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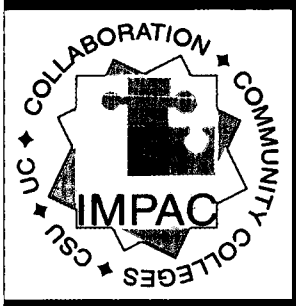
ABSTRACT

The Intersegmental Major Preparation Articulated Curriculum (IMPAC) is a faculty-designed, faculty-run project designed to assist the student transfer process from the California Community Colleges (CCC) to the University of California (UC) and the California State University (CSU) systems. In June, 2000, the Chancellor of the California Community College System awarded the first of five $550,000 annual grants to fund the work of IMPAC. The goals of the IMPAC project include: (1) reaching intersegmental consensus on the required elements to be included in the lower division preparation for the major; (2) working with other intersegmental transfer efforts; (3) increasing transferability of students between campuses and between the three higher education systems; and (4) decreasing the time to degree for students. IMPAC has grouped the range of available transfer majors into five clusters of disciplines: (1) Sciences; (2) Applied Sciences; (3) Business and Government; (4) Social and Behavioral, and Language; and (5) Arts and Humanities. This report includes annual reports from Science Cluster 1, which includes the following disciplines: Biology, Chemistry, Mathematics, and Physics; and Science Cluster 2, which includes Agriculture, Computer Science, Earth Sciences, Food Science and Nutrition, and Nursing. (NB)

IMPAC ANNUAL REPORT

2000-2001



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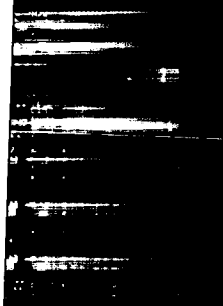
FOOD SCIENCE AND NUTRITION

MATHEMATICS

PHYSICS

NURSING



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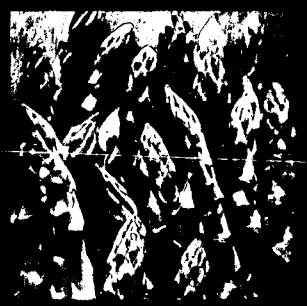

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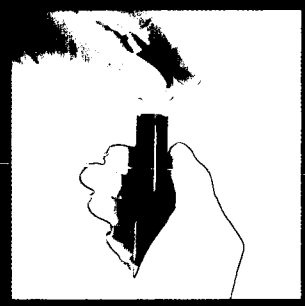

CHEMISTRY

TABLE OF CONTENTS

INTRODUCTION LETTER

Hoke Simpson, ICAS C

February 21, 2002

Dear Colleague,

On behalf of the Intersegmental Committee of Academic Senates (ICAS), I am presenting this report of the Intersegmental Major Preparation Articulated Curriculum (IMPAC) Project as accepted by ICAS. The report is a summary of the Science Cluster I and II faculty-to-faculty discussions during 2000 and 2001.

ICAS would like to congratulate the IMPAC lead coordinators and lead discipline faculty members for their preparation of the enclosed report. Similarly, ICAS would like to thank the more than 500 faculty members that participated in the faculty-to-faculty discussions at the four regional meetings and the statewide meeting. The IMPAC project is the measure of intelligence and goodwill of the faculty in all three segments who gather to explore the complex issues surrounding students' preparation for their intended major. It is obvious from this report that work remains to eliminate the academic barriers to transfer for all our students: the IMPAC project is the obvious vehicle to continue such efforts.

ICAS would also like to thank other organizations who have assisted in making the work of IMPAC so successful, specifically Articulation System Stimulating Interinstitutional Student Transfer (ASSIST), California Articulation Number system (CAN), and the California Intersegmental Articulation Council (CIAC).

Finally, ICAS would like to thank Governor Gray Davis for funding this very important project and the Board of Governors of the California Community Colleges, Executive Vice Chancellor Patrick Lenz (California Community Colleges), Executive Vice Chancellor David Spence (California State University) and Associate Vice President Dennis Galligani (University of California) for their continued support as a demonstration of their commitments to education.

Yours collegially,

Hoke Simpson, Chair

EXECUTIVE SUMMARY

The Intersegmental Major Preparation Articulated Curriculum (IMPAC) Project originated in the Intersegmental Committee of Statewide Academic Senates (ICAS) of the California Community College (CCC), University of California (UC), and California State University (CSU) systems. IMPAC is a unique faculty project designed to assist the student transfer process from the community colleges to the UC and CSU systems in their chosen major. The project, as explained in the Introduction that follows, is funded by a $2.75 million grant that supports for five years the development of an infrastructure for faculty from the three higher education systems to meet regionally at regular intervals to discuss issues, concerns, and academic procedures that impinge upon the transfer process for students between the community college and the UC and CSU systems. Specifically, the grant funds faculty discipline and interdiscipline dialogues that address prerequisite and lower division courses students must complete prior to transfer to either the CSU or UC systems.

In this its first fully-funded year, the IMPAC Project experienced a remarkable surge in interest and participation, in achievements and new agreements. The project's Steering Committee, under the aegis of the Intersegmental Committee of Academic Senates (ICAS), regularized its reporting format and adopted participant evaluation forms; we also tracked the efforts to induce affected faculty and administrators in all three higher education segments to engage in the on-going faculty-to-faculty dialogues at the heart of this effort and to "institutionalize" this project within the on-going work of their departments. Steering Committee members promoted IMPAC's efforts in more than ten formal presentations to professional gatherings of faculty, to systemwide administrators, to student support service providers, to governing boards, and to state legislators.

To communicate its efforts more broadly, the project also produced 10,000 copies of its newsletter, sending it to all identified faculty, to deans, to system administrators, to governmental leaders and to legislators. In addition, IMPAC's expanded website at www.cal-impac.org carries the listing of participants (both by segment and by discipline), as well as the notes of the discussions and this annual report, after consideration by the field and accepted by ICAS.

During the 2000-2001, 541 faculty attended the regional and statewide meetings (see Appendix A). Their findings, in turn, have been reviewed by them and their discipline faculty colleagues across the state.

In this year's annual report, you will note a uniformity of reporting. Appendix B explains this new format in greater detail. Generally, concerns are reported, and potential solutions offered in these segments:

Discipline Issues, Trends, and Concerns

At least 87 issues and concerns are identified by the faculty in the nine disciplines reported here.

- Faculty report that transferring students in the sciences and science-intensive areas have often failed to complete the necessary lower division coursework for those majors; on the other hand, many of those students would require 3-4 years at a community college to complete all remedial and preparatory coursework.
- Faculty in all segments share concern for standards and seek to ensure rigor.
- Requirements of some prerequisites that serve as "gatekeepers" in 4-year institutions may become barriers in the community college.
- Faculty recruitment, hiring, and retention remain of critical concern in these fields.

Recommendations for Specific Action

To address these issues and concerns, faculty in the groups made 44 specific recommendations for further action. For example:

- Monitoring of existing, innovative curricular efforts.
- Research to determine beyond anecdote the experiences of transfer students.
- Greater communication with potential transfers, using websites and brochures.
- Increasing communication with regional feeder community colleges.
- Identification of some strategies to identify critical faculty shortages (mathematics, nursing, computer science) and in related area.
- Continue discussions regarding teacher preparation (e.g., mathematics for K-6 and for secondary teachers).
- Possible posting of university syllabi outline on web (after due consideration of intellectual property issues) as indicators of changed approaches, new textbooks, new emphases that should be monitored and considered by community college faculty.

Cross-Disciplinary Recommendations

The 26 recommendations in this category call for greater collaboration and joint study for resolution, and a new examination of related coursework that can be viewed as complementary but not necessarily required in the major. These recommendations become the nucleus of discussions among the disciplines in the next year.

Intersegmental Transfer Initiatives

One of the most significant developments this year were the steps taken by ICAS and the California Articulation Numbering System (CAN) Board and its Executive Director to draw in faculty from UC. To that end, ICAS committed itself to encouraging greater UC and CSU participation into IMPAC discussions and the CAN processes; in return, the CAN Board has agreed to accept any modifications of CAN descriptors of this year's four majors (food science and nutrition, agriculture, biology and physics) without further faculty review. IMPAC is also forwarding to the CAN Board for its consideration, IMPAC faculty's recommendations for revisions of 5 existing descriptors; for 1 new sequence; for 21 new courses to be CANned; and most importantly, recommendations for revisions of the CAN process itself so that the segmental transfer processes including CSU Lower Division Core and others, might be increasingly integrated. IMPAC and new articulation officers will next pursue agreements offered to community colleges by 9 CSU campuses as a result of these IMPAC discussions. (See Appendix C).

In addition, ICAS and the IMPAC faculty are also forwarding to the CAN Board of Directors programmatic recommendations calling for possible designators for learning modules to differentiate essential and optional elements needed for students transferring into biology, chemistry, physics, mathematics, and computer science. Concurrently, the IMPAC faculty are forwarding recommendations of new CAN procedures designed to encourage even wider UC and CSU participation in CAN reviews.

The IMPAC Steering Committee proposed, and ICAS concurred, that the Steering Committee should be enlarged to incorporate articulation officers who would follow the discussions across the year and be of particular assistance to the discipline faculty at the regional and state meeting. The statewide intersegmental organization of articulation officers has enthusiastically endorsed this proposal; its representative to the Steering Committee will be working with the steering committee and the academic senates to identify articulation officers to serve in this capacity. The faculty have also called for a uniform statewide articulation process (and form) to ease their review work. This revision effort is currently being coordinated by ASSIST, and IMPAC faculty hope to have an opportunity to review their work.

Finally, the reports contain calls for one new degree program and future consideration by IMPAC faculty of an IGETC alternative for science-intensive majors. Tentatively called SciGETC, this alternative will be among topics of future IMPAC discussions where faculty will be asked to explore what might comprise such an alternative. If recommended by IMPAC, this recommendation would be forwarded to ICAS for segmental consideration.

This report concludes with a look toward next year's efforts and appendices that validate this year's valuable progress.

INTRODUCTION

Background

The Intersegmental Major Preparation Articulated Curriculum (IMPAC) project originated in the Intersegmental Committee of Statewide Academic Senates (ICAS) of the California Community College (CCC), University of California (UC), and California State University (CSU) systems. IMPAC is a unique faculty-designed, faculty-run project designed to assist the student transfer process from the community colleges to the UC and CSU systems for the baccalaureate degree. In June 2000, the Chancellor of the California Community College system awarded the first of five $550,000 annual grants to fund the work of IMPAC.

Goals and Purposes of the Project

IMPAC is expected to continue as long as articulation is needed among the higher education systems. The goal of IMPAC is for faculty in the disciplines, through regional and statewide meetings, to come to a common understanding of lower-division, major preparation that serve as prerequisites to upper-division work at UC and CSU campuses. Faculty review, revise and update prerequisite and lower-division course requirements for the major and seek to define the content areas, competencies, skills, and experiences transferring students must have to compete successfully at the upper division level. Resultant course descriptions will serve as the basis for articulation among UC, CSU, CCC and other institutions so that students may smoothly transfer in a manner that assures both full preparation and complete credit for courses completed. The goals of the IMPAC project include:

- Reaching intersegmental consensus on the required elements to be included in the lower division preparation for the major;
- Working with other intersegmental transfer efforts: the California Articulation Numbering (CAN) project, Articulation System Stimulating Inter-institutional Student Transfer (ASSIST), Intersegmental General Education Transfer Curriculum (IGETC), GE-Breadth/IGETC, the CSU Regional Core Alignment Project, and the community college organizations of counselors, articulation officers, and transfer center coordinators;
- Increasing transferability of students between system campuses and between the three higher education systems, and
- Decreasing the time to degree for students.

IMPAC also seeks to increase intersegmental faculty collaboration, strengthen the alignment of curriculum and the rigor of its delivery, build trust among faculty of the three segments, and better serve students whose education is a shared mission of both the sending and receiving institutions.

As a result of IMPAC, ICAS hopes to improve student transfer through increased awareness and involvement of faculty and ensure that all students are well prepared for upper-division work. Students should be able to avoid unnecessary course work prior to transfer, assure that all required courses are taken before transfer, and not have to repeat courses taken successfully at the community college in preparation for the major.

Process

The IMPAC project over the next five years will create an effective infrastructure within and between academic disciplines. IMPAC has grouped the range of available transfer majors into five broad areas or "clusters" of disciplines. These five discipline areas are listed below. Each year additional disciplines will be added until all disciplines are included. These grouped clusters of disciplines generally reflect the overlap of prerequisites for a given major. Thus, in Science Cluster I, students majoring in physics commonly will need pre-transfer work in mathematics to be eligible for the major. Biology majors need mathematics, as well as some chemistry and physics, to be successful as biology majors. Majors in Applied Sciences (Cluster 2) build upon the core courses of Cluster 2. Thus, the interdisciplinary discussions cross clusters as well as disciplines.

2000 Sciences (Cluster 1):
biology, chemistry, physics, and mathematics.

2001 Applied Sciences (Cluster 2):
agriculture, computer science, earth sciences, food science/nutrition, and nursing.

2002 Business and Government (Cluster 3):
computer information systems, criminal justice, business, economics, and political science. In addition, the Steering Committee has determined that the engineering and geography disciplines should commence discussions in year 2002.

2003 Social & Behavioral (Cluster 4):
anthropology, geography, history, psychology (including human development), and sociology.

2004 Language (Cluster 4):
English, ESL, foreign languages, communications/ speech, and journalism.

2005 Arts & Humanities (Cluster 5):
art/fashion/interior design, theater arts, humanities, music, and philosophy.

To be considered prior to 2005, pending completion of CSU's internal review: teacher preparation/liberal studies.

In our pilot year, project participants came to understand that, to capture the full range of coursework needed for successful transfer, it is essential that we facilitate both discipline and cross discipline faculty dialogues. In fact, we have found that such interdisciplinary discussions can have immediate and lasting effect when faculty come to understand the reality and impact of given requirements on student transfer chances. For example, upon discussion and reflection, faculty from biology and mathematics concluded that the historical practice of requiring calculus-based physics for biology transfers is more tradition than necessity. The conversations between physics and biology can lead to a more flexible articulation of the algebra-based physics as appropriate for bioscience transfers. This outcome will be of immediate benefit to students, particularly those who want to transfer from smaller or more rural community colleges unable to offer such advanced courses on a regular basis.

For 2000-2001, ICAS, through its Steering Committee, identified lead faculty in each of the nine disciplines in the Science Cluster. Work began by these lead faculty on developing matrices showing major-preparation requirements at each UC and CSU and summarizing the courses offered in a given major at every community college. After review by the Steering Committee, these major prep matrices served as the basis for preparing tables of course descriptions using information from on-line catalogs. Work then began on determining the extent of articulation of major prep courses. Matrices for each UC and CSU for each major was constructed to show numbers for courses already articulated from each community college. Information from the state repository for articulation agreements, Articulation System Stimulating Interinstitutional Student Transfer (ASSIST), was used to create these articulation matrices. Tables of course descriptions and the articulation matrices were put together by the staff of the Academic Senate for the California Community Colleges.

The next step in this process was to hold regional meetings (see Appendix A dates, locations, and

attendees). Lead Faculty members representing UC, CSU, and CCC facilitated these four regional meetings. Private colleges and universities were invited to attend as well. Articulation officers, as well as representatives from the CAN System and ASSIST, were present as resources. Also attending were observers from ICAS, from the three system offices, and graduate students at two universities who studied our project. Like the statewide meetings, regional meetings scheduled time for both disciplinary and interdisciplinary discussions. The discipline faculty began their discussion with an evaluation of the IMPAC matrices and descriptions and to review the status of their existing articulation, identifying potential new agreements that might be fostered. It is anticipated that these discipline-based faculty discussions will lead to increased curriculum alignment across all the segments.

The interdisciplinary discussions that follow later in the day remain essential in building cohesive and coherent programs in the major and in easing what are perceived by students and segments alike as barriers to effective transfer. From these interdisciplinary discussions have come significant recommendations and new understandings among disciplines and their faculty. As faculty from the applied sciences joined the discussions this year, they posed additional salient questions and requested instructional innovation from their science and mathematics colleagues; nursing faculty, for example, requested a revised curriculum in chemistry and biology for their nursing students who struggle under high-unit demands, imposed by external agencies.

Regional meetings are also designed to seek and secure several agreements among departments in the region. Commitments are sought from faculty at four-year institutions to notify community college faculty of impending curriculum changes and to collaborate on those changes to the extent feasible. When major preparation requirements are changed, receiving departments will be asked to establish a one-year period during which community college students will be accepted under previous requirements. Community college faculty will in turn be expected to invite a representative from a four-year department to participate in the program review now required under the six-year accreditation cycle.

After each regional meeting is concluded, the Lead Discipline Faculty member prepared a report summarizing statements of the competencies and preparation expected of students entering upper-division work in the major. These reports are posted on the IMPAC website and widely circulated for comment by the field. Steering Committee members presented material and commentary for review to ICAS. ICAS then further disseminated those reports containing the core competencies and preparation for each discipline as determined thus far to affected faculty of UC, CSU and CCC, using Web site resources, professional organizations, and internal structures for distribution.

These feedback loops, as well as the alternating regional and state meetings, are extremely important steps in generating sufficient dialogue and building consensus among discipline faculty. The perceived legitimacy of the products is critical in securing widespread "buy in" by faculty across all the institutions.

Thus, over a five-year period, the essential understanding of pre-transfer, lower division, major preparation for each undergraduate major will have been forged by faculty across the segments. These understandings will be concretized in matrices and agreements. An infrastructure of discipline committees, agreements, and contacts will have been established. And the machinery will have been institutionalized for the absolutely essential ongoing review and cyclic renewal of those agreements. By linking these reviews to the ongoing work of articulation officers, using CAN to formalize these course descriptions, and publishing and maintaining the articulation agreements in the ASSIST database, these dynamic agreements about undergraduate major preparation will constitute a considerable advance for students negotiating transfer among the segments of higher education in California.

CONCLUSION: A LOOK TO THE FUTURE

The IMPAC Steering Committee and all participants are committed to fostering the growth and maturity of this significant project. Among the goals for the 2001-2002 project year are these:

- Increased participation by UC and CSU discipline faculty;
- Institutionalization of articulation officer within the program, assigning an officer to each discipline discussion throughout the series of regional meetings;
- Provide training and orientation to new lead discipline faculty as they rotate into the program;
- Ensure continuity of project leadership while still providing for a new faculty to exert leadership and energy;
- New identification of and more effective communication with key campus leadership (deans, department chairs);
- Consideration of inclusion of the liberal studies program (elementary education, multiple subject credential);
- Creation of a proposed science-intensive alternative to IGETC, particularly for physical sciences and engineering students;
- Submission of additional CAN descriptors; and
- Continued promotion of IMPAC's direction, achievement, and goals through presentations to organizations, government and governance groups.

APPENDICES

ROSTERS

SOUTH REGIONAL MEETING DECEMBER 2, 2000 HYATT ISLANDIA SAN DIEGO

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CSU Fullerton

Hollis, Wendy
Nursing
Los Angeles Harbor College

Jensen, Betty
Nursing
Humbolot State University

Keating, Sarah
Nursing
UC Irvine

Keely, Beth
Nursing
CSU Long Beach

Latham, Chris
Nursing
CSU Fullerton

Lewis, Irene
Nursing
San Jose State University

Mathai, Mariamma
Nursing
CSU Fresno

McFarlano, Pat
Nursing
ACNL

McGee, Susan
Nursing
CSU San Bernaroino

Miller, Rebecca
Nursing
Santa Ana College

O'Brien, Noreen
Nursing
Cypress College

Oxley, Gozil
Nursing
CSU Fresno

Peterson, Catherine
Nursing
San Diego City College

Rector, Cherie
Nursing
CSU Bakersfielo

Sawyer, Penny
Health
Merceo College

Schutte, Donna
Nursing
Riversioe College

Sexton, Sigrio
Nursing
Long Beach City College

Sparks, Rox Ann
Nursing
Merceo College

Sutherlano, Suzanne
Nursing
CSU Sacramento

Taylor, Maggie
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LA County College of Nursing & Allieo Health

Thobaben, Marshelle
Nursing
Humbolot State University

Tutor, Patricia
Nursing
Riversioe College

White, Margaret
Nursing
Sierra College

Wilson, Mary
Nursing
CSU San Bernaroino

Younger, Rhonoa
Nursing
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Blecher, Lee
Sciences
CSU Long Beach

Physics

Coleman, Larry
Physics
UC Davis

Eickemeyer, Jim
Physics
Cuesta College

Karant, Yasha
Physics
CSU San Bernaroino

Katkanant, Vanvilai
Physics
CSU Fresno

Rainey, George W.
Physics
CSU Pomona

Weston, Gary
Physics
CSU Haywaro

Wolf, Phil
Physics
Mt. San Antonio College

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Articulation
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Acaoemic Senate for California Community Colleges

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DISCIPLINE ANNUAL REPORTS

This following section contains the annual reports for 2000-2001 submitted by the Lead Discipline Faculty member for each discipline. Each annual report includes these categories:

1. Summary of Identified Issues: This category provides a narrative of findings that emerged during discussions, replete with examples, debated topics, and discussion of support courses if relevant.

2. Identified Trends/Future Directions: This category includes any changes anticipated in the field; changes now being considered at 4-year institutions, implications for K-12 instruction; tendencies noted of programs to include/exclude requirements (e.g., information competencies). This section, like the "Topics for Further Discussion" below, provides grist for discussions in the years to come.

3. Comments from Statewide Meetings and the General Field: This category records the comments from the statewide meetings, noting their origins.

4. Recommendations for the Discipline: This category will offers recommendations based on the regional and statewide meetings.

5. Recommendations for Support Courses (if discussed): This category notes recommendations for related support courses. While not all disciplines may need to consider related support courses, this section provides an opportunity for any relevant recommendations.

6. Topics for Further Discussion: This category contains information about work to be continued, unresolved issues, recommendations for joint meetings with other disciplines. The topics thus enter into the more public as "hot topics," and provide the following year's group with an opening agenda.

7. Recommendations Forwarded or to be forwarded to: This category contains recommendations for outside organizations such as CAN, ASSIST, or CIAC.

8. Outreach presentations made by members of this group: This category highlights IMPAC presentations made to professional and faculty groups around the state.

BIOLOGY

Prepared by Beverly Shue, Los Angeles Harbor College, Lead Discipline Faculty for Biology

Summary of Identified Issues

The biology faculty discussed the final report prepared from the first year IMPAC pilot project 1999-2000, including early findings and cross-disciplinary issues to be examined further in 2000-2001. The issues identified and discussed include the biology course content for the required year majors sequence, whether to add a third required course for biology majors in molecular genetics, the appropriate pre-requisite(s) if colleges adopt a third required biology course, reviewing and revising as needed the CAN biology descriptors, content areas, and sequences, and adding new CAN biology courses and/or sequences. Issues dealing with interdisciplinary issues included when should organic chemistry be taught, lower division or upper division, the amount of biochemistry that should be included in organic chemistry if it is taught at the lower division level, and the type of physics course required for biology major and the math requirement, i.e., three-semester calculus-based, two semester algebra-trigonometry based, or two semester calculus-based physics requirement. Courses in the biological sciences serve as requirements in other programs, including RN nursing, nutrition, and agricultural sciences. Most of the biology-related interdisciplinary issues dealt with the RN program and pressure from both colleges and external accrediting agencies concerned about the number of units required to complete the RN major. These issues are elaborated later in this report.

In particular, the discussions in 1999-2000 by the chemistry faculty on whether to teach organic chemistry as lower division or upper division have an impact on the biology majors in two respects. The first affects how much of the major preparation can be completed prior to transfer; especially at the four-year colleges that have a lower division organic chemistry that is a pre-requisite for an upper division organic chemistry required for biology majors. The second concern affects colleges adding a required third biology course for majors where organic chemistry has been established as a pre-requisite. Discussion of organic chemistry is recommended for 2001-2002.

Concerns surfaced about the biology major that did not deal with articulation, prerequisites, and/or majors' preparation, but rather with administrative issues of enrollment, class size and attaining additional fiscal resources such as Partnership for Excellence (PFE) funding at community colleges. Although these factors influence some biology departments in their decision-making process, the biology faculty agreed that concerns about class size and graduating more biology majors should not influence curriculum quality or academic rigor.

The differences in the approach and emphasis in teaching lower division biology majors courses were noted, where the community colleges and CSUs both strongly emphasize the lecture-laboratory approach, while many UCs have designed their lower division biology course as lecture courses. At many UCs, the approach to teaching lower division introductory biology may involve several lecture-only quarter courses and as few as only one introductory laboratory course.

Identified Trends/Future Directions

Several large urban community colleges have recently added a molecular genetics course as a third course requirement for their biology majors, increasing the unit requirement from 10 units to 13 or 14 units. The pre-requisite for this third course is completion of the two semester courses in biology; one college additionally requires organic chemistry as a pre-requisite for this third course. There are importance implications for students when colleges add a third course requirement, especially if the student wishes to transfer in two years.

Comments from Statewide Meetings and the General Field

The 1999-2000 recommendations on updating the CAN descriptions and developing new CAN sequences were reaffirmed in this year's discussions. There is a strong need to update the existing CAN descriptions and develop new CAN biology courses to more accurately reflect changes in biology, especially in the field of molecular genetics. The current CAN Biology course descriptions were developed when the discipline focused on botany-zoology. Since then great

strides in molecular genetics research have emerged, and updating CAN descriptors are greatly needed.

The new CAN sequences in biology proposed in 1999-2000 were reaffirmed, and faculty are still interested in having further discussion and finalization of these sequences. The biology faculty discussed and identified content areas taught in CAN Biol 2, 4, and 6 and identified twenty-five content topics or modules to use in describing BIOL CAN SEQ A. The discipline faculty recommended using more current terms to describe the biology courses and content in sequence A. (See Can Biology Changes.)

The introduction of Science Cluster II, particularly nursing, to a lesser extent agriculture and nutrition, shifted the dynamic of the discussion from the initial IMPAC pilot year. The dialogue expanded from the courses required for biology majors to discussing biology courses to require for the nursing curriculum. Microbiology, anatomy, physiology courses are required for RN Nursing majors. Of the three course microbiology is the least affected by the concerns expressed by nursing faculty about the total number of units required to complete the RN program. Microbiology is a four-unit course or a five-unit course with chemistry pre-requisite and no concerns were expressed about this RN requirement.

Some community college biology departments reported being pressured by their nursing colleagues to re-evaluate their anatomy and/or physiology courses. The total number of units for anatomy-physiology varies from five to ten units of lecture and laboratory, taught either as a single course, two separate courses, or two semester integrated courses. This pressure comes from two sources: the college itself and external accrediting agencies that certify RN programs. There is increasing concern among the community college nursing faculty about the total number of units students must take to complete the RN degree.

While the biology faculty are concerned about the number of units in anatomy and physiology, they strongly advocate maintaining instructional quality and rigor. Some reported pressure to reduce the number of units in anatomy, to teach specific anatomy content, and to eliminate or de-emphasize other topics. Others reported that requests were made to rearrange and restructure their anatomy and physiology courses. There was no general consensus on how to solve the problem of high-unit majors; at present each community college responds to specific local concerns.

The prerequisites for anatomy, physiology, and microbiology were discussed at all regional meetings. The pre-requisite course for anatomy on one community college required biology with a lab course. Chemistry was most commonly a required pre-requisite course for physiology. An anatomy course was strongly recommended before taking physiology. Chemistry is required as a pre-requisite for the microbiology course that is required for nursing or biology majors.

The biology faculty at the regional and statewide meetings met with other disciplines to discuss interdisciplinary issues. The following is a summary of those discussions.

Physics: The physics requirement for biology majors continues to be a dilemma for community colleges and their students.

The issue for the college is the ability to offer a three-semester, calculus-based sequence, compared to a two-semester algebra-trig based physics. Biology faculty expressed concerns about the purpose of the physics requirement for biology majors. Several issues emerged and remain unanswered, including discussing the student goal of pursuing a biology major (professional school or pursuit of knowledge in biology), identifying the role of physics as a requirement for the biology major, and identifying the appropriate level of physics to require for biology majors.

Unsubstantiated opinions and statements from faculty at four-year institutions that biology majors were pre-med students who did not make it to medical school were not well received by the biology and agriculture faculty. Conflicting comments from one regional meeting to the next dealt with whether or not calculus-based physics is required for admission to medical school.

This discussion stimulated comments on colleges structuring a course requirement to a specific student

audience, i.e., focusing in on the relevance of topics in physics for the biology students. Negative comments were heard from some physics faculty who taught "Physics for Biologists"–it was asserted that there were no suitable texts available using this applied approach, and the physics faculty teaching the course were not satisfied with the teaching process or the student learning. The unresolved issues include: 1) Which physics course to require for biology majors, three-semester calculus-based physics or two-semester algebra-trig based physics? 2) When should students take physics (before or after transferring)? and 3) Why do biology students take physics (biology majors with a pre-med focus vs. biology majors with multiple goals other than applying for medical school)?

Chemistry: Because of the number of chemistry and biology courses required in lower division (two to four chemistry courses and two to three biology courses, plus several math courses) the groups discussed the fact that many community college students defer taking physics until after they transfer. Biology faculty accept the importance of completing the first semester majors chemistry course as a pre-requisite for cell and molecular biology, but the pre-requisite for the emerging third biology course requirement of molecular genetics is an unresolved issue. Community colleges requiring the molecular genetics course for their biology majors are generally in urban areas with large student populations, located near a UC and several CSU. These colleges have a high number of transfers to the UC system. In addition, the chemistry pre-requisite for the molecular genetics course varies, but may include completion of organic chemistry. If the latter is required, this presents an additional barrier to completing the entire lower division requirements before transferring.

The biology faculty questioned the organic chemistry requirement for biology majors in terms of the course content, which only lightly touches upon topics of greatest concern for biology majors (i.e., biochemistry). It appears that this organic chemistry requirement is related to medical school, dental school, and pharmacy school, though the biology faculty agreed that the strong emphasis on synthesis organic is not as important as a more thorough discussion of biochemistry: carbohydrates, proteins, lipids, and nucleic acids. These topics are of great value to biologists in understanding metabolism, molecular genetics, cell physiology, and microbiology. A review of the two-semester organic chemistry required for chemistry majors, medical and pharmacy students ended in a difference of opinion between the biology and chemistry faculty as they did not agree on the depth of coverage. The biology faculty felt there were too much emphasis on synthesis and too little coverage of biochemistry (one or two weeks in the second semester and no coverage in the first semester of organic chemistry). This topic should be discussed next year.

Nursing: The interdisciplinary meetings with the biology and nursing faculty dealt with the tough issues of high-unit RN requirements for the community college nursing programs that received accreditation from the National League for Nursing Organization. Much of this dialogue originated from biology departments that were asked by their RN faculty colleagues to offer an anatomy course without a biology course pre-requisite for RN students. The biology faculty agreed, however, that pre-RN students who took a biology course before they took anatomy were much better prepared to succeed in the anatomy course.

There were also concerns about the balance of topics covered in the chemistry course for nursing students who need a brief introduction to basic chemistry, more organic chemistry coverage, and significant biochemistry coverage. The chemistry course deemed "ideal" for nursing students could affect the content of the chemistry pre-requisite course for microbiology and/or physiology and course transferability.

No one disputed the value and importance of chemistry as a pre-requisite for microbiology or physiology; the number of laboratory hours per week for these two courses varied from three to six hours per week. A limited number of community colleges have a physiology course without a chemistry pre-requisite. The groups felt that an analysis of the content of anatomy and physiology courses, the appropriate prerequisites for each course, and the number of units, lecture hours and laboratory hours should be undertaken.

Agriculture: The agriculture faculty expressed a concern about the prerequisites for the biology courses

their majors might take as electives. The main courses of interest to the agriculture faculty were botany/plant science/applied botany, entomology, and certain ecology courses. These courses had prerequisites that are achievable by agriculture majors (i.e., these courses usually did not require the 5-unit majors Chemistry as a pre-requisite) and the cell and molecular biology course was not a pre-requisite to taking the specialty biology courses of interest to agriculture majors.

Nutrition: Microbiology and physiology are the two main cross-disciplinary courses that nutrition and/or food science students take with respect to courses in biology discipline. This is especially true for dietetics majors. There were few concerns expressed about these courses; however, the chemistry pre-requisite for nutrition, food science, and dietetics majors was discussed. As with the RN concerns, the content and ability of these majors to complete the chemistry required for physiology and microbiology was discussed. Because the number of units was not an issue, the nutrition faculty more readily accepted the introductory chemistry courses required for their majors. The introductory level chemistry course is not the standard Chemistry 1A level, but a course that includes inorganic and a discussion of some organic/biochemistry. This course appears to satisfy the microbiology and physiology course prerequisites as well.

Recommendations for the Discipline

1. Research the latest changes in lower division biology courses at the CSU campuses and determine if the CSU system is planning to realign and reconfigure their biology courses and the chemistry pre-requisite(s). Identify the content of any realigned biology courses.
2. Research the latest changes at the UC level (see Recommendation No. 1).
3. Resolve conflicting data on the physic sequence required for biology majors and the mathematics prerequisites for these physics courses.
4. Resolve the chemistry requirements for the various sub-specialties (majors) within the biology discipline.
5. Identify the direction for possible changes in CAN biology courses: descriptions of the majors sequence A, new CAN courses and CAN sequences, identifying topics or content modules.
6. Determine the status of CAN in relationship to biology.
7. Work on completing, revising, and updating the grids in biology, unless the UC and/or CSU plan major biology course restructuring at the lower division level.
8. Continue refining the interdisciplinary dialogues with nursing, physics, and chemistry.
9. Undertake an analysis of the content of anatomy and physiology courses, the appropriate prerequisites for each course, and the number of units, lecture hours and laboratory hours.

Recommendations for Support Courses (if discussed):

Topics for Further Discussions

- High unit majors such as nursing and the role of prerequisites.
- Physics questions referenced above.
- Emerging third biology course requirement of molecular genetics.
- Inclusion of more topics in biochemistry in the organic chemistry course(s).
- Deciding if organic chemistry is lower division or upper division.

Recommendations Forwarded to CAN:

See next page.

Outreach Presentations

Los Angeles Community College District Academic Senate was informed of each Los Angeles region IMPAC meeting and the final statewide meeting. This included a regular agenda item at two or three District Academic Senate meetings. In addition, the Local Senate was informed of each LA region IMPAC meeting and statewide meeting.

CAN BIOLOGY CHANGES

Red: proposed new language
~~Strikethrough~~: proposed deletion of existing CAN description

CAN BIOL 2: PRINCIPLES OF BIOLOGY: CELL/MOLECULAR BIOLOGY

This course will cover principles and applications of basic chemistry, biochemistry, procaryotic and eucaryotic cell structure and function, homeostasis, cell ~~division~~ cycling, molecular biology, molecular genetics including signal transduction and transcription, Mendelian genetics, cell~~ular respiration~~ metabolism including both photosynthesis and respiration, virology, and immunology. The philosophy ~~and methods~~ of science, scientific method and experimental design are ~~emphasized~~ foundational to the course. Lab course.

The following eleven topics or content modules make up CAN Biol 2:

Basic chemistry
- Biochemistry
- Molecular biology
- Procaryotic and Eucaryotic Cell Structure and function
- Cell Cycling
- Cell Metabolism: photosynthesis and respiration
- Homeostasis
- Molecular Genetics: signal transduction and transcription
- Mendelian Genetics
- Virology
- Immunology

CAN BIOL 4: PRINCIPLES OF ANIMAL DIVERSITY

This course covers protists and the comparative structure, organ system functions, development, evolutionary history, taxonomy and systematics, and behavior of animals. Population genetics, ~~and~~ mechanisms of evolution including speciation and natural selection, and environmental impact are also ~~considered~~ emphasized. Lab course.

The following eight topics or content modules make up CAN Biol 4:

Protists
- Comparative organ systems: structures and functions
- Animal Development
- Mechanisms of evolution: population genetics, speciation and natural selection
- Phylogeny
- Animal taxonomy and systematics
- Behavior

Environmental Impact

CAN BIOL 6: PRINCIPLES OF PLANT DIVERSITY

This course covers photosynthesis, algal protests, fungi, comparative plant structure, organ system functions, development, evolution, phylogeny, and taxonomy of plants. Principles of population and community ecology and ecosystem interactions are ~~also considered~~ emphasized. Lab course.

The following eight topics or content modules make up CAN Biol 6:

Protists (algae)
Fungi
Comparative plant structure and organ system function
Phylogeny
- Plant taxonomy and systematics
- Photosynthesis
- Population and community ecology
- Ecosystem interactions

CAN BIOL SEQUENCE A: CAN BIOL Sequence A consists of the twenty-five topics (or content modules) listed for CAN Biol 2 + 4 + 6. Community colleges and the CSU campuses may offer the topics in their Biology Majors course year in any sequence (two semesters or three quarters), may combine their content topics or modules in different courses, and may use slightly different terms to describe their college's content topics or modules. At a minimum most community colleges offer the year major sequence as two courses, each consisting of three

lecture and six laboratory hours per week. The purpose of identifying content topics or modules is to enable four year universities to identify specific gaps in content coverage that could be used in course articulation; colleges could offer special topics courses in Biology to fill in on the content gaps.

CAN BIOL 12 HUMAN PHYSIOLOGY

This course covers basic biochemistry, cell metabolism, acid-base relationships, membrane function, basic genetics, alleles, and inherited disorders. The nine body systems are studied in the context ~~The study~~ of function, integration, and homeostasis of organ systems. Lecture/ Lab. Recommended: one college level course in each in anatomy and chemistry.

The following seven content topics or modules make up CAN Biol 12:

Basic biochemistry

Acid-base relationships

Basic cell metabolism

Membrane function

Basic genetics, alleles

Inherited disorders

The nine body systems: function, integration, homeostasis of organ systems

Recommended: Consider adding another new CAN Biology course (in addition to the molecular genetics recommended in 1999-2000:

CAN BIOL ZZ: BIODIVERSITY AND EVOLUTION

Course description to follow

Findings from 1999-2000; Reaffirmed 2000-01

Prerequisites for the Major

Biology Majors Courses

Content Distribution: Biology Courses—

two semesters; many are adding a 3rd semester course Molecular Genetics

1. Biology Principles, Cell, Respiration, Energy, Mendelian Genetics CAN Bio 2
2. Animal, Physiology Survey CAN Bio 4
3. Plant, Ecology, Evolution CAN Bio 6
4. New Course: Molecular Genetics CAN Bio X

("X" = identify a new CAN number)

CAN Biology Descriptors

CAN Bio 2: Principles of Biology: Cell/Molecular Biology

CAN Bio 4: Principles of Animal Diversity (Zoology)

CAN Bio 6: Principles of Plant Diversity (Botany)

CAN Bio Seq A = CAN Bio 2 + 4 + 6

CAN Bio 10: Human Anatomy

CAN Bio 12: Human Physiology

CAN Bio Seq B = CAN Bio 10 + 12

CAN Bio 14: Principles of Microbiology

[See Discussion below: Additional CAN Biology Courses and changes in content and descriptions are recommended]

Sequence for taking the classes CAN Sequence A [CAN Bio 2, 4 + 6]: there is no common order or sequence for enrolling in Biology courses for the major

a) Some colleges allow these three courses to be taken in any sequence

b) Most require CAN Bio 2 first, then the other two in any sequence

c) Some require the opposite of #b: CAN Bio 4 or 6 first, then CAN Bio 2 as the last course in the sequence

The Chemistry Pre-requisite for CAN Bio 2, 4, and/or 6: Most require Chemistry as a pre-requisite to CAN Bio 2 [commonly known as "Cell and Molecular"], but this varies depending on content alignment for these lower division Biology majors courses at each individual college [mainly where the "Cell and Molecular" are taught, i.e. in the colleges equivalent to CAN Bio 2, 4, or 6].

General Conclusion on Biology CAN Sequence A as currently configured:

a) The most important transfer and articulation factor for students is to complete the entire sequence before transferring; articulation agreements are very important, but some have not been honored

b) The challenge for CCs: to convince CSU, but especially UC, that the content covered in CAN Bio Sequence A is "close enough" preparation for success as a Biology major after transfer.

Chemistry Pre-requisite for Biology Major Courses

1. 1 Semester of non-Chemistry major Chemistry course
   CAN Chem 6
2. 1 Co-requisite of Majors Chemistry course
   CAN Chem 2
3. 1 Pre-requisite of Majors Chemistry course
   CAN Chem 2
4. Chemistry Descriptions
   CAN Chem 2 = 1st semester for the Science Major
   * Required for Bio 2, 4, or 6
   CAN Chem 4 = 2nd semester for the Science Major
   CAN Chem Sequence A = CAN Chem 2 + 4
   ** Required for the Biology Majors, but not for CAN Bio A
   CAN Chem 6 = 1st semester for Allied Health Majors
   CAN Chem 8 = 2nd semester for Allied Health Majors
   CAN Chem Sequence B = CAN Chem 6 + 8
   CAN Chem 12 = Quantitative Analysis (Most colleges do not offer)
   CAN Chem Sequence C = CAN Seq. A + CAN Chem 12
   CAN Chem 14 = 1st semester Organic Chem for Science Majors
   *** Some colleges that have adopted a three-semester lower division Biology sequence are considering requiring CAN Chem 14 for this "new" third "Cell and Molecular" – CAN Bio X course

CAN Chem 16 = 2nd Semester Organic Chem for Science Majors

*, **, *** are comments from the 1999-2000 and reaffirmed in the 2000-2001 discussions

Physics Requirement for Biology Majors

1. Most require 1 year of Physics w/o Calculus
   CAN Phys A
2. Some require 1 semester of Physics + allow 1 additional unit
   CAN Phys 2 to be taken after transfer to "make up for content gaps" missed
   CAN Phy 2
3. Physics Course Descriptors
   CAN Phys 2 = General Physics (Algebra/Trig based) Mechanics, Heat

   CAN Phys 4 = General Physics (Algebra/Trig based) Electricity, Optics, Modern Physics
   CAN Phys A = CAN Phys 2 + 4

   CAN Phys 8 General Physics (Calculus based) for Physical Sci/Engineering majors

   CAN Phys 12 General Physics (Calculus based) for Physical Sci/Engineering majors

   CAN Phys 14 General Physics (Calculus based) for Physical Sci/Engineering majors
   CAN Phys B: CAN Phys 8 +12 + 14

Comments:

1. The physics requirement for Biology majors presents a major problem because of the wide variation among CSU and UC on what math is required for the Physics course and why.
2. The Physics requirement varies from the three-semester, calculus-based Physics to one semester of Physics plus one additional unit to make up for content gaps at the CC.
3. The rationale for requiring Biology majors to take CAN Phys B is to ensure the university that the Pre-Med majors "do well" on the MCAT exam. No comments were put forth on the value of the content for Biology majors.
4. One CC had great difficulty in scheduling physics course sequences due to the polemic of wanting to offer courses required for the major juxtapositioned against administrative concerns for small class size and the cost involved in offering three semesters of low enrollment classes.

Math Requirement for Biology Majors Varies

1. Semester of Calculus
2. A GE Math Course

Statistics Requirement for Biology Majors

1. 2 require statistics
2. 1 has no statistics requirement

There was very little discussion on the math requirements for Biology

Recommended:

1. Add CAN Bio X –Molecular Genetics
2. Develop new CAN Biology Sequences

a) Organismic Biology: CAN Sequence A = CAN Bio 2 + 4 + 6

b) Allied Health Biology Preparation: CAN Sequence B = CAN Bio 10 + 12

c) Molecular Biology: new CAN Molecular Sequence 2 + 4 + 6 + X

d) Human Biology: new CAN Sequence 2 + 10 + 12 (Intro + Anatomy [10] + Physiology [12])

e) Biotechnology Track: new CAN Sequence 2 + X + 14 (Intro + Molec Gen. + Micro)

Discussion from 1999-2000—Issues in physics are still unresolved; New Can Biology has not occurred, Math requirements vary greatly with no general pattern

CHEMISTRY

Prepared by William Fink, UC Davis, Lead Discipline Faculty for Chemistry

Summary of Identified Issues

For the most part, articulation of chemistry majors between community colleges and four-year institutions works well. The greater the flow of information between the four-year campus and its local community college feeders, the more successful is the articulation process and the articulating student. There are occasional problems encountered by students who have perhaps not understood the demands of the chemistry curriculum. As occurs in the curriculum of many science majors, the first two years of the chemistry curriculum is spent teaching and learning the fundamentals of the subject. The unit load of these fundamentals is appreciable and includes the following:

- 2 years of mathematics
- 1 year of physics with calculus
- 1 year of general chemistry
- 1 year of organic chemistry
- 1 semester of quantitative analysis (if possible).

Given the curriculum demand within the major, there is little room to satisfy general education requirements, and students who concentrated solely on IGETC may arrive on the receiving campus having finished little of the fundamental work for the major. If this happens, the student's progress to the degree will be lengthened minimally by one year, and often by nearly additional two additional years.

While articulation of general chemistry courses between the segments works very well, there is not the same universal experience of good articulation for the organic chemistry sequence. There are many historical, pedagogical, and financial aspects reasons for this difficulty.

1. Many four-year campuses have designated organic chemistry as an upper division course, thereby creating a barrier to articulation to those campuses with organic chemistry designated as upper division. To some this designation is extent historical with the institutions; to some extent, it is pedagogical as the course's intellectual content is very demanding. Nonetheless, the central role that organic chemistry has assumed in many sciences requires that students in many disciplines take it early in their academic careers so they may build upon that central base of knowledge. It is therefore important that community colleges teach organic chemistry effectively.

2. The community college faculty indicated that local financial resources were often stretched to their limits by the demands of instrumentation purchase and maintenance. It is extremely important that local community college administrations understand that a commitment for quality instruction in chemistry for their students requires the attention of full time Ph. D. chemists as instructors and the provision and maintenance of reasonably modern laboratory instruments.

3. The range of responses to organic chemistry for articulation purpose varies widely with the receiving campus: Some campuses will accept articulation only if transferring students score satisfactorily on a standard examination in organic chemistry. Others have different levels of organic chemistry courses to which articulation agreements may be written. Lastly, students sometimes perceive that it could be advantageous to get upper division credit for organic chemistry by delaying taking it until after transfer.

One very positive outcome of the IMPAC discussions between four-year institution faculty and the community college faculty has been the communication that the upper division vs. lower division credit is truly unimportant for the academic careers of transferring students. The accumulation of these historical, pedagogical, and financial complications for articulation of organic chemistry present barriers that can be overcome, but creates difficulties for transferring students. Complicating the articulation of organic chemistry for chemistry majors is the fact that many other science

majors need organic chemistry, perhaps not to the level of laboratory experience and practice that is needed by the chemistry major. Many of the receiving campuses have instituted separate course sequences to satisfy the needs of majors of other than chemistry, but because of much lower enrollments, it is often not possible for community colleges to offer more than a single organic chemistry sequence. Additional discussions and efforts on the part of both receiving campuses and the community colleges will be required before a general solution of these organic chemistry articulation issues can be remedied. The discussions this year have helped to clarify the issues for both receiving campuses and the community colleges.

Cross-disciplinary discussions with nursing faculty have identified a desire on the part of the nursing faculty to develop a one-semester course covering general chemistry, organic chemistry, and biochemistry, with topics carefully selected to produce the expertise in chemistry that a practicing nurse requires. Presently there is a two-semester course covering these topics, but because of unit caps on the nursing curriculum as a whole, nursing faculty feel they cannot afford the typical ten units of this course in their curriculum. Because of the importance of chemistry as a basic science for nursing, the nursing faculty do feel a common background in chemistry is essential for all nurses; they hope to further this discussion with chemistry faculty at individual campuses to develop the ideal course.

Identified Trends/Future Directions

1. Articulation of Organic Chemistry

Most important is the internal handling of articulation of organic chemistry courses. As this is discussed, however, the chemistry faculty must bear in mind the need for organic chemistry in other disciplines, and that the majority of students in organic chemistry are, in fact, majors in these other disciplines. While the intellectual rigor of the courses must be maintained for these students, the laboratory need not so demanding as for the chemistry major. Compromises for articulation may be achievable, with receiving campuses providing additional laboratory experience for the chemistry major, while recognizing and accepting the articulating student's achievements in the lecture portion of the course.

2. Nursing Discipline's Needs

Extensive local discussion between chemistry and nursing faculty will be required if the nursing faculty's desire for a one-semester chemistry course for nursing is to be achieved. A major concern, particularly at smaller community colleges, will be whether the creation of a separate course for nursing will erode demand for the more complete two-semester course to the point where it can no longer be offered. Other disciplinary areas that might also be affected—e.g. nutrition and dietetics, radiation technology, dental hygiene, and dental assistance—may also need to be included in the discussions.

3. Distance Learning

Finally, disciplines will need to grapple with the role of distance learning and instruction delivered over the Internet. This is particularly important for the laboratory sciences such as chemistry, where the hands-on laboratory experience has been regarded as an essential component of the instruction.

4. Changes in Instructional Calendar

Changes in the structure of the academic year and the resulting impact on instructional modes were discussed. As local administrations experiment with innovative instructional time frames, these aspects must be recognized.

Comments from Statewide Meetings and the General Field

From the San Diego Regional Meeting

CSU San Marcos is presently undertaking an experimental resequencing of the first two years of chemistry major courses from 2 semesters General Chem followed by 2 semesters of Organic Chem to 1 semester of General Chem, 2 semesters of Organic Chem + final semester of General Chem.

The intent of the reordering is to permit students time to bring their math and quantitative skills up to needed levels for the second semester of General Chemistry while enabling progress to be made through the more descriptive material. They expect that they will eventually dual track students, permitting those with demonstrably prepared math skills to follow the traditional order while using the newer order for those students who are not yet fully math prepared. The community college contingent sees a similar lack of math skills as an impediment to student progress, but notes that their cadre of students has a still lower level of preparation such that they need both math preparation and a chemistry prep course before entering general chemistry. This latter experience seems similar to the level of student preparation at UC.

A very laudable grass roots movement similar in intent to IMPAC has been active among the San Diego County Chemistry departments. They have an annual meeting that is held in rotation at the different institutions with attendees from all community college, CSU and UC chemistry faculty where articulation, pedagogy, and other academic issues are discussed. Perhaps IMPAC can help to export this idea to other areas of the state.

There was extensive discussion of means to increase the level of competency of students entering general chemistry. Use of a screening diagnostic test is widespread.

Articulation among the institutions seems to be working well for general chemistry. There are some anomalies regarding equivalency of organic chemistry courses. Examples of UC campuses accepting equivalency of a course while a CSU campus denies it, and an UC campus requiring passing at the 75th percentile on the ACS final exam were reported. IMPAC may be in a position to provide a network of contacts for instances when outright denial of equivalency is an outcome of course articulation review. Instructor to instructor contact may clarify ambiguities in documentation of course articulation agreements.

The rising role of distance learning has not yet presented itself in articulation issues for chemistry major courses, but this moving target may add complexity to articulation in the near future.

Afternoon cross-discipline discussions with nutrition and nursing were held. The discussion with nutrition centered upon identifying suitable chemistry courses for prerequisites to enable community colleges to teach courses in nutrition that would transfer as equivalent to courses at 4-year institutions, offered typically in the sophomore year, that have a chemistry prerequisite. The course commonly taught at community colleges that have a semester of general chemistry followed by a semester of organic and biochemistry was suggested as a suitable prerequisite.

The major concern regarding chemistry from the nursing instructors was how to get chemistry into their curriculum for the ADN while staying under the total unit cap imposed by the National League of Nursing. Some alternatives discussed were: 1) Removing some GE requirements for the nursing curriculum such as possibly creating a new degree of Associate in Nursing rather than Associate in Science in Nursing. The new offering might avoid the necessity of meeting some of the GE requirements presently being imposed. 2) Moving some required clinical work outside the boundary of the degree as part of a "residency program". This alternative did not seem practicable to the nursing instructors. Other discussion paired the issue of the ever-expanding demands of new knowledge being required for professional competence in many technical areas and the increasing inconsistency of that increase with a two-year/four-year curriculum.

Concern regarding a broader articulation with proprietary private institutions such as National University of Phoenix University was also expressed, as increasing numbers of community college students transfer to them. As these private institutions have expressed little concern about articulation issues with the community colleges, some of the rewards for community college preparation of students for transfer vanish when the transfer is to such institutions.

From the Bay and North Regional Meeting

The chemistry session began with a statement that to make a smooth transition to a four-year institution, students making normal progress towards transfer in the chemistry major should complete the following coursework

1 year general chemistry
1 ½ years Calculus
Linear Algebra and Differential Equations
1 year organic chemistry
A physics with calculus course
1 semester of quantitative analysis or equivalent

Often transfer students divert their attention to completing GE requirements. To the extent that completion of GE requirements takes time away from their completion of the above central major material, they may wish to consider carefully the point at which they focus on general education requirements.

A lengthy discussion of the importance of quality instruction in the organic chemistry course ensued. A number of four-year campuses expressed reservations about the laboratory-readiness of their community college transfer students. The importance of good instrumental exposure, instruction, and experience is paramount. Participants expressed a divergence of opinion regarding the importance of hands-on experience of NMR: some believed that the hands-on experience could not be replaced by instruction via simulations, while others believed a firm grasp of the underlying theory of NMR was more important for long-term success. All agreed, however, that instrumental experience is important for chemistry students who must convert textbook exercises into practical working abilities. Significantly, the community college faculty indicated that local financial resources were often stretched to their limits by the demands of instrumentation purchase and maintenance, as well as the hiring of full time Ph. D. chemists. From these discussions, two requests emerged:

- Some community college faculty expressed a desire to have the four-year faculty identify two levels of instrumentation experience: the absolutely required vs. the ideal exposure.
- Faculty at four-year institutions, on the other hand, expressed a desire for more information to be provided in course articulation requests. Particularly helpful would be to include indications of course expectations such as old exams, course syllabi, and laboratory experiment descriptions.

Fostering a network of known contacts to transmit this information among the practicing professionals involved in the course creation and the course articulation approval process can help enormously in resolving ambiguities in submitted information. One of the important outcomes of IMPAC is the generation of these networks.

Another point of concern among both community college faculty and four-year institution faculty was a worry about a disparity of standards across institutions. Community college faculty indicated worries about enrollments shifting between community colleges in the same area if one campus offers a course that is perceived by students as being easy, while another adheres to rigorous instruction. From the perspective of the four-year campuses, courses that have similar descriptions from different institutions produce significantly different student backgrounds.

During afternoon discussions with the nursing faculty, they expressed a desire for a one-semester course that would cover the essentials of general chemistry, organic chemistry, and biochemistry as related to the practice of nursing. This course was of particular interest for the Associate Degree in Nursing programs where unit caps on the program force the faculty to make very hard decisions about material to include/omit from the program. A one-semester course in the essentials of chemistry for nursing would be a major step in producing better nurses for the new millennium. Two institutions in attendance indicated they were cooperating with their local nursing programs to meet these needs. San Francisco City College has a draft course outline prepared for precisely this purpose. CSU Chico is

developing a course to be delivered by distance learning methods to provide outlying nursing students fundamental instruction in chemistry. The merits of these two programs need to be monitored for possible extension to other campuses of higher education in California.

From the Los Angeles Metropolitan Area Meeting

During the chemistry breakout session, two major topics regarding articulation difficulties for students between community college and four-year institutions were discussed. These were: 1) difficulties students encounter after transfer if they have not appropriately prepared themselves for the major; and 2) the continuing ambiguous placement of organic chemistry within the upper or lower divisions and the consequences for transferring students.

Some transfer students choose to focus on breadth requirements at the community college and delay the basic core courses of general chemistry, organic chemistry and mathematics; this strategy may have educational benefits while still being detrimental to student progress. In a highly pyramidal curriculum like chemistry, students who have not completed the basic chemistry, math and physics courses in timely fashion during their lower division study find themselves necessarily stretching their time to graduation by a minimum of an extra year. UC Irvine has instituted a policy that students may not transfer to the campus as a chemistry major without having at least completed general chemistry and one year of calculus. Community college instructors indicated that their counselors may lack information regarding the importance of completing the basic science and math courses before students transfer to the four-year institutions. They encouraged the incorporation of such advice in flyers or letters sent to community college counselors.

The issue of whether organic chemistry is an upper division or a lower division course and what strictures are placed on articulation for that course for community college students was discussed at considerable length. The following represents the range of responses: Some institutions

- partially accept community college organic chemistry courses, requiring students to complete additional courses in organic chemistry.
- accept the equivalency of the community college course only if the student scores successfully on a standardized organic chemistry test, such as is available from the ACS chemical education division.
- offer their organic chemistry as an upper division course.

Community college students perceive a disadvantage in taking the community college course for which they will not receive upper division credit, particularly when they will be obliged to complete specific numbers of upper division units as a requirement for the degree at their transferring institution. This latter concern about the required upper division units after transfer was strongly rebuffed by those attendees from the four-year institutions that accept the equivalence of the community college course. They pointed out that there are ample numbers of upper division requirements that a transfer student must yet take and that, at least for the typical BS degree, those specific chemistry requirements along with any remaining upper division breadth requirement are sufficient to meet the degree requirements for upper division credit without any additional work. Community college attendees again expressed interest in having a letter from the four-year institutions directed to the chemistry chairs and to the academic counselors at the community colleges that would explicitly point out the ease with which the upper division unit requirement for the degree is met. The students' grapevine convinces them that it is "better" to take organic chemistry after transfer than before, and this grapevine information may be limiting enrollment in community college organic chemistry courses to the point where the courses are not offered for lack of sufficient enrollment. Absent a universal agreement on the treatment of articulation of the organic chemistry courses, it would be useful to try to develop a small number of standards out of the existing treatments and to identify which institutions fall under which standard.

The suggestion that CSU campuses develop a plan for articulation of organic chemistry across their statewide system arose. Since there are more intercampus transfers within the CSU system than generally within UC, there would be greater interest in developing a general articulation plan. Once the CSU system had established a norm for transfers within itself, that norm might serve to move both the community colleges and UC to move toward its acceptance.

Chemistry met with nursing faculty after lunch. The chemistry group was interested in hearing what the nursing profession wanted for a chemistry course. The chemistry requirements for nursing programs vary widely across the state. Some require no chemistry, others require courses involving general chemistry, organic chemistry, and biochemistry. The nursing instructors indicated that their programs are under increasing pressure to include more specialized topics, and that they believe that better preparation in chemistry is desired for their students, but that the community college programs do not have sufficient units available to accommodate two semesters of a five-unit course. They are very interested in working with chemistry instructors to develop a one semester five-unit course that would include components of general chemistry, organic chemistry, and biochemistry of importance to nursing.

From the Central Area Regional Meeting

Once again, the difficulties of smaller community colleges to purchase and maintain the expensive instrumentation and to hire appropriate faculty needed for modern organic chemistry arose. The biology curriculum at Oxnard Community College has recently added one-semester organic chemistry course; however, their administrators were concerned that requiring only one semester of the year-long course would lead to insufficient enrollment during the second semester. Subsequently, they withdrew their support for the one-semester course.

The UCSB community college outreach program promotes awareness that science majors should complete the lower division courses required for the prior to transfer. The outreach officials are meeting on a regular basis with counseling officers at community colleges and are explaining this preference to them. All UC and CSU outreach efforts should be encouraged to reinforce this message to ensure satisfactory progress by transferring students.

Changes in the structure of the academic year and the resulting impact on instructional modes were discussed. For example, for laboratory instruction, fifteen 3-hour blocks are more efficient than the equivalent amount of time presented by twelve 3-hour-45-minute blocks. As local administrations experiment with innovative instructional time frames, these aspects must be recognized.

Cuesta College employs distance learning to meet the needs of students whose schedules cannot readily accommodate conventional lecture times. The Archipelago program is used as a web and media based replacement of the lectures. The software is flexible enough to insert local requests for electronic interaction with the instructor of the course. This provides a mechanism to ensure steady student progress. The students complete the laboratory portion of the course in conventional laboratory sections.

In cross-disciplinary discussions, both nutrition and nursing faculty expressed an interest in an integrated one-semester course including general chemistry, organic chemistry and biochemistry. The Associate Degree in Nursing (ADN) programs are under severe pressure to accomplish their curriculum under mandated unit caps, but believe their students need a good course in portions of chemistry relevant to nursing. A dilemma facing smaller community colleges is the budgetary restrictions of offering multiply targeted chemistry courses, each with low enrollments. If a steady enrollment of about twenty or twenty-five students can be assured, then a targeted course can be developed. San Francisco City College has developed a course that appears very attractive to the community college nursing curriculum. A drawback for students taking a one-semester course for an ADN program, however, will be that should they choose to transfer to

a four-year program that requires a two-semester course, they will be confronted with an articulation problem requiring additional, perhaps repetitive work. At those community colleges where enrollment can justify such a specialized chemistry for nursing course, the chemistry faculty and nursing faculty need to begin dialogue to define the parameters and content for the course.

The discussion with earth sciences faculty centered on the importance of the including descriptive inorganic chemistry in the general chemistry course. Chemistry curricula have been emphasizing atomic structure and molecular bonding, but for earth science applications, some more pragmatic material is especially important. Included would be:

- topics of societal importance and economic significance of compounds,
- the origin of compounds from their ores and the processing of required to render them,
- mineralogy and solid phase crystallography,
- silicate chemistry, and
- rudiments of radiochemistry as applied to estimates of mineral ages.

The chemistry faculty assured the earth science faculty that these topics are addressed in general chemistry, that the depth of treatment of any one of them is, of course, variable among institutions, but that chemistry faculty are sensitized to the need for inclusion of practical, macroscopic level, descriptive chemistry as well as the abstract, molecular composition of matter.

Recommendations for the Discipline

1. Initiate a project to establish categorically the courses to which community College courses must articulate on each of the four-year campuses. This project should solicit revised descriptors for CAN courses that the receiving institution would be prepared to accept as a description of a course articulating with their courses. The meetings this year have been conducted with circulation of a grid of courses believed to be the target courses for articulation at each of the 4-year campuses in California, but many technical errors were identified in these grids during the course of the meetings. Further, the premise of the grid was articulation to the B.S. major curriculum. That premise is, however, too narrow to address all the articulation issues. A minimum of three grids is required, because many of the articulation issues involve students who transfer with majors other than chemistry. The grids for B.S. major in chemistry, A.B. major in chemistry, and B.S. major in biochemistry should be collected, along with suggested CAN descriptors for courses that receiving institutions would accept for articulation to their courses. The present CAN descriptors may be used as suggested starting points campuses comment. Specific information regarding how the campus handles articulation of transfer students offering a community college course in organic chemistry should also be solicited. This project would provide information for recommendations 2 below.

2. Develop a limited number of typical models for treatment of articulation of organic chemistry courses. With the aid of the information provided from the receiving campuses, it should be possible to formulate these models. Subsequent identification of which campuses adhere to which models and dissemination of that information to community college faculty can greatly resolve the ambiguities and uncertainties that cause much of the anxiety for transferring students regarding the articulation of their organic chemistry courses.

3. Monitor the success of chemistry for nurses courses now offered at City College of San Francisco (and being readied by Chico) for possible implementation on other campuses.

4. Consider identifying a number of standards regarding the transferability of organic chemistry and identify which institutions fall under which standard.

5. Explore the possibility that CSU campuses would develop a system-wide plan for articulation of organic chemistry for presentation and discussion with other segmental faculty within IMPAC

6. Use the good offices of IMPAC to achieve the following:

- assisting local campus chemistry and nursing faculty in their efforts to develop courses that will serve their students needs;
- expanding or supporting current regional discussions among chemistry fashion as is currently done in the San Diego area.

Topics for Further Discussion

Resolution of the articulation problems of the organic chemistry course will take some time. Continued discussions of this point are essential. Development of the course for nurses will also remain a discussion point. While the chemistry faculty have taken the approach that only articulation of complete course sequences should be attempted by students, the lead taken by physics and biology to identify units of instruction that need to be included should be examined for its potential applicability to general chemistry and organic chemistry. Perhaps some preliminary discussion regarding distance-learning courses and how to deal with laboratory in that context may be broached.

Recommendations Forwarded/to be Forwarded to:

CAN: Explore the possibility of a revision of the CAN process, that might attract UC's participation in CAN. Revision of the chemistry course descriptors compiled from recommendation 1 above might achieve broader consensus as an articulation vehicle. Further revision of the CAN process might require each course seeking identification with a CAN number to be subject to examination and certification of course content quality by a faculty review committee containing representatives of all three segments of higher education in California. This quality certification by a faculty committee would carry significant weight in individual articulation agreements. Eventually, as confidence in the CAN process grew, CAN certification might begin to serve as a central articulation review, strongly reducing or possibly replacing the present need for multiple binary agreements. The existence of the IMPAC project and its continued funding may make this a propitious time to initiate these changes, as resources may be available to establish this revision. Such a possible revision of procedure might be shared with CIAC to explore whether UC would be willing to reconsider its participation in CAN if revised.

CIAC: If CAN is prepared to consider a revised procedure involving joint faculty review of course quality, would it become a vehicle by which the three segments can pursue simplified articulation procedures? Consider its possible impact on existing mechanisms of articulation. Would it interfere with present procedures for reaching articulation agreements? Could it complement and/or assist present procedures?

MATHEMATICS

Prepared by Marshall Cates, CSU Los Angeles, Lead Discipline Faculty for Mathematics

Summary of Identified Issues

Four areas of concern arose in nearly every meeting: 1) The level of Differential Equations and Linear Algebra, which is sometimes upper division and sometimes lower division; 2) The need and level for instruction in writing proofs; 3) The need for early warning and informal contacts between community colleges and four year institutions whenever curriculum changes are planned; 4) The need for a description for Discrete Mathematics, a course of great interest for Computer Science.

Identify Trends/Future Directions

Physics is nearly universally required as part of the Mathematics Major. It is seen as the most important way for students to put the calculus to work, after all calculus was invented to solve physics problems, and as a way to solidify the concept of vectors. However, in the last 50 years other areas have become more quantitative, using mathematics extensively. Economics, biology, and computer science are but three of several areas where mathematics majors could put their mathematics to work. It was argued successfully at one of the regional meetings that we should no longer cite physics as being required in a model mathematics major. We should embrace the concept that for some students, other math intensive applications would better suit their needs. Thus we should allow for different sciences or applications to play the role in the major, once filled by physics.

At least in the CSU, a larger and larger percentage of mathematics majors are planning on being high school mathematics teachers. Consequently departments will have to examine their major, not only allow for such preparation, which we all do, but to really make it one of our core concerns.

Comments from Statewide Meetings and the General Field

It was argued that physics should not be required of every mathematics major. There are now several disciplines that have intensive use of mathematics at the level accessible to early mathematics majors. We should allow these in the major in place of physics. This argument, when first proposed was rejected by all community college instructors, in fact by most all in attendance, but as discussion continued giving examples of valid learning objectives from different disciplines, more and more acceptance followed, until in the end, a motion to this effect passed. As a side note, there was a comment to the effect that the host of biology prerequisites for upper division biology classes has kept mathematics majors from contributing to the growth of mathematical modeling in that field. Mathematicians would have a lot to contribute in the modeling arena without having to know the vocabulary of anatomy classes for example.

The computer science faculty presented their need for a course in discrete mathematics. Their professional organization had adopted a list of topics for such a course. At a joint meeting between mathematics and computer science, we debated the design of this course. Much of the debate centered on the prerequisite for such a course. The prerequisite sets the level of the class. This was a difficult decision since, a calculus prerequisite would delay students taking the class in the major, while the level or depth of the class would greatly benefit from a calculus prerequisite. At the joint meeting with computer science faculty the majority opinion settled on a calculus prerequisite, that is the sophistication desired would require a stronger background.

The discussion of the role that community colleges should play in the development of competence in creating proofs started with the desire by computer science for their majors to have early training in this area. This is usually accomplished in a class such as discrete structures. Since the construction of proofs is the essence of upper division mathematics, clearly mathematics majors are also in need of instruction. Most four-year institutes have found it necessary to create specialized classes to help their mathematics majors develop this essential skill. All community colleges demonstrate proofs in their classes and most ask students to prepare proofs, but few give actual instruction on proof techniques. It was recommended that all community colleges try to incorporate proof instruction into key classes.

We spent a great deal of time looking at CAN descriptors. In fact, most was spent on the description for the General Education course for liberal arts majors. Finally, we

admitted that we had not come prepared to discuss in detail the description of these service courses, but could make some headway with major courses. Subsequently, we abandoned even that modest goal, finally coming to believe that a separate conference on CAN descriptors was needed to make consensus headway.

Recommendation for the Discipline

If a four-year institution's requirement for differential equations is at the upper division level and a transfer student has taken a similar course (at the lower division level) the four-year institution should try to give "content" credit for the course even though they cannot transfer the course.

The same for linear algebra, recognizing that there is a strong difference between an early junior level and a senior/graduate level linear algebra course.

Four-year institutions should keep in close contact with their area community colleges. They should alert them early in the process about proposed changes in the curriculum including major course modifications. This is especially important if the proposed changes could affect articulation agreements. It is proposed that on a regional basis that there should be a face-to-face meeting at least once per year. Institutions could rotate hosting such meetings.

Proofs need to be part of the community colleges' curriculum. Not just demonstrated in classes, but expected of mathematics majors. It is unlikely that community colleges can support a separate course for this purpose, but it is essential for students to do proofs within existing courses.

Recommendations for Support Courses

Discrete mathematics is an important issue for computer science. Roughly speaking, finite mathematics is the non-calculus mathematics useful to business majors and discrete mathematics is the non-calculus mathematics useful or necessary for computer science majors. Thus Boolean algebra, the fundamental mathematics of and/or decision making and Lattice Theory, the structures underlying data structures are topics to be included in discrete mathematics courses. While the topics are not fully prescribed in this emerging course, there is a great deal of agreement. Computer science professional societies have developed lists of suggested topics. What is not well discussed is the desired level of such a course, and where is the ideal position in the curriculum for such a course. Unfortunately, the desired placement for the course (early or later) is at odds with the desired level (freshman, sophomore) for the course. Add to this mix the desired sophistication of the problems considered in the course and there is no general agreement.

Topics for Future Discussion

- Engage in relevant discussions with Engineering. A review of the topics needed from calculus as well as the need for experience in modeling would be two starting points.
- Discuss with computer science the outcomes desired from Discrete Mathematics as well as the level of prerequisites.
- Discuss the content of the service courses for prospective elementary school teachers. There is a disparity between the demonstrated performance in elementary topics such as fractions, percentages, and number sense and the areas we think should be learned such as geometry, number theory, statistics.

Recommendations Forwarded/ to be forwarded to CAN

Convene a CAN discipline review committee to thoroughly review CAN descriptors. Can descriptors for Discrete Mathematics and for Mathematical Proofs need to be created. Our review indicates that while the major courses are in pretty good shape there is much disagreement in the descriptors for the service courses such as the General Education courses for non-quantitative majors, the math for elementary teachers, and statistics. While we started this review at our statewide meeting it was clear that the participants didn't feel empowered to propose these descriptors. Participants for this review committee should be empowered by their institutions to propose changes. The process then should continue with a wide dissemination of the proposed changes with feedback solicited.

PHYSICS

Prepared by Larry Coleman, UC Davis, Lead Discipline Faculty for Physics

Summary of Identified Issues

Two physics sequences are of importance in articulation. We define these as follows.

1. University Physics (CAN Physics B or C) is the course taken by physical science and engineering majors. It uses calculus up to and including multivariable (vector) differential and integral calculus. This course has an associated laboratory for all but the modern physics term. It may or may not include a discussion section as well as a lecture.

2. College physics (CAN Physics A), sometimes referred to a "pre-med" physics, physics for biologists, or "algebra-trig" physics. This course is/can be taught with a small amount of calculus. College physics includes an associated laboratory.

Out of these designations arises a fundamental issue: the lack of articulation for the college physics course, as the vast majority of community colleges cannot offer both an algebra-trig course and physics course demanding "a little bit of calculus, in addition to the more demanding physics course for the intended major. The solution here will demand a collaboration of the physics faculty and faculty in other disciplines, particularly those in biological sciences, to reach an agreement that the "little bit of calculus" course can be articulated to the algebra-trig course. The solution of this issue would be a major step in easing this problem encountered by transferring students in these fields.

A related issue is the nature of the physics needed by those bioscience students intending to enter the health science fields. Presently, there is confusion as to what medical and similar professional schools require of their incoming students and what may be tested as part of their admissions process. We have agreed with the biological sciences faculty to investigate the desires of these post-graduate schools and seek to respond to the needs of those students.

A third issue emerges when students do not complete the physics sequence at a single institution, rather taking a semester here, another there, and hoping to complete some work after transfer. This piecemeal approach seldom is serviceable: students miss out on crucial units or topics offered in differing semesters at different institutions, and repeat segments they have had in a prior course. On the other side of the transfer process, the receiving institution is likely to require these students to repeat an entire course simply to acquire those essential modules not yet taken. To reduce costly and needless repetition, to reduce students' understandable frustration, to promote progress to degree, yet to ensure students' appropriate preparation, physics faculty must continue to resolve this issue. Several potential solutions are discussed in this report.

Identified Trends/Future Directions

Some universities (UC Davis) and several community colleges are currently offering mini-units to augment existing course work, permit review of topics, and allow transfer students who did not acquire education in some modules to make up that deficit.

At UC Davis, for example, one-unit modules are offered as a need is identified on a case-by-case basis as students transfer into the physics program. Similar self-paced modules are being explored on community college campuses in conjunction with labs or learning centers.

Comments from Statewide Meetings and the General Field

Physics faculty from all three segments met at the statewide meeting. Overall, there was easy agreement on the basic lower division major curriculum. The introductory physics curriculum has been fairly "standardized" as evidenced by the lack of variance in the textbooks.

During the 2001 statewide meeting, the assembled physics faculty focused on the university physics course, and in discussions with our bioscience colleagues on the college physics course.

Outstanding questions for the major preparation curriculum are these:

- How much modern physics and when? – CAN Physics Sequence B or C?
- Is introductory calculus based physics one year, four quarters, or three semesters?
- How much of what type mathematics should be pre or co-requisite to which sections of the course?
- How to deal with non-uniformity of sequencing within the course—a particular problem for students who do not complete the sequence before transfer, or who attempt to assemble the sequence by taking different terms at different community colleges.
- How much linear algebra and differential equations should be required in the lower division?

The first two questions are linked as the amount of modern physics included in the "introductory course" is a major portion (but not all) of the differences in the course length. The third question is complicated by the differences in mathematics sequences and the sequencing of the physics topics within the university physics course. We spent a good part of the statewide meeting working out a solution to the fourth question of sequence variation (see below). The fifth question was not significantly addressed and will need more discussion among physics faculty.

The statewide meeting focused on questions of topic sequence within the university physics course. We agree that some variation is to be expected and that we can ameliorate the negative effects of this on transfer by "decreasing the granularity" of the CAN system. We propose to agree on a set of physics topics or modules that could then be assigned module numbers. Thus the university physics sequence (as well as the college physics sequence) would be described not only by the current brief catalog description but also by the module numbers in each term. In this way instructors and articulation officers and college staff would get a much clearer picture of how much a student had covered in the sequence. This scheme would mean that an individual term-long course would be designated with a CAN number followed by a listing of the covered modules. Thus, those students required to have physics for a variety of majors, and particularly those who do not complete the sequence at a single institution, would readily understand in which term they would be offered urgent sequences. This method would also permit their counselors and their receiving institutions to readily identify which modules the student had completed, and identify strategies to enable students to complete needed "missing" modules without repeating coursework or delaying progress for transfer.

Our group discussion resulted in the following set of draft "course modules." For each module we have listed the major subtopics/concepts. We present the below for discussion in a wider group of physics faculty.

Module 1: MECHANICS
- Vectors and Scalars
- Newton's Laws
- Statistics
- Linear Kinematics and Dynamics
- Rotational Kinematics and Dynamics
- Conservation Laws
- Gravitation

Module 2: MECHANICAL WAVES & OSCILLATIONS
- Waves on a string
- Standing Waves
- Interference
- Resonance
- Superposition
- Sound
- Doppler Effect

Module 3: SIMPLE HARMONIC MOTION

Module 4: THERMAL PHYSICS
- Calorimetry
- Heat Transfer
- Kinetic Theory
- Thermodynamics

Module 5: FLUIDS
- Density
- Hydrostatics
- Archimedes Principle
- Pascal's Principle
- Hydrodynamics
- Bernoulli's Principle

Module 6: ELECTROSTATICS & DC CIRCUITS
- Charge
- Coulomb's Law
- Fields
- Potentials
- Gauss's Law
- Voltage, Current, Resistance
- Capacitance
- Kirchoff's Rules
- Flux
- EMF (?)

Module 7: MAGNETISM, AC CIRCUITS & MAXWELL'S EQUATIONS
- Faraday's Law
- Ampere's Law
- Biot-Savart Law
- Magnetic Fields
- RC,RL,RLC Circuits
- Phasors
- Inductance
- Lenz's Law
- Flux(?)

Module 8: E&M WAVES
- Speed of Light
- Color, Frequency
- Momentum and Energy of E&M Waves

Module 9: GEOMETRIC OPTICS
- Reflection
- Refraction
- Ray Tracing
- Lenses
- Mirrors
- Optical Instruments

Module 10: PHYSICAL OPTICS
- Interference
- Diffraction
- Polarization
- Dispersion
- Resolution
- Phase

Module 11: SPECIAL RELATIVITY

Module 12: QUANTUM MECHANICS
- Experimental Basis of Quantum Mechanics
- Particle-Wave Duality
- Wave Functions
- Atoms and Molecules
- Applications of Schrodinger's Equation
- Topics from Solid State, Nuclear & Particle Physics

It should be noted this is but a starting point for needed further discussion. The CAN Board and the segments would also have to adopt this modification/addition to the CAN scheme.

Our discussion with the biology faculty centered on the college physics sequence (CAN Physics Sequence A). This is the course required for biological science majors of all types and some of the other science majors, for example psychology, BA in geology, physical therapy, consumer science, *et cetera*. On all of the UC campuses and approximately one half of the CSU campuses, this course has a calculus prerequisite. While little calculus is used in the course, the reasons given for requiring it range from—"it raises the level of the course" to "because we can, since calculus is required for the bioscience major." Called for is continued discussion and collaboration of the physics faculty with the faculty in biological sciences to reach an agreement on this matter to resolve this barrier.

At the 2001 statewide meeting the issue of what the medical schools require was raised. It was found that much confusion exists as to exactly what is being taught on our campuses and what the health science professional schools desire/require. We will survey the CSU and UC physics departments and work to establish what the health science school requirements are.

Recommendations for the Discipline

- Survey the CSU and UC physics departments to determine how they respond to demands in the health sciences professional schools.
- Determine what is presently being required for MCAT preparation and for admission to health science professional schools.

Recommendations for Support Courses

- Continue to review the college physics courses as needed by majors in bioscience, seeking a resolution to this dilemma.

Topics for Further Discussion

- Seek to resolve how much linear algebra and differential equations should be required in the lower division.

Recommendations Forwarded/ to be forwarded to

CAN: Advise the CAN Board of the discussions in the field concerning the modules proposal.

CIAC: Work with articulation officers and counselors to continue recommending to students that they complete sequences of courses at a single institution and that they complete their lower division preparation for the major prior to transfer.

Outreach presentations made by members of this group

Lead Faculty Coordinator Lawrence Coleman made an IMPAC presentation to a system-wide gathering of deans of undergraduate education.

AGRICULTURE

Prepared by Ron Nishinaka, Lead Discipline Faculty

Summary of Identified Issues Identified Trends/Future Directions

Comments from Statewide Meetings and the General Field

As the Community College Board of Governor's New Initiative in Workforce Preparation and Economic Development is on the 2002 community college docket, it becomes more critical than ever that viable, up-to-date articulated curriculum be in place to meet these new challenges of vocational education. Three of the seven key elements of this new initiative include developing an over-arching road map, integrating curriculum by connecting the vocational education curriculum to the rest of the college curriculum, and focusing on transfer to both four-year institutions and to the workplace. These are significant for agriculture education and fit the special niche of our common goals with this timely IMPAC project.

A Brief Overview of the Agriculture Discipline

The primary focus for the first year of the project was vastly different from the focus of other IMPAC disciplines and clusters. The Agriculture Discipline is in unique in that our industry area actively supports a State Agriculture and Natural Resources Advisory Committee which works closely with the California Community College Agriculture Council and State Agriculture Director's Committee. We are also fortunate to have a strong California Agricultural Teachers Association (CATA) which advocates for our profession and promotes progressive agriculture education at all levels of our educational system. There are over sixty community colleges that have agriculture programs in the State of California; four-year institutions having such programs include California Polytechnic State University, San Luis Obispo; California State Polytechnic University, Pomona; California State University, Chico; California State University, Fresno; and University of California, Davis.

In agriculture, we have been meeting across the segments to write and up-date curriculum since the early 1990s through grants funded by the California Community College Chancellor's Office for the following program areas (see Table 1)

The initial task for our three IMPAC regional meetings was to bring all agriculture institutions (UC, CSU, CCC) together to discuss the discipline issues and review ongoing projects. As noted in the regional meeting

	Year	No. of Courses	CCAG CANS Course #	Lead College
Agribusiness	1997-98	7 courses	100-199	Santa Rosa
Animal Science	1995-97	14 courses	200-299	Modesto
Environmental Horticulture	1997-98	15 courses	300-399	Modesto
Mechanized Agriculture	1993-95 (Reviewed 1999)	16 courses	400-499	Reedley
Plant Science	1991-93 (Reviewed 1997)	16 courses	600-699	Merced
Natural Resources/ Forestry	2001-02		500-599	Modesto Junior College

TABLE 1

reports, each curriculum area has already developed a model common core of courses which meet industry standards, integrates academic and vocational competencies, and meet university transfer requirements. All courses have addressed the five SCANS standards (Secretary's Commission on Achieving Necessary Skills).

Copies of the 68 course outlines were distributed at all meetings and are on file in the CCC Academic Senate IMPAC project office.

IMPAC regional meetings also afforded faculty an opportunity to review Modesto Junior College's Course Articulation Number System Project. Their grid sheet identifies the specific courses articulated for each curriculum area with assigned California Community Colleges Agriculture Course Articulation Numbering System (CCAG CANS) course numbers of 100 - 699.

Attendees to this statewide activity were first-time participants to the IMPAC project. Following the regional meeting, updated model curriculum packets and course articulation project grid sheets were distributed and reviewed by the group.

The proposed courses to forward for CAN numbers was also discussed along with the course articulation grid sheet. Both documents were given preliminary approval to go forward pending a check with Modesto Junior College on the status of their project efforts.

The outcomes of these regional meetings and statewide conference (by group consensus) are:

1. Re-affirmation of the five curriculum areas and the 68 courses and course outlines thus far developed.

2. Approval of the proposed course list for obtaining California Articulation Numbers

Topics for Future Discussion

1. We surveyed participants, inviting them to attend additional IMPAC meetings to assist in developing a preparatory course of transfer courses in each of the program areas.

2. Anatomy/Physiology and Food Land/Politics courses were mentioned as possible courses to consider in the future.

3. Other items or topics for future discussions were identified as "intersegmental" issues pertaining to agriculture curriculum.

As the Community College Board of Governor's New Initiative in Workforce Preparation and Economic Development is on the 2002 community college docket, it becomes more critical than ever that viable, up-to-date articulated curriculum be in place to meet these new challenges of vocational education. Three of the seven key elements of this new initiative include developing an over-arching road map, integrating curriculum by connecting the vocational education curriculum to the rest of the college curriculum, and focusing on transfer to both four-year institutions and to the workplace. These are significant for agriculture education and fit the special niche of our common goals with this timely IMPAC project.

Recommendations Forward to CAN:

Pending discussion with Modesto Junior College on the status of their project, these proposed courses would be forwarded.

CAN DESCRIPTORS FOR REVIEW—AGRICULTURE

CAN: AG 2
TITLE: Ag Computers
DESCRIPTION: Applied microcomputing for agribusiness management. Evaluation of alternative microcomputing systems and software. Use of word processing, spreadsheet, and database management programs; applications to agricultural enterprise management and agricultural financial planning.

CAN: AG 4
TITLE: Basic Ag Mechanics
DESCRIPTION: Description not available.

CAN: AG 6
TITLE: Introduction to Animal Science
DESCRIPTION: A scientific overview of livestock and poultry; highlights anatomy and physiology, reproduction, nutrition, behavior, health, and marketing; pertinent environmental and social issues, to include animal welfare. Includes human opportunity to influence trait inheritance, population densities, and productivity. Laboratory recommended

CAN: AG 8
TITLE: Introduction to Plant Science
DESCRIPTION: Introduction to and application of principles of plant science to production of cultivated crops; including how yield and quality are affected by breeding, propagation, culture, harvesting, storage, and marketing. Laboratory required.

CAN: AG 10
TITLE: Plant Propagation
DESCRIPTION: Principles and methods of propagating plants, sexual and asexual: field crops, fruits, vegetables, ornamentals, seeds, spores, cuttings, layering, grafting and budding. Propagation media and rooting aids. Laboratory required.

CAN: AG 12
TITLE: Feed and Feeding
DESCRIPTION: Composition and selection of feeds; characteristics of nutrients; principles of nutrition; nutrient requirements of non-ruminant and ruminant animals; and formulating diets to meet these requirements.

CAN: AG 14
TITLE: Introduction to Soil Science
DESCRIPTION: Biological, chemical, physical and mineralogical soil properties. Interpretation of soils information for agricultural management and production. Proper land use and conservation; soil and water management. Laboratory required.

CAN: AG 18
TITLE: Ornamental Plant Identification
DESCRIPTION: Classification, nomenclature, and identification of common tress, vines, shrubs, ground covers, turf grasses, bedding plants, and house plants. Characteristics of important plant families are discussed. Laboratory required.

CAN: AG 20
TITLE: Introduction to Beef Cattle Science
DESCRIPTION: A study of the beef cattle industry emphasizing the importance of breeds, selection, evaluation, nutrition, breeding principles, disease control, equipment, facilities, and marketing. Laboratory recommended.

CAN: AG 22
TITLE: Introduction to Sheep Science
DESCRIPTION: A study of the sheep industry emphasizing the importance of breeds, selection, evaluation, nutrition, breeding principles, disease control, equipment, facilities, and marketing. Laboratory recommended.

CAN: AG 24
TITLE: Introduction to Swine Science
DESCRIPTION: A study of the swine industry emphasizing the importance of breeds, selection, evaluation, nutrition, breeding principles, disease control, equipment, facilities, and marketing. Laboratory recommended.

CAN: AG 26
TITLE: Introduction to Equine Science
DESCRIPTION: A study of the horse industry emphasizing the importance of breeds, selection, evaluation, nutrition, breeding principles, disease control, equipment, facilities, and marketing. Laboratory recommended.

CAN: AG 28
TITLE: Introduction to Dairy Science
DESCRIPTION: Description not available.

COMPUTER SCIENCE

Prepared by John Tarjan, CSU Bakersfield, Lead Discipline Faculty for Computer Science

Summary of Identified Issues

Several key issues emerged. It is interesting to not that an almost identical list of issues came up at all four regional meetings. They are discussed below.

Topics to be Covered in the Calculus Series

Faculty were fairly united in the belief that most important outcome from taking the calculus series would be mental discipline and mathematical/logical reasoning. Performance in calculus is one of the best predictors of performance as a Computer Science major. Almost all four-year faculty agreed that computer science majors should take the series designed for engineering majors.

Topics to be Covered in Discrete Mathematics

There was less congruence in terms of topical coverage in the discrete math course. Boolean algebra and proofs were mentioned the most frequently.

Topics to be Covered in the Physics Series

There was relatively little agreement on topics. The faculty agreed that computer science majors should take the same physics taken by science and engineering majors (possible to substitute chemistry). Four-year faculty agreed that it should be calculus-based. Two-year faculty were less concerned about a calculus prerequisite. It was felt that exposure to rigorous scientific thinking was more important that specific topics, although electricity, etc. may be more relevant topics for computer science majors.

Skills Required to do Well in a Computer Science Program

As mentioned above, the mental discipline required to succeed in a rigorous calculus series and a rigorous science series is considered a good predictor of success in a computer science program. Study skills, English fluency, logical reasoning and abstraction were frequently mentioned as other requirements for success.

Prerequisites/Course Sequencing

There was a great deal of variation between the three systems as to course sequencing and prerequisites. Part of the problem arises because many of the computer-related coursework taught at the community colleges is taught to an audience much broader than computer science majors.

Baseline Curriculum

The "typical" lower-division course pattern for computer science majors was treated at every meeting. It was somewhat surprising to the facilitator how much overlap there was at the lower-division level, despite concerns about rigor and coverage in those courses. Faculty at each of the regional meetings independently came up with a very similar "baseline" lower-division curriculum to be recommended to computer science majors.

Identified Trends/Future Directions

The faculty identified several trends and future directions in computer science.

The Language Problem

There was a good deal of pessimism that the problem of different programming languages could ever be "solved." It would be very difficult to get different programs with different emphases to standardize on a language for Computer Science 1 and Computer Science 2 at one point in time, much less to get programs to change that language in unison.

Evolving Nature of Computer Science

It was agreed that since computer science is such a dynamic field, whatever comes out of these efforts will require that future monitoring, discussion and revision would constantly be needed.

CAN

No computer science courses are currently CANned, including Discrete mathematics. Future groups may wish to address this issue.

EARTH SCIENCES

Prepared by Peter Schiffman, UC Davis, Lead Faculty for Earth Sciences

Summary of Identified Trends

Faculty from community colleges, CSU, and UC are in general satisfied with the current lower division requirements for the Geology/Earth Science degree. But they also acknowledge that their biggest challenge lies in convincing community colleges students of the need to complete these requirements prior to transfer. Most of the discussion amongst Earth Science faculty at the regional meetings centered on ways this could possibly be accomplished.

Summary of Identified Issues

1. Many community college geology majors transfer to four-year colleges and universities without having completed most—if any—of their math, physics, and chemistry requirements while attending the community college.

2. Students completing IGETC requirements at the community colleges often fail to complete the pre-calculus/calculus math and other science prerequisites for the Geology major offered at four-year schools.

3. Community college students' enthusiasm about Earth Sciences, kindled in classes such as Physical and Historical Geology, leads to these same students transferring out of community colleges "too" early (i.e., before completing their math and other science requirements).

4. Currently only Physical and Historical Geology have CAN numbers; however, a majority of community colleges offer more classes than this. Should other geology courses, such as Oceanography, Environmental Geology, and Mineralogy be given CAN status?

5. There needs to be improved communication amongst faculty in community colleges and four-year schools, especially regarding curricular changes and presenting information about transferring from a community college to a particular four-year program.

Comments from Statewide Meetings and the General Field

Participants in meetings across the state expressed these concerns:

1. In an ideal world, math, physics, and chemistry courses would incorporate some geologic examples into their curriculum, e.g., in assigned problem sets. Since this is not likely to happen, Earth Sciences faculty should make a greater effort to incorporate math, chemistry, and physics into their own courses. This may be particularly important for courses in Physical and Historical Geology, as these are the only two geology courses that are considered lower division.

2. Earth Sciences faculty need to be even more vigilant in advising their potential transfer students to complete math, chemistry, and physics prerequisites required for major preparation at four-year schools, even at the expense of IGETC. Some attendees at all regional meetings suggested that high-unit major programs (like Earth Sciences) need a new program of study to replace IGETC as a community college graduation model (specifically a program that stresses completion of major preparation requirements in math, chemistry, and physics

3. One way to try and keep Earth Science students at community college while completing their lower division major requirements would be to establish joint enrollment at four-year colleges and universities. This would allow these students, while in their final year at community college finishing their basic science requirements, to take more advances geology courses at their local college/university. Many CSU campuses are in effect already doing this on a limited basis under their cross-enrollment policies.

4. Currently only Physical and Historical Geology have CAN descriptors; however, a majority of community colleges offer more classes than this. The attendees at the regional meetings debated whether other

Comments from Statewide Meetings and the General Field

Curricular Changes without Adequate Notice to Community Colleges

Many community college faculty indicated that insufficient articulation was taking place with four-year campuses. Computer science faculty initiate needed changes but often do not fully appreciate the amount of lead time necessary to implement changes at the community college level.

Importance of Rigor in Lower-Division Coursework

A fairly common concern is that transfer students have not been exposed to the same level of rigor in their lower-division coursework that native four-year students have been. Many faculty felt that the best indicator of success in the computer science major was performance in a rigorous physics and calculus sequence. Most felt that these disciplines helped develop the critical thinking and reasoning skills essential for computer science students.

Difficulty Community Colleges have Offering Several Levels of a Similar Course, Even Though the Objectives of the Students May Vary Widely

Most community colleges are capable of offering rigorous sections of Computer Science 1, Computer Science 2, etc. However, most of the students taking computer science courses at this level are not intending to transfer to four-year computer science programs. They may be seeking a certificate, an A.S., or to transfer to a Computer Information System program. Only a minority ever transfer to a computer science or a computer engineering program. It is likely economically infeasible to offer sections just geared to computer science or computer engineering majors.

Confusion of CIS, CS, CE Curricula by Community College Students

Many students begin at community colleges with an interest in computing, with no firm idea of what type of program they eventually will seek to transfer to, if indeed they do transfer. This makes the problem of generalist computer science courses that may be less than optimal for computer science transfers even more difficult to overcome. Faculty are put in a very difficult position trying to gear coursework for students while only being able to offer a limited number of sections.

Shortage of Instructors

Given that the starting salaries of some students who have only a certificate are sometimes above those of instructors, it is becoming increasingly difficult to attract and retain computer science faculty at the community colleges. The problem is mirrored at the CSU campuses and to a lesser extent at UC campuses.

Need for "Remediation/Bridge Courses" upon Transfer to a UC Campus

Experience has shown at many four-years that even students who have done relatively well in articulated lower-division coursework are not sufficiently prepared upon transfer to be successful in upper-division coursework. Much of this situation can be attributed to use of different programming languages at different campuses, but clearly not all of it. Computer Science 1, Computer Science 2, etc. taught at the community colleges often do not cover as many topics as those at the four-years. Several campuses have addressed this problem by developing "bridge courses" for transfer students. Most of these students "catch up" fairly well by taking these courses even though, or perhaps because, many topics may be repeated.

Use of Different Programming Languages Across Campuses

Everyone recognized this as a problem. No one had a proposal to overcome it.

Need for Continuous Intersegmental Meetings

The meetings were seen as very valuable by faculty from all segments. Given the issues identified and the dynamic nature of computer science, it was felt that these meetings should somehow become institutionalized.

Students should take Calculus for Engineers and Scientists and Majors' Physics

These sequences are good training for the mind. They should be rigorous. The mental discipline, critical thinking, etc. required are essential for success upon transfer.

Different Programming Language Standards Cause Serious Problems for Transfer Students

This came up again and again. No approaches to this problem would seem too forthcoming given the diverse nature of programs and faculty.

CSAB/IBET Accreditation Standards and the ACM/IEEE Curriculum Guidelines

These standards can serve as the departure point for discussion of curriculum, skills sets, etc. They can be very helpful in efforts such as IMPAC.

CS Program Impaction

Many computer science programs are impacted. Not all four-year or two-year programs have an incentive to increase the number of majors, making facilitating transfer seem perhaps less important to faculty.

Computer Science is Not a Four-year Program

Native student routinely require five years or more. Community college students with weak math skills and job commitments may be looking at 7 or 8 years.

Some Students at Community Colleges May Need three to four-years of Coursework (especially mathematics) Prior to Transfer

Confusion of Computer-Related Disciplines and Programs

There is confusion among many new students as to their ultimate goal within the field of computing. Some may desire certification, some belong in CIS programs, a minority of those without clear direction will end up as transfer computer science majors.

Lower-Division/Upper-Division Coursework

There is some variation in the designation of lower/upper-division coursework. Several courses and topics were treated differently across the four-year campuses.

Recommendations for the Discipline

- Faculty at four-year institutions should post current course syllabuses on the web to allow for timely notification of changes in content/approach/texts.
- Faculty at two-year institutions should work to make sure the courses recommended to transfer students are appropriate to prepare them for the appropriate four-year program (CIS, CS, etc.). Computer Information Systems and Computer Science programs differ so widely in approach and required coursework that students not taking the "appropriate" courses will suffer from unnecessary and/or insufficient preparation. For example, a computer science transfer student who took computer information system foundation coursework would likely be delayed more than a year due to math and science coursework.
- An intersegmental computer science curriculum group should be established to keep the dialogue on lower-division curriculum going after IMPAC runs its course. Curriculum and associated issues will continue to change and evolve.
- Communication between community colleges and UC campuses should be increased. There are currently very few formal or informal lines of communication between faculty. IMPAC has provided a much needed avenue for discussion. Perhaps some agency could provide funding for service-area community colleges and UC campuses to get their faculty together for transfer and articulation discussions on a periodic basis.
- Future groups should determine which courses should apply for CAN status and should review and recommend any existing descriptors as well.

Recommendations for Support Courses

- The one-year physics series should be calculus-based and have a laboratory (the same applies to chemistry, if selected as an option). Computer

science majors should take the same sequence as science and engineering majors. This point was stressed by almost all four-year computer science faculty and most community college computer science faculty. The physics faculty were all in agreement.

- Computer science majors should take the same calculus series as science and engineering majors. There was a fairly strong consensus on this point across computer science and math faculty.
- The discrete mathematics course should contain: functions, relations, and sets; basic logic (including Boolean algebra and 1st order predicate calculus); proof techniques (including proof by construction, proof by induction and proof by contradiction); the basics of counting; graphs and trees; and discrete probability. The math faculty were very solicitous in asking for topics and approaches that would be desirable. It is unclear how much of the input from the computer science faculty will actually be implemented in new/revised sections of discrete math courses taught through math departments.

Topics for Further Discussion

We recommend that next year's group take up the following tasks:

1. Circulate the recommended baseline curriculum as broadly as possible and solicit feedback.
2. Come to closure on the baseline curriculum.
3. Work with ICAS to form an Intersegmental computer science Curriculum Advisory Committee to keep this process going and any recommendations up-to-date.
4. Explore the possibility of developing CAN descriptors for Computer Science 1, Computer Science 2, Machine Architecture/Assembly Language, and Discrete Mathematics (or whatever the final configuration of baseline transfer courses looks like).
5. Keep the dialogue open between systems and try to formalize contacts on a regional basis.

Recommendations Forwarded/ to be Forwarded to:

CAN: Work with the discipline to explore possible CAN descriptors for Computer Science 1, Computer Science 2, Machine Architecture/Assembly Language, and Discrete Mathematics.

ASSIST: Develop a report of the current state of articulation in computer science across four-year institutions and distribute it to next year's group.

CSU CSIS Chairs Council: Review the baseline curriculum and get comments to the lead discipline faculty member as a means to keep the council informed and ensure system-wide feedback.

Outreach Presentations Made by Members of This Group:

Organization	Date/Place	Presenter's Name	Number Present
CSU Business Assessment Meeting, Cal Poly, Pomona	4/20/01	Tarjan	25

The purpose/progress of IMPAC was reviewed. These faculty/administration assessment leaders were informed of the CIS and business clusters beginning next year and were asked to encourage participation from their respective faculties.

geology courses, such as Oceanography, Environmental Geology, and Mineralogy might be given CAN status. The majority agreed that for cost and staffing reasons, it is unrealistic to expect that community colleges can teach a Mineralogy course (especially one with Optics) that would be (CAN) equivalent to that taught at a four-year institution. Most attendees also agreed that on paper, community college courses on Oceanography and Environmental Geology are very similar to those taught at four-year colleges. Yet at four-year colleges, these courses presently have upper-division status. While discussion about possible revision yielded some suggestions at the statewide meeting, this topic will be added to next year's agenda.

5. Geology departments at 4-year schools can and should do more outreach to community colleges. For example, they can design specific informational links for prospective community college transfer students (and their advisors) on departmental websites. (See an example of this at http://www-geology.ucdavis.edu/www/studentinfo/transfer.html). Community colleges should be specifically invited to attend departmental open houses, and community colleges instructors should consider bringing their students to these events. Field trips should be run jointly with faculty and students from community colleges and 4-year schools. This would have the added benefit of creating and maintaining interaction with faculty from a variety of schools. Finally, the possibility of forming a listserve or chat room about the issues addressed in this and other meetings should be examined.

Recommendations to the Discipline

1. Identify strategies to urge students, in the strongest language possible, to complete prerequisites before transfer.

2. Earth Sciences faculty should make a greater effort to incorporate math, chemistry, and physics into their own courses, particularly in Physical and Historical Geology.

3. Establish joint enrollment at four-year schools for Geology students in their final year at a community college, allowing them to take more advances geology courses at their local university while finishing their basic science requirements at the community college. Many CSU campuses are already doing this with their cross-enrollment policies.

4. Geology departments at four-year schools can and should do more outreach to community colleges. Specific recommendations include:

- designing specific informational links for prospective community college transfer students (and their advisors) on departmental websites.
- invite community colleges to attend departmental open houses to which these instructors should consider bringing their students
- run joint field trips with faculty and students from community colleges and four-year schools. This strategy would have the added benefit of creating and maintaining interaction with faculty from a variety of schools.
- form a listserve or chat room where issues addressed in this and other meetings should be examined.

Recommendations for Support Courses

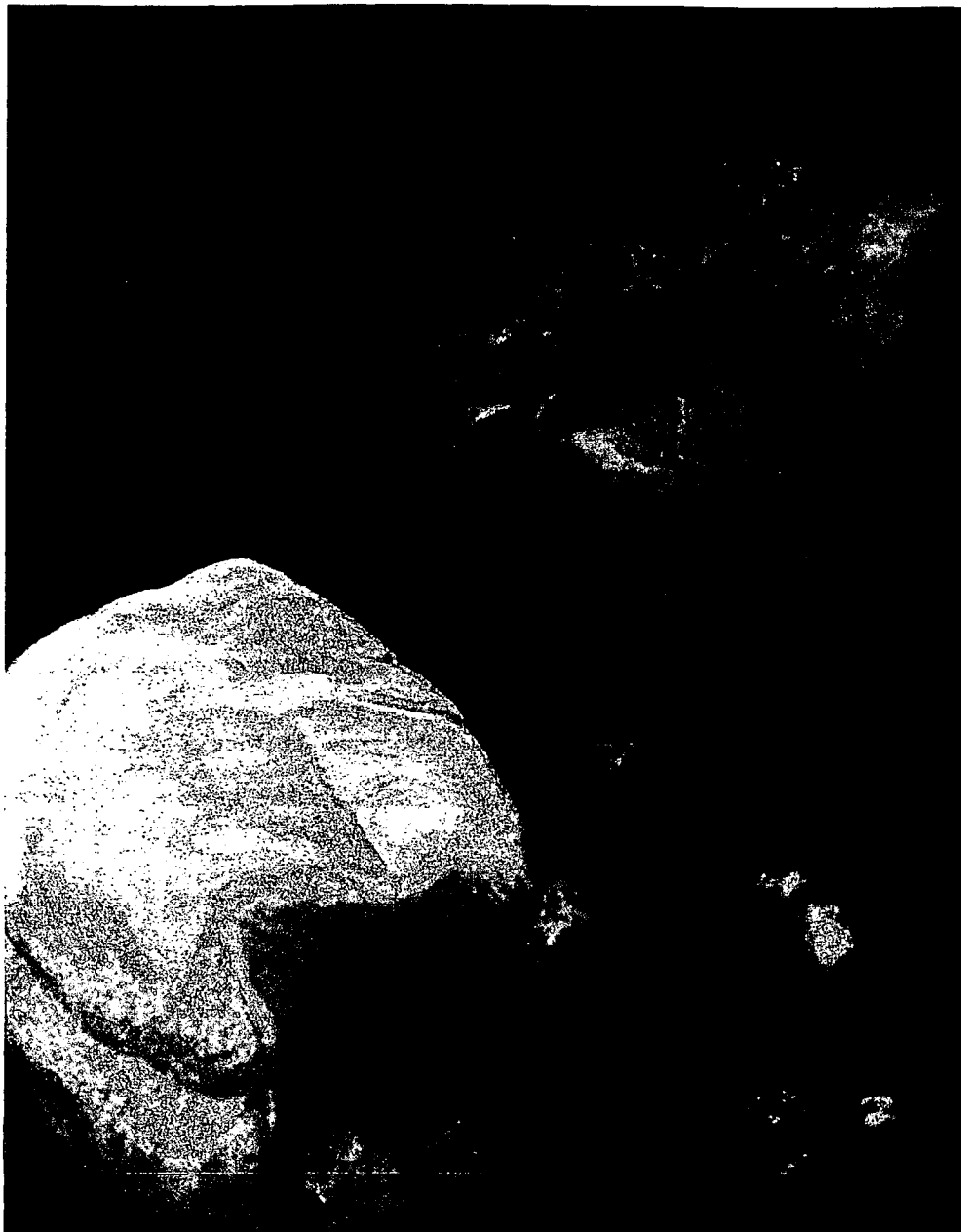
Join with other disciplines to consider what might comprise a science alternative to the IGETC model to serve Earth Sciences and other science-intensive majors.

Topics for Further Discussion

1. Consider what might comprise a science alternative to the IGETC model to serve Earth Sciences and other science-intensive majors.

2. Consider establishing CAN descriptions for courses in Mineralogy, Oceanography, and Environmental Geology

3. Alternatively, consider a mechanism for waiving requirements for upper division courses that have already been taken at the lower division (e.g., Oceanography and Environmental Geology).



FOOD SCIENCE AND NUTRITION

Prepared by Jill Golden, Orange Coast College, Lead Discipline Faculty for Food Science and Nutrition

Summary of Identified Issues

The Food Science and Nutrition faculty meet in San Diego, LA Metro Region, Bakersfield, Oakland and at the Los Angeles Airport. The major issues discussed were:

- Articulation between the community college and CSUs is very confusing to the student. Each CSU accepts different courses from the Community College. The Commission on Accreditation of Dietetic Education (CADE) recommends undergraduate preparation but it is interpreted differently at each CSU. No undergraduate preparation is identified in Community College catalogues.
- Currently, articulation is a one-on-one process with one community college and one university. Simplifying this process will be very beneficial to the student.
- Nutrition is not considered a "science" or "allied science" by other departments on campus. Thus, many students are confused about this major.
- Location of "Nutrition" in the catalog is key so that students can easily identify it. Currently, on many campuses, Nutrition is listed under "Family and Consumer Sciences" or the like. This is very confusing, the students may assume that it is not available on campuses (if they don't find it under "N"), or assume that it is not a real "science" major (since it is listed under a different title).
- At many CSUs the first Nutrition class (CAN FCS 2) is offered at the upper division level and/or has a chemistry prerequisite. CSUs including CSU San Francisco, Northridge, Cal Poly Pomona, San Bernardino, Los Angeles, and San Diego are examples of this. The community college faculty feels strongly that this hinders recruitment efforts since our students cannot transfer this class as part of their major. Most community colleges have strong Nutrition classes because they are listed in General Education Option I and II under Area E - Lifelong Learning. Most do not have any prerequisites for this class. This course uses a book similar to that used at the CSU in their non-major lower division course Nutrition Course. We are looking for some compromise here.
- Enrollment in Food Science and Nutrition programs across the state is low and decreasing at many schools. Community college faculty would like to recruit students into these programs and feel a strong transfer Associate of Science Degree may be helpful.
- Many community colleges do not have an Associate of Science Degree in nutrition specifically designed for students interested in transfer to CSU.
- Community colleges now offer all of the required general education courses including English, Public Speaking, General Chemistry, Organic Chemistry, Biology, Anatomy, Physiology, Statistics, Sociology, Economics, Psychology, Political Science, and Computer courses.
- Dietetic Technician students are required to complete practical experience at local hospitals, community agencies, schools and other agencies. CADE has stated that these hours may articulate to Internships so that DTR graduates do not have to repeat many of the hours. Currently Internships have no formal arrangement for this articulation.
- There are a limited number of Dietetic Internships in California; students are often required to go out of state for their internship.
- There is no Dietetic Technician Training in central or northern California. Central California is looking to distance education to train DTR's.
- There is no CAN number for two transferable courses taught across the state, these include Orientation to the Profession and Sanitation and Safety.

- Many universities do not require a lab with cultural foods. However, a lab would be nice, but not necessary. Those who teach this course (without lab) usually have students bring ethnic food into class as part of the course requirement.
- Students are often confused by the differences between majors in Nutrition versus Dietetics. Both have very different course requirements and career placement.

Identified Trends/Future Directions

Declining enrollment is the major issue facing Food Science and Nutrition programs at CSUs and community colleges in California. Many CSUs are seeking qualified students. Employment opportunities are increasing, salaries are up and we are not graduating enough students to meet current needs. Recruitment and retention are major issues. The major preparation in Family and Consumer Science is not being offered at many CSUs. Concern among faculty involved in Family and Consumer Science (FCS) Teacher preparation is that we are not training future High School FCS faculty.

Comments from Statewide Meetings and the General Field

Faculty attending these meetings strongly support the development of an Associate of Science (AS) Degree in Nutrition. There was general agreement on which courses could be included. Faculty are hopeful that this AS could lead to 2 + 2 agreements between community college and CSUs that will ease transferring process for the students and better utilize faculty and resources.

Recommendations for the Discipline

- Development of Associate of Sciences degree in Nutrition
- Work to add this degree to the community college disciplines list
- Development of a transferable Nutrition Course that will be accepted in the lower division at the CSU.
- Adoption of two new courses by CAN, Sanitation and Safety and Introduction to the Professions.
- Encourage community colleges to identify and publicize appropriate undergraduate preparation in their college catalogues.
- Urge campuses to list "Nutrition" in their college catalogue index under multiple titles so students seeking it separately from "Family and Consumer Sciences" or "Food Sciences" can be referred to the appropriate section of the catalogue for more information.
- Seek formal arrangement for articulation of internships.

Topics for Further Discussion

- Refinement of the AS in Nutrition
- Completion of model major preparation materials required by the California Community College Chancellors Office.
- Development of a Directory of Community Colleges, CSU's and UC's in California that offer Nutrition and Food Science with contact people and a accurate listing of lower division Nutrition courses.
- Publicity of the new AS degree
- Development of 2 + 2 programs between feeder Community Colleges and CSU's or UC's.
- Discussion about the placement of the first nutrition class at the upper division or lower division in the various CSUs

RECOMMENDATIONS TO BE FORWARDED TO CAN

The following two courses should be added to the CAN list in Family and Consumer Science.

1. Sanitation and Safety

Basic principles of personal and institutional sanitation and application of these principles to food preparation, storage, service; prevention of food contamination. Regulations of the California Health and Safety Code. Emphasis on the supervisor's responsibilities in maintaining high standards of these principles. Training to meet certification requirements for food handlers.

Core components: Importance of sanitation; microorganisms; contamination; foodborne illness and food allergies; food storage and handling; personal sanitation; HACCP principles, sanitary facilities and equipment; sanitation regulations; accident prevention; crisis management; and pest management.

> CSUs that have a similar class include: Cal Poly Pomona, CSU Long Beach, CSU Los Angeles, Cal Poly San Louis Obispo.

2. Introduction to the Professions

Orientation to careers in Dietetics, Nutrition Science, Food Science and Food Service Management. Introduction to professional associations, publications and legislation pertinent to the professions discussed. Core components: Professional Associations, professional ethics, publications, legislation, employability, career goals, career preparation, evolving career opportunities (Speakers in professional areas and from local university programs as well as field trips may be included)

> CSUs which have a similar class are: CSU San Bernardino, Cal Poly Pomona, CSU San Diego, San Jose State and CSU Long Beach.

The following two course descriptions should be updated:

FCS 26 Food Science Technologies: add "Chemistry of foods" after "exploration" of in the first line as indicated below.

Exploration of chemistry of foods, food processing and technology and how it affects the color, flavor, texture, aroma and quality of foods. Core components remain the same.

FCS 28 Cultural and Ethnic Foods. Modify descriptor as indicated below.

Regional, ethnic, cultural, religious, historical and social influences on food patterns and cuisines.

Core components: Specialized equipment and utensils related to cultures; regional, ethnic, cultural, religious, historical and social influences; traditional foods of selected cultures; geographic factors in food availability; global food issues; sanitation and safety practices; application to the food industry.

NURSING

Prepared by Louise Timmer, CSU Sacramento, Lead Faculty for Nursing

Summary of Identified Issues

There was an overwhelming response from the nursing chairs and faculty from the CSU, UC and community college nursing programs. Strong interest was expressed in continuing to work with the IMPAC project. All nursing faculty expressed a need to collaborate with the ADN and BSN programs to reduce the barriers for nursing students in the community colleges to transfer to the CSU and UC nursing programs. Attendees at the 4 regional meetings included representatives from 16 of the 17 CSU nursing programs, all UC nursing programs, and 22 of the 71 community college nursing programs. All together 73 nursing faculty attended the four meetings; 12 participants were chair/director/dean administrators and 61 were faculty. The meetings were held on Saturday and attendance would have been higher except for the short timeframe for notification of the meetings. Several faculty sent regrets but indicated they wanted to be included in future meetings.

Issues

Several issues, concerns, and needs were discussed by the chairs and nursing faculty relating to prerequisite coursework, general education pattern requirements, and transfer and articulation concerns between the community college and the CSU and UC systems. Issues were discussed that related to accreditation requirements with the California Board of Registered Nursing and the National League for Nursing. The demographic changes in the nursing student pool and their affect on student enrollment and composition were discussed. A more detailed description is provided in the report.

Student Pool

At the San Diego regional meeting, the nursing applicant pool was discussed. All California nursing programs are experiencing an older female population in the thirty to forty year range, second degree students, English as a second language students, and a more multicultural student applicant pool. Male applicants continue to be a small number of the applicants. In several community colleges, English and math competency are significant issues, as well as interpersonal communication skills. College coursework remediation and socialization into the nursing profession are areas of concern. This creates a significant role for faculty in the preparation of students for professional practice.

Several faculty remarked that in certain areas of the state, nursing programs were no longer impacted. However, the health care facilities in all geographic areas are in need of registered nurses. Recruitment concerns were discussed and several faculty recommended that recruitment efforts should include both the middle and high school students.

Prerequisite Courses

The faculty at every regional meeting expressed a concern for the science prerequisite, in particular, biology, mathematics, and chemistry. Some campuses require biology as a prerequisite to physiology. Mathematics requirements do not contain content pertinent to nursing practice, e.g., ratios and systems of measurement. This content is currently being taught in the nursing programs as a review course or as part of the Skills Laboratory.

Chemistry was the science course that concerned the majority of the faculty in both the community college and CSU nursing programs. Several faculty felt that the chemistry course that should be a prerequisite to the nursing programs is biochemistry. However, on community college and CSU campuses, inorganic and organic chemistry courses are usually required before students take biochemistry. Several faculty remarked that associate degree nurses often do not want to take the chemistry courses required by the BSN programs and list this as a significant barrier that prevents ADN nurses from seeking the baccalaureate degree in nursing.

In the interdisciplinary discussions with the chemistry faculty, the nursing faculty requested a chemistry course be developed for nursing students that contain a moderate amount inorganic and organic content, but focused mainly on biochemistry. The chemistry faculty voiced concerns that included ensuring adequate enrollment in this course, academic rigor, and appropriateness in higher education. Discussion focused on academic preparation for a professional degree such as business, engineering, or nursing. A chemistry course tailored for the nursing program at San Francisco City College has been taught and has proven to

be very successful. Chemistry faculty at all regional meetings were open to further discussion with nursing faculty. Nursing faculty were asked to determine the competencies for such a course and if enrollment could be guaranteed, chemistry faculty would collaborate to develop an integrated chemistry course for nurses and other allied health students.

Grids

At each regional meeting the grid for the 13 CSU generic nursing programs was reviewed. All 13 nursing programs require chemistry, anatomy, and microbiology as prerequisite courses. However, the social and behavioral sciences, English, mathematics, nutrition, and speech may either be prerequisites or co-requisites for admission to the nursing program. Only one nursing program has physiology as a co-requisite course. The CSU nursing programs have been meeting all year as part of the CSU Core Alignment Discipline Project with a grant from the Chancellor's Office. The goals of this project are to align all prerequisite and lower division courses among the CSU campuses. The purpose is to facilitate articulation and transfer within the CSU system. The CSU nursing discipline project committee anticipates the total alignment of prerequisites by the end of the academic year, 2001.

A similar grid for the 71 community college nursing programs was developed, and is being completed, as a result of the IMPAC project. This grid was discussed at the final meeting for the academic year.

General Education Requirements

Faculty from the ADN nursing programs expressed concerns about the variance in the number of general education (GE) courses required by the campuses within the community college system. It was reported that the number of general education requirements has increased over the past years. Math requirements have increased on many campuses and additional courses have been added, such as computer literacy/informatics and critical thinking. English and history units have increased from 3 to 4 units on some campuses. The GE courses vary between 16-49 units. Faculty believe that the different GE requirements for each campus create a major barrier for nursing students to transfer from one campus to another. In addition, the CSU system has added requirements of English, speech, mathematics and critical thinking courses that must be taken prior to transferring from the community colleges. These prerequisite courses will be especially burdensome for the associate degree nurse who wishes to transfer to the CSU for the baccalaureate degree in nursing. At present, only 70 units may be transferred to the CSU system. Transfer students frequently have many additional units that are not counted.

Similar barriers exist within the CSU campuses for general education requirements, creating a barrier for nursing students to transfer to other CSU nursing programs.

High School Preparation

The faculty discussed the lack of high school preparation for the study of nursing in college. The students may decide on the nursing major without having any high school science and math background. Those students must then take high school equivalent courses of math and chemistry at the community college prior to enrolling in the college level courses.

Lower Division Nursing Courses

A grid was reviewed of the 13 generic CSU nursing programs lower division nursing courses. Very few nursing courses are offered as lower division, except at CSU Los Angeles. Recently, CSU Los Angeles aligned their nursing program with some community colleges in their region. In the pilot program between CSU Sacramento and Sacramento City College all pre-licensure nursing courses are lower division to facilitate the transfer of the community college ADN nurses into the junior year of their baccalaureate nursing program. However, the CSU nursing students cannot easily transfer within the nursing programs. It is anticipated that the CSU Core Alignment Nursing Committee will review the lower division nursing courses in the next academic year, 2001-2002.

Matriculation vs. Articulation

The community college nursing faculty expressed the concern that pre-licensure nursing courses have to be challenged by examination or retaken to matriculate in some baccalaureate nursing programs. This policy in not only a barrier to ADN nurses returning for advanced degrees, but is also very costly and delays the time to the

baccalaureate degree. Out of state associate degree nurses have similar difficulties when matriculating into the CSU or UC systems for the baccalaureate degree. If all pre-licensure nursing courses were lower division in all nursing programs, articulation could be almost seamless.

A grid for the community college nursing courses is being developed through the IMPAC Project and will be re-viewed at the April meeting. A barrier to students who transfer within the community college nursing programs is the difference in the sequencing of nursing courses in the program.

At the Bakersfield meeting, the Interim Director of Nursing at the College of the Redwoods, Meredith Trinque, shared her experience in the development of a fully articulated LVN to RN to BSN nursing model for the state of Connecti-cut. She mentioned that three states, Colorado, Maryland, and Connecticut have developed state articulated nursing programs that follow a career ladder beginning with the licensed vocational nurse (LVN) to the associate degree nurse (ADN) to the baccalaureate degree nurse.

Accrediting Agencies Requirements: National League for Nursing Accrediting Commission (NLNAC) and California Board of Registered Nursing (BRN):

ADN faculty expressed a concern in content requirements and unit limitations identified by accrediting agencies; National League for Nursing Accrediting Commission (NLNAC) and the California Board of Registered Nursing (BRN). Currently, the NLNAC maintains a standard of 60-72 semester units/credits (90-108 quarter) for Associate degree Nursing programs. The BRN identifies content as follows: 36 units for the arts and science for nursing, six units for communication and 16 units for related natural, behavioral and social sciences. The 22 units (6 units for communication and 16 units for natural, behavioral and social sciences) may count for the general education requirements for the associate degree. However, on some community college campuses there may be additional general education course requirements for the associate degree. In colleges where this is the case, a student's progress toward an associate degree may be slowed. Furthermore, the NLNAC limit of 72 semester units may be surpassed and accreditation for the nursing program may be placed in jeopardy. As the complexity and acuity of patients in the health care facilities increased over the years, the need arose for more knowledge and clinical training to achieve competency in the nursing content areas required by state law. This has resulted in a curricular dilemma among faculty attempting to keep to a specified timeframe and the unit standard for the pre-licensure nursing programs. Some faculty expressed a desire to dialogue with other faculty and consultants from the BRN as to what content and clinical experiences to keep and what to eliminate from the nursing curricula and still have students achieve competency in the content areas required by California law.

1998 PEW Commission Report on the Health Professions

The 1998 PEW report on Health Professions may need to be reviewed as it indicates several competencies for the entry level nurse that increase the theory and clinical units needed to meet them. There appears to be a philosophical conflict between the 1998 PEW Report and NLN expecta-tions of entry level nursing programs.

Identified Trends/Future Directions

Enrollment Capacity

Enrollment is limited in all of the 94 pre-licensure and 26 master's degree nursing programs, both state-supported and private. The latest statistics on enrollment in California nursing programs was compiled 1998-991. At this time, there were 3556 ADN, 1447 BSN, and 35 entry level master nurses graduated, totaling 5038 new graduates from all 94 pre-licensure nursing program. Unfortunately, over the past 5 years, applications to pre-licensure nursing programs have declined throughout the state. California Employment Development Department (EDD) concluded that the state does not have a sufficient supply of nurses to meet the health care demand in the next 10 years. By 2006, EDD projects an increase need of 67,440 new registered nurses over the 197, 000 nurses currently employed. According to the California Department of

Consumer Affairs, California ranks the 50th in the nation in the proportion of RNs to 100,000 population (585/ 100,000).

From the figures presented by the Consumer Affairs Department, California has two problems; limited capacity in pre-licensure nursing programs and a declining interest in pursuing nursing as a career.

Increase Demands for Nursing Services

The changes in the health care system to managed care and integrated health care networks have increased the demand for RNs prepared at the baccalaureate and master levels. The need for nurses with advanced practice in primary care is increasing in the integrated health care systems. Nurses are expected to delivery primary health care in clinics and community health settings and provide supervision and training for other health care personnel.

Registered nurses are expected to manage many patients in a hospital or community health agency and supervise care given by other licensed nurses and unlicensed health care workers. Health education and home health care are increasing the responsibilities of registered nurses. Public health caseload continues to rise as the numbers of uninsured persons, homeless, and indigent citizens increase.

Changes Needed in Nursing Education:

For the past five years, several nursing organizations have met with nursing faculty in the state supported and private universities and colleges to explore and develop better systems of education and articulation in order to meet the critical nursing shortage in California. In 1999, the California Strategic Planning Committee for Nursing (CSPCN) developed a model for role differentiation in nursing practice. The model addressed the educational preparation, competencies, and skills among the registered nurses. CSPCN includes representatives of over 40 nursing organizations in California and its purpose is to establish a master plan for the nursing workforce that will ensure an adequate supply of nurses for the state. The goal is to create a mechanism whereby nurses may progress through an education process that progresses from LVN to ADN to BSN to MSN. The intent is to align curricula in the licensed vocational nursing (LVN) and RN nursing programs so to reflect education and competencies for each level of education. All competencies are based on California law as administered by the California Board of Vocational Nursing and the California Board of Registered Nursing.

Unlike previous nursing shortages, health care employers not only predict an increased need for registered nurses but also a need for bachelor and master prepared nurses. Approximately, 73% of nursing admissions are to associate degree programs and while these admissions are expected to increase, admissions to BSN programs are decreasing each year. At present, only 16% of associate degree RNs continue their nursing education and obtain higher degrees. Changes in nursing education must occur to ensure that California has a nursing work force with the appropriate education and skills to meet the state's health care demands. The Institute of Medicine study in 1994 concluded that the educational mix of nurses is inadequate for current and future delivery of nursing services. The education of nurses needs to be aligned with the levels of professional judgment required of nurses in all health care settings. Nurses must be able to work in complex health care systems that demand a high level of clinical judgment, management skills, and increasing clinical autonomy to supervise other health personnel.

Comments from Statewide Meetings and the General Field

The nursing faculty made several comments. These comments included:
Most useful part of the discussion

- Sharing with faculty from other nursing programs
- Sharing of common issues, number of units, common issues in related disciplines
- Collaborating with nursing colleagues
- Understanding what each nursing program requires.
- Cross disciplinary discussions, CAN discussions, discussions with biology, chemistry, math faculty
- Prioritizing of issues for nursing programs.

Ideas for more successful sessions included:

- Break up sessions for community college and CSU nursing programs and have one representative present the ideas during the whole nursing session.
- Identify how nursing programs can clean out the deadwood courses that all community colleges agree to and add common core courses. Then discuss the same with the CSU and UC nursing programs.
- Have national league for nursing and board of registered nursing representatives at the meetings.
- More direction in preparing for meetings with other disciplines.
- Invite hospital administrators to meetings

The information was shared with other faculty at department meetings. All faculty wanted to continue to meet together to work on common issues among the nursing programs in the CSU,community college, and UC systems. The faculty identified activities to become involved in at the local level for articulation such as:

- Work with campus chemistry or community college chemistry faculty to design an integrated chemistry course.
- Discussion with campus biology, chemistry, math, and computer science faculty to align nursing competencies with science prerequisite courses.
- Update local articulation agreements with community colleges for nursing programs.

When asked how the nursing faculty heard about the IMPAC meetings, responses included:

- Letter from IMPAC and nursing dept. chair
- IMPAC's nursing discipline coordinator, Louise Timmer
- Nursing director of college

Recommendations for the Discipline

1. Develop an articulated set of prerequisite and lower division nursing courses for the ADN and BSN programs and reduce matriculation barriers between ADN and BSN programs. Specifically,
   - Create grids with course descriptions for the prerequisite courses and lower division courses in the ADN and BSN programs, both private and public, in California.
   - Create grid for community college ADN programs that describes the number and composition of units to the degree.
   - Discuss which courses would serve as California Articulated Number (CAN) courses.
   - Survey BSN programs, public and private, to determine matriculation barriers to admission for the ADN transfer students.
2. Review preparation of students for admission to nursing programs. Specifically,
   - Create grid of admission requirements for ADN and BSN programs, public and private.
   - Review grid to determine similarities and differences.
   - Review retention and attrition rates for ADN and BSN programs.
   - Review remediation process for ADN and BSN programs.
   - Review passage rate for state board licensure exam for nursing programs.
   - Determine relationship among preparation level for admission, retention rates, remediation process and success, attrition rates and passage rates for the state board licensure exam.
   - Discuss feasibility of pre-entrance assessment testing for admission to nursing programs.
3. Meet with the Board of Registered Nursing Education Consultants and representatives from the National League for Nursing Accreditation Consultants to discuss content areas and units to the degree for ADN programs. Specifically,
   - Arrange meetings for ADN programs/faculty who want to meet with the BRN education consultants to discuss content areas, competencies, skill sets and units required for licensure in California.

- Arrange meetings for ADN programs/faculty who want to meet with the NLN Accreditation consultants to discuss the maximum number of units to the degree acceptable for accreditation.

4. Develop nursing recruitment strategies for the students in the K-12 grades.

- Discuss recruitment ideas that provide K-12 students with opportunities to observe the diversity of nursing care given by registered nurses in all health care settings.
- Develop campus-school programs that link K-12 students to activities with nursing students.
- Develop recruitment programs that reach all segments of the community.
- Seek funding sources; public and private, grants and community partnerships, to implement the recruitment strategies.

Recommendations for Support Courses (if discussed)

1. Create an integrated chemistry course for all nursing programs. Specifically,

- Determine content, competencies, and skills set for an integrated chemistry course.
- Hold campus meetings with the chemistry departments to discuss the components of an integrated chemistry course.
- Determine feasibility of the integrated chemistry course as a CAN course.

2. Review the General Education Patterns on the college/university campuses with ADN and BSN programs. Specifically,

- Determine the competencies, skills set, and units required for general education patterns at each campus.
- Create grid for the general education patterns on campuses with ADN and BSN programs, public and private.
- Review grid for similarities and differences.
- Determine whether general education courses are/can be CAN course.
- Discuss feasibility of dual enrollment in the community college and CSU system for the prerequisite and general education courses.

Topics for Further Discussion

All of the recommendations listed above are unresolved issues that need further discussion and decisions made to facilitate student articulation and transfer process among and between the community college, UC, and CSU systems. In addition, further discussion of the recruitment and retention issues in the nursing programs need further elaboration to discover what factors impact on recruitment and retention of students in the nursing programs in the community college and CSU systems. CAN numbers for common prerequisite and lower division nursing courses are essential topics for next year. Discussions of essential content, competencies, skills with the accrediting organizations for the nursing programs of the community colleges will be made available. Lastly, a discussion relating to a statewide articulated nursing curricula beginning with the LVN and progressing to the BSN such as the Connecticut model will occur at next year's meetings.

Recommendations Forwarded/to be forwarded to:

CAN: The prerequisite courses and nursing courses for the pre-licensure nursing degree will be discussed and decided next year, 2001-2001.

ASSIST: The prerequisite courses and the nursing courses will be reviewed next year.

CIAC: Meetings with the counselors for the community college and CSU nursing programs will be held next year.

Outreach presentations made by members of this group:

California Hospital Association	March 8, 2001	Louise Timmer
American Nurses Association of California	March 10, 2001	Louise Timmer

RECOMMENDATIONS TO CAN

SCIENCE CLUSTER I

BIOLOGY MAJORS COURSES

Content Distribution: Biology Courses—
two semesters; many are adding a 3rd semester course Molecular Genetics

1. Biology Principles, Cell, Respiration, Energy, Mendelian Genetics CAN Bio 2
2. Animal, Physiology Survey CAN Bio 4
3. Plant, Ecology, Evolution CAN Bio 6
4. New Course: Molecular Genetics CAN Bio X
("X" = identify a new CAN number)

CAN Biology Descriptors

CAN Bio 2: Principles of Biology: Cell/Molecular Biology

CAN Bio 4: Principles of Animal Diversity (Zoology)

CAN Bio 6: Principles of Plant Diversity (Botany)

CAN Bio Seq A = CAN Bio 2 + 4 + 6

CAN Bio 10: Human Anatomy

CAN Bio 12: Human Physiology

CAN Bio Seq B = CAN Bio 10 + 12

CAN Bio 14: Principles of Microbiology

[See Discussion below: Additional CAN Biology Courses and changes in content and descriptions are recommended]

Sequence for taking the classes CAN Sequence A [CAN Bio 2, 4 + 6]: there is no common order or sequence for enrolling in Biology courses for the major

a) Some colleges allow these three courses to be taken in any sequence

b) Most require CAN Bio 2 first, then the other two in any sequence

c) Some require the opposite of #b: CAN Bio 4 or 6 first, then CAN Bio 2 as the last course in the sequence

The Chemistry Pre-requisite for CAN Bio 2, 4, and/or 6: Most require Chemistry as a pre-requisite to CAN Bio 2 [commonly known as "Cell and Molecular"], but this varies depending on content alignment for these lower division Biology majors courses at each individual college [mainly where the "Cell and Molecular" are taught, i.e. in the colleges equivalent to CAN Bio 2, 4, or 6].

General Conclusion on Biology CAN Sequence A as currently configured:

a) The most important transfer and articulation factor for students is to complete the entire sequence before transferring; articulation agreements are very important, but some have not been honored

b) The challenge for CCs: to convince CSU, but especially UC, that the content covered in CAN Bio Sequence A is "close enough" preparation for success as a Biology major after transfer.

Chemistry Pre-requisite for Biology Major Courses

1. 1 Semester of non-Chemistry major Chemistry course
   CAN Chem 6
2. 1 Co-requisite of Majors Chemistry course
   CAN Chem 2
3. 1 Pre-requisite of Majors Chemistry course
   CAN Chem 2
4. Chemistry Descriptions

   CAN Chem 2 = 1st semester for the Science Major
   * Required for Bio 2, 4, or 6

   CAN Chem 4 = 2nd semester for the Science Major
   CAN Chem Sequence A = CAN Chem 2 + 4
   ** Required for the Biology Majors, but not for CAN Bio A

   CAN Chem 6 = 1st semester for Allied Health Majors

   CAN Chem 8 = 2nd semester for Allied Health Majors
   CAN Chem Sequence B = CAN Chem 6 + 8

   CAN Chem 12 = Quantitative Analysis (Most colleges do not offer)
   CAN Chem Sequence C = CAN Seq. A + CAN Chem 12

   CAN Chem 14 = 1st semester Organic Chem for Science Majors
   *** Some colleges that have adopted a three-semester lower division Biology sequence are considering requiring CAN Chem 14 for this "new" third "Cell and Molecular" – CAN Bio X course

   CAN Chem 16 = 2nd Semester Organic Chem for Science Majors
   *, **, *** are comments from the 1999-2000 and reaffirmed in the 2000-2001 discussions

Physics Requirement for Biology Majors

1. Most require 1 year of Physics w/o Calculus
   CAN Phys A
2. Some require 1 semester of Physics + allow 1 additional unit
   CAN Phys 2 to be taken after transfer to "make up for content gaps" missed
   CAN Phy 2
3. Physics Course Descriptors
   CAN Phys 2 = General Physics (Algebra/Trig based) Mechanics, Heat

   CAN Phys 4 = General Physics (Algebra/Trig based) Electricity, Optics, Modern Physics
   CAN Phys A = CAN Phys 2 + 4

   CAN Phys 8 General Physics (Calculus based) for Physical Sci/Engineering majors

   CAN Phys 12 General Physics (Calculus based) for Physical Sci/Engineering majors

   CAN Phys 14 General Physics (Calculus based) for Physical Sci/Engineering majors
   CAN Phys B: CAN Phys 8 +12 + 14

Comments:

1. The physics requirement for Biology majors presents a major problem because of the wide variation among CSU and UC on what math is required for the Physics course and why.
2. The Physics requirement varies from the three-semester, calculus-based Physics to one semester of Physics plus one additional unit to make up for content gaps at the CC.
3. The rationale for requiring Biology majors to take CAN Phys B is to ensure the university that the Pre-Med majors "do well" on the MCAT exam. No comments were put forth on the value of the content for Biology majors.

4. One CC had great difficulty in scheduling physics course sequences due to the polemic of wanting to offer courses required for the major juxtapositioned against administrative concerns for small class size and the cost involved in offering three semesters of low enrollment classes.

Math Requirement for Biology Majors Varies

1. Semester of Calculus
2. A GE Math Course

Statistics Requirement for Biology Majors

1. 2 require statistics
2. 1 has no statistics requirement

There was very little discussion on the math requirements for Biology

Recommended:

1. Add CAN Bio X –Molecular Genetics
2. Develop new CAN Biology Sequences

a) Organismic Biology: CAN Sequence A = CAN Bio 2 + 4 + 6

b) Allied Health Biology Preparation: CAN Sequence B = CAN Bio 10 + 12

c) Molecular Biology: new CAN Molecular Sequence 2 + 4 + 6 + X

d) Human Biology: new CAN Sequence 2 + 10 + 12 (Intro + Anatomy [10] + Physiology [12])

e) Biotechnology Track: new CAN Sequence 2 + X + 14 (Intro + Molec Gen. + Micro)

Discussion from 1999-2000—Issues in physics are still unresolved; New Can Biology has not occurred, Math requirements vary greatly with no general pattern

Chemistry

Explore the possibility of a revision of the CAN process, that might attract UC's participation in CAN. Revision of the chemistry course descriptors compiled from recommendation 1 above might achieve broader consensus as an articulation vehicle. Further revision of the CAN process might require each course seeking identification with a CAN number to be subject to examination and certification of course content quality by a faculty review committee containing representatives of all three segments of higher education in California. This quality certification by a faculty committee would carry significant weight in individual articulation agreements. Eventually, as confidence in the CAN process grew, CAN certification might begin to serve as a central articulation review, strongly reducing or possibly replacing the present need for multiple binary agreements. The existence of the IMPAC project and its continued funding may make this a propitious time to initiate these changes, as resources may be available to establish this revision. Such a possible revision of procedure might be shared with CIAC to explore whether UC would be willing to reconsider its participation in CAN if revised.

Mathematics

Convene a CAN discipline review committee to thoroughly review CAN descriptors. Can descriptors for Discrete Mathematics and for Mathematical Proofs need to be created. Our review indicates that while the major courses are in pretty good shape there is much disagreement in the descriptors for the service courses such as the General Education courses for non-quantitative majors, the math for elementary teachers, and statistics. While we started this review at our statewide meeting it was clear that the participants didn't feel empowered to propose these descriptors. Participants for this review committee should be empowered by their institutions to propose changes. The process then should continue with a wide dissemination of the proposed changes with feedback solicited.

Physics

Advise the CAN Board of the discussions in the field concerning the modules proposal. The faculty group discussion resulted in the following set of draft "course modules." Listed for each module are the major subtopics/concepts. The proposal on the next page will need discussion in a wider group of physics faculty.

Module 1: MECHANICS

- Vectors and Scalars
- Newton's Laws
- Statistics
- Linear Kinematics and Dynamics
- Rotational Kinematics and Dynamics
- Conservation Laws
- Gravitation

Module 2: MECHANICAL WAVES & OSCILLATIONS

- Waves on a string
- Standing Waves
- Interference
- Resonance
- Superposition
- Sound
- Doppler Effect

Module 3: SIMPLE HARMONIC MOTION

Module 4: THERMAL PHYSICS

- Calorimetry
- Heat Transfer
- Kinetic Theory
- Thermodynamics

Module 5: FLUIDS

- Density
- Hydrostatics
- Archimedes Principle
- Pascal's Principle
- Hydrodynamics
- Bernoulli's Principle

Module 6: ELECTROSTATICS & DC CIRCUITS

- Charge
- Coulomb's Law
- Fields
- Potentials
- Gauss's Law
- Voltage, Current, Resistance
- Capacitance
- Kirchoff's Rules
- Flux
- EMF (?)

Module 7: MAGNETISM, AC CIRCUITS & MAXWELL'S EQUATIONS

- Faraday's Law
- Ampere's Law
- Biot-Savart Law
- Magnetic Fields
- RC,RL,RLC Circuits
- Phasors
- Inductance
- Lenz's Law
- Flux(?)

Module 8: E&M WAVES

- Speed of Light
- Color, Frequency
- Momentum and Energy of E&M Waves

Module 9: GEOMETRIC OPTICS

- Reflection
- Refraction
- Ray Tracing
- Lenses
- Mirrors
- Optical Instruments

Module 10: PHYSICAL OPTICS

- Interference
- Diffraction
- Polarization
- Dispersion
- Resolution
- Phase

Module 11: SPECIAL RELATIVITY

Module 12: QUANTUM MECHANICS

- Experimental Basis of Quantum Mechanics
- Particle-Wave Duality
- Wave Functions
- Atoms and Molecules
- Applications of Schrodinger's Equation
- Topics from Solid State, Nuclear & Particle Physics

Science Cluster II

Agriculture

Review the following CAN descriptors:

CAN: AG 2
TITLE: Ag Computers
DESCRIPTION: Applied microcomputing for agribusiness management. Evaluation of alternative microcomputing systems and software. Use of word processing, spreadsheet, and database management programs; applications to agricultural enterprise management and agricultural financial planning.

CAN: AG 4
TITLE: Basic Ag Mechanics
DESCRIPTION: Description not available.

CAN: AG 6
TITLE: Introduction to Animal Science
DESCRIPTION: A scientific overview of livestock and poultry; highlights anatomy and physiology, reproduction, nutrition, behavior, health, and marketing; pertinent environmental and social issues, to include animal welfare. Includes human opportunity to influence trait inheritance, population densities, and productivity. Laboratory recommended

CAN: AG 8
TITLE: Introduction to Plant Science
DESCRIPTION: Introduction to and application of principles of plant science to production of cultivated crops; including how yield and quality are affected by breeding, propagation, culture, harvesting, storage, and marketing. Laboratory required.

CAN: AG 10
TITLE: Plant Propagation
DESCRIPTION: Principles and methods of propagating plants, sexual and asexual: field crops, fruits, vegetables, ornamentals, seeds, spores, cuttings, layering, grafting and budding. Propagation media and rooting aids. Laboratory required.

CAN: AG 12
TITLE: Feed and Feeding
DESCRIPTION: Composition and selection of feeds; characteristics of nutrients; principles of nutrition; nutrient requirements of non-ruminant and ruminant animals; and formulating diets to meet these requirements.

CAN: AG 14
TITLE: Introduction to Soil Science
DESCRIPTION: Biological, chemical, physical and mineralogical soil properties. Interpretation of soils information for agricultural management and production. Proper land use and conservation; soil and water management. Laboratory required.

CAN: AG 18
TITLE: Ornamental Plant Identification
DESCRIPTION: Classification, nomenclature, and identification of common tress, vines, shrubs, ground covers, turf grasses, bedding plants, and house plants. Characteristics of important plant families are discussed. Laboratory required.

CAN: AG 20
TITLE: Introduction to Beef Cattle Science
DESCRIPTION: A study of the beef cattle industry emphasizing the importance of breeds, selection, evaluation, nutrition, breeding principles, disease control, equipment, facilities, and marketing. Laboratory recommended.

CAN: AG 22
TITLE: Introduction to Sheep Science
DESCRIPTION: A study of the sheep industry emphasizing the importance of breeds, selection, evaluation, nutrition, breeding principles, disease control, equipment, facilities, and marketing. Laboratory recommended.

80

CAN: AG 24
TITLE: Introduction to Swine Science
DESCRIPTION: A study of the swine industry emphasizing the importance of breeds, selection, evaluation, nutrition, breeding principles, disease control, equipment, facilities, and marketing. Laboratory recommended.

CAN: AG 26
TITLE: Introduction to Equine Science
DESCRIPTION: A study of the horse industry emphasizing the importance of breeds, selection, evaluation, nutrition, breeding principles, disease control, equipment, facilities, and marketing. Laboratory recommended.

CAN: AG 28
TITLE: Introduction to Dairy Science
DESCRIPTION: Description not available.

Food Science and Nutrition

The following two courses should be added to the CAN list in Family and Consumer Science.

1. Sanitation and Safety

Basic principles of personal and institutional sanitation and application of these principles to food preparation, storage, service; prevention of food contamination. Regulations of the California Health and Safety Code. Emphasis on the supervisor's responsibilities in maintaining high standards of these principles. Training to meet certification requirements for food handlers.

Core components: Importance of sanitation; microorganisms; contamination; foodborne illness and food allergies; food storage and handling; personal sanitation; HACCP principles, sanitary facilities and equipment; sanitation regulations; accident prevention; crisis management; and pest management.

CSUs that have a similar class include: Cal Poly Pomona, CSU Long Beach, CSU Los Angeles, Cal Poly San Louis Obispo.

2. Introduction to the Professions

Orientation to careers in Dietetics, Nutrition Science, Food Science and Food Service Management. Introduction to professional associations, publications and legislation pertinent to the professions discussed. Core components: Professional Associations, professional ethics, publications, legislation, employability, career goals, career preparation, evolving career opportunities (Speakers in professional areas and from local university programs as well as field trips may be included)

CSUs which have a similar class are: CSU San Bernardino, Cal Poly Pomona, CSU San Diego, San Jose State and CSU Long Beach.

The following two course descriptions should be updated:

FCS 26 Food Science Technologies: add "Chemistry of foods" after "exploration" of in the first line as indicated below.

Exploration of chemistry of foods, food processing and technology and how it affects the color, flavor, texture, aroma and quality of foods. Core components remain the same.

FCS 28 Cultural and Ethnic Foods. Modify descriptor as indicated below.

Regional, ethnic, cultural, religious, historical and social influences on food patterns and cuisines.

Core components: Specialized equipment and utensils related to cultures; regional, ethnic, cultural, religious, historical and social influences; traditional foods of selected cultures; geographic factors in food availability; global food issues; sanitation and safety practices; application to the food industry.

IMPAC ANNUAL REPORT
PREPARED BY IMPAC STEERING COMMITTEE AND ACCEPTED BY ICAS
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DESIGN AND LAYOUT BY RITA SABLER

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