

NEFEC SPRING 2013 PARENT/STUDENT NIGHT

Margaret S. Lee, Assoc. Prof.
Director of Engineering Technology

EDUCATIONAL & CAREER PATHWAYS IN SCIENCE, TECHNOLOGY, ENGINEERING & MATH

Science

Technology

Engineering

Math

Medicine

STEM Jobs in the Workforce

- A lot of people work in STEM fields
 - About 4 out of every 20 jobs in the U.S. – 18.1%



- They make more money than people who work in non-STEM fields
 - About 5 out of every 20 dollars earned in the U.S.— 23.9%



STEM Occupations are Classified Based on...

- Post-secondary education required
 - ▣ Certificates A.S. B.S. M.S. Ph.D.
- Skills and training + professional credentials
 - ▣ Medical licenses, Registered Professional Engineer, ISA Certified Control Systems Technician
- Work performed
 - ▣ Designs... Analyzes... Assists... Supervises...
Routine... Under supervision of...

Different Levels of Education Required

Cert. A.S. B.S. & M.S. Ph.D. PostDoc

Scientist	Mathematician	Medicine (research)
Scientist Engineer	Mathematician	Medicine (clinician)
Engineer/Engineering Medicine (clinician)	Technologist Allied Health	Mathematician
Science Technician Engineering	Allied Health Technologist/Technician	
Science Technician Engineering	Allied Health Technician	

Different Kinds of Work Activities

Theoretical

Scientist **M**athematician **M**edicine (research)

Scientist **M**athematician **M**edicine (clinician)
Engineer

Engineer/**E**ngineering **T**echnologist **M**athematician
Medicine (clinician) **A**llied **H**ealth

Practical

Science **T**echnician **A**llied **H**ealth
Engineering **T**echnologist/Technician

Science **T**echnician **A**llied **H**ealth
Engineering **T**echnician

Salary IS NOT a Smooth Spectrum!

PostDoc	Scientist	Mathematician	Medicine (research)
Ph.D.	Scientist	Mathematician	Medicine (clinician)
B.S. & M.S.	Engineer	Engineer	Technologist
A.S.	Medicine (clinician)	Allied Health	Mathematician
Cert.	Science Technician	Allied Health	Engineering Technician

Salary IS NOT a Smooth Spectrum!



New York Methodist Hospital



Dr. Jason Jenkins, U. of Mo.

Diagnostic Medical
Sonographer

A.S. Degree

\$64,380 median annual salary

44% projected 10 yr. job growth

Agriculture & Food Scientist

Ph.D.

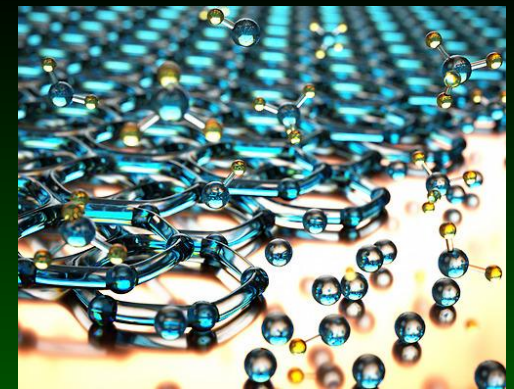
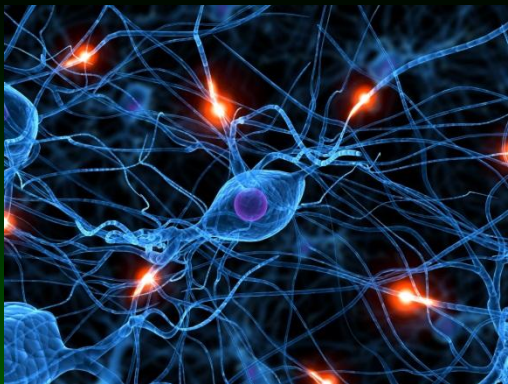
\$58,450 median annual salary

10% projected 10 yr. job growth

Careers in Science

What Does a Scientist do?

- Science is the discovery of new knowledge acquired through theoretical systematic study of phenomena
- Scientists theorize about how different systems function, then design and perform experiments to generate and analyze data that prove or disprove their theory

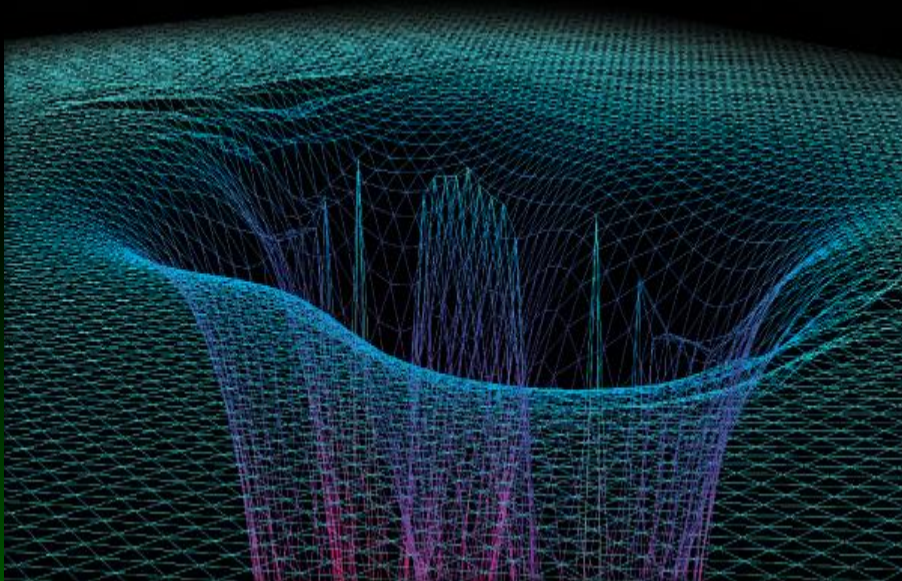




Dr. David Still, Plant Scientist, Cal Poly



Dr. Corinne Bachmann, Lawrence Berkeley Natl Lab



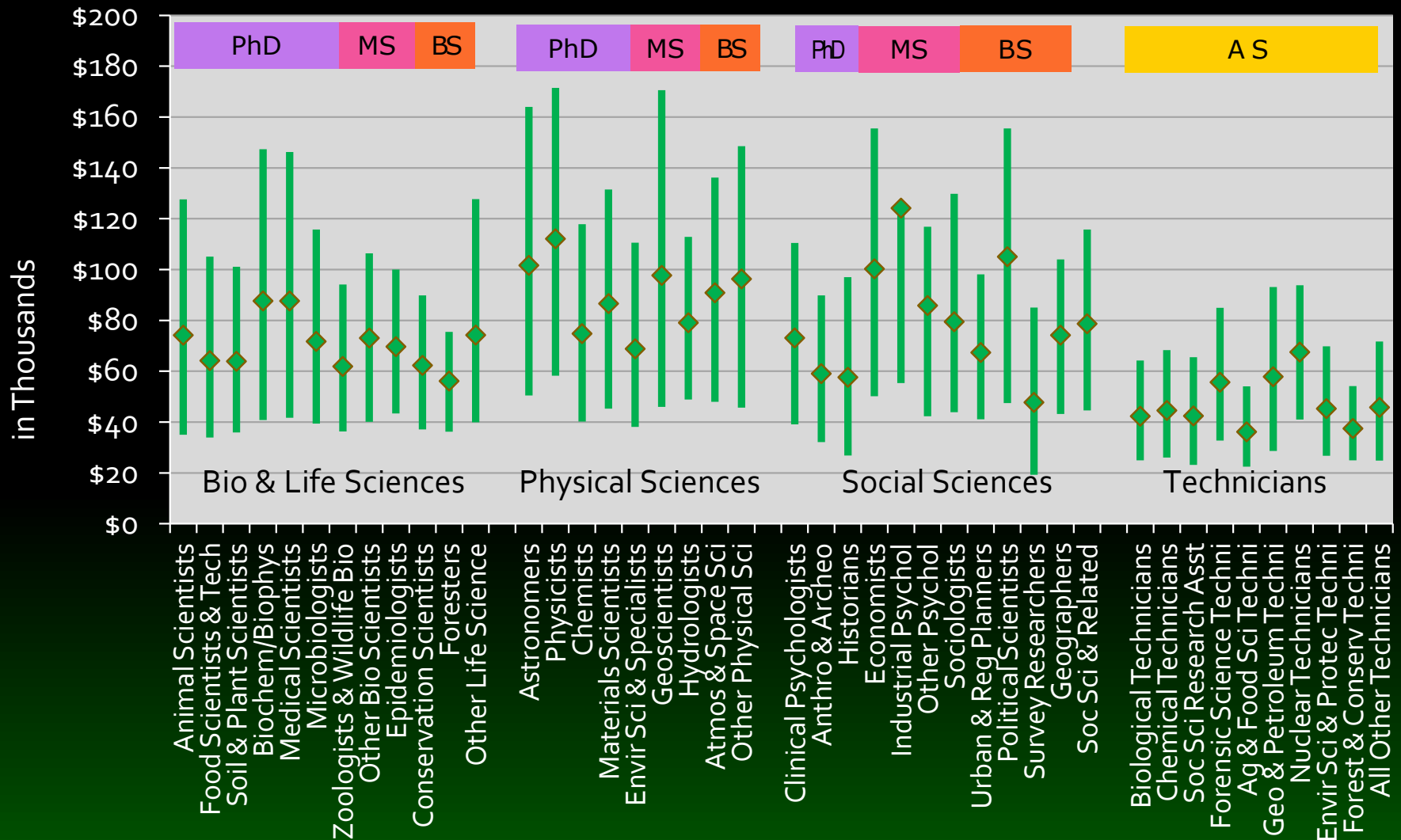
Dr. Eric White
Geophysicist
US Geological
Service



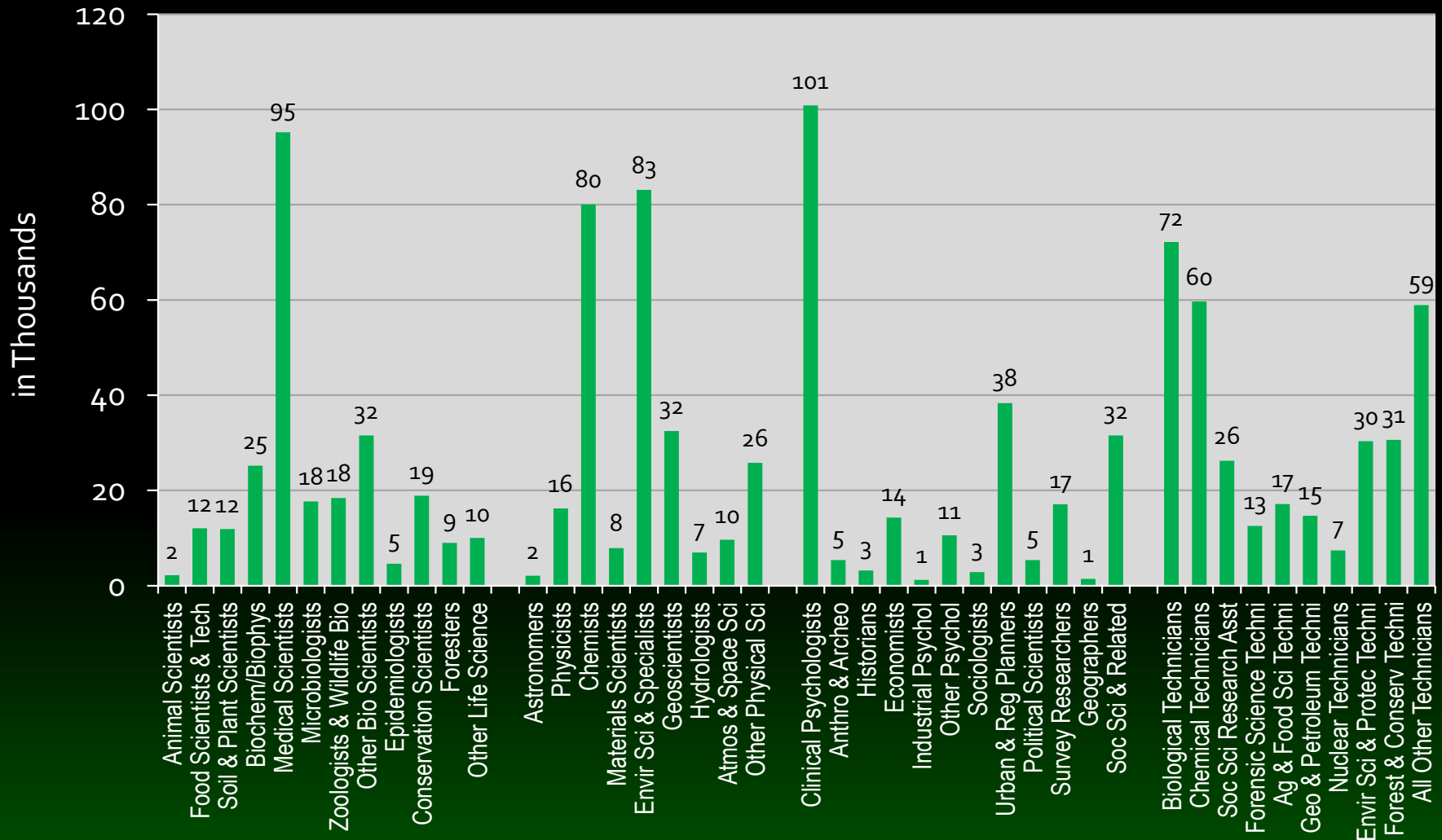
Scientific Occupations

- Distributed at ends of educational spectrum
 - A.S. for technicians
 - Ph.D. for researchers
- Most work as faculty at research universities or for state and federal governments
- Hundreds of disciplines and specializations
- Salaries vary **WIDELY**

Physical, Life & Social Science Occupations – Annual Salary Ranges



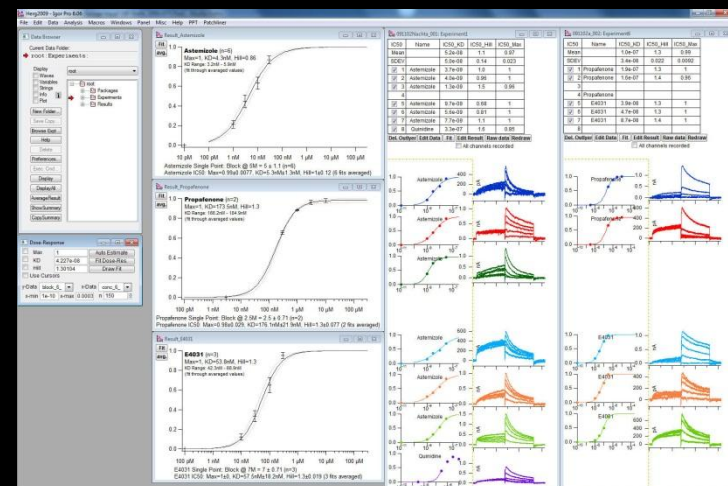
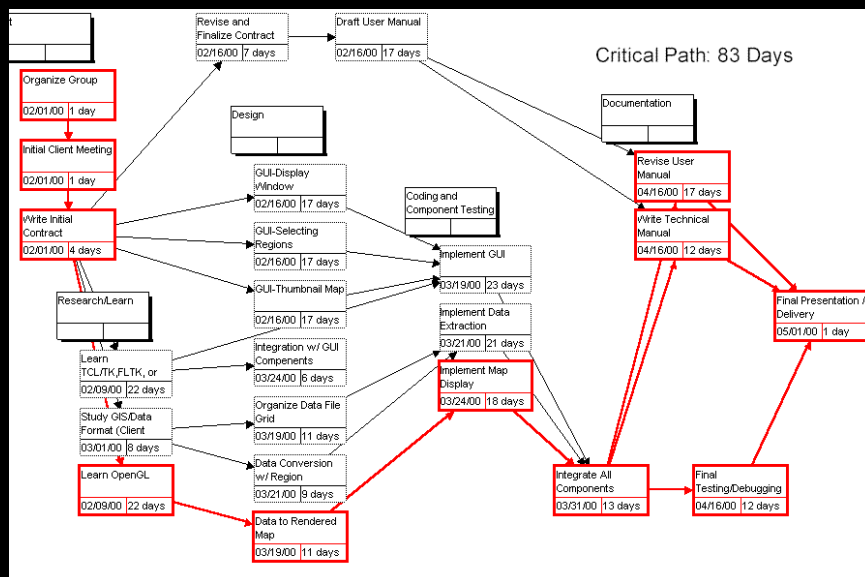
Science Occupations – Total Employment



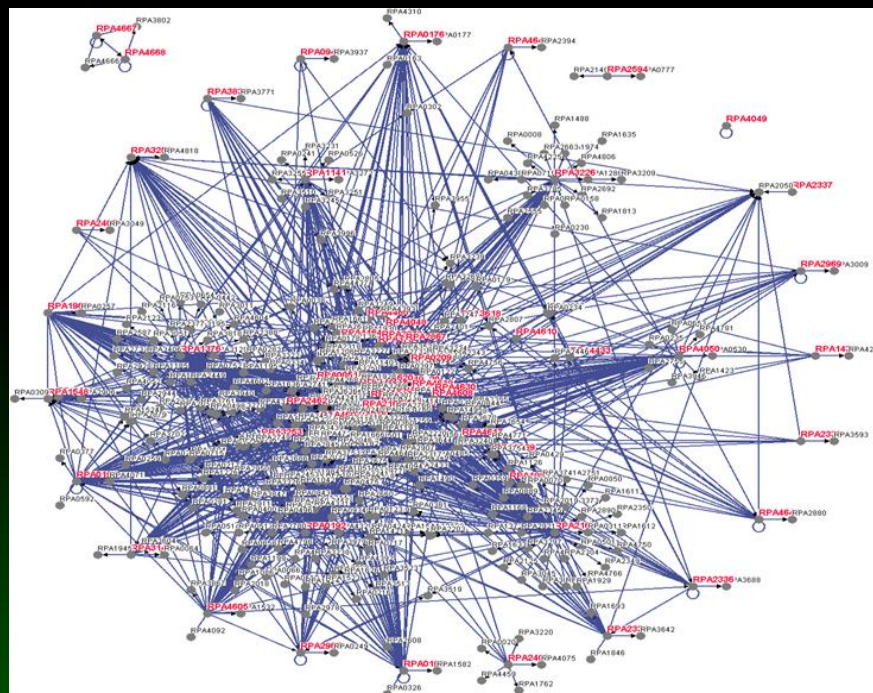
Careers in Math

What Does a Mathematician Do?

- Collect, organize, analyze, interpret, and summarize numerical data to provide usable information
- Forecasting for phenomena of interest
- Apply mathematical modeling and other optimizing methods that assists management with decision making
- At PhD level, conduct research in fundamental mathematics or in application of mathematical techniques to science, management, and other fields



Data Analysis Software by Nanion



Microbial Protein-Protein Interactions (MIPPI), Center for Molecular and Cellular Systems

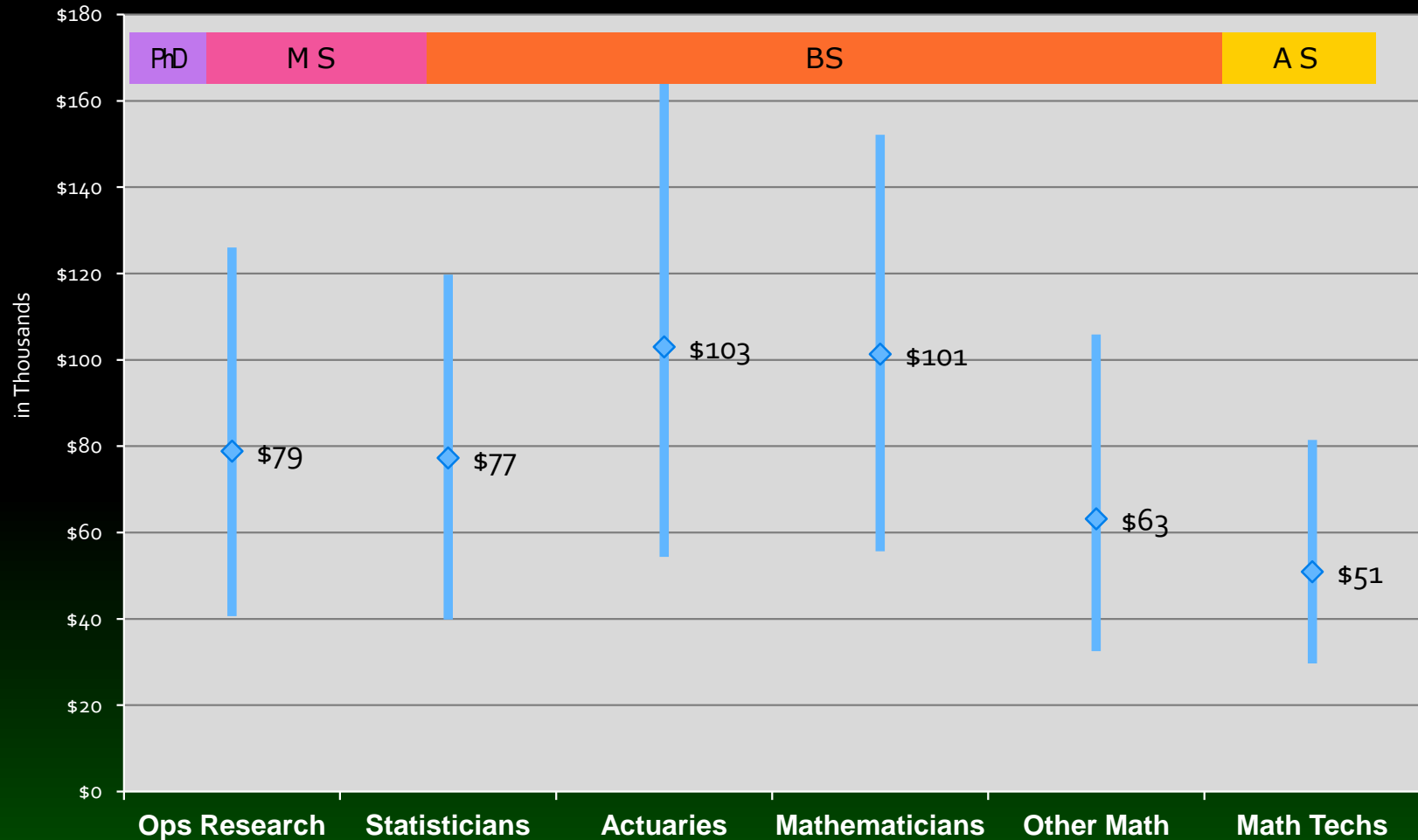


Stock Price Forecast, Bank of America

Math Occupations

- Distributed throughout educational spectrum
 - Jobs for all degree levels from technician to research mathematician
- Work in both private and public sectors
- Only a few actual job titles
 - Operations Research
 - Statisticians
 - Actuaries
 - Mathematicians

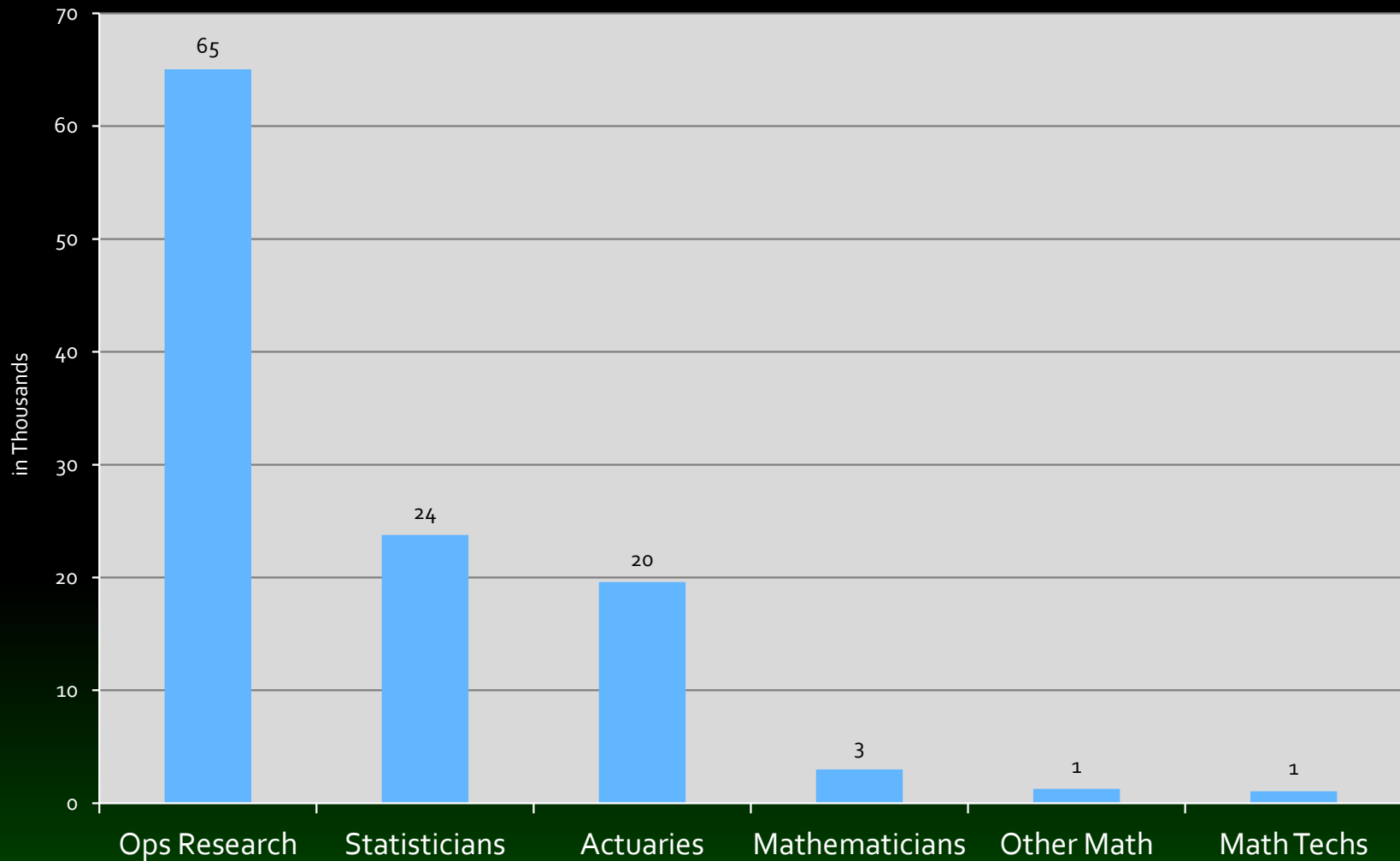
Math Occupations – Annual Salary Ranges



Source: Department of Education/National Center for Education Statistics: Integrated Postsecondary Education Data System Completions Survey, 2008

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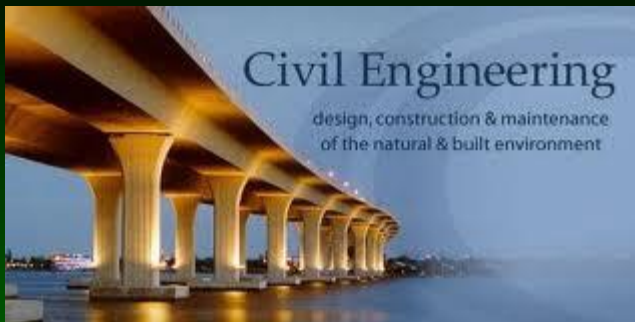
Math Occupations – Total Employment

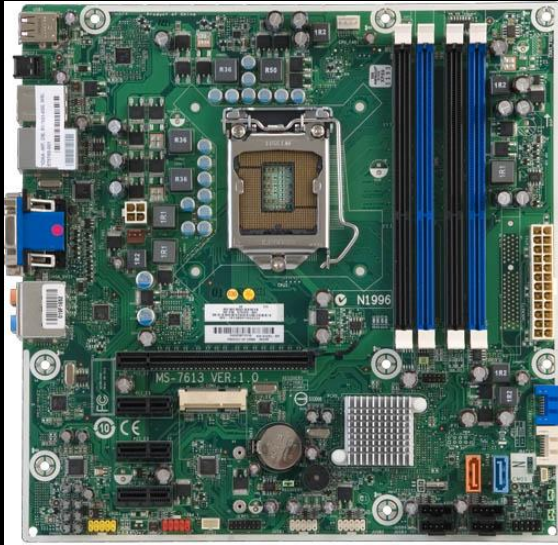


Careers in Engineering

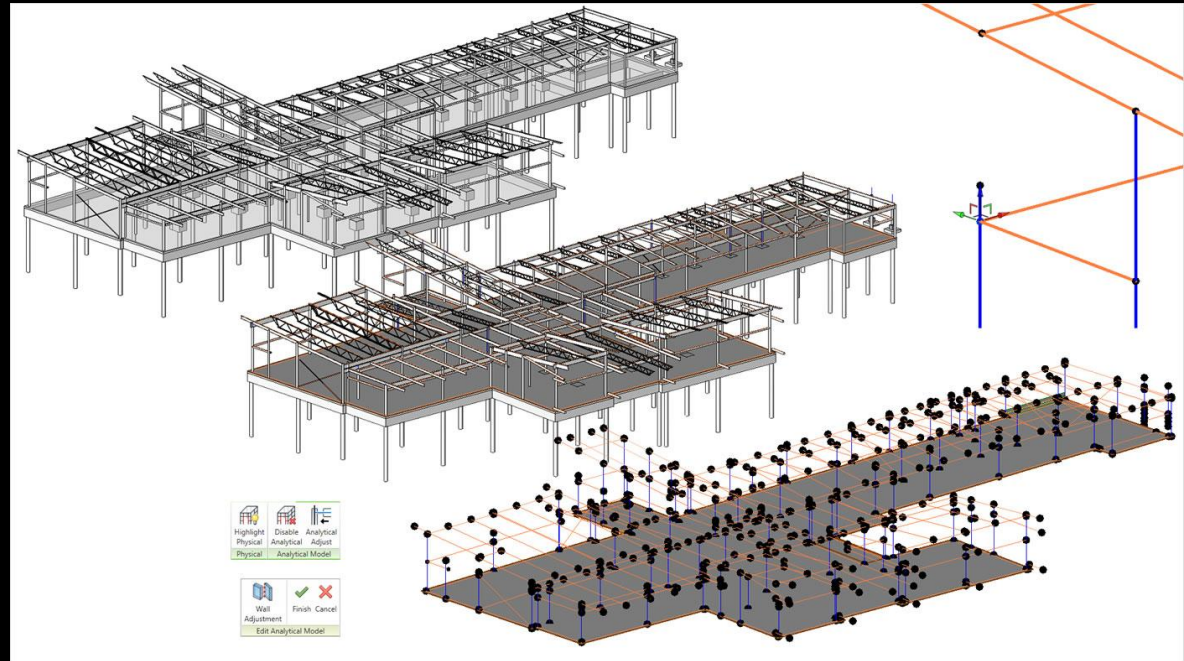
What Does an Engineer do?

- Engineering is the application of scientific knowledge to achieve practical ends such as the design, manufacture, or operation of efficient and economical structures, machines, processes, and systems





Computer Hardware: HP Pavilion Elite HPE-355uk Desktop Motherboard



Civil: Structural Engineering using AutoDesk Revit Structures



Aerospace: Space Shuttle Columbia, NASA

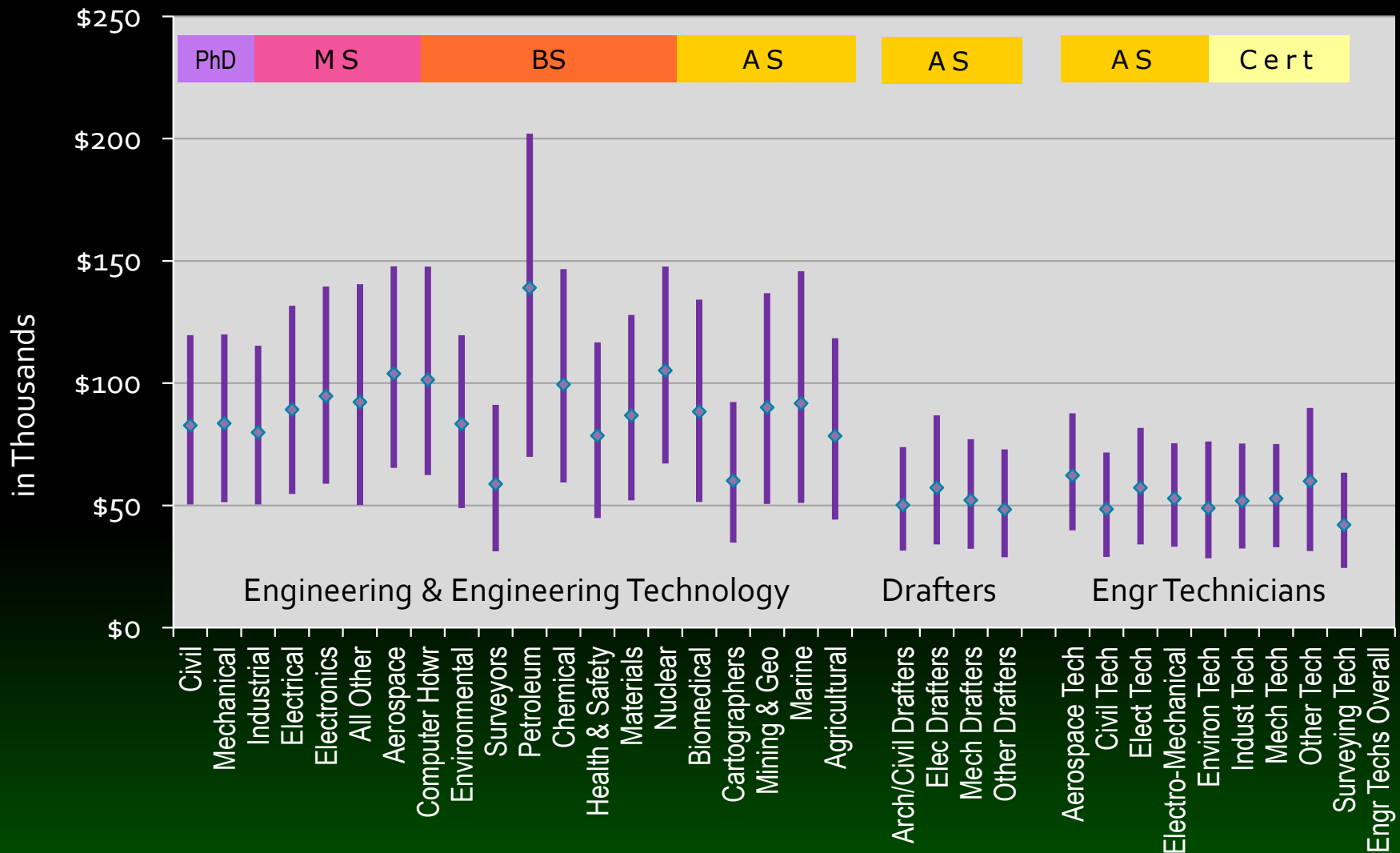
Engineering Scientist vs. Engineer vs. Engineering Technologist vs. Technician

- **Engineering scientists** are the most theoretical of the team members
 - Apply new discoveries to advance, have an earned doctorate in engineering.
- **Engineers** develop ways to economically utilize science
 - Conception, design, development and formulation of new systems and products
 - Implementation, production and operation of engineering systems
 - Most have B.S. from accredited EAC/ABET program
- **Engineering technologists** apply engineering and scientific knowledge combined with technical skills to support engineering activities
 - Have B.S. or A.S. in engineering technology.
 - Application oriented, somewhat less theoretical and mathematically oriented
 - Typically concentrate their activities on the applied design, using current engineering practice
- **Engineering technicians** work with equipment, primarily assembling and testing component parts of devices or systems that have been designed by others
 - Usually work under direct supervision of an engineer or engineering technologist
 - Assembly, repair, or to making improvements to technical equipment by learning its characteristics, rather than by studying the scientific or engineering basis for its original design
 - Important problem solving individuals whose interests are directed more to the practical than to the theoretical aspect of a project
 - Two years of college-level work leading to an associate degree, typically taken at community colleges or certain technical institutes, is required

Engineering Occupations

- Cover all regions of the educational spectrum
 - A.S. for technicians, A.S. and B.S. for Technologists,
 - M.S. for designers, Ph.D. for researchers
- Commercial, governmental and educational fields
- More than 30 disciplines and specializations
- Not a large difference in salary between educational levels

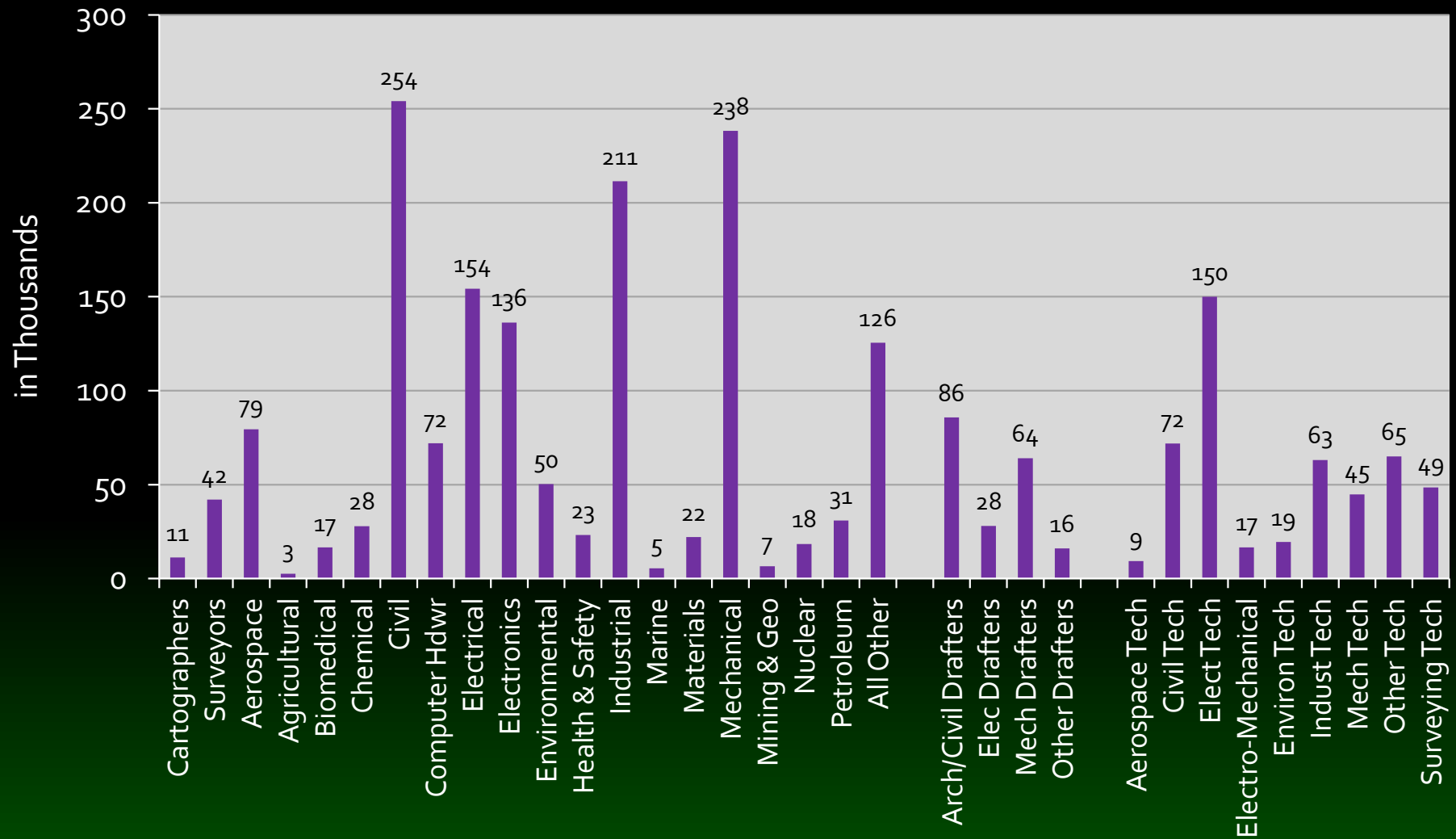
Engineering Occupations – Salary Ranges



Source: Department of Education/National Center for Education Statistics: Integrated Postsecondary Education Data System Completions Survey, 2008

Source: U.S. Dept. of Labor Bureau of Labor Statistics Occupational Outlook Handbook, 2010

Engineering Occupations – Total Employment



Careers in Medicine

What is Medicine?

- Applying health science, biomedical research, and medical technology through surgery, medication or therapies, to diagnose, treat and prevent disease

Medical Clinical Practice

- Doctors and therapists personally assess patients in order to **diagnose, treat, and prevent** disease using clinical judgment
- Usually includes direct patient contact

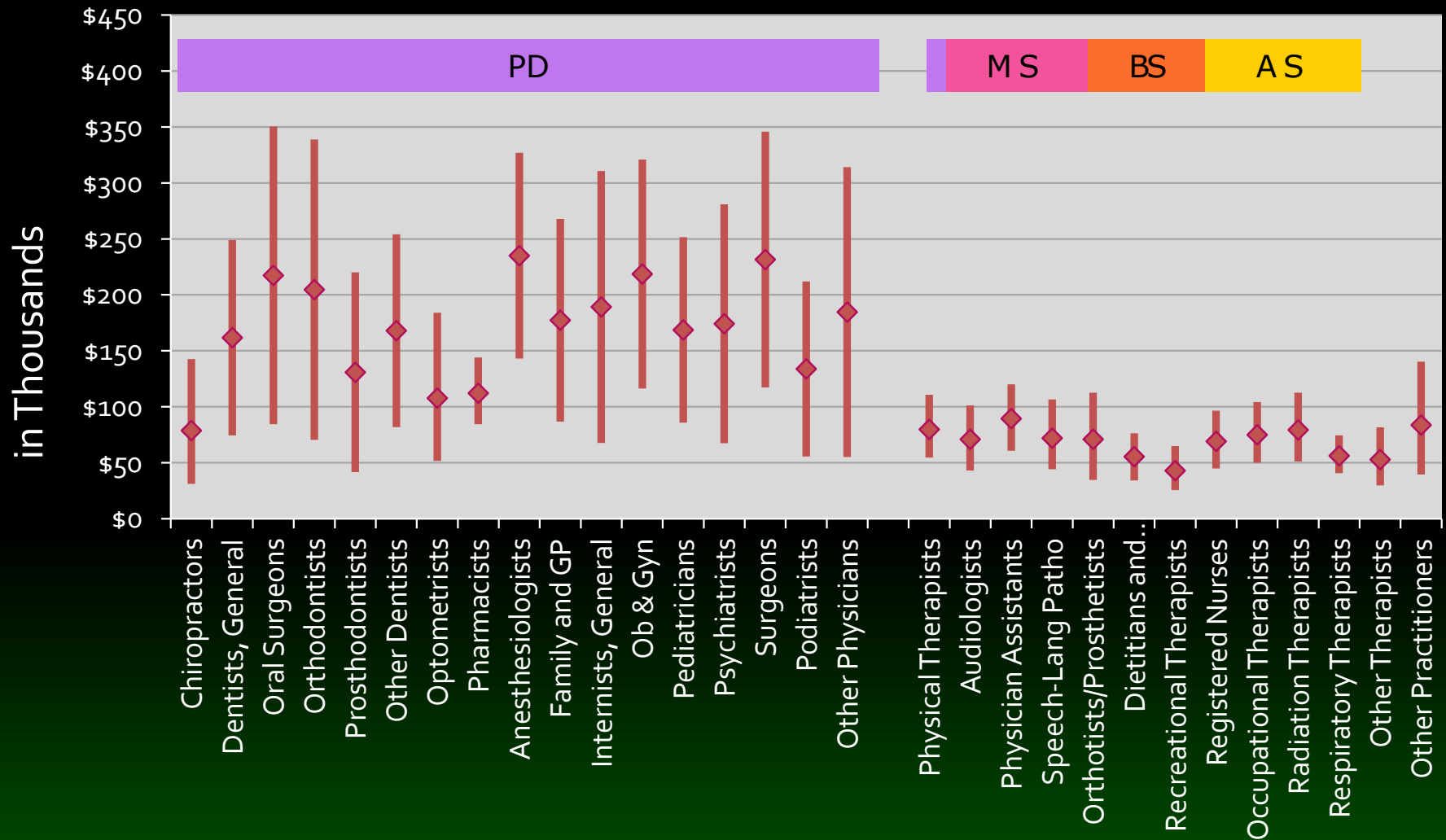


University of Louisville School of Medicine

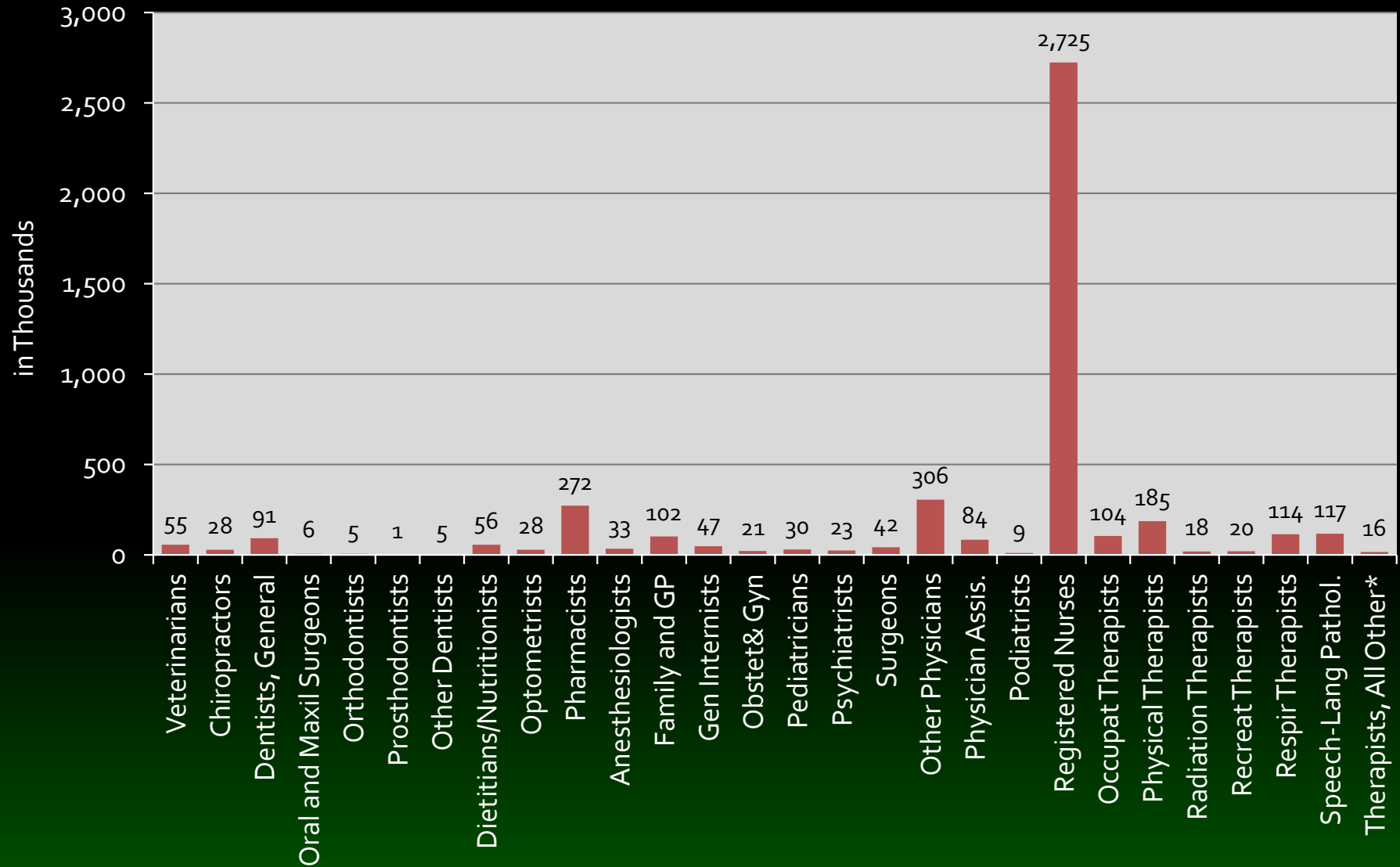


State of Connecticut, Dept. of Public Health

Clinical Practice – Salary Ranges



Medical Clinical – Total Employment



Allied Health (Technologists and Technicians)

- Allied health professionals perform technical and scientific functions, such as performing tests and analyses, in medical laboratories
- May or may not include direct patient contact



University of Mississippi Medical Center

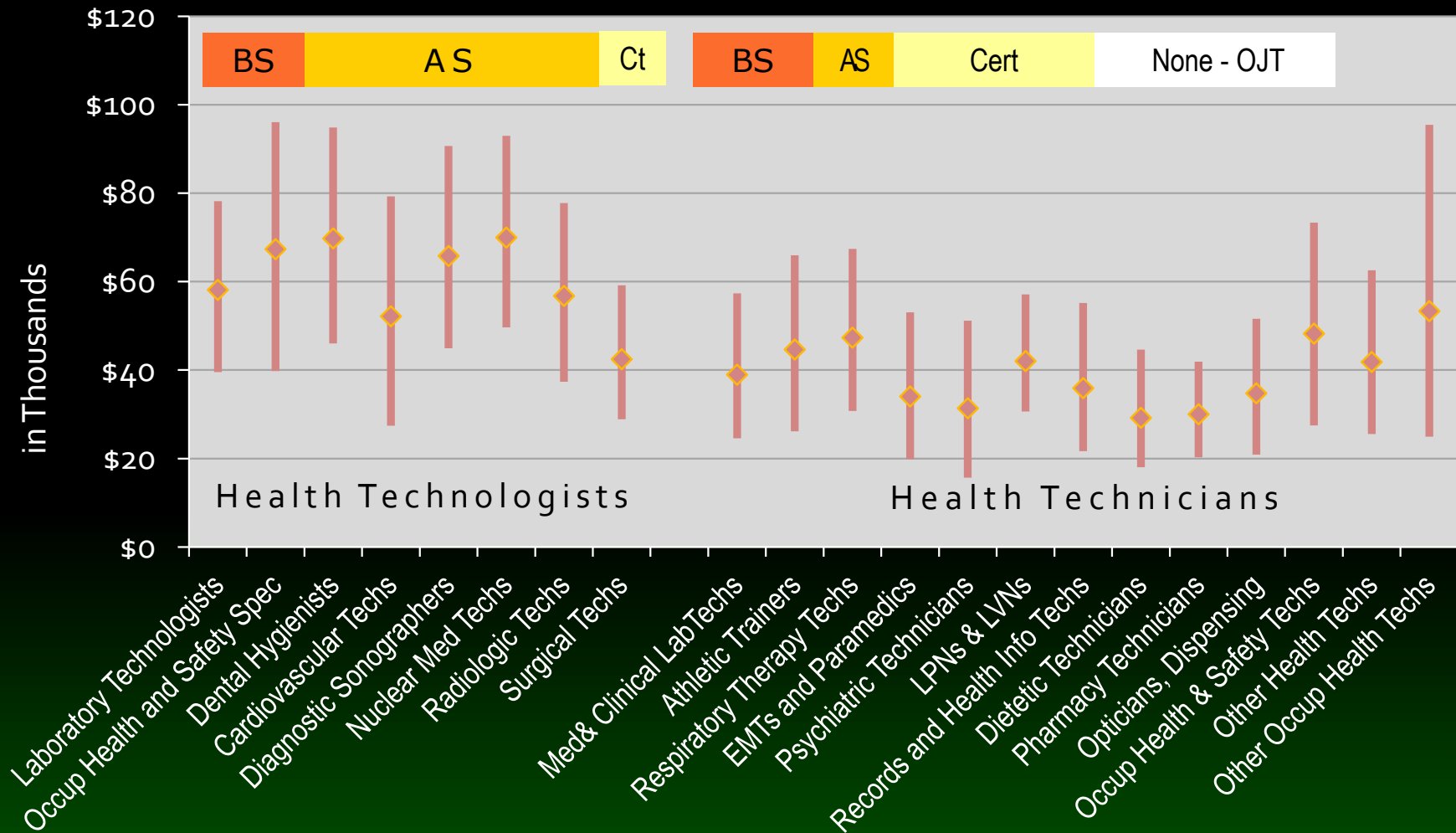


New Hanover Regional Medical Center –
Wilmington, NC

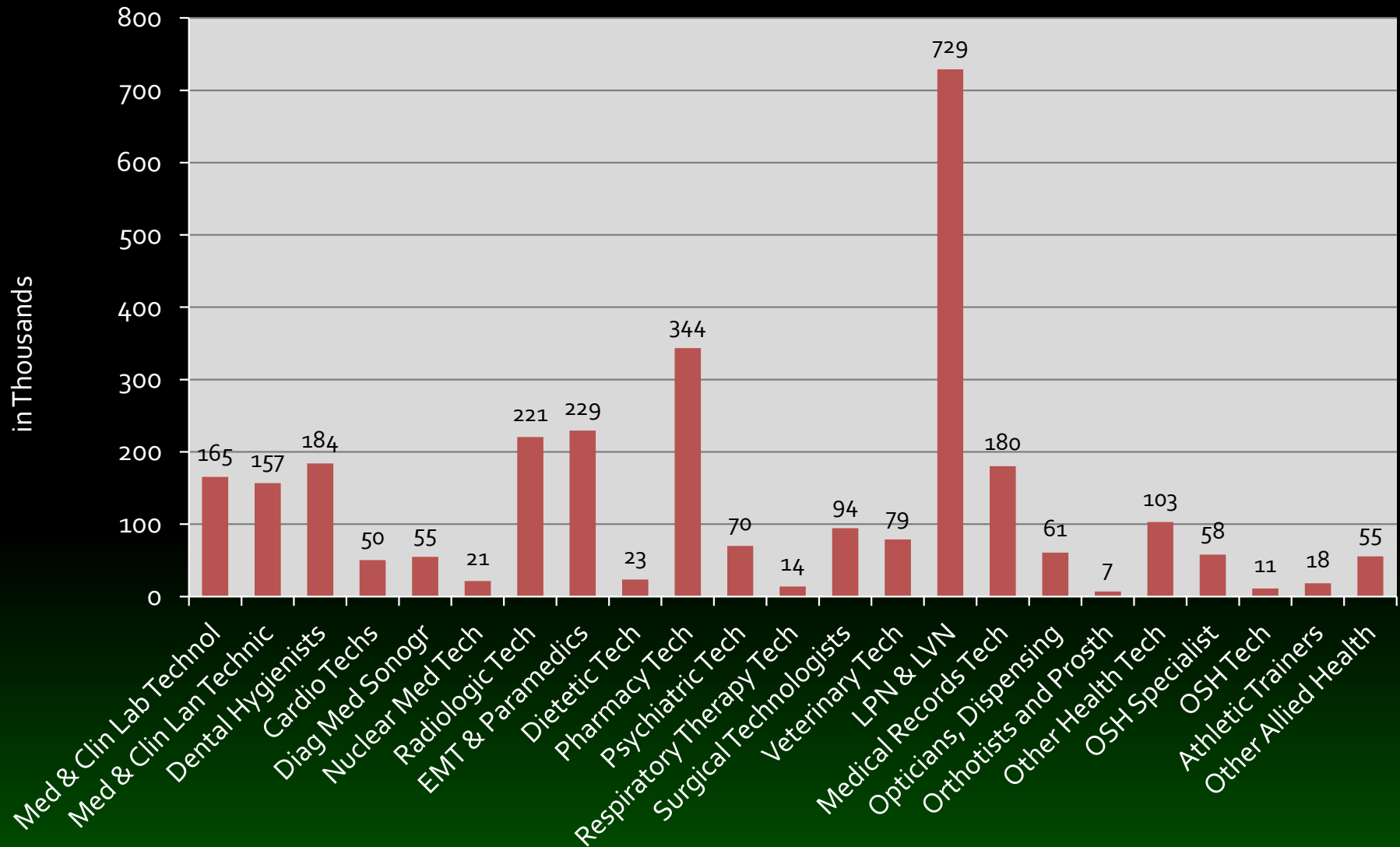


Houston Chronicle

Allied Health – Salary Ranges



Allied Health – Total Employment



Where to Learn More

Sloan Career Cornerstone

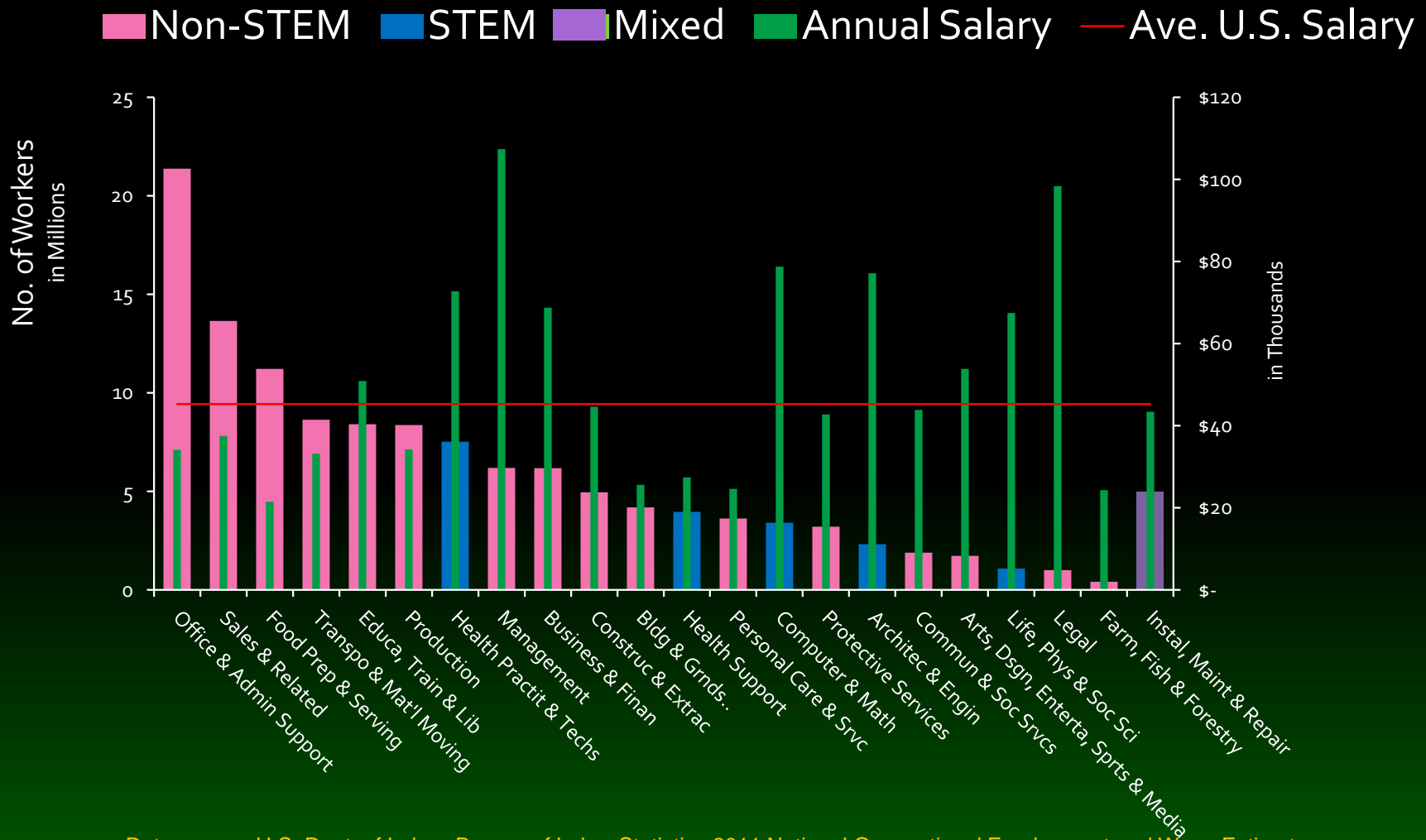
- SLOANCAREERCORNERSTONE
 - www.careercornerstone.org
- This site is a comprehensive education, networking, job hunting and career planning resource center for those pursuing careers in engineering, mathematics, information technology and the physical sciences.

Dept. of Labor, US Bureau of Labor Statistics

- Occupational Outlook Handbook
 - <http://www.bls.gov/ooh/>
- Info about all U.S. occupations, including...
 - Salary information
 - Number of jobs and 10 year job growth forecasts
 - Descriptions of work environment and what they do
 - Career paths and educational requirements
 - Geographic distribution/concentration of actual jobs

Questions?

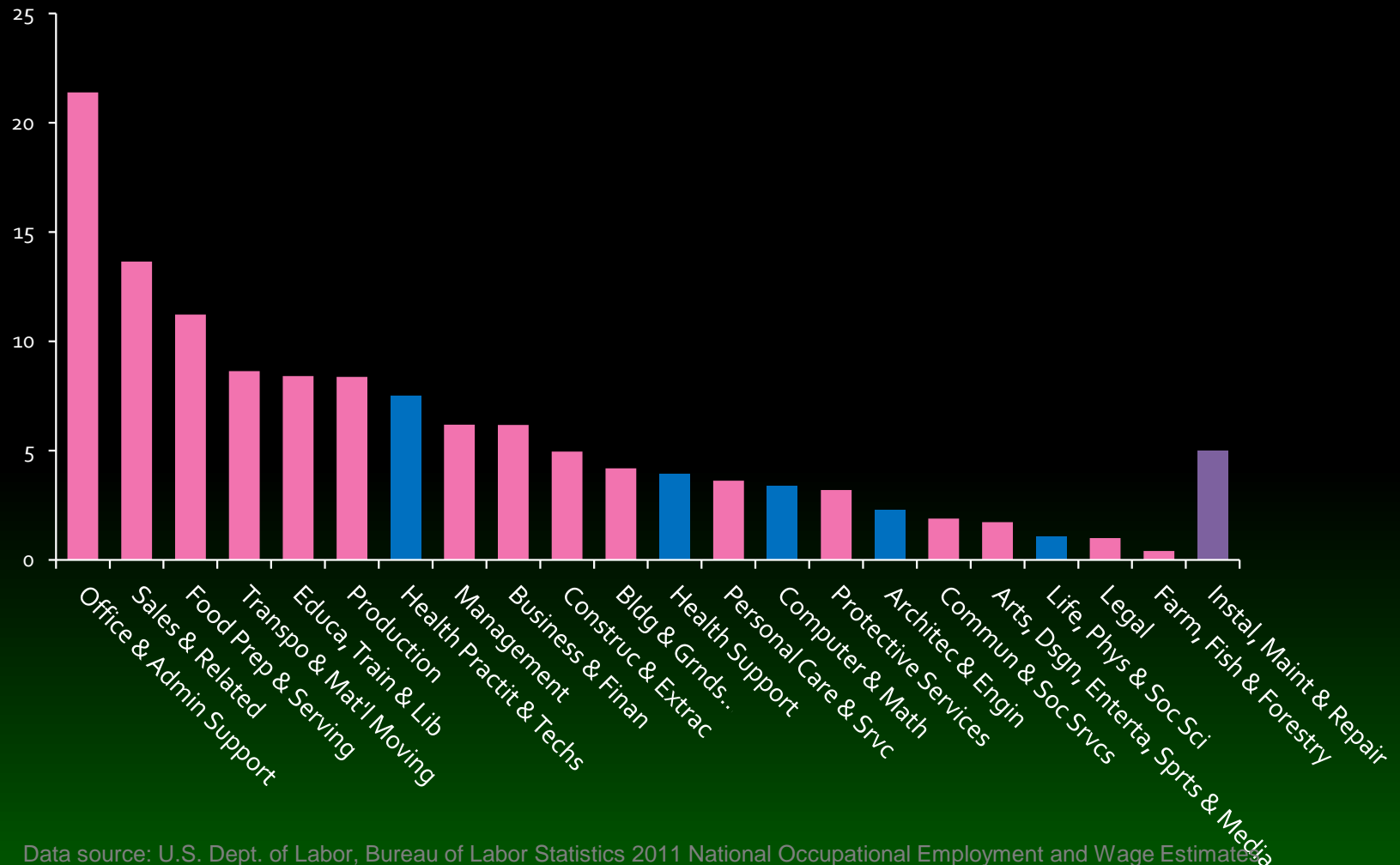
U.S. Employment and Salary by Occupational Sector



Data source: U.S. Dept. of Labor, Bureau of Labor Statistics 2011 National Occupational Employment and Wage Estimates

U.S. Employment by Occupational Sector

■ Non-STEM ■ STEM ■ Mixed



EDUCATIONAL ATTAINMENT DEFINED

Post-Secondary Education in STEM Fields

- Credit Certificate
 - Short course of study, typically 3-6 classes
 - Can take as little as a single semester
 - Usually at Vocational School or Community College
 - NOT a true degree, may or may not “articulate”

- Associate of Science Degree or A.S.
 - Generally takes 2 years
 - Requires around 60 semester credit hours
 - High school diploma or GED to get in
 - Usually at a community College or State College
 - *May or may not* articulate into a B.S. *class for class*

Post-Secondary Education in STEM Fields

- Bachelor of Science Degree or B.S.
 - Generally takes 4 years for life science and math, 5 years for engineering or physics
 - Requires around 100-120 semester credit hours
 - High School diploma **OR** *first 2 years of college* to “get in”
 - *Sometimes* an A.S. or A.A. may count for first 2 years of B.S.
 - Usually at a research university or a state college
 - College or university accreditation is important
 - Readily articulates into an M.S.

Post-Secondary Education in STEM Fields

- Master of Science Degree or M.S.
 - Generally takes 1-2 years, depends on discipline and school you attend
 - Requires around 30-60 *graduate* semester credit hours
 - Requires an accredited B.S. to get in
 - Often have requirements for particular undergrad courses too
 - At a research university
 - Can be terminal degree, a BS/MS combo, or “pre-Ph.D.”
 - Some schools offer a “5 and out” M.S. program with no B.S. earned first
 - May be able to dual enroll to articulate M.S. courses as some or all of Ph.D. coursework

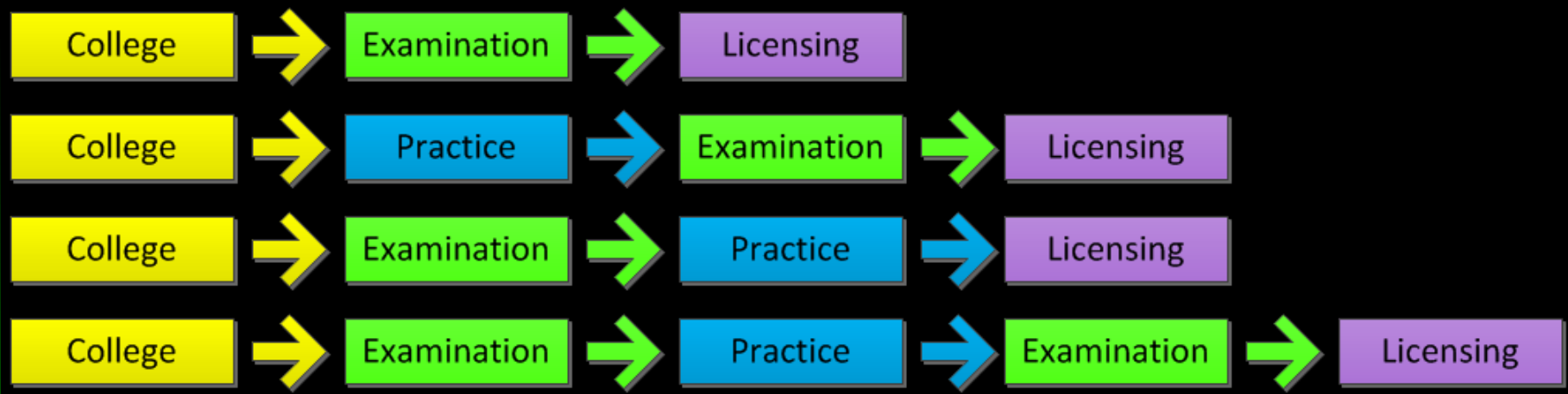
Post-Secondary Education in STEM Fields

- Doctor of Philosophy or Ph.D.
- Doctor of Medicine or M.D.
 - Generally requires 2 years of coursework plus additional 2-10 years research and dissertation
 - Requires around 30-60 *graduate* semester credit hours of course work + ≥ 15 credits dissertation
 - Must have a B.S. or M.S. to get in
 - With clever advising and dual enrollment, most or all of M.S. courses can “double dip” for Ph.D.
 - Always at an accredited research university

Professional Credentials for STEM Careers

Professional Credentials Prove Skills & Training

- Generally a multi-step process
 - Step 1: get the skills
 - This is NOT always through post-secondary ed!
 - Step 2: Demonstrate your skills competency through examination
 - Step 3: Registration and licensing



Demonstration of Competency

- Proof of competency by examination
 - Occurs at all educational and occupational levels
 - A.S. Engineering Technology → ISA Certified Control Systems Technician
 - M.D. → Board of Medical Examiners Certified Medical Doctor
- Administered by state examination boards or independent professional organizations
- For many STEM professions, competency by examination is required before you can get a job
 - **WARNING!** Award of a “certificate” by a college or university **IS NOT THE SAME** as being “board certified”

Licensure & Registration

- Administered by the state government
- Demonstrates to the public an individual's competency, qualification, and expertise in professional practice
- Emphasizes the protection of the public health, safety, and welfare within society
- Often are portable to other states through reciprocity agreements
 - Florida, California and New York usually DO NOT honor reciprocity!

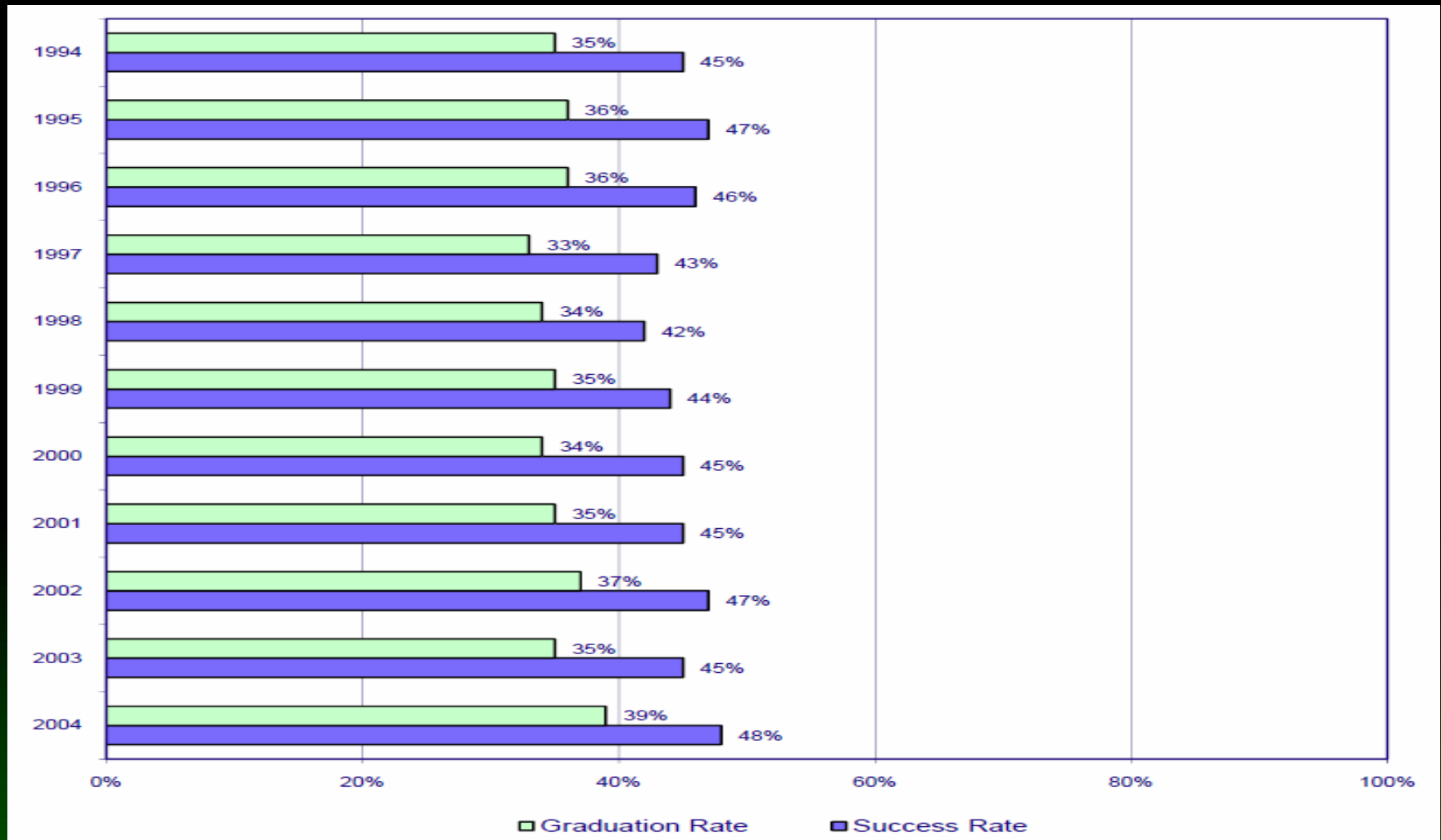
What is a University? A State College?

Florida's Two-Plus-Two Post-Secondary System

- In 1957, a report entitled "The Community Junior College in Florida's Future" was approved by the State Board of Education. The report outlined the orderly development of a statewide system of community colleges, clearly designating these institutions as the entry point for students beginning their postsecondary education. Before 1957, Florida had three universities and four community colleges. The General Education Agreement guaranteed the transfer of all general education credits from a public community college to a state university. This agreement also prohibited the universities from requiring any additional general education courses if a student had completed a general education program at a community college.

During the rapid growth that followed, four universities were opened without a lower division and the other five had severe limitations placed on lower-level enrollments (hence, the two-plus-two system). Between 1957 and 1972, twenty-four new community colleges were opened, bringing the total to twenty-eight. This expansion of the postsecondary systems spurred the development of a new articulation agreement.

FAU's Six-Year Success & Graduation Rates First Time In College Students



FAU's Six-Year Success & Graduation Rates AA Degree Transfer Students

