Report of the Review Committee  
Department of Statistics  
Oregon State University  

January 26, 2016

1. Overall Recommendation
The committee recommends for the present to maintain the support for the department with modest investments to preserve their strengths at the MS and PhD level, but to invest and expand the department of statistics over the longer term, to meet the growing needs for persons trained in Statistics and Data Science, and to meet the growing opportunities for collaborative interdisciplinary research at OSU.

2. Summary of Findings and Recommendations
The committee comprised of two external and two internal members met for one full day, December 1, 2015, to meet with faculty, staff and administrators in small groups to gain insight into the strengths, weaknesses, and opportunities that are facing the department. We had very good interactions with these groups, and coupled with the self-study completed over the past year, make the following recommendations.

1. Ecampus funds and summer support tuition should be shared at some proportion (we suggest 50:50) with the department(s) to provide an incentive for department(s) being entrepreneurial. Having this direct proportional resource, based on their success is very important for moral in the departments. This also empowers departmental leadership to seek out opportunities that improve the department’s reputation and stature. These funds could also be used to improve the staff support in the department.

2. Additional funds from the VP of research to supplement the operation of the consulting service should be requested. These investments could be tied to joint collaborative research with statistics faculty using the CAS model as the basis for accountability.

3. New faculty hires could be co-funded from other colleges (like the CAS arrangement) to support research collaborations. An alternative model would be joint appointments (with shared budget support), or courtesy appointments (without shared support).
4. Assistance from the dean of CAS was offered in our discussion to provide staff support for grant pre-award. This offer should be accepted to learn how this could be done efficiently. Faculty members could be more efficient in soliciting grant support if the barriers are lowered for the routine aspects of applying for funding. Other universities benefit from having staff dedicated to performing the routine aspects of preparing the grants, such as budget preparation, checking compliance with instructions, preparing outreach and facilities statements, and maintaining existing support statements.

5. If the statistics option in mathematics is maintained, then CoS should provide resources to the statistics department to develop the new courses needed for the statistics option. This should be an additional faculty member at minimum, to provide additional sections to keep enrollment levels at a reasonable level. In the long term, and more helpful for the statistics profession, would be to have an undergraduate statistics major, rather than a statistics option in mathematics. A statistics major could have two tracks – a graduate studies option, which would have a strong mathematics component (equivalent to the current math major with a statistics option), and an applied option with a minor in another discipline.

6. To satisfy the increasing need for high-performance computing, faculty members should apply for time on NSF supercomputers. They should also apply for computer resources in their NSF or other grants (with computer intensive needs) to potentially contribute to the CoS shared compute cluster.

7. The committee had considerable discussion about the MS degree without a thesis. Although stronger than a professional degree, the department might consider identifying more students for entry directly to the PhD program and prioritizing funding for those students. However, given that the department uses the MS program to attract high quality students, they do attract some students who eventually decide to pursue the PhD who may not otherwise attend OSU.

8. Opportunities exist for funding joint faculty appointments, which would broaden the base of expertise in the statistics faculty. The review schedule did not afford the chance to meet with faculty in other departments. The review team suggests finding ways to incorporate them into the life of the department, perhaps with occasional colloquia, and focused research groups formed for the purpose of applying for joint grants. These ‘adjunct’ faculty members may be interested and benefit from more interaction.

9. We heard discussion that the consulting course should be a 3-credit course, given the workload. We feel the department curriculum committee should address this, and decide how much credit it is worth. We also heard that the
exposure and experience working on consulting projects was very valuable, and the students derived much benefit from it. To improve the benefit to the research portfolio at OSU, graduate students from other departments should be encouraged to visit the consulting service earlier in their program, so they can get advice at the design stage of their research.

10. The Math department should provide a one-quarter measure theory course for the Stat department, and perhaps also the mathematical probability course. We heard that the regular measure theory sequence taught by the math department, aimed at the math majors, has been quite variable in how it is taught, and not a reliable course for the Statistics graduate students. A one-quarter course, designed for Statistics majors, probably taught by one of the probabilists in the Math department would be more appropriate.

11. Students do not all have adequate computing skills for a modern statistics course when they arrive at OSU. It was suggested that an R course could be offered in their first year, first quarter, to provide some basic computing skills. This could be broadened to also teach basic algorithms and programming techniques.

12. Instructors feel as an integral part of the program, not exploited, and are given funds for professional growth activities. This signifies a healthy climate that promotes a positive moral in the department.

3. Detailed Findings

INTRODUCTION

• The objectives of the review, participants, order of events and organization of the report

This report provides an external review of the graduate program of the department of statistics at Oregon State University. The committee comprised James L Rosenberger (Department of Statistics, Penn State University), Michael L LeBlanc (Department of Biostatistics, University of Washington), James Coakley (College of Business, OSU), and Sourabh V Apte (College of Engineering, OSU). The committee had an initial dinner meeting November 30, 2015 with the Dean of the Graduate School, Dr. Brenda McComb, to discuss the goals and schedule for the one-day visit, and the external members met with Dr. Virginia Lesser for breakfast on the day of our scheduled interviews. On November 12, 2015 Kim Calder, executive assistant to the dean of the graduate school, sent the committee a complete copy of the Statistics Graduate Program 10 year review, along with the appendices.

INPUTS

• The mission of the program, and its relationship and alignment with the mission of the academic college(s), Graduate School and university mission
The statistics department is a core program that serves multiple graduate and undergraduate programs within the university. The program is housed in the College of Science (CoS), but also has direct funding support from the College of Agricultural Sciences (CAS). The stated mission of the department is "...to contribute to the overall objectives of Oregon State University and the Colleges of Science and Agriculture Sciences through...” While it may be appropriate in a mission statement to acknowledge your primary funding sources, it does seem to restrict providing services to the broader university community. In light of the need to form additional relationships with other research programs within the university, and the growing importance and recognition of the statistical and data sciences for the success of the research mission of the university, the department should revisit their mission statement.

- **Recruitment and enrollment trends of students**
  There has been a significant increase in the number of applications to the department over the last 10 years, from 90 to 175. Although the admission rate to the Master’s degree program has dropped to approximately 25% of applicants, and with about 40% accepting, this still results in a substantially increased enrollment of students. The high GRE scores of incoming students also support that they are getting high quality graduate students.

- **Admissions selectivity and other indications of selecting high quality and diverse students**
  The Department uses a Graduate Admissions Committee. The majority of admissions are to the Master’s degree program. Direct admission to the PhD is possible, but the applicant must find a faculty member who will sponsor them prior to admission. In the past year, 44 applied for direct entry to the PhD, 3 were admitted, yet only 1 was funded and enrolled.

  For the Master’s program, the top candidates are funded with GTA positions. This funding does help to attract top candidates into the Master’s degree program. The Master’s students complete a comprehensive exam at the end of the first year, and performance on this exam determines whether they will be invited to stay on for the PhD.

  The Department gives short presentations at regional Colleges (Salem, Portland, and Tacoma Washington) to provide information about their graduate program. Other than these regional presentations, they do not directly or actively recruit students. They rely on referrals from the recruiting activities of the Graduate School, such as hosting McNair Scholars to contact underrepresented domestic student populations. Given the very low domestic diversity within the student population, the Department should consider using a more direct approach to advertise their program to underrepresented groups.

- **Level of financial support of student, and as compared to peers**
  From our meetings with the department head and faculty, there seemed to be adequate
support for the graduate students, and indeed the impression was that OSU was quite successful in being able to recruit high quality graduate students. However, having some additional discretionary funds as recruiting bonuses would be helpful to compete for the top students. A very important strength we noted from talking with the students was the impression that the department is a very welcoming and friendly community, which potential recruits sense when they visit. The team questioned the department policy of funding most students as MS candidates when they apply, and then after they pass the PhD Qualifying Exam, continue to fund them as PhD students. However, this strategy as mentioned elsewhere does seem to fit the department’s current vision.

We comment here on the data taken from Appendix Table C: Financial Support for Graduate Students. For the last year for which data is given, 2013, we note there were 6 GRAs and 36 GTAs funded, for a total of 42 students funded. Of these 42 students, 24 were Master’s students and 18 PhD students. The committee felt that as the department matures with the planned hiring of one or two senior faculty members, and successful promotion of the current cohort of strong junior faculty, the proportion of PhD students should increase. The median level of GTA funding for both Master’s and PhD students was $1,836/month, for approximately half time employment. This seems to be in the typical range for their competition, and would translate to an annual fulltime salary of $44K.

However, almost completely missing, which top programs would like to have are graduate Fellowships or Scholarships, which could be offered to the most outstanding students. Appendix Table C only shows one Fellowship in 2013 awarded by the graduate school, but recently apparently others have become available.

- **Curriculum strength**
  The Department of Statistics teaching effort is summarized in Appendix Table D: Characteristics of graduate courses. This gives the counts of the number of individual course sections of 500 level, 600 level, and 400/500 level courses from 2004/05 through 2012/13 academic years. This data shows the number of sections over the decade from 119 to 137 sections, a 15% growth.

  From Appendix Table E: Graduate Level Student Credit Hours (SCH), the Statistics department in 2013 generated 4,282 SCH. With 34 course sections taught by graduate faculty, and assuming 3 SCH per course, the typical average size section had \((4282/3)/34 = 41.9\) students. Given that some first year graduate courses are much larger, the advanced graduate courses for PhD students would be reasonably small, perhaps 8-15 per section. We understood from the discussion with faculty and students that many of the PhD courses are only offered every other year, to allow for adequate enrollment.

- **Quality of personnel and adequacy to achieve mission and goals**
  The Appendix Table I: Faculty productivity, shows an indication of an improved publication record, with 3/12 or 25% of faculty publishing a total of nine publications in
2003/04, whereas a decade later 10/10 or 100% of faculty contributed to a publication record of 31 publications in 2013/14. This trend shows real growth in this important indicator of research productivity.

However, grant funding for research may require more informed interpretation than the team was able to understand. In 2003/04 the Appendix Table I shows $11.5 million in grant funding, a notable outlier! Then from 2004/05 there was a steady increase from a low of $57K to a peak of $824K in 2011/12 and then ending in 2013/14 at $300K. However, it isn’t clear whether these amounts are the total grant awarded in the year, or the total amount charged to grants during the year on active grants, though likely the former.

From discussions with the junior faculty there seems to be the potential for increasing the grant success, both individually and by focusing more on joint collaborative grants. The current faculty, although skewed to the junior ranks, are energetic, cohesive and appear to be very supportive of each other and the department. The department has a proud legacy with trailblazing faculty who provided leadership for the profession in several areas. The committee hopes this record can inspire the current staff and faculty to reach again for excellence in achieving their mission.

The department head, Professor Virginia Lesser, has provided excellent leadership during the past few years, in the opinion of the committee. In addition to directing the Survey Research Center, she has attended to the myriad responsibilities of directing the department during a time of significant faculty turnover due to retirements and hiring junior faculty. Finding an excellent senior hire could provide relief from some of this administrative burden in the near term.

- **Level and quality of infrastructure**

The Statistics Department faculty members participate in a computing cluster (COSINE) by using their startup funds, some departmental funds, and OSU’s RERF funds that is shared by faculty and their research groups for computing needs and data storage. This cluster is mainly for research activities. Although the startup funds and departmental funds were used to build this computer cluster, its maintenance and upgrade will need continual support. Most of the computing cores get outdated in 3-4 years. The faculty mentioned they need more computing resources, including a computing laboratory for teaching and for student usage. This is especially important for the proposed Data Analytics program, which will require accessing and analyzing large data sets on a computer, which can support virtual users.

**Recommendation to Improve Research and Teaching Infrastructure**

Other colleges maintain computer laboratories for students to use and also for teaching courses. The College of Science may want to invest in setting up and maintaining computing infrastructure for teaching as well as research. The faculty should also look into applying for national supercomputing resources funded by NSF or other funding
agencies. For example, NSF’s XSEDE supercomputing facility, allows principal investigators (PI) to apply for computing time on their cluster every year for free, especially if the PI is supported by the funding agency. They also have computing time available for educational purposes and assign equivalent expenditures as additional, indirect support, which will also help the faculty make their research portfolios stronger (https://portal.xsede.org/).

- **Quality of organizational support**
  The Statistics Graduate Program has one full time staff person (as graduate student coordinator, scheduling), and two half-time persons each with a split appointment with Biochemistry and Biophysics. One of the half time appointments is for the office manager (budget analysis and some grant budget support) and another is for institutional research that supports faculty searches, the P&T process, GTA appointments, among others. Previously they had two full-time FTE staff persons within the program, but recent restructuring resulted in split appointments with Biochemistry and Biophysics. So even though they effectively have the same FTE of staff as before, the split appointments present difficulty in providing quality support. The split appointments are not necessarily due to staff skill sets, but more related to funding. The split appointments require these staff members to move from one office to another making it inefficient for them to support the two departments. Student advising is handled by an Associate Professor. Due to the split appointments, some of the office jobs are done directly by the department chair overloading her responsibilities. Student work-study workers are not being used, which would be very cost effective help for some of these tasks. Discretionary funds generated by Ecampus courses are no longer being provided to the department chair. There was considerable concern expressed by the staff that the growing Data Analytics online program will create additional challenges and burden the already understaffed office.

Unlike other OSU-colleges, the College of Science (CoS) does not provide Web support or help with grant writing, e.g., construction of the budget, help with Cayuse, submission of the proposals, etc. The faculty members themselves currently do these tasks. The online admissions process is perceived as not very effective and staff expressed fear that growth would mean increased applications and enrollment. They feel that having two full time staff in addition to the half time office manager would help substantially with the organizational support.

**Recommendation to Improve Administrative Support**
The CoS should invest in office support to realize the growth and meeting the needs and the mission of the department. A college level office that focuses on grant writing and grant preparation, including preparation of budgets, is urgently needed. This would be particularly valuable for large multi-investigator grants, but it is a standard resource even for individual PI proposals at many universities. Dedicated administrative support to help submit proposals will increase the effectiveness of faculty members seeking funding. Since the Statistics department also serves College of Ag Sciences, at our
meeting with the college deans, Dean Arp, of the CAS offered to provide partial staff support for grant writing. The committee thought that the CoS should accept this offer, and work toward having its own grants support person(s) or office serving all departments. Statistics should also consider using student work-study workers to help assist with some of the time-consuming office tasks associated with admissions to help the administrative staff.

Productivity

• 4- and 8-year graduation rates for master’s and doctoral students
There has been a significant increase in the number of applications to the department over the last 10 years. Even though the admission rate to the Masters Program has dropped to approximately 25%, and about a 40% acceptance rate, that still results in a substantially increased enrollment of students. The high GRE scores of incoming students also support the claim that they are getting high quality graduate students.

• Publications or evidence of other scholarly work by students and faculty
The junior faculty and recent recruits are a key aspect of the strength of the department. The energy of this group of faculty members was clear during our meetings at the site visit. With respect to research activities, they publish in high impact journals such as Journal of the American Statistical Association, Biometrics, Journal of Graphical Statistics, Statistics in Medicine and the Journal of the Royal Statistical Society. In addition, the total number of research publications has significantly increased over the last several years as evidence of increased productivity of the faculty in the department. Student scholarship as measure by achieving travel awards is well documented in the Self Study Document and shows their success via ASA student travel and other awards.

• Student satisfaction with their education and mentoring experiences
The OSU Survey Research Center (OSU-SRC) conducted a survey of 2014 graduate students in Statistics for the department. From the survey, more than 90% of both PhD and masters students rated Level of teaching and Quality of teaching very good. PhD students rated courses with rigor lower with very good or good totaling 71%, but this is likely related to courses in the past having much smaller fraction of PhD students to Masters students unlike current enrolment. In terms of guidance received from their major adviser, students were highly satisfied with accessibility, professionalism and research guidance.

• Viability of scholarly community within which students can interact
Quoting from the survey summary: “For most categories, the majority of PhD respondents thought the opportunities were very or somewhat adequate for all categories.” Clearly the teaching opportunities as offered by GTAs were considered high, with 86% of PhD students rating them as very adequate.” However, the PhD graduates expressed some concern about the lack of opportunities for graduate
research assistantships, with 29% saying “slightly” and 14% saying “not at all adequate.” (p. 50).

Outcomes and Impacts
• Equity, inclusion and diversity activities
The department participates in university wide diversity activities, such as contacting underrepresented minorities who indicate Statistics as an area of interest. However, they do not feel that their stipend levels are competitive nationally, and use their limited Foundation funds to increase the amount awarded for top students.

• Placement and success of graduates
Based on the survey of recent graduates, the Department of Statistics has a very good record of placing its graduates. To quote from the self study (P. 46):

Each alumnus (graduating in the past 10 years) was asked about how long did he or she search for a job in statistics. Of the 51 respondents, 82% stated 0-6 months, 14% stated 7-12 months, and 4% stated 13-24 months. A follow-up question asked about whether the search ended up with a job in statistics. Eighty-six percent of alumni stated yes. There were too few PhD graduates to the survey to provide comments by degree type.

• Satisfaction of students and graduates with their education and their post-graduation employment success
The department surveyed their students and recent graduates in 2014 resulting in 38 completed survey responses. As reported in the self-study (p. 48), of the 38 respondents 93% of PhD students and 87% of MS students were somewhat or very satisfied with the available courses offered though the department. Also, 93% of PhD respondents rated both the level of teaching and the quality of teaching as very good (50% and 36%, respectively) or good (43% and 57%, respectively). Fifty percent of the PhD respondents rated the rigor as good and 29% of PhD respondents rated it as fair. Only 21% of PhD respondents rated the rigor as very good. However, Master’s students rated these qualities higher. This suggested to the committee that the teaching of courses aimed primarily at the MS students, resulted in the PhD students not feeling challenged to the extent they would prefer in the past.

• Professional or national rankings/ratings
The most respected source for measuring the quality of graduate programs are the decadal studies by the National Research Council (NRC) of the National Academy of Sciences. The 1995 study Research-Doctorate Programs in the United States – Continuity and Change ranked Statistics and Biostatistics programs with data collected in the early 1990s. In this study, the Department of Statistics at OSU ranked 37.5 out of 63 departments included in the study. (See Appendix smphys_h.xls)

The recent study by the NRC, A Data-Based Assessment of Research Doctoral Programs
in the United States, published in 2011 from data collected in 2006, provided interval estimates, with the lower (5%ile) and upper (95%ile) limits, for the ranks based on two methodologies to determine the rankings, S-ranking (for survey-based), and the R-rankings (for regression based). Based on this study, the Department of Statistics at OSU received an S-ranking (47 – 56) and an R-ranking (37 – 56). Even with the uncertainty represented by the 90% intervals, it appears the ranking of the department remained flat or fell during the decade from 1995 to 2005.

Quoting the Vision of OSU: “To best serve the people of Oregon, Oregon State University will be among the Top 10 land grant institutions in America.” For the Statistics Department to share in achieving this goal, there will need to be major investment in the program by hiring key senior faculty to provide leadership. An important strategy would be a policy of returning funds (suggest 50% of net income) earned through the recent investment in the Data Analytics online program, to provide incentives to the department to grow the program. This has the dual benefit of meeting the needs for trained data scientists and analysts in the workforce, while building the budget for growing the Statistics department to meet the growing need for service courses across the university.

- Community engagement activities
  Graduates are highly sought in non-profit research institutions due to the level of training and advising they receive while at OSU. As the University of Washington example shows, Masters graduates are taking significant roles in design and conduct of nationally conducted NIH funded clinical trials.

CONCLUSION AND RECOMMENDATIONS FOR IMPROVEMENT
Overall the committee felt that the department has strong leadership and was performing well given the recent number of retirements and hiring of a number of junior faculty members. This current situation was the basis for recommending modest growth of the program in the short term, to allow the junior tenure track faculty to reach their stride and achieve tenure. However, given the goals of the department and the increasing need for statisticians and data scientists, the university would be wise to invest for growth in the department in the medium term, i.e. next five years. Assuming the new online Data Analytics program is successful, the income stream from this program provides justification for investing new resources in the department, including tenure track faculty, to build both in quality and manpower to provide the necessary instruction to meet the demand.

As mentioned above, the recent decision to create an undergraduate option in Statistics in the math department is useful for meeting the demands for well-trained data scientists. However, if it results in resources being directed to the mathematics department, rather than the statistics department, it may not provide the desired outcome. An alternate approach would be to create a Statistics undergraduate major,
which would bring more visibility to the Statistics department, and properly reflect the core focus of these students in Statistics rather than Mathematics.

The statistics faculty members contribute significantly to the teaching and research mission of the University. In addition new methodological and collaborative statistical science impacts the research activities in both CoS and more broadly within the OSU community. This builds on relationships and the funding history of CAS statistics activities. Students are very happy in their department. Faculty members have a productive research record, they are accessible, and they really care about the students. Even instructors attend faculty meetings and participate in social events. Current faculty, although skewed to the junior ranks, are energetic, cohesive and appear to be very supportive of each other and the department. The department has a proud legacy with trailblazing faculty who provided leadership for the profession in several areas.