



# The Role of Research Centers in an Innovation Ecosystem

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# Challenge



How do you create an ecosystem that:

- Promotes the advancement of new technologies
- Focuses on commercialization, not basic research
- Encourages multi-institutional partnerships
- Executes multi-institutional legal agreements
- Provides for revenue return
- Remain sustainable?

# The NTI Model



How do you create an ecosystem that:

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- *Executes multi-institutional legal agreements*
- *Provides for revenue return*
- **Remain sustainable?**



# Statement of the Problem

“I don’t care if it’s nano, micro, yocto, groucho or zeppo; if it gets me to the FDA 10 minutes faster, I’m interested”

Source: WWVP, Business Development, Multinational Pharm Company

# Hype guarantees Problems



**“Science has cured every disease known to mice.”**

**(Dave Weiner, U. Penn)**

# NTI value proposition



The NTI value proposition derives from the combination of the following key elements:

1. Leadership team that integrates faculty, economic development experts, and university technology transfer officials;
2. Multi-university participation through a novel, comprehensive IP-pooling and revenue-sharing strategy;
3. Strategically-targeted funding programs to universities and companies that promote faculty-industry collaboration and prioritize university IP with commercial potential;
4. Dedicated staff for commercialization;
5. Extensive outreach, networking, information sharing, and marketing efforts.

Benefits accrued in the successful commercialization of nanotechnologies, increased cooperativity between and among partner institutions, establishment of new organizations modeled on the NTI program and real economic impact for the region in terms of company formation and job growth.

- Background and History
- Funding and Projects

# ***2012-2013 PIN Funding***



Center	Category	Timeline	Funding
Nanotechnology Institute (NTI)	Commercialization / Company Financing	2 Years	\$1,157,550
PA Nano Commercialization Center	Commercialization / Company Financing	2 Years	\$638,900
Lehigh University	Business Assistance / Commercialization / Workforce Development	1 Year	\$487,950
Penn State University - NMT	Workforce Development	2 Years	\$659,500
Penn State University	Equipment Acquisition / Business Assistance / Commercialization	2 Years	\$206,100



# Why NTI/ECI



- **The NTI was created in 2001 and the ECI created in 2009 with funding from BFTDA.**
  - The goal of the funding is to create new models for the commercialization of university discoveries.
  - NTI funded through Pennsylvania Initiative for Nanotechnology (PIN)
  - ECI funded through Pennsylvania Initiative for Energy (PIE)
- Regional goals included: catalyzing interest in & commitment to nanotechnology by area institutions & providing dollars & support for emerging enterprises commercializing nanotechnology and clean energy
- The NTI/ECI are the only multi-institutional models for nano & clean energy pioneered a joint technology transfer capability...impact for SEPA
- The NTI/ECI are the only university commercialization initiatives not managed by a university→aided focus on commercialization

# *The NTI Institutional Community*



## **Affiliated Institutions:**

- Children's Hospital of Philadelphia
- Fox Chase Cancer Center
- Harrisburg University of Science and Technology
- Lehigh University
- Millersville State
- Philadelphia University
- Temple University
- Thomas Jefferson University
- University of the Sciences
- Villanova University
- Widener University

# *The ECI Institutional Community*



## **Affiliated Institutions:**

- Harrisburg University of Science and Technology
- Millersville State
- Penn State
- Philadelphia University
- Temple University
- Villanova University
- Widener University

# *PA RapidNanoNet*



Carnegie Mellon University

Drexel University

Lehigh University

National Institute of Standards and Technology

Pennsylvania State University

University of Pennsylvania

University of Pittsburgh

# *The NTI Corporate Community—the CAG*



The CAG provides strategic direction to NTI programs, ensuring a focus on commercially relevant and realistic activities and goals

## **Affiliated companies/Members of Advisory Board**

- AccelBeam Pharma
- Angle Technology Ventures
- Arkema
- Harris & Harris
- LifeSensors
- Livingston Group/Axiom Capital
- Lockheed Martin
- Phoenix IP Ventures
- Rhodia/Solvay
- WoodcockWashburn

# Key Structural & Program Components



- Multi-institutional
- Joint tech transfer team with BFTP/SEP
- Inter-institutional agreements for IP, NDA, Confidentiality
- Revenue sharing model
- Programs targeted to create joint work with SMEs & large corporations

# *The NTI's Unique Legal Agreements*



- Common CDA-both Individual and Corporate
- NanoCommercialization Group
- Collaboration Agreement--MOU on Intellectual Property
  - Governance
  - Invention and License Procedures
  - Joinder Agreement
  - Inter-Institutional Agreement
  - Revenue Sharing Agreement

# *The NTI Collaboration Agreement*



- Everyone has a responsibility to share in any new IP and be permissive with access to any relevant background IP.
- The document codifies Governance and Management
- The document includes the language for royalties to NTI with reference to the formula in the IIA.
- The agreement has a term of 20 years, independent of any term limits imposed by a confidential agreement since there should be continuing royalties beyond 5 years and a requirement by NCG to continue to monitor all IP.



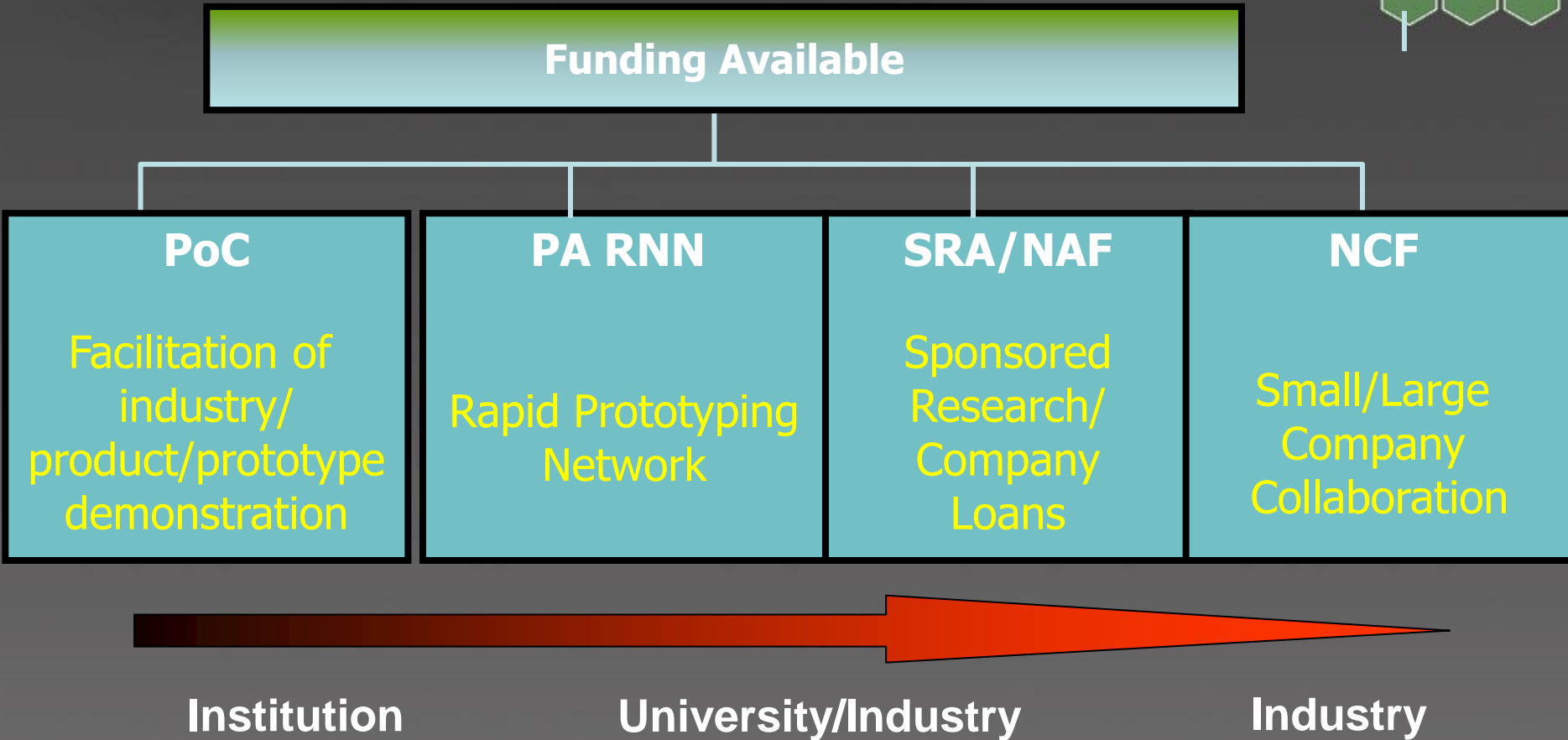
# ***The Role of the NanoCommercialization Group (NCG)***



- Dedicated Penn/Drexel tech transfer team; BFTP role
- “One-stop shopping” for license agreements
- Identify and market all nano-related IP among NTI institutions
- Manage IP disclosures, IP evaluation and patenting
- Increase potential of IP
  - Identify IP packages resulting in increased potential
  - Includes limited due-diligence
  - Provide Proof-of-Concept funding
- Help investigators engage with industry partners

# Funding and Projects

# *NTI /ECI Funding Structure*



# Company/Institution Funding Programs



## Translational Research Fund

**Eligibility:** Faculty at one of the NTI-affiliated institutions are eligible. Projects should increase the commercial value or alternative use of recent inventions and should show a clear path towards commercialization.

**Stage of Technology:** Must have IP (at least at Application Stage)

**Size of Award:** Up to \$150,000

**Institution Match:** Waiver of Overhead on projects <\$75K

# Company/Institution Funding Programs



## **NanoApplication Fund (NAF)**

**Eligibility:** Companies in Pennsylvania or willing to re-locate to Pennsylvania to work with one of the NTI/ECI-affiliated institutions are eligible. Projects should increase the commercial value or alternative use of recent inventions and should show a clear path towards commercialization.

**Size of Award:** Up to \$50,000

**Company Match:** 1:1 (50% cash minimum)

**Form of Investment:** Interest-bearing loan\*

**Institutional Partner:** NTI-affiliated academic institution. At least 10% of the budget must be contracted to the academic institution.

\*If principal repaid within 3 years, all interest is waived

# Company/Institution Funding Programs



## Matches for Sponsored Research Agreements

**Eligibility:** Researchers with an executed SRA with a for-profit company. All team members who receive funds must have Principal Investigator (PI) status at NTI/ECI-affiliated institutions.

**Size of Award:** Up to \$50,000 of matching funds per project subject to the following conditions:

- A match between 25 - 40% of the SRA for in-state companies

- A match between 20 - 33% of the SRA for out-of-state companies

- Final determination of % match to be made by Operating and Oversight Committees

# PA RapidNanoNet



## **Eligibility:**

Companies in Pennsylvania or willing to re-locate to Pennsylvania to work with one of the network facilities are eligible. Projects should increase the commercial value or alternative use of recent inventions and should show a clear path towards commercialization.

**Size of Award:** Up to \$10,000 per project

## **Match:**

A 1:1 cash match is required. Proposals that involve higher cash matching funds will be granted higher priority for selection.

***NTI/ECI Funded Projects:  
2008 - 2013***



<b>Technology Sector</b>	<b>No. Projects</b>	<b>\$ Funded</b>
Life Sciences Probes Sensors Delivery Biomaterials	27	\$2,050,000
Energy Generation Solar Storage Other	33	\$2,180,000
NanoMaterials Materials Devices Water	7	\$ 360,000



# ***NTI/ECI Funded Corporate Partners: 2009 - 2012***



<b>Technology Sector</b>	<b>Company Name</b>	<b>Location</b>
<b>Life Sciences</b>	Anima Cell Metrology	Bernardsville NJ
	CFD Research Corporation	Huntsville AL
	Keystone Nano	State College PA
	Leversense	Newtown Square PA
	Nano Blox (2)	Clarion PA
	Sunstones Biosciences	Philadelphia PA
<b>Physical Sciences</b>	ATRM/J&J	Raynham MA
	Exxon Mobil	Annandale, NJ
	FMC Corporation	Philadelphia PA
	Lockheed Martin	Cherry Hill NJ
	PChem Associates	Bensalem PA
	Rhodia	Bristol PA
	SFC Fluidics	Fayetteville AR
	Syngenta	Munchwilen Switzerland

# ***NTI/ECI Funded Corporate Partners: 2009 - 2012***



<b>Technology Sector</b>	<b>Company Name</b>	<b>Location</b>
<b>Energy/Water</b>	Accelbeam	Garnet Valley, PA
	Chevron USA Inc.	Richmond, CA
	Met-Pro	Harleysville, PA
	NanoBlox	Clarion PA
	Net Scientific America, Inc.	Philadelphia, PA
	PA Sustainable Technologies	Lehigh PA
	pChem	Bensalem PA
	Polymer Phases	Bristol PA
	Rhodia Inc.	Bristol, PA
	Viridity Energy	Philadelphia, PA
	Y-Carbon	King of Prussia PA

# Metrics and Deliverables

# Direct Impact Since Inception (NTI Alone)



Category		2000 - 2007	2008 - 2009	2010 - 2012	Total Since Inception
<b>IP Assets</b>	New Disclosures	169*	195	220	<b>821</b>
	Patent Applications		166	167	
	Issued Patents		19	54	
<b>Licenses (including Option)</b>		12	23	32	<b>67</b>
<b>Start-Up/Spin-Out</b>		11	11	21	<b>43</b>
<b>Jobs Created/Retained</b>		NR**	105	83	<b>&gt;200</b>
<b>Businesses Assisted</b>		NR	25	29	<b>&gt;60</b>
<b>Follow-on Funding/Leverage</b>		<b>\$160M</b>	<b>\$50.4M</b>	<b>\$73.3M</b>	<b>\$284M</b>

# Direct Impact Since Inception (NTI & ECI)



Metric	NTI	ECI	Totals
<b>Total funding since inception (in \$M)</b>	<b>\$23.5</b>	<b>\$2.2</b>	<b>\$25.7</b>
<b>Cumulative results since inception</b>			
IP Activity (Disclosures, Apps, Issued)	<b>830</b>	<b>184</b>	<b>1014</b>
Licenses	<b>67</b>	<b>28</b>	<b>95</b>
Start-up/spin-outs	<b>46</b>	<b>4</b>	<b>50</b>
Jobs Created/Retained	<b>234</b>	<b>84</b>	<b>318</b>
Companies Assisted	<b>69</b>	<b>39</b>	<b>108</b>
Follow-on funding/Leverage (in \$M)	<b>\$ 293M</b>	<b>\$ 43M</b>	<b>\$336M</b>

# Success Stories



## Translational Research Programs:

Three multi-institutional core programs funded between 2008-2011. All three technologies generated multi-institutional IP and all three have now been licensed.

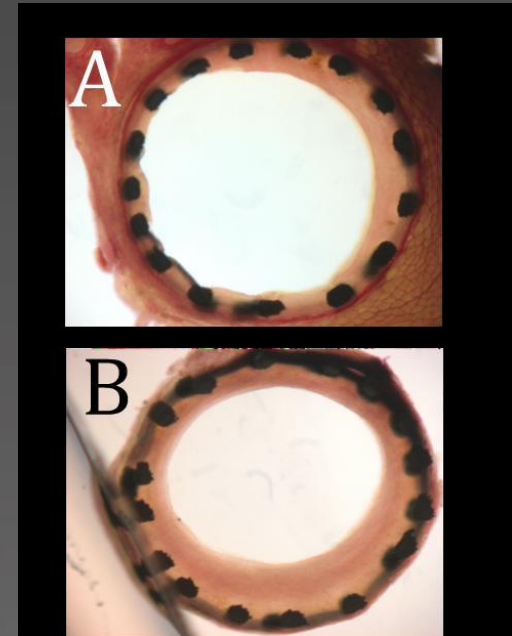
1. Nanoscale Cellular Probes  
*Penn*, Temple, Drexel
2. Array Piezoelectric Nanocantilever Biosensors  
*Drexel*, Temple, Fox Chase
3. Nanofibrous scaffolds  
*Drexel*, Penn, CHOP

# Success Stories



## Company Spin-out: Vascular Magnetics (CHOP)

1. Initial funding from NTI to Dr. Robert Levy (CHOP)
2. Follow-on funding from QED (Science Center)
3. Technology spun out to Vascular Magnetics, Inc.
  - First CHOP spin-out
  - Hired experienced CEO
4. Secured \$7M Series A from Devon Park Ventures



# ***Integration with Regional Translational Research Programs***



- **Wallace Coulter Foundation Endowment for Biomedical Engineering/Drexel University**
- **QED Fund/University City Science Center**
- **Innovator's Fund/Fox Chase Cancer Center**
- **Technology Commercialization Loan Fund/BFTP**



# ***NTI's Impact: The Model Works***

## **Comparison with National Proof-of-Concept Centers**



	<b>Von Liebig Center</b>	<b>MIT Deshpande Center</b>	<b>NTI</b>
<b>Location/affiliation</b>	Jacobs School of Engineering, UCSD	School of Engineering, MIT	13 Southeastern PA Research Institutions + BFTP/SEP
<b>Initial funding</b>	\$10,000,000	\$17,500,000	\$9,000,000
<b>Source</b>	Gift from the von Liebig Foundation	Gift from Jaishree and Guraraj Deshpande	PA Department of Community and Economic Development
<b>Grant sizes</b>	Seed Grants: \$15,000 - \$50,000	Ignition Grants: up to \$50,000; Innovation Grants: up to \$250,000	Up to \$120,000 for individual projects; \$750,000 for multi-institutional projects
<b>Number of funded proposals</b>	82	100	121
<b>Total amount of grants awarded</b>	\$4,600,000	\$11,000,000	\$17,094,492
<b>Number of licenses</b>	>6	>20	67
<b>Number of start-ups</b>	26	23	43
<b>Number of jobs created/retained</b>	>180	>400	>200      33

# *NTI's Impact: The Model Works*



2009 - 2011 Cumulative Data

	Start-Ups	Licenses	IP apps	Issued Patents	Licensing Revenue	Research Expenditures
University of Pennsylvania	16	222	1124	173	\$ 37,341,705	\$ 2,486,371,000
Drexel	8	51	195	60	\$ 656,998	\$ 332,509,517
Temple	4	11	36	7	\$ 1,964,444	\$ 323,678,871
Penn State	13	68	256	125	\$ 6,445,438	\$ 2,349,892,000
Lehigh	0	0	45	8	\$ 232,316	\$ 131,203,069
Carnegie Mellon	30	134	129	95	\$ 19,085,565	\$ 717,719,000
University of Pittsburgh	11	226	196	89	\$ 11,848,923	\$ 2,192,186,000
Purdue	28	248	436	157	\$ 13,969,409	\$ 1,697,460,000
Rutgers	21	242	303	89	\$ 15,355,881	\$ 1,077,512,404
U. Cal System	180	781	2805	884	\$ 389,588,798	\$ 15,276,719,440
U. Texas System	75	493	976	413	\$ 136,150,904	\$ 7,165,549,187
MIT	60	306	1696	500	\$ 211,770,000	\$ 4,266,447,000
NTI	20	36	223	28	\$ -	\$ 7,000,000

# Model Evolution



Phase I	Phase II	Phase III
2001 – 2007	2008 – 2010	2011- Present
Focus on early stage research	Move to later stage, pre-commercialization	No change
Life Science focus	Removed tech focus—all comers; Creation of ECI	No change
Multi-institutional	Decreased emphasis	Reduced emphasis further
First iteration of Collaboration Agreement	Second iteration of Collaboration Agreement	Expansion to include non-local and non-State entities
Beginnings of NCG	Fully functioning and staffed NCG	Reduced staffing
Non-optimal engagement with industry	Increased engagement: added FFS, SRA /NAF	Added RNN
Workforce	Eliminated	No change
<b>Budget Focus</b>		
58% early	51% early	0% early
42% later	49% later	100% later