Final Report on the AY 2004-2005
College of Natural and Agricultural Sciences
Freshman Scholars Program

A Program to Attract, Motivate, and Retain New Students in the Sciences at UCR

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Program Description

This report describes outcomes for a pilot program, started in Fall 2004 in CNAS, that was designed to positively affect the academic progress of CNAS freshmen at UCR. It summarizes formal statistical evaluations of the program that were conducted at the end of each quarter of AY 2004-05 as well as at the end of AY 2004-05 to assess the impact on student retention and academic performance in the sciences.

This program was available to incoming freshmen in CNAS who participated in the three-quarter Chem 1 series beginning with Chem 1A in Fall 2004. Only new freshmen were accepted into the CNAS Freshman Scholars Program with signups on a first-come basis beginning at the summer 2004 orientations. Students were required to be math-qualified for Chem 1A in the Fall; that is, they were required to be prepared to begin Math 9A (or a higher level calculus course) simultaneously with Chem 1A. CNAS Freshman Scholars enrolled in a single lecture section of Chem 1A (Fall), B (Winter), C (Spring) during AY 2004-05. These lecture sections were offered each quarter of the Chem 1 sequence by ladder-rank faculty who agreed to coordinate and supervise three experienced TAs who were Chemistry Graduate Students and assigned to the course.

Each Scholar participated in a Chem 1 discussion section of 20-25 students led each quarter by one of three experienced TAs appointed by the Chemistry Department. This program was open to the 208 freshmen applicants for the Fall Quarter who agreed to participate in the add-on discussion section (Chem 1DA, 1DB, and 1DC, 1 unit each, S/NC grading). For these discussion sections, students were required to complete homework problems assigned by the course instructor, took quizzes covering the lecture material, and participated in other appropriate activities designed to clarify lecture principles and concepts. Additionally, access to on-line practice exams was made available to students in these sections. Insofar as possible, students stayed in the same Chem 1D discussion section for each of the three quarters of the course.

Freshman Scholars also agreed to participate in mandatory workshops throughout the year given by peer mentors who were trained and supervised by the Learning Center. Workshops focused on problem-solving skills, test-taking skills, library usage, and other university acclimatization issues. These workshops did not just teach such skills in the abstract but in the context of the Chem 1 course material. The students developed a sense of community with their peer mentor and other students in the group, and developed study strategies as academic partners for success in the sciences.

Freshman scholars who completed the program were offered the opportunity to apply for up to 25 CNAS paid summer research positions in faculty labs for summer 2005. As a result, fifteen applicants were awarded 8-week research appointments during summer 2005.

Analysis of the CNAS Freshman Scholars Program

A thorough evaluation of the program at the end of each academic quarter was conducted with the help of Prof. Dan Jeske, Director of Statistical Consulting Collaboratory. All the students enrolled in each of the CHEM 1A (Fall), Chem 1B (Winter), and Chem 1C (Spring) lecture sections were included in the analysis. The data, obtained through the Registrar, included a variable data set for analysis of the CHEM 1A grades both of students participating in the CNAS Scholars Program, and, hence, the CHEM 1D course, and of those students *not* participating in the CNAS Freshman Scholars Program. The data used for the analysis included ethnicity, sex, age, class standing, GPA, units taken, grade in MATH 9A, term in which MATH 9A was taken, Chem 1A grade, AP score of AP chem Test, AP Math grade and which course

taken, SAT Score, CHEM 1A instructor, participation in CHEM 1D, and University Honors Program participation.

The results of these analyses yielded the following formula, where $\hat{Y}$ is the student's Grade in Chem 1A on a 4-point (A=4, B=3, C=2, D=1, F=0) scale:

$$\hat{Y} = \beta_0 + x(\text{adjGPA or pGPA}) + x(\text{Gender}) + x(\text{Instructor}) + x(\text{class year}) + x(\text{APchem}) + x(\text{honors}) + x(\text{ethnicity}) + x(\text{discussion format})$$

		x		
	Factors affecting Students' GPA	Fall (CHEM 1A)	Winter (CHEM 1B)	Spring (CHEM 1C)
	Intercept (β_0)	-1.07	-0.28	-1.488
	Adj/pGPA*	1.14	1.049	1.086
Gender	male	0	0	0
	female	-0.15	-0.103	0.051
Instructor	No. 1	0	0	0
	No. 2	0.32	n/a	0.217
	No. 3	n/a	0.056	n/a
	No. 4	n/a	-0.33	n/a
Class year	FR	0.02	-	-
	SO	-0.29	-	-
	Jr	0.11	-	-
	SR	0	-	-
Honors	If in Honors	-	0	0
	If NOT in Honors	-	0.218	-0.0146
Ethnicity	A (Asian)	0.02	0.0217	0.0473
	B (African American)	-0.34	-0.406	-0.065
	H (Hispanic)	-0.39	0.0504	0.165
	O (Other, Declined to State)	0.03	0.158	0.097
	W (Caucasian)	0	0	0
AP CHEM	If in APChem	-	0	0
	If NOT in APChem	-	-0.543	0.198
CHEM 1D	If in CHEM 1D (N) [+]	0.64 (193)	0.148 (131)	0.087 (118)
	If NOT in CHEM 1D (N') [+]	0 (725)	0 (498)	0 (379)

*The Adj/pGPA was either 1) the Adj GPA (Fall quarter) was the GPA that the student earned in all other classes *except* Chem 1A in the Fall quarter or 2) the pGPa (Winter, Spring quarter) was the GPA that the student had earned *prior* to the quarter in question.

[+] N= CNAS Freshman Scholars student headcount; N'=Nonparticipant student headcount

These results show that participation in CHEM 1D (CNAS Freshman Scholars Program) had a significant *positive* effect on students' Grades in CHEM 1A. On average, participation raised the students' grades by +0.64. In the regression analysis, the teaching format (if student participated in the CNAS Scholars Program or not) has a very high significance (p_value <0.0001), indicating that the two different formats affected students' performance. The 95% confidence interval for this effect is 0.56±1.96x0.1. Similar calculations were performed at the end of each subsequent quarter to show the effect on students' performance in CHEM 1B and CHEM 1C.

The analysis for CHEM 1B showed a less dramatic improvement in students' average Grade as a result of participation in the CNAS Freshman Scholars Program, with a grade improvement of 0.15. In the analysis for CHEM 1C, there was a smaller CHEM 1C grade benefit for students in the Freshman Scholars Program over those who were not.

The following chart shows the fraction of students who received D's and F's in each section of the on-sequence CHEM 1A, 1B, and 1C course during AY 04-05. Sections with no CNAS Scholars are shown as Non-participant sections. The section with the CNAS Freshman Scholars is given in the third column. In each case, this section had the smallest fraction of D/F grades. Note, however, that only about 50 to 60% of the students in this section were in the program.

A breakout of the participant and non-participant D/F rates for this CNAS Scholars lecture section only is shown in the last two columns. Clearly, the D/F rate for participants was by far the lowest of all the students in this course, even when compared with students in the same lecture section. (Not all other variables were controlled, however. For example, the non-participants in this section included non-freshmen and some were repeating the course.)

	Non-participant section 1	Non-participant section 2	Participant section	Rate for Participants Only in Participant Section	Rate for Non-Participants Only in Participant Section
CHEM 1A	110/292 (37.7%)	78/306 (25.5%)	42/319 (13.2%)	4/192 (2.1%)	38/127 (29.9%)
CHEM 1B	27/169 (15.9%)	60/198 (30.3%)	23/261 (8.8%)	4/132 (3%)	19/129 (14.7%)
CHEM 1C	24/105 (22.9%)	28/161 (17.4%)	10/230 (4.3%)	1/119 (0.8%)	9/111 (8.1%)

There are several possible reasons for the trend of decreasing effectiveness of participation in the CNAS Freshman Scholars Program during the academic year from CHEM 1A to CHEM 1B and CHEM 1C.

One possibility is that better students dropped out of the program at the end of the first quarter because they judged that the cost (time) to benefit (grade improvement) was, for them, marginal. Honors students, for example, dropped out the program because, in part, it was too time consuming. A second possibility is that students who felt that they had gained the necessary skills by participation in the first quarter may have dropped out of the program because they felt they could succeed without continuation in the program.

It is important to note that the students remaining in CHEM 1DC may have actually benefited most from the CNAS Freshman Scholars program, in that they were able to pass the whole CHEM 1 sequence, whereas if they had not remained in the program, they might have had more difficulty passing the course in earlier quarters. This conjecture is supported by the results from a questionnaire given to students at the end of CHEM 1DC that is given in the Appendix 1. The students clearly believed that the discussions and workshops were helpful to them. The students who completed the program were very satisfied with the program and their progress.

The table below gives insight into why some students did not complete all three quarters of CHEM 1D. Some of the students who chose not to complete the program did so because of conflicts in their schedule and the inflexibility of the program. I.e. Students were

not permitted to mix and match discussion and workshop sections. However, this issue has been addressed by program changes for the current year. Also, some students felt that the program consumed too much of their time.

Quarter	Reason	# of Students
End of CHEM 1DA	Chose not to continue (non-honors)	35
	Chose not to continue (honors)	10
	Did not Pass CHEM 1 or CHEM 1D	7
	No longer in CHEM 1 (other than failing)	7
End of CHEM 1DB	Chose not to continue (non-honors)	4
	Chose not to continue (honors)	4
	Did not Pass CHEM 1 or CHEM 1D	3
	No longer in CHEM 1 (other than failing)	1

The summer undergraduate research component of the CNAS Freshman Scholars Program was highly successful. Fifteen undergraduates participated in the summer research. The received a stipend of $2000 each for 8 weeks. In addition to meeting weekly with Dean Scott where they discussed their research, they also participated in the CNAS Summer Undergraduate Research Conference on Oct. 8, 2005. Several of these students also presented their research at the Southern California Conference on Undergraduate Research (SCCUR) that took place at UC Riverside on Nov. 19, 2005. The students, their faculty mentor, and their research are listed in Appendix 2.

Appendix 1

CNAS Freshman Scholars Evaluations (completed Spring 2005), Compiled

	1 Strongly disagree	2	3 Somewhat disagree	4	5 Somewhat Agree	6	7 Strongly Agree
1. The discussions helped me understand the chemistry course material better.	0	1	4	4	16	33	35
2. The small class (discussions) was an ideal place to ask questions about the chemistry material presented in class.	1	0	2	5	16	26	45
3. Having one extra hour a week with a chemistry TA allowed me to clarify course material that was presented by my chemistry professor.	0	2	2	6	18	26	38
4. Attending workshops at the Learning Center was helpful.	1	2	3	6	15	25	39
5. The time commitment (2 workshops and 1 discussion) was the ideal time commitment.	4	3	8	12	24	22	19
6. If you disagree with #5, please enter an "ideal" time commitment for yourself in hours per week.							
7. In addition to the discussions and workshops, I also attended my chemistry professor's office hours.	50	9	10	11	4	3	0
8. I would attend the sessions at the Learning Center even if they were not mandatory.	8	4	9	23	20	19	15

1. What was the primary reason you applied for the CNAS Scholars program?

Reason	# of students
Extra help	39
Summer Research Opportunity	5
For the extra unit	1
No Specific reason (just because)	5

2. Do you think letting students choose different discussions and workshops would make it easier for students to plan their schedules? (i.e. different workshop and discussion sections?)

	# of Students
Yes	84
No	5
Maybe	1

3. Was it or would it have been helpful:

a. to have the CD provided by Prof. Rettig to practice problems?

	# of Students
Yes	71
No	11
Maybe	9
Never Used It	2

b. to have the same discussion TA through out the year?

	# of Students
Yes	65
No	16
It doesn't matter	3
Maybe	10

c. to have the same workshop leader throughout the year?

	# of Students
Yes	70
No	6
Maybe	11
Not Really	7

d. to be in a discussion with the same group of students throughout the year?

	# of Students
Yes	74
No	3
Maybe	3
Not Really	11

4. What, if anything, would you change about the CNAS Scholars program?

	# of Students
Nothing	19
Reduce the number of workshops	7
Scheduling Flexibility	16
Offer discussions for Organic Chemistry (other classes)	10
Workshops/Discussions not mandatory	8

Appendix 2

CNAS Freshman Scholars Summer 2005 Research Participants

Perveen Chattha
Major: Biological Sciences
Faculty Mentor: Prof. Sarjeet Gill, Cell Biology and Neuroscience
Research: to identify and characterize the gene(s) that result(s) in reproductive complications in Drosophila melandogaster (fruit fly) upon treatment with natural pesticide azadirachtin.

AJ Checa
Major: Biochemistry
Faculty Mentor: Prof. Gary Scott, Chemistry
Research: to synthsize polyacene photodimer crystals and to determine their crystal structure.

Katherine Hawkins
Major: Biological Sciences
Faculty Mentor: Prof. Mike Marsella, Chemistry
Research: to synthesis enediynes for application in anti-tumor therapies.

Julie Huss
Major: Biochemistry
Faculty Mentor: Prof. Mike Coffey, Plant Pathology
Proposed Research: to generate a forensic database format that will provide an easy resource for retrieving the genotypic and phenotypic data of the plant pathogen Phytophthora.

Shiv Kalaria
Major: Biological Sciences
Faculty Mentor: Prof. Seung-Chul Kim, Botany
Research: to conduct a molecular evolution study of Woody Sow-Thistle alliance in the Canary Islands.

Sandy Kim
Major: Biological Sciences
Faculty Mentor: Prof. Chris Bardeen, Chemistry
Research: to image the dynamics of a single DNA molecule.

Gloria Lai
Major: Biological Sciences
Faculty Mentor: Prof. Prue Talbot, Cell Biology and Neuroscience
Research: to provide evidence that the three known chemicals in cigarette smoke (3-ethylpyridine, pyrazine and phenol) inhibit growth of the fetus and placenta in mammals.

Wilson Lau
Major: Biological Sciences
Faculty Mentor: Prof. Eugene Nothnagel, Botany
Research: to test spinach phytoglycolipids for their emulsifying activity.

Travis Lee
Major: Biological Sciences
Faculty Mentor: Prof. Carol Lovatt, Botany
Research: to determine if argenine, rather than proline is produced in response to carbohydrate deficits plants.

Adam Navas
Major: Undeclared Math
Faculty Mentor: Prof. Dan Jeske, Statistics
Research: to understand Markov analysis and its application to reliability.

Samir Patel
Major: Biological Sciences
Faculty Mentor: Prof. Nancy Beckage, Entomology
Research: to analyze Aedes aegypti mosquito midgut proteins.

Ryan Pedigo
Major: Biological Sciences/Chemistry
Faculty Mentor: Prof. Francisco Zaera, Chemistry
Research: to generate hydrogen fuel from the reformation of natural gases such as methane via thermal activation and catalysis.

Roberto Rivas
Major: Mathematics
Faculty Mentor: Prof. Zhuang-dan Guan, Mathematics
Research: to understand the applications of diiferential equations.

Linda Truong
Major: Biochemistry
Faculty Mentor: Prof. Guy Bertrand, Chemistry
Research: to synthesize ligands for use in palladium complexes in the alpha-arylation of acetophenone.

Stephanie Vu
Major: Biological Sciences
Faculty Mentor: Prof. Connie Nugent, Cell Biology and Neuroscience
Research: to determine if the deletion of the last five origins of replication before the telomere on an artificial chromosome has any effect on the rate of chromosome loss observed in the stn1 mutant strains in the yeast Saccharomyces cerevisiaie.