



Labor Market Context: Demand for and Supply of Scientists & Engineers

*COSEPUP Committee on Underrepresented
Groups and the Expansion of the Science and
Engineering Workforce Pipeline*

March 11, 2008



15 minutes, 5 points

1. Don't depend on shortage claims
2. Pay attention to demand (not only supply)
3. Don't blame it all on K-12
4. URM: Maximize equity, maximize potential
5. Be honest with students



1. Don't rely on shortage claims

- n Conventional claim

- n more S&Es = economic, strategic advantage
- n "Human capital mercantilism"

- n S&E "shortages"; "shortfalls": long history

- n 1950/60s: post-Sputnik Cold War competition
- n 1980s: NSF Director (Cong. Investigation)
- n 1990s: IT industry (followed by Bust)
- n Recent: Industry (Gates), NAS Report – need to compete w/China, India, Europe



Weak argument: demand for S&Es slack...

- n Much variation over time, field, location
- n Consistent w/ tight labor markets in some specialties (especially new/growing)
- n But, if anything, data point to surpluses
- n RAND on late 1990s high-tech boom:
rising S&E unemployment that "while the overall economy is doing well, is a strong indicator of developing surpluses of workers, not shortages."
- n Since: IT, telecom, biotech bubbles burst



Can't find evidence of shortages

- n Researchers at RAND, Urban Institute, Harvard, Georgia State, Georgetown
- n Some National Academies committees (but cf. "Rising Above..." report)



Yet “shortage” claims persist - why?

- n Interest groups making their case
 - n Employers
 - n Universities
 - n Government funders
 - n Immigration lawyers
- n Intend no harm; just promoting interests
- n But politicians, journalists often believe
- n & govt agencies often fail to analyze

U.S. workforce in S&E occupations: 1983–2006

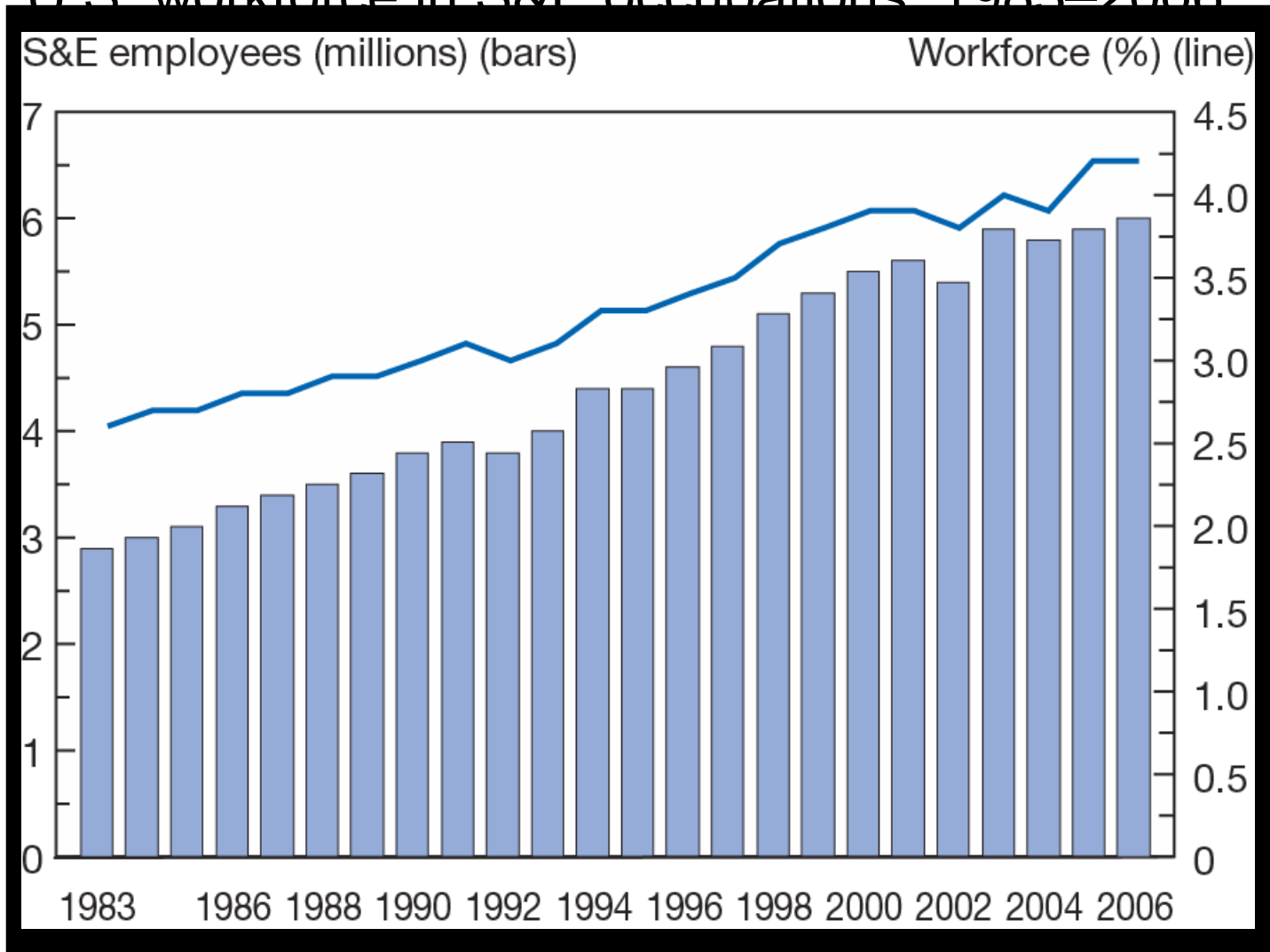
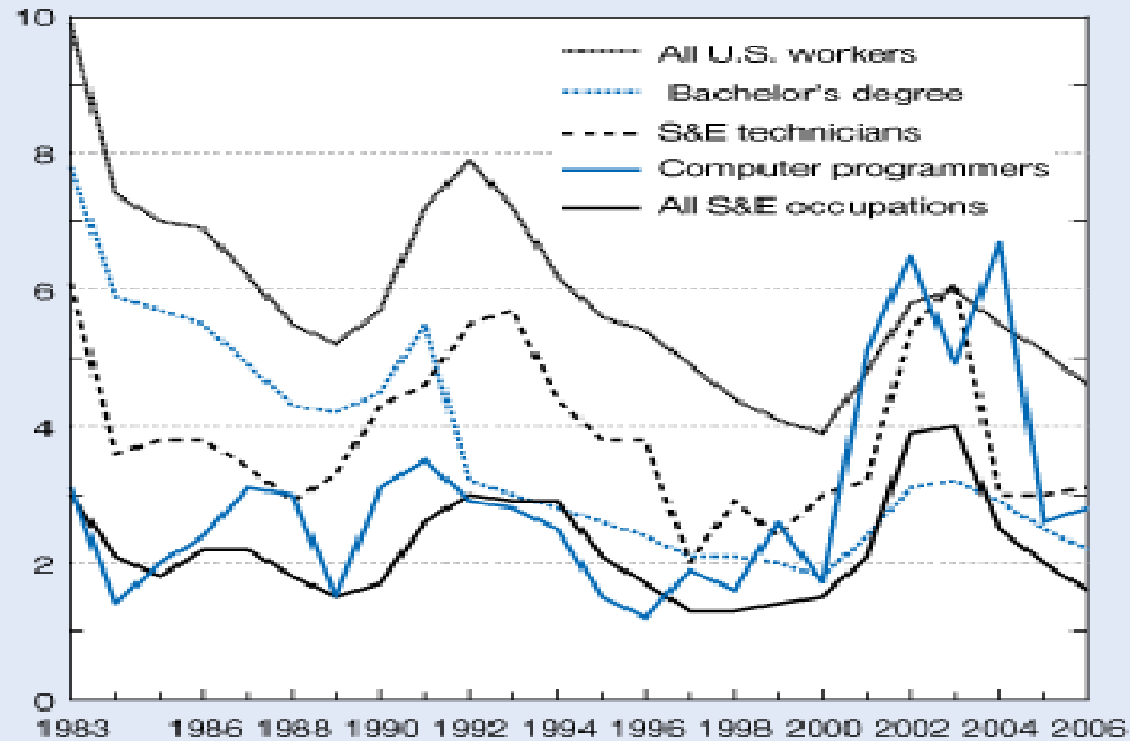


Figure 3-12
Unemployment rate, by occupation: 1983–2006

Percent



SOURCE: National Bureau of Economic Research, Merged Outgoing Rotation Group Files; Bureau of Labor Statistics, Current Population Survey.

Science and Engineering Indicators 2008



2. Demand as impt as supply

- n Supply: Overwhelming focus
- n Demand: Little attention paid
- n Yet supply & demand are always linked
- n & future demand hard to forecast

Typical report recommendations

Tapping America's Potential (2005)

- n More/better K-12 teachers
- n More S&E undergrad/grad
 - n More scholarships & loan-forgiveness at all levels
- n More S&E immigrants
- n More research funding



Rising Above the Gathering Storm (2006)

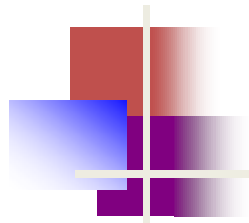
- n More/better K-12 teachers
- n More S&E scholarships
 - n +25,000 4-yr undergraduate
 - n +5,000 3-yr graduate
- n More S&E immigrants
- n More research funding
- n Double R&D tax credit





Weak demand=hard career paths

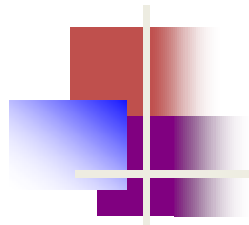
- n PhDs: Long degree + postdoc(s)
- n Tenure-track scarce, decision delayed
- n Fed research grants impt, but difficult
 - n (NB: 1st NIH grant now at age 42+)
- n Concerns:
 - n Loss of creativity of young scientists
 - n Affects later career decisions
 - n Deters future PhDs



Postdocs vs. tenured faculty

<i>Discipline</i>	<i>1987</i>	<i>1999</i>	<i>% Δ</i>
n Life Sciences	0.54	0.77	43%
n Physics/math	0.20	0.19	-5%
n Engineering	0.11	0.16	45%

n Source: Richard Freeman, Okun Lectures, Yale 2003



Engineering, IT: booms, busts

- n Attractive entry level, usually
- n But unstable career paths, buffeted by:
 - n boom/bust high-tech industries
 - n Defense procurement – erratic
 - n Offshore outsourcing
 - n Importing “specialty workers”



The future...is hazy...

- n Depends heavily on demand trends
- n Alas, many unknowables, many shocks
 - n Government S&E budgets: unpredictable
 - n Defense Department procurement
 - n Private markets: speculative booms & busts
- n Past forecasts: wildly wrong
 - n NSF Director's forecasts, late 1980s
 - n "Accurate forecasts have not been produced."
[National Research Council, 2000]
- n And getting harder (offshore outsourcing)?



3. Don't blame it all on K-12

- § Often ignored fact, but...
- § High % entering freshmen already intend S&E major
- § High intentions among all groups
 - § 31 % white
 - § 43 % Asian/Pacific Islander
 - § 35 % underrepresented minorities
- § Little change over decades

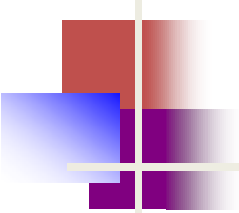
§ Source: HERI, UCLA surveys, recent years



BUT: retention low

- n < 1/2 intending freshmen complete major
 - n 1/3 shift out
 - n ~1/5 drop out
- n Significant losses of intending S&Es
- n So: a focus with high leverage: increase completion % from <50% to 60-70%

Some research sources...

- 
- n Modeling study ('90s) showed feedback
 - n NBER Science & Eng Workforce Program
 - n Study of S&E transition pts (Urban Institute)
 - n Postdocs:
 - n Sigma Xi National Postdoc Survey
 - n Study of "labor shortages" (Johns Hopkins)
 - n Study of S&E retention/completion (Cornell)
 - n Why low rates? Related to careers, demand?



4. URM: where fit?

- n Filling “shortages” = weak rationale
 - n Shortages = mirages? Lobbying pts?
 - n Universities can happily import S&E
 - n Employers can happily import, offshore
- n Question: are there special demand aspects for URMs?



Goal: Maximize potential

- n Fundamental matter of equity
- n Fulfill students' interests, potentials
 - n Loss of unique ability, creativity
- n Minimize constraints, barriers, e.g.:
 - n Lack of parental and other role models
 - n Isolation
 - n Wealth/income differentials
 - n Cultural/historical career prestige
 - n Weaker K-12 preparation



5. Students deserve honesty

- n Avoid pitches, rosy lenses
- n Accurate info re: excitement, challenges
- n Avoid disappointments, self-blame
- n But **STRONGLY** support those who are capable and interested



Close w/ few personal opinions

- n Reform K-12 science/math?
 - n **My view:** good; all need in 21st C
 - n US: high % in bottom groups in PISA
 - n But weak as “fill the pipeline” argument
- n Improve post-secondary S&E?
 - n **My view:** good, w/ focus on completion
- n Increase supply from abroad?
 - n Heavily lobbied (see 2006 Senate bill)
 - n **Be careful:** may REDUCE domestic flows



Summing up...

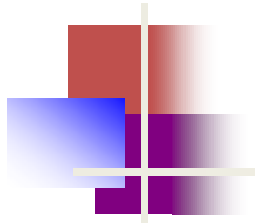
1. Don't depend on shortage claims
2. Pay attention to demand (not only supply)
3. Don't blame it all on K-12
 - Higher education interventions needed too
4. URM: Maximize equity, maximize potential
5. Be honest with students



Thanks!

Comments welcome!

Michael S. Teitelbaum
Alfred P. Sloan Foundation
teitelbaum@sloan.org



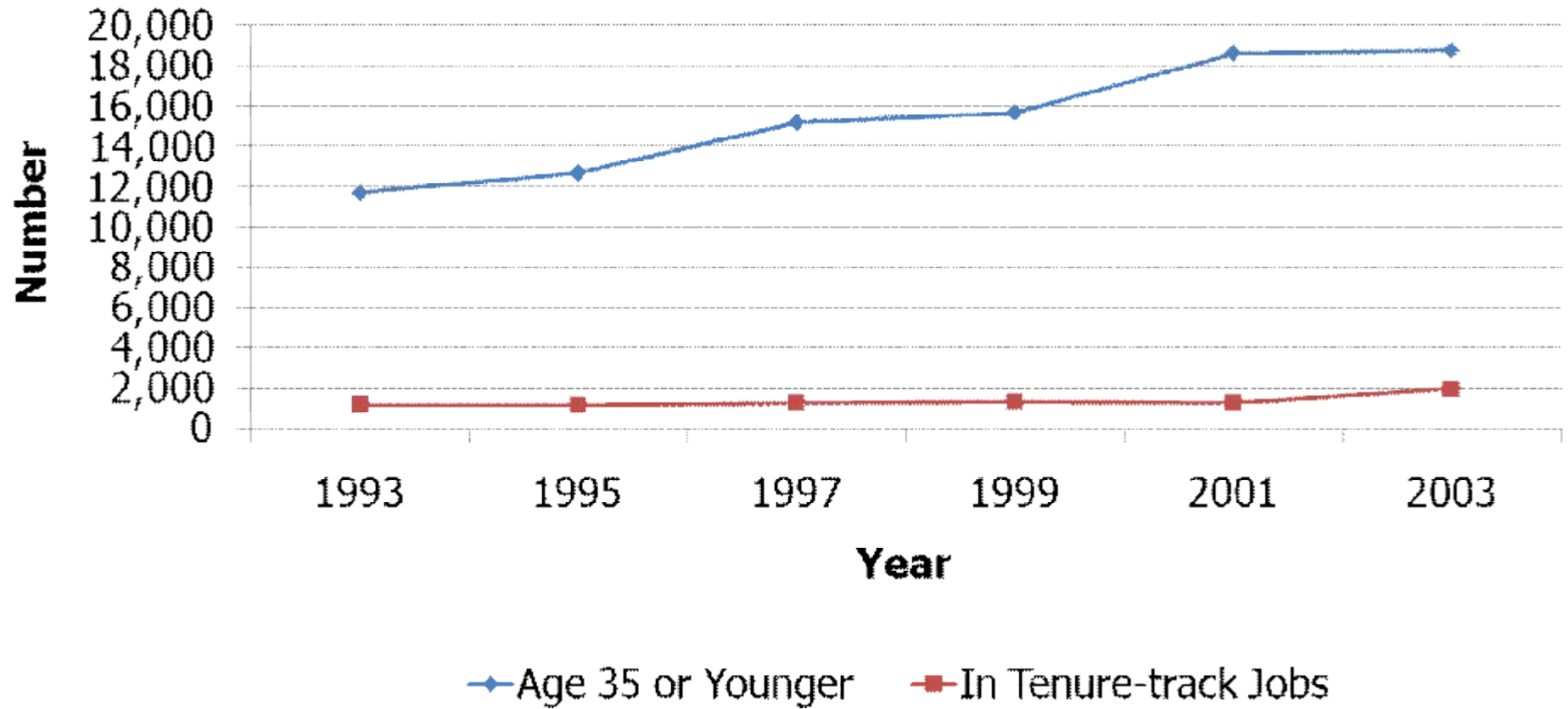
Additional slides on NIH

Case study:

Hard landing on the supply side

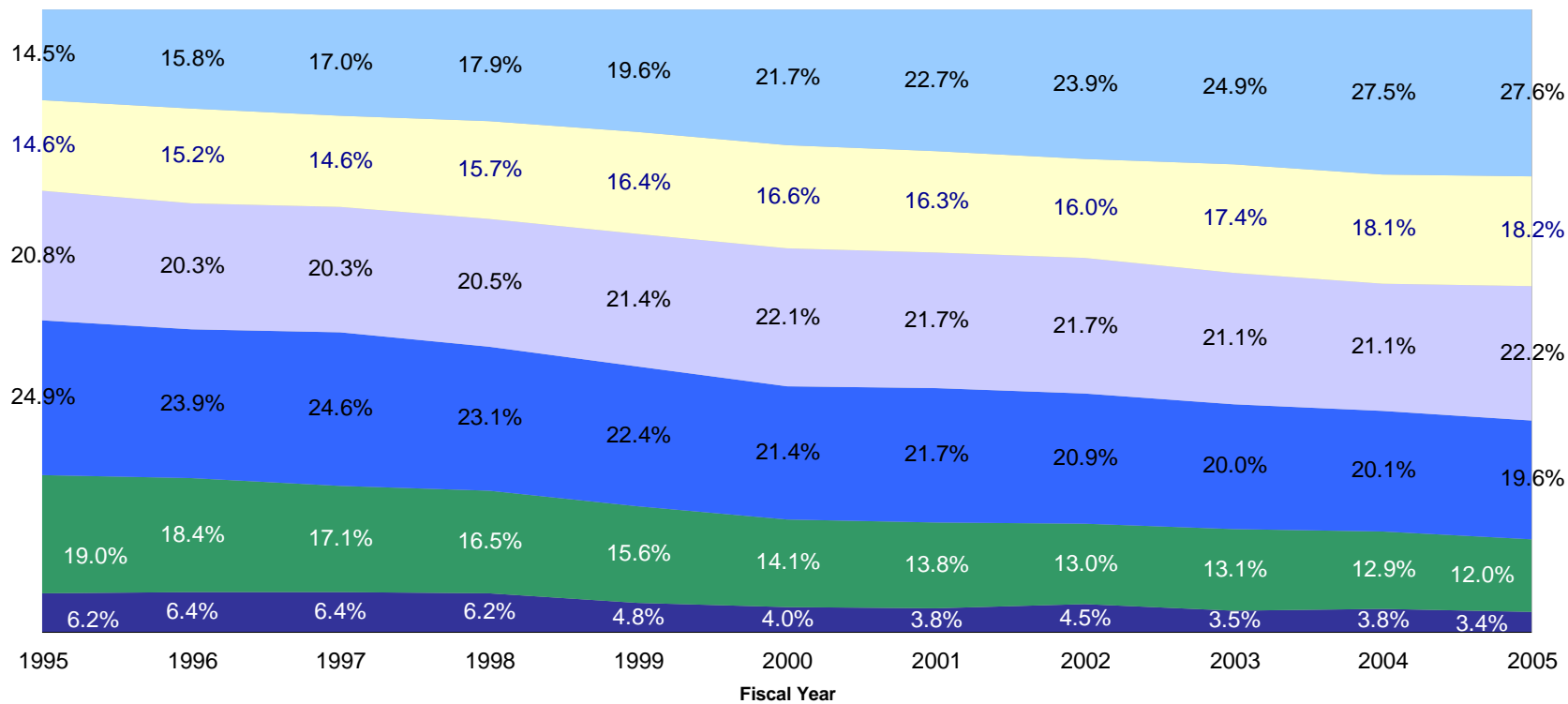
- n PhDs & postdocs funded by research grants
- n So more research funds = more PhD students and postdocs
- n Lag, then more seeking NIH research \$
- n => declining grants success rate
- n ...especially for younger scientists
- n NIH budget doubled in 5 years (1998-2003)
 - n \$13.6 billion → \$27.3 billion

Biomedical PhDs Trained in U.S. Age 35 or Younger



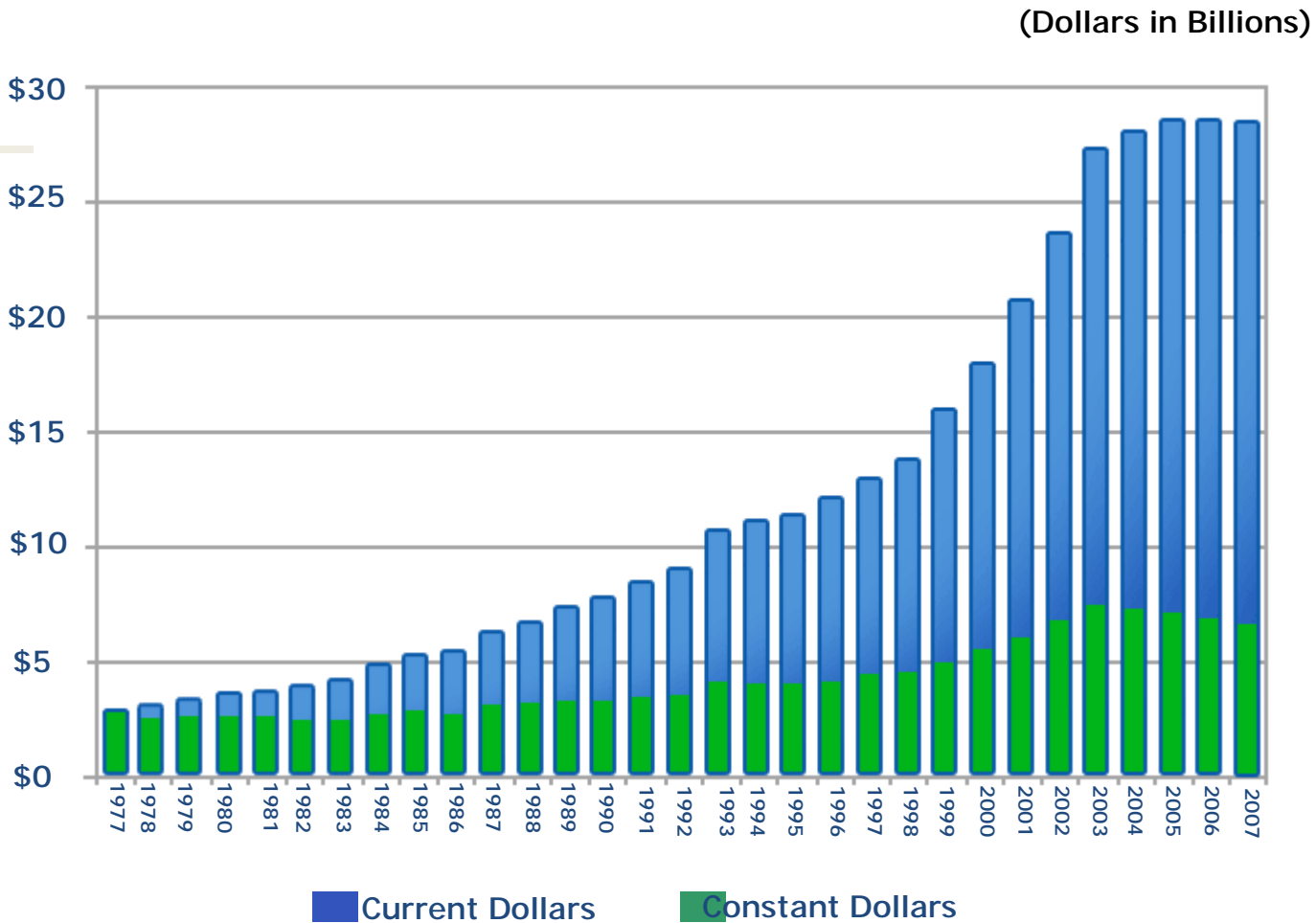
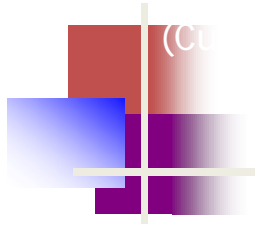
Source: Survey of Doctorate Recipients, NSF. The use of NSF data does not imply NSF endorsement of the research methods or conclusions contained in this report.

NIH Competing R01 Equivalent Awardee



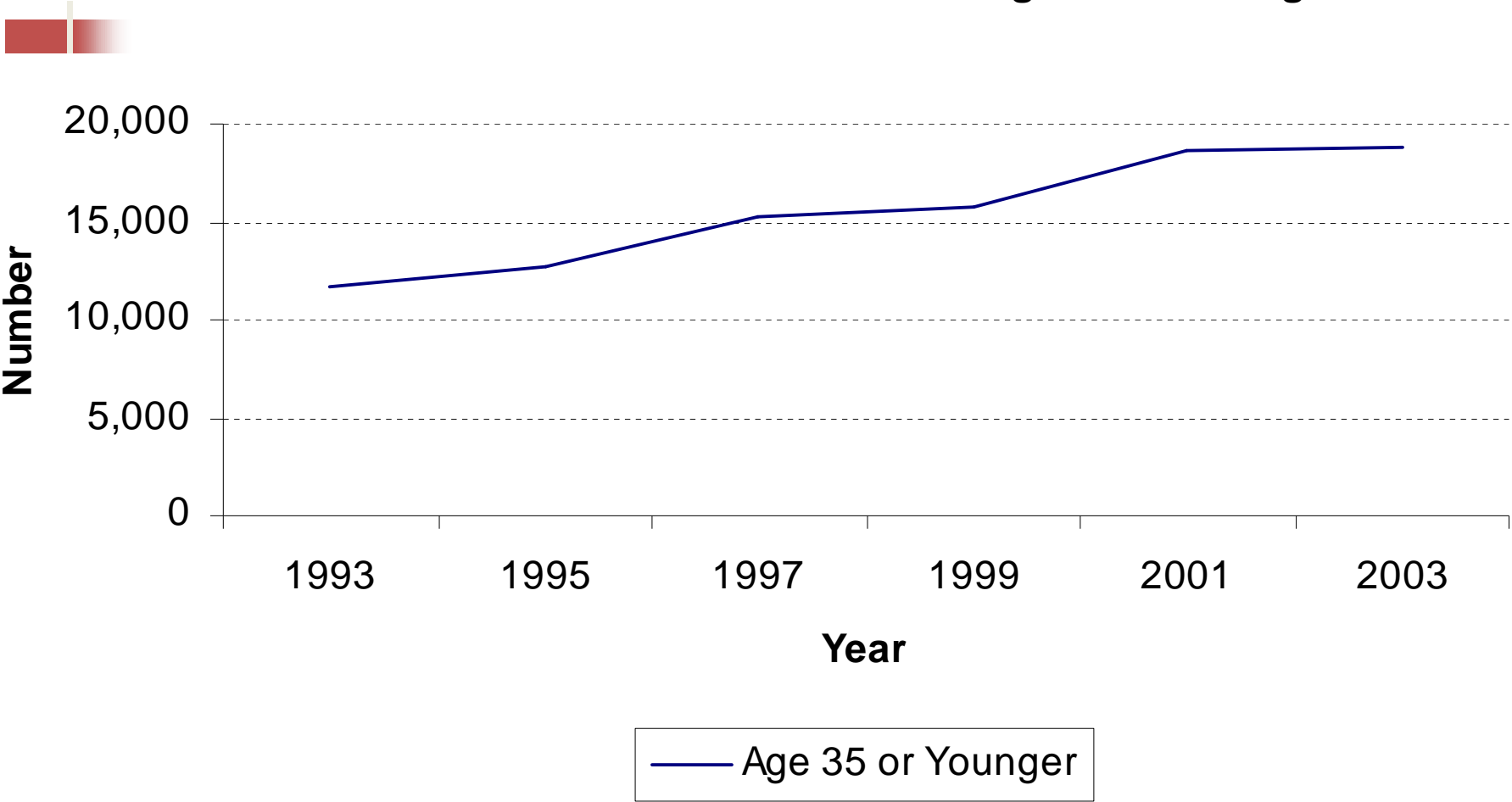
■ 35 and Younger
 ■ 36 - 40
 ■ 41 - 45
 ■ 46 - 50
 ■ 51 - 55
 ■ Over 55

NIH, OER for AIRI



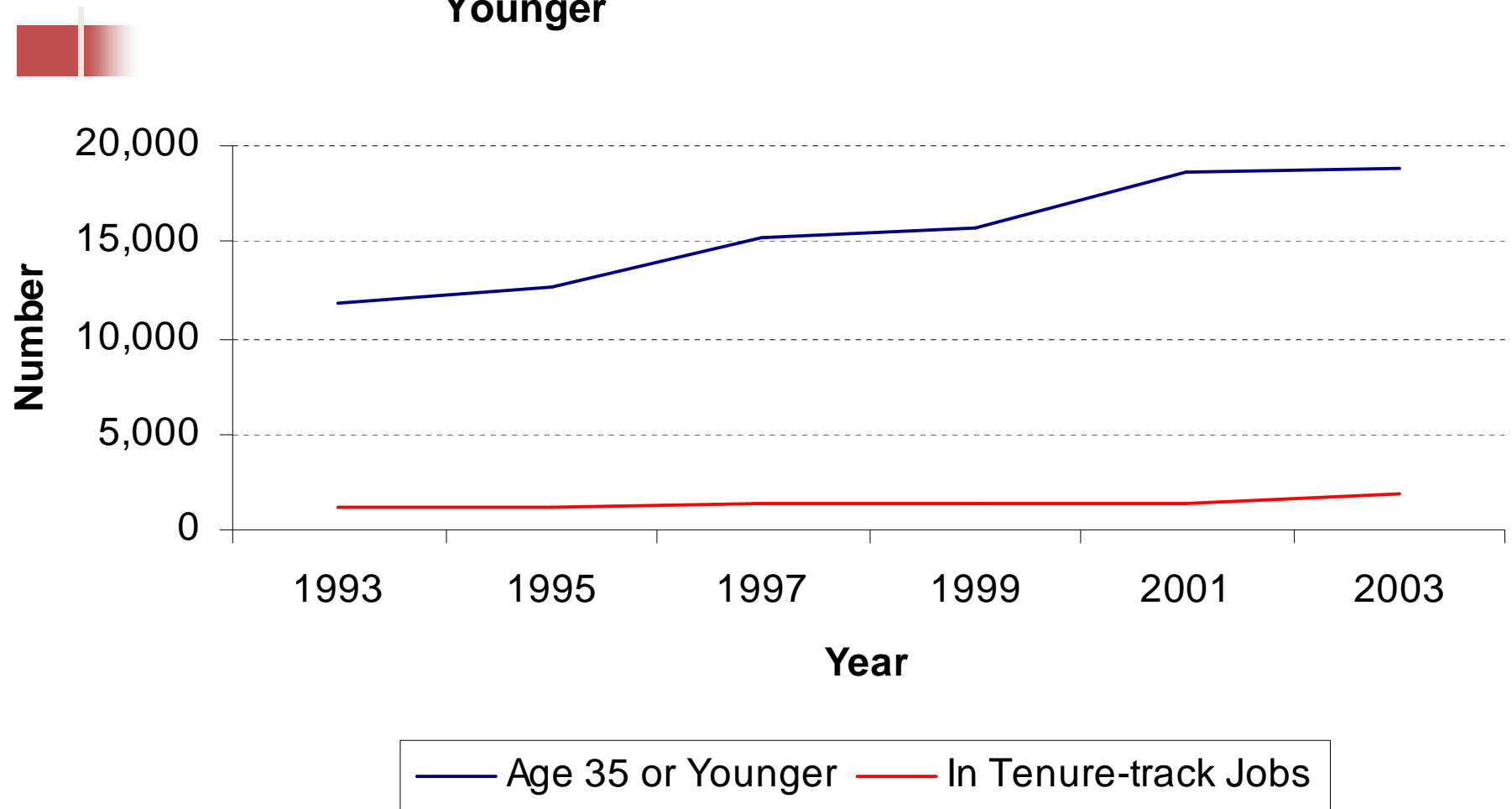
OER: NIH Budget over time

Biomedical PhDs Trained in U.S. Age 35 or Younger



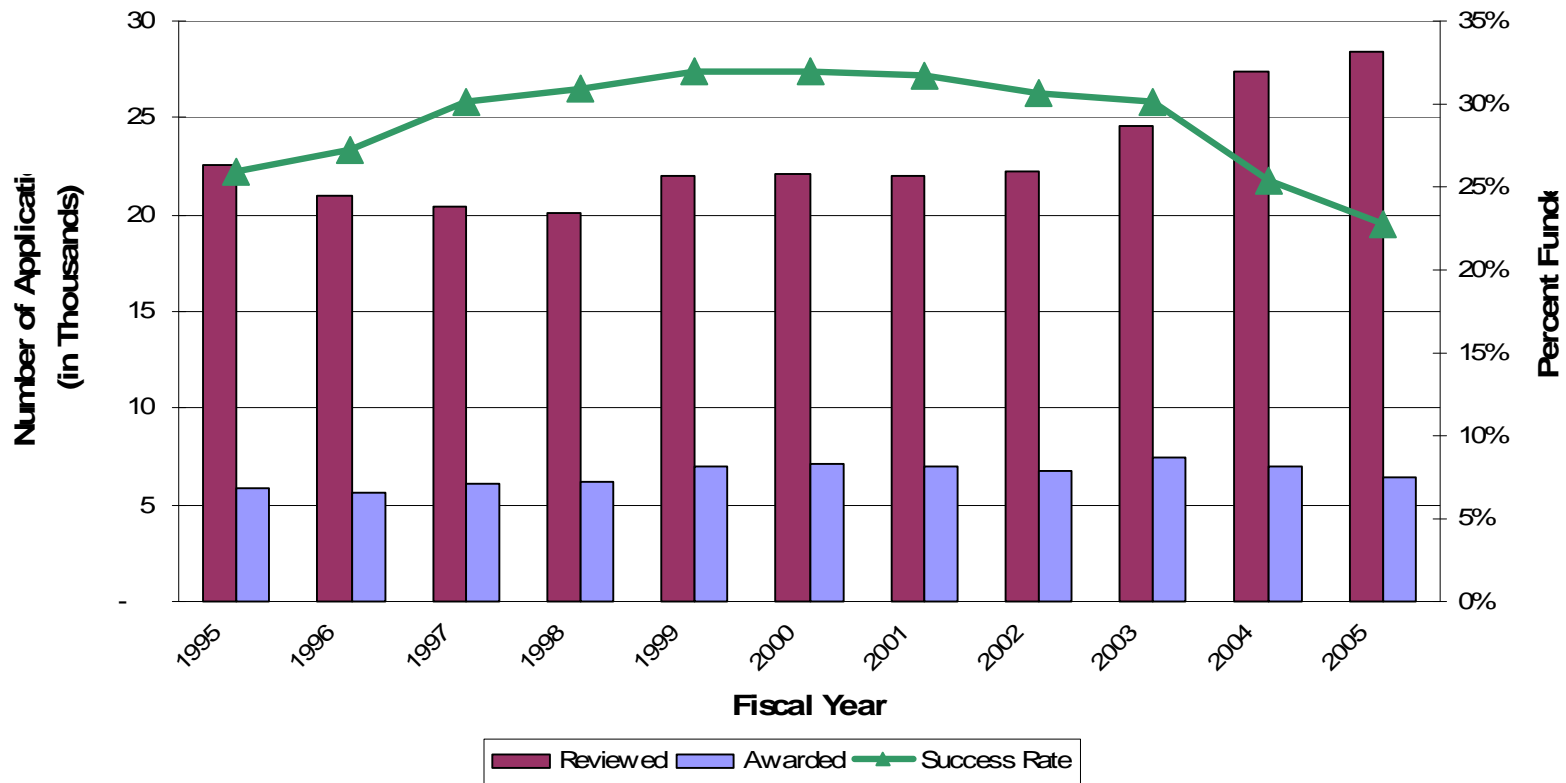
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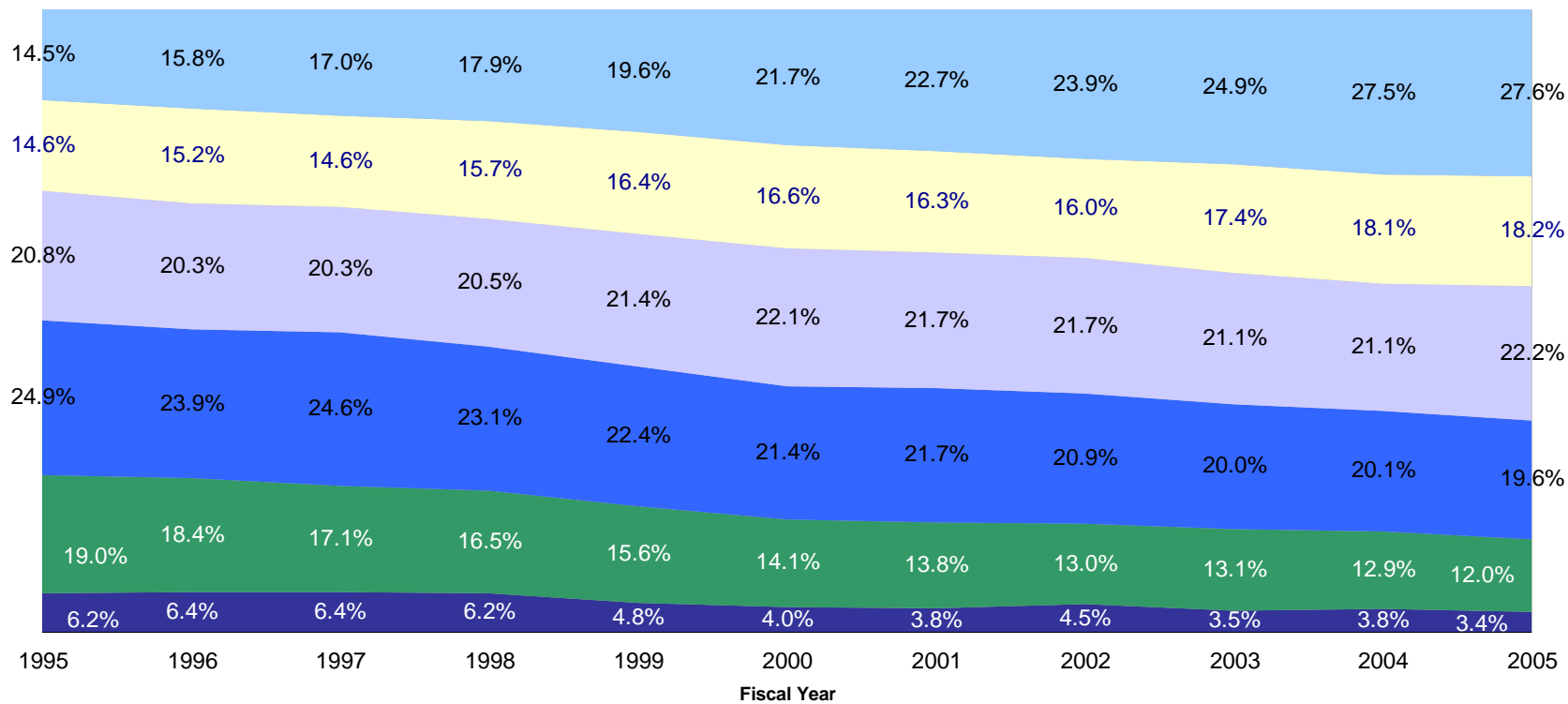
Number of NIH Competing R01 Equivalent* Applications, Awards and Percent Funded (Success Rate)



NIH, OER: "Investment..."

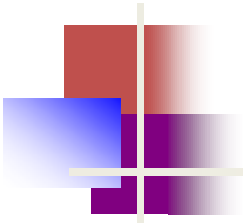
R01 Equivalent* Includes R01, R23, R29 and R37

NIH Competing R01 Equivalent Awardee

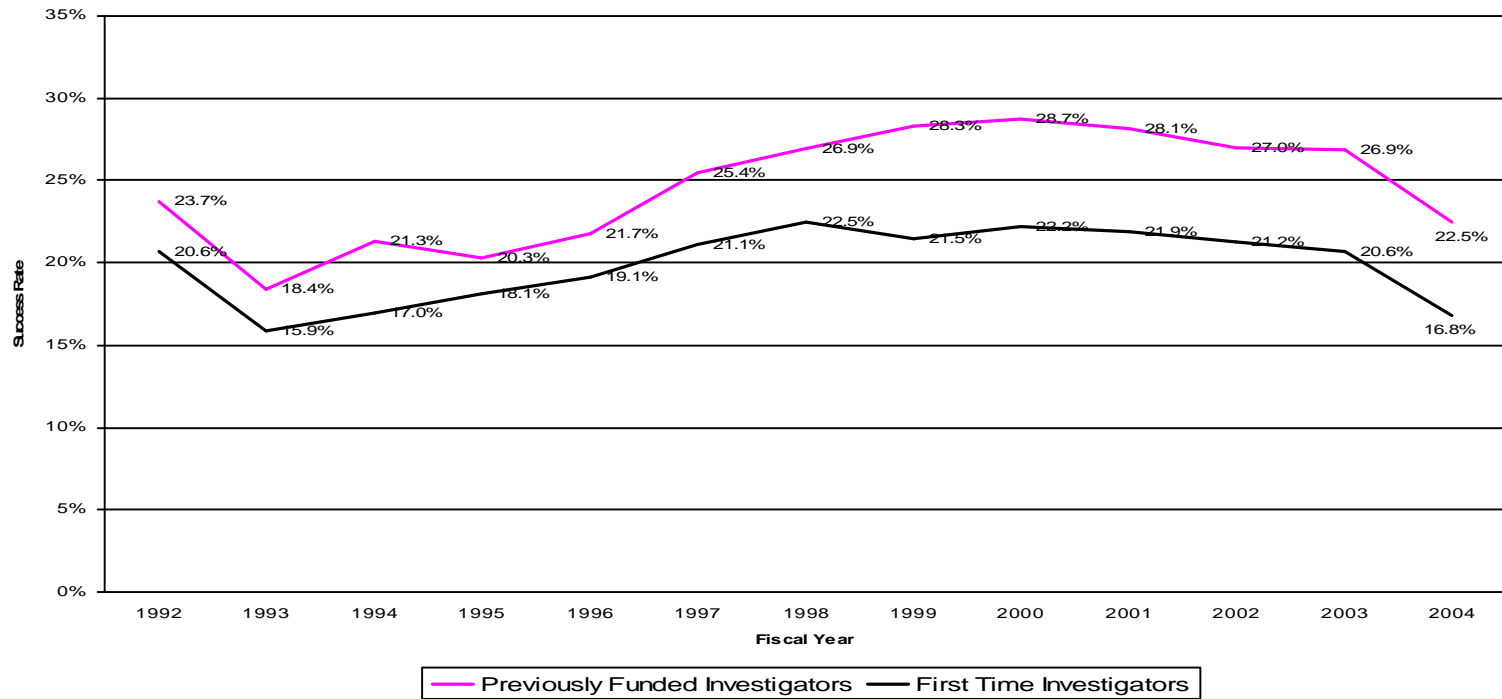


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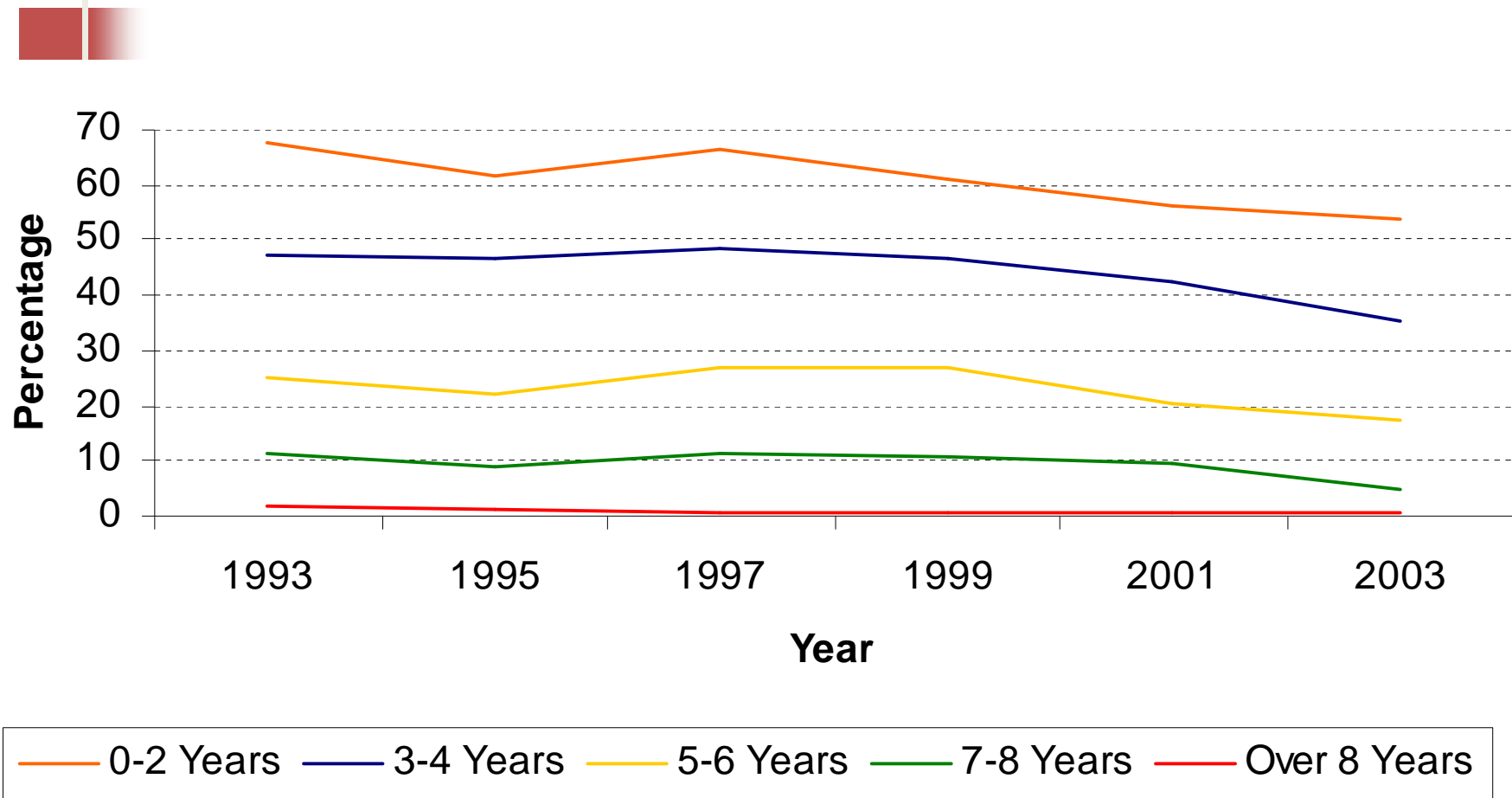


NIH New (Type 1) Competing R01 Equivalent Applications Success rates for first time and previously funded investigators



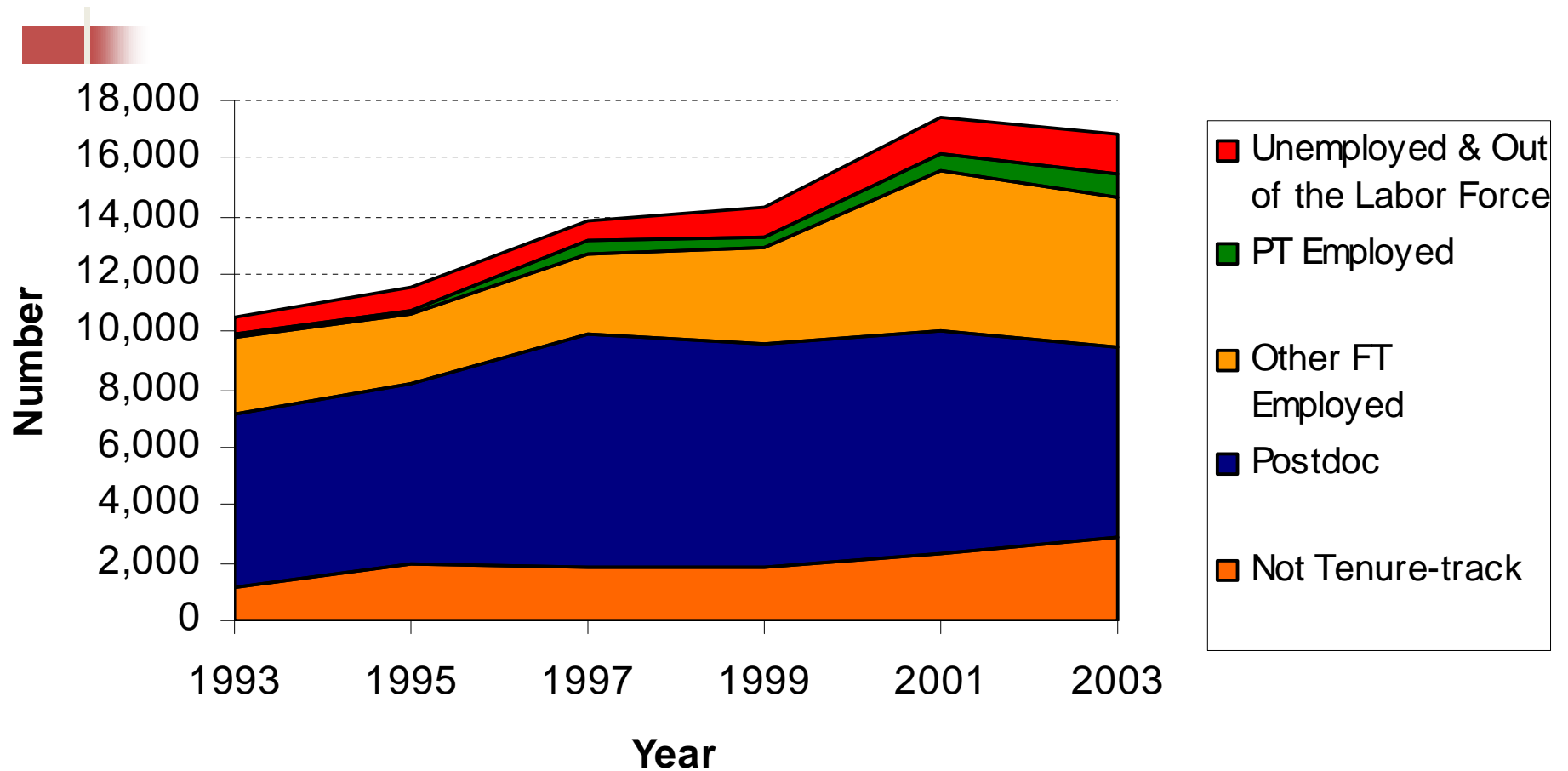
R01 Equivalent = R01, R29, and R37 activities.

Proportion of Biomedical PhDs Trained in U.S. in Postdoc Positions By Time Since Degree

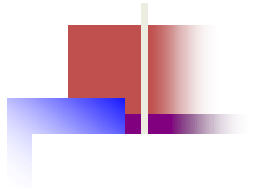


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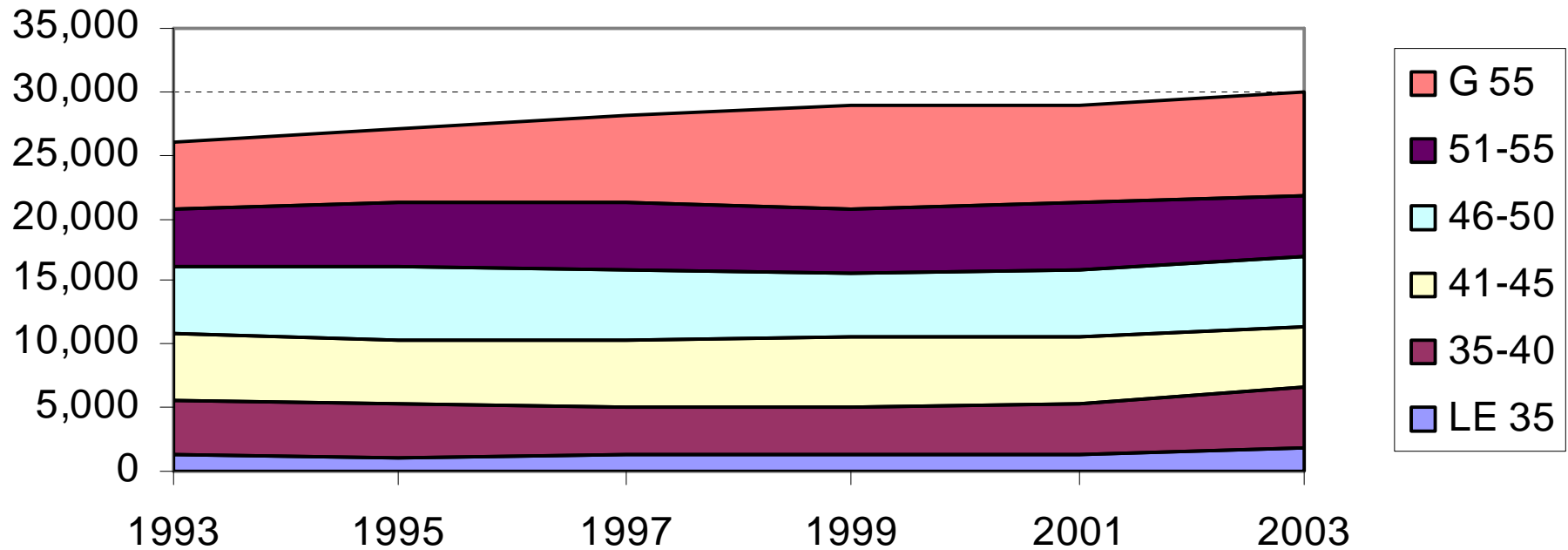
Labor Force Status of Biomedical PhDs Trained in U.S. Age 35 or Younger in Other than Tenure-Track Positions



Source: Survey of Doctorate Recipients, NSF. The use of NSF data does not imply NSF endorsement of the research methods or conclusions contained in this report.

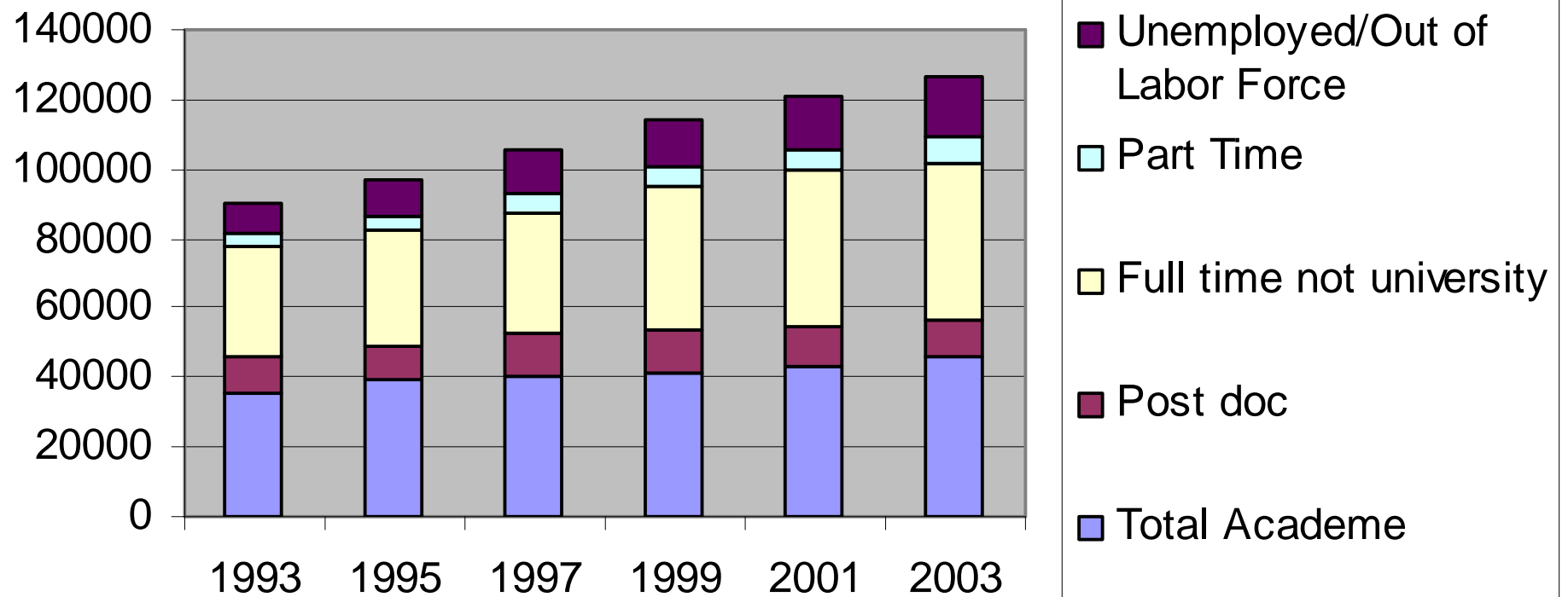


Tenure Track Biomedical Faculty by Age



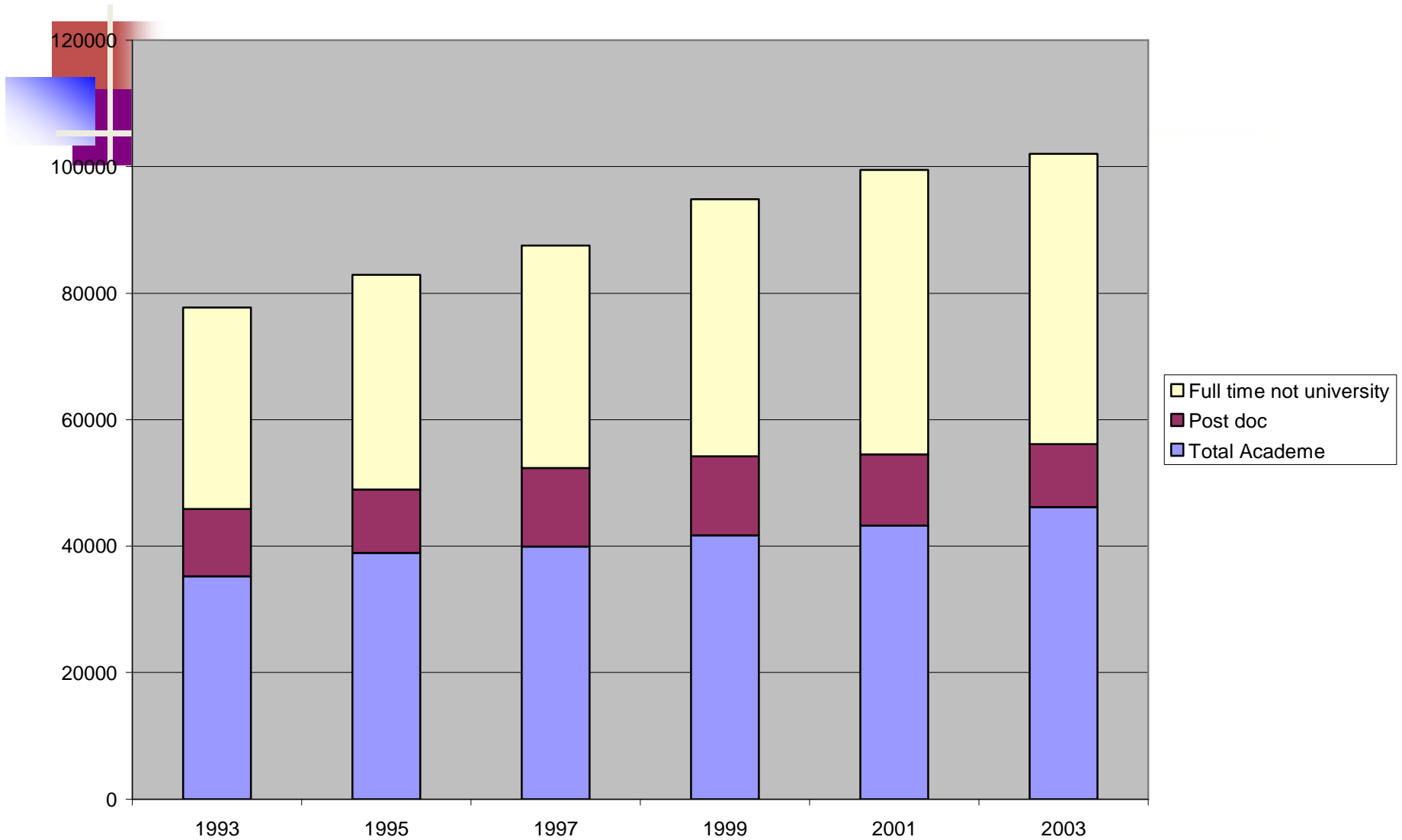
Tenure track status is for those trained in U.S. Source: Survey of Doctorate Recipients, NSF. The use of NSF data does not imply NSF endorsement of the research methods or conclusions contained in this report.

Labor Force Status: Biomedical PhDs



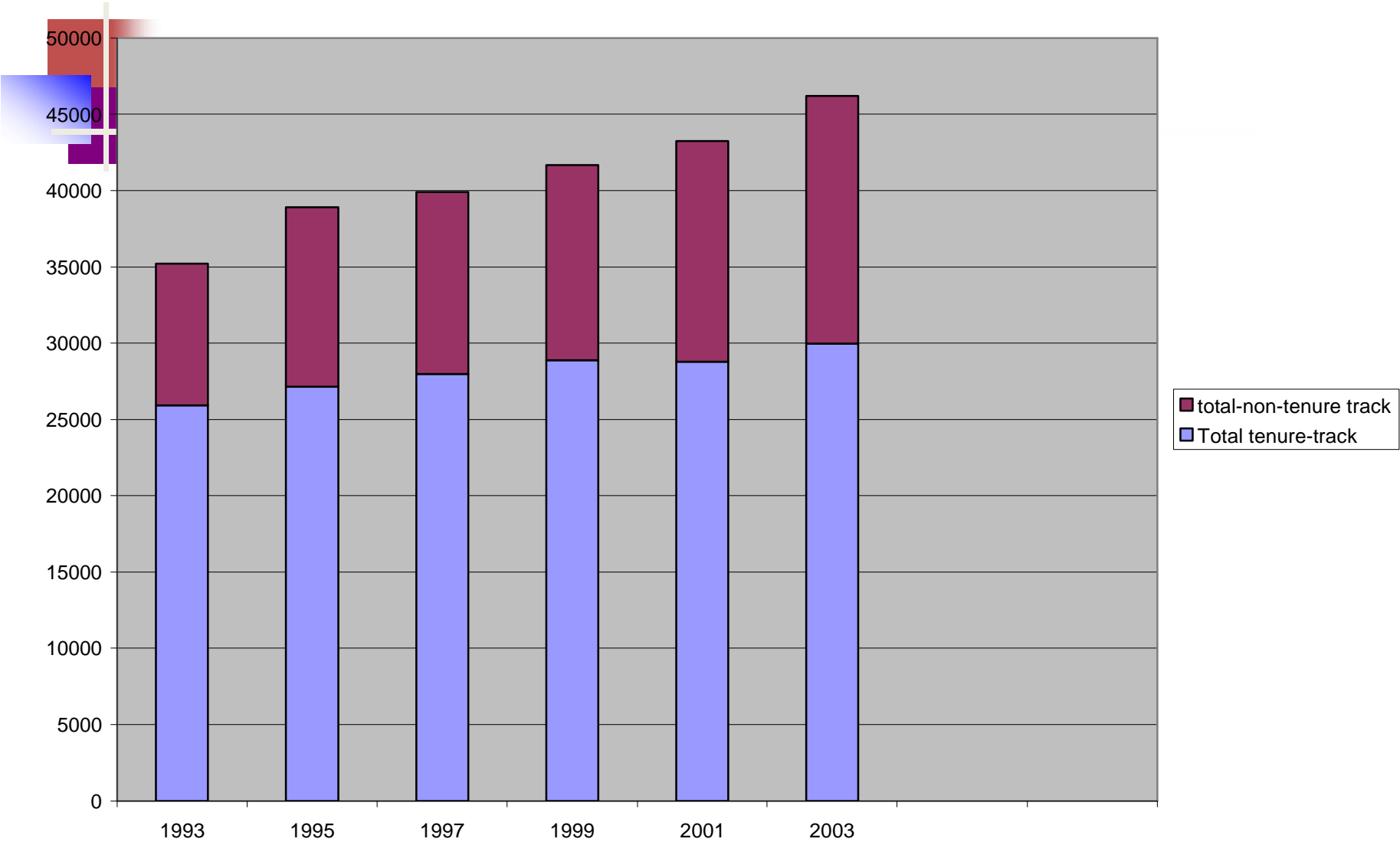
Labor force Status for those trained in the U.S. Source: Survey of Doctorate Recipients, NSF. The use of NSF data does not imply NSF endorsement of the research methods or conclusions contained in this report.

Full Time Positions by Sector: Biomedical Sciences



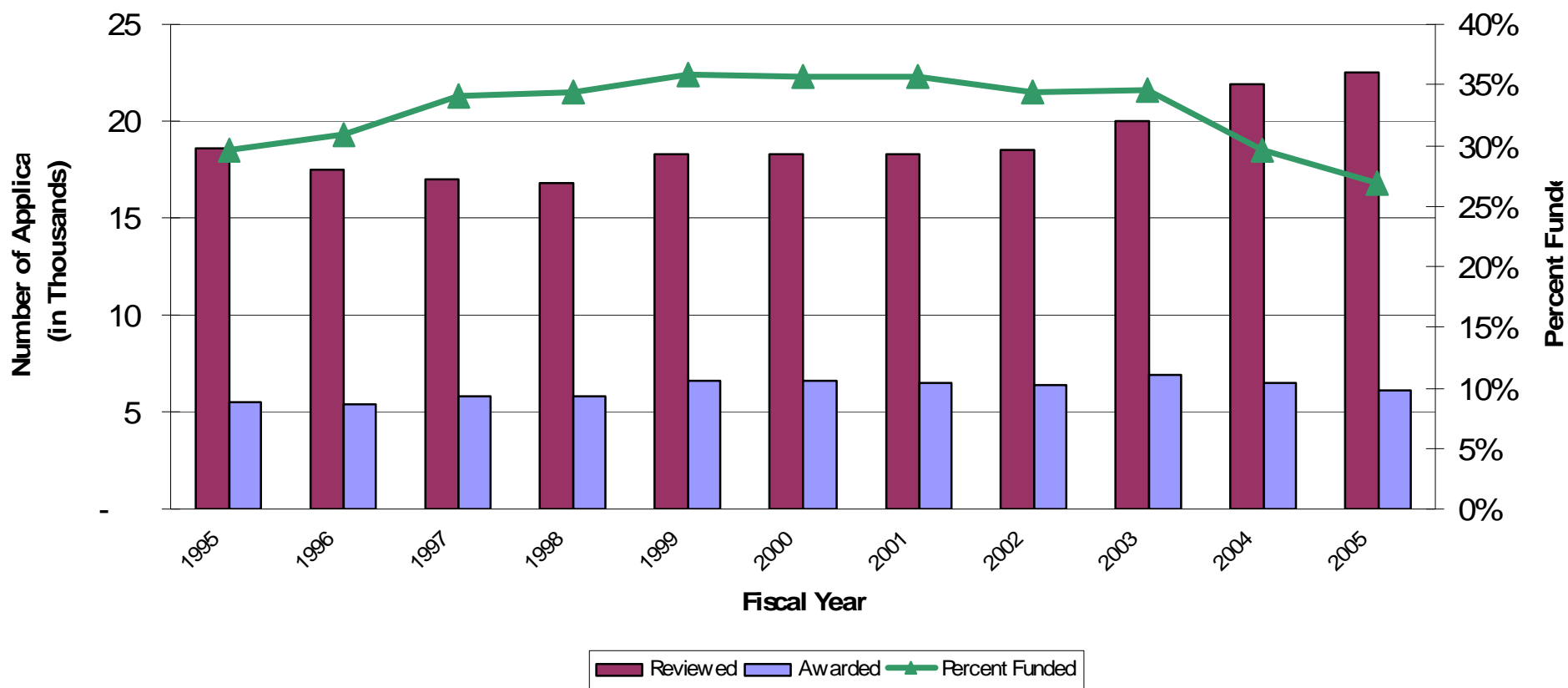
Slide shows positions for those trained in the U.S. Source: Survey of Doctorate Recipients, NSF. The use of NSF data does not imply NSF endorsement of the research methods or conclusions contained in this report.

Tenure Track Status: Biomedical Sciences



Slide shows tenure tract status for those trained in the United States. Source: Survey of Doctorate Recipients, NSF. The use of NSF data does not imply NSF endorsement of the research methods or conclusions contained in this report.

Number of NIH Competing R01 Equivalent* Applicants Reviewed, Awarded, and Percent Funded (Success Rate)



R01 Equivalent* Includes R01, R23, R29 and R37