Memo to: COSM College Council

From: Department of Biology

Regarding: Request for change to College Math requirement

Currently students in the College of Sciences and Mathematics (except in the division of Nursing) are required to take MTH 233 Calculus I as a college requirement. The Biology Department requests that the college consider a change to the college requirements allowing students instead to take advanced statistics (STA 320) in place of MTH 233. The current and proposed catalog wording is as follows:

**Current (p 417 Catalog)**

1. Core Curriculum

B. Mathematics (4 Hours)

* MTH 233

2. College Requirements

* Three or four hours from MTH 220, 234, depending on requirements of major

**Proposed Revision**

1. Core Curriculum

B. Mathematics (3-4 Hours)

* MTH 220 or 233 as stipulated by program requirements

2. College Requirements

* Three or four hours from MTH 220, 233, 234, or STA 320 depending on requirements of major

**Rationale for the Request**

Mathematics of one form or another are central to all scientific disciplines. The most important form of mathematics for most biology majors is statistics. Basic statistical principles such as sampling size and strategy, and mean, median, and mode are included in all levels of biological courses. These concepts, along with probability theory, are covered in MTH 220. However, biological studies and analyses are founded upon statistical techniques including ANOVA, regression, forms of multivariate analysis such as PCA, Chi Squares, and contingency tables. These techniques are (in part) taught in STA 320. In addition, the ability to use SAS or R taught in STA 320 is of itself a marketable skill for biology students. Lack of training in these techniques makes it very difficult to teach students the proper analytical skills necessary to do biological research and makes it difficult for students to understand the biological literature which hinges on these techniques.

The current college math requirements hamper biology student success in that they emphasize calculus, which most biologists do not use, at the expense of statistics, which we use on a daily basis. Lack of adequate statistical training means that our biology graduate students at best require statistical remediation at the beginning of graduate studies, and at worse may deny otherwise highly qualified students the opportunity to enter the program of their choice.

The proposed change will not negatively affect medical school preparation. All medical disciplines currently require statistics and only two, optometry and pharmacy, require calculus (and will of course be advised to take caluculus). In addition, the proposed change is in line with the Texas Higher Education Coordinating Board Tuning of Biology for Mathematics which states “The biology graduate uses basic algebraic expressions and mathematical approaches to solve problems. The graduate applies statistical analysis to data and selecting appropriate mathematical strategies to analyze such data in post-graduate or work environments” (http://www.thecb.state.tx.us/index.cfm?objectid=8FFC700A-D9F8-57C3-CD178199FADC8CD4).

In a recent study of requirements for a BS in Biochemistry, Dr. Michele Harris also found that Sam Houston, UNT, UTSA, and UT Tyler required either Calculus I or Calculus I and II for a BS in Biology, while Lamar requires pre-calculus. As the Biology Department considered the proposal to change the math requirement to allow statistics to replace calculus we looked at the math requirement for graduate schools by subdiscipline at UT, Texas A&M, Duke, U Florida, U Illinois, U Kansas, Oklahoma State, and U Washington. Zero of eight botany programs required calculus, zero of eight Ecology and Evolutionary Biology programs required calculus, one (U Texas) of seven microbiology programs required calculus, one of eight Cell and Molecular programs (U Texas) required calculus, and one of two Biotechnology programs (U Kansas) required calculus. Cumulatively, only three out of thirty-three graduate school programs (9%) analyzed stipulated calculus as part of their entry requirements.

Based on the clear need for statistical skills in Biological studies combined with the general lack of a calculus requirement for graduate studies in most graduate programs we feel that our request will be beneficial to the bulk of our students. While the requested change takes us away from undergraduate program requirements at sister institutions in Texas, this change will bring us more closely in alignment with the THECB Tuning for Biology. As such, we feel that this change will put our students mathematically at the forefront of their colleagues from peer institutions by better preparing them for the types of math most biologists commonly use.