GRADUATE EDUCATION IN PHARMACY SCHOOLS AND COLLEGES

Trends in Research and Graduate Affairs in Schools and Colleges of Pharmacy, Part 3: Underrepresented Minorities

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Objective. To examine the landscape of research and graduate affairs nationally and within schools and colleges of pharmacy. This report, part 3 of a three-part series, focuses on underrepresented minority (URM) faculty members and students, with a focus on recruitment and retention.

Findings. There has been a substantial increase in recruitment of Asian faculty members by schools of pharmacy over the last 10 years, but there has been only minimal changes in the numbers of Black and Hispanic faculty numbers, which reflects the challenges in recruitment and retention of URM faculty members. Consistently low enrollment of Black and Hispanic graduate students over a 10-year period demonstrates that pharmacy schools could improve their stated diversity initiatives and goals. Despite an overall increase in PhDs conferred over the last 10 years, international students continue to receive the majority of degrees conferred. Graduation rates of Black and Hispanic students have remained low, suggesting that continued and sustained efforts are needed to recruit, support, and graduate URM students.

Summary. Pharmacy schools must make a focused investment and effort toward increasing the diversity of their graduate enrollees by modeling their recruitment, enrollment, and retention strategies after national programs and best practices. Because there is a direct link between the number of faculty role models and the recruitment of students, pharmacy schools must enhance the recruitment, retention, and success of URM faculty members. Further, pharmacy schools should provide inclusion training to encourage better communication with URM advisees.

Keywords: graduate, diversity, underrepresented minority, recruitment, retention

INTRODUCTION

According to the Survey of Earned Doctorates (SED), over the last 10 years there has been a significant increase in the number of diverse doctoral awardees in the Life Sciences.¹ Likewise, gender diversity among science faculty members at schools and colleges of pharmacy across disciplines has increased substantially over the past 10 years. These changes are in alignment with diversity trends observed in other professional programs and in the disciplines of science, technology, engineering, and mathematics (STEM).^{2,3} However, racial and ethnic diversity within the sciences in pharmacy schools, especially with regard to Blacks and Hispanics, has not been as significantly transformational as gender has, despite continued emphasis by funding agencies to support diversity in the workplace.

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OBJECTIVE

This article is the third in a series of three articles describing the graduate research landscape of US schools and colleges of pharmacy from various perspectives: programs and faculty, students and graduates, and diversity. The objective of this paper was to summarize the demographics of faculty and full-time PhD enrollees and PhD graduates over a 10-year period from FY2008 to FY2017, highlighting changes in demographics inclusive of race and ethnicity. Issues with faculty and student retention are also discussed.

FINDINGS

For this study the authors elected to classify race and ethnicity in five major categories: White, Black, Asian, Hispanic, and a combined category of other. Data from the American Association of Colleges of Pharmacy (AACP) on nonwhite categories except for foreign/international were so limited that it was not appropriate to generalize any findings or trends. According to the US Census Bureau, Native Hawaiian and other Pacific

Islanders represented .2% of the US population in 2018; American Indian and Alaska Native, 1.3%; and those of two or more races, 2.7%.⁴ In FY2008, AACP included the category of Native Hawaiian/Other Pacific Islanders with Asian. In FY2017, AACP reported Asians and Native Hawaiian/Other Pacific Islanders separately. Thus, we combined the latter with American Indian/Alaska Native, Two or More Races, Unknown, and International/Foreign with “other.”

Excluding the combined “other” category and comparing the proportions of race and ethnicity between FY2017 AACP data and 2018 US Census Bureau estimates of the US population, AACP data indicated that the race/ethnicity of science faculty at US pharmacy schools was 66% White, 5% Black, 26% Asian, and 4% Hispanic. The Census Bureau estimated that 77% of the US population was White, 13% Black, 6% Asian, and 18% Hispanic. The percentage of foreign-born US residents is estimated to be 14% (American Community Survey, Census Bureau).⁵

Diversity in pharmacy science faculties between FY2008 and FY 2017 is evidenced in Table 1; specifically, the table provides a 10-year snapshot of the numbers of White, Asian, Black, Hispanic, and other faculty members in five science disciplines combined. The number of White faculty members showed a moderate 7% increase over the 10-year period, while the number of Asian faculty members increased by 63% (from 344 to 559). At the same time, there was an 11% increase in the number of Black science faculty members and a 27% increase in Hispanic faculty members. However, the actual headcounts for these URM are troubling. In FY2017, the 10-year increase in numbers of Black and Hispanic science faculty members were just 11 and 17 respectively,

compared to increases of 215 Asian and 91 White science faculty members.

The Association of American Medical Colleges (AAMC)⁶ database provided the ethnicity and race of basic science faculty members in academic medicine (Table 2), which was compared to the racial composition of similar roles in pharmacy schools. The faculties are slightly more diverse in pharmacy in terms of race and ethnicity, both overall and those who are full professors, although the same progress was not observed when comparing gender diversity among faculty members in the basic sciences in medicine and pharmacy (Table 3). The lack of representation of Black and Hispanic faculty members is evident in both medicine and pharmacy, both overall and at the professor rank, and in both science and all other disciplines of pharmacy.

The gender and race/ethnicity trends over the last 10 years for pharmacy science faculty members are illuminating (Table 4). In FY2008, there were 1,995 scientists in schools and colleges of pharmacy; 512 (26%) were female and 1,483 (74%) were male. The races or ethnicities of the 512 female scientists were White 337 (66%), Black 45 (9%), Hispanic 30 (7%), Asian 74 (14%), and other and foreign 26 (7%). By FY2017, the number of female scientists in pharmacy schools had grown to 783 of 2,521 (31%) faculty members. Of the 783 female faculty members, 444 (57%) were White, 55 (7%) Black, 31 (4%) Hispanic, 157 (20%) Asian, and 96 (12%) other and foreign. The number of Asian female scientists nearly doubled and gained almost the same number of positions as White female scientists. However, the most striking statistic is that the number of Black female scientists increased by only 10 and Hispanic by only one over the 10-year period, and

Table 1. AACP Science Faculty^a by Rank and Race/Ethnicity

	White		Black		Hispanic		Asian		Other ^b		Total	
	FY08	FY17	FY08	FY17	FY08	FY17	FY08	FY17	FY08	FY17	FY08	FY17
Provost	—	4	—	1	—	0	—	1	—	0	—	6
Dean	47	54	7	5	2	0	1	4	1	1	58	64
Associate Dean	75	88	1	5	1	2	5	16	4	14	86	125
Assistant Dean	30	30	6	4	2	2	0	7	4	2	42	45
Professor	476	500	25	24	14	15	101	147	47	91	663	777
Associate Prof	382	429	31	34	16	30	84	178	35	107	548	778
Assistant Prof	286	292	32	40	28	28	149	202	63	128	558	690
Instructor	28	15	0	0	0	2	3	2	1	3	32	22
Lecturer	6	9	0	0	1	2	1	2	1	2	9	15
Total	1,330	1,421	102	113	64	81	344	559	156	348	1,996	2,522

^a Science faculty include AACP disciplines of Biological/Biomedical Sciences, Medicinal/Pharmaceutical Chemistry/Pharmacognosy, Pharmaceutics, Pharmacology/Toxicology, and Social Administrative Sciences

^b Other includes Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, Two or More Races, Unknown, International/Foreign

Table 2. Comparing Racial/Ethnic Diversity of Science Faculty in Academic Medicine and Pharmacy, FY2017

All ranks (%)	Medicine ^a	Pharmacy ^b
White	71	66
Asian	24	26
Black	2	5
Hispanic	2	4
Professor only (%)		
White	83	73
Asian	14	21
Black	1	3
Hispanic	2	2

^a Association of American Medical Colleges, Faculty Roster: U.S. Medical School Faculty, Table 13: U.S. Medical School Faculty by Sex, Rank, and Department, 2017. <https://www.aamc.org/data/facultyroster/reports/486050/usmsf17.html>. Medicine Basic Sciences departments included Anatomy, Biochemistry, Microbiology, Pathology (Basic Science), Pharmacology, Physiology, Other Basic Sciences

^b Pharmacy science faculty include AACP disciplines of Biological/Biomedical Sciences, Medicinal/Pharmaceutical Chemistry/Pharmacognosy, Pharmaceutics, Pharmacology/Toxicology, and Social Administrative Sciences

proportionately decreased in representation among female scientists from 9% to 7% and 7% to 4%, respectively. This clearly highlights the challenges surrounding the recruitment, progression, mentoring, and success of female URM faculty members in pharmacy schools. The percentages of URM female scientists continued to lag far behind that of their male colleagues.

The data in Table 4 also provide insight into the diversity within the different science disciplines as it relates to race and ethnicity. The science disciplines grew by 526 faculty positions during the 10-year period. The greatest increase was reflected in the 209 positions held by Asian faculty members; the smallest percent increase for all disciplines was seen among White science faculty members at 7%; however, this group still gained 91 positions overall. The only notable shift in diversity among the science disciplines was in pharmaceuticals, with a decrease of 62 White faculty members and increases of 8 Black, 56 Asian, and 53 other and foreign faculty members. Overall, Black science faculty members gained a net of just 11 positions over the 10-year period, with losses in medicinal chemistry (three positions) and pharmacology (five positions), offset by gains in the biological sciences (five positions), pharmaceuticals (eight positions), and social and administrative sciences (six positions). Hispanic faculty members in the science disciplines increased by 17 positions overall, albeit the increase in each discipline was in the

single digits, ranging from no increase in pharmaceuticals to seven positions in biological sciences.

The race and ethnicity data for science faculty at schools and colleges of pharmacy are consistent with other professions, including medicine. This points to the fundamental challenge in the recruitment and retention of URM, specifically Black and Hispanic scientists. There is a significant body of knowledge that has provided insight to the drivers and challenges surrounding science faculty careers for both well-represented groups and URM. For this study, the well-represented (WR) group includes White and Asian faculty members, and URM focuses on Black and Hispanic. Those URM that are interested in faculty careers, or are already in academia, state that they are motivated by the importance of being a role model, mentoring others, and serving their communities.⁷ In the same report, major drivers for WR candidates include academic freedom. In addition, the two factors that were indicators of career destination for WR candidates were faculty advisor influence and family influence. Surprisingly, neither of those factors were important drivers for URM faculty career decisions.⁷ This demonstrates the need for a different, perhaps team-based approach to recruitment and retention of URM science faculty.

The numbers of pharmacy science faculty members stratified by tenure status, race, and ethnicity are presented in Table 5. The number of tenured and tenure-track science faculty positions increased by 277 (17%) between FY2008 and FY2017; science faculty positions that are nontenure track and at non-tenure institutions increased by 249 (62%). The number of tenured Asian faculty members increased by 99 (66%) between FY2008 and FY2017. This was the largest increase noted for tenured faculty members, while the number of Black tenured faculty members decreased by eight (14%), and Hispanic faculty members neither loss nor gained additional tenured positions. The number of White tenured faculty members decreased by 17 (-2%). The number of tenure-track Asian science faculty members increased by 52 (43%), whereas the number of White tenure-track faculty members increased by 5 (2%) and the number of Black tenure-track faculty member increased by 16 (67%). Among non-tenure track science faculty and faculty at non-tenure institutions, changes from FY2008 and FY2017 by race were as follows: White increased by 103 (39%); Asian increased by 59 (121%); Black increased by only 3 (15%); and Hispanic increased by 17 positions (121%). These numbers clearly show that much more effort is needed in recruitment and retention of URM faculty members. While the percentage of senior tenured faculty members has increased, the prospect of tenure is

Table 3. Gender Diversity of Science Faculty in Academic Medicine and Pharmacy, FY2017

	Professor		Assoc	Prof	Asst	Prof	Instructor	
	M	F	M	F	M	F	M	F
Medicine ^a								
Anatomy	420	159	268	131	272	179	44	50
Biochemistry	815	238	411	174	461	246	72	50
Microbiology	614	192	362	170	345	251	31	42
Pathology (Basic Science)	386	170	255	180	353	385	36	49
Pharmacology	611	170	295	151	364	213	69	52
Physiology	526	139	258	101	253	155	51	36
Other Basic Sciences	1,765	690	1,043	666	1,450	1,151	156	213
Total	5,137	1,758	2,892	1,573	3,498	2,580	459	492
% Female		25		35		42		52
Pharmacy ^b								
Biological/Biomedical Sciences	45	16	52	33	72	55	3	0
Medicinal/Pharm.Chem/Pharmacognosy	195	35	149	35	98	34	1	0
Pharmaceutics	138	46	138	48	87	60	1	4
Pharmacology/Toxicology	144	45	139	67	87	55	5	1
Social Administrative Sciences	71	39	64	50	54	85	4	3
Total	593	181	542	233	398	289	14	8
% Female		23		30		42		36

^a Association of American Medical Colleges, Faculty Roster: U.S. Medical School Faculty, Table 13: U.S. Medical School Faculty by Sex, Rank, and Department, 2017. <https://www.aamc.org/data/facultyroster/reports/486050/usmsf17.html>. Medicine Basic Sciences departments included Anatomy, Biochemistry, Microbiology, Pathology (Basic Science), Pharmacology, Physiology, Other Basic Sciences

^b Pharmacy science faculty include AACP disciplines of Biological/Biomedical Sciences, Medicinal/Pharmaceutical Chemistry/ Pharmacognosy, Pharmaceutics, Pharmacology/Toxicology, and Social Administrative Sciences

only becoming more challenging because of a variety of factors, and the outlook is particularly dire for Black and Hispanic science faculty members.

This analysis examined the tenure status of URMs in schools and colleges of pharmacy. These findings were consistent with a national analysis of minorities in science and engineering faculties at research universities, which concluded that there are relatively few tenured and tenure-track URM faculty members in these research universities.⁸ This study also noted that minorities are less likely to enter or remain in science and engineering when they lack mentors and role models. In most science and engineering disciplines, the percentage of URMs among recently hired faculty members is not comparable to that of recent minority PhD graduates, and is far below that of recent BS recipients.⁸

Graduate Students: Enrollment, Demographics, Degrees

The numbers of PhD students enrolled full-time in schools and colleges of pharmacy from FY2008 to FY2017 are presented in Table 6. Although PhD enrollment increased by a modest 6% (189 students) over this 10-year time period, the proportion of URMs remains largely unchanged. International students comprised 51%

of total graduate student enrollment in FY2008 and 49% in FY2017, for a net gain of 31 students. White students were the next largest group of enrollees, at 32% of the FY2008 total and 31% of the FY2017 total, increasing by 44 students. The third largest demographic is Asian, representing 7% of all graduate enrollees in FY2008 and 8% in FY2017, with a total increase of 22 students over the time period. Black PhD students actually decreased from 5% to 4% of the total, with a net loss of 11 students, and Hispanic representation increased by 1% (from 2% to 3%), with a large gain of 33 students. After removing international/foreign students and recalculating the proportions (Table 6), it becomes even more evident that continued efforts must be made for recruitment and enrollment of Black and Hispanic graduate students in pharmacy schools.

Taken together, the numbers of Black and Hispanic graduate students increased almost imperceptibly (by only 1%) from FY2008 to FY2017. The number of Hispanic students increased by 50% (from 66 in FY2008 to 99 in FY2017), but the number of Black students actually declined by 8% (from 143 to 132 students) over the time period (Table 6). The consistently low enrollment numbers for Black and Hispanic students over a 10-year period demonstrates the need for more resources for and

Table 4. AACP Science Faculty Disciplines, Race and Ethnicity, and Gender

FY2008	White		Black		Hispanic		Asian		Other ^a		Total	
	M	F	M	F	M	F	M	F	M	F	M	F
Biological Sciences	49	27	3	3	3	3	23	6	8	3	86	42
Medicinal/Pharm	278	59	15	7	10	5	80	11	37	2	420	84
Chem/Pharmacognosy												
Pharmaceutics/Pharmacy	222	89	10	7	5	6	96	26	47	7	380	135
Pharmacology	272	91	19	11	14	5	53	21	28	8	386	136
Social and Administrative Sciences	172	71	10	17	2	11	18	10	9	6	211	115
Total	993	337	57	45	34	30	270	74	129	26	1,483	512
FY2017												
Biological Sciences	94	64	5	6	11	2	44	21	34	14	188	107
Medicinal/Pharm	288	65	12	7	12	4	106	20	69	18	487	114
Chem/Pharmacognosy												
Pharmaceutics/Pharmacy	169	80	15	10	7	4	129	49	81	26	401	169
Pharmacology	251	117	15	10	15	8	83	31	55	20	419	186
Social and Administrative Sciences	175	118	11	22	5	13	34	36	18	18	243	207
Total	977	444	58	55	50	31	396	157	257	96	1,738	783

^a Other includes Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, Two or More Races, Unknown, International/Foreign

action by schools and colleges of pharmacy in their diversity initiatives and goals to enhance the recruitment, retention, and success of URM students.

The representation of international students in pharmacy schools is especially notable. According to the 2010 *The Path Forward* report,⁹ the proportion of

all doctoral degrees awarded in the United States to international students grew from 18% in 1977 to 43% in 2007. In 2015, the Survey of Earned Doctorates (SED)¹ reported that 26% of all US graduates in science, engineering, and the life sciences were international students. In comparison, the proportion of degrees awarded

Table 5. AACP Science Faculty Disciplines,^a Tenure Status, and Race and Ethnicity

		FY2008	FY2017	% change
White	Tenured	799	782	-2
	Tenure Track, Nontenured	269	274	2
	Nontenure Track or Nontenure Institution	262	365	39
Black	Tenured	58	50	-14
	Tenure Track, Nontenured	24	40	67
	Nontenure Track or Nontenure Institution	20	23	15
Hispanic	Tenured	29	29	0
	Tenure Track, Nontenured	21	21	0
	Nontenure Track or Nontenure Institution	14	31	121
Asian	Tenured	147	246	67
	Tenure Track, Nontenured	121	173	43
	Nontenure Track or Nontenure Institution	76	135	78
Other ^b	Tenured	65	156	140
	Tenure Track, Nontenured	62	101	63
	Nontenure Track or Nontenure Institution	29	96	231
Total	Tenured	1,098	1,263	15
	Tenure Track, Nontenured	497	609	23
	Nontenure Track or Nontenure Institution	401	650	62

^a Science faculty include AACP disciplines of Biological/Biomedical Sciences, Medicinal/Pharmaceutical Chemistry/Pharmacognosy, Pharmaceutics, Pharmacology/Toxicology, and Social Administrative Sciences

^b Other includes Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, Two or More Races, Unknown, International/Foreign

Table 6. PhD Enrollments Based on Race and Ethnicity

	FY2008	FY2017	Change	FY2008 (%)	FY2017 (%)	Change (%)
International	1,491	1,522	31	51	49	-2
White	923	967	44	32	31	-1
Asian	217	239	22	7	8	0
Black	143	132	-11	5	4	-1
Hispanic	66	99	33	2	3	1
Other ^a	69	139	70	2	4	2
TOTAL	2,909	3,098	189	100	100	
Numbers and Proportions excluding International/Foreign						
White	923	967	44	65	61	-4
Asian	217	239	22	15	15	0
Black	143	132	-11	10	8	-2
Hispanic	66	99	33	5	6	2
Other ^a	69	139	70	5	9	4
TOTAL	1,418	1,576	158	100	100	

^a Other includes Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, Two or More Races, Unknown, International/Foreign

to international students in schools and colleges of pharmacy was 57% (306 out of 537 PhD degrees) in FY2017. The proportion of international graduates in schools and colleges of pharmacy is substantially greater than national proportions in science and engineering. There is a general expectation that non-international PhD graduates of pharmacy schools will enter the US workforce. This may also be the case with international students. AACP and schools and colleges of pharmacy do not consistently track the career destination country of international graduates. However, SED data suggests that over the past 20 years, temporary visa holders who earn their PhD degrees in the United States stay in this country.¹ The so-called “stay rate” has increased from 55% in 1995 to 75% in 2015. Although there are no verified data on the stay rate of international PhD graduates, the SED report states that the stay rate for international life sciences graduates was nearly 80% in 2015. Based on national estimates, in FY2017 more than 200 international graduates from pharmacy schools stayed in the United States.

The numbers of PhD degrees awarded from FY2008 through FY2017 by schools and colleges of pharmacy are presented in Table 7. According to the SED,¹ there were 54,664 research doctorate degrees awarded in US institutions in 2017. In the same year, the number of PhDs from schools and colleges of pharmacy was 537, representing one percent of research doctorate degrees conferred in 2017. Consistent with the increase in the number of new pharmacy schools, expanded or new graduate programs and increases in overall institutional research funding, there has been an increase (15%) in PhD degrees conferred in the 10-year period. International students

received the highest total number and proportion of degrees, with a significant (38%) increase in 2017 (Table 7). White graduates followed international graduates with 164 graduates in 2008 and 156 in 2017. Asian graduates decreased in the number of degrees from 46 to 33 over the 10-year period, Hispanic graduates also decreased from nine to six, although Black graduates increased from 11 to 18. The persistently low numbers of Black and Hispanic graduates suggest that current efforts to recruit, support, and graduate URM students are not enough to improve representation.

The numbers as well as proportions of Black and Hispanic graduates are similar to URM enrollees. Between FY2008 and FY2017, there was a 64% increase in Black graduates (from 11 to 18) and a 33% decrease in Hispanic graduates (from 9 to 6). The percentages disguise a nearly imperceptible increase of four individuals in both groups in a 10-year period. Further, the percentages of FY2017 graduates who were URM were 3% Black and 1% Hispanic.

Forty percent (213 of 537) of PhD graduates in FY2017 came from 15 schools and colleges of pharmacy. Collectively, these institutions received 53% of both NIH funding (\$218M) and total awards (\$320M) in FY2017, and employed 46% (672) of the funded faculty members across the Academy. Among their PhD graduates, 46% (98) were female, 40% (85) were international students, and 2% were Black or Hispanic. Among these 15 schools’ 213 graduates in FY2017, there were only five Black or Hispanic graduates. Regardless of funding, every school should have a core value of diversity, but that is not enough. A significant amount of effort is clearly needed among these schools and colleges, including implementation of

Table 7. PhD Graduates Based on Race and Ethnicity

	FY2008	FY2017	Change	FY2008 (%)	FY2017 (%)	Change (%)
International	221	306	85	47	57	10
White	164	156	-8	35	29	-6
Asian	46	33	-13	10	6	-4
Black	11	18	7	2	3	1
Hispanic	9	6	-3	2	1	-1
Other ^a	17	18	1	4	3	0
TOTAL	468	537	69	100	100	
Numbers and Proportions excluding International/Foreign						
White	164	156	-8	66	68	1
Asian	46	33	-13	19	14	-4
Black	11	18	7	4	8	3
Hispanic	9	6	-3	4	3	-1
Other ^a	17	18	16	7	8	1
TOTAL	247	231	-16	100	100	

^a Other includes Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, Two or More Races, Unknown, International/Foreign

programs proven to effectively recruit and retain URM students.

DISCUSSION

Faculty diversity has been shown to improve learning outcomes for all students, with a particularly positive influence on the recruitment, retention, and persistence of students from underrepresented backgrounds.¹⁰⁻¹² Diversity in many respects (including but not limited to, or exclusive of, personal demographic characteristics such as race/ethnicity and gender) can improve research outcomes, broadening the scope of inquiry and increasing creativity in problem solving.¹³ Yet, despite best intentions, diversifying the professoriate remains “perhaps the least successful of the diversity initiatives,”¹⁴ and the number of women and minorities who are professors is significantly less in comparison with their share of the PhDs awarded. Underrepresented minorities receive nearly 13% of biomedical science PhDs awarded to US citizens, yet receive fewer than 5% of all NIH R01 grants and make up <2% of the basic science tenured/tenure-track faculty members at US medical schools.⁸ Institutional hiring practices and climates have been cited as barriers to diversifying the faculty,¹⁵ and evidence still persists that suggests evaluation biases based on race and ethnicity and gender still exist, even when controlling for training and prior productivity.¹⁶⁻¹⁸

Has racial bias in NIH funding impacted the ability of URMs to achieve tenure? A general expectation at many institutions is that tenured faculty members possess federal funding, along with other expectations. A recent analysis of the NIH grant review outcomes may shed

some light on tenure challenges for URMs. For many years there has been discussion within the NIH regarding racial disparities as they relate to grants being awarded. In 2011, NIH Director Dr. Francis Collins convened the Working Group on Diversity in the Biomedical Research Workforce to examine the findings of an NIH commissioned study entitled, Race, Ethnicity, and NIH Research Awards. This study, conducted by Ginther and colleagues, examined the funding probability of PhD R01 applicants during FY2000-FY2006 with respect to applicant race and ethnicity. The results of the study were concerning and suggested that racial and other bias existed within the grant review process. The major findings were as follows: there were significant disparities in R01-funding probability for both Asian applicants (5% less likely) and Black applicants (13% less likely) compared to White applicants. The disparity between Black and White applicants persisted with the 2006-2010 cohort and revealed a large difference in the number of applicants who were URMs (Black, 1%) compared to the number who were White (64.6%). From FY1999 to FY2009, 73% of applications from Blacks were determined to not be of “sufficient scientific merit” to be “fully discussed,” compared to the 59% of applications from Whites that received this determination. The funding successes of the applicants’ institutions were also examined, and the 30 most highly NIH-funded institutions were found to have a higher probability of receiving funding than those from institutions ranked lower, regardless of whether a disparity was observed for Black applicants.

Based on these findings, Collins convened the aforementioned Working Group on Diversity in the

Biomedical Research Workforce and charged the workgroup to examine multiple hypotheses to address bias in grant review. The workgroup examined the role of unconscious bias related to the disparities observed in research awards. The workgroup also implemented mechanisms to address implicit bias and diversity awareness training for both scientific review officers (SROs) and members of review panels. In addition, the workgroup started a pilot program to anonymize applications by removing identification of applicant and/or the applicant organization.

According to AACCP data, 15 institutions reported having 1279 FTE faculty members, 672 funded faculty members including 421 NIH-funded faculty members, and \$320M in total awards including \$219M in NIH funding in FY2017. Each of these 15 schools and colleges of pharmacy had in excess of 30 funded faculty members, while in FY2008, only one pharmacy school reported having more than 30 funded faculty members. It is incumbent upon all pharmacy schools, and especially the deans and graduate programs in these 15 institutions, to address conscious and unconscious bias within existing power structures and to acknowledge the challenges with URM faculty recruitment and retention. Search committees must actively seek out and recruit Black and Hispanic graduates for faculty positions, and graduate programs must develop and maintain supportive environments in order to retain their junior science faculty members.

The SED survey regarding URM PhDs provides a basis for comparison to the data from schools and colleges of pharmacy. According to this report, participation by URM in graduate education has increased over the last 20 years.¹ The report states that there was a 70% increase in the number of doctorate degrees in the life sciences awarded to Blacks over the past 20 years and a more than doubling in the number of doctorate degrees awarded to Hispanics. According to the report, in the life sciences, Asians were the largest URM to receive a life science doctorate degree in 2014 with 10% of the majority, followed by Hispanics and Blacks at 6% each. The percentage of Asian, Black, and Hispanic doctorates from schools and colleges of pharmacy in 2017 was 6%, 3%, and 1%, respectively. These numbers demonstrate a significant deficit in the proportions of Black and Hispanic graduates from pharmacy schools, compared with national data.

Strengthening the research enterprise and professoriate by ensuring the best researchers from all backgrounds participate requires a better understanding of the career decision-making process of recent PhDs, and how it might differ for scientists from underrepresented groups. Individual choice may also contribute to some of

the underrepresentation seen at the faculty level. That is, highly skilled biomedical scientists from all backgrounds, including those underrepresented in faculty positions, may be choosing other career pathways because academic careers may be viewed as less attractive, welcoming, or satisfying than other professional options.¹⁸

Because the URM numbers for other professions and science graduate programs are more positive than those for pharmacy,¹⁹ we examined the literature to gain insight on the challenges we face, opportunities that might be available, and best practices to follow to achieve a more favorable outcome for the pharmacy profession. The social and behavioral literature has provided research and perspectives on the challenges that impact the success of URM students in graduate education. An insightful assessment was that examining the so-called “double-bind” experienced by Black female science graduate students.²⁰ This work summarizes factors that may negatively impact or influence URM recruitment and success in graduate programs. The report notes several environmental factors that impact the experience of the URM female graduate student. These include social isolation in home departments, the lack of role models, and the difficulty of “finding their place” in departments.²⁰ These challenges, in some instances, result in academic difficulty and other qualitative issues that are difficult to observe as well as to address effectively.

Further, these authors reported on a quantitative data analysis that identified significant bias in scoring patterns for National Science Foundation¹ graduate fellowships. This study examined scoring patterns for NSF graduate student fellowships and found that Black female applicants relative to others were significantly less likely to receive high panel rating averages or to receive offers of fellowships. Competitive training grant awards received during a graduate education experience enhance post-graduate opportunities for students, especially if academia is their career destination. Because the recipients of these awards are usually selected through a peer-review process, they are generally looked upon as prestigious. The degree to which this activity has impacted the progression of Black female students has not been ascertained. In addition to recruitment initiatives for URM, examining those best practices to retain and graduate URM is critical to enhancing the ethnic and racial diversity within schools and colleges of pharmacy.

The pipeline of graduates from schools and colleges of pharmacy continues to grow, but targeted efforts are needed to further increase the proportions of female and URM enrollees and graduates. The numbers of enrollees in and graduates from pharmacy schools continue to outpace previous numbers, but not at rates commensurate

with the capacity and funding of these institutions. There have been consistent positive increases in the number of female graduates from pharmacy schools, but the enrollment and degrees conferred for Black and Hispanic students continues to be low and inconsistent with national data and milestones.¹ Although the number of graduates that have completed PhD programs in pharmacy schools is reported to AACP, there is no verified data stating their first employment nor specific information providing insight on the drivers for certain career choices. Nonetheless, there is a perceived or real decline in the number of pharmacy graduate students pursuing faculty positions in academia that is consistent with national data. Furthermore, as pharmacy schools continue the discussion on diversifying academia, recruitment of both Hispanic and Black faculty members remains stubbornly stagnant. However, there have been significant gains in international, Asian, and female graduates entering academia.

As noted in the previous section, there was no substantive change in number of URM science faculty members between FY2008 and FY2017 in US schools and colleges of pharmacy. An insightful report³ that examined factors that influenced the career choices of WR and URM PhD-trained scientists employed in academic and non-academic positions. Factors influencing an academic career choice included: having more publications, having a desire for autonomy and to partner with other academicians; having the right working conditions, geographic location, intellectual challenge, and salary/benefits; and attaining a position that was endorsed by advisors or mentors. URM PhD scientists in academia reported, somewhat surprisingly, that their mentors had had little influence on their career choice. This finding suggests that mentors can better inform the career paths for URM students, and non-science mentoring sessions with advisors are critical. In summary, graduate mentors and advisors have significant opportunities to provide counsel to all trainees on their career paths. Graduate programs, departments, schools, and universities must establish strategies to ensure these critical mentoring opportunities are recognized and implemented with their diverse graduate mentees.

Successful Approaches to Enhancing Diversity in Biomedical Graduate Programs

As evident in the static data on pharmacy graduate enrollees (Table 6) and graduates (Table 7), schools and colleges of pharmacy continue to be ineffective in diversifying graduate students and science faculty members. Most universities now have diversity in their “core values” statements, but lack strategic goals or specific

funding to enhance diversity within their student body or faculty. Clearly, a more proactive approach to diversity is required to meet the stated core institutional values.

The Meyerhoff Graduate Fellows Program at the University of Maryland Baltimore County (UMBC) is an a model of successful investment in URM graduate student recruitment, retention, and excellence. This long-standing program began in 1996 with a Minority Biomedical Research Support-Initiative for Maximizing Student Diversity (MBRS-IMSD) grant from the National Institute of General Medical Science. The goal of this program is explicitly to increase diversity among students pursuing PhD degrees in the biomedical and behavioral sciences.¹¹ As of 2011, the program had produced nearly 100 graduates and had an equal number of students currently in the program. The program has an 80% retention rate that far exceeds the national rate of 50%. The Meyerhoff Graduate Fellows Program has demonstrated sustained excellence in diversifying graduate educational programs and is widely considered to be a national model of success in higher education.

The Meyerhoff approach to supporting URM PhD students includes identifying high-achieving students; offering significant financial aid, tutoring, and other support; and fostering teamwork and esprit de corps. Barriers to implementation include earmarking dedicated funding in an era of declining resources, faculty resistance or old biases, and lack of leadership commitment to improving diversity as a true institutional priority. Six years ago, the Howard Hughes Medical Institute (HHMI) provided grant funding to two universities, Pennsylvania State University at State College and the University of North Carolina (UNC) at Chapel Hill, to replicate the Meyerhoff program on their campuses, which has been very successful. In 2019, the HHMI announced a competition to fund expansion of the Meyerhoff program to as many as six more institutions.²¹

CONCLUSION

Two decades ago, various organizations and foundations including the AACP Commission on the Future of Graduate Education in the Pharmaceutical Sciences²² recommended that graduate programs provide more curricular or experiential options to increase the breadth of skills of graduates. Despite significant progress in this area, this recommendation is still timely, perhaps more so now because of the continuously changing workforce needs.

Although there has been a substantial increase in recruitment of Asian faculty members across each of the major science disciplines, the numbers of Black and Hispanic faculty numbers in each of the major disciplines

have changed minimally over the last 10 years. Schools and colleges of pharmacy must enhance the recruitment, retention, and success of URM faculty members as there is a direct link between faculty members as role models and recruitment of students. College, school, and department leadership should strive to better understand factors that inhibit URM faculty members from joining schools and colleges of pharmacy. In addition to recruitment initiatives for URM, examining those best practices to retain and graduate URM PhD students is critical to enhancing the ethnic and racial diversity within pharmacy schools. Schools should collect data and share metrics to evaluate progress in these areas. Additionally, the Academy should continue to encourage NIH and other funding organizations to find ways to minimize implicit bias in grant review and scoring.

After 10 years of opening new schools and colleges of pharmacy, increasing the capacity of existing schools, adding new and/or expanding current graduate programs, and increasing research dollars to support graduate education, there are no commensurate positive increases in Black and Hispanic enrollees and graduates. The consistently low enrollment for URM students over a 10-year period demonstrates the need for pharmacy schools to prioritize their stated diversity initiatives and goals, and make a focused investment and effort to enhance the recruitment, retention, and success of URM students by modeling national programs and best practices, such as the UMBC Meyerhoff Program. To truly change the culture, pharmacy schools should provide inclusion training to encourage better communication with URM advisees. Graduate programs, departments, schools, and universities must establish strategies to ensure that essential and appropriate mentoring approaches are implemented for all of their diverse graduate mentees.

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