The objective of the present study was to evaluate productivity outcome measures for recent research grants and fellowships awarded through the American Osteopathic Association (AOA) Bureau of Research. Recipients of grants and fellowships that were awarded between 1995 and 2001 were contacted by mail, e-mail, or telephone and asked to provide information about publications, resulting grant awards, advances in clinical care, or other notable products that were generated from their projects.

For grants funded between 1995 and 1998, 76% of principal investigators reported a notable product from their study. By contrast, for grants funded between 1999 and 2001, only 31% reported a notable outcome. This difference most likely can be attributed to the lag time between the awarding of a grant and actual completion of the project, the processing of the data, and the publication of the results. Several recipients of 1999–2001 grants were optimistic about eventually generating a notable product.

Most (79%) of the 1995–2001 fellows met the requirements for successful completion of their project. Many fellows exceeded the minimal requirement by publishing their results, continuing research activity, attracting extramural grant monies, or entering an academic position. It appeared that a much larger proportion of osteopathic fellows went on to academic careers than their counterparts who did not have fellowship training.

From 1995 to 2001, the AOA Bureau of Research awarded $3,072,140 in research grants and fellowships. To date, these awards have helped the recipients bring an additional $5,659,329 of extramural funds for research at osteopathic institutions. The Bureau of Research grant and fellowship programs have been successful both scientifically and in terms of financial outcomes.
Methods

Recipients of AOA research grants and fellowships that were awarded during 1995–2001 were contacted by mail and asked to provide information about outcomes or notable products from their projects. As only about 20% of grant recipients responded to the initial mail survey, an attempt was made to reach each principal investigator by telephone or e-mail. Also, an inquiry was made at the AOA Division of Publications to identify any pertinent manuscripts in press at the Journal of the American Osteopathic Association. Research fellows were difficult to contact, as many of them had relocated and some were no longer at osteopathic institutions. Fortunately, reliable information from their mentors or from AOA files was available. By using these various methods, data were obtained on 95% of the grant recipients and 100% of the fellows. Each of the contacted recipients was surveyed or interviewed to determine whether any notable products or outcome measures were generated from the AOA-funded projects. In the case of grants, notable products/outcome measures were defined as a peer-reviewed publication or manuscript in press, an advance in clinical care, a resulting funded grant proposal, the establishment of a teaching/educational program, or receipt of the JAOA Northup Medical Writing Award. For research fellowships, recipients were considered to have completed their study successfully if they submitted a final report based on the activities described in the proposal. Many of the fellows exceeded this requirement by either publishing a full-length article in a peer-reviewed journal, continuing research activities beyond their fellowship period, contributing to a successful extramural grant application, or entering an academic position. Thus, for fellows, there are three categories of outcome measures: (1) those who exceeded the minimum standard by generating a notable product, (2) those who met the minimal standard by submitting an acceptable final report, and (3) those who did not submit a final report.

Table 1
Types of Notable Products Generated From Grant Projects

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>n</th>
<th>Publication</th>
<th>Funded Grant</th>
<th>Educational Program</th>
<th>Clinical Advance</th>
<th>Award Received*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>9</td>
<td>6</td>
<td>xxxx</td>
<td>xx</td>
<td>xx</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1996</td>
<td>10</td>
<td>7</td>
<td>xxxxxxx</td>
<td>xx</td>
<td>—</td>
<td>x</td>
<td>xx</td>
</tr>
<tr>
<td>1997</td>
<td>7</td>
<td>6</td>
<td>xxxxxxx</td>
<td>xxx</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1998</td>
<td>16</td>
<td>13</td>
<td>x xxxxxxxxxx</td>
<td>xx</td>
<td>x</td>
<td>xxx</td>
<td>—</td>
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<tr>
<td>1999</td>
<td>6</td>
<td>1</td>
<td>x</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2000</td>
<td>6</td>
<td>4</td>
<td>x</td>
<td>xx</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2001</td>
<td>4</td>
<td>1</td>
<td>x</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

* Receipt of the Northup Medical Writing Award of the Journal of the American Osteopathic Association.

N indicates total number of projects; n, number of projects for which a notable product was reported (some projects generated more than one type of product); x, one product attributed to the recipient of a grant.

Figure 1. For years 1995–2001, seed grants that had a notable product are shown. The percentage with products is shown for each year. For years 1995–1998, 75.6% of principal investigators had a significant product.

American Osteopathic Association.
Results
Grants
Figure 1 shows the number of grants for which notable products were generated for each year from 1995 through 2001, and the Table summarizes the specific types of products that were generated from these projects. As judged by the criteria described in Methods, notable products were generated for 38 (66%) of the 58 grants that were funded during this time. However, there appeared to be a dichotomy between grants funded early in the time period and grants funded in later years. For the 42 grants funded in 1995–1998, notable products were generated from 32 (76%) of the projects. By contrast, for the grants funded in 1999–2001, notable products have thus far been generated from only 6 (38%) of the 16 projects. This apparent dichotomy most likely reflects the lag times between the awarding of a grant, actual completion of the project, and subsequent generation of notable products, such as the presentation and/or publication of results. This conclusion would seem to be borne out by the fact that many of the more recent grant recipients reported that they had submitted manuscripts for publication, but that the manuscripts had not yet been accepted. In addition, several other recent recipients reported that they were in the process of preparing their results for publication.

Fellowships
Figure 2 shows the data for recipients of fellowships that were awarded each year between 1995 and 2001. Of the 38 recipients, 12 met the minimal standard by submitting the required final report, whereas an additional 18 respondents exceeded the minimal standard by ultimately generating a notable product. Table 2 shows the specific types of notable products that were generated from these fellowships.

Table 2
Types of Notable Products Generated by Research Fellows

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>n</th>
<th>Publication</th>
<th>Funded Grant</th>
<th>Faculty Appointment</th>
<th>Used for Advanced Degree</th>
<th>Continuing Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>6</td>
<td>3</td>
<td>xxxxxxxxxx</td>
<td>—</td>
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<tr>
<td>1996</td>
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<td>1</td>
<td>x</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1997</td>
<td>5</td>
<td>4</td>
<td>xxx</td>
<td>—</td>
<td>x</td>
<td>—</td>
<td>xxx</td>
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<tr>
<td>1998</td>
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<td>x</td>
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<tr>
<td>1999</td>
<td>4</td>
<td>3</td>
<td>xx</td>
<td>x</td>
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<tr>
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<td>1</td>
<td>—</td>
<td>x</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2001</td>
<td>12</td>
<td>4</td>
<td>—</td>
<td>xxx</td>
<td>x</td>
<td>—</td>
<td>xxx</td>
</tr>
</tbody>
</table>

* Additional products are anticipated, as several residents aspire to academic careers and developing research programs. N indicates total number of fellowships; n, number of fellowships for which a notable product was reported (some fellowships generated more than one type of product); x, one product attributed to a fellow.
generated by the fellows. Thirty (79%) of the 38 respondents met or exceeded the minimal standard for successful completion of their fellowship as defined in Methods.

Publications
In responding to the survey, grant and fellowship recipients informed us as to whether their results had been published, and they identified the specific journal(s) in which the results were published. Of the 36 grant recipients who generated a notable product, 16 reported that they had at least one publication resulting from their project, with several recipients reporting multiple publications. Of the 18 fellowship recipients who generated a notable product, seven had at least one peer-reviewed publication. As seen in Table 3, manuscripts from the bureau-sponsored grants and fellowships have been published in 16 peer-reviewed journals, with several of them being of high prestige and scientific impact.

Financial Implications
Between 1995 and 2001, the AOA awarded a total of $3,072,140 in research grants and fellowships. Figure 3 summarizes the average size of the seed grants awarded each year. Our findings indicate that AOA grant recipients have to date obtained an additional $5,659,329 in support for research and education projects from granting agencies outside the AOA. In responding to our survey, these investigators reported that their prior AOA support was a crucial factor in obtaining these extramural funds.

Discussion
To the best of our knowledge, no previous studies examining specific outcome measures for AOA-funded grants and fellowships have been published. The few results assembled were never published or disseminated within the profession. These previous efforts focused almost exclusively on publications as a favorable outcome measure, with the primary source of information being the progress reports that grant recipients are required to submit at the end of their funding period. Unfortunately, these reports can vary markedly in the level of detail that investigators provide regarding the publication and presentation of results and the future direction of the project. This problem is compounded by the fact that the reports are often submitted before the investigators have had sufficient time to publish their results and by the fact that most recipients do not spontaneously inform the bureau of any publications or other measures of productivity after their final report has been submitted.

Our study was undertaken to obtain up-to-date data and analyze the productivity outcomes of AOA-funded
grants and fellowships. We used multiple measures of productivity, including publications, subsequent grant funding, advances in clinical practice, and the development of educational programs. In addition, the grant and fellowship recipients were contacted directly to obtain the most up-to-date information possible. By using this approach, we were able to obtain data from more than 95% of grant and fellowship recipients and to analyze critically the specific measures of productivity.

Grants
In considering the results of the grant productivity analysis, we believe that the most pertinent data are for the grants that were awarded more than 4 years ago, because sufficient time has passed to allow the investigators to complete their studies and generate publications and other identifiable measures of productivity. Our results show that of the grants funded in 1995–1998, notable products were generated from 76% of the projects. Moreover, the principal investigators of the grants for which notable products were generated reported that they had published at least one manuscript related to their grant and that several investigators reported multiple publications. It is our impression that this level of productivity is significantly higher than previously thought. The level of productivity revealed in this study is even more impressive when one considers that the grant awards were relatively modest in terms of dollars. Because the AOA grants have tended to be small, a cost-benefit comparison with other granting agencies would be of interest, though the necessary data for performing such an analysis are not immediately available.

While the present analysis focused primarily on the smaller seed grants that are the primary funding mechanism supported by the Bureau of Research, two projects funded through the bureau were larger than the typical seed grants. Results from a low back pain study conducted through Rush Presbyterian Hospital and Midwestern University’s Chicago College of Osteopathic Medicine have been published.5 One aspect of the Maine Osteopathic Outcomes Study was recently published,6 and another is being prepared for publication (Boyd Buser, DO, oral communication, July 2003). These projects have been closed at the AOA, and the results are included in financial calculations on yield, following. The largest current osteopathic research initiative is the Osteopathic Research Center based at the University of North Texas Health Science Center at Fort Worth–Texas College of Osteopathic Medicine. This 4-year project is in its second year and is not included in this report.

Fellowships
Our results indicate that most research fellows (79%) met or exceeded the minimum requirements for successful completion of the program. More significantly, half of these individuals have had their results accepted for publication or have used them to attract extramural funding. This would seem to be a good level of productivity, given the fact that these were 1-year fellowships. It is interesting that several of the fellowship recipients have gone on to careers in academic medicine, with both osteopathic and allopathic faculty appointments being granted.

Return on Investment and Implications for the Profession
In light of the limited financial resources available to the Bureau of Research, one of the most important outcome measures is the return on the investment in research. This is an especially important issue because the colleges of osteopathic medicine have not, for the most part, received federal or national association funding of their infrastructure and research programs that is proportionate to the number of practicing osteopathic physicians.4,7 The results of the present analysis indicate that the $3,072,140 that was awarded in grants and fellowships between 1995 and 2001 has helped investigators bring in $5,659,329 from other extramural sources, which represent a yield of 184%. It is likely that this return on the initial investment will increase as some of these successful investigators will be submitting additional proposals for extramural funding.

Impact of Grants and Fellowships on the AOA Research Conference
Beyond the favorable return on investment, the Bureau of Research programs are the AOA’s most significant initiative in creating a research culture in the osteopathic profession. Are the bureau’s programs fostering such a research culture? An analysis of the programs for the recent AOA Research Conferences would indicate that they are. For example, of the invited speakers at the 2002 Research Conference, 77% had previous Bureau of Research grant or fellowship support that provided the research background and data for the basis of an invited talk. Of the tentative speakers for the 2003 conference, 74% have had such support. This indicates that funding of research projects by the bureau was critical to development of the conference program and that the recipients of bureau-funded grants and fellowships are assuming leadership roles in the research efforts of the profession. It should also be noted that the recent research conferences have been of markedly escalating quality. The 2002 Research Conference had for the first time formal NIH recognition and financial support; NIH support for the 2003 conference is pending.

In summary, the results of this analysis provide strong evidence that most grants and fellowships sponsored by the AOA Bureau of Research are yielding multiple outcomes and are fostering the growth of research in the profession. The Bureau has served an invaluable role in funding start-up projects that would not have found support else-
where. The osteopathic profession is at the exciting stage where the principal investigators on prior seed grants are beginning to attract substantial extramural support for projects that will promote patient care.

References

Editor’s Note
At the time this article was written, accepted, and processed for publication, the American Osteopathic Association (AOA) entity awarding research grants was called the Bureau of Research. At the July 2003 meeting of the AOA’s Board of Trustees and House of Delegates in Chicago, the Bureau was officially renamed the Council on Research.