

Research & Occasional Paper Series: CSHE.20.08

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UNIVERSITY OF CALIFORNIA, BERKELEY

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A SERU Project Research Paper *

**THE “TURNING POINT” FOR MINORITY PRE-MEDS:
The Effect of Early Undergraduate Experience in the Sciences on Aspirations to Enter
Medical School of Minority Students at UC Berkeley and Stanford University**

November 2008

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ABSTRACT

The University of California faces the challenge of increasing the diversity of students graduating from its medical schools while also adhering to mandated restrictions on the use of race or ethnicity in the admissions process. Students from diverse backgrounds who gain admission as undergraduates to UC Berkeley and express an early interest in a medical career are an important potential source of medical students for the UC system. However previous data suggest that many of these undergraduate students lose interest in a medical career and never apply to medical school. We report on research that tracked the strength of students' interest in a medical career from freshman matriculation through the end of sophomore year. Comparing students by self-described racial or ethnic group, we found a sharp decline in interest among all groups. We then interviewed a stratified sample of these students, asking what factors contributed to the observed decline in interest in premedical studies. Negative experience in science courses, principally chemistry, was the main factor contributing to students' loss of interest. The adverse impact of chemistry courses was reported disproportionately by students from underrepresented minority groups, causing many of them to turn away from a possible medical career. If the UC system hopes to increase the diversity of its undergraduates who go on to medical school, it may need to reassess the structure and content of its undergraduate science curriculum, principally chemistry.

The University of California faces conflicting policy expectations regarding the training of physicians for the state of California. With the growing racial and ethnic diversity of the state's population, it is crucial for the University to increase the diversity of the medical profession within the state by increasing the diversity of the students graduating from its medical schools.¹ Simultaneously, the University must operate within the dictates of Proposition 209 and

* The SERU Project and Consortium is a collaborative effort based at the Center for Studies in Higher Education at UC Berkeley and focused on developing new types of data, analysis, and innovative policies relevant to major research universities. For more information, see <http://cshe.berkeley.edu/research/seru/>.

federal court rulings, avoiding race-based preferences in the selection of students for admission either to the undergraduate university or to medical school.²

While the University may not use racial or ethnic preferences in its admissions procedures, it is appropriate for the University to invest resources in support of students from historically underrepresented minority groups (URM) who gain admission based on their own personal and academic strengths. URM students who are undergraduates at a UC campus form a logical pool from which to encourage students to seek admission to medical school, and ultimately to enter the medical profession in California. Having gained admission to the University of California as an undergraduate suggests that these individuals have the academic potential, given the appropriate educational opportunity, to succeed in the premedical curriculum required for admission to medical school.

However, our previous research at Stanford University, whose undergraduates are on an academic par with undergraduates at campuses such as UC Berkeley, has documented a worrisome "leakage" from the premedical pipeline.³ In a typical year, a URM student who enters Stanford aspiring to become a physician is less than half as likely as a non-URM student eventually to apply to medical school. It appears that, over the four years of the undergraduate experience, Stanford loses fifty or more URM students per class who once had hoped to become a physician. It is not that these students fail to graduate; rather, they abandon premedical studies and pursue other career trajectories.

In response to low numbers of URM students choosing to major in the biological sciences (a common major for premedical students), in 1992 UC Berkeley established the Biology Scholars Program (BSP). With funding provided by the Howard Hughes Medical Institute, BSP had the goal of "promot[ing] the success of undergraduates from economic, gender, ethnic, and cultural groups historically underrepresented in the biological sciences" by providing "a continuum of resources available to help its members address critical transitions (e.g., making the high school-to-university academic and social adjustment, declaring a major, applying to graduate or professional school) throughout their undergraduate years."⁴

The question arises as to whether URM students who enter UC Berkeley with an interest in pursuing premedical studies experience the same decrease in the strength of that interest as do Stanford students. Particularly in light of the goal of the BSP to help these students during the "critical transitions" of adjusting to the demanding academic environment of UC Berkeley, it is important to identify any loss of interest in premedical studies that may occur among URM students during their first one to two years as undergraduates. We undertook this study to compare the interest level over time of UC Berkeley students and of Stanford students who, as entering freshmen, expressed an interest in pursuing premedical studies. We wished to identify any specific factors that may adversely affect these students' interest in premedical studies, and eventually in a medical career.

Methods

Survey of the strength of students' interest in being pre-med

After IRB review and approval, the Office of Student Research at UC Berkeley provided us with identifying information on all entering freshmen for the 2003-04 and 2004-05 academic years. We sent an e-mail to each of these students, asking if they were interested in pursuing premedical studies at Berkeley, and if so, asking them to link to a web-based survey. Those who responded to the e-mail by linking to the survey were first given information about the study, and then asked to link to a second page that asked a series of questions. One of these questions asked: "Please choose a whole number between 1 and 10 from the Interest Scale which best describes your current interest in being pre-med." The students were then shown a 10-point scale, with the following prompts located at the numbers indicated:

- 10 So committed to pre-med that nothing can stop me
- 9
- 8
- 7 Probably will be pre-med

- 6
- 5
- 4 Probably will not be pre-med
- 3
- 2
- 1 Absolutely no interest whatsoever in pre-med

Students could indicate only a single whole number in response. Earlier piloting of this 10-point scale at Stanford using a test/re-test methodology confirmed its reliability. We categorized respondents according to their self-identified racial or ethnic group, and calculated mean interest levels for each group.

Toward the end of the spring semester of these students' sophomore year, we repeated the survey, sending an e-mail to each student who had responded to the survey as entering freshmen and asking them to indicate their current level of interest in pursuing premedical studies. We sent two rounds of follow-up e-mails to non-respondents. We again calculated a mean response for each racial/ethnic group.

We also conducted a similar survey at Stanford for students entering as freshmen in the fall of 2002, 2003, and 2004. The methodology at Stanford was somewhat different in that the Registrar's Office at Stanford surveys each entering student in the summer before matriculation. One of the questions on that survey asks, "At this point in your life, if you are thinking of pursuing a graduate degree, in which area(s) would you do so?" The Registrar's Office provided us with the name and contact information for each student who indicated "medicine" in response to this question. We surveyed these students at the beginning of freshman year and the end of sophomore year, using the same methodology described above. We then calculated mean interest levels for the different racial/ethnic groups. We have reported the results of the Stanford study elsewhere.³

We then compared the level of interest between Berkeley freshmen and Stanford freshmen according to racial/ethnic group. We also compared the change in mean interest level for these groups between the beginning of freshman year and the end of sophomore year. For both groups we report data from students who responded to our survey both at the beginning of their freshman year and at the end of their sophomore year.

Interview regarding factors affecting students' level of interest in being pre-med

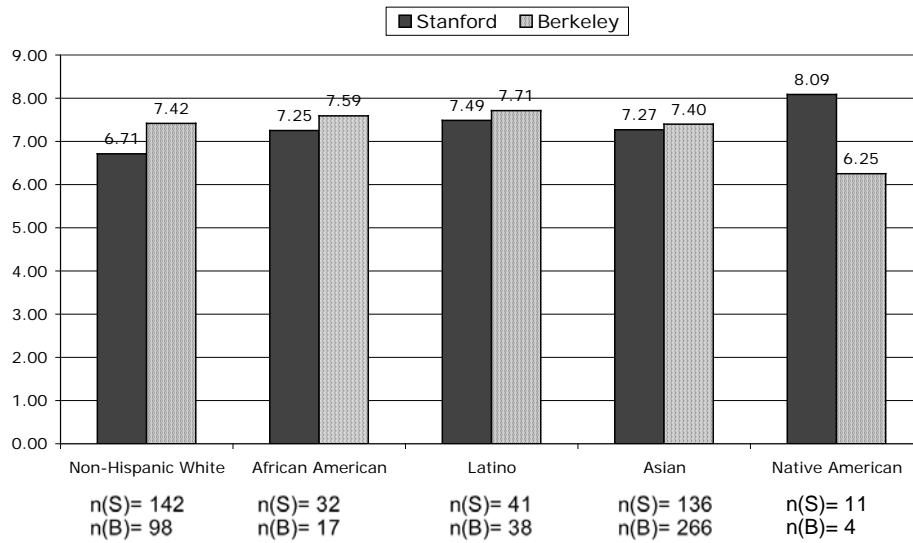
As a follow-up to the surveys we conducted one-on-one interviews with 63 of the responding students, administered between the end of the subject's sophomore and senior years. We divided respondents into two groups: URM and non-URM, and randomly selected students from each group for interview. In doing so we over-sampled URM students, getting a final interview sample of 29 URM students and 34 non-URM students. Based on the results from our study of Stanford students, in which science courses which the students had taken (principally chemistry) were found to be a principal factor that discouraged students' interest in continuing in premedical studies, we asked the interview subjects at Berkeley the following question: "Were there any specific courses at Berkeley that discouraged your interest in medicine?" All survey responses were reviewed by two coders to assure consistency in coding.

Results

Survey responses

A total of 423 Berkeley freshmen responded to our survey. The mean level of interest in pre-med at the beginning of freshman year for each of the five principal racial/ethnic groups is shown in Figure 1. In the figure, we compare the interest level of these Berkeley students with that of 362 Stanford freshmen. The number of students in each racial/ethnic group is shown at the bottom of the chart, with n(S) indicating the number of students in the Stanford sample and n(B) indicating the number in the Berkeley sample. For African-American, Latino, and Asian student groups, the initial level of interest is similar at the two universities. Native American respondents at Berkeley reported a substantially lower level of interest than those at Stanford, while the white respondents at Berkeley reported a somewhat higher level of initial interest than those at Stanford.

Figure 1
Level of Interest in Premedical Studies
at the Beginning of Freshman Year



In Figures 2A (Stanford students) and 2B (Berkeley students) we compare the change in reported level of interest in premedical studies between the beginning of freshman year and the end of sophomore year.

Figure 2A
Change in Interest Among Stanford Students in
Continuing Pre-Medical Studies

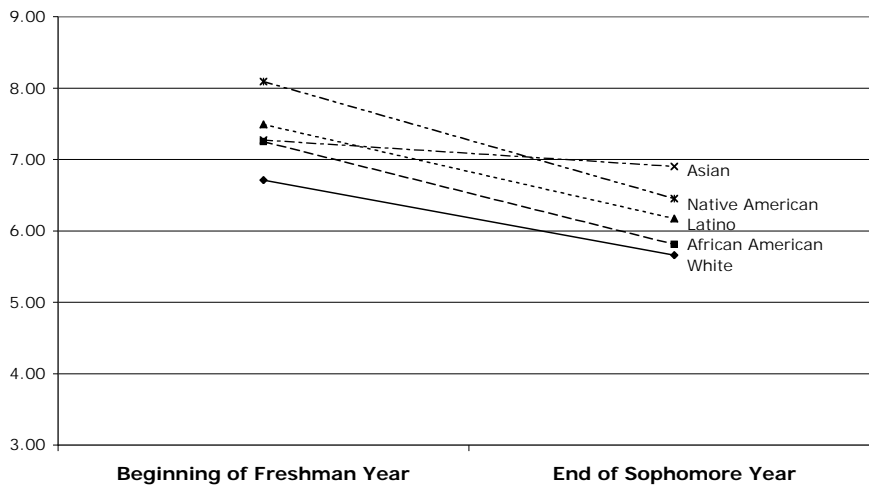
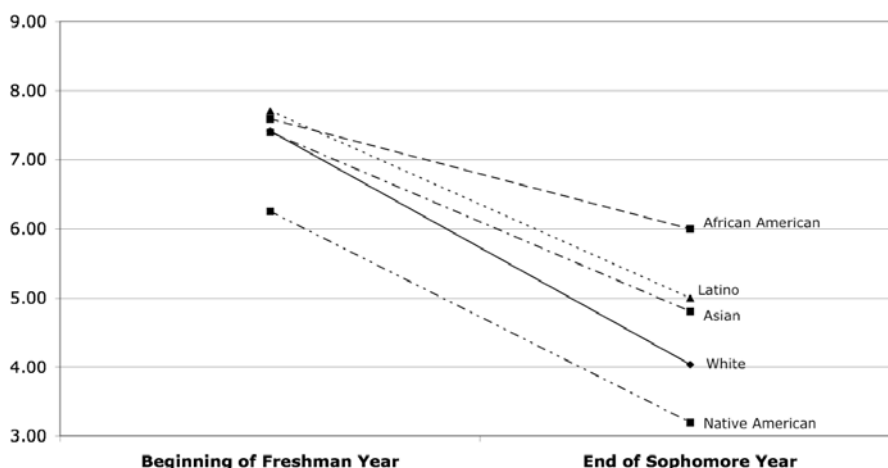


Figure 2B
Change in Interest Among Berkeley Students in
Continuing Pre-Medical Studies



Several interesting patterns can be seen in comparing the responses of Berkeley students and Stanford students. While Berkeley students and Stanford students generally start their freshman year with about the same level of interest, the decline in that level of interest is quite a bit greater at Berkeley, as indicated by the steeper slopes of the lines. White (loss of 3.38 points), Asian (loss of 2.59 points), and Latino (loss of 2.71 points) students at Berkeley lose substantially more interest than white (loss of 1.05 points), Asian (loss of 0.37 points), and Latino (loss of 1.32 points) students at Stanford.

By comparison, African American students at Berkeley (loss of 1.59 points) and at Stanford (loss of 1.44 points) have a similar level of decline. However, while African American students at Stanford have the second-largest decline among all racial/ethnic groups, at Berkeley they have the smallest decline, ending the sophomore year with the greatest interest in continuing premedical studies of all the racial/ethnic groups.

Native American students at both Berkeley (loss of 3.05 points) and Stanford (loss of 1.64 points) report the largest decline of all the groups. Compared to the other racial/ethnic groups at Berkeley, Native American students start out with the lowest level of interest and remain in that position at the end of sophomore year. At Stanford Native American students start out with the highest level of interest and end with the second highest level.

Interview responses

Students' responses to the question, "Were there any specific courses at Berkeley that discouraged your interest in medicine?" are shown in Table 1.

Table 1

List of Courses that Discouraged Students' Interest in Premedical Studies

Course	<u>Most discouraging course</u>		<u>List of all discouraging courses reported</u>		
	URM Students (N=29)	Non-URM Students (N=34)	Course	URM Students (N=29)	Non-URM Students (N=34)
Chemistry (all courses)	20	12	Organic chemistry	11	12
Biology	3	3	Inorganic chemistry	11	4
Math	4	2	Chemistry-unspecified	4	2
Physics	1	3	Chemistry - total	26	17
IDS	0	1	Biology	9	9
Language courses	0	1	Math	11	2
No course discouraged me	1	12	Physics	1	5
			DS	0	1
			Language courses	0	1
			No course discouraged me	1	12

As shown on the right side of the table, 28 of 29 URM students (97%) mentioned at least one course that discouraged their interest in medicine, with only one student reporting no discouraging courses. Many of these students mentioned more than one course. By contrast, 22 of the 34 non-URM students (65%) mentioned at least one course as discouraging them, with 12 students reporting no discouraging courses. Of the students reporting at least one discouraging course, courses in chemistry were mentioned substantially more often than other courses.

For those students mentioning more than one course, the interviewer followed up with a question asking the student to identify the one course that was the most discouraging for them. Of the 28 URM students mentioning at least one course, chemistry was cited as the most discouraging course by 20 (71%). Of the 22 non-URM students mentioning at least one course, chemistry was cited as the most discouraging course by 12 (55%). It thus seems that, in a manner consistent with the results of our interviews with Stanford students, chemistry courses are the single factor that discourages students the most from continuing in premedical studies. While the non-URM students mention organic chemistry courses substantially more often than inorganic chemistry courses, URM students mention the two courses at about the same rate.

While more than one-third of the non-URM students responded that none of their courses discouraged their interest in premedical studies, only one of the 29 URM students reported this absence of discouraging courses. It appears that the standard premedical courses at Berkeley are quite a bit more discouraging for URM students than for non-URM students.

Consistent with our concern that many of these URM students, especially those coming from a disadvantaged educational background, may be vulnerable to a loss of self-confidence during the early university experience, with a resultant shifting of professional aspirations, we have excerpted below specific text that addresses this issue from our interviews with six URM students. We looked for any mention by the student during the interview of a course that was so discouraging that, as a result of having taken it, the student may have changed his or her aspiration regarding a career in medicine.

Subject 1 – Latina female

Q: How would you compare your current level of interest in becoming a physician with the interest you had when you entered as a freshman?

A: I wanted to do it a lot freshmen year, but afterwards I stopped.

Q: What were the factors that led to the decrease in your level of interest?

A: I didn't think that I could do very well in the chemistry classes... I wanted to be pre-med when I first got here. But then after the first semester, I stopped... I think a lot of students get scared after Chem IA.

Subject 2 – Latina female

Q: What were the factors that led to the decrease in your level of interest?

A: Chemistry. [laughter] Yeah, just the level of competitiveness here ... I'm sorry, but chemistry is just — having to take that much and study a lot it's just — I don't like doing that. So it's just like why do that? ... I've heard many experiences after taking Chem 3. This is just like the peak. You like it or you don't. This is the turnaround point.

Subject 3 – African-American female

Q: How would you compare your current level of interest in becoming a physician with the interest you had when you entered as a freshman?

A: It's changed a lot. Yeah, so. When I first came, I wanted to go into health care. And that's what I knew I wanted to do. But then when I started taking the classes, it changed.

Q: What were the factors that led to the decrease in your level of interest?

A: Mainly just the classes and the level of difficulty in the classes. I had to repeat Chem IA.

Subject 4 – African-American female

Q: Were there any specific courses that discouraged your interest in medicine?

A: I think having to drop Chem IA in the Spring of my first year made me question whether or not I could do it ... I really didn't tell anyone because I didn't want to seem stupid. And then when I eventually had to drop it, I remember like I was hiding from certain people because I didn't want them to know. [laughter] ... So it was just a matter of me not wanting to feel dumb around other people.

Subject 5 - African-American female

Q: How would you compare your current level of interest in becoming a physician with the interest you had when you entered as a freshman?

A: Well, my first semester I was in Chem IA and calculus. And it was just like really, really big lectures and a lot of time. And I just felt like I wanted something that was smaller and more focused ... A lot of people get scared either before or after O-chem and decide they don't like it [medicine] anymore.

Subject 6 – Latina female

Q: Were there any specific courses that discouraged your interest in medicine?

A: Chem IA. Introduction to Chemistry or whatever. I took it twice. Um, well once I dropped after the 10th week mainly because on my part I felt that I didn't put enough effort. It just seemed like no matter how hard I tried, I would still probably do bad on the test and stuff like that ... That's probably the class at Berkeley that discouraged me from being pre-med ... my friends also felt discouraged ... they dropped out of their pre-med pursuit because of Chem IA.

Discussion

Among freshmen who enter Berkeley with an initial interest in pursuing premedical studies, there is a clear pattern of a substantial reduction in the strength of that interest by the end of sophomore year. When we compare the Berkeley data to similar data obtained from entering freshmen at Stanford, we see a substantially sharper decline in interest among Berkeley students. In addition, the decline is seen among all racial/ethnic groups at Berkeley, while at Stanford the decline in interest among white and Asian students was less than that among African American, Latino, or Native American students.

There is a troubling consistency at the two universities in the magnitude of the loss of interest among Native American students. There are relatively small numbers of these students at both campuses, and at both campuses the early premedical experience of Native Americans appears to be the most discouraging of the groups we studied. This finding may be of interest to those at the two universities responsible for providing academic support for Native American undergraduates.

A principal cause of the decline in interest among Berkeley students seems readily apparent. Early experiences in the premedical science courses are frequently reported as having discouraged a student's interest in continuing in premedical studies. Based on the results of our interviews, chemistry courses are the principal source of the discouragement reported by these students. The discouraging effects of chemistry courses appear to be felt more acutely by the URM students, with 20 of the 28 URM students who reported at least one discouraging course identifying chemistry as the course that discouraged them most.

From the results of our interviews it appears that the adverse effects of chemistry courses experienced by many of the URM students leads directly to these students questioning their own ability to continue to pursue a medical career, and as a consequence dropping medicine as a possible career trajectory. For these students, entering Berkeley with the hope of become a physician and then having a negative experience in a chemistry course is a major turning point in their life. In the words of the students whose interview text appears above:

"I didn't think that I could do very well in the chemistry classes ... I wanted to be pre-med when I first got here. But then after the first semester, I stopped."

"I'm sorry, but chemistry is just ... I don't like doing that ... This is just like the peak. You like it or you don't. This is the turnaround point."

"When I first came, I wanted to go into health care ... But then when I started taking the classes, it changed."

There is, however, one aspect of the data that suggests a potential solution to the problem of loss of interest among many of the very students the state of California needs to continue on to become physicians. As described above in Figures 2A and 2B, both at Stanford and at Berkeley, the African-American students began (7.25 at Stanford, 7.59 at Berkeley) and ended (5.81 at Stanford, 6.00 at Berkeley) at about the same level of interest. However, the African-American students at Stanford ended with the second lowest interest level among the various groups, while the African-American students at Berkeley consistently maintained the highest level of interest of any group.

The reason the African-American students at Berkeley remained at a high level of interest relative to other Berkeley students may be reflected in the following excerpts taken from the interviews with three African-

American students. When asked if there were any people or programs at Berkeley that helped the student to maintain her interest in a medical career, these students responded:

"I guess the people that would come the closest to that would be the people in BSP. [Biology Scholars program] When I came to them Spring of last year telling them about my chem problems, they just sat me down and told me that...[it] doesn't mean my whole plans are gonna be thrown off track...If it wasn't for them, I don't know who I'd turn to."

"Just knowing there's people at BSP who have made it...Just kinda made me think that I could be there one day."

"Well, the leaders of BSP...From BSP they tell us about research opportunities, and...like they go over what classes you need to take as well."

We found repeated evidence in the interview transcripts, with African American students as well as with students from other racial and ethnic groups, that the Biology Scholars Program is viewed by these students as a crucially important bulwark of support as they go through the demanding, and often discouraging, early premedical curriculum, especially the curriculum in chemistry.

Summary and conclusion

In 1953 a national consortium of medical schools and professional organizations issued a report on *Preparation for Medical Education in the Liberal Arts College*.⁵ Led by Aura E. Severinghaus, Associate Dean of the Faculty of Medicine of Columbia University, the report looked explicitly at what role the early premedical sciences should play in screening students for medical school. It recommended the following:

The liberal arts college, therefore, has the important responsibility of trying to prevent students from cherishing inappropriate professional ambitions too long ... Effort should be made as early in the student's college career as possible to determine whether, on the basis of personality, character, motivation, and academic performance, he is qualified to go into medicine. If it is decided that he is not qualified, then every intelligent device ... should be used to persuade him to reevaluate his professional objective. (11)

Severinghaus' committee recommended using success, or the lack thereof, in the premedical sciences as an important means to discourage students from maintaining their interest in a medical career. Severinghaus went even further in making this expectation explicit

There is considerable difference of opinion as to the extent of the responsibility which the undergraduate college should assume for those students who are weeded out of the group seeking admission to medical school... (11)

Today's students who speak of "weeder courses" are not imagining things. Since at least the 1950s, introductory courses in chemistry have been used at colleges and universities throughout the U.S. to "prevent" students who do not do well in them "from cherishing inappropriate professional ambitions too long" – in a phrase, to weed them out. At UC Berkeley as well as at Stanford, this weeding process is still based largely on students' early experiences in chemistry. It falls disproportionately on students from underrepresented racial and ethnic groups, many of whom enter the university from a position of educational disadvantage. Yet these are the very students the University of California's system of medical education is expected to train as physicians to meet the health manpower needs of our increasingly diverse state. It appears that the time is right for a fundamental reassessment of the historical premedical curriculum and pedagogy, with a goal of encouraging the personal and intellectual growth of our many and diverse talented students, rather than weeding them out at an early age.

NOTES

- ¹ Grumbach K, Odom K, Moreno G, *et al.* Physician Diversity in California: New Findings from the California Medical Board Survey. Center for California Health Workforce Studies, University of California, San Francisco. March 2008, available at <http://futurehealth.ucsf.edu/cchws/Ca%20Med%20Board%20FINAL%203%204%2008.pdf>, accessed 4/25/08.
- ² Cohen JJ. The Predictable Price of Proposition 209. *Academic Medicine*. 1999; 74:528.
- ³ Barr, DA, Gonzalez, M, Wanat, SF. The Leaky Pipeline: Factors Associated With Early Decline in Interest in Pre-Medical Studies Among Under-Represented Minority Undergraduate Students. *Academic Medicine*. 2008; 83(5) – May 2008, in press.
- ⁴ Matsui J, Liu R, Kane CM. Evaluating a Science Diversity Program at UC Berkeley: More Questions Than Answers. *Cell Biology Education*. 2003; 2:117–121.
- ⁵ Severinghaus AE, Carmen HJ, Cadbury WE. Preparation for Medical Education in the Liberal Arts Colleges – The Report of the Subcommittee on Preprofessional Education of the Survey of Medical Education. New York: McGraw-Hill, 1953.