ARIZONA STATE UNIVERSITY

To: Elizabeth Phillips
Provost

November 14, 2012

From: Robert Page
Vice Provost and Dean

Subject: Changing Natural Science General Studies Requirement

I am requesting that Arizona State University change its existing Natural Sciences General Studies requirement from 8 credits to 7 credits; and that the 7 credits include one 4-credit laboratory science course (one SQ or SG course). The other 3 credits can be achieved through either an additional laboratory science SQ or SG course or through a non-lab science course (courses that would include all of the SQ or SG learning goals except the requirement that the course include weekly laboratory or field sessions and accompanying reports).

The General Studies requirement at Arizona State University is designed not only to prepare our graduates for success in their chosen professions or advanced study in graduate or professional school, but to equip them to enter the world as contributing and informed citizens, ready with a broad set of knowledge and skills that will ensure a lifetime of continued learning. The components of General Studies include both the development of core skills (writing, communication, quantitative reasoning) along with broad exposure to traditional branches of knowledge — the arts and humanities, the social sciences, and the natural sciences.

Natural Science is one of five "Core Areas" in ASU's General Studies requirement. As is noted in the Academic Catalog:

> *The natural sciences help students appreciate the scope and limitations of science and its contributions to society. Natural science areas of study include anthropology, astronomy, biology, biochemistry, chemistry, experimental psychology, geology, microbiology, physical geography, physics and plant biology. Knowledge of methods of the scientific inquiry and mastery of basic scientific principles and concepts are stressed, specifically those that relate to matter and energy in living and nonliving systems. First-hand exposure to scientific phenomena in the laboratory is important in developing and understanding the concepts, principles and vocabulary of science.*

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Currently, students are required to take 8 credits (specifically, two laboratory science courses) to fulfill the Natural Science requirement. At least one of the two courses must be designated as "Natural Sciences – Quantitative (SQ)," a 4-credit laboratory course that includes substantial introduction to the fundamental behavior of matter and energy in physical and biological systems. The second course can be an additional SQ course or a course designated as "Natural Sciences – General (SG)," a 4-credit laboratory course that covers aspects of scientific inquiry that lend themselves to more qualitative or descriptive discussions of science.

Attached is a look at our peer institutions. All 30 of the universities surveyed include natural science courses as part of their general studies curriculum, however, only half specifically require a course with a laboratory component and only one other university (Oregon State University) requires two laboratory science courses (one lab science course in the Biological Sciences and one lab science course from the Physical Sciences).

If the goals of our natural science requirement are for our students to explore the scientific method, understand science as a way of knowing, and appreciate the ways scientists test hypotheses using measurement, data collection, and experimentation, laboratory-based courses provide but one way to achieve these objectives. Lecture and seminar classes, when properly developed, can provide students insights into scientific thinking and can be delivered in a more efficient and cost effective way. Labs are expensive and by their nature require specialized classrooms, costly equipment, and additional supervisory staff. And while labs are essential for science majors to develop the skills and knowledge essential for their disciplines, these classes may not be the most appropriate way for non-science majors (students who may only take a handful of science courses while undergraduates at ASU) to develop the scientific literacy outcomes outlined in our General Studies requirement.

As it currently stands, few of our SQ or SG courses were designed specifically for non-science majors. Indeed many of the courses included on ASU's SQ and SG lists serve purposes beyond the fulfillment of general studies requirements – introductions to the major, the first or second course in a sequence of science skills-building courses, pre-requisites to disciplines beyond the specific lab science course, etc.

Over the past year, I have discussed this proposed change with our ASU's faculty leaders (chairs/directors in our college, members of the CLAS Faculty Senate, along with deans from other schools and colleges). There has been no opposition to this idea. In fact, many applauded the change, were eager to see it implemented, and looked forward to working with our college to develop General Studies science courses specifically for non-science majors.

General Studies Science Requirements of Arizona State University's Institutional Peers

INSTITUTION	GENERAL STUDIES SCIENCE REQUIREMENT	LAB REQUIREMENT
Arizona, University of	Total 3 science; 2 Tier 1 non-lab and 1 Tier 2 (most are non lab). No specific lab requirement.	No.
California State University system	As of June 2009, all schools were to align their general education requirements with executive order. Scientific Inquiry and Quantitative Reasoning 12 semester hours or 18 quarter hours: 3 (4) physical science, 3 (4) life science, lab for either the physical science or life science, 3 (4) hours math/quantitative reasoning.	Yes.
California, University of - Berkeley	The only university graduation requirements are in writing and American History and Institutions. Other than that, each college sets its own requirements.	No – but transfer students entering under IGETC have to take one lab science and one non-lab.
California, University of – Los Angeles	The only university graduation requirements are in writing and American History and Institutions. Other than that, each college sets its own requirements.	No – but transfer students entering under IGETC have to take one lab science and one non-lab.
California, University of – Santa Barbara	Three courses from a list of science, math, and technology courses – this is somewhat dependent on the major of the student since the only university graduation requirements are in writing and American History and Institutions.	No – but transfer students entering under IGETC have to take one lab science and one non-lab.
Cincinnati, University of	9 credits, 6 credits of which must be from the College of Arts and Sciences	No.
Colorado, University of – Boulder	The only general education requirement is for the college, not the university – for the College of Arts and Sciences, the core curriculum is 13 semester hours, including a two-course sequence and a laboratory or field experience.	Yes.
Connecticut, University of	6 to 7 credits in science and technology.	Not necessarily.

Florida State University	7 semester hours natural science, includes one lab course	Yes.
Florida, University of	9 credits of Physical and Biological sciences	Not specific.
Illinois, University of – Chicago	At least one course from the content area, Analyzing the Natural World; many on the list do have a lab component.	Not necessarily.
Iowa, University of	Minimum of 7 semester hours, including one lab.	Yes.
Iowa State University	Minimum of 11 credits, including 3 in the mathematics disciplines and 8 in the natural sciences. Cannot fill with courses from the major.	Not necessarily but likely.
Kansas, University of	For the B.A., three courses from Natural Sciences and Math division, with no more than one course from each division of: Biological sciences, Earth sciences, Mathematical sciences, Physical sciences. The B.G.S. requires 2 from the division. At least one must be a lab course.	Yes.
Kansas State University	At least 18 hours of approved UGE courses, 1/3 of which must be upper division. This is very vague and do not specify science.	No.
Maryland, University of	3 courses required for Natural Sciences and Mathematics; up to two from the Physical Sciences and up to two from Life Sciences. At least one science course must include or be accompanied by a lab taken in the same semester.	Yes.
Massachusetts Institute of Technology	9 classes in math, science and technology: 2 classes in physics, one in chemistry, one in biology, a lab science, 2 Restricted Electives in Science and Technology, 2 classes in calculus.	Yes.
Minnesota, University of	4 credits in biological sciences, must include a lab or field experience; 4 credits in physical sciences, must include a lab or field experience.	Yes.

Missouri, University of	At least 9 credits in biological science, physical science, and/or mathematical science including at least one with a lab component in biological and physical science. Must be from at least two different departments.	Yes.
Nebraska, University of – Lincoln	Since fall 2009 students must take 3 hours in each of 10 ACE learning outcomes. Competency 4 suggests a science course, but does not specify.	No.
North Carolina State University	A total of 7 credit hours from the university approved GEP Natural Sciences course listing including a least one laboratory course or course with a laboratory.	Yes.
Northern Arizona University	7 semester hours; one must be have a lab component	Yes.
Oklahoma, University of	7 hours, 2 courses from different disciplines, including one laboratory component	Yes.
Oregon State University	Biological Science with lab (4 or 8 credits), Physical Science with lab (4 or 8 credits).	Yes (2 courses).
Pennsylvania State University	9 credits of courses with GN designation	Not necessarily.
Rutgers, State University of New Jersey	6 credits from natural science disciplines: astronomy, biological sciences, chemistry, geology or physics.	No.
Temple University	2 courses of three hours each in Science and Technology.	Not necessarily.
Texas, University of – Austin	9 semester hours, consisting of 6 hours in one discipline and three hours in a second	Not necessarily.

	discipline	
Washington, University of	Minimum of 20 quarter-hours in The Natural World	Not necessarily.
Washington State University	Total of 10 hours with at least 3 each in both the biological and physical sciences, and including at least 1 credit hour of laboratory sessions.	Yes.