

## Analysis of Biology Majors Program for WASC “Action Letter” – Fall 2007

This document was prepared in response to the memo from the SVPASA, 13 Sep. 2007, requesting specific ‘qualitative’ information. We preface our information with some comments to the ad-hoc analysis committee about analysis of the BA program in isolation from the rest of the Biology program. While course outlines on file do have answers to item 7 “student objectives” this old term did not necessarily elicit what we would view as measurable student learning outcomes (SLOs). The report includes an appendix of SLOs from the current curricula, which constitutes a snapshot of where we are presently in developing SLOs that will eventually be formalized in the course outlines. This snapshot also gives the best picture to date of what the program intends for its majors and we present some focus points for continued discussion.

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## 1. Preamble

### 1.1. Biology courses are required by many other Programs

It is important at the outset to note that there is a high proportion of non-majors courses taught by Biology faculty and this needs to be considered in the program credit hour production, number of FTE faculty, cost per student, etc. The Biology courses are important components of meeting community and regional needs. Some faculty in the Division of Natural Sciences (DNS) teach non-majors courses most of the time, others some of the time, and several courses in the Biology program are taught by faculty who are not in DNS but are in the Western Pacific Tropical Research Center or the Marine Laboratory. Some of the courses that support other programs are biology majors courses and enrollment is mixed:

Self-study Table B-6. UOG programs dependent upon biology courses (as of Fall 2005)

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CNAS: Agriculture Major (BI 157, BI 157L, BI 158, BI 158L, BI 315, BI 315L)
CLASS: Anthropology Major (Electives: BI 315, BI 315L)
CLASS: Psychology Major (Electives: BI 157, BI 157L, BI 158, BI 158L)
CPS-SOE: Secondary Education Major (Subject major 30-58 credits in BI; or General Science teaching Area Specialty: BI 157, BI 157L, BI 158, BI 158L, "Science Seminar Course" [does not exist!], and 16 credits of upper division science courses)
CPS-SOE: Teacher prep concentration: (starting fall 05) (BI 124, BI 124L required + BI 125, BI 125L [recommended] or BI 100, BI 100L or BI 110, BI 110L)
CPS: SONSWHS (formerly Health & Physical Education Major), Concentration in Exercise Science (BI 124, BI 124L, BI 125, BI 125L)
CPS: SONSWHS: Nursing Major prerequisites (BI 124, BI 124L, BI 125, BI 125L, BI 225/L)
CPS: SONSWHS: Pre-Physical Therapy (BI 124, BI 124L, BI 125, BI 125L, BI 157, BI 157L, BI 158, BI 158L)

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### 1.2. There are many 'undocumented' Biology Majors

We also wish to note that there are effectively more majors than appear in the Registrar's records, because of continuing failure in the advising system. The discrepancy is larger in the lower levels, especially BI 157/158 and these affect the cost effectiveness, retention rate, and other calculations, especially because overall program numbers are relatively small. Additionally, retention calculations are affected by the fact that Biology does not control admission to the program (unlike Nursing, for example). In our Self Study we displayed retention based on Registrar's data for sophomores and above and we tracked individual names:

Self Study, 2005, Table B-4. Retention of biology majors: Status—as of Spring 2005—of the biology majors (sophomores and above) listed by Registrar in Spring 2002.

Graduated from UOG in BI	27 (including Sp05 grads)
Graduated from UOG in other field <sup>a</sup>	2
Transferred to off-island university	5
Not yet graduated	1
Status unknown	2
Dropped out	0
Student unknown (not a bio major?)	1
Total	38

<sup>a</sup> Two students listed two majors and graduated in the other one.

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One final very important point must be made regarding the BI majors program: student achievement of the outcomes depends not only on the Biology courses but also the required Chemistry, Physics, and Mathematics courses as shown in an updated version of the matrix presented to WASC in Feb. 2007 (Appendix 2).

In short, the Biology Program supports and is supported by other programs and cannot be properly analyzed in isolation.

## **2. Requested 'qualitative' data on Biology BA majors program**

### *2.1. External recognition and other measures of program quality*

- a. Acceptance of students to grad programs, medical school, local employment.

Table B-9: Summary of employment of the 40 BA Biology graduates 2000-2004, based on one faculty member's records. The data are neither complete nor up to date but suggest the success of our students in finding biology-related employment.

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Employed in biology-related jobs	23 (58%)
Entered graduate or professional school	10 (25%)
Employed in non-biology jobs	3 (7%)
Unknown	4 (10%)

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b. Successes of undergraduate students include mainland research internships (feedback from mentors and program directors), and a top award for a presentation of a cellular research poster at the 2006 national ABRCMS conference.

- c. Repeated NIH RISE program funding (\$1.3 M for years 5–9).  
d. The Biology Self-Study was externally reviewed.

### *2.2. Course outlines with SLOs linked to biology major goals.*

The official course outline form calls for "student objectives" (item 7), and the use of this term predates the emphasis on SLOs. Moreover, the course outlines are official, approved documents that cannot be readily adjusted as a syllabus can be. Thus there are various responses to item 7 in the course outlines, some of which resemble SLOs. The Dean has tasked us with updating our syllabi, and we have been working to refine our SLOs in those documents (Table on next page). They will eventually go into revised course outlines. SLOs currently available in syllabi are included in Appendix 3. It will be apparent that there is still much uncertainty about how to write statements that summarize the core outcomes of a course in measurable activities by the students.

The task of linking these SLOs to Biology Program Goals is part of the work Dean Yudin requested for this academic year. Biology BA goals (Appendix 1) were first published in the 2005–06 catalog. Biology faculty recognize the need to operationalize the published goals with measurable objectives. A summary of the program goals that the SLOs support is shown in the revised matrix from WASC poster (Appendix 2). Faculty continue discussion of key expectations and outcomes for graduates. We are exploring ways of expressing intended program outcomes, including critical thinking outcomes utilizing core biological concepts (Appendix 4). These discussions should lead to modified statements of course goals expressed in SLOs and linked to intended program outcomes.

The analysis plan for one Bio BA outcome is presented in Appendix 5 and initial results in Appendix 6.

Table summarizing status of SLOs for all required and upper-division elective courses for the Biology BA major. The SLOs are presented in Appendix 3. <sup>(a, b, c)</sup>

Course identifier	Course SLOs in <i>syllabus</i>	Course SLOs in <i>course outline</i> <sup>(d)</sup>	Program goals reflected in either <sup>(e)</sup>
BI 120	yes	yes	yes
BI 157	yes	yes	no
BI 158	yes	yes	no
BI 225	?	no	no
BI 302 and 302L	yes	yes	yes
BI 303	yes	yes	no
BI 310	yes	yes	no
BI 315	yes	yes	no
BI 320	yes	yes	yes
BI 321	yes	yes	yes
BI 333	yes	yes	no
BI/AG 345	no	yes	no
BI/AN 360	no	?	no
BI 365	yes	yes	no
BI/PY 405	?	?	no
BI 410	yes	yes	no
BI 412	no	yes	no
BI 416 and 416L	yes	yes	no
BI 419 and 419L	yes	yes	no
BI 425 and 425L	yes	yes	no
BI/AG 430	yes	?	no
BI 440	yes	yes	no
BI 474	yes	no	no
CH 102	yes	yes	no
CH 103	?	yes	no
CH 310 A and B	yes	yes	no
CH 311 and 312	yes	yes	no
PH 251	yes	yes	no
PH 210, 211	?	yes	no
MA 203	yes	yes	no

<sup>(a)</sup> The extent and quality of the SLOs is still very variable at this stage in their development.

<sup>(b)</sup> Most separately-listed lab courses are integral parts of the corresponding lecture courses and have integrated SLOs.

<sup>(c)</sup> The course outlines on the UOG web are those existing from CAS days and are buried on the CAS section of the UOG website.

<sup>(d)</sup> The course outline form calls for "student objectives", not SLOs. As with the syllabi, responses to this item are very variable in their conformity to SLOs. "Yes" in this column means that the statements can be read in some way as SLOs.

<sup>(e)</sup> A curriculum map showing relation of courses to program goals is given in Appendix 2.

### *2.3. Centrality to UOG / CNAS College Mission*

The Biology BA program goals are central to the University's mission to enlighten, discover and serve; these goals are echoed in the College's academic mission. Highly qualified full-time and part-time faculty with a range of expertise and many years experience in teaching Pacific Islanders are actively engaged in research on biological/environmental problems of local and regional relevance. Faculty engage students in learning about Pacific island ecosystems and universal biological principles. Undergraduate students have many opportunities to conduct research on- and off-campus. The requirements of Biology degree program compare well with those of stateside programs. The Biology program prepares students to work in local agencies such as DAWR or EPA, and prepares them to enter professional or advanced degree programs, including PhDs and MDs at stateside universities. Because of small class sizes and recently acquired instrumentation, students have hands-on laboratory experiences that are not available at many large institutions. The majors are enthusiastic, diligent and capable students, many of whom wish to (and do) return to Guam to serve their home island after getting advanced degrees. Biology graduates are able to apply their biology knowledge and skills to locally important issues (as stated in goal #1) and are able to learn new knowledge and skills as needed and as the science develops. Continued lifelong learning is implicit in the Biology BA goals.

### *2.4. Support of Strategic Initiatives*

(a) Student success. (1) The Biology program faculty have worked for over a decade, through Dept. Education Title III grants (including MSEIP) and NIH-RISE to increase student success in biology by providing structured assistance with mastering scientific language; a series of three science communication courses is now (as of 2007–08) a requirement in the biology program and these courses have also attracted the interest of Chemistry faculty. The new NIH-RISE grant requires our Research Assistants to learn responsible conduct of research and other professional skills, thus supporting program goal #6 which has the intent of assisting students to improving their career success. (2) The institutional effort to strengthen advising is expected to improve retention of students in biology by guiding them into the program in their first year, so they can follow the recommended path instead of concentrating on their General Education courses in the first two years and then trying to fit four years of intense science courses in the last two years. We look forward to the achievement of this initiative!

(b) Academic Quality. The Biology Program faculty have, over the last 6–7 years revitalized the learning environment through several grant initiatives, and we are now at the point where we need additional faculty to maintain this entrepreneurial effort while not compromising teaching capacity of the unit (see Program Review recommendations under section 2.6). Through several federally funded programs, in support of the Biology Program Goals, students have opportunities to learn from modern science equipment, better curricula, paid research experiences, and off-island travel for research, workshops, and conferences.

The improvements achieved include equipping a lab and developing a curriculum for molecular biology, a computer classroom, new clinical- and research-grade microscopes, and new courses that bring the biology program closer to national expectations for graduates (as enunciated in the National Academy of Sciences report

*Bio2010*). There are now research labs in the Science building. Students have many opportunities for summer internships at first-tier research universities (Rutgers, Baylor College of Medicine, UCSD, etc.), which gives the students the opportunity to test their learning and skills in high-power research settings. For example, Dr. Tim Johnson, U. California San Diego STARS program, wrote, "In our 2005 STARS program your three students, Dayna Lucuab, Rozalyn Pama, and Frankie Mendiola, performed excellently. ... They have been well prepared for their research placements with our prestigious faculty and have been motivated to excel." Two students who just conducted research through the NIH Fogarty grant were offered five year PhD scholarships at a Florida university. Students bring their successes home and give confidence to the other students that their BA in Biology at UOG prepares them well.

**Self Study Table C-3 (updated). Federal grant applications and awards in support of Biology program and biology faculty research.**

Number of applications 1999-2006	16
Number of funded applications	11
Total direct costs awarded (approx)	\$ 4.1 M
Indirect costs awarded (approx)	\$ 300,000
<b>Federal agencies:</b>	
NSF-CCLI, National Science Foundation Course, Curriculum & Laboratory Improvement Program	
NIH-NIGMS-MBRS, National Institutes of Health, National Institute of General Medical Sciences, Minority Opportunities in Research, Research Initiative for Scientific Enhancement	
US-Dept. Education Title III Minority Science Engineering and Improvement Program	
CSREES, Cooperative State Research, Education, and Extension Service	
NOAA, National Oceanographic and Atmospheric Administration	
Dept. Defense, Navy	

Faculty continually improve their skills and biological knowledge; they read journal articles and books, network via email and at conferences, and reflect on how they are guiding student learning.

(c) **Institutional Efficiency & Effectiveness.** Biology program faculty continue to seek out best practices and processes. The WASC requirements for outcomes assessment should continue to be a stimulus to further development of an already effective program. We envision a curriculum that should ultimately be sufficiently well mapped (1) to explicitly identify and systematically guide student learning through incremental iteration (gradually increasing knowledge and skills through repeated but more challenging engagement with the science), (2) to identify any unnecessary effort, (3) to systematically fill gaps in the pathways to student success through additional courses (e.g., the Biostatistics course presently in preparation through collaboration with Mathematics) or, if necessary, through additional faculty (as previously done to add molecular biology capacity), and (4) to make optimal use of current faculty with as little reliance as possible on particular individuals for continuity.

(d) Community Engagement and Land Grant mission. The Biology program supports the regional focus of our Land Grant status as noted below in section 2.5. UOG is an open-admissions Land Grant institution; we must proactively assist local students in meeting UOG and WASC standards. Two examples of how the Biology program adapts to the Land grant circumstances include Principles Biology and the Science Communication courses. Principles of Biology lays the foundation for the program by assisting students to overcome the variable and often inadequate and science preparation offered in most local (Guam) high schools. The SciComm courses guide students in applying critical thinking tenets to writing and reading the scientific literature and to the presentation of scientific research; the first course in particular is intended to help students overcome barriers to success in biology.

Biology students are regularly featured in print and broadcast advertising as the university “pursues markets” to increase enrollment. Examples include the UOG recruiting DVD, TV recruitment advertisements, and the University Magazine.

### *2.5. Meeting student and regional needs*

The curriculum reflects a responsiveness to the needs of local and regional communities through support of local needs in environmental, health care, and related areas. Some of this support is directly in the majors program, some through courses that serve other majors; as noted above, some courses serve both biology and other majors.

#### (a) Student needs.

The curriculum prepares students well to work with regional environmental issues including wildlife and environmental impact assessments. There are no national standards for biology as a whole, or for particular subdisciplines except for some guidelines for biomedical research careers (*Bio 2010*). Thus, we measure our success in meeting student needs via graduates’ successes in their chosen careers (see Table B-4, above). Graduates work at local and national environmental consulting companies and have even started their own companies. Several biology students and graduates work at Dept. Agriculture Division of Aquatic Resources and Wildlife, Guam Environmental Protection Agency, and the Guam Crime Lab, and still others have become teachers, medical doctors, optometrists, etc. on Guam.

Biology courses also meet the needs of majors in fields other than biology (see Preamble). Some courses are mostly for non-majors, such as Human Anatomy and Physiology, and others are primarily majors courses, such as Principles of Biology. Successful completion of Microbiology and both semesters of Human Anatomy and Physiology is required of students who wish to enter the Nursing program. School of Education (SOE) students planning to teach in middle or high schools (secondary education) are able to choose a number of biology courses, or even double major. Principles of Biology and Genetics are requirements for the “graduate track” Agriculture degree.

(b) Community needs. Several careers supported by the Biology major program are on the Board of Regents’ Educational Majors Career Priorities List (12/19/06), including medicine in general and several specializations (cardiology, diabetes...), environment, and biomedical and marine science. The Biology program supports biomedical student aspirations to help address island health problems. Recent Ph.D.



graduates all expressed the desire to work on Guam and 3 of the 4 are addressing minority health issues in postdoctoral positions.

*2.6. Completed Program Review, with recommendations acted upon*

The last Self-Study for Program Review was submitted to the College AAC and Dean in Nov. 2005 and reviewed by the Senate Program Review team in March 2006, but was subsequently misplaced and did not leave Senate until January 2007. The Self Study noted that almost no action had been taken by administration in response to the recommendations of the previous (1999) report regarding faculty, facilities and advisement. However, some of our needs were met by faculty who successfully sought grants that addressed some of the professional development and equipment needs. Several recommendations were made in 2005 (listed in Appendix 7). Essentially all that involved administrative action or finances have yet to be acted upon. Two part-time positions that were supporting Anatomy and Physiology were converted to one full-time tenure-track. For assessment, CNAS faculty have been left to struggle (goaded but largely unsupported) in completing the new WASC requirements. Progress with SLOs was noted in section 2.2 above.

A special plea was made at the time (Appendix C-1 in the Self Study) that Nursing not be allowed to expand without concomitant increase in support of Biology and Chemistry; this too was ignored. That expansion has now created a resource crisis in our programs. Our ability to support our majors has been impacted.