TECH COMMERCIALIZATION AND BUSINESS DEVELOPMENT

Stephen G. Nappi
Associate Vice President
Innovation Surge
Fueled by Research Growth

In 2014, Temple joined the ranks of the top 100 research universities in the US.

- $257M in annual research expenditures
- 88th overall in federal research expenditures
  - 57th among public universities
- Highest growth among $100M research institutions from FY 2004-2013
  - $1B in annual requests
- Growth and diversity - 70% government funded, 10% industry & foundation funded, 20% of funding from all other sponsors
Innovation Surge
Fueled by Research Growth

### Key Tech Advancement Trends

<table>
<thead>
<tr>
<th>Year</th>
<th>Trend Description</th>
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<tbody>
<tr>
<td>2015</td>
<td>Inventions reach record high in 2015: 115 received, up from 60 or less in prior years</td>
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<tr>
<td>2015</td>
<td>Patent filings increase by 60% in 2015, followed by a record high 33 filed in 2016</td>
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<tr>
<td>2016</td>
<td>Commercialization deals (“technology transfers”) spike in 2016: 18 license/options signed, triple the amount compared to the prior year</td>
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<tr>
<td>2017</td>
<td>Startups reach a new high in 2016 and may double this year</td>
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### 2016 Stats

<table>
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<tr>
<th>Stat</th>
<th>Description</th>
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<tbody>
<tr>
<td>Inventions</td>
<td>90 Inventions received, 376 over past 5 years (39% of total), potential record high this year</td>
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<tr>
<td>Patents filed</td>
<td>33 Patents filed, 121 in the past 5 years (55% of total), potential record high this year</td>
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<tr>
<td>Patents issued</td>
<td>10 Patents issued, 52 in the past 5 years (25% of total), break out years projected in 2018-2019</td>
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<tr>
<td>License/Options</td>
<td>18 License/Options, 44 in the past 5 years (25% of total), break out years underway</td>
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<tr>
<td>Startups</td>
<td>4 Startups, 16 in the past 5 years (52% of total), break out year expected this year</td>
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<tr>
<td>Income</td>
<td>$1.2M in income, $14.9 in the past 5 years (53% of total), break out year projected in 2018</td>
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<tr>
<td>Investment</td>
<td>$357K invested in tech development resulted in $756K in funding to advance tech. $1.3M invested since 2014 resulting in $1.9M in external funding for a total of $3.3M directed to tech advancement over the past 3 years.</td>
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A significant increase in the rate of discovery has been met with a substantial increase in the rate of technology transferred to industry partners.
Tech Pipeline

Devices & Drug Delivery
- Microspheres for masking bitter taste
- Controlled release tech
- Tumor detection
- Removal of metallic items during surgery
- Infusion catheter for pulmonary embolism and DVT
- Reduction of blood viscosity
- Methods and devices for improving wound healing

Therapeutics
- Heart failure based on BAG3 regulation
- Eradication of HIV, JCV, HSV, and other viruses
- HR-deficient Cancers
- Insulin Resistance
- Dysregulation of dopamine receptor D3 for schizophrenia, drug abuse and addiction
- Skin disorders using SCFA
- Neurodegeneration and fibrosis
- Detection and treatment of brain injury

Tech & Materials
- Physician Compliance
- Antimicrobial Agents
- Short-wave infrared materials
- High-performance computing system
- Lithium Ion battery materials
- Virtual reality based rehab for balance impairment
- Smart glasses for better balance and mobility
Tech Pipeline

Discovery  Development  Field/Clinical Testing  Market

Therapeutics
- 5HT7 for IBD (BioSP/Janssen)
- Multi-tail phage for antibiotic resistant infections (BioSP/Janssen)
- Curli fibers for IBD (BioSP/Janssen)
- GLT-1 for ALS, cerebral palsy (Science Center, BioMotiv)
- Pulmonary Inflammation (BioSP/Janssen)
- Diagnostic and therapeutic for COPD (BioSP/Janssen)
- Nrf2 for treatment of Psoriasis (BioSP/Janssen, Phase 1 Ventures)
- New drug candidates for arthritis (BioSP/Janssen)

Devices, Tech & Materials
- Wearable thermo tech (AmpTech)
- AutoEEG for detecting seizure and related activity (Science Center, STTR)
- Disinfectant tech for antibacterial-resistant surfaces (Science Center)
- Chocolate viscosity reduction (AmpTech, Bloomer)
- Optical communication system (Coherent, Inc.)
- RoadMap for student performance (Microsoft)
- Advanced respiratory devices (AmpTech)
- Lithium Ion battery technology (Phase 1 Ventures)
**Tech Pipeline**

**Patient Impact**
- ESTYBON® in Phase III clinical trials for patients with:
  - Myelodysplastic Syndromes (MDS)
  - Acute myeloid leukemia (AML)
  - Chronic lymphocytic leukemia (CLL)
  - Solid tumors, including metastatic pancreatic cancer
- 6 additional products in the pipeline for the treatment of cancer and radiation injury

**Economic Impact**
- Temple spinout located in Newtown, PA
- Generating high-paying jobs with a workforce of 75 in 2013
- $200M in private investment
- The Commonwealth, through the Ben Franklin Technology Partners, provided $250K in seed funding

**Temple Impact**
- $13.5M received since 1999
- Tech Development Fund launched
- Incubation space secured
- Business development arm established
- Leveraging Temple’s drug discovery and translational research capabilities to develop new discoveries to benefit patients and the economy
QS Energy

OTCQX: QSEP

CHAIRMAN & CEO

QS ENERGY

TECHNOLOGY IMPROVES FLOW RATE OF CRUDE OIL PIPELINES

REDCHIP

Money Report

YOUTUBE CHANNEL
Tech Pipeline

- Discovery
- Development
- Field/Clinical Testing
- Market

- Insect Control
- Dental Burs
- Dental Burs
- CFS Test
- Building Materials
- MONQCLE
- hge Healthcare Solutions
- Temple University

Office of the Vice President for Research
### The Process!

<table>
<thead>
<tr>
<th>Research</th>
<th>Discovery</th>
<th>Protection</th>
<th>Marketing</th>
<th>Development</th>
<th>Contracting</th>
</tr>
</thead>
<tbody>
<tr>
<td>$236M+</td>
<td>115</td>
<td>35</td>
<td>100+</td>
<td>$500K</td>
<td>400+</td>
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**Research**
- Active and embedded Tech ID program to assist at the pre-discovery stage
- Practical Knowledge Series for outreach and education

**Discovery**
- Screening program to select tech with the highest commercial potential
- New tech analyst fellows

**Protection**
- Strategic IP protection to support commercial goals and potential products
- 5 primary law firms retained

**Marketing**
- BD arm to attract entrepreneurs and industry partners
- Alliances with MABA, PA Bio, NJTC, PACT, AHA, PICC, AUTM, LES
- Increasing use of social media
- 20+ tech com events

**Development**
- Tech Development Fund to engage companies and POC programs
- Alliances with BFTP, BioAdvance, Science Center, Osage, BioStrategy Partners

**Contracting**
- Rapid deal making by licensing professionals
- Central Industry Interface
- Reduce delays for agreements
- MTAs, CDAs, Industry Funding, Data Use, MOUs
COMMERCIALIZATION | Business Development
Temple University and Ben Franklin Technology Partners of Southeastern Pennsylvania have developed a new joint initiative: **Temple Ventures—Powered by Ben Franklin**. The new initiative is a $1 million startup accelerator designed to assist startup companies advancing Temple-created technologies.

**Launch** > $100K to assist with company launch

**Fund** > $800K for investment

**Incubate** > $100K to mentor and build
Partnership with Temple University, Penn State, Rutgers, The State University of New Jersey, Lehigh

P1V establishes a company, provides business expertise, funding (SBIR/STTR), and strategic guidance in the following phases:

- **Phase 0**: match entrepreneur and develop commercialization strategy ($25K value)
- **Phase 1**: Upon receipt of an SBIR or STTR, company is eligible for $150K in additional funding
- **Phase 2**: Upon receipt of a Phase 2 SBIR/STTR, company is eligible for $300K in additional funding

Temple Phase 1 Spinouts: LytPhage Pharma, BioSignal Analytics
The Germinator
An Industry/Academia/NGO Collaboration

- Place technology on critical path
- Foster collaboration
- Industry Academia cultural exchange
- ID technologies of interest

1/2 Funding

Germinator Grants

1/2 Funding

Administration

Office of the Vice President for Research
COMMERCIALIZATION | Accelerators

Joint Partnership
Academia • Industry • Government

- Intellectual Property
- Licensees
- Principal Investigators
- Fundamental Science
- Establish and Accelerate New Business
- Industry and Investment Relationships
- Design, Engineering, and Prototyping
- Clinical Project Management Expertise
- Rigorous Financial and Technology Vetting Process
- FabNet/TAI Funding
- Investor Relationships

Clear Commercialization Path

Innovative Medical Products
### Drug Development and Delivery
- **SFA Therapeutics**: Psoriasis, spinning
- **Recensa Therapeutics**: Psoriasis, PIV
- **Praeventix, LLC**: IBD, BioSP
- **Sterotherapeutics LLC**: NASH (liver inflammation)
- **Allysta Pharmaceuticals, Inc**: Dry eye
- **Arrevus, Inc**: Antibiotic
- **Medvas**: Breast cancer
- **Excision BioTherapeutics, Inc**: HIV, JCV, HSV and other viruses
- **LytPhage, Inc**: Antibiotic-resistant infections; BioSP
- **Protea Biopharma**: Antiviral
- **Renovocor, Inc**: Heart failure
- **Diffregen LLC**: AML
- **Onconova Therapeutics**: Myelodysplastic syndromes
- **Ang Holdings**: Delivery tech for caffeine and other substances

### Medical Diagnostics and Devices
- **Avix Medical**: Tumor detection
- **Melzi, Inc**: Surgical device for metal removal
- **Advanced Inhalations Solutions**: Respiratory dosing regulator; AmpTech
- **Thrombolex**: Pulmonary embolism and DVT
- **Orthomend Research, Inc**: Nano-diamond absorbable bone repair screws
- **RED Laboratories**: CFS test
- **Proplex Technologies**: Early detection of breast, liver, lung and brain cancers

### IT/Health IT
- **HGE Healthcare Solutions, LLC**: Remote COPD management
- **Guiding Technologies Corp**: Virtual assistant for autism; Temple Ventures, STTR/SBIR
- **BioSignalAnalytics**: Auto scanning of EEG signals (AutoEEG™); QED, P1V, STTR
- **Legal Science Partners**: MonQcle™ Business and legal Intelligence system, SBIRs

### Advanced Materials and Manufacturing
- **PolyCeramX**: Lithium Ion battery tech; P1V
- **NovaLyse, Inc**: Next gen disinfectant technology; QED
- **Advanced Chocolate Technology**: Chocolate viscosity reduction
- **Amitron**: Water purification; SBIR

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**Tech Transfer Underway**
- Business
- Science & Tech
- Dentistry
- Education
- Engineering
- Law
- Liberal Arts
- Medicine
- Pharmacy
- Public Health
• Processes 400+ contracts per year, including the following agreement types:
  ✓ Material Transfer Agreements
  ✓ Confidentiality Agreements
  ✓ Data Use Agreements
  ✓ Industry Sponsored Research
  ✓ Data Use Agreements
  ✓ Master Research Agreements
  ✓ Memorandums of Understanding
  ✓ License, option and other intellectual property agreements
• Manages large master and consortium contracts, including Janssen and ARL
• Handles the negotiation of all terms for submission to University Counsel for review and signature
A HUB FOR INNOVATION

The Hub Design Concept

- RACP Funding Awarded
- 1:1 match by Temple
- Collaboration with SHRO
- 6,700 sq. ft. in Tuttleman Learning Center
- Central campus location
- Convening, making, learning space for students, industry partners, community collaborators and sponsors
The Team

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