The Grant Writing Academy: An Intervention to Increase Grants Awarded to Historically and Presently Marginalized Individuals in STEM

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Introduction:

A grant writing academy (GWA) is a comprehensive workshop designed to demystify the grant-writing process and assist participants in preparing grants from start to finish through mentoring and peer review. The GWA is intended to be an accessible, low-cost intervention aimed at helping historically marginalized scientists gain funding for their research. The majority of participants in a GWA should be those who have been minoritized in STEM, including, but not limited to the following groups: historically and presently excluded people (Black or African American, Hispanic or Latinx, American Indian or Alaskan Native individuals), people with disabilities, women or non-binary individuals, and people identifying as LGBTQ (Cech and Waidzunas, 2021, Haverkamp, et al., 2021, National Center for Science and Engineering Statistics, 2021). The ideas presented in this document are intended to guide the reader in setting up a GWA at their own institution; we note that flexibility and patience are also key for planning any event, and that the target demographic (being minoritized scientists) should be prioritized when setting up a GWA. Finally, when planning a GWA, we encourage cross-institutional partnerships with diverse institutions, such as Historically Black Colleges or Universities (HBCUs), Minority Serving Institutions (MSIs), R2s, Masters-degree granting, or community colleges (U.S. Dept. of Education, 2016). Institutional collaboration will make it more likely that grant-writing skills are being provided to historically excluded scientists.

Grant writing is a vital skill for all scientists, especially as they progress through the STEM web. Though grant reviewers often suggest improving an applicant's grant writing skills when rejecting their grant, the lack of concrete resources available for historically marginalized students in STEM leaves them at a grave disadvantage. This is especially troubling in light of the disparity in funding between grants awarded to white scientists versus Black scientists, as white scientists were 1.7 times more likely to be awarded grants in 2011 (Ginther, et al. 2013). Unfortunately, this disparity still persists in today's world (Ginther, et al. 2018, Taffe and Gilpin, 2021). Combined with the dearth of published literature on this subject, major concerns can be raised as to whether the attempts to diversify grant awardees are authentic, especially since grants are valued as the academic currency of success. grant recipients should resemble the

American population as a whole, which means 14% of grants should be awarded to Black scientists (Pew Research Center, 2021). In 2011, Black scientists represented 1.4% of total grants submitted, with the calculated likelihood of an awarded grant being 19.9% (Ginther, et al., 2011). White scientists represented 69.9% of the grants submitted, with the likelihood of an awarded grant being 36.4% (Ginther, et al., 2011). We are a long way away from reaching representation on the grant submission level, let alone the grant award level, but the first step is to ensure that historically minoritized scientists at all levels -- faculty, graduate students, and undergraduate students -- have access to a GWA.

Methods:

An effective GWA requires several different components that can be tailored to support the target demographic, including a robust curriculum, modifications to reduce academic structural barriers, and mentoring. Importantly, a GWA should be taught by faculty members who have consistently demonstrated excellence in grant-writing, and preferably are members of the GWA's target demographic. For institutions that do not have faculty members of the target demographic, we suggest partnering with other, more diverse institutions. However, we strongly encourage hiring historically and presently marginalized individuals as members of faculty. By doing so, we will be able to break out of the toxic cycle of underrepresentation and, further down the line, see a more accurate depiction of a diverse STEM field.

The GWA curriculum should include a thorough description of the grant-writing process, opportunity to draft and revise one's own grant, allow for peer editing, and participation in a mock grant review panel; the format for this curriculum would be via lectures, active learning, and group work. Before the course starts, we suggest sending out a survey that asks the participants relevant questions regarding their demographic information; have several grants selected that each participant is eligible for and can apply to based on their work in the GWA. Initially, the course should open with lecture-based presentations on the grant-writing process. These lectures should encompass the terminology, structure, and include examples of successful grants. Lectures should also include examples of unsuccessful grants for the purpose of critiquing their errors; lecturers should structure the discussion so that the participants are identifying the errors in the grants. The lectures should also cover benefits and pitfalls of the grant application process, as well as a broad overview of the various types of award available based on the individual's demographic and field.

The lectures will provide a strong informational foundation for participants to enter the focus of the workshop, which entails writing a grant of their own (if they have not done so already) and participating in a mock grant review panel. For participants with prepared grants, encourage them to revise and fine tune their prepared materials in light of the lecture material. The mock grant review panel will comprise the informal feedback portion of the workshop and

will utilize both active learning and group work, as participants will be separated into groups and review grants that originated or were revised at the GWA. We believe that reviewing grants is vital for learning how to write them. As this portion of the course may require more hands-on time with each small group, it might be wise to see if additional faculty are available to assist during this period. Although this tentative structure suggests what the curriculum should generally possess, coordinators should make adjustments that align with the need and level of the participants. Formal feedback will be provided by faculty members that will read over the grants and return them with comments after completion of the course. We believe that GWA alumni can play a significant role in the implementation of future GWAs. We suggest that there is a follow-up with GWA participants (outside of research purposes) to offer mentoring and networking opportunities for future workshops, as well as invitations to related events at the host institution.

Tier 1 (Faculty):

Targeting traditionally marginalized faculty that work at R2 universities will serve both as a direct and "bottom-up" approach to address the disparity of historically minoritized students in STEM (U.S. Dept. of Education, 2016). Adequately funded faculty are able to support not only their own research and careers, but also the budding careers of historically and presently excluded students through mentorship via research opportunities in their labs. Additionally, well-funded faculty are able to submit grants that can fund Course-based Undergraduate Research Experiences (CUREs) or applications to host programs, such as the Howard Hughes Medical Institute's Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science (HHMI SEA-PHAGES), which is co-administered by Graham Hatfull's research group at the University of Pittsburgh.

Well-funded faculty are also able to address issues that historically marginalized students face, like those posed by the systemic wage gap. In addition, some students may have financial or familial obligations during times where other students typically attend research internships that may be unfunded. Grant funding removes obstacles that would otherwise hinder historically marginalized students' progress in STEM. Grant funding also helps students develop their passion and build their resume without sacrificing financial gain needed to support daily life. Faculty funding has the ability to have the greatest impact on all three tiers of higher education, as faculty hire and mentor graduate and undergraduate students; funding faculty is vital for the success of historically excluded groups in STEM. As faculty are the most important population for the GWA, we recommend a summer weekly intensive workshop.

Tier 2 (Undergraduate Students):

An undergraduate's propensity for success is often contingent on proper training, funding, and the ability to develop strong writing skills; a GWA would provide invaluable support in these areas. Faculty Primary Investigators (PIs) are often and unfortunately overworked and underfunded, lacking the time to provide significant support to sharpen undergraduate students in the art of grant-writing. However, this workshop should target grants that support efforts to diversify STEM and have broad scientific application. Taking part in a GWA would allow for undergraduate students to build up their self-efficacy and scientific identity, which are essential components for student retention. Experience in grant writing would allow undergraduate students to have a smoother transition to graduate school, with funding to support graduate research, tuition, and a stipend. GWA participation also offers an excellent opportunity to meet faculty members and form important professional connections. We recommend a 2-credit course for the undergraduate tier.

Tier 3 (Graduate Students):

Graduate students will also benefit tremendously from developing grant writing skills that will support their future research. The GWA offers an alternative avenue for graduate students to improve their grant-writing skills, and if awarded, graduate students could support their tuition, stipend, and materials to move effectively through their research program. Graduate students are more likely to have grants prepared or in the draft stage; the GWA will allow for feedback and mentored revising that may increase the likelihood of receiving a grant (Smith, et al., 2017). The skills gained from the GWA would also provide a solid foundation for graduate students as they move to the next phase of their careers, and especially if they transition to PIs or other mentorship roles.

We recommend a 3-credit course and/or summer intensive workshop for graduate students. The summer intensive does not have to be separate from faculty and may require the completion of the 3-credit course as a prerequisite.

STEM Coordinator:

The GWA is an affordable yet valuable tool to fund historically marginalized scientists and should be institutionally supported with the expectation of hiring a qualified STEM grant coordinator. This individual should have expertise in grant writing, reviewing, and preferably represent the target demographic of the GWA. The coordinator should be responsible for running the GWA, developing projects, partnerships, curriculums, and recruiting historically minoritized scholars. Furthermore, the coordinator would be responsible for managing records of participant performance and improvement over time to aid in data collection. One example of a successful grant-writing intervention took place at Montana State University, where researchers set up a grant writing boot camp focused on increasing grant submission for female faculty in STEM.

The program coordinator recorded an increase in grants submitted, grants awarded, and rate of award per submission one year after the boot camp (Smith, et. al., 2017). This type of data collection could be invaluable in highlighting the benefits of grant writing workshops for historically and presently excluded individuals in STEM .

Mentoring is a key component of a successful GWA, as mentors are vital for revealing the hidden curriculum of STEM and providing constructive feedback during the grant-writing process (Haeger, et al., 2018). We envision pairing more experienced grant writers with those writers that do not have as much experience; the inaugural GWA may have difficulty with finding mentors. However, we encourage outreach to the scientific community to support the first round of participants; future GWA classes will have the opportunity to be mentored by alumni.

Lack of funding limits the support R2 institutions can provide to traditionally marginalized individuals in STEM; the GWA provides a cost-effective investment that is likely to increase the amount of grants awarded and papers published, therefore increasing the institution's overall funds and impact (Smith, et. al., 2017). All institutions can benefit from implementing a GWA, but institutions that lack a dedicated staff member for grant writing assistance may find the format of a GWA particularly useful. Additionally, the GWA naturally funds further extensions of itself, as it is inherently a cyclical process; grants written during the course can include a section for funding of future GWAs. Based on this model, the GWA will be self-sustaining, using funding from grants written by authors at the host institution. Additionally, as previously mentioned, there is a dearth of literature on grant-writing interventions for helping traditionally marginalized scientists. Institutions hosting GWAs are poised to address this disparity by collecting data before and after adoption of this workshop and submitting results for publication. As GWAs can result in both increased funding and publications for an institution, the return on investment can be monumental (Smith, et. al., 2017). Over time, increased funding for the program can result in increased staff, metrics, and self-sustainment.

In order to comprehensively address structural barriers present in academia, a GWA should be structured to be as accessible as possible for the diverse demographics present in R2 institutions, HBCUs, and community colleges. Some examples of academic structural barriers include transportation, accessibility, scheduling, and financial resources. We suggest the implementation of some or all of the following planning recommendations to address these barriers and promote equity through the GWA. First, there should be a virtual, hybrid, or in-person option that is hosted at an ADA-compliant location easily accessible by public transit. Flexible scheduling options (e.g., nights or weekends) should be offered in order to allow parents or full-time employees to attend. Childcare availability after hours may be crucial. Finally, attending a GWA should be free, but at the very least, the cost should be minimal. Incorporating these accommodations is vital to authentically planning a GWA.

Setting up a GWA begins with an email. If setting up a cross-institutional partnership, you should identify the institution that you plan to partner with and email a professor in your department of interest. If you are hosting a GWA within your own institution, email the chair of your department, then communicate with your administration to fine tune the details. Find professors who have excellent grant ratings and ask them to work with you on this project. If you are not a member of a historically and presently marginalized group, it is vital that you consult the Diversity, Equity, and Inclusion department at your institution for guidance. Far too often, diversity work falls on the shoulders of historically excluded faculty in a phenomenon titled "cultural taxation" (Gewin, 2020). By taking the first step towards institutional collaboration with the common goal of helping traditionally marginalized groups succeed, we can work towards a more inclusive STEM society.

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