

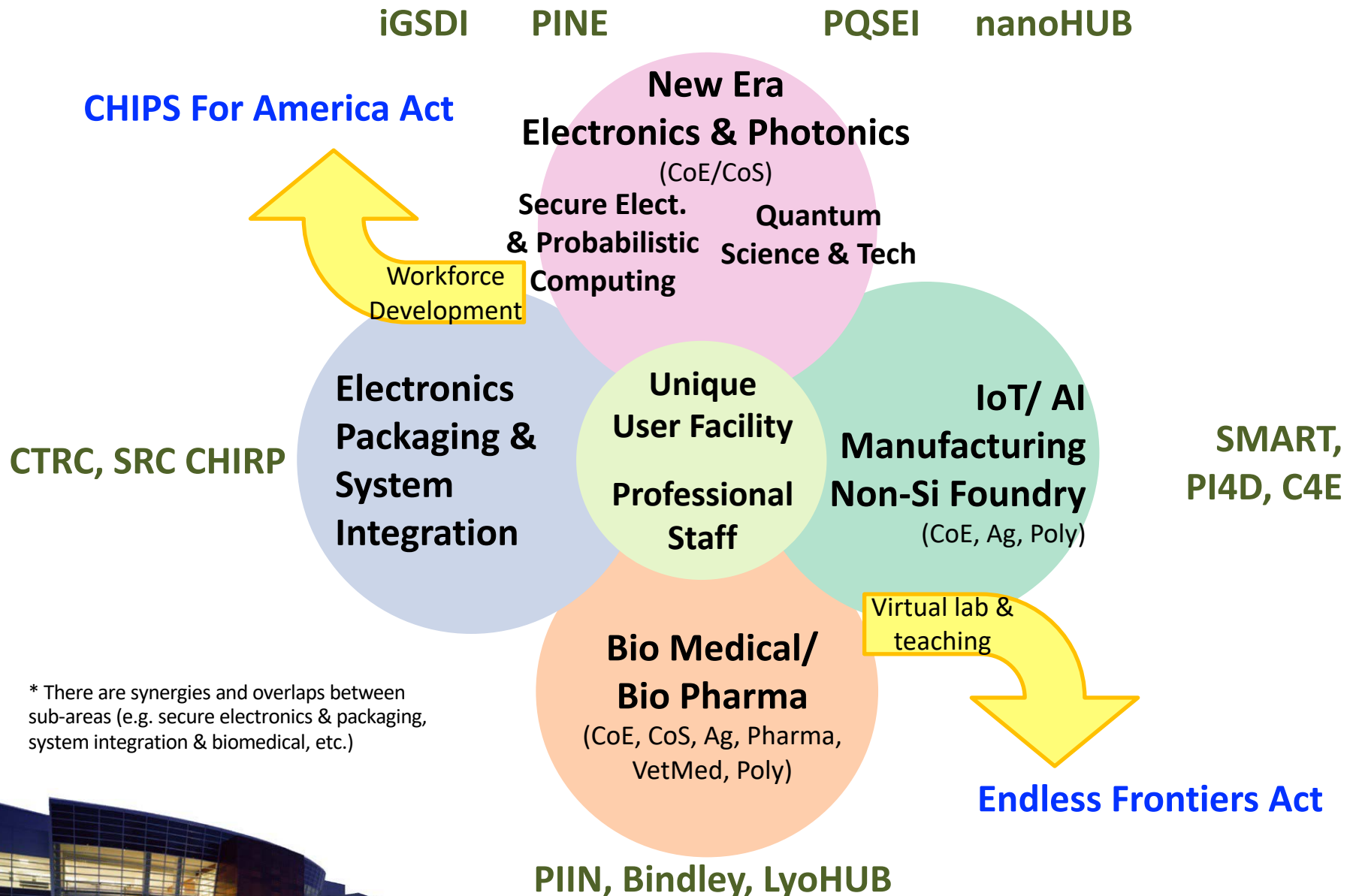
# ***Birck Nanotechnology Center*** ***Future Centers of Excellence***

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# Centers of Excellence Bringing Together Different Colleges and Purdue Centers



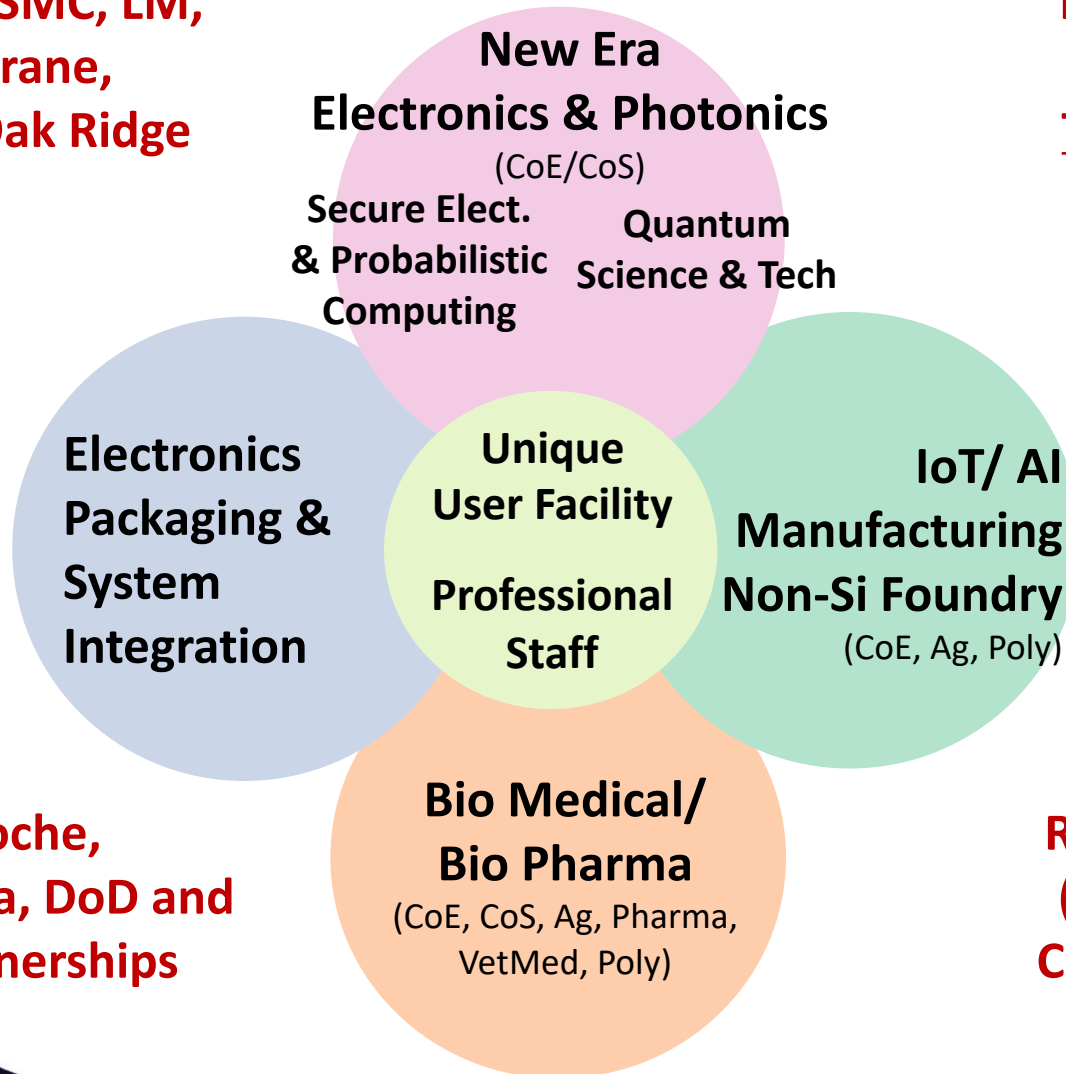
\* There are synergies and overlaps between sub-areas (e.g. secure electronics & packaging, system integration & biomedical, etc.)



# Centers of Excellence Leveraging National Initiatives and Strategic Partnerships

**Microsoft, SRC, TSMC, LM,  
Intel, Samsung, Crane,  
Draper, Sandia, Oak Ridge**

**National Initiatives  
in Quantum and  
Trusted Electronics**



**Eli Lilly, Elanco, Roche,  
Industry Consortia, DoD and  
National Lab partnerships**

**Regional Ecosystem  
(WHIN, DP District,  
Convergence Build.)**



## (1) New Era Electronics & Photonics

Enhance our leadership as top centers in quantum and microelectronics. New directions in quantum electrodynamics/ metrology/ photonics-superconducting hybrid, Quantum/AI. Unique 8" tools for training and characterization. Collaborations with TSMC, Intel, Microsoft, Samsung, etc., bring together researchers from Physics, Chemistry and ECE.

## (2) Electronics Packaging/ Systems

Brings unique back end of the line (BEOL) fab capabilities to SRC Packaging, Cooling Technology Research Centers (20 industry members), and DoD Cornerstone Microelectronic Workforce Consortium. Enable asymmetric response to major federal initiatives in Secure Electronics, Harsh Environments, and others. Strengthen collaborations between ME, MSE, ECE, Physics

## (4) IoT/AI Manufacturing

Expanded SMART industry consortium (Applied Mat., Bayer, UTC/Carrier, Fluke/Landauer, Sartorius, AeXonis); IoT devices for healthcare and regional testbeds in digital ag and manuf.; shared lab for MiBio (ChemE, Chem, BME, HHS), Future Center of Excellence in AI/ R2R manufacturing and the basis of non-silicon foundry near Purdue

## (3) Bio Medical/ Biopharma

Soft material microfabrication for implantable bioelectronics, soft robotics and organ-on-a-chip for STEM cell and cancer research. Industry partnership (Eli Lilly, Elanco, Roche, ...). Synergy with the state-of-the-art packaging lab. Expand LyoHUB industry consortium with pilot-scale modules with robotics/ automation. FDA training



Research Thrusts		Resident Faculty
<b>Electronics</b>	6	Alam, Appenzeller, Z. Chen, Janes, Morisette, Ye
<b>Photonics</b>	9	Alaeian, Bermel, Boltasseva, Hosseini, Hung, Jacob, Kildishev, Narimanov, Shalaev
<b>MEMS/ Microsystem</b>	4	Bhave, Mohammadi, Peroulis, Weinstein
<b>Physics (Cond. Matter)</b>	6	Y. Chen, Ma, Malis, Manfra, Rohkinson, Hung
<b>Thermal/ Packaging</b>	8	Marconnet, L. Pan, Ruan, Warsinger, Weibel, Xu, Yazawa
<b>R2R/ Manufacturing</b>	8	Cakmak, Chiu, Mei, Rahimi, Shakouri, Stanciu, Wei, Ziaie
<b>Nanobio/ Soft Materials/ LyoHUB</b>	13	Cappelleri, Garner, Han, Lelievre, Mei Mcnally, Panigrahi, Savran, Suter, Verma, Wereley, Alexeenko, Topp
<b>Material Growth/ Char.</b>	4	Capano, Marinero, Na, H. Wang
<b>AFM/ Surface</b>	4	Raman, Reifenberger, Rhoads, Wagner

## (1) New Era Electronics & Photonics

- Secure Electronics
- Quantum Electrodynamics/ Metrology
- Quantum Photonics /Supercond. & AI

**Collaborators:** Lundstrom, Datta, Upadhyaya, T. Li, Sen Banerjee, Weiner, Agrawal, Kais, Klimeck, Hood?, ,...

## (2) Bio Medical/ Soft Mat./ Biopharma

- Implantable Electronics, Organoid on a chip
- LyoHUB

**Collaborators:** H. Lee, C-H. Lee, Jayant, Nawrocki, Wu K. Park, Pinal, Carvajal, Irazoqui, Linnes, Martinez, Chortos?, Proctor?, Bao?, ...

## (3) Electronic Packaging/ MEMS/ System

- 3D heterogenous integration
- BEOL Hybrid Tools/ Devices

**Collaborators:** Handwerker, Blendell, Subbarayan, Strachan, Chawla, Jung ?, Jones ?, ...

## (4) IoT/AI Manufacturing

- Low-cost IoT manufacturing / Regional Testbeds
- Resilient AI Network for Manufacturing

**Collaborators:** Boudouris, Dou, Allebach, Bagchi, B. Ribeiro, Bertino, Mansson, Tien Li, Kumar, Youngblood, Tallman, Chatzidakis, Cheng, Newell, Salas, ...

# How Can Purdue Compete with Other Centers of Excellence?

