

Science, technology, engineering, and mathematics (STEM) occupations: a visual essay

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STEM occupations—technical jobs in science, technology, engineering, and mathematics—play an instrumental role in expanding scientific frontiers, developing new products, and generating technological progress. These occupations are concentrated in cutting-edge industries such as computer systems design, scientific research and development, and high-tech manufacturing industries. Although educational requirements vary, most of these occupations require a bachelor's degree or higher. Accordingly, STEM occupations are high-paying occupations, with most having mean wages significantly above the U.S. average. Using May 2009 data from the Occupational Employment Statistics (OES) program, this visual essay takes a closer look at STEM occupations.

For the purposes of this essay, the STEM occupation group is defined as consisting of 97 specific occupations that made up about 6 percent of U.S. employment¹—nearly 8 million jobs—in May 2009. These 97 occupations include those in computer and mathematical sciences, architecture and engineering, and life and physical sciences. Because managerial and postsecondary teaching occupations associated with these functional areas require similar skills and knowledge, these managerial and teaching occupations are included among the 97 occupations, as are two sales occupations that require scientific or technical education at the postsecondary level: sales engineers and wholesale and manufacturing sales representatives of technical and scientific products. This is only one possible definition of STEM occupations; other definitions exist that may be better suited for other uses.²

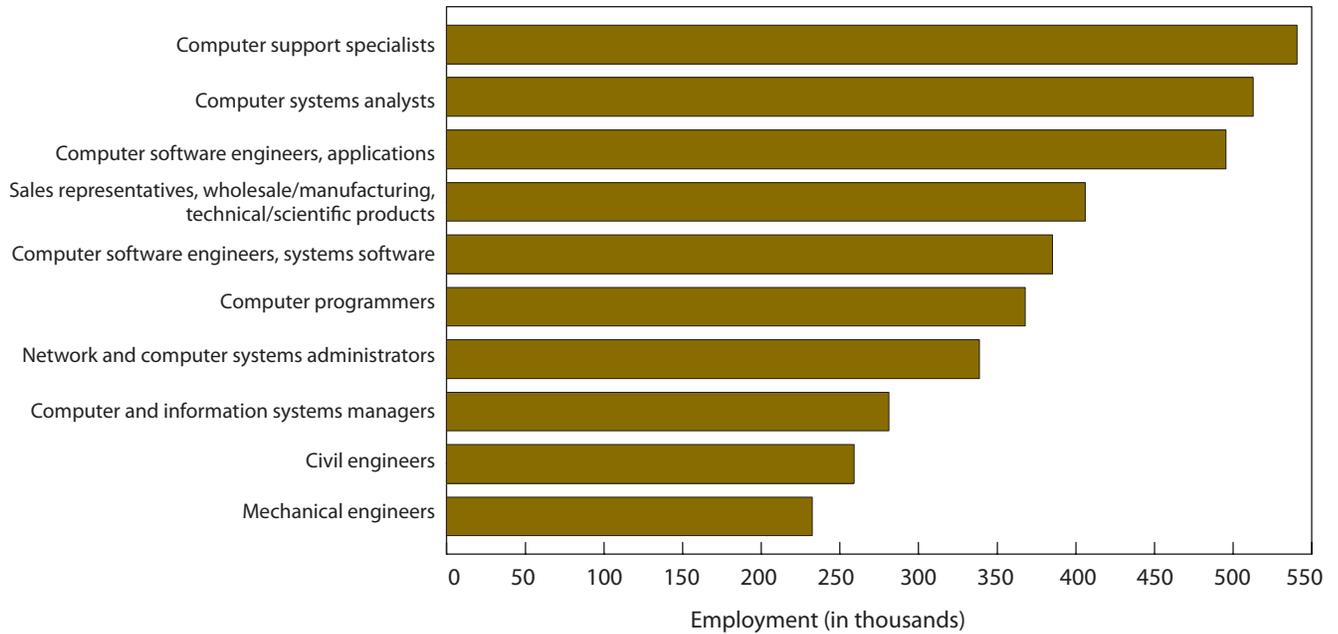
The first two charts in this visual essay present an overview of the largest STEM occupations as well as the highest- and lowest-paying STEM occupations. These charts are followed by information on the industries with especially large proportions of STEM occupations, and a more detailed look at one of these industries, pharmaceutical and medicine manufacturing. The remainder of the visual essay focuses on geographic differences in employment and wages for STEM occupations. Several charts in this last section rely on the concept of location quotients, which are ratios that compare an occupation's share of employment in an area to its share of U.S. employment. For example, an occupational group that makes up 10 percent of employment in a specific metropolitan area and 2 percent of U.S. employment would have a location quotient of 5 for that metropolitan area. A location quotient above 1 indicates a stronger-than-average local presence of STEM occupations.

The aggregate data for STEM occupations presented here are based on a special tabulation of Occupational Employment Statistics data created for this visual essay. OES estimates for individual STEM occupations, including national industry-specific data and cross-industry data for the Nation, States, and metropolitan/nonmetropolitan areas, are available from the BLS Occupational Employment Statistics homepage at www.bls.gov/oes/home.htm. This visual essay was prepared by Ben Cover, John I. Jones, and Audrey Watson, economists in the OES program. For more information, contact the OES program at oesinfo@bls.gov.

¹The Occupational Employment Statistics survey provides an estimate of all full- and part-time wage and salary jobs in nonfarm industries. The survey does not include the self-employed, owners and partners in unincorporated firms, household workers, or unpaid family workers.

²For example, a narrower definition might exclude STEM managerial and postsecondary teaching occupations, while a broader definition might include social science occupations or occupations directly associated with manufacturing and repairing technologically advanced products and equipment, such as semiconductor processors or avionics technicians.

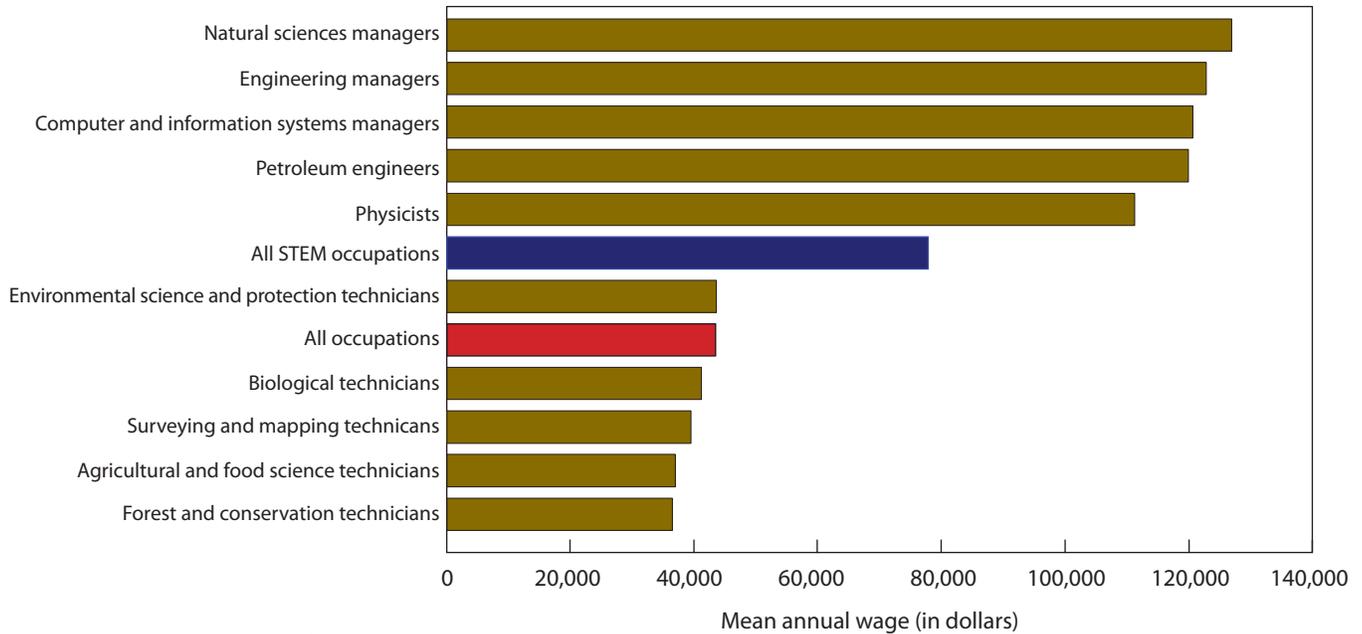
1. Employment by occupation for the largest STEM occupations, May 2009



SOURCE: U.S. Bureau of Labor Statistics

- Most of the largest STEM occupations were related to computers.
- The largest STEM occupations—computer support specialists; computer systems analysts; and computer software engineers, applications—each had employment of approximately 500,000. By comparison, the largest occupations overall, retail salespersons and cashiers, had employment of 4.2 and 3.4 million, respectively.
- The largest STEM occupation that is not specifically computer related was sales representatives, wholesale and manufacturing, technical and scientific products, with employment of about 400,000.

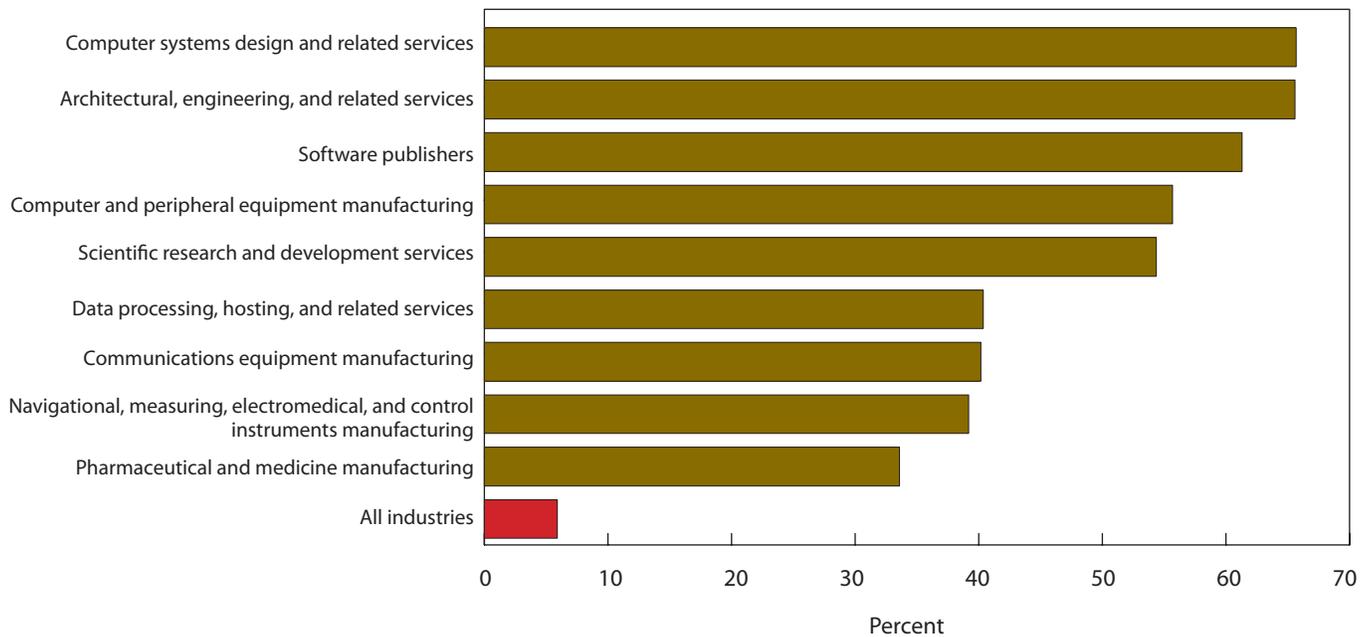
2. Highest- and lowest-paying STEM occupations, May 2009



SOURCE: U.S. Bureau of Labor Statistics

- Overall, STEM occupations were high-paying occupations. The average annual wage for all STEM occupations was \$77,880 in May 2009, and only 4 of the 97 STEM occupations had mean wages below the U.S. average of \$43,460.
- Natural science managers was the highest-paying STEM occupation.
- The highest-paying STEM occupations had mean annual wages of \$100,000 or more, and included all of the managerial STEM occupations, petroleum engineers, and physicists.
- Although the wages for the lowest-paying STEM occupations were not far below the U.S. mean for all occupations, there were considerable differences between the wages of the highest-paying and lowest-paying STEM occupations. Technician and technologist occupations—including forest and conservation technicians, agricultural and food science technicians, surveying and mapping technicians, and biological technicians—tended to be among the lowest-paying STEM occupations.

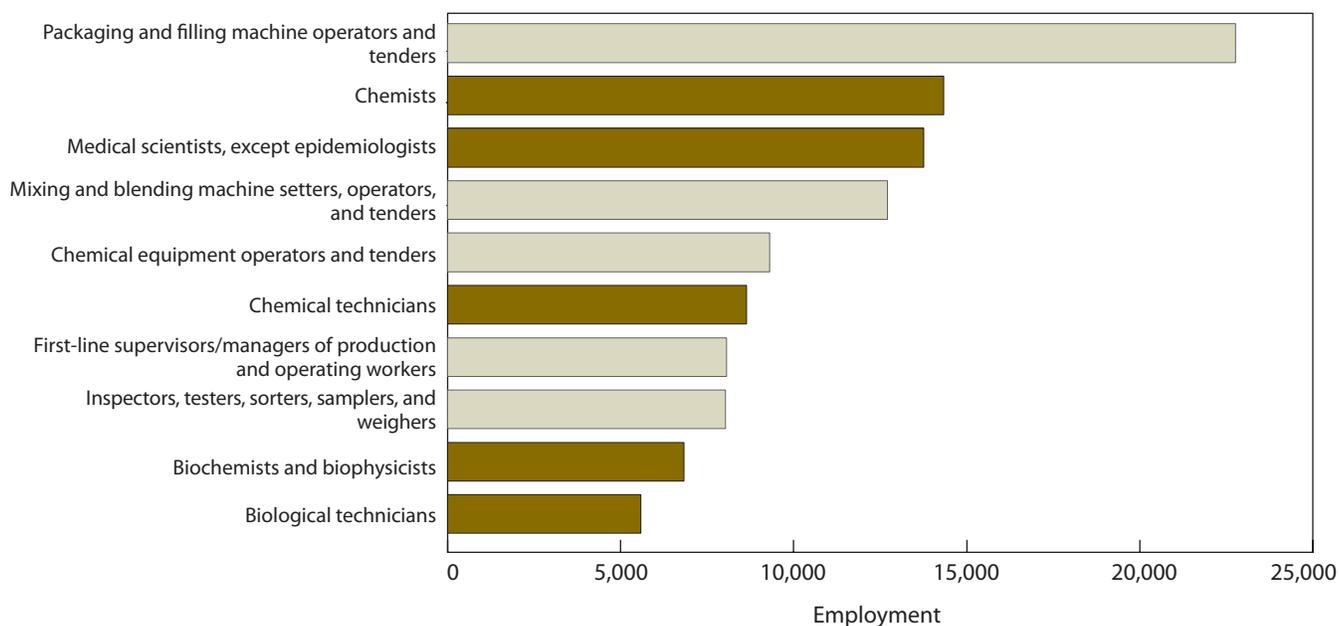
3. STEM occupations as a percent of industry employment for selected industries, May 2009



SOURCE: U.S. Bureau of Labor Statistics

- STEM occupations made up 6 percent of U.S. employment, but more than half of employment in some industries.
- More than half of the jobs in scientific research and development services; computer and peripheral equipment manufacturing; software publishers; architectural, engineering, and related services; and computer systems design and related services were in STEM occupations. The share in the latter two industries was the highest, at nearly two-thirds.
- STEM occupations accounted for 34 to 40 percent of jobs in data processing, hosting, and related services and in several high-tech manufacturing industries.
- Some industries had almost no STEM occupations. Those in which STEM occupations made up less than 0.1 percent of the jobs included several retail trade and food service industries, child day care, personal care services, nursing care facilities, and community care facilities for the elderly.

4. The largest occupations in the pharmaceutical and medicine manufacturing industry, May 2009

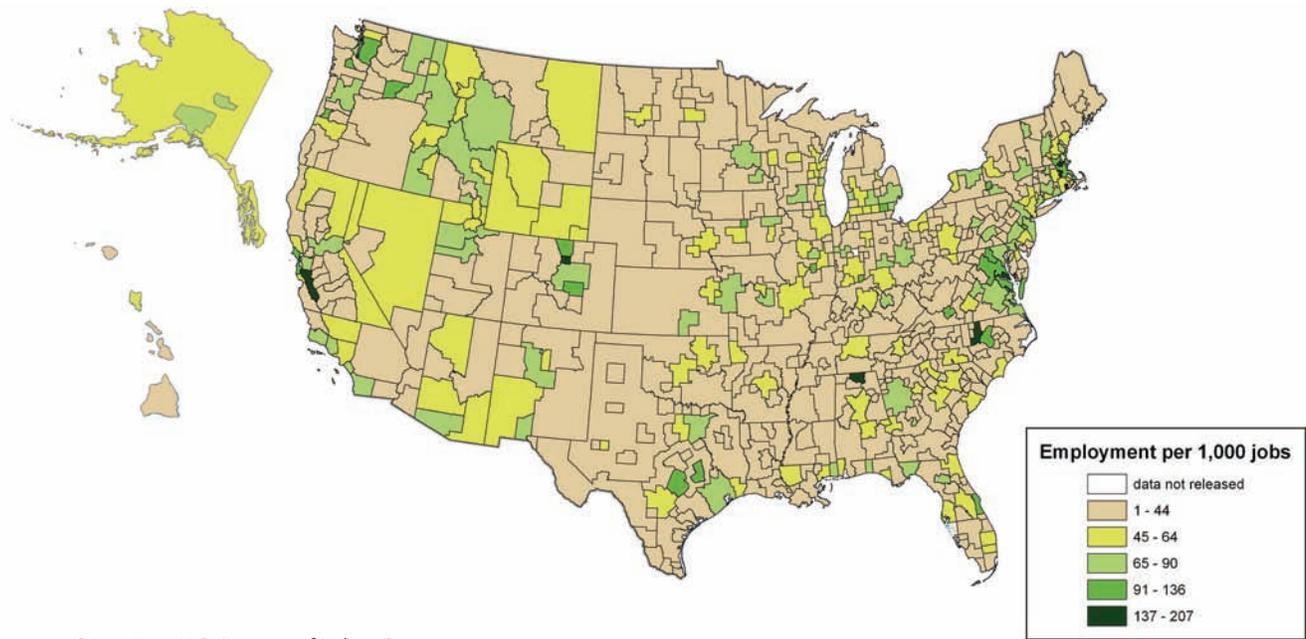


NOTE: Darker bars indicate STEM occupations.

SOURCE: U.S. Bureau of Labor Statistics

- Chemists and medical scientists were the largest STEM occupations in pharmaceutical and medicine manufacturing, with employment of 14,340 and 13,760, respectively, and were the second and third largest occupations in the industry. Several of the largest occupations in this industry, however, were production occupations, including the industry's largest occupation, packaging and filling machine operators and tenders, which had employment of 22,760.
- The five STEM occupations shown in the chart made up about 17 percent of total employment in pharmaceutical manufacturing, and about 52 percent of the industry's STEM employment.
- About 30 percent of all biochemists and biophysicists, 18 percent of chemists, and 14 percent of medical scientists, except epidemiologists, were employed in this industry.
- Biological technicians employed in pharmaceutical manufacturing earned an average of \$42,950 per year, not statistically different from the mean of \$43,460 for all occupations in the U.S. The remaining four STEM occupations in this chart had above-average wages, ranging from \$46,740 for chemical technicians to \$91,720 for medical scientists, except epidemiologists.
- As is typical for industries with high percentages of STEM occupations, the overall average wage in pharmaceutical manufacturing (\$63,450) was substantially above the U.S. all-occupations mean. However, several other industries with high percentages of STEM jobs had higher overall mean wages; this reflects, in part, the prevalence of relatively low-paying production occupations in pharmaceutical manufacturing.

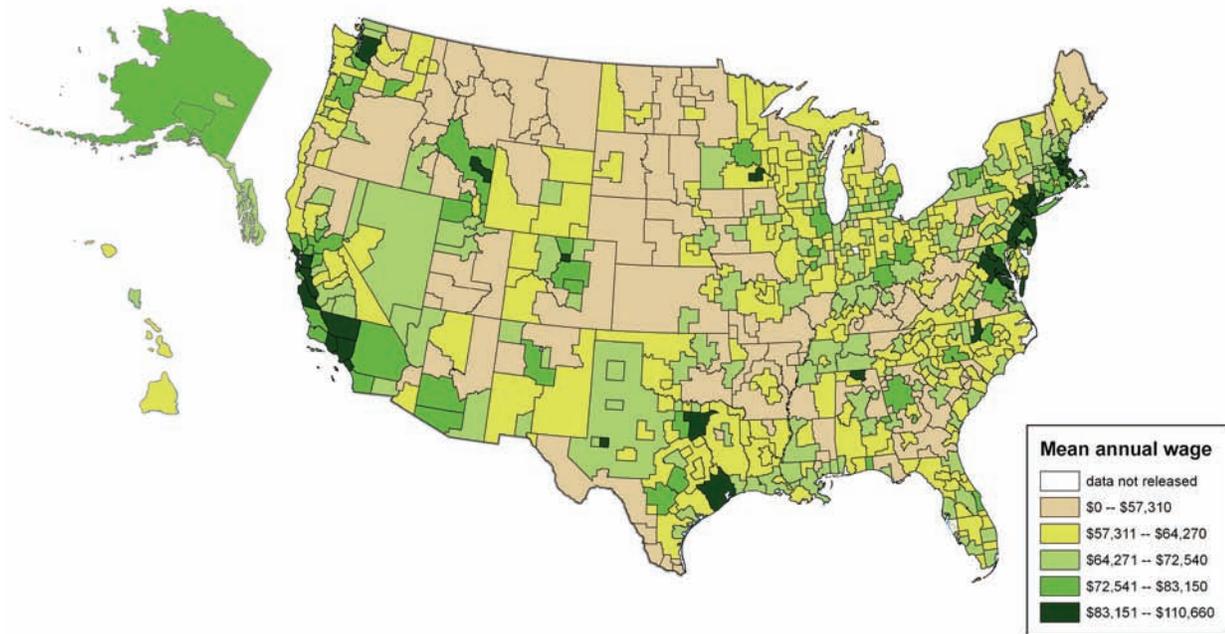
5. STEM occupations as a percent of total employment, by geographic area, May 2009



SOURCE: U.S. Bureau of Labor Statistics

- High concentrations of STEM occupations are usually in areas with technology centers and research parks.
- The metropolitan areas where STEM occupations accounted for at least 15 percent of total jobs were San Jose-Sunnyvale-Santa Clara, CA (193 per 1,000 jobs); Boulder, CO (173 per 1,000 jobs); Huntsville, AL (167 per 1,000 jobs); Framingham, MA (162 per 1,000 jobs); Lowell-Billerica-Chelmsford, MA-NH (158 per 1,000 jobs); and Durham, NC (157 per 1,000 jobs).
- The concentration of STEM occupations in San Jose-Sunnyvale-Santa Clara, CA, which includes the center of Silicon Valley, Santa Clara County, was more than three times that for the U.S. as a whole.
- The highest concentration of jobs in STEM occupations was not found in the center of Silicon Valley (San Jose-Sunnyvale-Santa Clara, CA), but in a nonmetropolitan area, St. Mary's County, MD (207 per 1,000 jobs).

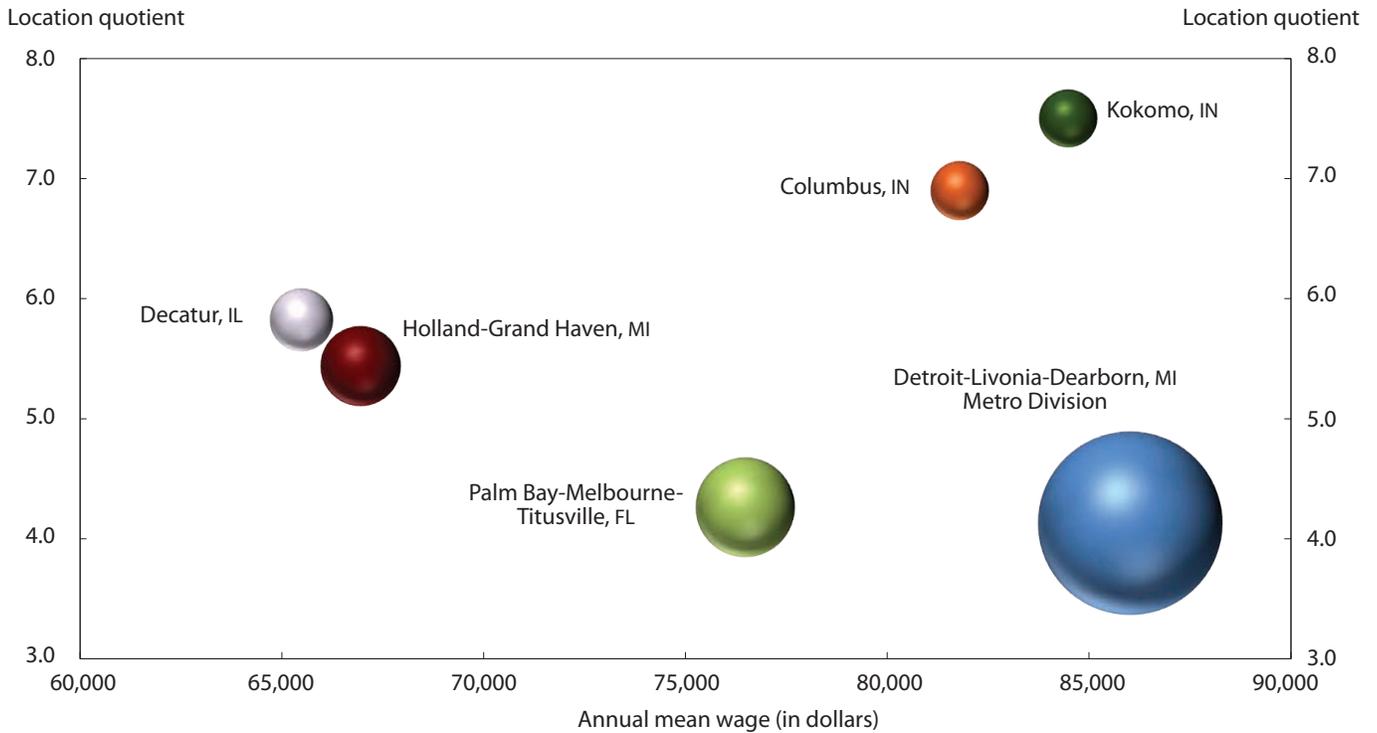
6. Annual average STEM wages, by geographic area, May 2009



SOURCE: U.S. Bureau of Labor Statistics

- The areas with the highest annual average wages for STEM occupations were Idaho Falls, ID (\$110,660); San Jose–Sunnyvale–Santa Clara, CA (\$109,930); San Francisco–San Mateo–Redwood City, CA (\$97,970); Washington–Arlington–Alexandria, DC–VA–MD–WV (\$94,610); and Lowell–Billerica–Chelmsford, MA–NH (\$94,190).
- Areas with high concentrations of STEM occupations tended to have higher wages for those occupations. An area's mean wages for STEM occupations and their concentration (STEM jobs per 1,000 jobs) had a correlation coefficient of 0.67; this indicates that areas with higher wages for STEM jobs also had relatively more STEM jobs. For instance, San Jose–Sunnyvale–Santa Clara, CA, had STEM employment of 171,290 with a high job concentration (193 per 1,000 jobs) and a high annual average wage (\$109,930). With STEM employment of 3,090, Idaho Falls, ID, is an example of an exception to the relationship between higher concentrations of STEM occupations and higher wages. Despite its especially high average annual wage for STEM occupations, Idaho Falls had a STEM job concentration (62 per 1,000 jobs) near that of the United States overall (44 per 1,000 jobs).

7. Geographic areas with the highest location quotients for industrial engineers, by wage and employment level, May 2009

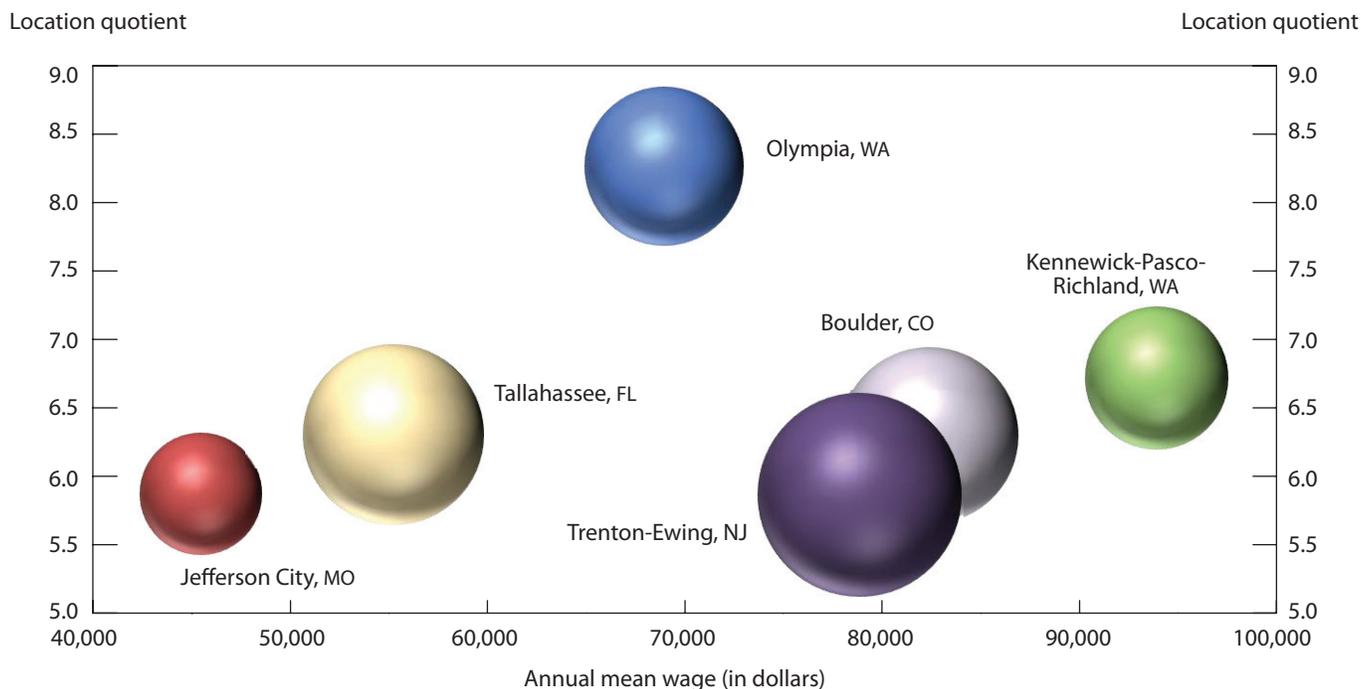


NOTE: Bubble size shows employment level.

SOURCE: U.S. Bureau of Labor Statistics

- Industrial engineers held fewer than 2 of every 1,000 jobs in the U.S. as a whole, but approximately 7 to 12 jobs per 1,000 in the areas shown.
- Most of the geographic areas where industrial engineers made up a relatively large share of local employment were in Michigan or Indiana. Decatur, IL, and Palm Bay-Melbourne-Titusville, FL, also had among the highest employment shares of industrial engineers.
- Although industrial engineers made up above-average shares of employment in the geographic areas shown on the chart, most of these areas did not have high employment levels for industrial engineers. Detroit-Livonia-Dearborn, MI, had the highest number—4,670—among the areas shown. Palm Bay-Melbourne-Titusville, FL, was next highest with 1,330 industrial engineers, while the other areas each had fewer than 1,000.
- Of the areas shown, only Kokomo, IN, and Detroit-Livonia-Dearborn, MI, had wages for industrial engineers above the U.S. average of \$77,090 for this occupation.

8. Geographic areas with the highest location quotients for environmental scientists and specialists, including health, by wage and employment level, May 2009

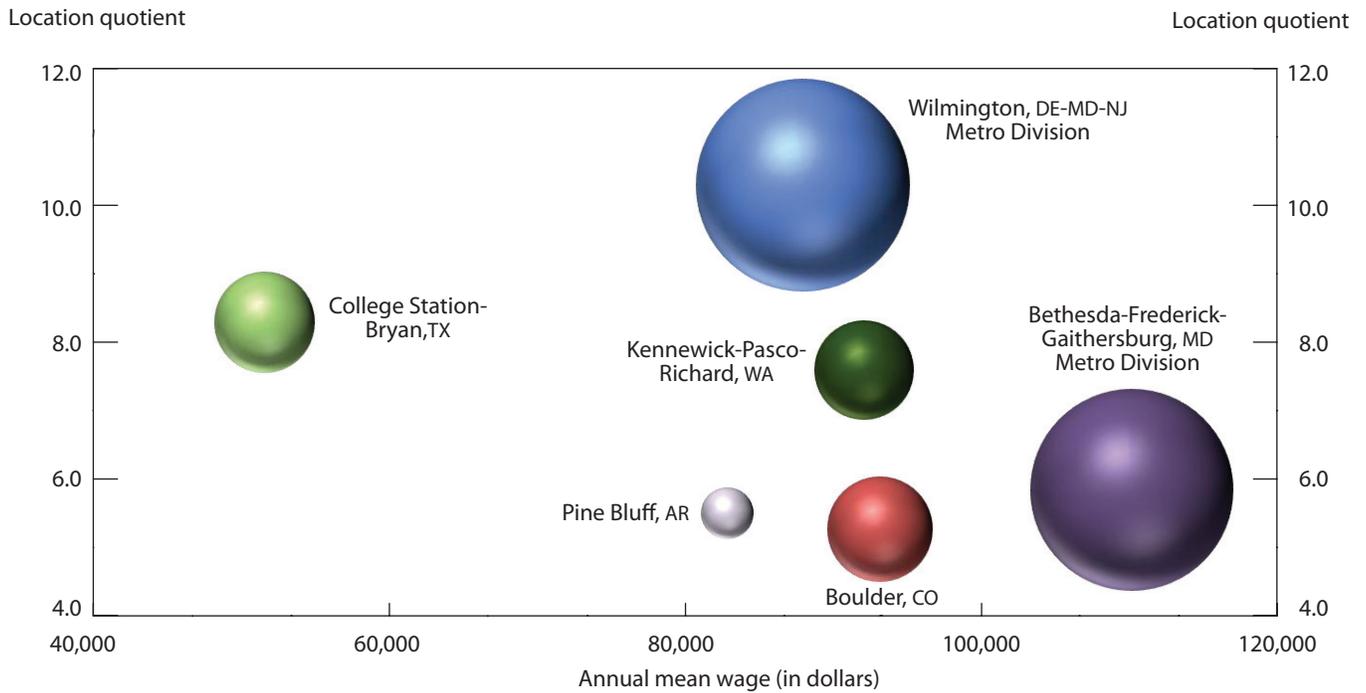


NOTE: Bubble size shows employment level.

SOURCE: U.S. Bureau of Labor Statistics

- Olympia, WA, had the highest concentration of environmental scientists and specialists of any metropolitan area in the United States: environmental scientists and specialists, including health made up approximately 5 jobs per 1,000 in Olympia, more than 8 times the average employment share of this occupation in the U.S. as a whole. A second metropolitan area in Washington, Kennewick-Pasco-Richland, also had one of the highest employment shares of environmental scientists and specialists.
- Despite their high employment concentrations of environmental scientists and specialists, each of the areas shown had fewer than 1,000 jobs in this occupation. Among the areas included in the chart, the number of environmental scientist and specialist jobs ranged from 300 in Jefferson City, MO, to 840 in Trenton-Ewing, NJ. By contrast, areas with relatively large numbers of environmental scientist and specialist jobs included the Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Division (3,440); Houston-Sugar Land-Baytown, TX (2,650); the Boston-Cambridge-Quincy, MA New England City and Town Area Division (2,040); and the Seattle-Bellevue-Everett, WA Metropolitan Division (1,980).
- Wages for environmental scientists and specialists varied widely among the areas shown, from \$43,610 in Jefferson City, MO, to \$88,040 in Kennewick-Pasco-Richland, WA. The U.S. average wage for this occupation was \$67,360.

9. Geographic areas with the highest location quotients for chemists, by wage and employment level, May 2009

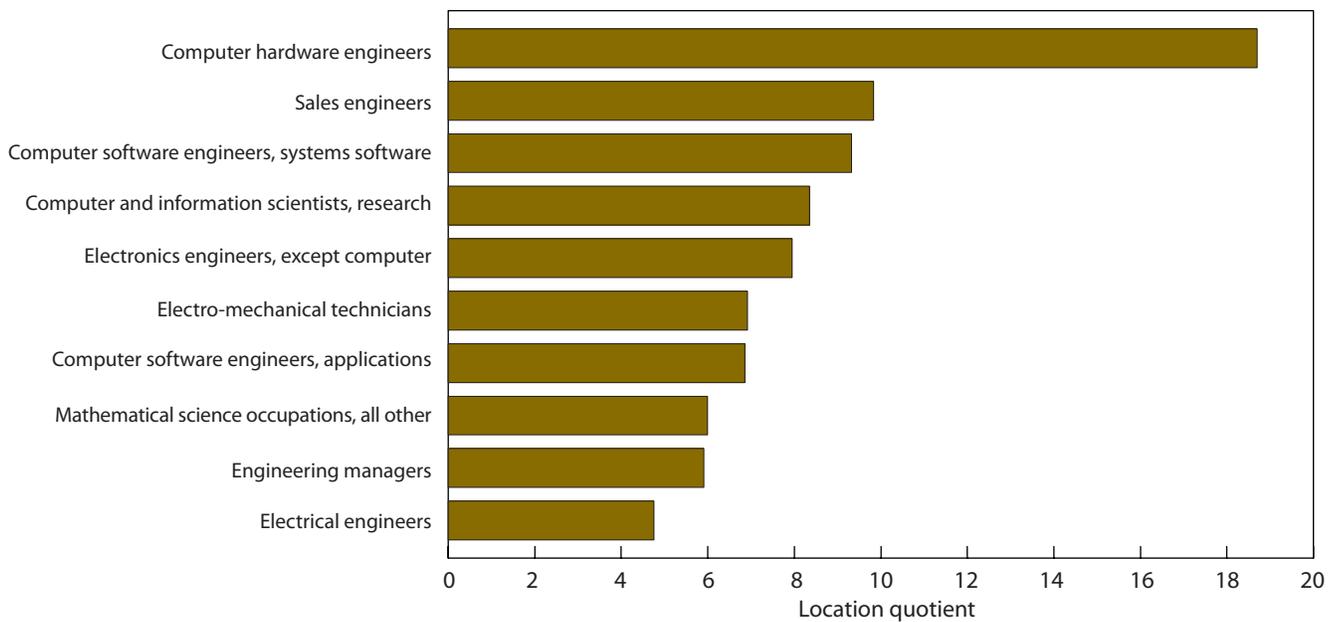


NOTE: Bubble size shows employment level.

SOURCE: U.S. Bureau of Labor Statistics

- The Wilmington, DE, area had an employment concentration of chemists more than 10 times the U.S. average. Although chemists accounted for less than 1 job per 1,000 in the U.S. as a whole, chemists held more than 6 of every 1,000 jobs in the Wilmington, DE-MD-NJ Metropolitan Division and 5 of every 1,000 in College Station-Bryan, TX.
- Of the areas shown, the Wilmington, DE and Bethesda-Frederick-Gaithersburg, MD Metropolitan Divisions had the highest numbers of chemists, with employment of 2,070 and 1,870, respectively. The remaining areas in the chart each had 500 or fewer chemist jobs.
- Wages for chemists in all of the areas shown except College Station-Bryan, TX, exceeded the \$72,740 U.S. average for chemists. With an average wage of \$108,710 for chemists, Bethesda-Frederick-Gaithersburg, MD, had the highest pay of any of the areas shown.

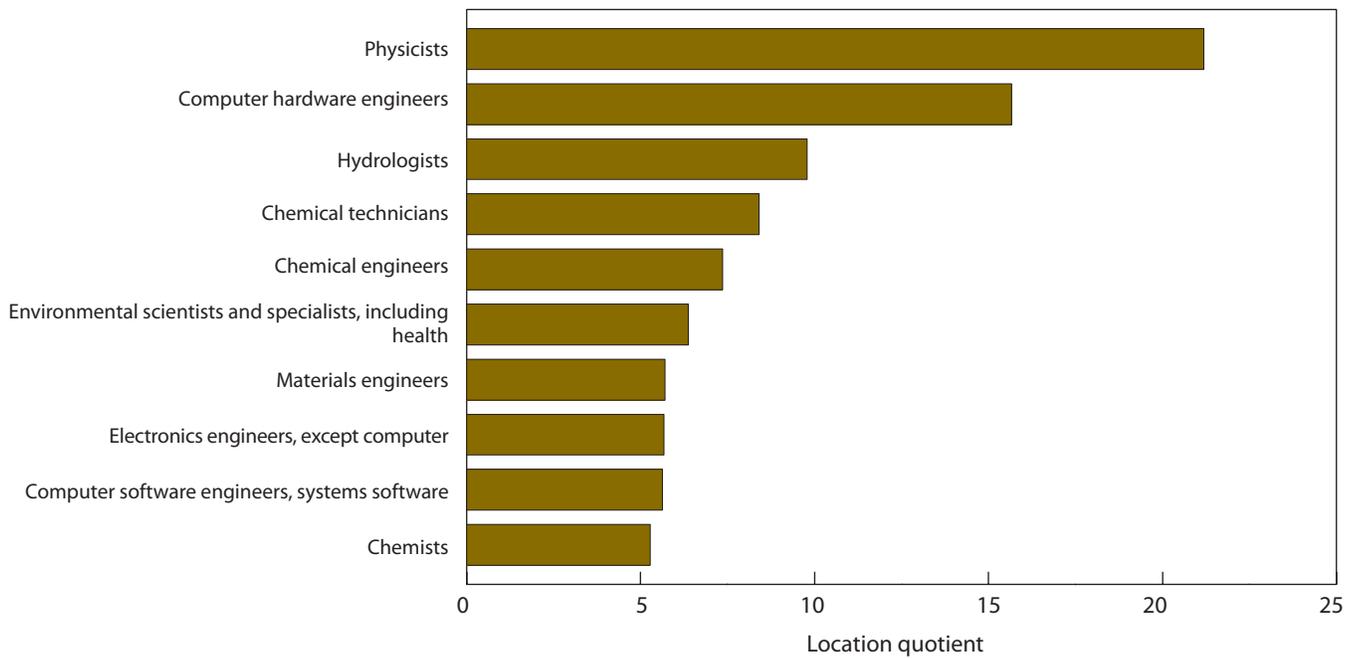
10. STEM occupations with the highest location quotients in San Jose-Sunnyvale-Santa Clara, CA, May 2009



SOURCE: U.S. Bureau of Labor Statistics

- Most of the STEM occupations with the highest location quotients in San Jose-Sunnyvale-Santa Clara, CA, were related to information technology.
- Computer hardware engineers made up almost 1 percent of employment in San Jose-Sunnyvale-Santa Clara, CA, while computer hardware engineers nationwide made up only 0.05 percent of total employment; the result is a location quotient of nearly 19.
- Although computer hardware engineers had the highest STEM location quotient in San Jose-Sunnyvale-Santa Clara, CA, their employment level (8,310) was exceeded by that of computer software engineers, systems software (24,460).
- Wages for the occupations shown ranged from \$61,090 for electro-mechanical technicians to \$162,760 for engineering managers. All wages were higher than the national average for that occupation.

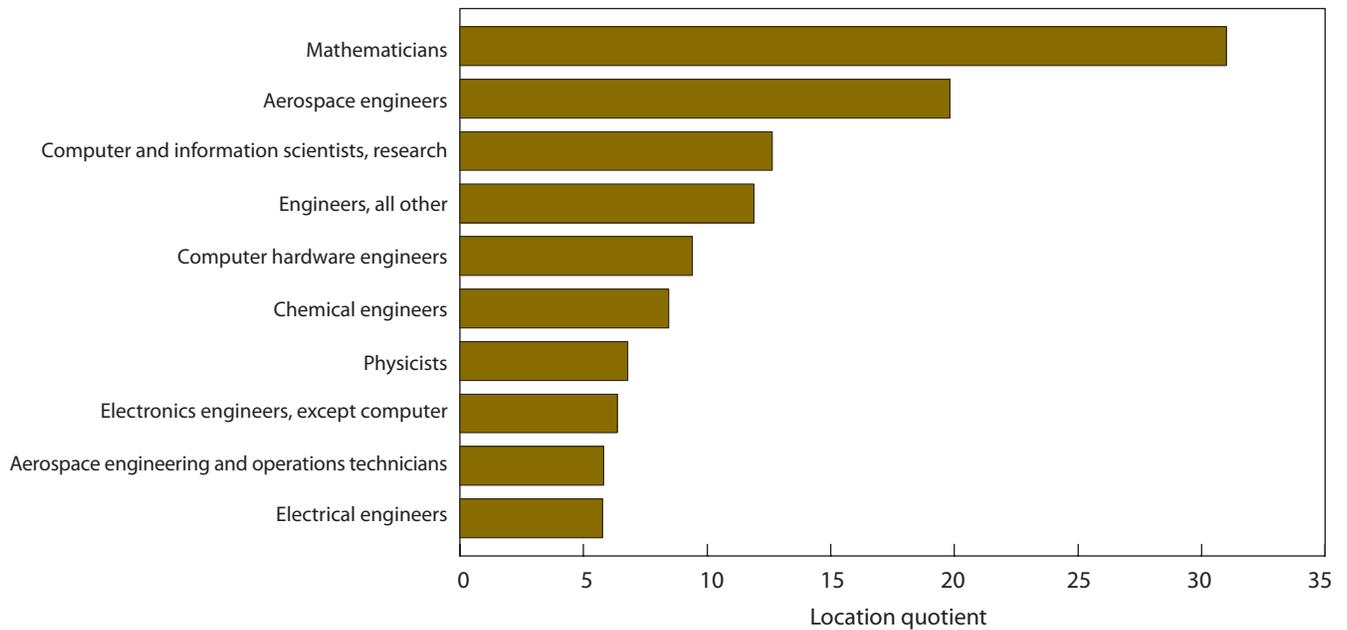
11. STEM occupations with the highest location quotients in Boulder, CO, May 2009



SOURCE: U.S. Bureau of Labor Statistics

- The STEM occupations with the highest location quotients in Boulder, CO, were related to the physical sciences and engineering even though the STEM occupations with the highest employment levels were those related to information technology.
- The concentration of employment for physicists in Boulder, CO, was 21 times the national average.
- Although physicists had the highest location quotient among the occupations shown, the chart's occupation with the highest employment level was computer software engineers, systems software, (2,590) and the lowest was hydrologists (80).
- Wages for the occupations shown ranged from \$59,820 for chemical technicians to \$116,640 for computer hardware engineers.

12. STEM occupations with the highest location quotients in Huntsville, AL, May 2009



SOURCE: U.S. Bureau of Labor Statistics

- The STEM occupations with the highest location quotients in Huntsville, AL, were related to math, engineering, information technology, and the physical sciences.
- The concentration of employment for mathematicians in Huntsville, AL, was 31 times the national average; mathematicians accounted for 0.62 of every 1,000 jobs in Huntsville.
- Among Huntsville's STEM occupations with high location quotients, the occupation with the highest level of employment was engineers, all other, with 2,980. Although aerospace engineers had a location quotient close to 20, this represented fewer jobs.
- Wages for the occupations shown ranged from \$64,800 for aerospace engineering and operations technicians to \$106,980 for engineers, all other.