Chapter 8
Graduate Education Accomplishments

Criterion Three – Graduate Education*: Colorado State University is accomplishing its graduate educational purposes.*

Introduction

CSU's institutional mission statement establishes its role as a comprehensive graduate research institution, and one of the University's four programmatic aims is to provide high-quality graduate programs as stated in Chapter 5:

> **Provide a High-Quality Graduate Experience**
>
> The University will continue to review and enhance the educational opportunities available to graduate students. Graduate students will be provided with the necessary means to reach the highest levels of learning in their field, to make scholarly contributions directed toward the well-being of humanity, and to develop their abilities as professional leaders.

Graduate programs advance scholarly research, creative artistry, and specialized education.

CSU has demonstrated excellence in graduate education through graduate programs that advance the learning of high-level professional and technical skills appropriate for graduate study. Students completing graduate programs offered at CSU are well prepared for their careers, and many of these programs have risen to national and international prominence. CSU's graduate degree programs are in high demand and attract academically talented students. Evidence for effective learning and continuous program improvement are demonstrated through a variety of methods appropriate to each discipline**.** This chapter provides examples of excellence in graduate programs, describes the organization of graduate education, discusses enrollment trends, and identifies strengths and challenges. Evidence is provided that CSU is accomplishing its graduate education purposes.

Graduate Education Programs

Excellence in Graduate Education

Designated Programs of Excellence

Outstanding programs at CSU have been awarded distinction as CCHE Programs of Excellence and PRSEs. As discussed in Chapter 2, a Program of Excellence designation by CCHE is an honor awarded to only a few academic programs that have demonstrated a long-term commitment to excellence. PRSEs (described in Chapter 9) are research and scholarly programs selected internally that have achieved distinction and set a standard of excellence for programs throughout the institution. These excellent academic programs are the home of some of the best graduate and professional degree programs offered by CSU. Through such outstanding programs, graduate students have opportunities to participate in cutting-edge

research and learn from nationally and internationally distinguished scholars. Graduate students are provided opportunities to become directly involved in the discovery and dissemination of new knowledge by co-publishing with their faculty mentors. While presenting their research results in national and regional scientific meetings, they are able to experience the frontiers of discovery within their disciplines.

Specialized Accreditation

Professional degree programs in Social Work, Music, Business, and the PVM program hold specialized accreditation from their respective accrediting bodies. Other graduate programs with specialized accreditation include the MS in Human Development and Family Studies (Marriage and Family specialization), the MEd in Education and Human Resource Studies (Counseling and Career Development specialization) the MS in Occupational Therapy, the MS in Business Administration, and PhD in Counseling Psychology.

External Recognition

Excellence in graduate education is demonstrated by the national rankings of many CSU graduate programs and other forms of external recognition. A few examples are as follows:

- The PVM program was ranked second in 2003 by the *U.S. News and World Report*. Over the past eight years, the PVM program has been rated consistently as one of the top three programs in the country.
- In 2002, the Occupational Therapy program was ranked in the top ten in the country by *U.S. News and World Report*.
- In 2002, CSU's Vocational/Technical Education program (MEd and PhD in Education and Human Resource Studies) was ranked ninth by *U.S. News and World Report*.
- The Graduate Program in Marriage and Family Therapy received the National Program of Excellence Training Award from the American Association of Marriage and Family Therapy in 1999.
- The College of Engineering was ranked 56th in the nation in *U.S. News and World Report's* "America's Best Graduate Schools in 2004."
- Chemistry has been listed in the top 50 graduate programs in the U.S. for federal funding for FY03 according to *Chemical and Engineering News*, and ranked 37th in Research/Doctoral Programs by the National Research Council.
- *Kiplinger's* magazine named CSU's distance MBA program as one of the best in the country in 2002.

High-Quality Learning Environments

Chapter 9 addresses the research and artistic accomplishments of CSU faculty, and provides evidence of high-quality facilities and well-funded research. Graduate students benefit from these successes through the use of state-of-the art equipment and laboratories available for their thesis and dissertation research. Graduate programs affiliated with Centers, Institutes, and Other Special Units (CIOSUs) designated as PRSEs and/or CCHE Programs of Excellence have exceptional opportunities to participate in ongoing research programs of these prestigious units. For example, the Animal Reproduction and Biotechnology Laboratory is an integral part of the Department of Biomedical Sciences graduate program. Each year approximately 20-30 graduate students learn from direct participation in these research activities. A few additional examples are the Center for Environmental Toxicology and Technology, the Center for Research on Writing and Communication Technologies, the Infectious Diseases Program, the Optoelectronic Computing Systems Center, the Tri-Ethnic Center for Prevention Research, and The Water Center. Other unique learning environments and facilities also support graduate education and advance learning.

- The internationally recognized James L. Voss Veterinary Teaching Hospital (VTH) is a state-of-the-art facility providing excellent training for students in the PVM program and for graduate students. Close interactions between the PVM and Biomedical Sciences programs provide a unique educational environment. Comparative medical programs use animals with naturally occurring disease as the basis for research and teaching models in biomedical sciences. This environment provides opportunities for PVM students to become familiar with, and participate in, cutting-edge biomedical research. The Animal Cancer Center will be installing telemedicine capabilities in its new facility. Special multi-user telemedicine capabilities will be provided to enhance communication and education opportunities between the VTH and other institutions.
- The Department of Chemistry maintains a Central Instrument Facility that is open to all University researchers and their graduate students. It is the only such facility in the Western region of the country.
- The Engines and Energy Conversion Laboratory in Mechanical Engineering, a 26,000 gsf laboratory, is equipped with new and renovated equipment donated to the program by a wide variety of industrial donors. The value of specialized research equipment in the laboratory exceeds $6M.
- The new facility of the Natural Resources Ecology Laboratory (NREL) features state-of-the-art computer equipment, geographical information systems, and the newest technology for biological, chemical and physical analysis to support multidisciplinary research of graduate students. Research at the NREL represents a

broad array of disciplines including ecology, biogeochemistry, atmospheric science and human ecology. Over 60 graduate students have benefited from the NREL faculty and research facilities over the last five years.

- The CSU-CHILL radar facility, funded by NSF and the State of Colorado, supports the atmospheric research community by providing data and evaluating experimental techniques for the remote sensing of the atmosphere. Between 1995 and 2000, over 18 dissertations and 16 theses in the Department of Atmospheric Science were completed using CSU-CHILL data. During 2002, the CSU-CHILL Radar supported five research projects with two sponsored by NSF funding.

In addition to strengths in the life sciences and physical sciences, CSU provides other unique and specialized laboratories and centers that support graduate education. For example, the Laboratory of Public Archaeology is one of the few sites in the Rocky Mountain region authorized to receive artifacts from the National Park Lands. As the Public Policy Institute is developed, graduate students are expected to have the opportunity to participate in policy analyses on future issues facing the State. The new School for the Arts and the University Center for the Arts will provide the academic structure and facilities necessary to advance graduate programs in music, theatre, art, and design.

Both on- and off-campus facilities provide opportunities for students in education and the social sciences to develop advanced professional skills. Graduate students in programs requiring extensive clinical training gain valuable experience in departmental clinics (e.g., University Counseling Center, Psychological Services Center, and the Center for Family and Couple Therapy). Many departments in CAHS use the local community as a learning laboratory, with well-established internships in hundreds of human service agencies and schools. The Research and Development Center for the Advancement of Student Learning, a collaboration between CSU and Poudre School District, serves as an applied environment for doctoral students to research and evaluate innovative programs and best practices to advance education.

Students enrolled in the Student Affairs in Higher Education MS graduate program interact closely with DSA administrative staff members, many of whom supervise their practicum and assistantship experiences. DSA, with its multiple dimensions, provides hands-on learning for future leaders in higher education and offers a unique opportunity for students to learn from experts in student services.

Enhancing Programs Through Strategic Partnerships

CSU has developed a number of partnerships that give added value to CSU's graduate programs and provide unique opportunities for graduate students. These partnerships

build on existing and emerging strengths, and provide a competitive advantage when recruiting high quality students.

As an example, CSU and the Peace Corps created a cooperative master's degree program in 1988 to integrate real-life field studies and international development practice with applied academic content. Through this partnership, the number of Peace Corps Master's International (PCMI) Degree Programs at CSU has expanded, with the most recent one added in 1998. Three PCMI programs are now offered that combine a 2-year Peace Corps commitment with a master's degree in Natural Resources, Agriculture, or Teaching English as a Second Language. This partnership has been valuable to the Peace Corps, and it currently funds one graduate assistantship at CSU each year. The PCMI program has also served as an effective graduate recruitment tool. Currently 22 graduate students are enrolled in the program, and most are non-residents.

Relationships with the private sector have also strengthened graduate education. The Department of Manufacturing Technology and Construction Management has formed an effective partnership with leaders in the construction industry. Valuable industry internships have been established and courses now include location-based teaching to enhance the real-world application of theory. Through the Construction and Manufacturing Applied Research Center, companies identify needs and work with graduate students and faculty to develop practical solutions. The opportunities provided have resulted in a redesign of the graduate curriculum and the addition of an applied research project. The Department has also reorganized its external advisory committee to provide a more structured avenue for industry input.

The Department of Atmospheric Science is engaged in scientific partnerships with Ball Aerospace and Technologies Corporation that greatly benefit CSU graduate students. As one component of this program, a master's student in the department is supported by Ball throughout a two-year study program. The student awardee also interns at Ball Aerospace over the summer. This award is made to a new student every two years. CSU graduate classes also visit Ball Aerospace to observe first-hand their work on CloudSat, part of NASA's Earth System Science Pathfinder program to study the effects of clouds on climate and weather.

Organization of Graduate Education

The Graduate School

The Graduate School has general responsibility over all graduate degree programs and is under the direction of the Graduate Dean. The purpose of the Graduate School is to promote high quality post-baccalaureate education and further the scholarly research and creative artistry with which such education is intimately linked. Individual departments are responsible for defining the academic requirements for their degree programs, but the

University has specified that certain academic practices and procedures shall apply to all graduate degrees regardless of the departments and colleges in which study is undertaken. The Graduate School applies and administers these requirements, monitoring compliance with the University's policies and procedures in such areas as the admission of graduate students, design of programs of study to obtain graduate degrees, and completion of all requirements to graduate. The Graduate School is the unit that awards graduate degrees.

The Dean of the Graduate School promotes excellence in graduate education and fosters a positive learning environment for advanced study. In addition, the Dean provides coordination for enrollment management and financial support, and advocates for recruitment of a broadly diverse student body. The Graduate School maintains official University graduate student records of credits earned, formal programs of study, academic standing, progress toward the degree, and graduation. Descriptions of all current graduate programs and graduate education policies are published each year in the *Graduate and Professional Bulletin*. Other Graduate School publications include the *Registration and Orientation Information for Incoming Graduate Students*, *Graduate Studies Handbook*, and the *Thesis Manual*, and all are available online.

Academic Departments and Colleges

Academic departments provide oversight for graduate programs in their disciplines and, in some cases, coordinate with other departments in interdisciplinary research and graduate education. Departments typically designate one or more individuals (depending on the number and diversity of graduate programs within the unit) to coordinate graduate admission decisions and respond to inquiries from potential graduate students. Departments typically charge a Graduate Committee with the responsibility of reviewing and recommending changes in graduate education policies and programs. Graduate education policies are included in each department's code. Departments may have requirements in addition to, or more stringent than, those of the University.

Academic colleges serve a coordinating function for distribution of funds (e.g., teaching assistantships) allocated by the Graduate School. Some colleges manage coordinated graduate recruitment activities to attract high-quality and diverse applicants. College Deans serve as advocates for graduate programs within their respective colleges, and set priorities for new graduate education initiatives.

Scope of Programs

An overview of all graduate degree programs (Table 5-3) and the purposes of each academic college are provided in Chapter 5. Individual graduate programs are listed in the BID forms (Appendix A). Most CSU graduate degree programs are closely aligned with the

traditional land-grant mission in the areas of agriculture, engineering, natural resources, and applied human sciences. CSU offers 19 master's programs, 14 doctoral programs and five professional programs that are not available at other institutions in the State of Colorado. Many of these programs are in CAS, CAHS, CNR, and CVMBS. Most of them reflect the unique mission of Colorado's land-grant institution with exclusive authority given to CSU for programs in agriculture, forestry, natural resources and veterinary medicine.

CSU participates in the Western Regional Graduate Program (WRGP), a student exchange program that makes high-quality, distinctive graduate programs available to students in the West at a reasonable cost. This program is sponsored by WICHE, a regional organization created to facilitate resource sharing among higher education systems. WRGP permits qualified students from 14 of the 15 WICHE states to enroll in selected graduate programs outside their home states at resident tuition rates, thus expanding programs available to Colorado residents.

The purpose of graduate education varies considerably among the programs. The scope of programs includes diverse purposes such as professional education in preparation for service career pathways; education and training focused primarily on preparing teachers for academic tracks within the discipline; or preparing experimental research scientists for industrial positions. As a result, graduate programs may be structured quite differently with an emphasis on internships and practica, college teaching experience, or laboratory based research.

Interdisciplinary Studies

Many opportunities for interdisciplinary learning are available at CSU to prepare students to address complex issues in today's world. Graduate students have the opportunity to enhance their disciplinary training with additional coursework from the following university-wide ISPs: Biomedical Engineering; Exercise Science and Nutrition; Food Science/Safety; International Development Studies; Geospatial Science; Molecular, Cellular, and Integrative Neurosciences; and Women's Studies. These programs consist of a series of courses focused on one area and studied from a variety of perspectives. ISPs can be easily integrated with degree program requirements for many majors. A significant commitment to interdisciplinary education is demonstrated in the two interdisciplinary programs that culminate in master's and doctoral degrees: the Graduate Degree Program in Ecology (GDPE) and the Cell and Molecular Biology (CMB) Degree Program. These programs are designated as Intra-University (IU) programs for data tabulation.

The GDPE provides advanced training in current ecological methods, theories, concepts, controversies, and applications by synthesizing knowledge from a wide variety of traditional disciplines in science. The program is a cooperative effort by 111 faculty from 17

departments in six colleges who share a common interest in Ecology. Graduate students in this program benefit from an annual Visiting Distinguished Ecologists Lecture Series involving national and international scholars.

The CMB graduate program is a cooperative effort by approximately 50 faculty from 11 departments in four colleges. Interdisciplinary interactions among faculty and graduate students are fostered through an excellent seminar program that brings in approximately 30 outside speakers each year to enhance scientific discussions. The CMB currently participates in three training grants that complement department programs in Cancer Biology, Toxicology, and Reproductive Biology.

Responding To Changing Student and Societal Needs

Several recent changes in graduate education policies and programs have been made to meet needs of constituents. Changes in graduate policy and programs are first deliberated by the Committee on Scholarship, Research, and Graduate Education. As a standing Faculty Council committee, the duties of this committee include recommending to the Faculty Council policies concerning the Graduate School, and reviewing and forwarding (with recommendations to the University Curriculum Committee) proposals for new graduate programs and changes in existing graduate programs. Academic departments are responsible for defining the academic requirements for their degree programs that are appropriate for their disciplines.

Policy Changes

Recent graduate education policy changes have provided more flexibility in admission and program requirements in response to the increased diversity of learners and their motivations for seeking graduate study. Requirements have also been modified to provide students in specified programs more options and flexibility in the design of programs of study. The policy changes listed below demonstrate how CSU has responded creatively and without compromising quality.

Admissions Requirement Changes

CSU has developed three sets of criteria for admission to graduate programs that are designated as tracks. Track I graduate admission, long used at CSU and still the norm for most graduate programs, requires traditional measures of academic potential. In 1999, Faculty Council approved Track II, which does not require a minimum undergraduate GPA or GRE/GMAT scores. Track II recognizes the contributions of professional experience to academic success, and is only available to individuals with at least five years of professional experience after receiving a baccalaureate degree. As of Fall 2003, approximately 857

students had enrolled in graduate degree programs through Track II admission with the majority in CAHS and COB programs. Preliminary evidence shows that Track II is a viable pathway for access to graduate studies at CSU. The students entering through Track II admissions are successful in their academic programs; only 3% of those admitted through this track were dismissed or placed on academic probation.

In 2002, an additional track for admission, Track III, was established to encourage undergraduate students with strong scholarly research interests to begin their graduate programs during their junior years, and to provide flexibility in the scheduling and completion of upper-division undergraduate requirements along with graduate course requirements. This track allows students who have completed at least 75 credits of course work toward their degrees, and met other requirements, to apply for admission to combined bachelor's/master's degree programs within their majors. The first department to participate in Track III admissions was Biochemistry and Molecular Biology (a PRSE) with a 5-year combined BS/MS degree program. A Track III admissions option for Electrical and Computer Engineering was approved in Fall 2003. Other graduate majors planning to implement this option are Interior Design and Mathematics.

In 2002, the institutional requirement that all Track I applicants present GRE or GMAT scores for admission consideration was removed, allowing each degree program to establish its own test requirements for graduate admission. This decision was based on the diversity of graduate programs and their purposes at CSU, and the view that indicators of potential success are best determined by the faculty directly involved in each graduate program. Fewer than 25% of CSU peer institutions had a GRE/GMAT requirement. Many CSU departments have retained this requirement, using GRE/GMAT performance as one of several indicators of potential for graduate study. Increasingly, departments are considering work experience, demonstration of leadership ability, and other qualitative measures as important factors in admission decisions.

Plan C Coursework Option for Master's Degree

Traditionally, the two options of Plan A (thesis) and Plan B (professional paper or project) have been available for master's degree programs. The Plan C option, designed for professional degrees, was approved in 1996. Plan C is a coursework-only option with no thesis, project or final exam, and is offered in Business (MBA), Computer Science (MCS), Forestry (MF), and Engineering (ME) at CSU. In contrast to Plans A and B, credit for informal coursework (i.e., independent studies, internships, supervised college teaching) does not fulfill Plan C degree requirements resulting in a requirement for more graduate level coursework. Other departments, such as Fishery and Wildlife Biology, are developing proposals for new Plan C master's programs.

Increased Options in Instructional Delivery

CSU has a long history of offering graduate courses at a distance to working professionals. The University has taken advantage of new technologies to offer more efficient and convenient methods of advanced instruction through DCE. Currently 14 master's programs and two doctoral programs can be completed through distance learning. Details on the development and delivery of these programs are provided in Chapter 13. The Libraries and other services provide excellent support for distance students, and recent policy changes permit participation in oral examinations by the student and/or one or more members of the examining committee by electronic link.

Distance programs use methods of delivery designed to meet the needs of specifically targeted audiences. Three graduate degree programs offered at a distance are designed as fully online programs. Other programs, such as the Executive MBA Program at the Denver Center, offer face-to-face instruction at a distance site. The SOE uses a variety of methods for course delivery in its Community College Leadership Program, including two-way compressed video, which brings students together electronically once a week in interactive sessions. These programs place an emphasis on building strong cohorts of students and having seminar-based learning experiences that capitalize on the extensive experience that many of their graduate students bring to the classroom.

Program Changes

New Programs and Specializations

Graduate programs at CSU reflect the latest developments in their respective disciplines and continue to refine programs consistent with faculty and program strengths. Over the past five years, several specializations have been added to existing degree programs (e.g., Electrical and Computer Engineering Specialization in Master of Engineering; Rhetoric and Composition specialization in English MA; Public History-Museum Studies specialization in History MA) and new ISPs have been developed in Biomedical Engineering, Food Science/Safety, Geospatial Science, International Development, and Integrated Resource Management. Other degree programs have been reconfigured and/or renamed, but few new graduate degree programs have been implemented.

In colleges with a limited number of doctoral programs, creative and collaborative approaches have been used to increase doctoral education opportunities. For example, SOE is one of two units in CAHS with doctoral programs, and it is collaborating with six other departments in the college to provide broader access to doctoral-level education. The Interdisciplinary Studies specialization in the Education and Human Resource Studies doctoral program offered by SOE is designed for students who wish to gain mastery of educational skills and also focus on a complementary discipline. Other collaborations have

occurred across colleges. The Department of Human Development and Family Studies participates in the doctoral lifespan option within the Applied Social Psychology Program in the Department of Psychology. These collaborations have been cost-effective and have expanded educational opportunities for students seeking doctoral degrees.

Proposed Degree Programs

CSU offers rigorous programs of graduate study, approved through a well-defined curriculum process as outlined in Chapter 7. New degree programs are developed by academic faculty and reviewed by the appropriate Faculty Council committees to assure academic coherence, quality, and integrity. The Board approves all new majors and degree programs, name changes of existing majors or degree programs, and the elimination of programs. Until recently, proposed graduate degree programs were initially reviewed by CCHE through submission of concept papers. Criteria used in reviewing proposals for new graduate degree programs and specializations include quality and capacity of the institution to deliver the program. Changes in CCHE procedures are expected to reduce the time required to obtain approval for new graduate programs. CCHE plans to continue to review all graduate programs for final approval and closely monitor enrollment demand.

Proposed doctoral degrees presently at various stages of development include Biomedical Engineering, Environmental Engineering, Geospatial Information Sciences, Communication and Information Technology, Environmental Toxicology, Human Bioenergetics, Discourse Studies, Music Therapy, and American History. The proposed PhD in American History would be a joint program with the University of Wyoming that has an American Heritage Collection. If approved and implemented, these new programs could take advantage of existing strengths, provide advanced study in emerging fields, and expand doctoral opportunities in CLA. However, they must be able to provide reasonable assurance of capacity and demand to sustain enrollment at levels that fulfill CCHE benchmark criteria (described below).

Enrollment Demand and Selectivity

Most of CSU's graduate programs attract highly qualified applicants from across the country, and indeed the world. Approximately one-third (32.9%) of all graduate students and one-half (49.8%) of new graduate students in Fall 2003 were non-residents. Of the 5876 new applicants seeking graduate study at CSU for Fall 2003, only 38% were admitted, and 48% of admitted students enrolled (Table 8-1). A trend exists toward more selective admissions and increased numbers of admitted students choosing CSU for graduate study. Many of CSU's graduate programs are highly competitive, particularly programs affiliated with PRSEs. For example, 8% of the 310 students who applied to the PhD program in Chemistry were

Table 8-1. Demand and selectivity of graduate admissions by academic college, Fall 2003.

College	Number of Applications	Number Admitted	Percent Admitted	Number Enrolled	Percent Enrolled
CAS	224	101	45%	46	46%
CAHS	951	488	51%	292	60%
COB	316	209	66%	143	68%
COE	1399	435	31%	143	33%
IU	163	43	26%	19	44%
CLA	735	372	51%	173	46%
CNR	271	99	36%	47	47%
CNS	1543	377	24%	138	37%
CVMBS	274	90	33%	64	71%
Total	5876	2214	38%	1065	48%

admitted, and 75% of these enrolled. Only 9% of 68 applicants to the PhD program in Atmospheric Science were admitted, and 67% enrolled. These percentages demonstrate high demand, a selective admissions process, and programs that compete effectively for students.

CCHE, in accordance with policies described in Chapter 6, tracks student demand for graduate programs and identifies those not meeting the following benchmarks: master's degree programs that fail to graduate at least three students in the current year or a total of five in the last three years, and doctoral programs that fail to graduate at least one student in the current year or a total of three in the past three years. Few graduate degree programs at CSU have had difficulty meeting these benchmarks. Two degree programs have been dropped due to low enrollments since the last accreditation review: the Master's in Home Economics in 1996 and the MS in Pathology in 2000. The PhD in Rangeland Ecosystem Science is the only graduate program at CSU that did not meet these benchmarks in FY02, but it exceeded the minimum threshold in FY03. The program will also be modified as the department is restructured into the Department of Forest, Rangeland, and Watershed Stewardship.

Graduate Education Planning

Over the past few years, several graduate education task forces have addressed ways to continue to strengthen graduate education at CSU. Task Force reports have targeted the need for innovative and interdisciplinary graduate programs, higher graduate student stipends, and increased funding to recruit students of the highest quality. These reports also acknowledged the strong connection between graduate education and research, and concluded that advancement in graduate education must be aligned with other institutional priorities and investments. Graduate education is included as one of the five major planning areas in the current Division of Academic Affairs strategic planning process (discussed in Chapter 11).

Profile of Graduate Students

Quality of Entering Graduate Students

The overall quality of CSU's graduate applicants has remained high. Between Fall 1998 and 2002, average GRE quantitative scores of entering students increased 2% (602.7 to

614.7) and analytical scores increased 3% (597.7 to 615.7), while verbal scores were relatively unchanged. The quality of students attracted to and enrolled in the PVM program is excellent. Entering students had a mean 3.60 GPA with combined verbal, quantitative and analytical GRE scores of 1763. The quality of the distance MBA students at CSU is also impressive. In 2003, the average GMAT score exceeded 620, up from 565 in 1997. According to AACSB data, CSU GMAT scores equal or exceed those of peer and aspirant peer institutions such as Kansas State, Michigan State, Texas A&M, the University of Nebraska, and the University of Missouri. Further, the CSU GMAT average is within three points of students from some elite programs such as the University of Illinois and Pennsylvania State. Many applicants to CSU's graduate programs have significant professional experience, and some are in leadership positions in education, business, industry and other fields.

Diversity of Graduate Students

CSU's graduate student population has become more diverse due to targeted recruitment efforts, greater availability of distance education programs, and other programmatic and policy changes. This diversity is demonstrated not only in gender and ethnic/cultural diversity, but also in work and other life experiences students bring to their degree programs. The University commitment to diversity, broadly-defined, has resulted in a graduate student population from varied backgrounds and with differing needs for advanced education.

In Fall 2003, the average age was 31 years for graduate students and 27 years for PVM students. In Fall 2003, women comprised 49% of graduate students, ranging from 18% in COE to 71% in CAHS and 75% in the PVM program. The Department of Chemistry, with a graduate program of over 100 students, has addressed its higher attrition of females compared to males by organizing a Women in Chemistry group in 1998. This group, composed of female students and the five female faculty mentors, meets to discuss career opportunities, participate in applicant interviews for faculty positions, and assist with recruiting new female graduate students. The program seems to be effective in creating a welcoming and affirming environment. In FY95, nine female students and 18 male students entered the graduate program in Chemistry. In FY03, the number of new female students had increased to 15.

International students add an important diversity component to the University's graduate student body, particularly as the University places a greater emphasis on global linkages and international collaborations in research. Graduate students come to CSU from over 90 countries, contributing unique perspectives to the learning environment.
Slow but steady progress has been made in attracting students from ethnically-diverse backgrounds to CSU's graduate programs, particularly at the master's level. The enrollment

Table 8-2. Number of degrees awarded by ethnicity in FY03.

	Master's Degrees	PhD Degrees	DVM Degrees	Total Degrees
Asian	29	5	3	37
Black	16	2	1	19
Hispanic	39	2	9	50
Native American	14	2	1	17
Non-minority	929	171	118	1218
Total	1027	182	132	1341

of minority master's students has continued to increase in both number and percentage, and this trend can also be seen in the number of master's degrees awarded. Table 8-2 shows the number of graduate and professional degrees earned by ethnically diverse students in FY03. These students accounted for 9.5% of total master's degrees, 6.0% of total doctoral degrees, and 10.6% of total DVM degrees.

CSU's PVM program enrolls more ethnic minorities than any other veterinary medicine program in the country (with the exception of Tuskegee, an historically black institution). Enrollment of ethnic minority students in this program has remained relatively stable in the 12-14% range over the last five years and degree percentages are consistent with those of enrollment, suggesting excellent retention of ethnic minority students admitted into the program.

The Graduate School awards a Martin Luther King Jr. Fellowship and two McNair Graduate Student Fellowships each year to promote diversity in graduate education. CSU also participates in the Colorado PEAKS Alliance for Graduate Education and the Professoriate Program. This NSF-sponsored program is designed to recruit and retain underrepresented minority graduate students in science, engineering, and mathematics. Support is provided for PEAKS fellowships, travel funds for students to attend professional conferences, and visiting scholar funds. The University also sponsors several other programs, discussed in Chapter 9, designed to create a pipeline to graduate education for undergraduates from underrepresented groups.

The Graduate Discovery Program is another successful approach for increasing ethnic minority enrollment. CAS started this program in 1992 as a way to identify and recruit minority graduate students to agricultural sciences, and received the USDA Award for Group Excellence in Advancing Minorities in Agriculture in 1997. Over 108 students have participated in this program and more than 60 have pursued advanced degrees, 40 of these at CSU. The Graduate Discovery Program was directly responsible for a mutually beneficial collaboration between Southern University and CSU that has expanded to include successful annual recruitment of students from Southern University into CAHS master's and doctoral programs.

Despite these gains, more concerted effort to recruit and support ethnic minority students at the graduate level is needed. Given the demographic composition in the State, the potential for increasing enrollment in graduate study at CSU by Hispanics is significant.

Enrollment Trends

An in-depth analysis of graduate enrollment trends was undertaken in 2003 (*Toward a Strategic Evaluation of Graduate Education at Colorado State University)*, comparing the number of master's and doctoral graduates at CSU with national trends and peer data. Numbers of degrees were selected as the metric for comparison since completion of a degree is the critical measure of successful graduate education outcomes. This metric counts all students receiving degrees from on-campus programs as well as those receiving graduate degrees through off-campus E&G programs and cash-funded programs offered by DCE. Student FTE comparisons were not used as a source of comparative data because both groups (E&G funded and cash-funded) and are not included in these numbers. Also, the periodic variations in continuous registration policies (since its inception in 1997) make it difficult to accurately track changes in graduate student FTE numbers over time.

Since FY98, the number of students receiving master's degrees from CSU graduate programs has steadily increased (Table 8-3) and at a higher rate than at peer institutions. The number of master's degrees earned at CSU in FY03 was the second highest in the University's history. CSU has mirrored national trends in declines in total doctoral degrees awarded, but at a higher rate. Recent enrollment numbers suggest that this trend is reversing. The proportion of graduate students (not including PVM students) in the total student population has remained fairly constant at approximately 15% over the past five years. Master's programs grew at a pace similar to undergraduate growth and comprised 85% of total graduate degrees in FY03.

Table 8-3. Number of graduate degrees awarded by CSU, FY98-FY03.

	FY98	FY99	FY00	FY01	FY02	FY03
Master's	914	952	1053	950	989	1027
PhD	214	188	180	157	148	182
Total	1128	1140	1233	1107	1137	1209

Table 8-4. Number of master's degrees by academic college, FY98-FY03.

College	FY98	FY99	FY00	FY01	FY02	FY03
CAS	55	55	48	51	58	48
CAHS	186	216	197	216	213	322
COB	231	250	309	264	223	193
COE	135	107	131	83	88	100
IU	6	10	10	12	9	14
CLA	129	137	120	130	137	139
CNR	62	56	61	57	70	59
CNS	62	60	88	73	92	72
CVMBS	47	61	89	64	99	80
Total	914	952	1,053	950	989	1,027

Trends in Colleges

Table 8-4 shows the number of master's degrees produced by college from FY98 through FY03. CAHS produced the largest number of master's degrees in FY03, and both CAHS and CVMBS have experienced significant increases in numbers of master's students since FY98.

Doctoral programs, concentrated in three colleges (CVMBS, CNS, COE), produced 62% of the PhDs in FY03. Four other colleges (CAS, CAHS, CNS, CLA) accounted for the

Table 8-5. Number of PhD degrees by academic college, FY98-FY03.

College	FY98	FY99	FY00	FY01	FY02	FY03
CAS	16	16	24	18	13	15
CAHS	31	18	24	24	16	19
COE	46	39	31	24	33	30
IU	5	8	9	6	8	12
CLA	5	8	8	7	6	12
CNR	24	17	15	5	11	12
CNS	58	61	47	52	40	58
CVMBS	29	21	22	21	21	24
Total	214	188	180	157	148	182

Table 8-6. Number of degrees earned by international students, FY98-FY03.

Degree	FY98	FY99	FY00	FY01	FY02	FY03
Master's	106	128	117	82	136	98
PhD	55	41	40	37	39	39
Total	161	169	157	119	175	137

remainder of doctoral degrees earned in FY03, and COB does not have a doctoral program (Table 8-5).

Doctoral programs, concentrated in three colleges (CVMBS, CNS, COE), produced 62% of the PhDs in FY03. Four other colleges (CAS, CAHS, CNS, CLA) accounted for the remainder of doctoral degrees earned in FY03, and COB does not have a doctoral program (Table 8-5).

International Students

International students comprise a small but significant portion (19%) of the graduate student population at CSU (Table 8-6), particularly at the doctoral level, with over half of international graduate students enrolled in COE and CNS. International students cannot qualify for resident tuition in Colorado, which places CSU at a competitive disadvantage. Recent central coordination of international student recruitment and retention is expected to result in increased enrollment. In 2000, the EBC approved funding (approximately $60,000 over three years) for international student recruitment in Asia and the Middle East, and the Provost allocated approximately $140,000 in FY04 to cover tuition premiums (the difference between resident and non-resident) for international students contributing to critical research programs.

Support for Graduate Students

Financial Support

Assistantships

Graduate Assistantships (GAs) offer a key source of financial support for students who are pursuing graduate degrees. Stipend support for graduate students is available through research (GRAs), teaching (GTAs), and a small number of Graduate Service Assistantships (GSAs). GTAs and GSAs are supported primarily by state-appropriated, resident instruction funds, and GRA funds flow primarily from sponsored research. GTAs contribute significantly to the instructional mission of the University, and GRAs support the research mission. Both types of assistantships provide valuable experience and are viewed as an essential part of graduate education in many disciplines. From FY98 to FY02, the number of GAs increased by 16.4%, from 1342 to 1563.

Table 8-7 shows the number of GAs in FY03 by college. Support for doctoral education is strongly linked to the availability of assistantship funds. Successful

procurement of more external funding for GRAs will be critical for future growth in doctoral programs. Research funding accounted for 49% of all graduate stipends at CSU in FY03, compared to only 39.9% in FY98. The Graduate School administers a GRA tuition premium account to fund the difference between resident and non-resident tuition for non-resident first-year GRAs.

The Graduate School establishes the minimum stipend amount for all GA positions each year (departments may offer higher amounts), and the annual increase in the minimum stipend is linked to the average increase for faculty salaries. The minimum GA stipend for FY04 is $1134 per month for a half-time assistantship (20 hours per week), with no increase from the FY03 level. A recent analysis of graduate stipends at CSU found that GRA stipends experienced real growth of between 2-3 times that of the CPI between FY98 and FY03, while GTA and GSA stipends have remained flat. In 2001, the stipends offered to CSU's prospective graduate students were approximately 10-14% less than the average offered by other public institutions in five of six selected fields according to a survey of 45 AAU members (*Chronicle of Higher Education,* 2002).

Table 8-7. Graduate Assistantships by academic college, FY03.

College	GTA FTE
CAS	110
CAHS	144
COB	54
COE	239
CLA	205
CNR	179
CNS	422
CVMBS	139
Other	71
Total	1,563

Fellowships and Sponsored Students

CSU has been successful in securing prestigious fellowships for its students based on the quality of its research programs, particularly in the highly funded research areas. The number of NSF Fellows at CSU doubled from 7 to 14 during FY94 to FY02. Students are also funded through NASA, DOE, and EPA Star Fellowship Programs. Over 18 students are currently supported through an Integrative Graduate Education and Research Training Grant funded by NSF. Participating students receive training through the Program for Interdisciplinary Mathematics, Ecology, and Statistics (PRIMES), learn to use advanced quantitative tools to address ecological problems, and acquire the skills to work at the interface of these disciplines. Post-DVM graduate students in various CVMBS PhD programs have successfully obtained NIH Career Development grants to pursue advanced education. In FY03, two students received these competitive training grants with each award having an annual stipend of $46,404.

Graduate Fellowships have been available through the Graduate School to assist departments with early recruitment of exceptional students. In particular, the CCHE Fellowship Program has been effective for this purpose by providing selected departments with $7,000-$12,000 in flexible funds. Funding was reduced from $300,000 in FY03 to $208,000 in FY04, and a total of $140,000 is projected for FY05. The awarding of 3F Fellowship funds to graduate students is linked to PRSEs to support graduate education in these outstanding areas.

Between 25-30% of CSU's international students were sponsored by embassies, agencies, or foreign universities from FY98 to FY02, compared to a national average of approximately 7%. In FY03, CSU's percentage dropped to 18% as a result of national and international events such as 9/11, conflict in the Middle East, and downward economic trends that are now stabilizing. For FY04, sponsored students will approach 20%. The number of sponsoring agencies has increased to an all-time high of 22.

Health Benefits

Graduate students and veterinary residents holding at least a quarter-time (10 hours a week) assistantship appointment and enrolled for a minimum of six credits are eligible for a benefit payment to help cover the cost of health insurance. The benefit payment is less than half the total cost for single person coverage, and does not compare favorably with the packages offered to graduate students at peer institutions. This optional insurance is in addition to campus health service funded through student fees.

Academic Support

Library Support

Advanced graduate study requires access to scholarly resources and the University Libraries has made steady progress in increasing the size of its collections and providing access to materials electronically. The Libraries provides group, individual, and credit course instruction to graduate students to assist them in developing graduate-level literature search skills for advanced research needs. Libraries faculty has also established close links with academic departments to better accommodate their priorities for collection development. Every academic department has a Library representative, and Morgan Library has subject matter specialists with responsibilities for different disciplines. Department representatives are consulted before any reductions in periodical subscriptions are made. They are also asked to prioritize new acquisitions to support existing and emerging academic programs, thus shaping collections development. External assessment has shown overall advancement in ARL rankings for the University Libraries (discussed in Chapter 6). Responses to the *LibQUAL+ Spring 2003 Survey* by graduate students showed CSU services compared favorably with other ARL libraries.

Statistical Consultation

CSU also provides central support for the development of strong research skills. The Graybill Statistical Laboratory provides statistical consulting with over 2,175 appointments each year. Over 1000 researchers use these services: 46% are master's students and 26% are PhD candidates. In addition, two Statistics graduate students are available for drop-in

consulting for graduate students from other disciplines. Consulting services range from assisting in planning and design of experiments to the analysis and interpretation of results. While most graduate students are trained in research design, methodology, and analysis as part of their graduate study, students wanting to use advanced methods have access to additional expertise outside their home departments at no charge.

Teaching Assistant Training

Central support is provided for strengthening teaching skills. CSU offers specialized training and support for graduate students planning to pursue an academic career and those that are currently GTAs. In addition to the annual GTA workshop, graduate students can receive academic credit for a Seminar on College Teaching through the Graduate School and enhance their teaching skills through observing master teachers in the classroom and developing a teaching portfolio. As a participant in the Colorado Preparing Future Faculty Network, CSU provides additional opportunities for students to acquire more advanced pedagogical skills and knowledge. Individual colleges also recognize the importance of preparing students to be teacher-scholars (in addition to researchers) to meet expectations in their future faculty roles. For example, a workshop entitled *Becoming a Teacher* was co-sponsored by the Graduate School and the CVMBS in Fall 2003.

Campus Housing

CSU provides housing for students and their families through Apartment Life (65-70% of the residents are graduate students and approximately 55% of the 954 units are occupied by international students). The majority of the ratings on the exit surveys for Apartment Life have been very positive. An exit survey given to residents in FY03 showed that 97.6% agreed that living in Apartment Life helped them achieve their academic goals and enhanced their ability to study, an increase from 95.4% in FY99. Based on feedback from students, more programming staff have been added in the family housing areas to engage the younger (0-17 age group) population and to meet the needs of students who are single parents. In 1998, CSU contracted with a private vendor to open a daycare center near the family housing units to serve the University community, including the dependents of students.

The Career Center

The Career Center assists students with career planning resources, job search tools, and opportunities for on-campus interviews with potential employers. The Career Center on-campus recruiting database and resume referral system provide employers easy access to graduate student resumes. In FY03, about 12% of the individuals who received career counseling through the Career Center were graduate students. Several colleges have partnered

with the Career Center to create liaison positions, and increasingly graduate students are using their services. The COB Career Center Liaison conducts weekly seminars for graduate students and provides consultation on career management. Presentations on interviewing skills and alternative careers in science are given by the CVMBS Career Center Liaison to graduate students in Biomedical Sciences. The Liaison in CNS conducts workshops for PhD chemistry students on resume writing and on-campus recruiting with approximately 25-26 students attending each year.

Assessing Graduate Education Outcomes

Program Improvements and Enhanced Learning Environments

CAHS, COB, CLA, CNS, and CVMBS have accredited graduate and/or professional degree programs with program assessment as an integral component of specialized accreditation processes. In addition, all academic departments undergo a 6-year program review, which includes assessment of student learning, application of assessment findings, and program improvements. Surveys of alumni and employers are typically included as indirect measures. This information is often shared with college or department advisory councils, obtaining additional input to determine changing workplace skills and identify enhancements needed to keep CSU's graduate programs relevant. Mechanical Engineering, for example, is continuing to maintain strong MS and PhD programs in Energy and Environment, Advanced Materials and Plasmas, and Biomedical Engineering in alignment with the three important future areas of mechanical engineering identified by a recent NSF study – energy/environment, micro/nano technology, and biotechnology. Occupational Therapy, known nationally for its curricular innovations, is exploring the possibility of implementing an OTD degree program to meet the needs of its graduates for doctoral education.

Some colleges have reorganized their programs to further advance existing strengths. For example, COE transferred the Bioresource and Agricultural Engineering graduate program from the former Department of Chemical and Bioresource Engineering to the Department of Civil Engineering to create a stronger interdisciplinary focus.

Major shifts in the focus of some graduate degree programs have occurred through strategic initiatives. For example, the Department of Health and Exercise Science changed its name from Exercise and Sport Science in 1999 to reflect its new health-related emphasis. The graduate program was completely revised based in part on input from alumni. Five new tenure-track faculty members were hired to strengthen the research infrastructure in neurophysiology, cardiovascular physiology, cellular bioenergetics, epidemiology, clinical biomechanics, and aging. A $1.8M Human Performance Clinical/Research Laboratory facility was completed in May 2000 to house state-of-the-art research equipment. External funding

increased over 5000% from FY93 to FY01, enabling the Department to attract higher quality students as evidenced by the increased average combined verbal and quantitative GRE scores of incoming graduate students from 1020 to 1178.

Assessment Processes for Improving Learning Outcomes

Due to the individualized nature of graduate education, particularly at the doctoral level, direct assessment of student performance is formalized through a series of program requirements. These outcomes are evaluated by members of the graduate student's advisory committee for demonstration of research and technical proficiencies, content knowledge in field of study, and evidence of critical thinking and application of knowledge. In some departments, a Graduate Committee periodically assesses the progress being made by each graduate student and makes recommendations to the department faculty.

Beyond assessment of individual student performance, most academic departments have developed additional systematic methods for assessing the effectiveness of their programs in achieving desired learning outcomes. In 2003, most graduate programs reported student learning outcomes, and this activity will continue on an annual basis. Graduate programs develop and submit outcomes using the PRISM online reporting system (discussed in Chapter 7). APAIC members review graduate program assessment plans after each reporting cycle, providing feedback on planning improvements and identifying best practices. This systematic review and subsequent dialogue has increased the capacity for refining departmental assessment plans and improvement of programs. The following sections provide examples of best practices in assessment in graduate programs at CSU.

Early Assessment of Learning Outcomes

Early assessment of student learning in graduate programs permits departments to modify their curricula and teaching strategies in ways that maximize graduate student learning as illustrated by the following examples.

- Incoming students in the Chemistry graduate program take the American Chemical Society placement tests in analytical, inorganic, organic, and physical chemistry. Students with deficits in content knowledge are then required to achieve the desired level of competency through additional coursework and mentoring. Test results have provided useful input to assist this department in developing methods for improving the academic preparation of its students and comparing pre- and post-learning.
- Faculty of Biochemistry and Molecular Biology expect graduate students to demonstrate mastery of structural biology, molecular genetics, and cell biochemistry. A committee of three faculty members with expertise in these three areas administers

an oral examination to each student upon completion of first-year coursework. Each examiner assesses the performance of each student on the examiner's own questions and those of other committee members using a scale with predetermined criteria. The aggregate results indicate areas that may need modification in course delivery or coverage to enhance student learning.

Evaluation of Final Projects in Academic Programs

Graduate programs have different purposes and intended academic outcomes for their students. Therefore, faculty members vary in their approaches to assessing the quality of final graduate student projects in their respective disciplines, while upholding institutional and disciplinary standards.

- For the MA in English and MFA in Creative Writing, the assessment of success of the thesis, project, or portfolio (depending on the Plan option) is achieved through data collected from both faculty and graduating students. All members of each thesis or project committee complete a short questionnaire for each thesis or project, offering qualitative remarks. Committee members also use a 4-point scale to measure the success of structure, methodology, and originality of the completed work. Graduating students complete an exit survey that prompts them to reflect on their own learning. They also use a 4-point scale to measure the success of their learning about structure, methodology, and originality. This assessment across all student projects identifies strengths and areas needing improvement to be addressed at the program level.
- To evaluate the research aspect of their graduate program and make program improvements, a central faculty committee in the Department of Psychology reviews the methods sections of a randomly selected number of dissertations to evaluate research methodology. This approach assures research excellence across all five departmental graduate options.

Evidence of Graduate Student Learning Outcomes

Evidence of graduate student learning outcomes at CSU is illustrated by their many accomplishments. Students from a broad range of disciplines have received national recognition based on the skills and knowledge acquired in their graduate programs. Performance on licensing exams show that CSU graduates compare well against a profession-wide standard. Learning outcomes are also demonstrated by the high rate of employability of CSU graduates. Upon graduation, they compete well because they have the requisite skills to contribute to society and its changing needs.

Student Awards and Other Forms of Recognition

The accomplishments of graduate students have been recognized each year with numerous national and regional awards. These awards attest to the quality of learning acquired through the University's graduate programs. A few recent examples include:

- In 2003, an Atmospheric Science graduate student was one of 11 selected to participate in the nationwide American Meteorological Society Summer Policy Colloquium in Washington, DC.
- In 2002, an Atmospheric Science graduate student was awarded the "Best Graduate Student Oral Presentation" at the Society for the Advancement of Chicanos and Native Americans in Science annual conference.
- In 2002, a Student Affairs in Higher Education (SAHE) graduate student received the Graduate Student Case Study award from the American College Personnel Association.
- In 2002, an English graduate student received the Western Association of Graduate Schools Outstanding Thesis Award.
- In 2001, a graduate student in Human Development and Family Studies received the student award for Excellence and Potential for Contribution to the Field of Family Studies by the National Council on Family Relations.

Performance on Professional Exams

Direct measurement of student learning outcomes is also demonstrated by the performance of CSU's graduate students on professional exams. The following selected examples demonstrate mastery and application of content in a variety of disciplines:

- The clinical residency training programs offered by the Department of Clinical Sciences have a national and international reputations for quality, with >90% successfully passing comprehensive specialty certifying examinations. Many of the graduates from the residency program have become leaders in their specialties in either private practices academic institutions.
- In 2000, 98% of PVM graduates passed the National Board Examination and 99% passed the Clinical Competency Test for licensure to practice.
- Graduates of the music therapy program have a 100% pass rate on board certification exams, as compared to approximately 75% nation-wide.
- In 2003, the pass rate of CSU graduates on the National Board For Certification in Occupational Therapy examination was 92%, compared to 82% for all US programs.

Post-Graduation Placement

An indirect measurement of student learning outcomes is the employability of CSU

graduates upon completing their graduate or professional training:

- In a recent survey of PhD graduates from the Department of Psychology, 100% were employed either in university, research, government, industry or private practice settings.
- Placements rates for SAHE graduate students were 100% and approximately 95% for other graduate programs in the SOE.
- Graduates of the PVM program are well prepared to serve the needs of society. More than 90% of graduates from 5 to 15 years post-graduation are actively engaged in professional activities, and approximately 90% of students have received one or more job offers by the time of graduation.

Key Strengths

- **Colorado State University provides excellent graduate programs that effectively serve student and societal needs.**

  Many of CSU's graduate and professional programs have national and international reputations for excellence and innovation. Growth in master's degree programs at CSU has been stronger than national trends and peer groups. CSU has demonstrated responsiveness to changing needs of students and society by adapting its programs and policies accordingly, without compromising the quality or integrity of its graduate degree programs. The self-study provides patterns of evidence that CSU is accomplishing its graduate education purposes in fulfillment of Criterion Three.

Challenges and Opportunities

- **Higher levels of graduate student support are required to remain competitive in the recruitment of the highest quality students.**

  CSU has a strong track record of successful recruitment of graduate students, and admissions have been highly selective. As the cost of a pursuing a graduate degree continues to increase, competitive stipends will be required to maintain this position. Continued success in securing external funding for research and other forms of scholarship may offset some of the consequences of current declines in institutional resources.

- **Investment in graduate education is necessary to continuously improve learning environments and the acquisition of advanced skills.**

CSU is committed to maintaining high-quality graduate education and promoting excellence in existing programs. Recent task force reports on graduate education are being given serious attention as strategic planning in this area moves forward. Consideration is being given to advancing new graduate programs, particularly at the doctoral level, with a strong market demand.