Academic Entrepreneurship and Innovation –

How Biomedical Informatics (BMI) Can Be a Transforming Agent

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Department of Biomedical Informatics
University of Pittsburgh School of Medicine

In partnership with Innovation Institute
• BMI is in a unique position to create a pipeline for software innovation from grants
• We need to support workflows which to foster and support faculty innovation
• We must recruit and train entrepreneurs
• Set targets & provide new incentives that reinforce this “new” academic career path
Academic Entrepreneurship and Innovation

The Impetus

- NIH funding is has stagnated while industry R&D has grown
- BMI needs to find other sources of funding
- We must reboot to promote industry collaboration
- Call to action!!!
- HIT needs us...
- **So do patients!**

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**Fig. 1** Growth in medical research funding by source from 1994 to 2012 ($, in billions)
How to Promote a Cultural Shift in Innovation
Leadership and Incentives

- Pitt’s new Dean of School of Medicine/Senior Vice-Chancellor for the Health Sciences, University Chancellor & UPMC Enterprises have launched partnerships in innovation & entrepreneurship.
- Biomedical Informatics at Pitt is home to the Center for Commercial Applications of Healthcare data focused on faculty innovation/commercialization.
- Pitt aims to incentify & promote tenured academic entrepreneurs.
- This model has relevance nationally to Depts of BMI.
Academic Entrepreneurship and Innovation Transform Training/Mentoring in BMI

- Mastering this innovation cycle will be a key attractant to creating a “pipeline” of talent to BMI
- BMI Summer Scholars program brings Innovation Interns to our new Center
- Faculty Mentorship & Training Programs will be key!!!
- Center for Commercial Application (CCA) of Healthcare Data
- Pittsburgh Health Data Alliance
The Life Cycle of BMI Innovation & Entrepreneurship

Flexibility and Speed of Software Innovation

- NIH, NSF Grant Funding
- CRADA SBIR/STTR
- De-Risk Technology
- Market Analysis Mgmt Plan
- Validation of Technology
- Adv Product Development
- Build Customer Base and Sales
- Acquisition or Buy Out

Licensing, Options, & New Company Creation

Health System & Local Biz Development

Early University Ecosystem Reliance

PI R&D Software/Algorithms

In partnership with Innovation Institute
The Life Cycle of BMI Innovation & Entrepreneurship

Innovation – IP, Investments and Upside

PI R&D Software/Algorithms

- NIH, NSF Grant Funding
- CRADA SBIR/STTR

IP Development Patents/Copyright

- Early University Ecosystem Reliance

Reinvestment in BMI R&D Software Engineering

- Licensing, Options, & New Company Creation

Capital Venture Investment

- Early Investment Angel or Regional

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The Value of Industry Academic Partnerships

- Early University Ecosystem Reliance
- Licensing, Options, & New Company Creation
- Capital Venture Investment
- Reinvestment in BMI R&D Software Engineering

PI R&D Software/Algorithms

- NIH, NSF Grant Funding
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- Acquisition or Buy Out
- Build Customer Base and Sales

Early Investment

- Angel or Regional Capital Venture Investment

Health System & Local Biz Development

- Adv Product Development
- Validation of Technology

Early Investment De-Risk Technology

- Market Analysis Mgmt Plan

IP Development Patents/Copyright

- CCA

Software Engineering

- IP Development
- Patents/Copyright

Software/Algorithms

- NIH, NSF Grant Funding
- CRADA/SRA SBIR/STTR
Cooperative Research and Development Agreements (CRADAs) and Sponsored Research Agreements (SRA) will be key!!!

- Non-Dilutive Funding
- Scientific/Clinical Expertise
- Market Knowledge
- Product Development Capital

Modified from Max Dizard, CCA team member
## Workflow: BMI Innovation & Industry Pipeline

<table>
<thead>
<tr>
<th>Stage</th>
<th>Basic R&amp;D</th>
<th>Translational Research</th>
<th>Seed Stage</th>
<th>Growth Stage</th>
<th>Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>T-2yrs</td>
<td>T=0</td>
<td>T+1-2yrs</td>
<td>T+3-4yrs</td>
<td>T+5-6yrs</td>
</tr>
<tr>
<td>Grant Funds</td>
<td>$2M</td>
<td>$1M</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Industry Investment</td>
<td>$0</td>
<td>$500K</td>
<td>$1M</td>
<td>$3M</td>
<td>$&gt;10M</td>
</tr>
<tr>
<td>Industry Ownership</td>
<td>0%</td>
<td>0%</td>
<td>60%</td>
<td>70%</td>
<td>80%</td>
</tr>
<tr>
<td>Product Revenue</td>
<td>$0</td>
<td>$0</td>
<td>$500K</td>
<td>$5M</td>
<td>$50M</td>
</tr>
</tbody>
</table>

Modified from Max Dizard, CCA team member
Tech Transfer in BMI has great potential but...

- Generate licensing revenue and new funding
- Recruit best students/faculty, create endowments
- Foster industry collaborations and partnerships

However:

In 2012, only 224 (0.56%) out of 40,007 active licenses generated more than $1M (AUTM U.S. Licensing Survey, 2013)
Academic Innovation & Entrepreneurship: Where are We Today? Our Solution

• **Solution:** We are doing this a Pitt BMI with an embedded “academic accelerator” sciVelo ([https://scivelo.pitt.edu/](https://scivelo.pitt.edu/)) to curate grant innovation portfolios to commercial success

• Staffed by bioengineering (BioE) and multi-disciplinary health sciences trainees and faculty

• Assist through entire innovation life cycle

• BMI + BioE partnership = pure gold!!!
Pitt BMI Invention Disclosure History

Nine Years

25% Approved
100% Denied

16 Months

2006-May 2015

May 2015-Now
Now Newco SpIntellx

PI: Chakra Chennubhotla PhD | Comp. and Sys. Bio. | Medicine
Co-PI: Lansing Taylor PhD | Drug Discovery Institute | Medicine
Founders–Jeff Fine MD | Pathology & Michael Becich MD PhD | Biomedical Informatics

- UPMC optioned SPDx/SpIntellx technology (pilot funding)
- Tech Development Progress (funding through CCA):
  - Breast atypical ductal hyperplasia (ADH) image dataset compiled
  - Spatial analytics for ADH implemented
  - Explainable AI user interface developed
  - Software platform branded as HistoMapr-Breast
  - HistoMapr-Breast 56% more efficient than a manual approach
  - More sensitive (88% vs 48%) than manual calls made by pathologists without HistoMapr-Breast
- Progress
  - NSF SBIR grant funded and successfully completed (2019)
  - Key partnership with CellNetix Pathology and Laboratories
  - Series of seed financings led by Newlin Investment
- Next Steps
  - HistoMapr-Breast final validation with CellNetix pathologists
  - Commercialize HistoMapr-Breast

**Intellectual Property Status:**
Strong IP portfolio for unbiased spatial analytics, explainable artificial intelligence (xAI) and spatial systems pathology. 7 Patents, Exclusive Licenses from Pitt, Trademarks and additional IP Pending

https://www.spintellx.com/
A cancer usually hosts hundreds to thousand genomic alterations. The foremost question:

**Which genomic alterations drive a patient’s cancer?**

TDI perform patient-specific inference to identify the drivers of a specific tumor

↑ Effective personalized targeted therapy
↓ Inefficient Treatment & Cost

**Identification of drivers makes genomic information actionable**

**Intellectual Property Status:**
Provisional Patent filed with USPTO in 2016
Newco launched in 2019 - DeepRX

**Clinical Tools**
**Personalized Cancer Medicine**

**The TDI System**

**Status:**
Clinical validation funded by ITTC in 2017 ($1M)
Coronary Artery Disease Intelligent Detection via Metabolomic Expression (CADidME)

PI: Vanathi Gopalakrishnan, PhD | Department of Biomedical Informatics

CADidME Solution: Precision CVD Risk Assessment

Patient presents at PCP or Cardiologist

Focus on individuals eliminates need for race-specific algorithms

Provider Experience

CADidME Machine Learning and Knowledge Base

Biomarkers (lipids, inflammation, etc)
Hypertension? Obesity? Diabetes?
Demographic Data
Medications
Phase 1: Metabolomic Data
Environmental Smoker?
Phase 2: Genomic Data
Family History

CADidME uses rule based learning on multiple data sets (metabolomics, phenotype, lifestyle, subclinical scores, genotype data) to characterize individual cardiovascular disease (CVD) events and outputs cardiology decision support for the proper diagnosis and management of CVD.

Intellectual Property Status: 3 Pitt Invention Disclosures filed 2019
Fall Sentinel – Nursing Home Fall Risk Reduction

**PI:** Richard Boyce, PhD | Biomedical Informatics | Medicine

- EHR used to continuously estimate falls risk
- Warnings triggered when fall risk increases
  - Falls-related injuries-deaths
  - Drug-drug interactions
  - CMS Penalties

**Intellectual Property Status:**
- ID# - Multifactorial Falls Risk Monitoring - Accepted 6/13/15
- ID# - Customized Clinical Informatics Framework – Accepted 9/13/15
A Voice-Interactive Virtual Assistant (AVIVA)

PI: Derek Angus, MD | Department of Critical Care Medicine
Co-I: Andrew King, PhD | Department of Critical Care Medicine
Co-I: Greg Cooper, MD, PhD | Department of Biomedical Informatics

A virtual assistant -
Frees ICU team from the computer and empowers teams to work at their highest level.

AVIVA (FHIR) app

AVIVA voice

AVIVA system

EHR

AVIVA app

Clinical knowledge

Data-driven learning

AVIVA FHIR-hose

EHR/other data

PHDA funded 2020-2021
Realtime Evaluation for Adverse Events using Intraoperative Neurophysiological Monitoring (READE IONM)

PI: Partha Thirumala, MD | Neurological Surgery
Co-Is: Shyam Visweswaran, MD PhD, Kayhan Batmanghelich, PhD & Jeremy Espino, MD MS | Dept. of Biomedical Informatics

- Developing machine learning algorithms to detect brain ischemia/stroke in realtime using electroencephalograph (EEG) during surgery.
- Current evaluation utilizes visual analysis of EEG.
- READE IONM algorithms embedded in the current monitoring software platform will enable reliable, objective and earlier detection of intraoperative stroke to allow for quicker intervention and better outcomes.

- Funded by PHDA CCA 2020-2021 ($0.5M)
- Completed First Gear program in 2020 to begin customer discovery
- Regulatory path verified by expert, plan in hand
- 2 Pitt Invention Disclosures filed in 2021

-status:
NewCo READE.ai with 4 co-founders being spun out in 2021.
Manage Engagement with Industry Partners
Map to UPMC Enterprise (PHDA/CCA) focus areas: **Clinical Tools**, **Pop Health**, **Consumer-Centric Health Care** and **Business Services and Infrastructure**

Speaker had SFCOI with Omnyx

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Omnyx™
A GE Healthcare and UPMC Venture

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Evolent Health

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Health Fidelity

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ImPACT

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Health Catalyst

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Innovation Institute

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Shire

Enabling people with life-altering conditions to lead better lives.
Measuring Expectations—The 20/20/20 Rule for Academic Entrepreneurship

What % of faculty should get involved in entrepreneurship?

What % of these faculty entrepreneurs should commercialize?

What % of entrepreneurs will leave to form new company?

20%

20% of 20% = 4%
Commercialize IP
Success = 7 figures

20% of 4% = >1%
Form a company

Copyright, Patent, or License option their IP @ Pitt = Tenured Entrepreneurs
Conclusions:

- BMI is in a unique position to create a pipeline for software innovation from grants.
- We need to support workflows which to foster and support faculty innovation.
- We must recruit and train entrepreneurs.
- Set targets & provide new incentives that reinforce this “new” academic career path.
- Pitt, UPMC & BMI are pushing the envelope...
Where We Are Going:
Pittsburgh Healthcare Innovation Ecosystem
For Further Information:

NOTE: e-mail me at becich@pitt.edu
- Additional questions/clarifications
- PDFs of articles mentioned and copy of PPT

**Academic Entrepreneurship & Commercialization – Pittsburgh Healthcare Data Alliance**

https://pitt.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=98c24706-2cf0-4175-8369-b9b236a2dede (Pitt only)

Pittsburgh Health Data Alliance (PHDA) - https://healthdataalliance.com/ (Public access)


Center for Machine Learning and Health - https://healthdataalliance.com/partners/carnegie-mellon-university/

First Six PHDA Projects Funded – Press Release March 22, 2016 -
http://www.upmc.com/media/NewsReleases/2016/Pages/phda-funded-projects.aspx

**DBMI Web Site** = http://www.dbmi.pitt.edu

University of Pittsburgh
Dept. of Biomedical Informatics