of relevance to macular degeneration and edema, the research team has demonstrated that the hit compound



- attenuates oxidative stress-induced apoptosis and retinal cell death *in vitro*
- inhibits angiogenesis *in vitro*
- decreases and protects against retinal vascular leakage in type I diabetic rats
- reduces leukostasis in type I diabetic rats
- reduces retinal neovascularization and VEGF expression in OIR mice
- exhibits protective effects on retinal photoreceptor function in streptozotocin induced diabetic rats.

Progress: The OU research team has commenced medicinal chemistry efforts to optimize the hit compound and has now developed new derivatives that are superior to both the initial hit and fenofibrate in both level of PPARα agonism and potency. Optimization efforts and paralleled biological evaluation continues.

Potential Therapeutic Utility:

- Wet age-related macular degeneration (AMD)
- Diabetic retinopathy

Development Stage: Research

Abbreviations: OIR: oxygen-induced retinopathy; **PPARα:** Peroxisome proliferator-activated receptor alpha; **VEGF:** vascular endothelial growth-factor

IP Status: Patent pending

Lead Investigators:
Adam S. Duerfeldt, Ph.D.
Jian-Xing Ma, Ph.D.

Engagement Contact: Gina McMillen, DVM, PhD
Office of Technology Development
(405) 271-7725
gina-mcmillen@ouhsc.edu

The UNIVERSITY of OKLAHOMA
Office of Technology Development

MRSA Treatment with β-lactams

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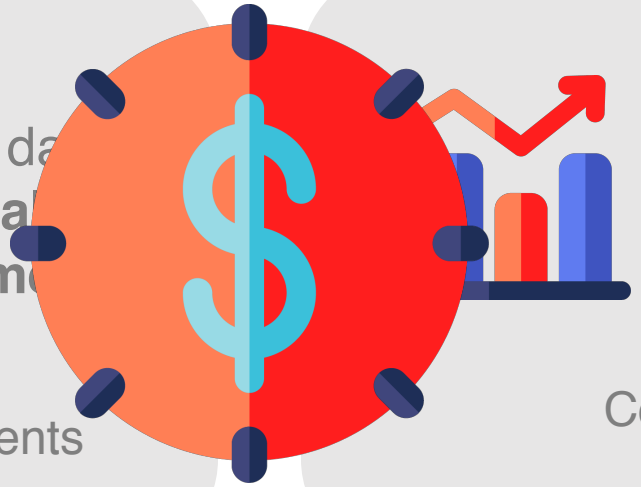
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Focused on gathering da
to support **fundamental**
knowledge advancem

Grant applications • Publications • Patents



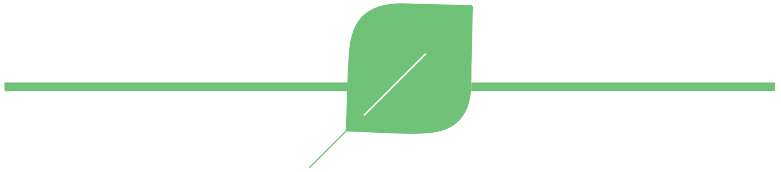
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GrowthFund

The UNIVERSITY of OKLAHOMA
Office of Technology Development



Move OU innovation closer to the market

Investing in innovation that is:

Solving a real need

Led by a strong team

Demonstrating a distinct advantage

Supported by relevant market feedback

Eligibility

- All OU inventors/researchers (faculty, staff & grad student)
- Shorter term, commercially-focused projects
- Must have a disclosure filed with the Office of Technology Development prior to application

Award Process

- Application opens in January 2018
- Finalists are selected for Full Proposal & Pitch (Feb/Mar)
- Full Proposal & Pitch Presentation (Apr)
- Awards Celebration – up to $50,000 (Apr/May)



New Antibiotics to Treat MRSA Infections

Further evaluate efficacy • Optimize dosing

ou.edu/otd/growthfund



Questions?