Date: August 31, 2016

To: Academic Affairs

From: Frank Galey, Dean, College of Agriculture and Natural Resources

Re: Molecular Biology MS Graduate Program Review

I would recommend this program be retained at the University of Wyoming with the following comments.

- Depending on the cutoff period, this program is close-to, or just above the cut-off of 15 graduates over a 5 year period. The most recent OIA data suggests that 18 students have graduated from this program through 2016, spring.
- These students are internally and not state-supported other than those competitive programs managed internally.
- This department is a stellar producer of PhD students. The MS graduate program does not add courses that would otherwise not be taught to graduate students. This grant-active faculty need, and fund, a mix of MS and PhD students and all students must take the major graduate courses.
- MS graduates have a world of well-paying opportunities in biomedical laboratories or for enhanced studies at PhD programs around the country. This is an area where after-graduation employment is not a concern.
- This department might want to explore synergies with other units producing MS students much as they have with the interdepartmental “MCLS” PhD program.

Thank you and please let me know if you wish to discuss this further.

Academic Program Review
Report Template
University of Wyoming
Office of Academic Affairs
March 2016

(adapted from SDSU)

Deans and Directors who administer an authorized major or course of study approved by action of the Board of Trustees will be responsible for conducting program reviews. Four key elements should be addressed in each academic program review: (1) Program Demand, (2) Program Quality, (3) Mission Centrality, and (4) Cost.

For each program that is reviewed, a recommendation will be made by the Academic Dean to the Vice President of Academic Affairs.

Instructions: *Please provide the following information:*

Title of Program/Specialization: Masters of Science in Molecular Biology
Indicate whether undergraduate or graduate program/specialization: Graduate Program
Department and College: Agriculture
Department Head Name and contact information (phone, email):
Peter Thorsness (307-760-3300, thorsnes@uwyo.edu)

Part 1 – Program Review

Instructions: *Please answer each of the following questions. Items listed under each question have been provided to help guide your response. If an item is not applicable, simply indicate "N/A".*

1. **Program Demand*:**
   (*Note: If degrees granted exceeds cutoff, delay review until next round*.)
   a. Number of graduates over 5-year period: 18 (OIA data)
   b. Enrollment in major/specialization over 5-year period: 33 (OIA data)

* Cutoffs for "Low Demand" Designation -- *Degrees Granted*

- Bachelor's Programs: Average – 5 per year; 5-year total: 25
- Master's Programs: Average – 3 per year; 5-year total: 15
- Ph.D. Programs: Average – 1 per year; 5-year total: 5

(See APPENDIX A for the types of programs that will be excluded from review.)

2. **Program Quality: Is the program of high quality?**
   a. Program accreditation
      iii. For all other programs include:
         1. Date of most recent Academic Program Review (APR)
            N/A

b. Credentials of faculty
    i. Include a list of all faculty by name, highest degree and discipline of highest degree.

Grant Bowman, PhD Genetics and Cell Biology (male, Caucasian)
David Fay, PhD Molecular Biophysics and Biochemistry (male, Caucasian)
Jay Gatlin, PhD Cell and Developmental Biology (male, Caucasian)
Jason Gigley, PhD Microbiology and Immunology (male, Caucasian)
Mark Gomelsky, PhD Bacterial Genetics (male, Caucasian)
Don Jarvis, PhD Virology and Glycobiology (male, Caucasian)
Pamela J. Langer, PhD Biology (female, Caucasian)
Daniel Levy, PhD Biochemistry (male, Caucasian)
Kurt Miller, PhD Biochemistry (male, Caucasian)
Mark Stayton, PhD Biochemistry and Biophysics (male, Caucasian)
Peter Thorsness, PhD Biochemistry (male, Caucasian)
Daniel Wall, PhD in Microbiology (male, Caucasian)
Naomi Ward, PhD Biological Sciences (female, Caucasian)
Bridget Decker, PhD Microbiology and Immunology (female, Caucasian)
Rachel Watson, MS Molecular Biology (female, Caucasian)
John Willford, PhD Animal & Veterinary Science (male, Caucasian)

    ii. Also, include a breakdown by gender and ethnicity.

        12 Caucasian males, 4 Caucasian females

    iii. Grants awarded to academic personnel: Previous 5 years

Over the 5 year period encompassing 2009 – 20014, the Department of Molecular Biology was awarded $13,712,366 in extramural grants. Listed below are grant awards that are currently active and come from National (almost exclusively ***Federal***) funding sources.

- PI: Wall 05/01/2012-01/31/2017 20% effort, NIH R01 GM101449 $1,344,250 total award over five years. Project title: Protein exchange and self-recognition in myxobacteria biofilms.
- NIH 5R21EB018539 (PI: Gomelsky) 04/01/2014-03/31/2016 (extended to 09/30/2016) Bacteriophytochrome-based optogenetic tools for mammalian gene regulation.
- NIH 1R21AI117198 (PIs: Yang & Gomelsky) 01/02/2015-12/31/2016
- Cyclic di-GMP-dependent regulation of metabolism and virulence in Borrelia burgdorferi. ♦ NIH P20GM103432 (Wyoming INBRE). Ph.D. assistantship and tuition. 09/01/2016-08/31/2017
- National Institutes of Health (NIH) (GM066868-10). "Characterizing Novel Functions of Conserved NIMA Family Kinases". Total costs: $1,697,343
- National Institutes of Health/INBRE (P20 GM103432). Total costs: $29,000
- NIH R56AI118483 (P.I., Dr. Donald L. Jarvis. Dr. Jason P. Gigley and Dr Qingsheng Li collaborators) 07/15/15 to 06/30/16 "Impact of Fc glycosylation profile on HIV-specific bNAb functions".
- P30-GM103398 Neuroscience Pilot Project, Jonathan Fox and Jason Gigley co P.I.s 7/1/2015-6/30/2016 "Interaction between neuroinflammation and neurodegeneration studied using latent *Toxoplasma gondii* infection in a mouse model of Huntington's disease"

- 1R15DK098696 - 01A1 (P.I. Dr. Naomi Ward, Dr. Jason P. Gigley collaborator) 9/1/2014-8/31/2017 “Functional significance of the microbiome in Hirschsprung's enterocolitis”
- NIH (R44 GM093411; MPI’s Fath-Goodin, Paratechs and Geisler, GlycoBac): "Enhancing mammalian glycoprotein production in the baculovirus expression vector system". 12-1-12 to 08-31-16; $1,410,000 ($1,047,788 total; $451,937 to GlycoBac).
- NIH (R01 NS076853; P.I. Jarvis): "Elucidating the cellular mechanisms of prion propagation and clearance". 06-01-13 to 05-31-17; $925,499 Total ($654,063 direct).
- NIH (R43 GM102982; MPI’s Jarvis, UW and Geisler, GlycoBac): "Glycoengineering insect cells for commercial recombinant glycoprotein production". 09-30-13 to 07-31-16; $599,241 Total ($155,268 total, $107,081 direct to DJ).
- NIH (R43 GM109504; Jarvis consultant to P.I. Geisler, GlycoBac): "Engineering cells for concurrent protein drug biosynthesis and polysialylation". 11-1-13 to 8-31-16; Total $148,202
- NIH (R43 AI112118; Jarvis consultant to P.I. Maghodia, GlycoBac): "Glycoengineered baculoviruses for the production of more efficacious influenza vaccines". 03-1-14 to 11-30-16; Total $225,000
- NIH R56AI118483 (P.I. Jarvis): “Impact of Fc glycosylation profile on HIV-specific bNAb functions”. 7-15-15 to 6-30-17 (Total $595,965; $150,568 direct to DJ).
- NIH R44GM102982-03 (MPI’s Jarvis and Geisler; on pay list) “Glycoengineered insect cells for commercial biologics manufacturing”. 4-1-16 to 3-31-18 (Total $998,306; $170,638 total, $142,198 direct to DJ).
- NIH R01 (R01GM113028); **PI Levy**, co-investigators Jay Gatlin and John Oakey “Integration of *Xenopus* Extract and Microfluidics to Study Organelle Size Scaling” $1,331,420 total over five years (3/1/15 – 1/31/20)
- American Cancer Society Research Scholar Grant (RSG-15-035-01-DDC); **PI Levy** “Regulation of Nuclear Size in *Xenopus* Embryos and Cancer Cells” $792,000 total over four years (7/1/15 – 6/30/19)
- NIH R15 (R15GM106318); **PI Levy** "Mechanisms of Steady-State Nuclear Size Regulation in *Xenopus*" $310,582 total over three years (9/1/13 - 8/31/16)
- NSF (CHE1413696); PI Krisztina Varga, **co-PI Levy** "Structural-Functional Characterization of a Hyperactive Antifreeze Protein" $550,000 total over three years (8/1/14 - 7/31/17)
- 2012-2017 NIH R01 “Mechanics of Bipolar Mitotic Spindle Assembly” Total amount: $1,321,470 (Gatlin - PI)
- 2014-2018 Pew Biomedical Research Fellowship Award; Total amount: $240,000, (Gatlin – PI)
- 1518171 (Bowman and Rongsong Liu, Dept. Mathematics) 8/15/15 – 8/14/18 National Science Foundation / MCB $625,462; “A scaffolding protein is a multivalent hub for organizing bacterial cytoplasm.”
- 1R01GM118792-01 (Bowman) 08/01/16 – 07/31/20 National Institute of Health / NIGMS $820,351; “Bacterial Mechanisms for Establishing and Maintaining Cell Polarity”.

iv. Grants submitted by academic personnel: Previous 5 years

There are currently 24 active grants from National (Federal) sources (listed above) in the Department of Molecular Biology. Funding rates from these granting agencies are less than 10%, meaning that only one in ten submitted grants are funded. The faculty of the Department of Molecular Biology probably is funded at a rate greater than 1 in 10 of submissions, but it seems likely that over 200 grants were submitted to Federal Funding Agencies by our faculty during the past 5 years.

v. Publications/presentations by academic personnel

A sampling of faculty publications from 2015 and 2016:

- Vassallo C., Pathak D.T., Cao P., Zuckerman, D.M., Hoiczyk, E. and **Wall, D**. 2015. Cell rejuvenation and social behaviors promoted by LPS exchange in myxobacteria. *PNAS*. 112(22):E2939-46.
- Tissue repair in myxobacteria: A cooperative strategy to heal cellular damage. Vassallo CN, Wall D. BioEssays : news and reviews in molecular, cellular and developmental biology. 2016; 38(4):306-15.
- Sibling Rivalry in Myxococcus xanthus Is Mediated by Kin Recognition and a Polyploid Prophage. Dey A, Vassallo CN, Conklin AC, Pathak DT, Troselj V, Wall D. Journal of bacteriology. 2016; 198(6):994-1004.
- How Myxobacteria Cooperate. Cao P, Dey A, Vassallo CN, Wall D. Journal of molecular biology. 2015; 427(23):3709-21.
- Köseoğlu VK, Heiss C, Azario M, Topchiy E, Güvener ZT, Lehmann TE, Miller KW, Gomelsky M. 2015. Listeria monocytogenes exopolysaccharide: origin, composition, biosynthetic machinery, and c-di-GMPdependent regulation. Mol Microbiol 96:728-43.
- Hengge R, Galperin MY, Ghigo JM, Gomelsky M, Green J, Hughes KT, Jenal U, Landini P. 2015. Systematic nomenclature for GGDEF and EAL domain-containing c-di-GMP turnover proteins of Escherichia coli. J Bacteriol 198:7-11.
- Ryu MH, Youn H, Kang IH, Gomelsky M. 2015. Identification of bacterial guanylate cyclases. Proteins 83:799-804.
- McCarter LL, Gomelsky M. 2015. Fifty ways to inhibit motility via c-di-GMP: the emerging P. aeruginosa swarming story. J Bacteriol 197:406-9.
- Naomi L. Ward, Deanna Nguyen, Nanda Kumar N. Shanmugam, Yan Song, Richard Hodin, Bobby J. Cherayil, Hai Ning Shi, and Allan M. Goldstein. Antibiotic treatment induces long-lasting changes in the fecal microbiota that protect against colitis (in press)
- **Kamneva, O.K.**, S. Poudel, and **N.L. Ward**. 2015. Proteins related to the Type I secretion system are associated with secondary SecA_DEAD domain proteins in some species of Planctomycetes, Verrucomicrobia, Proteobacteria, Nitrospirae and Chlorobi. PLoS One 10(6):e0129066. doi: 10.1371/journal.pone.0129066.
- **Kamneva, O.K.**, S. Poudel, and **N.L. Ward**. 2015. Proteins related to the Type I secretion system are associated with secondary SecA_DEAD domain proteins in some species of Planctomycetes, Verrucomicrobia, Proteobacteria, Nitrospirae and Chlorobi. PLoS One 10(6):e0129066. doi: 10.1371/journal.pone.0129066.
- Bhatnagar, S., Badger, J.H., Madupu, R., Khouri, H.M., O'Connor, E.M., Robb, F.T., **Ward, N.L.**, and J.A. Eisen. 2015. Genome sequence of the sulfate-reducing thermophilic bacterium *Thermodesulfovibrio yellowstonii* Strain DSM 11347T (Phylum Nitrospirae). Genome Announcements 3(1). pii: e01489-14. doi: 10.1128/genomeA.01489-14.

- Bhatnagar, S., Badger, J.H., Madupu, R., Khouri, H.M., O'Connor, E.M., Robb, F.T., **Ward, N.L.**, and J.A. Eisen. 2015. Genome Sequence of a Sulfate-Reducing Thermophilic Bacterium, Thermodesulfobacterium commune DSM 2178T (Phylum Thermodesulfobacteria). Genome Announcements 3(1). pii: e01490-14. doi: 10.1128/genomeA.01490-14.
- **Kamneva, O.** and **N.L. Ward**. 2015. A putative novel secretion system related to both Sec and Type I secretion systems is found in Planctomycetes, Verrucomicrobia, and some species of Proteobacteria. PLoS ONE
- Wang, F., Kaplan, J.S., Gold, B.D., Bhasin, M.K., **Ward, N.L.**, Kellermayer, R., Kirschner, B.S., Heyman, M.B., Dowd, S.E., Cox, S.B., Dogan, H., **Steven, B.**, Ferry, G.D., Cohen, S.A., Baldassano, R., Moran, C.J., Garnett, E.A., Drake, L., Otu, H.H., Mirny, L.A., Libermann, T.A., Winter, H.S., and K. Korolev. 2016. Detecting microbial dysbiosis associated with pediatric Crohn's disease despite the high variability of the gut microbiota. Cell Reports 14(4):945-55. doi: 10.1016/j.celrep.2015.12.088. Epub 2016 Jan 21.
- Economopoulos, K.P., **Ward, N.L.**, Phillips, C.D., Teshager, A., Patel, P., Mohamed, M.M.R., Hakimian, S., Cox, S.B., Ahmed, R., Moaven, P., Kaliannan, K., Alam, S.N., Haller, J.F., Goldstein, A.M., Bhan, A.K., Malo, M.S., and R.A. Hodin. 2016. Prevention of antibiotic-associated metabolic syndrome in mice by intestinal alkaline phosphatase. Diabetes Obesity and Metabolism 18(5):519-27. doi: 10.1111/dom.12645. Epub 2016 Mar 22.
- Melissa Kelley, John Yochem, Michael Krieg, Andrea Calixto, Maxwell G. Heiman, Aleksandra Kuzmanov, Vijaykumar Meli, Martin Chalfie, Miriam B. Goodman, Shai Shaham, Alison Frand, and David S. Fay* (2015). FBN-1, a fibrillin-related protein, is required for resistance of the epidermis to mechanical deformation during C. elegans embryogenesis. eLife, Mar 12;4. PMID: 25798732.
- John Yochem, Vladimir Lazetic, Leslie R. Bell, Lihsia Chen, and David S. Fay* (2015). C. elegans NIMA-related kinases NEKL-2 and NEKL-3 are required for the completion of molting. Dev. Biol. 398, 255-266. PMID: 25523392
- Gigley, J.P. (2016) The Diverse Role of NK cells in immunity to Toxoplasma gondii infection. *PLOS Pathogens, Pearls* Accepted for publication 1/4/2016.
- Geisler, C., Mabashi-Asazuma, H., Kuo, C.-W., Khoo, K.-H. and Jarvis, D.L. 2015. Engineering ß1,4-galactosyltransferase I to reduce secretion and enhance *N*-glycan elongation in insect cells. J. Biotechnol. 193:52-65. PMC4278940.
- 81.Mabashi-Asazuma, H., Sohn, B.-H., Kim, Y.-S., Kuo, C.-W., Khoo, K.-H., Kucharski, C.A., Fraser, M.J., and Jarvis, D.L. 2015. Targeted glycoengineering extends the protein *N*-glycosylation pathway in the silkworm silk gland. Insect Biochem. Mol. Biol. 65:20-27. PMC4628589.
- Mabashi-Asazuma, H., Kuo, C.-W., Khoo, K.-H. and Jarvis, D.L. 2015. Modifying an insect cell *N*-glycan processing pathway using CRISPR-Cas technology. ACS Chem. Biol. 10:2199-2208. PMC in process.
- Czuchry, D., Desormeaux, P., Stuart, M., Jarvis, D.L., Matta, K., Szarek, W.A., and Brockhausen, I. 2015. Synthesis of the sialyl-T antigen: Biochemical characterization of a novel α2,3-sialyltransferase WbwA from pathogenic *Escherichia coli* serotype O104 and comparison to human ST3GAL1. J. Bacteriol., 197:3760-3768. PMC4652054.
- Revoredo, L., Clausen, H, Moremen, K.W., Jarvis, D.L., Ten Hagen, K.G., Tabak, L.A., and Gerken, T.A. 2015. Mucin type O-glycosylation is controlled and ordered by short and long range glycopeptide substrate recognition that varies among members of the polypeptide GalNAc transferase (ppGalNAc-T) family. Glycobiology 26:360-376. PMC4767052.
- Maghodia, A.B., Geisler, C., and Jarvis, D.L. 2016. Characterization of an Sf-rhabdovirus-negative *S. frugiperda* cell line as an alternative host for recombinant protein production in the baculovirus-insect cell system. Prot. Expr. Purif. 122:45-55.
- Geisler, C. and Jarvis, D.L. 2016. Rhabdovirus-like endogenous viral elements in the genome

of *Spodoptera frugiperda* insect cells are actively transcribed: implications for adventitious virus detection. Biologics 44:219-225.

- Geisler, C., Mabashi-Asazuma, H., and Jarvis, D.L. 2015. An overview and history of glycoengineering in insect expression systems. Meth. Mol. Biol. 1321:131-152. No PMC.
- Harrison, R.L. and Jarvis, D.L. 2016. Transforming lepidopteran insect cells for continuous recombinant protein expression. Meth. Mol. Biol. 1350:329-348. PMC in process.
- Harrison, R.L. and Jarvis, D.L. 2016. Transforming lepidopteran insect cells for improved protein processing. Meth. Mol. Biol. 1350:359-379. PMC in process.
- Mukherjee, R.N., Chen, P., **Levy, D.L.** (2016). Recent advances in understanding nuclear size and shape. *Nucleus*, 7(2):167-186.
- Jevtic, P., Milunovic-Jevtic, A., Dilsaver, M.R., Gatlin, J.C., **Levy, D.L.** (2016). Use of *Xenopus* cell-free extracts to study size regulation of subcellular structures. *International Journal of Developmental Biology*, In press.
- Vukovic, L.D., Jevtic, P., Edens, L.J., **Levy, D.L.** (2016). New insights into mechanisms and functions of nuclear size regulation. *International Review of Cell and Molecular Biology*, 322:1-59.
- **Levy, D.L.**, Heald, R. (2015). Biological scaling problems and solutions in Amphibians. In: Heald, Hariharan, and Wake (eds) *Size Control in Biology: From Organelles to Organisms*, Cold Spring Harbor Perspectives in Biology, Cold Spring Harbor Laboratory Press, 73-88. doi: 10.1101/cshperspect.a019166.
- Alexander M. Wolff, Tyler P. Rasmussen, Colter R. Wichern, Matthew R. Peterson, Mark M. Stayton and D. Paul Thomas Effects of pericardiectomy on training- and myocardial infarction-induced left ventricular hypertrophy, chamber dimensions and gene expression. (2016) International Journal of Sport Medicine *in press*.
- Yeast Vps13 promotes mitochondrial function and is localized at membrane contact sites. Park JS, Thorsness MK, Policastro R, McGoldrick LL, Hollingsworth NM, **Thorsness PE**, Neiman AM. Mol Biol Cell. 2016 Aug 1;27(15):2435-49. doi: 10.1091/mbc.E16-02-0112.
- Centrosomal clustering contributes to chromosomal instability and cancer. Milunović-Jevtić A, Mooney P, Sulerud T, Bisht J, Gatlin JC. Curr Opin Biotechnol. 2016 Aug;40:113-8.
- Nanoparticle Targeting and Cholesterol Flux Through Scavenger Receptor Type B-1 Inhibits Cellular Exosome Uptake. Plebanek MP, Mutharasan RK, Volpert O, Matov A, **Gatlin JC**, Thaxton CS.Sci Rep. 2015 Oct 29;5:15724
- Transposon Mutagenesis Paired with Deep Sequencing of Caulobacter crescentus under Uranium Stress Reveals Genes Essential for Detoxification and Stress Tolerance. Yung MC, Park DM, Overton KW, Blow MJ, Hoover CA, Smit J, Murray SR, Ricci DP, Christen B,**Bowman GR**, Jiao Y.J Bacteriol. 2015 Oct;197(19):3160-72

vi. National/international awards

Jay Gatlin

- 2015 Nikon Fellow, Marine Biological Laboratory, Woods Hole, MA
- 2014 Pew Biomedical Research Scholar Award, The Pew Charitable Trusts
- 2014 MBL Whitman Center Fellow, Marine Biological Laboratory, Woods Hole, MA
- 2013 MBL Whitman Center Fellow, Marine Biological Laboratory, Woods Hole, MA

Dan Levy

- 2015 American Cancer Society Research Scholar

Jason Gigley

- 2015 Public Policy Fellow, American Association of Immunologists

vii. Other

Service as journal editors and serving on grant review committees reflects positively on the individual and their home institution. Current faculty having those responsibilities include Ward, Wall, Gomelsky, Gigley, Gatlin, Levy, Fay, and Jarvis.

c. Program reputation
   i. If program is ranked, include rank and by what organization.
      N/A
   ii. Include a brief description of any other indicators of program reputation such as demand (e.g. waiting lists or over enrollment) for admission into program, employer data/feedback, etc.
      N/A
d. Curriculum of major or specialization
   i. Include a list of courses by prefix, number, title required in the major or specialization (do not include general education course unless required as part of the major requirements.)

The MS and PhD degree programs are tailored to individual students, and different students have different levels of preparation and areas of interest. The courses that every MS (or PhD student) take include:

MOLB5010	Problems in Molecular Biology
MOLB5050	Student Seminar
MOLB5051	Departmental Seminar
MOLB5052	Summer Seminar
MOLB5630-01	Advance Topics: Molecbio
MOLB5690	Thesis Research

All graduate students do take other courses, but an individuals exact curriculum is tailored to their particular training needs.

e. Distance delivery of program/major
   i. Note if the program is offered online and/or at one of the off-campus attendance centers (e.g., UW-Casper)

      N/A

f. Quality of Assessment Plan/data
   i. Include a brief description of the program assessment plan and how the data are used to inform decisions related to program quality and student learning.

The assessment of graduate programs in the Department of Molecular Biology has historically been based on two events for graduate students. PhD students take a qualifying exam at the end of the spring semester of their second year and then their final thesis

presentation at the end of their program (on average this occurs in year five). MS students have a meeting with their committee in the spring of their first year and then their thesis presentation, typically in the summer of their second year. MA students meet with their faculty committee at the end of their first semester and then present their paper in a presentation to the department and their committee, again typically sometime in the summer of their first (and final) year.

Two examples of added assessment opportunities include (a) annual presentations by MS and PhD students to the department at our "Molecular Monday" seminar series. As students progress through the program, the length and depth of the presentation increases, culminating in the 4 and 5th year PhD students presenting a fully-fledged 50-minute research seminar. The original intent of these presentations was two-fold: provide an opportunity for students to hone their presentation skills and for students to get critical feedback from an educated audience about their science. (b) Another opportunity for assessment occurs in the required seminar course MOLB5050 where formal instruction in the communication of science is provided.

Due in large part to the feedback from the University Assessment Coordinators Committee, we realized that we had multiple additional opportunities to assess student's growth in oral communication and maturation as experimental scientists. We developed an "oral presentation" scoring rubric that is used by all faculty, staff, and students in attendance at "Molecular Monday" presentations, MOLB5050 and at qualifying exams and thesis/dissertation defenses to evaluate oral presentations. Usually in excess of 30 experienced scientists are in the audience for Molecular Monday and defense presentations.

In addition to scientific papers and posters, the two written documents that every graduate student in any of the degree programs produce are a research proposal early in their program and the thesis or dissertation at the end of the program. We have developed a rubric that assesses the written document produced at those two events, and the committee members fill it out as part of their evaluation of the degree candidate.

We are in the early stages of gathering data, but the intent is to identify issues student's have in communication of complex scientific concepts and systematically address those in the appropriate formal courses. Those courses include MOLB5050 and MOLB5630-01.

g. Strategic Plan
    i. Include a brief description of any plans for the program or specialization that appear in the college/department strategic plan (i.e., facilities upgrades, curriculum changes, on-line or off-campus delivery, enrichment learning opportunities, etc.)

The Department of Molecular Biology is part of the University of Wyoming Science Initiative. As this program matures, MS and PhD students will have the opportunity to participate as mentors in the active learning classrooms and receive training on the enhanced instrumentation that will be obtained.

h. Other:

The Department of Molecular Biology has a very successful research program and graduate students at both the MS and PhD level are instrumental in that success. In return for participating in faculty directed research, they receive training and evolve into independent scientists. It should be noted that MS students in the Department of Molecular Biology are supported in one of three ways – (1) extramural research grants that pay tuition, fees and a stipend, (2) competitive intramural GA awards that pay tuition, fees, and a stipend, or (3) as self supported students. No graduate assistantships under the control of the Department of Molecular Biology are used to support MS students. Hence, the MS program in the Department of Molecular Biology is a "money-making" enterprise that benefits the students, faculty and the University.

3. **Mission Centrality: Does the program advance the mission of UW including institutional strategy?**
    a. Describe how the program supports the mission, vision and strategic goals of UW.

The University of Wyoming Strategic Plan 2009-2014 has a number of points that apply directly to the Department of Molecular Biology Masters of Science degree. Specifically within the College of Agriculture and Natural Resources section, action items 3 (Energy programming) and 11 (Increased numbers of graduate students) continued support of the MS program would address their continued success. Similarly, action items 14 (capstone courses) and 15 (Internships and externships), which largely lead to enhanced undergraduate education, are supported by the robust research environment to which the MS in Molecular Biology is an integral part.

    b. Describe how the program contributes to other programs across campus (i.e., general education courses, minor or support courses, interdisciplinary program, etc.)

The inclusive field of biomedical research – represented on campus by the Departments of Molecular Biology, Physiology, Vet Sciences, Pharmacy and some components of the Animal Science, Botany, and Chemistry programs – has historically been a successful University enterprise. In short, the Masters of Science program in Department of Molecular Biology contributes to this collective research environment by providing training opportunities for students and producing valuable research results that are required to sustain a successful positive working environment for biomedical researchers campus wide.

    c. Include placement data for graduates and indicate if graduates are working in the field or not.

None available

    d. Describe the uniqueness or duplication of this program across the UW.

The MS program of Department of Molecular Biology is potentially similar with respect to job opportunities or value in the preparation for further educational opportunities to MS degrees offered by the Departments of Animal Science, Veterinary Science, Physiology and Botany. With respect to a given job (e.g. – research lab technician) or further post-graduate education (e.g. – PhD programs or medical school), the topic and quality of the thesis determines the

relative value of the degree rather than the given program that administers it. In that sense, we believe the MS degree in Molecular Biology is most valuable for individuals seeking employment in a biomedical research laboratory, continued pursuit of a PhD in the broad field of biomedical research, or enhanced opportunities for gaining admission to medical school.

e. Other:

4. **Cost: Is the program financially viable?**
   a. Ratio of student credit hours per FTE

      From 2009-10 through 2013-14, the Department of Molecular Biology averaged 960 student credit hours for Graduate Courses. That includes both PhD and MS students and it is impossible to separate them. That means SCH/FTE for graduate courses is (on average) 56.5.

   b. Direct instructional expenditures: (Note: What this number means, how it was derived, and whether it provides any meaning in the real world is a mystery to the department.)
      i. Per student credit hour

For 2013-14, instruction unit expenditures were $1,413,880. Total student credit hours for that year were 4,665. Hence, direct instructional expenditures per student credit hour for 2013-14 was $303. Note, there is insufficient information available to make this calculation for only the MS program – it is inclusive of the BS, MS, and PhD program administered by the Department of Molecular Biology.

      ii. Per total degrees awarded

For 2013-14, instruction unit expenditures were $1,413,880. Total degrees awarded that year were 48. Hence, direct instructional expenditures per total degrees awarded for 2013-14 was $29,456. Note, there is insufficient information available to make this calculation for only the MS program – it is inclusive of the BS, MS, and PhD program administered by the Department of Molecular Biology.

      iii. Non-personnel expenditures per total academic FTE: (Note: What this number means, how it was derived, and whether it provides any meaning in the real world is a mystery to the department.)

For 2013-14, non-personnel expenditures were $153,404. The total student FTE for that year was 193.7. Hence, non-personnel expenditures per total student FTE for 2013-14 was $792. Note, there is insufficient information available to make this calculation for only the MS program – it is inclusive of the BS, MS, and PhD program administered by the Department of Molecular Biology.

   c. Course enrollment
      i. Number of classes falling under University minimums

Data from OIA says "11%", but number of classes is unknown (thought to be "zero").

ii. Lower-division courses falling under University minimums

Zero

d. Other instructional cost drivers, such as:
   i. Section fill rates
      N/A
   ii. Course completion rates
      N/A
   iii. Curricular complexity

While the subject material is often complex, in terms of the courses required for obtaining a Masters of Science in Molecular Biology the path is straightforward. All courses for a MS in Molecular Biology are coincident with upper division undergraduate courses and graduate courses taken by PhD students.

iv. Faculty course load

Sufficient to cover required courses.

e. Research expenditures per tenured/tenure-track FTE (and other academic personnel, where appropriate) (Note: What this number means, how it was derived, and whether it provides any meaning in the real world remains is a mystery to the department.)

Research expenditures for 2013-14 were $4,322,288. Tenured and tenure track FTE for that year was 16. Hence the research expenditures / Tenured and tenure-track FTE for 2013-14 was $270,143.

f. Compare your data to national benchmarks (Delaware data)

Delaware data was unavailable, despite our best "Google-foo" attempts.

g. Other:

MS students in the Department of Molecular Biology pay for their education in one of three ways – (1) extramural research grants that pay tuition, fees and a stipend, (2) competitive intramural GA awards that pay tuition, fees, and a stipend, or (3) as self supported students. No graduate assistantships under the control of the Department of Molecular Biology are used to support MS students. Hence, the MS program in the Department of Molecular Biology is a "money-making" enterprise that benefits the students, faculty and the University.

Part II - Recommendations

Instructions: *After the review is completed, the Dean in consultation with the Department Head will select one of the following recommendations. In the justification, address each of the items associated with the recommendation.*

1) **Retain Due to Critical Need**
   a) A college may recommend that a degree program be retained due to its ability to fulfill a critical workforce need or shortage area for the state.

   b) Justification for retaining due to critical need must include:
      i) Explanation of why the program is important to the University/State/region
      ii) Description of specific steps (already taken and/or planned) to increase enrollment and graduate production;
      iii) Preliminary outcomes of steps taken.

2) **Retain with Further Review Required**
   a) A college may request that a program be retained for further review for those degree programs that serve a specific function central to the mission of the college or university.

   b) Justification for retain due to further review must include:
      i) Explanation for how the program is central to the university's mission and the benefit to the system;
      ii) Description of specific steps (already taken and/or planned) to increase enrollment and graduate production;
      iii) Preliminary outcomes of steps taken.

3) **Consolidate with Another Program within College**
   a) A college may request that a program be consolidated with a similar program on campus that achieves similar degree requirements.

   b) Justification to consolidate with another program on campus must include:
      i) Explanation for how the degree requirements for the two programs warrant consolidation;
      ii) Evidence that the consolidation will meet graduate production thresholds, or specific steps to increase enrollment to meet production thresholds;
      iii) Preliminary outcomes of steps taken.

4) **Consolidate with Program(s) between Colleges/campuses (e.g., UW/C)**
   a) Two or more colleges may request that similar degree programs be consolidated to maintain equivalent degree programs.

   b) Justification for retaining due to cross-college consolidation must include:
      i) Explanation for how the consolidated programs will collaborate (e.g., sharing of required courses, shared faculty, etc.) to maintain graduate production thresholds;

ii) Evidence that multi-college collaboration will meet graduate production thresholds, or specific steps to increase enrollment if merging programs fails to meet production thresholds;
iii) Preliminary outcomes of collaboration between colleges.

5) **Terminate**
   a) A college may request that a program be terminated due to limited graduate production, lack of student interest, shifts in a given field of study, or continued declines in major enrollments.
   b) If the exigency for termination results from the program productivity review process then a brief justification to terminate a program should be included. Such a justification must include:
      i) Explanation for the decline in graduate production in the degree program;
      ii) Intended timeframe for submitting a program termination request to the Board of Trustees for their consideration;
      iii) Expected timeline to meet teach-out requirements established through the regional accrediting body.

APPENDIX A

"Low Productivity" Programs Excluded from Review Process

1) **Major Program Modifications**
   a) Degree programs that have undergone recent program modifications that adversely impact graduate production for a college.
   b) Modifications traditionally include programs that have undergone recent name changes during the reporting window that result in two equivalent degree programs.

2) **Program/Major Specializations**
   a) Degree programs that have one or more specializations which reduce the total number of graduates.
   b) The exclusion may apply only for those specializations where the combination results in graduate production that meets the establish threshold for the degree.

3) **Terminated Programs**
   a) Degree programs that have been inactivated during the reporting period, but still depict graduates that fall below the established thresholds.
   b) Terminated programs will remain on the Program Productivity Report until inactive programs have completely cycled through the established reporting period.

4) **New Programs**
   a) Degree programs that have been activated within the past 7 years resulting in limited graduate production due to program implementation.
   b) Institutional review may be requested prior to the 7^{th} year if graduate production is not scaling to the required thresholds for the degree level.