

The Status of Forensic Science Degree Programs in the United States

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Abstract Although forensic science has long been an area of public interest, the recent and extraordinary success of hit TV shows such as the CSI series is thought to have brought about a new generation of students with an interest in forensic science. Despite the widespread belief that the number of forensic science programs in the United States has grown over recent years in response to this heightened demand, there has previously been little factual data presented to support these assertions. Presented here is a numerical evaluation of the number of programs offering forensic science degrees, criminal justice degrees, and forensic chemistry degrees over a thirty-year period, as well as a summary of the current accreditation system for forensic degree programs in the United States. Also presented is a discussion on the retention and graduation rates for students majoring in forensic chemistry at Ohio University, a program which was founded in 1976 and is now accredited by FEPAC.

Keywords Accreditation, American Academy of Forensic Sciences (AAFS), American Board of Criminalists (ABC), criminology, CSI-effect, education, forensic chemistry, forensic science, Forensic Science Aptitude Test (FSAT)

Introduction

The higher education system plays an important role in establishing an educated workforce that is both scientifically adept and socially responsible. Graduates entering any law enforcement agency—whether at the county, state, or national level—assume responsibility for enforcing the policies and laws set forth by the relevant governing bodies. As such, it is critical to the success of these agencies that new employees exceed some kind of minimum standard of competence. Educators in the higher education system have a moral obligation to develop this aptitude by ensuring that their graduates receive the appropriate scientific, technical, communicative, and ethical training required for their chosen specialties. Forensic science degrees are publicized by providers as being the fastest route to careers related to criminal law, despite the fact that most employers have little comprehension of what a “forensic science” degree entails (Almirall & Furton, 2003). An unfortunate result of the ‘CSI effect’ (Houck, 2006; Podlas, 2006; Cole & Dioso-Villa, 2007) is that many of the high-school graduates that choose foren-

sic science degrees are often ill-equipped to tackle the level of scientific rigor required in the higher-quality programs that seek accreditation by FEPAC (AAFS, 2008). As a result, large attrition rates are common in the higher-quality programs as most students switch to non-‘hard’ science majors. This discourse will address the difficulties that academic institutions face in balancing supply and demand for forensic scientists, as well as the commensurate problem of informing high school students about the real-life requirements, expectations, and career options for careers in forensic science. Statistical analyses of data from Ohio University’s thirty-year-old forensic chemistry program is provided to support these national and worldwide trends.

Growth in Enrollment

Perhaps due to a hesitation to turn away students and forego lucrative tuition fees, many universities in the United States have responded to the increased demand from high-school graduates by either admitting more students to their existing forensic science-related programs, or by starting new programs in forensic areas. Growth, therefore, occurs in two forms: 1) admission of more students to existing programs, and 2) creation of new

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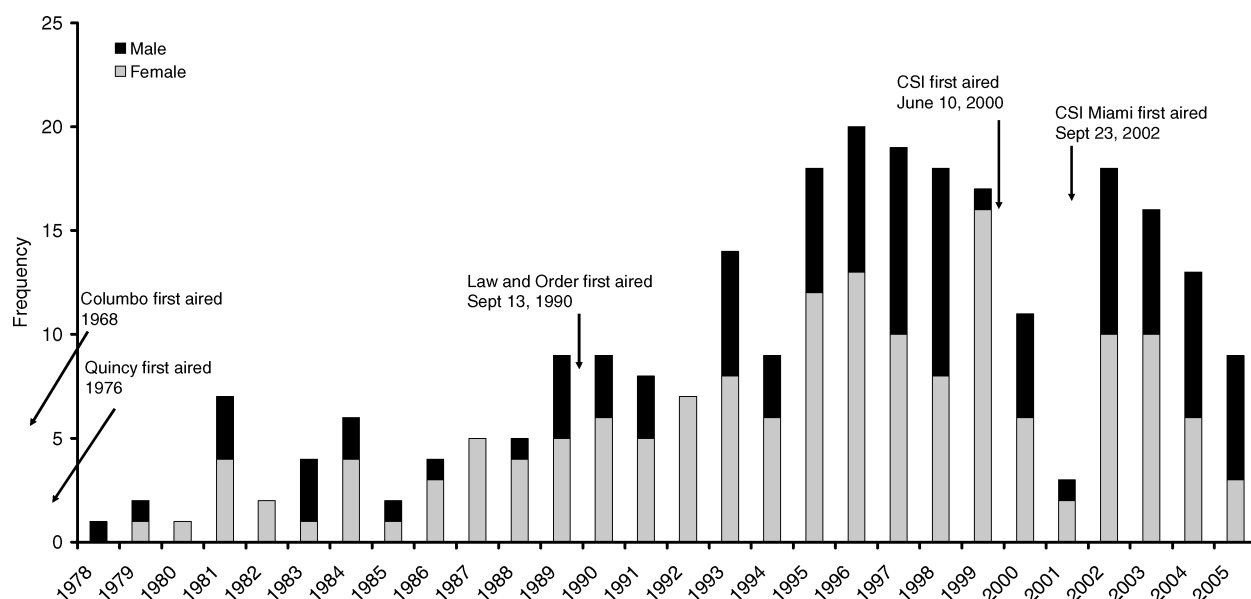


Figure 1. Histogram showing the number of graduates with a BS in forensic chemistry from Ohio University from 1977–2006. Female students account for 62% of the 257 graduates.

programs. These two types of growth are quantified below in more detail.

Figure 1 shows the growth in the number of Ohio University graduates with a forensic chemistry degree from the program's inception in 1976 until 2007. Unfortunately, records for admission into the program over the same period were not available. The number of graduates remained quite constant throughout the 1980s and early 1990s, at four to nine students per year. By the late 1990s, the number of graduates was consistently higher, at around seventeen to twenty students per year. Given the typical 4.5-year delay between initial admission and graduation, the data indicates that the major growth in the number of enrollees in the program at Ohio University occurred in the early- to mid-1990s, well before the airing of the first *CSI* episode in 2000. If the growth was at all inspired by TV-related programs, Ohio University seemed to have experienced a “*Law and Order* effect” or “*X-Files* effect,” since both programs first aired in the early 1990s (1990 and 1993, respectively). The small number of graduates in 2001 is most likely related to the fact that Ohio University administered a placement chemistry test for incoming freshmen for the first time in 1997. This placement test decreased the number of enrollees completing the general chemistry series by approximately 40 percent.

Growth in Number of Programs

To investigate the growth in the number of undergraduate programs in the United States in more detail, data

was collected from *The College Blue Book* (MacMillan) publications at approximately five-year intervals from 1977 to 2007. For 2007, data from the resources tab on the Web site of the American Academy of Forensic Sciences (AAFS) was used in addition to *The College Blue Book* data (AAFS, 2007). The results are shown in Figure 2. The histogram is broken down into degree titles containing the names ‘forensic science,’ ‘forensic chemistry,’ and ‘criminology.’ A similar growth has occurred in the United Kingdom, even though the funding situation for higher education is somewhat different (SEMTEA, 2004). From 1977 to 2002, there was an inclusive average of 1.3 new programs per year for all three degree types, which signified no appreciable increase in the growth rate of new programs. In contrast, the five-year period from 2002–2007 witnessed the creation of 110 new programs, with the growth divided quite evenly between the aforementioned three areas of specialization. This corresponds to twenty-two new programs per year. The growth in the number of programs certainly has accelerated since the first airing of *CSI*, although it would be questionable to assign *CSI* as the only causal relationship (Shelton, Kim, & Barak, 2006).

FEPAC Accreditation

In 1999, NIJ published a comprehensive report titled “Forensic Sciences: Review of Status and Needs.” The report acknowledged that the training needs of the forensic community were “immense” and recommended funding “accredited academic institutions” (NIJ, 1999). Because

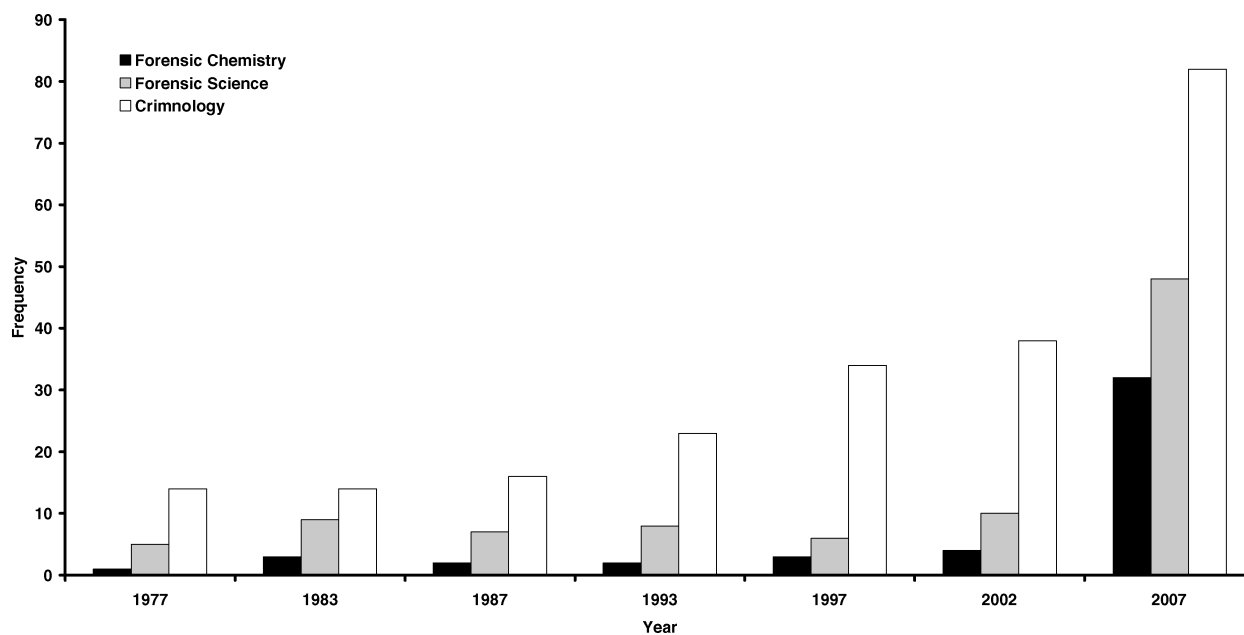


Figure 2. Histogram showing the cumulative number of forensic science-related bachelor's degree programs in the United States containing the words 'forensic chemistry,' 'forensic science,' or 'criminology' from 1977–2007. Data was compiled from *The College Blue Books* and the AAFS Web site.

accreditation with standard-setting bodies did not exist in 1999, the report suggested the establishment of an accreditation body, such as a technical working group, which could help set national standards to accredit or certify academic forensic training programs. Following these recommendations, NIJ funded West Virginia University (WVU) to help establish the Technical Support Working Group on Education and Training in Forensic Science (TWGED), which first met in the summer of 2001. With contributions from forty-nine forensic practitioners, educators, and members of governing bodies, NIJ published guidelines on the educational and training aspects of forensic science in order to serve educational institutions, students, and laboratories (NIJ, 2004). Following these more detailed recommendations, the AAFS established the Forensic Science Education Programs Accreditation Commission (FEPAC) in 2002 to administer the accreditation process. The current accreditation process requires that at least two graduating classes be completed before accreditation is concurred. Currently (October 2008), there are twelve bachelor's-level accredited programs and seven master's-level accredited programs.

The accreditation process helps establish a level of scientific rigor in each participating program and entails interaction between the academic institution and at least one professional forensic science laboratory (AAFS, 2008). Accreditation also requires that the curriculum receive recommendations from an advisory board composed of forensic professionals and other stakeholders. Finally, the

program must adhere to certain standards regarding the management of students' complaints (should they exist).

The number of FEPAC accredited programs is also growing. Figure 2 shows the growth in the enrollment and graduate numbers for six BS and three MS programs currently holding FEPAC accreditation. The data was voluntarily submitted by each organization to FEPAC. The programs include Arcadia University (MS Forensic Science), Cedar Crest College (BS with a concentration in Forensic Science), Eastern Kentucky University (BS Forensic Science), Marshall University (MS Forensic Science), Metropolitan State College of Denver (BS Chemistry with a concentration in Criminalistics), Michigan State University (MS Forensic Science), Ohio University (BS Forensic Chemistry), West Chester University (BS Forensic and Toxicological Chemistry), and West Virginia University (BS Forensic and Investigative Science). Figure 3a shows that the average BS enrollment has slightly increased over the seven-year period from fifty-seven to eighty-five students, and that the average MS program size has remained almost constant at around eighteen students. The average number of graduates per BS and MS program has increased from ten to seventeen students and zero to seventeen students, respectively, over the same period. This data shows that for the accredited programs studied, both the size of the program and the number of graduates has witnessed a modest gain over the seven-year period from 1998–2005. However, Figure 3b shows that the total number of students enrolled in—and graduating from—the

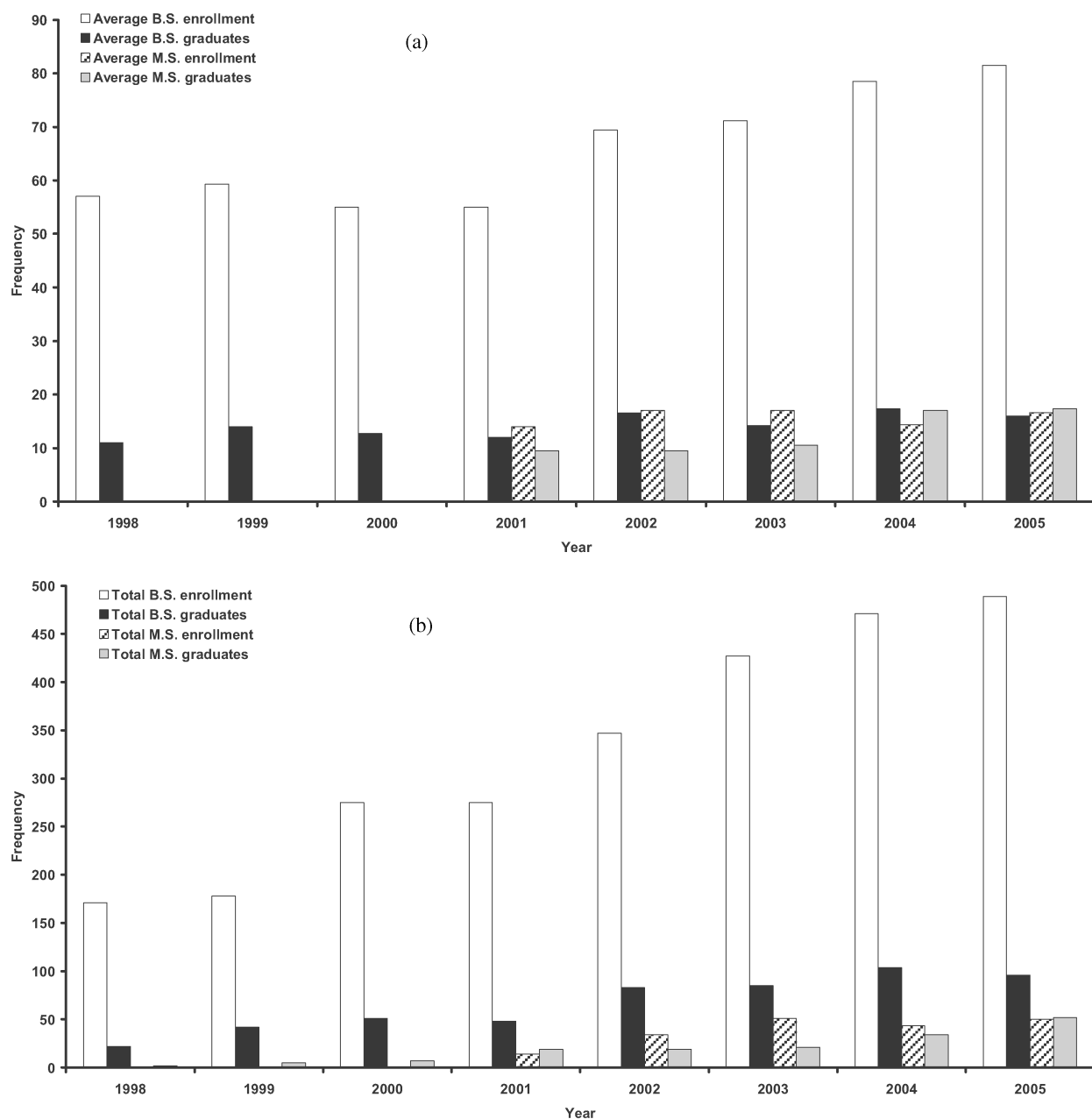


Figure 3. Histograms showing the growth in the number of enrolled students and graduating students from six bachelor-level and three master's-level FEPAC-accredited programs: (a) shows average values, and (b) shows total values.

same programs have tripled over the same seven-year period, primarily because of the introduction of new programs. A similar, though less dramatic, increase is also observed in the total number of MS enrollees and graduates. This data indicates that the considerable growth in the number of students seeking forensic-related degrees at FEPAC-accredited universities is primarily due to the introduction of new programs rather than growth in enrollment of existing programs. Although the graduation rates for MS-level students is close to 100 percent, the grad-

uate rates for the BS-level programs is much lower, as will be described later.

Forensic Science Aptitude Test (FSAT)

As part of the formation of FEPAC and the accreditation process, the TWGED also recommended that graduates from accredited universities complete a standardized test

to determine the educational outcomes of the participating programs. A standardized test to fulfill this purpose, called the FSAT (Forensic Science Aptitude Test), was established through the American Board of Criminalists (ABC) with funding support from NIJ through its cooperative agreement with WVU: ABC is a volunteer organization overseeing the examination and certification of professional forensic scientists. The FSAT exam is similar in format and length to the ABC General Knowledge Exam (GKE). The test was administered for the first time in the spring of 2007 at all eight of the undergraduate and graduate-level FEPAC-accredited programs. Students taking part in the exam received their individual absolute and relative scores, while each university received a summary of the ranking of their students' scores in each of the subdisciplines of the exam. The FSAT was administered again in the spring of 2008, with the results still pending. Feedback from Ohio University students taking part in the FSAT exam indicated mixed feelings about the exam itself, but positive feelings regarding how the results reflected collective standing with respect to other institutions.

Retention Rates, Graduation Rates and Performance (GPA)

Anecdotal evidence suggested that the forensic chemistry majors at Ohio University were academically underperforming relative to other majors such as non-forensic chemistry. Ohio University's Office of Institutional Research performed a detailed evaluation of the three metrics outlined in the section title. The results are shown in Figure 4. Figure 4a confirms that, relative to chemistry majors, forensic chemistry majors are less likely to return in their second year. A paired, one-tailed t-test corroborated the hypothesis that forensic chemistry majors are significantly less likely to be retained ($p = 0.011$). These two majors were both significantly worse than the College of Arts and Science's comprehensive average retention rate. The retention rate data indicates that there is a significant difference between students entering as forensic chemistry majors and those entering as chemistry majors.

Before enrolling for the first of the general chemistry classes at Ohio University, all chemistry majors are required to take a placement exam. A score of 32 or more (out of 60) enables them to register for the regular freshman general chemistry class, CHEM 151, whereas a score of less than 32 places them in a remedial chemistry class, CHEM 150 (formerly CHEM 121). Figure 5 shows that forensic chemistry majors are significantly more likely to fail the placement exam than straight chemistry majors, which is in turn indicative of inferior prior preparation for the curriculum. This assumption is supported

by the fact that the composite ACT score for the 2008 entering freshmen is typically 1.2 points lower for forensic chemistry majors ($n = 25$) compared to all other chemistry majors ($n = 98$). Following this 'poor' start, forensic chemistry majors are then on a slippery slope that, unfortunately, leads to their exodus from the university in the first year. Retention rate data at the college level shows that grade point average is the primary factor influencing retention rates. Students with a GPA > 2.0 have a first-year retention rate of approximately 88 percent, whereas students with a GPA < 2.0 have a first-year retention rate of around 41 percent.

Following the disturbing ($\sim 25\%$) first-year attrition in forensic chemistry majors at Ohio University, the chance of success in subsequent years improves dramatically. For example, Figure 4b shows that the probability of graduating in six years (58%) is not significantly different between the forensic chemistry majors and chemistry majors (62%), and is only slightly less than the college average (65%). This indicates that forensic chemistry majors have a significantly better retention rate for years 2–5 than do their chemistry major counterparts. For the academic year 2006–2007, there was no significant difference between the average GPA of enrolled forensic chemistry majors and the average GPA of all other chemistry majors.

The institutional data at Ohio University supports the following hypothesis: A certain proportion—perhaps as large as 25 percent—of the forensic chemistry majors are not well prepared or suited for the curriculum. Reasons for the lack of preparedness could be related to poor advisement on the part of Ohio University or poor research regarding personal compatibility with the program on the part of the student. Another reason for the poor performance of the subset of the entering freshmen could be related to a *CSI*-type-effect (Houck, 2006; Podlas, 2006; Schweitzer & Saks, 2007), which argues that the students have a misguided opinion about what is expected of them in a forensic science program. It is possible that the majority of students who withdraw from the program in the first year would not have considered registering for a natural science degree had *CSI*-type programs not existed—a result, perhaps, of the “Professor's *CSI* effect” (Cole & Dioso-Villa, 2007). Personal communication with professors at other institutions indicates that the retention and graduation data shown here are quite similar to those of other large-enrollment FEPAC accredited BS programs. However, some programs apparently observe better success rates by instituting a matriculation period of a year or two before admission to the program (e.g., Cedar Crest College or after a formal interview process (e.g., West Virginia University). These additional requirements serve the interests of both the universities involved and the students; implementation increases the graduation rates of the students by better informing them about the expectations of the program and the employment opportunities

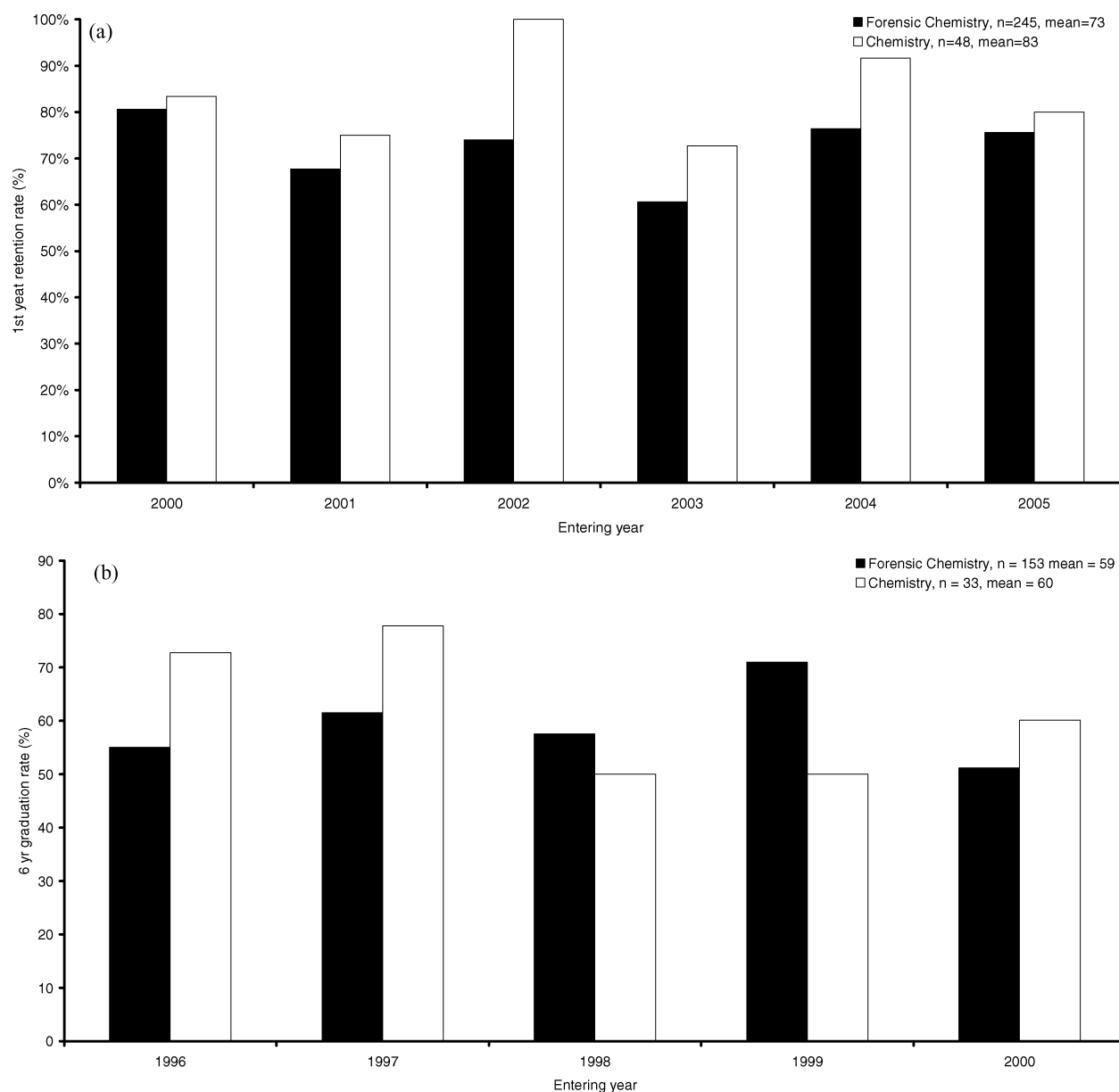


Figure 4. Histograms showing (a) first-year retention rates and (b) six-year graduation rates for students entering as forensic chemistry majors and chemistry majors in different years. Data only includes first-time, full-time students.

after graduation. The selectivity of admissions standards and the matriculation period used by some institutions makes it difficult to make an apples-to-apples comparison of the retention and graduation rates of students at different institutions.

One of the original goals of the FEPAC accreditation process was to ensure a minimum level of science-based curriculum, including math, physics, and chemistry. Students graduating with FEPAC-accredited forensic science or forensic chemistry degrees therefore find that their rigorous natural science education affords them career

opportunities outside the forensic science field. These options include almost any kind of laboratory work, such as for chemical companies, pharmaceutical companies, government laboratories, and medical laboratories. Many forensic educators feel strongly that FEPAC-accredited programs are not vocational degrees, not even dressed up ones, but that forensic science is a science in its own right, with synergism and overlap with other natural sciences. To name a few, forensic science claims concepts such as Locard's exchange principal and individualization of substances as concepts that are unique to this field. As the

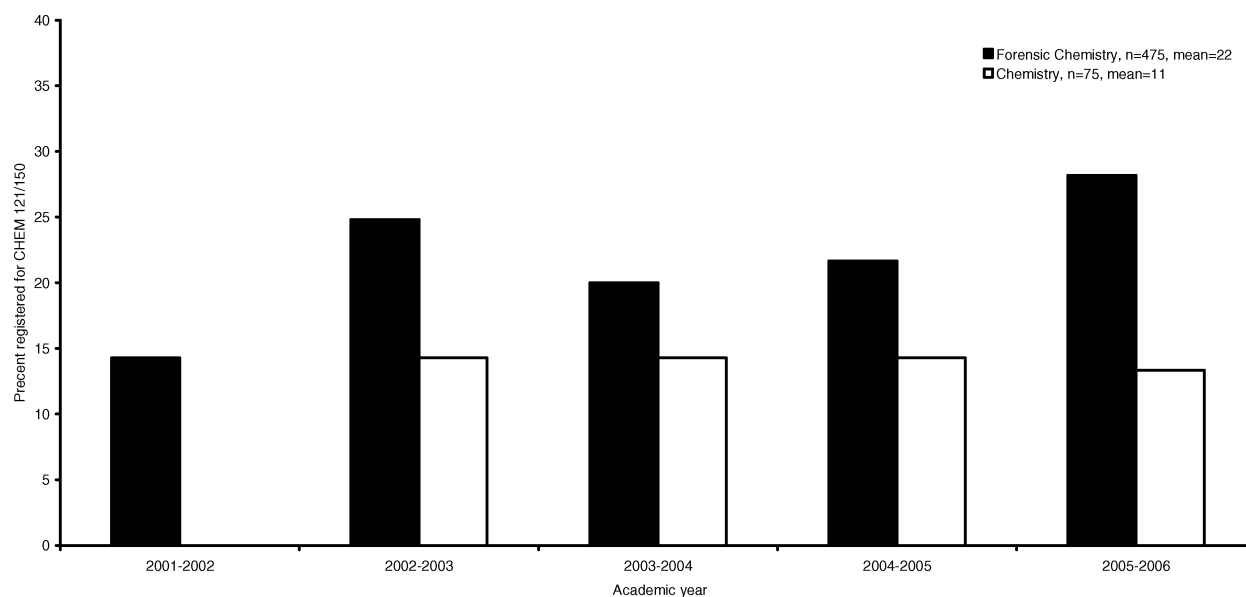


Figure 5. Histogram showing the percentage majors enrolling for CHEM 121/150 in each academic year. Enrolling for CHEM 121/150 indicates that the student failed the chemistry placement exam and was not eligible to register for the intended start of the freshman chemistry sequence, CHEM 151.

philosophical and scientific tools of forensic science continue to be developed, perhaps even the more skeptical scientists outside the forensic science community will begin to appreciate the contributions that forensic science can make to other scholarly bodies of knowledge.

Summary

Although we have not yet uncovered the reasons for students' motivation to pursue degrees in forensic science-related areas, the institutional data from Ohio University clearly shows that the growth in its program accelerated in the 1990s, well before the first *CSI* episode aired. However, it is the considerable growth in the number of programs since 2002, rather than the increase in the size of each program, that is generating the nationwide plethora of forensic science graduates. The number of master's-level programs is growing just as rapidly as the number of bachelor's-level programs. The increased growth rate in recent years is consistent with the advent of the genre of TV shows known as 'forensic dramas' (Shelton, Kim, & Barak, 2006), which developed since the airing of the first *CSI* show in 2000. The growth in the number of programs has far-exceeded the growth in the size of each program. It remains to be seen how long this growth can continue before the employment market is oversaturated with trained forensic scientists.

An accreditation board (FEPAC) and program is now in place for forensic science-related programs, and by most accounts seems to be operating very successfully. It will

take several years for the students, as well as academic and professional communities, to fully appreciate the value of accreditation. Even so, most stakeholders seem to understand the potential of such a system, especially since almost every other major professional society has an accreditation scheme for degree programs related to their fields of study. The FSAT exams are helping students and programs evaluate their educational outcomes, and hopefully will continue to do so in the foreseeable future.

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