

References

1. J. D. Walker, *Am. J. Phys.* **44**, 421 (1976).
2. Reference 1, p. 424.

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Causes and Correlations of Master's Degree Statistics

The article in the June 2003 issue of PHYSICS TODAY (page 32) on master's degree recipients in physics states:

People who added a master's to their resumé rated their undergraduate education as more useful preparation than those who stopped after the bachelor's. This rating shows the important role of physics departments, says report coauthor Rachel Ivie. "People who had a better undergraduate environment—better advising, better relationships with professors and other students—are more likely to complete graduate degrees."

Those statements are an example of the well-known fallacy of confusing correlation with causality. An equally

plausible explanation, one of many possibilities, for why master's degree recipients gave a high rating of their undergraduate education is that students skilled in physics tend to enjoy their undergraduate education and also tend to obtain higher degrees. The study's authors are not necessarily wrong, but they certainly do not have the data to prove their point.

It is disappointing, but all too common, to see scientists abandon their logical skills in discussions of policy and other nonscientific matters.

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Ivie replies: Many skilled physics bachelors choose not to obtain graduate degrees for various reasons. And 60% of the physics bachelors who earned master's degrees did so in fields other than physics.

I suggest that Laurette Tuckerman read the full report, available at <http://www.aip.org/statistics/trends/reports/masters.pdf>. It details our multiple measures of physics bachelors' evaluations of their undergraduate experiences. As the report shows, those with graduate degrees

in any field are more satisfied with undergraduate advising, supportiveness of professors, and working relationships with professors and students than are those without graduate degrees. However, those who earned master's degrees and work in scientific fields actually rate their undergraduate physics preparation lower than those who did not earn graduate degrees and who work in scientific fields. So at least retrospectively, physics bachelors without graduate degrees felt more prepared in physics than those who earned master's degrees in any field.

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An Observation on Hofstadter's Butterfly

Joseph Avron, Daniel Osadchy, and Ruedi Seiler have nicely highlighted the relevance of topological invariants, or Chern numbers, to the integer quantum Hall effect and to the conductance of a Hofstadter model when the Fermi en-