

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 physics 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, **prokaryotic and eukaryotic** cell structure and function, homeostasis, cell ~~division~~ **cycling**, **molecular biology**, molecular genetics **including signal transduction and transcription**, Mendelian genetics, ~~cellular 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
- Prokaryotic and Eukaryotic 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 protists**, **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 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