

Goldwater Scholarships in Mathematics, Science and Engineering
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History

In 1986 as Senator Barry M. Goldwater of Arizona was retiring, the U.S. Congress appropriated money to endow the Barry Goldwater Scholarships in Mathematics, Science and Engineering and to establish the Barry Goldwater Scholarship and Excellence in Education Foundation. The Foundation was established to foster excellence in science and mathematics as a tribute to the leadership, courage and vision of Senator Goldwater. The purpose of this independent micro agency of the executive branch of the federal government is to furnish a continuous supply of highly educated research mathematicians, natural scientists and engineers for the nation. The enabling act of Congress authorizes the award of undergraduate scholarships, graduate fellowships and honoraria to outstanding educators, teachers and persons who have volunteered to assist in secondary schools. Although the enabling act authorizes the Foundation to offer graduate fellowships and honoraria to teachers, up to this date only undergraduate scholarships have been awarded. Since 1989 the Foundation has held 23 competitions through which it has selected 6,418 undergraduate scholars from 615 academic institutions representing the 50 states, the Commonwealth of Puerto Rico and as a single entity, Guam, the Virgin Islands, American Samoa, the Trust Territories of the Pacific Islands and the Commonwealth of Northern Marianas.

Nomination and Application

Each regionally accredited four-year college or university has the opportunity to nominate up to four outstanding sophomore or junior-level students and each two-year college has the opportunity to nominate two outstanding students each year. Applicants must be nominated by the institutional representative (faculty representative) named by the campus chief executive officer (president, chancellor, rector, etc.). The Foundation contracts with ACT to accept, process and review the applications. The names of institutional representatives, as well as the forms and instructions for online nominations and applications, are found at www.act.org/goldwater.

2012 Goldwater Scholars

Table 1

| | Nominees | Scholars |
|-----------------------|-----------------|-----------------|
| Total | 1123 | 282 |
| Female | 43.1% | 38.3% |
| Male | 56.9% | 61.7% |
| Sophomore | 28.7% | 20.6% |
| Juniors | 71.3% | 79.4% |
| Two-Year Colleges | 2.4% | 0.4% |
| Four-Year Coll./Univ. | 97.6% | 99.6% |
| GPA | 3.8 | 3.96 |

Table 2

| Field of Study of 2012 Scholars | |
|----------------------------------------|------------|
| Computer Science | 10 |
| Engineering | 58 |
| 19 Bio or Biomedical | |
| 5 Electrical | |
| 17 Chemical | |
| 17 Other | |
| Mathematics | 20 |
| Science | 194 |
| 11 Biochemistry | |
| 25 Biology | |
| 35 Chemistry | |
| 32 Physics | |
| 91 Other or Combinations | |
| Total | 282 |

Statistical data for the 2012 Goldwater Scholars are presented in Tables 1 and 2 above. Although these data vary moderately from year to year, those for 2012 are reasonably representative of the scholars for the 23 competitions.

The competition to earn a Goldwater Scholarship is clearly quite competitive. An idea of just how intense the competition is can be gained from the success of Goldwater scholars in winning other prestigious scholarships. Scholars

from the 23 competitions have won 80 Rhodes Scholarships, 118 Marshall Scholarships and 110 Churchill Scholarships. In 2012, six of the fourteen Churchill Scholars were Goldwater Scholars.

Selection Process

Reviewers of Goldwater Scholarship applications are selected from faculty and others with broad research, teaching and administrative experience in mathematics, science or engineering. Reviewers also represent a variety of employers including governmental research and granting agencies, university admissions and financial aid offices, both private and public institutions, two-year colleges, four-year colleges and four-year universities. The reviewers now include Goldwater Scholars from some of the early scholars who have advanced in their careers.

The reviewers are paired in teams to evaluate the applications. All nominees are evaluated as a group by state of legal residence regardless of the location of the institution that nominated them. For example an institution that has a national student body may find that its four applicants are reviewed by four different teams while an institution with a student body primarily from one state would likely find that all its nominees are reviewed by one team. The reviewers will only evaluate nominees from states where they have not gone to school or worked. Even under these guidelines reviewers occasionally encounter a nominee of whom they have personal knowledge or with whom they have previous associations. This immediately disqualifies the reviewer and another team will review this nominee.

Quotas or targets are not assigned to the states and no emphasis is placed on selection by gender, type of institution, discipline of study within the qualifying disciplines or financial need of the nominee. The reviewers are given the approximate number of scholars the Foundation can financially support before the review begins. They know that if we have 1,200 nominees and the Foundation can financially support only 300 scholars, 900 or 75% of the nominees must be cut. A state may have 10 nominees from which the reviewers find none that meet the Goldwater Scholar standards so that state will get no scholars for that year. This happens. Another state might have five nominees and four are selected as scholars.

Four primary criteria are given approximately equal weight in reviewing an application. The criteria are: Academic Achievement, Progression Toward Goals, Essay Analysis, and Letters of Reference. Each criterion will be discussed in the following paragraphs. The review team selects a state where neither member has a conflict of interest. Each team member reviews the applications independently and assigns either a numerical rating or a descriptive rating such as good or outstanding for each criterion. The team members then discuss each nominee to make a decision on the scholars for that state.

Academic Achievement: In this category grades are an obvious consideration. Grades are compared to a scale of A being 4.0. On this scale the 2012 scholars had a GPA of 3.96. Completion of or plans to complete advanced courses in the major discipline or courses not required to earn a degree in the major discipline is a definite positive in this category. Academic awards and scholarships are also viewed as evidence of academic achievement. It is important to recognize that having a GPA of 4.0 does not assure that the nominee will be selected as a scholar. This is only about 25% of the consideration given an applicant. Nominees with a GPA lower than 4.0 are selected as scholars but they must be stronger in the other categories.

Progression Toward Goals: In this category the reviewers look for evidence of professional aspirations for a research career in mathematics, the natural sciences or engineering. Candidates who do not have a passion for a career in research should probably not be in this competition. If the career goal is to earn the MD/PhD (or other professional degree/PhD) the need to have a medical degree (professional degree) to facilitate the type of biomedical research desired must be clearly and convincingly articulated. This is also true of other disciplines such as engineering when the career aspiration is professional practice as opposed to research. Throughout the application a strong and consistent case must be made for a career in research.

All activities in which the nominee has participated will be considered under this category. The reviewers will evaluate research and all other extracurricular activities (athletics, the arts, student government, etc.) as well as the nominee's

statement of career goals. Although having completed a research project is a definite plus, candidates for this competition are not required to have done research. Nominees who have not started research should discuss a well-focused research project in which they would like to be involved. Nominees with research experience should cite evidence of publications, manuscripts in progress or in press, posters presented or oral presentations of the research and specify their role in the project including their role in preparing the manuscript or presentation. Class projects that involve laboratory work should not be listed as research.

Essay: The ideal essay is one written by the nominee reporting on a research project she/he completed. The essay should be written as if it were an article to be published in a scientific periodical to be read by a professional audience. Methodology that is well documented in the literature should be referenced and not described in detail in the essay.

Approximately the first page should be devoted to describing the project and essential methodology while the second page should be devoted to the results including the data collected and to an analysis of the results including the data and the significance of the findings.

If the research project is underway but not completed the first page of the essay should be similar to what is described above for a completed project. The second page should discuss the work that has been completed followed by what data have been collected and what will be collected. The final part should discuss how these data will be analyzed.

Nominees not having completed or initiated a research project should select a topic about which they are passionate and describe the project and the method of conducting the research. The scientific question to be addressed by the research should be clearly defined and the description of the research to be done should specify how the work will answer this question.

Letters of Reference: Candidates for nomination for Goldwater Scholarships should be advised that judicious selection of three faculty members to write letters of reference is critical. The relative professional stature of the authors is not as critical as is the fact that the author knows the candidate well and can discuss the candidate's potential for a research career. If the candidate has done research it is important to have the research mentor write one of the letters. Each of the three letters should address the candidate's potential for a research career. One approach to addressing this potential is to compare the candidate to other students the author has known at this stage in their careers and who have continued to graduate school to earn a doctoral degree before initiate a successful research career.

Too frequently letters appear to be generic letters changed slightly to fit this candidate. While the reviewers try not to penalize the student for the inadequacies of the letters' authors, these generic letters or letters written for other programs and changed to somewhat fit the Goldwater Program do not serve the student well. The letters of reference should be written to specifically address the characteristics of the nominee that qualify her/him to be a Goldwater Scholar.

Discretionary Credit: The reviewers are allowed to award very limited credit if the nominee has had to overcome extraordinary adversities or has extraordinary achievements. This credit, if awarded, is based on what the nominee writes under the heading *Personal Information* or what the institutional representative writes in the nomination part of the application.

Nomination

The application for a Goldwater Scholarship requires only that the institutional representative complete and sign the *Nominator* part of the application. However, the nominator is permitted to make comments at the end of the Nomination Form. The space is currently limited to 1500 characters and this option is not intended to be a fourth letter of reference or a summary of the three letters of reference. Comments from nominators are a part of the application that reviewers see. This is an opportunity for the nominator to present information about the nominee that may not have been available to the authors of the letters of reference or that the nominee may not feel comfortable writing about. Nominators also use this space to explain extenuating circumstances appropriate to the application. The intent in providing this limited space is to allow the institutional representatives flexibility to write anything they deem

appropriate for this applicant. The nominee is not penalized if nothing is written in this space; however, the nominator is encouraged to use this space constructively. It may help, it will not hurt.

Post Review Processing

The applications are reviewed in mid to late February. After the review, a list of the recommended scholars and a list of those recommended for Honorable Mention are provided to the Board of Trustees of the Barry Goldwater Scholarship and Excellence in Education Foundation for consideration at a meeting usually held around the middle of March. Appointment of scholars and those to be awarded honorable mention is not firm until the Board of Trustees approves the recommendation of the Review Committee. The decision of the Board of Trustees is final. After the Board of Trustees approves a list of scholars and a list of those to be awarded Honorable Mention, ACT posts both lists on the Goldwater website. This is usually done during the last few days of March. Scholars and those awarded Honorable Mention are provided a congratulatory letter from the Chair of the Board of Trustees, a frameable certificate and instructions for receiving payment of the scholarship.

Goldwater Scholarships are paid directly to the student by the U.S. Treasury making a deposit in the student's bank account as a lump sum annual payment. To receive payment the scholar must accept the scholarship, complete an information form and execute a request for payment signed by the Financial Officer of the institution. Sophomore scholars need to send a second request for payment for the senior year payment.

The stipend is set by the Board of Trustees at a maximum of \$7500. The enabling legislation specifies that cost to be considered include tuition, fees, books, room and board. The Foundation will only pay the amount of the cost of these items that exceeds the value of other scholarships. Approximately half those awarded Goldwater Scholarships receive less than the maximum stipend and usually 10 to 15 scholars receive no financial support. They are happy to receive the honor of being designated a Goldwater Scholar. In 2012 the average stipend for the 320 scholars (281 new scholars plus the carryover sophomores) was approximately \$6400.

Feedback on Unsuccessful Applications

Upon request, the Foundation will provide institutional representatives feedback on unsuccessful applications. In those cases where a sophomore applicant is not successful and where the applicant has continued to improve the depth and quality of the credentials important to the Goldwater Scholarship competition this feedback may be helpful in preparing the new application for re-nomination. This feedback may be especially important to those sophomore nominees who earn the designation of Honorable Mention and which the institution wishes to re-nominate.

W. Franklin (Frank) Gilmore is President of the Barry Goldwater Scholarship and Excellence in Education Foundation (BGSF). Prior to becoming President of BGSF Frank had been Professor and Chair of Medicinal Chemistry at the University of Mississippi, Vice President and Executive Vice President at West Virginia Tech and Chancellor of Montana Tech. He had reviewed applications for Goldwater Scholarships for 22 years. He holds a BS in chemistry from VMI, a PhD in organic chemistry from MIT, a certificate from IEM at Harvard and a postdoctoral year at Florida State.

John Lanning is the Assistant Vice Chancellor for Undergraduate Experiences and Professor of Chemistry at the University of Colorado Denver. At CU Denver, he directs and oversees campus-wide academic programs for the general education Core Curriculum, the First-Year Seminar program for high school students transitioning to the university, experiential learning through internships and undergraduate research, University Honors and Leadership, and Early Alert intervention for undergraduate students needing support. In 2012, John was selected as an Outstanding First-Year Advocate at the First-Year Experience conference for his work with students entering the university. John established the CU Denver Scholarship Committee to support undergraduate students applying for national and international scholarships, and he has served as a national scholarship reviewer for the Goldwater and Udall Foundations. He received his BS degree in chemistry from Iowa State University, his PhD in analytical chemistry from the University of Tennessee (Knoxville), and post-doctoral clinical research experience at Ohio State University.