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## **Improving Transfer Access to STEM Bachelor's Degrees at Hispanic Serving Institutions through the America COMPETES Act**

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This report was written by Dr. Alicia C. Dowd, Associate Professor and Co-Director at the Center for Urban Education, University of Southern California. Dr. Lindsey E. Malcom, Assistant Professor at the University of California, Riverside, and Dr. Elsa E. Macias, Director of Professional Development, Center for Urban Education, University of Southern California.

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In 2007, the Center for Urban Education began a three-year research grant funded by the National Science Foundation to determine practical ways of increasing Latinos' access to and success in STEM fields, with Dr. Alicia C. Dowd as Principal Investigator and Dr. Estela Mara Bensimon as Co-Principal Investigator. Through this study, CUE is examining the features of exemplary STEM policies and programs to identify ways for institutions—both Hispanic Serving Institutions (HSIs) as designated by the U.S. Department of Education, and non-Hispanic Serving—to increase the number of Latino STEM graduates.

### **HOW TO CITE THIS REPORT:**

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The America COMPETES Act authorized by Congress in 2007 directs the National Science Foundation to develop a Hispanic Serving Institutions Undergraduate Initiative, with the goal of increasing Latina and Latino<sup>1</sup> degree completion in science, technology, engineering, and mathematics (STEM) fields. Appropriations through this act substantially increase NSF's budget in traditional funding areas such as teacher preparation, research fellowships and scholarships, and laboratory facilities. Perhaps even more importantly, additional monies are allocated for curriculum development, experiential learning, and program evaluation, thereby providing greatly needed resources to spur pedagogical innovation.

This report is intended to inform the capacity-building effort by highlighting the role of Hispanic Serving Institutions (HSIs) in producing Latino STEM baccalaureates. It indicates a greater share of Latino students enrolled at HSIs earn degrees in key majors, such as computer science, mathematics, and engineering, than do their counterparts at non-HSIs. However, Latino students who transferred from community colleges to HSIs had lower rates of participation in these fields of study. Given the large number of Latinos in community colleges, transfer access to these fields must be increased in order to produce more Latino STEM baccalaureates.

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## **Latino Participation in STEM Fields Has Risen, But Not in Proportion to Population Growth**

The need for a highly skilled and educated workforce to ensure the nation's competitiveness and economic prosperity has been well documented (National Academies, 2006; NSF, 2006). Estimates by the National Science Board (2008) indicate that science and engineering jobs are expected to grow by 26% from 2004 to 2014, in comparison to a 13% growth in all other occupations. The impending mass retirement of America's older, relatively well-educated generation of baby boomers (Kelly, 2008) means that the United States is increasingly dependent on Latinas and Latinos to fill these positions. As the fastest-growing and youngest demographic group in the country, Latinos are projected to make up nearly 30% of the entire U.S. population by 2040 and will soon be the largest demographic group in several southwestern states (U.S. Census Bureau, 2008).

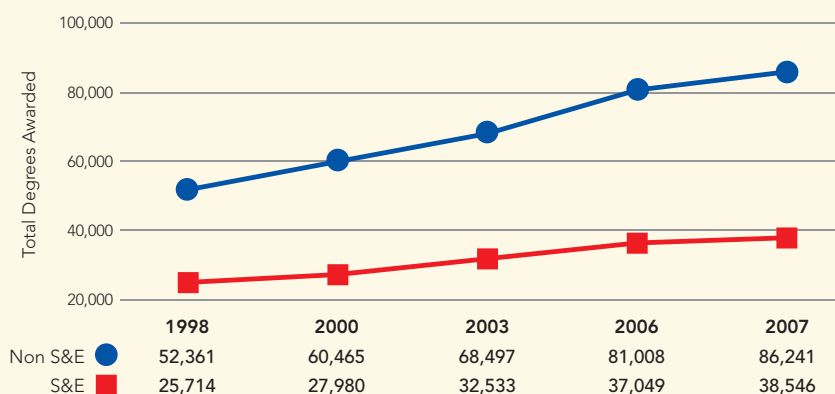
Latino participation in STEM fields has risen, but it has not kept pace with their growth within the general population. In 2007, Latinos were awarded 8.2% of STEM bachelor's degrees, which includes those in biological sciences, computer sciences, psychology,

***A three-year study at the University of Southern California's Center for Urban Education (CUE) is documenting the institutional pathways Latinos take in earning STEM baccalaureates. Given the large number of Latinos enrolled in community colleges, this report focuses on access to STEM bachelor's degrees by transfer students.***

<sup>1</sup> At times, we use the expression "Latinas and Latinos" to be explicitly inclusive of Latinas, and at other times, we use the expression "Latino," referring to both Latinos and Latinas, for ease of reference.

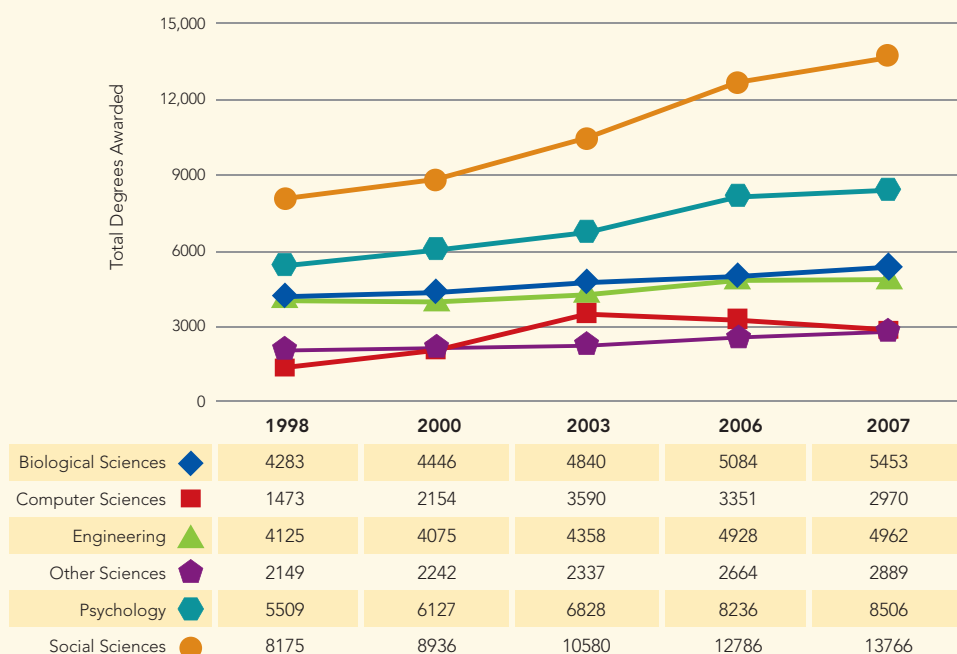
social sciences, and engineering (NSF, 2009). In addition, as illustrated in Figure 1, growth in the number of bachelor's degrees awarded to Latinos occurred primarily in non-science and engineering fields. From 1998 to 2007, there was a 64% increase in the number of non-science and engineering degrees awarded to Latino students, as compared to an increase of only 50% in science and engineering degrees awarded to Latino students. Furthermore, as Figure 2 shows, most of that 50% growth occurred primarily in the social sciences and psychology rather than in the biological sciences, engineering, computer sciences, and other fields categorized as sciences.

**Figure 1. Bachelor's Degrees Awarded to Hispanics in Science and Engineering (S&E) and Non S&E Fields, 1998–2007**



SOURCE: National Science Foundation, Division of Science Resources Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 1998–2007.

**Figure 2. Bachelor's Degrees Awarded to Hispanics in Science and Engineering Fields, 1998–2007**



SOURCE: National Science Foundation, Division of Science Resources Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 1998–2007.

## To Increase the Numbers of Latino STEM Baccalaureates, Look to Community Colleges

The role of community colleges has largely been overlooked in the national dialogue on how to increase the number of Latinas and Latinos in STEM careers (Epstein, 2006). Latinos are more likely to attend community college than are members of other racial-ethnic groups (Adelman, 2005), and nearly 60% of all Latinos enrolled in postsecondary education attend a community college (Snyder, Tan & Hoffman, 2006). Latino college students also tend to be concentrated in a small number of institutions, which are predominantly HSIs. Only 10% of the four-year institutions of higher education in the United States enroll the majority (54%) of Latino undergraduates (Horn, 2006). Any effort to increase the number of Latino STEM degree holders will depend on the institutional capacity of community colleges and HSIs to educate Latinas and Latinos in STEM fields.

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## Latino Transfer Access to STEM Fields of Study

To document the access Latina and Latino community college transfers have to different fields of study in STEM, this report compares the representation of transfer students, as indicated by those who hold associate's degrees,<sup>2</sup> among Latinos awarded STEM bachelor's degrees at HSIs and non-HSIs.<sup>3</sup>

Before considering degrees awarded to community college transfer students by field of study, it is important to note that although 40% of the bachelor's degrees awarded to Latinos in *all fields of study* are granted by HSIs (Hispanic Association of Colleges and Universities), only 20% of the bachelor's degrees awarded to Latinos in STEM fields are from HSIs. This disparity can be explained in part by the fact that HSIs have been chronically underfunded in the distribution of federal STEM research dollars, which has limited their capacity to offer the undergraduate research opportunities that are known to attract and retain students in the sciences (Foertsch, Alexander & Penberthy, 1997; Kinkead, 2003). The Hispanic Serving Institutions Undergraduate Initiative, as directed by the America COMPETES Act, is intended to remedy that shortfall.

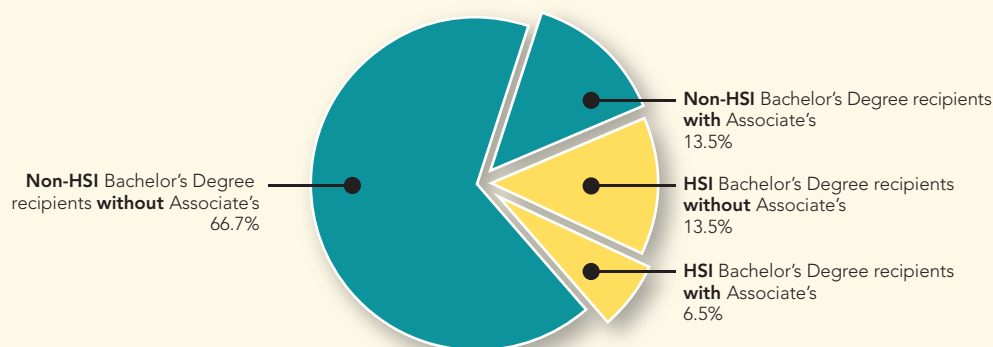
*Improvements in institutional capacity to award STEM bachelor's degrees can be geared towards transfer students to stimulate tremendous growth.*

<sup>2</sup> In this report, students who earn associate's degrees prior to the baccalaureate are referred to as "transfers." While we note that 46 percent of the Latinos in the 2003 sample of recent college graduates analyzed for our study had attended a community college at some point and some of them may have earned a substantial number of credits before enrolling at a four-year institution, we do not designate them as transfers. In other studies, however, individuals who earn twelve or more credits at a community college prior to matriculating at a four-year institution are also designated as transfers.

<sup>3</sup> Based on analysis of the National Survey of Recent College Graduates (NSRCG, 2003). For details regarding the data, our sample and methodology, see Malcom, L. E. (2008). *Accumulating (dis)Advantage? Institutional and financial aid pathways of Latino STEM baccalaureates*. Unpublished dissertation, University of Southern California, Los Angeles.



Figure 3. Latino STEM Bachelor's Degree Recipients, Graduates of HSIs and Non-HSIs, by Associate's Degree Completion



May not sum due to rounding.

SOURCE: Analysis of the NSF 2003 National Survey of Recent College Graduates (NSRCG). Weighted N=61,233

As shown in Figure 3 above, only a small percentage of Latino STEM baccalaureates, 6.5%, earn their bachelor's degree at an HSI after having earned an associate's degree.<sup>4</sup> Given the large number of Latinos who start out in community colleges, it stands to reason that improvements in transfer access to STEM programs at HSIs will lead to tremendous growth in the number of Latino STEM baccalaureates.

Figures 4 and 5 on the following page show that most transfer students who ultimately earn bachelor's degrees in STEM fields major in the **social and behavioral sciences**. This is true at HSIs, where these majors account for 60% of STEM baccalaureates, as well as at non-HSIs, where the share is 70%. There is one critical area of study in which HSIs graduate a substantially larger percentage of STEM transfers than non-HSIs. Of Latino STEM baccalaureates who graduate from HSIs 18% earn their degrees in **computer science and mathematics** (Figure 4) compared with only 5% at non-HSIs (Figure 5).

On the other hand, HSIs are considerably behind non-HSIs in terms of awarding bachelor's degrees to Latinos in the **biological, agricultural, and environmental sciences** (3% as opposed to 11%) and as well **engineering** (1% as opposed to 7%). America COMPETES funding could be used strategically to increase transfer access to these fields of study for Latinos at HSIs.

The very high proportion of transfer students graduating from HSIs with majors in fields related to **science and engineering** (18% as opposed to 6% at non-HSIs) reflect the major role community colleges play in preparing science educators and health care professionals and paraprofessionals, including nurses, paramedics, and emergency medical technicians (EMTs) (AACC, NACCTEP). They may also suggest there is untapped interest in engineering and technology professions among community college transfers.

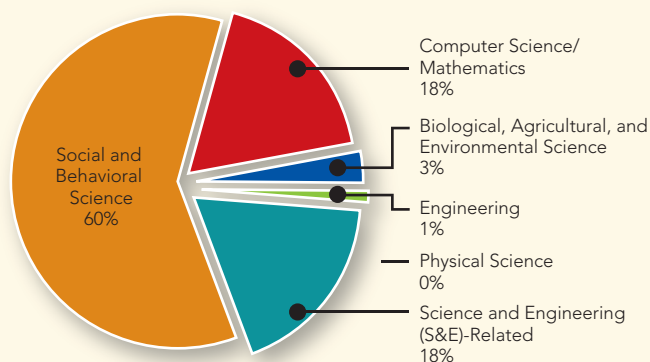
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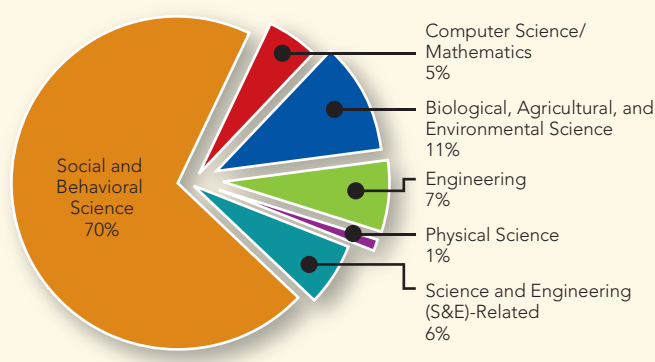
<sup>4</sup> The share of Latina and Latino STEM baccalaureates in NSF's 2003 Survey of Recent College Graduates who earned associate's degrees prior to the bachelor's varies greatly by state. This is particularly true for the five states with the largest populations of Latinos—California, Florida, Illinois, New York, and Texas (U.S. Census Bureau, 2008). Nearly half of all Latinos in Florida who were awarded a STEM bachelor's degree had also earned an associate's degree, which represents a much greater reliance on community colleges for STEM degree production in that state than elsewhere. In New York, California, and Illinois, the share of Latino STEM bachelor's degree holders who earned associate's degrees (27.9%, 22.2%, and 16.3%, respectively) was closer to the national average of 20%. The proportion in states other than these five was considerably lower, at 9.2%.

Figures 6 and 7 below, which compare the fields of study of Latino baccalaureates from HSIs and non-HSIs among those who did not first earn associate's degrees shows that, as with transfer students, HSIs do very well in graduating these students with majors in computer science and mathematics (a 27% share as opposed to 18% at non-HSIs). What is perhaps even more striking, given the very small share of transfers who earned engineering bachelor's degrees at HSIs, is the very substantial share of non-transfers earning engineering degrees, 14%. This success in graduating computer science/mathematics and engineering students reflects a smaller proportion majoring in the social and behavioral sciences, which constitutes a positive outcome in relation to the goal of preparing more Latinos to enter science and technology fields.

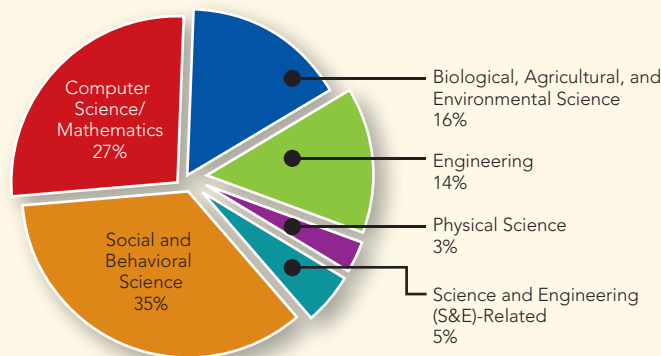
**Figure 4. Field of Study of Latino STEM Baccalaureates of HSIs Who Transferred with an Associate's Degree**



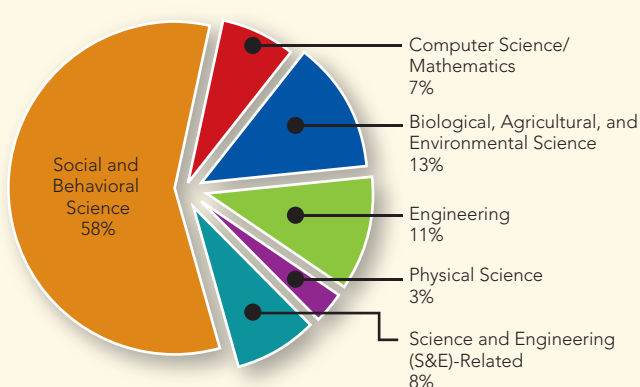
**Figure 5. Field of Study of Latino STEM Baccalaureates of Non-HSIs Who Transferred with an Associate's Degree**



**Figure 6. Field of Study of Latino STEM Baccalaureates of HSIs (No Associate's Degree)**



**Figure 7. Field of Study of Latino STEM Baccalaureates of Non-HSIs (No Associate's Degree)**



May not sum due to rounding.

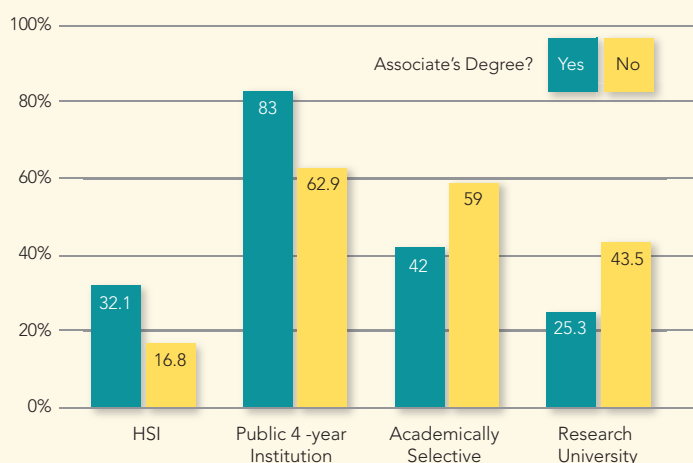
SOURCE: Analysis of the NSF 2003 National Survey of Recent College Graduates (NSRCG). Weighted N=61,233

Note: Transfers are defined as those who earned an associate's degree prior to earning the baccalaureate. Those who earned credits at community colleges without earning an associate's degree prior to bachelor's degree completion are not included among the transfer students. The comparison group in this report includes students who were direct entrants to four-year institutions and those who transferred without an associate's degree.

## Limited Transfer Access to STEM Bachelor's Degrees at Research Universities

Latino community college transfers who first earn associate's degrees have lower access to STEM bachelor's degrees at academically selective and private universities than their counterparts who do not earn an associate's degree prior to the bachelors. As shown in Figure 8, transfer students were more likely to graduate from HSIs (32.1% with an associate's degree compared to 16.8% without one) and from public four-year institutions (83% as opposed to 62.9%). However, they were less likely to graduate from academically selective institutions<sup>5</sup> (42% with an associate's degree compared to 59% without one) or from research universities (25.3% as opposed to 43.5%);

**Figure 8. Characteristics of Bachelor's Degree-Granting Institutions of Latino STEM Baccalaureates, by Associate's Degree Completion**



HSIs, which tend to be less selective non-research colleges and universities (Horn, 2006; Snyder & Hoffman, 2002; Brown & Santiago, 2004), have traditionally received about 50% of the federal funding awarded to non-HSIs and a fraction of the amount awarded to research universities. As a result, they typically afford their students fewer opportunities to engage in undergraduate or advanced research (Foertsch, Alexander & Penberthy, 1997; Kinkead, 2003). Such differences in the characteristics of the bachelor's degree-granting institution can constitute a significant disadvantage for STEM majors in the labor market or those who apply to graduate and professional schools (Kardash, 2000; Sabatini, 1997; Seymour et al., 2004).

These findings indicate the importance of using the America COMPETES Act funding to increase research and educational opportunities for Latinas and Latinos in STEM fields at HSIs as well as to improve their opportunities to transfer from community colleges to all types of universities.

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<sup>5</sup> Includes those institutions ranked from very competitive to most competitive by the 2005 Barron's Guide.



## Policy Recommendations

Provisions of the 2007 America COMPETES Act are intended to reverse the history of under-funding of HSIs, as compared to non-HSIs, to provide greater research and training opportunities in STEM fields to Latina and Latino students as well as increasing their institutional capacity.

- The National Science Foundation should provide incentives for colleges and universities to improve transfer pathways to bachelor's degrees at HSIs in the biological, agricultural, and environmental sciences and in engineering.
- Institutions should respond to the need for increased participation by Latinas and Latinos in STEM fields by examining institutional data disaggregated by race and ethnicity in order to identify curricular and structural obstacles to transfer students' bachelor's degree completion in the biological, agricultural, and environmental sciences and in engineering.
- Data on student success in and progression through key gateway and gatekeeper courses should be examined as part of NSF's Hispanic Serving Institutions Undergraduate Initiative proposal review, funding, and evaluation processes. Such a requirement will reveal points of intervention in the STEM curriculum at which student success can be increased through changes in pedagogy, counseling, and administrative policies.
- Funding for faculty involvement in curricular innovation and collaboration among four-year and two-year college professors is essential for increasing high quality educational opportunities for Latinos in STEM fields.
- States should enable community colleges to grant bachelor's degrees in STEM fields, particularly those in areas of critical need that have poor transfer access, such as engineering and the biological, agricultural, and environmental sciences.

In summary, we recommend that NSF's request for proposals for funding through the Hispanic Serving Institutions Undergraduate Initiative require institutions to present analyses of their student success data by fields of study in order to identify curricular milestones at which Latina and Latino students are experiencing good rates of progress and those at which they are being disproportionately lost. These analyses should include community college transfer students as an identifiable target group and indicate curricular improvements that will increase the production of Latino STEM baccalaureates.

Furthermore, the program evaluation design should incorporate ongoing institutional self-assessment as the basis for organizational learning and improvement. By doing so, institutions will be better able to allocate resources for problem areas and become more effective in adopting successful innovations.

Targeted federal funding for HSIs is valuable to increase the numbers of Latinos entering and succeeding in STEM fields and to achieve national college completion goals. HSIs show greater success than non-HSIs in graduating Latinos in some key STEM fields, particularly computer science and mathematics. Transfer students appear to have less access to bachelor's degrees in those fields, however.

Through NSF and other granting agencies, the federal government can provide needed resources and incentives to HSIs to build on prior successes to expand transfer access in STEM for community college students. Given the concentration of Latinas and Latinos in community colleges, this approach promises to be an effective strategy to increase the number of Latinos in STEM occupations that are critical for the nation's economic and social well-being.

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