



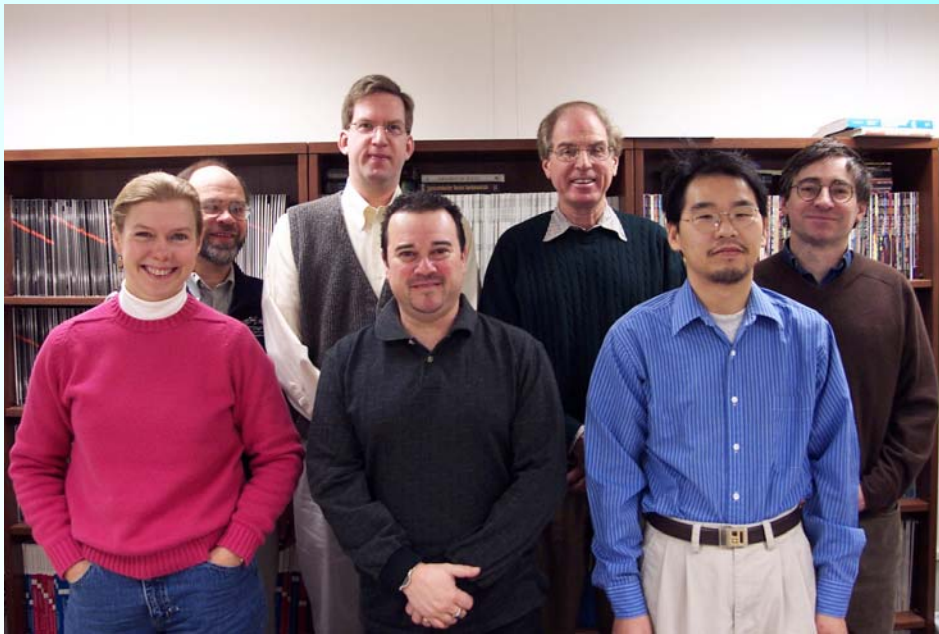
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# **Solid State Electronics and Photonics Electrical and Computer Engineering The Ohio State University**

*An Overview for Prospective Students*

<http://www.ece.osu.edu/ssep>

## SSEP Area: Who Are We?



### First Row

- Betty Lise Anderson
- Steven A. Ringel
- Wu Lu

### Second Row

- George J. Valco
- Paul R. Berger
- Leonard J. Brillson
- Patrick Roblin



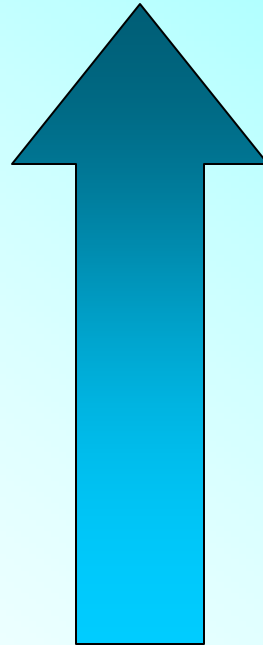
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# Areas of ECE Concentration

- Circuits
- Communications and Signal Processing
- Computer Engineering
- Controls
- Electromagnetics
- Power Systems
- Solid State Electronics and Photonics

# Areas of ECE Concentration

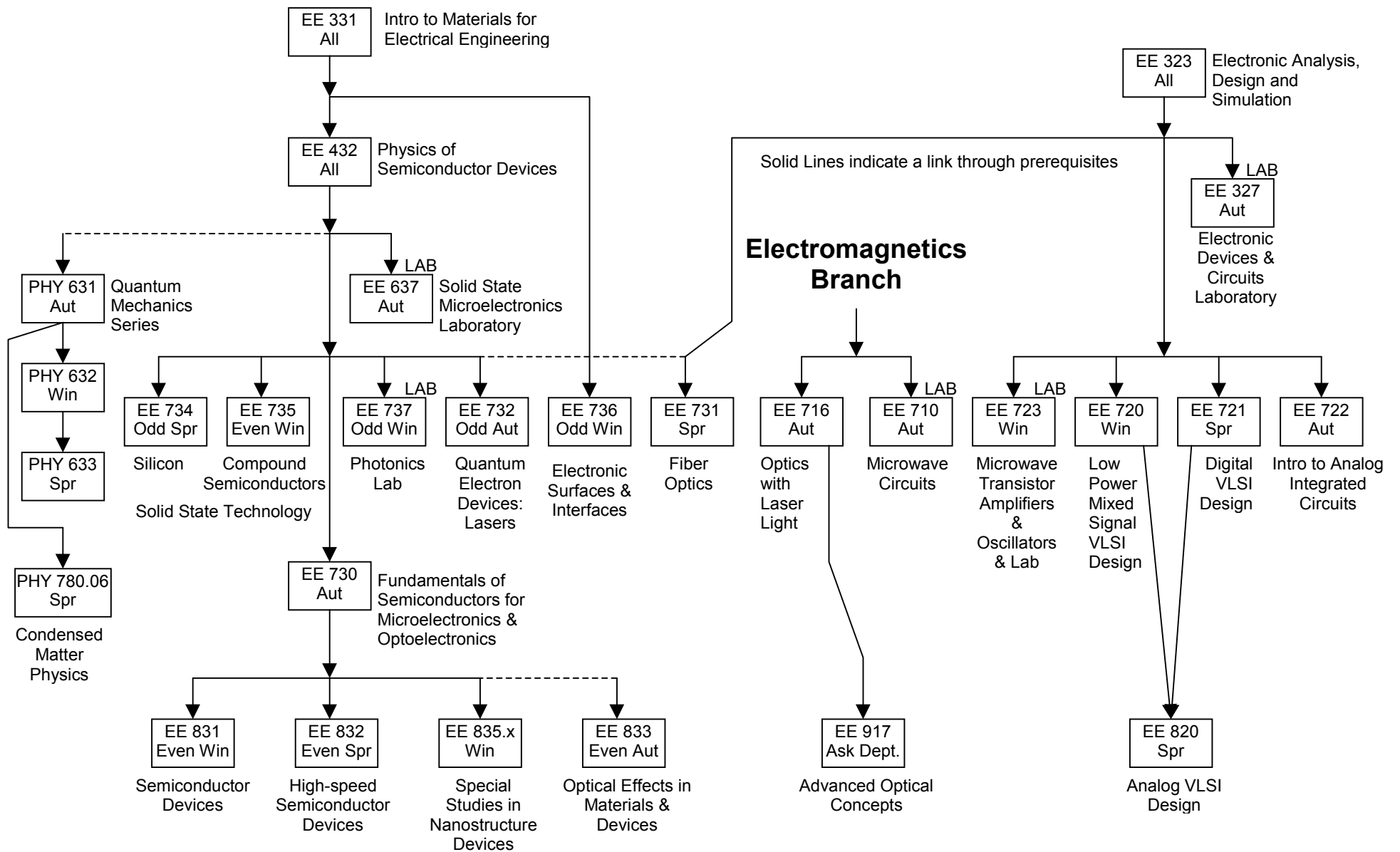
**“The Food Chain”**



- Controls
- Communications and Signal Processing
- Computer Engineering
- Electromagnetics
- Circuits
- **Solid State Electronics and Photonics**
- Power Systems

# Solid State Electronics and Photonics

# Circuits & Electronics Track



The terms "even" or "odd" refer to the year in which the quarter occurs. For example, autumn '02 is even, winter '01 is odd, even though they are in the same academic year.

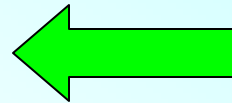
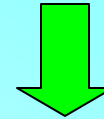
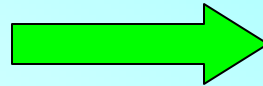


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# **Solid State Electronics and Photonics**

- **Electronic Devices**
- **Optoelectronic Devices**
  - **Solar cells, LED's, CD lasers, Fiber optics**
- **Nanoelectronics**
- **Plastic semiconductors**
- **Micro-machines**

# Computer Food Chain





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# Career Opportunities

- **Bachelor's**
  - **Manufacturing?**
- **Master's**
  - **Development?**
- **Ph.D.**
  - **Fundamental Research?**



# Moore's Law

A new technology every 2 years

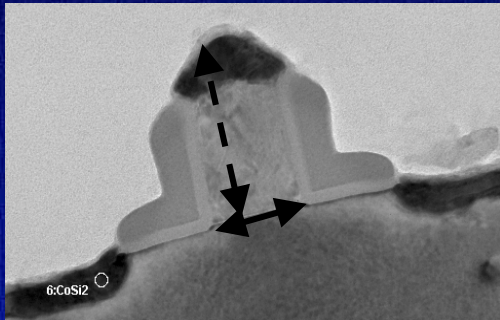
Process Name	<u>P856</u>	<u>P858</u>	<u>Px60</u>	<u>P1262</u>	<u>P1264</u>	<u>P1266</u>	<u>P1268</u>
1 <sup>st</sup> Production	1997	1999	2001	2003	2005	2007	2009
Lithography	.25 $\mu$ m	.18 $\mu$ m	.13 $\mu$ m	90nm	65nm	45nm	32nm
Gate Length	.20 $\mu$ m	.13 $\mu$ m	<70nm	<50nm	<35nm	<25nm	<18nm
Wafer Size (mm)	200	200	200/300	300	300	300	300





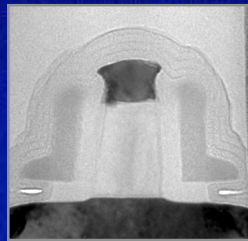
# Accelerated Scaling of Planar Transistors

130nm Node



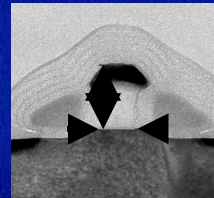
70nm Length  
(Production 2001)

90nm Node



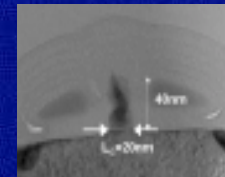
50nm Length  
(Production in 2003)

65nm Node



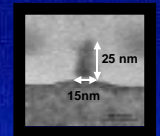
30nm Prototype  
(Production in 2005)

45nm Node



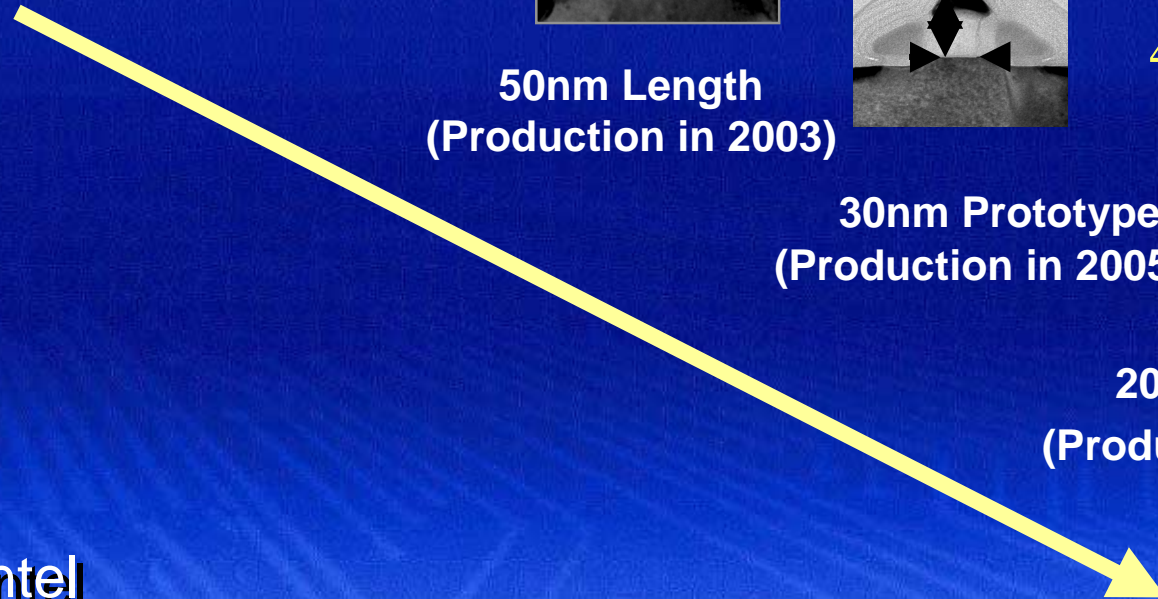
20nm Prototype  
(Production in 2007)

32nm Node



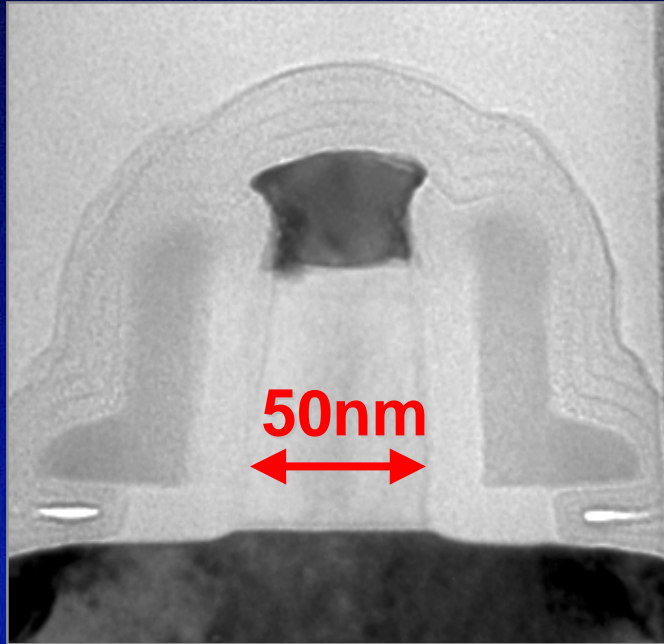
15nm Prototype  
(Production in 2009)

Intel



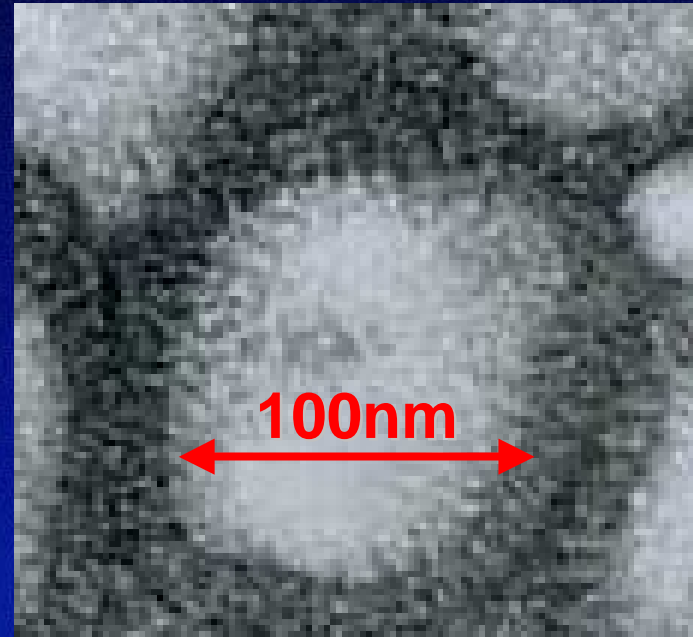


# Silicon devices are Nanotechnology



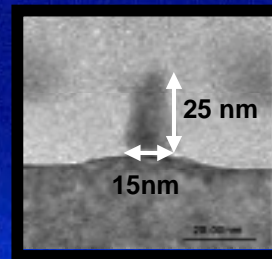
**Transistor for  
90nm process**

Source: Intel



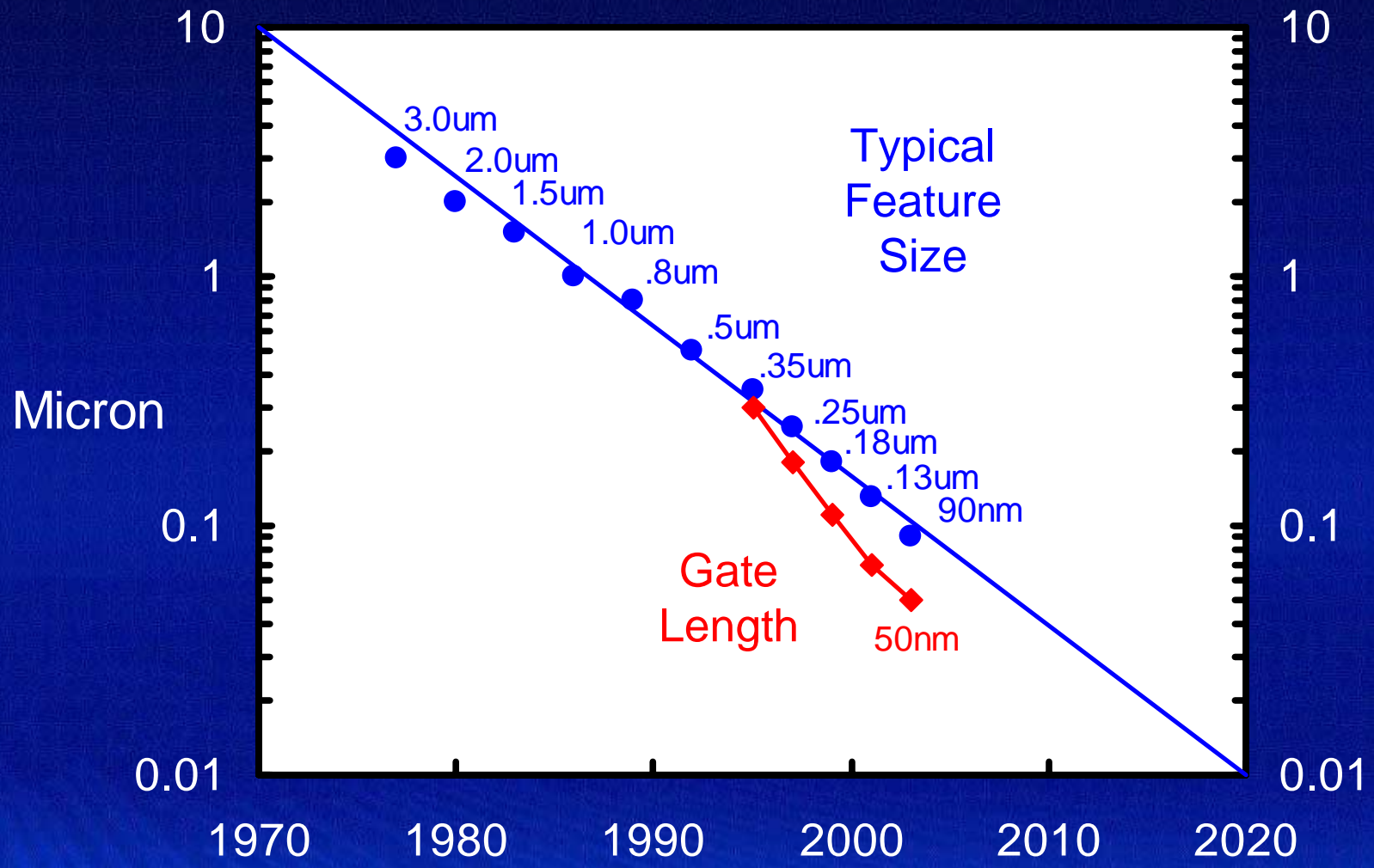
**Influenza virus**

Source: CDC



**15nm Research  
Transistor**

# Transistor Gate Length Scaling



*Transistor Gate Length is Smallest Feature on the Device*



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## Our OSU ECE Program

- **Ranked #22 in the nation out of 126 ECE Programs nationwide** by the National Research Council, the most comprehensive academic program review, every ~8-12 years!
- Highest in the State of Ohio.
- **Tier #1 Research University** – our faculty participate and drive leading edge research, not reading about it in a book.



# National Research Council Doctoral Program Study

## The Ohio State University – Engineering

<b>Department</b>	<b>Rank/Total</b> ➡ <b>Percentile</b>	<b>Quality</b>	<b>Effective</b>
Aerospace	24/33 ➡ 27.3%	2.84 (good)	3.03 (reasonable)
Biomedical	26/38 ➡ 31.6%	3.26 (strong)	3.25 (reasonable)
Chemical	40/86 ➡ 53.5%	2.73 (good)	3.07 (reasonable)
<b>Electrical</b>	<b>22/126 ➡ 82.5%</b>	<b>3.53 (strong)</b>	<b>3.63 (extremely)</b>
Mechanical	25/110 ➡ 77.3%	3.32 (strong)	3.28 (reasonable)
Material Science	21/65 ➡ 67.7%	3.48 (strong)	3.36 (reasonable)

# National Research Council Doctoral Program Study

## The Ohio State University – Sciences

<b>Department</b>	<b>Rank</b>	<b>Quality</b>	<b>Effective</b>
Chemistry	22/168 → 86.9%	3.87 (strong)	3.79 (extremely)
Computer Science	39/108 → 63.9%	2.92 (good)	2.94 (reasonable)
Math	29/139 → 79.1%	3.66 (strong)	3.13 (reasonable)
<b>Physics</b>	<b>24/147 → 83.7%</b>	<b>3.75 (strong)</b>	<b>3.70 (extremely)</b>
Astrophysics & Astronomy	23/33 → 30.3%	2.91 (good)	2.76 (reasonable)
Biochemistry & Molecular Biology	59/194 → 69.3%	3.16 (strong)	3.22 (reasonable)



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## ***Big is Small***

- **Breadth and Strength across Ohio State**
  - *Students change majors 3-4 times, on average.*
- **Feels Small Within ECE**
  - *ECEs know each other*
  - *ECEs know their faculty*
- **Interaction with Faculty**
  - *Within each ECE discipline, close knit.*





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## ***Thanks for your time!***

- Electrical and Computer Engineering is important.
  - *It has revolutionized the world we live in, and will continue to do so for the foreseeable future.*
- Electrical and Computer Engineers earn good money.
  - *ECE ranks at the top of engineering disciplines.*
- Electrical and Computer Engineering is fun!
  - *Challenging, exciting work.*