BOARD OF REGENTS OF THE UNIVERSITY OF WISCONSIN SYSTEM

Education Committee

Thursday, October 10, 2019
9:00 a.m. – 10:30 a.m.

UW-Superior Yellowjacket Union
Great Room
1605 Catlin Avenue
Superior, Wisconsin

A. Approval of the Minutes of the July 11, 2019 Meeting of the Education Committee

B. Approval of Changes to Regent Policy Documents (RPDs):
    1. Updating Criteria for the Care and Use of Laboratory Animals and Rescinding RPD 4-3, "Criteria for the Use of Animals in Research"
    2. Revisions to RPD 4-6, "Granting of Degrees, Honors and Awards"
    3. Removal of RPD 4-7, "Add/Drop Policy for Courses"
    4. Revisions to RPD 24-4, "Policy on the Role of Resident Assistants in Residence Halls"

C. Approval of the Reappointments of Dr. Sharon Dunwoody and Dr. Kenneth Rhoads Bradbury to the Natural Areas Preservation Council

D. UW-La Crosse: Approval of the Bachelor of Science in Computer Engineering

E. UW-Madison: Approval of the Bachelor of Arts and the Bachelor of Science in Data Science

F. UW-Whitewater: Approval of the Bachelor of Business Administration in Business Analytics

G. Report of the Vice President for Academic and Student Affairs
    1. Update on UW Student Behavioral Health Workgroups
    2. Annual Reports on UW System Academic Program Array and Remedial Education

H. Update on Freshwater Collaborative of Wisconsin

I. Host Campus Presentation: Small but Mighty: Embedded Influential Learning Experiences at UW-Superior

Education Committee **Item B.1.**
October 10, 2019

REGENT POLICY DOCUMENT REVIEW: RPD 4-3, "CRITERIA FOR THE USE OF ANIMALS IN RESEARCH"

REQUESTED ACTION

Adoption of Resolution B.1.a., updating the criteria for the care and use of laboratory animals in compliance with s. 36.40, Wis. Stats., and delegating authority to the President of the UW System to adopt updated criteria as necessary to maintain compliance with the law and accreditation standards.

Adoption of Resolution B.1.b., rescinding Regent Policy Document 4-3, "Criteria for the Use of Animals in Research."

Resolution B.1.a. That, upon the recommendation of the President of the University of Wisconsin System, and to comply with s. 36.40, Wis. Stats., the UW System Board of Regents approves the eighth edition of the *Guide for the Care and Use of Laboratory Animals* (National Research Council, 2011), and the third edition of the *Guide for the Care and Use of Agricultural Animals in Research and Teaching* (Federation of Animal Science Societies, 2010), as applicable, as the criteria for the use of animals in scientific research within the UW System.

The UW System Board of Regents further delegates authority to the President of the University of Wisconsin System to adopt any subsequent edition of the *Guide for the Care and Use of Laboratory Animals* and the *Guide for the Care and Use of Agricultural Animals in Research and Teaching* or another recognized standard as the systemwide criteria for use of animals in scientific research, as needed to maintain compliance with the law and accreditation standards.

Resolution B.1.b. That, upon the recommendation of the President of the University of Wisconsin System, the UW System Board of Regents rescinds and authorizes the Executive Director and Corporate Secretary to remove Regent Policy Document 4-3, "Criteria for Use of Animals in Research," because the policy does not meet the standards for a Regent Policy Document.

SUMMARY

The 1983-85 Biennial Budget (1983 Wisconsin Act 27) created s. 36.40, Wis. Stats., requiring the Board of Regents to "adopt criteria for researchers to follow regarding humane treatment of animals for scientific research purposes." The Board adopted the 1978 edition, "or succeeding editions," of the "*Guide for the Care and Use of Laboratory Animals*," to fulfill this requirement. Board minutes indicated UW System administrative policy had incorporated the guidelines for several years prior to their inclusion in Board policy. The Board later updated the policy to adopt the 1996 edition of the guidelines (Attachment A).

At its October 2019 meeting, the Board's Education Committee will consider a resolution that will update the criteria for the care and use of laboratory animals in scientific research and delegate authority to the System President to update the criteria in the future. While retaining the criteria as a Board Resolution, this proposal also recommends rescinding Regent Policy Document 4-3, "Criteria for the Use of Animals in Research," because it does not meet the standards of a Regent Policy Document. This proposal was developed as part of the ongoing Regent Policy Document Review process.

BACKGROUND

Federal Law and Accreditation Standards

While this proposal updates the criteria for use of animals in scientific research, these criteria serve as a minimum requirement only. In practice, UW System institutions must comply with an array of requirements under federal law, as well as accreditation standards where applicable. These include the Animal Welfare Act, the Public Health Service Policy on Humane Care and Use of Laboratory Animals, and, in some instances, accreditation standards established by the Association for Assessment and Accreditation of Laboratory Animal Care International.

The Animal Welfare Act

The primary federal law governing the welfare of animals used in research is the Animal Welfare Act (AWA), (United States Code, Title 7 (Agriculture), Chapter 54 (Transportation, Sale, and Handling of Certain Animals), Sections 2131– 2159).

The AWA sets standards for ensuring the proper housing, feeding, sanitation, and medical needs of animals. The AWA is the primary federal law that regulates the treatment of animals in research, exhibition and transport. Other federal laws, policies, and guidelines include coverage of species not covered by the AWA or additional specifications for animal care and use, but all refer to the AWA as the

minimum acceptable standard for the protection of animals in research.[1] The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Animal Care, enforces the AWA.

The Public Health Service Policy

While the AWA provides the basis for federal animal welfare laws and regulation, the *Public Health Service (PHS) Policy on Humane Care and Use of Laboratory Animals* (the *PHS Policy*) provides another standard for the care and use of laboratory animals.[2] The *PHS Policy* applies to any facility that receives PHS funds for research, which includes most colleges and universities. The National Institutes of Health in the U.S. Department of Health and Human Services publishes the *PHS Policy* under the authority of the Health Research Extension Act of 1985, Public Law 99-158, "*Animals in Research*" (November 20, 1985).

Among other requirements, the *PHS policy* requires institutions to use the "*Guide for the Care and Use of Laboratory Animals*" for creating institutional programs for protecting animals in research. Institutions must also ensure that its programs and facilities are either accredited by the Association for the Assessment and Accreditation of Laboratory Animal Care International (AAALAC) or that they are evaluated at least once every six months by the Institutional Animal Care and Use Committees (IACUC) to ensure compliance with the *PHS policy*. Institutions may not engage in any PHS-funded activity involving animals until the institution has provided a written "Animal Welfare Assurance," to the National Institutes of Health's Office of Laboratory Animal Welfare (OLAW) for review. The Assurance must demonstrate the institution's compliance with various provisions of the *PHS Policy*.

Association for Assessment and Accreditation of Laboratory Animal Care International (AAALAC)

AAALAC International accreditation is another means of ensuring the humane treatment of animals in research. According to its website, AAALAC International is a private, nonprofit organization that promotes the humane treatment of animals in science through voluntary accreditation and assessment programs. The AAALAC endorses the use of animals to advance medicine and science when there are no alternatives, and when it is done in an ethical and humane way. Four UW System institutions hold AAALAC accreditation, which the AAALAC website identifies as

[1] United States Department of Agriculture. (2019, July). Animal Welfare Act. Retrieved from Animal Welfare Information Center: https://www.nal.usda.gov/awic/animal-welfare-act

[2] Office of Laboratory Animal Welfare, National Institutes of Health. (2019, July). Office of Laboratory Animal Welfare. Retrieved from PHS Policy on Humane Care and Use of Laboratory Animals : https://olaw.nih.gov/policies-laws/phs-policy.htm

follows: UW-La Crosse, UW-Madison (with separate accreditations for the School of Veterinary Medicine, School of Medicine and Public Health, Graduate School, and College of Agricultural and Life Sciences), UW-Milwaukee, and UW-Oshkosh.[3]

AAALAC's voluntary accreditation process requires research programs to "demonstrate that they meet the minimum standards required by law, and are also going the extra step to achieve excellence in animal care and use." [4] To meet this goal, the AAALAC has adopted three primary standards for animal care and use programs. These include the 8th Edition of the *Guide for the Care and Use of Laboratory Animals* (*Guide*), NRC 2011; the *Guide for the Care and Use of Agricultural Animals in Research and Teaching (Ag Guide)*, FASS 2010; and the *European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes*, Council of Europe (ETS 123).[5]

Institutional Animal Care and Use Committees

Research institutions are required under federal law to establish an Institutional Animal Care and Use Committee (IACUC) to provide direct institutional oversight over the use and care of animals in research. Under the AWA, the IACUC must include a minimum of three members to include at least one Doctor of Veterinary Medicine with training or experience in laboratory animal science and medicine, and with direct or delegated program responsibility for activities involving animals at the research facility. The committee must also include one public member, not affiliated with the facility. The *PHS Policy* also requires institutions that receive PHS funding to establish an IACUC. Under the *PHS Policy*, the IACUC must include at least five members, including a veterinarian, a practicing scientist experienced in animal research, a person whose primary concerns are in a nonscientific area, and a person who is unaffiliated with the institution (a public member).

According to UW-Madison's website, the IACUCs, "…ensure that the care and use of animals on campus is ethical and humane by consulting federal regulations, veterinary standards of care, campus policies, and facility standard operating procedures."[6] In general, IACUCs are responsible for reviewing and approving research protocols related to the care and use of animals and for evaluating the research facility's program for the humane care and use of animals. An IACUC is responsible for investigating concerns about the humane care of

[3] AAALAC, International. (2019, July). AAALAC International. Retrieved from Accredited Organizations: https://www.aaalac.org/accreditedorgsdirectorysearch/aaalaclistall.cfm
[4] AALAC, International. (2019, July). About AAALAC. Retrieved from What is AAALAC?: https://www.aaalac.org/about/index.cfm
[5] AAALAC, International. (2019, July). About AAALAC. Retrieved from AAALAC's Three Primary Standards: https://www.aaalac.org/about/guidelines.cfm
[6] University of Wisconsin-Madison. (2019, July). Research Animal Resources and Compliance. Retrieved from IACUC Overview: https://www.rarc.wisc.edu/iacuc/iacuc_overview.html

animals in research and has the authority to suspend activities that it determines are not conducted in accordance with approved procedures or federal law. Under the AWA, the IACUC reviews the research facility's program for care and use of animals, using title 9, chapter I, subchapter A-Animal Welfare, as a basis for evaluation. For institutions not accredited by the AAALAC, the *PHS Policy* requires the IACUC to inspect the institution's animal care and use program at least once every six months, using the "*Guide for the Care and Use of Laboratory Animals,*" as a basis of evaluation. A full description of the responsibilities of the IACUC under AWA may be found in 9 CFR 2.31 and a description of IACUC responsibilities for PHS funded activities are found in section IV. B. of the *PHS Policy*.

All UW System institutions have established an IACUC. UW-Madison has four IACUCs, one for each of the following: the College of Agricultural and Life Sciences, the School of Medicine and Public Health, the School of Veterinary Medicine, and the College of Letters and Sciences and Vice Chancellor Office for Research and Graduate Education.

Regent Policy Document 4-3

The "*Guide for the Care and Use of Laboratory Animals*," (the *Guide*) has long been recognized as the standard of care for research animals. The *Guide* is a comprehensive set of guidelines that addresses topics such as the regulatory environment for research animal use, program management, the role of the IACUC, including its role in reviewing research protocols, environment and housing for terrestrial and aquatic animals, veterinary care, and physical plant requirements. The National Research Council developed the *Guide* specifically to "assist institutions in caring for and using animals in ways judged to be scientifically, technically, and humanely appropriate," and to "assist investigators with their obligation to plan and conduct animal experiments in accord with the highest scientific, humane and ethical principles."[7] Adoption of the *Guide* meets the statutory requirements of s. 36.40, Wis. Stats., and serves as a solid set of minimum standards for the care and use of animals. Adoption of the *Guide* as systemwide criteria for the use of animals in scientific research is also consistent with the requirements of the *PHS policy* and AAALAC accreditation standards.

Currently, RPD 4-3 adopts the 1996 edition of the *Guide*. This proposal requests that the Board adopt the 2011 version of the *Guide*, which is the most recent edition currently adopted by the PHS Policy and AAALAC International accreditation standards.

The proposal also recommends adopting the third edition of the *Guide for the Care and Use of Agricultural Animals in Research and Teaching (Ag Guide)* as minimum criteria for the use of agricultural animals in scientific research within the UW System. The *Ag Guide* establishes

[7] National Research Council of the National Academies. (2011). Guide for the Care and Use of Laboratory Animals. Washington D.C.: National Academies Press. Retrieved July 2019, from https://www.aaalac.org/resources/Guide_2011.pdf

standards to guide the care and use of agricultural animals in scientific research within the UW System.

This proposal does not change current institutional practices. Although RPD 4-3 references the 1996 edition of the Guide, institutions must meet the requirements of the 2011 edition of the *Guide* or, when applicable, the 2010 edition of the *Ag Guide,* to comply with federal law and accreditation standards.

To ensure that UW System's systemwide criteria for the use of animals in scientific research criteria remains current, this proposal also delegates authority to the UW System President to adopt any subsequent edition of the *Guide* and the *Ag Guide* or any other recognized standard, as needed to maintain compliance with the law and accreditation standards.

While updating and retaining the use of the *Guide* and adding the *Ag Guide* as the systemwide criteria for use of animals in scientific research, this proposal also recommends rescinding RPD 4-3 as a Regent Policy Document. Research administration is a complex endeavor. Institutions must comply with an array of legal requirements and meet high ethical standards, of which the care and use of animals is only one component. For example, institutions must also comply with a similar range of legal requirements and ethical obligations to protect the rights and welfare of human subjects used in research. Rescission of RPD 4-3 recognizes that the care and use of animals in research, along with all other research administration, is an institutional responsibility.

Regent Policy Documents are intended to establish fundamental principles and enduring statements to guide the UW System as a whole. The existing policy simply restates a resolution, provides no additional guidance, and does not meet the standards for a Regent Policy. This proposal retains, through Board Resolution, the *Guide* and adds the *Ag Guide* as systemwide criteria for the care and use of animals in scientific research while delegating the authority to the UW System President to update the criteria in the future. This approach provides UW System with the flexibility it needs to maintain updated criteria in compliance with changing laws and accreditation standards.

ATTACHMENTS

A) RPD 4-3, "Criteria for Use of Animals in Research" (Formerly 84-2)

4-3 CRITERIA FOR USE OF ANIMALS FOR RESEARCH (Formerly 84-2)

The criteria as stated within the 1996 edition, or succeeding editions, of The Guide for the Care and Use of Laboratory Animals, which is published by the Institute of Laboratory Animal Research, the Commission on Life Sciences, and the National Research Council, shall be the criteria for researchers to follow regarding the humane treatment of animals for scientific research purposes in accordance with Wis. Stats. § 36.40 (created by 1983 Wisconsin Act 27, sec. 908t).

History: Res. 3024 adopted 4/6/84

Education Committee **Item B.2.**
October 10, 2019

REGENT POLICY DOCUMENT REVIEW: RPD 4-6, "GRANTING OF DEGREES, HONORS AND AWARDS"

REQUESTED ACTION

Adoption of Resolution B.2., amending and renaming Regent Policy Document 4-6, "Granting of Degrees, Certificates, Honors and Awards."

Resolution B.2. That, upon the recommendation of the President of the University of Wisconsin System, the UW System Board of Regents approves amendments to Regent Policy Document 4-6, "Granting of Degrees, Honors and Awards," and renames the policy, "Granting of Degrees, Certificates, Honors and Awards."

SUMMARY

RPD 4-6, "Granting of Degrees, Honors and Awards," authorizes and establishes conditions for UW System institutions to grant degrees. At its October 2019 meeting, the Education Committee will consider a proposal to amend RPD 4-6 to meet the standards for Regent Policy Documents and to rename the policy, "Granting of Degrees, Certificates, Honors and Awards." This proposal was developed as part of the ongoing Regent Policy Document Review process.

BACKGROUND

In 1972, the Board adopted Resolution 140, codified as RPD 76-3, "Granting of Degrees, Honors and Awards," as part of the merger of the Wisconsin State University and University of Wisconsin Systems. Board minutes indicate that the resolution was intended to reconcile the fact that the former Board of Regents of the Wisconsin State Universities did not take any formal action prior to awarding degrees, but the former University of Wisconsin Board of Regents approved each semi-annual commencement. The policy authorized institutions to grant degrees and certificates for "Regent-approved instructional programs" to any candidate certified by the appropriate Registrar as having met the requirements for a degree or certificate. It stated that degree/certificate recipients must not be under disciplinary actions that could lead to suspension or expulsion and required the Registrar to keep a permanent record of degrees and certificates granted and file a

copy with the Secretary of the Board. Finally, the policy authorized the UW System to award "such honors, awards, medals and prizes as are customary at Commencement exercises."

In September 1976, the Board amended the policy to remove the requirement that institutions file a copy of a degree or certificate with the Secretary of the Board. The policy was amended again in April 1988 to allow all institutions to grant honorary doctoral degrees and to clarify that any institution could award "distinguished service awards, special medals, and prizes." A copy of the current policy, which was later renumbered as RPD 4-6, can be found as Attachment A.

The proposed changes to RPD 4-6, included as Attachments B and C, retain the existing provisions of the policy and incorporate the updated format for RPDs. The proposed policy also incorporates a relevant reference to the Board's statutory authority, while continuing to delegate authority to UW institutions to confer degrees and certificates. The policy includes a new provision clarifying that degree-granting UW institutions must follow procedures found in RPD 4-20 to award honorary doctorate degrees. The proposed policy also includes new provisions describing the oversight, roles, and responsibilities for implementing the policy.

Related Policies

- s. 36.11(7), Wis. Stats., "Confer Degrees."
- RPD 4-20, "Honorary Doctorate Degrees"

ATTACHMENTS

A) RPD 4-6, "Granting of Degrees, Honors and Awards" (Formerly 88-3) – Current Policy
B) RPD 4-6, "Granting of Degrees, Honors and Awards" (Formerly 88-3) – Proposed Policy Track Changes
C) RPD 4-6, "Granting of Degrees, Honors and Awards" (Formerly 88-3) – Proposed Policy

ATTACHMENT A: CURRENT POLICY

4-6 GRANTING OF DEGREES, HONORS AND AWARDS (Formerly 88-3)

The Board of Regents authorizes: the granting of degrees and certificates for Regent-approved instructional programs, from time to time, by each of the degree granting institutions of the University of Wisconsin System, to such candidates as are certified by the appropriate registrar as having met the requirements for their appropriate degrees and certificates, and who are not, at commencement, under disciplinary action or under charges that could lead to suspension or expulsion; each registrar to keep a permanent record of degrees and certificates granted; that each degree granting Institution of the University of Wisconsin System be authorized to award honorary degrees; and that distinguished service awards, special medals, and prizes may be awarded by any University of Wisconsin Institution.

History: Res. 4035 adopted 4/8/88; replaces 76-3.

ATTACHMENT B: PROPOSED CHANGES TO RPD 4-6 (Track Changes)

4-6 GRANTING OF DEGREES, CERTIFICATES, HONORS AND AWARDS

Scope

This policy applies to all UW System institutions.

Purpose

Section 36.11(7), Wis. Stats., authorizes the UW System Board of Regents to "confer such degrees and grant such diplomas as are usual in universities or as it deems appropriate." This policy delegates authority and establishes conditions for conferring degrees and certificates and awarding honorary degrees and other types of honors and awards to recognize individuals for distinguished service or excellence within a field of study.

Policy Statement

The Board of Regents authorizes: ~~the granting of~~each UW institution to confer degrees and certificates ~~for Regent-approved~~to candidates who have completed instructional programs offered by the institution and approved by the Board of Regents.~~, from time to time, by each of the degree granting institutions of the University of Wisconsin System, to such~~ Institutions may grant degrees and certificates to candidates ~~as~~who are certified by the ~~appropriate~~ institution's registrar as having met the requirements for the~~ir appropriate degrees and certificates~~ academic program, and who are not, at the time of commencement, under disciplinary action or under charges that could lead to suspension or expulsion.~~; each~~The registrar at each institution shall ~~to~~ keep a permanent record of degrees and certificates granted by the institution.~~; that each degree granting Institution of the University of Wisconsin System be authorized to award honorary degrees; and that~~

The UW System Board of Regents further authorizes each degree-granting UW institution to award honorary degrees, subject to the requirements of Regent Policy Document 4-20, "Honorary Doctorate Degrees." UW institutions may also award distinguished service awards, special medals, and ~~prizes may be awarded by any University of Wisconsin Institution~~ similar honors or awards to recognize individuals of exceptional accomplishments and distinction..

Oversight, Roles, and Responsibilities

Each UW institution is responsible for seeking Board approval, in accordance with Board of Regents and UW System Administration policies, of academic programs leading to a degree

or certificate and for establishing institutional policies and procedures for conferring degrees and certificates. The registrar at each institution is responsible for maintaining permanent records documenting the conferral of degrees and certificates. UW institutions are also responsible for establishing procedures for recommending and nominating recipients of honors and awards.

UW System Administration's Office of Academic and Student Affairs is responsible for managing the UW System's academic program array in accordance with RPD 4-12 and, in that role, shall coordinate the process for seeking Board approval for new degrees and certificates offered within UW System.

UW System Administration's Office of Finance is responsible for establishing financial guidelines associated with honors and awards.

The Executive Director and Corporate Secretary of the Board of Regents is responsible for coordinating Board approval of honorary doctorate degrees, as required under RPD 4-20.

History: Res.140, adopted 04/07/1972, created Regent Policy Document 72-x; Res. 1303, adopted September 17, 1976, replaced Regent Policy Document 72-x with Regent Policy Document 76-3; Res. 4035, adopted 04/08/1988, replaced Regent Policy Document 76-3 with Regent Policy Document 88-3, subsequently renumbered 4-6; Res. xxxxx, adopted xx/xx/xxxx, amended Regent Policy Document 4-6.

ATTACHMENT C: PROPOSED CHANGES TO RPD 4-6

4-6 GRANTING OF DEGREES, CERTIFICATES, HONORS AND AWARDS

Scope

This policy applies to all UW System institutions.

Purpose

Section 36.11(7), Wis. Stats., authorizes the UW System Board of Regents to "confer such degrees and grant such diplomas as are usual in universities or as it deems appropriate." This policy delegates authority and establishes conditions for conferring degrees and certificates and awarding honorary degrees and other types of honors and awards to recognize individuals for distinguished service or excellence within a field of study.

Policy Statement

The Board of Regents authorizes each UW institution to confer degrees and certificates to candidates who have completed instructional programs offered by the institution and approved by the Board of Regents. Institutions may grant degrees and certificates to candidates who are certified by the institution's registrar as having met the requirements for the academic program, and who are not, at the time of commencement, under disciplinary action or under charges that could lead to suspension or expulsion. The registrar at each institution shall keep a permanent record of degrees and certificates granted by the institution.

The UW System Board of Regents further authorizes each degree-granting UW institution to award honorary degrees, subject to the requirements of Regent Policy Document 4-20, "Honorary Doctorate Degrees." UW institutions may also award distinguished service awards, special medals, and similar honors or awards to recognize individuals of exceptional accomplishments and distinction.

Oversight, Roles, and Responsibilities

Each UW institution is responsible for seeking Board approval, in accordance with Board of Regents and UW System Administration policies, of academic programs leading to a degree or certificate and for establishing institutional policies and procedures for conferring degrees and certificates. The registrar at each institution is responsible for maintaining permanent records documenting the conferral of degrees and certificates. UW institutions are also responsible for establishing procedures for recommending and nominating recipients of honors and awards.

UW System Administration's Office of Academic and Student Affairs is responsible for managing the UW System's academic program array in accordance with RPD 4-12 and, in that role, shall coordinate the process for seeking Board approval for new degrees and certificates offered within UW System.

UW System Administration's Office of Finance is responsible for establishing financial guidelines associated with honors and awards.

The Executive Director and Corporate Secretary of the Board of Regents is responsible for coordinating Board approval of honorary doctorate degrees, as required under RPD 4-20.

Related Laws & Regent Policy Documents

- s. 36.11(7), Wis. Stats., "Confer Degrees."
- RPD 4-20, "Honorary Doctorate Degrees"

History: Res.140, adopted 04/07/1972, created Regent Policy Document 72-x; Res. 1303, adopted September 17, 1976, replaced Regent Policy Document 72-x with Regent Policy Document 76-3; Res. 4035, adopted 04/08/1988, replaced Regent Policy Document 76-3 with Regent Policy Document 88-3, subsequently renumbered 4-6; Res. xxxxx, adopted xx/xx/xxxx, amended Regent Policy Document 4-6.

Education Committee **Item B.3.**
October 10, 2019

REGENT POLICY DOCUMENT REVIEW: RPD 4-7, "ADD/DROP POLICY FOR COURSES"

REQUESTED ACTION

Adoption of Resolution B.3., removing Regent Policy Document 4-7, "Add/Drop Policy for Courses."

Resolution B.3. That, upon the recommendation of the President of the University of Wisconsin System, the UW System Board of Regents authorizes the Executive Director and Corporate Secretary to remove Regent Policy Document 4-7, "Add/Drop Policy for Courses," because the policy is obsolete.

SUMMARY

The Board of Regents adopted Regent Policy Document 4-7, "Add/Drop Policy for Courses," in response to a non-statutory legislative requirement that UW System institutions monitor and reduce any drop rate of more than 5 percent. The policy requires UW System Administration to submit an annual report to the Board of Regents describing the drop rate of each institution.

At its October 2019 meeting, the Board's Education Committee will consider the removal of RPD 4-7, "Add/Drop Policy for Courses," because the policy is obsolete. This proposal was developed as part of the ongoing Regent Policy Document Review process.

BACKGROUND

Regent Policy Document 4-7, "Add/Drop Policy for Courses" was adopted by the Board of Regents in September 1988, as part of a larger effort to manage enrollment and better align resources to meet student needs. The policy, included as Attachment A, was adopted, in part, in response to non-statutory language included in 1987 Wisconsin Act 27 that required each UW System institution to provide a report outlining plans to revise add/drop procedures.

Under the policy, UW System institutions are required to maintain drop rates of no more than five percent of credit hours registered at the close of the tenth day of classes. The policy requires any UW System institution with a drop rate in excess of five percent to develop a plan for reducing the drop rate and to submit the plan to UW System Administration for review. Finally, RPD 4-7 requires UW System Administration to submit an annual report to the Board of Regents describing the drop rate of each UW System institution.

This proposal would remove RPD 4-7 because the policy is obsolete. The conditions under which the Board adopted the policy no longer exist. Since the policy's adoption in 1988, the UW System has reduced its drop rate, with the most recent report noting that the systemwide drop rate has been at five percent or less for 27 consecutive years. Of the individual UW institutions, only the former UW Colleges had an annual drop rate exceeding five percent in the most recent report. The report noted that the recent restructuring may help those institutions reduce their drop rates. The report indicated that all UW institutions have policies in place to discourage students from registering for classes they do not intend to complete.

Removal of RPD 4-7 as a Regent Policy Document will not prohibit UW System Administration or UW System institutions from continuing to monitor and report drop rates or from revising drop rate policies as needed as part of larger efforts to monitor program quality and administrative efficiencies.

ATTACHMENTS

A) RPD 4-7, "Add/Drop Policy for Courses" (Formerly 88-10)

4-7 ADD/DROP POLICY FOR COURSES (Formerly 88-10)

The Board of Regents directs the University of Wisconsin System Administration to:

1. Monitor course drop rates at all University of Wisconsin System Institutions.

2. Require all University of Wisconsin System Institutions to reduce or maintain course drop rates during any academic year at no more than five percent of credit hours registered at the close of the tenth day of classes at the beginning of the fall and spring terms.

3. Effective in the fall of 1989, direct all University of Wisconsin System Institutions whose drop rates exceed five percent to develop and implement plans to reduce the drop rate to five percent or less. Such plans will be subject to the review and approval of System Administration.

4. Report to the Board of Regents annually on the drop rates of each Institution.

History: Res. 5045 adopted 9/9/88.

Education Committee **Item B.4.**
October 10, 2019

REGENT POLICY DOCUMENT REVIEW: RPD 24-4, "UNIVERSITY OF WISCONSIN SYSTEM POLICY ON THE ROLE OF RESIDENT ASSISTANTS IN RESIDENCE HALLS"

REQUESTED ACTION

Adoption of Resolution B.4., amending and renaming Regent Policy Document 24-4, "University of Wisconsin Policy on the Role of Resident Assistants in Residence Halls."

Resolution B.4. That, upon the recommendation of the President of the University of Wisconsin System, the UW System Board of Regents approves amendments to Regent Policy Document 24-4, "University of Wisconsin System Policy on the Role of Resident Assistants in Residence Halls," and renames the policy, "Role of Resident Assistants."

SUMMARY

Regent Policy Document 24-4, "University of Wisconsin System Policy on the Role of Resident Assistants in Residence Halls," establishes a systemwide policy to balance the responsibilities that Resident Assistants have as university employees not to engage in certain types of political and religious activities while on-duty, with their rights as students to participate in campus activities.

At its October 2019 meeting, the Education Committee will be asked to consider a proposal to amend RPD 24-4, "University of Wisconsin System Policy on the Role of Resident Assistants in Residence Halls," and to reformat the policy to meet standards for Regent Policy Documents as defined in RPD 2-3. The policy will also be renumbered for inclusion in Section 30, "Students," of the Regent Policy Documents. This proposal was developed as part of the ongoing Regent Policy Document Review process.

BACKGROUND

In December 2005, the UW System President convened a workgroup to recommend a set of principles to guide the Board of Regents and the President in establishing a systemwide

policy on the role of Resident Assistants (RAs). The President identified a need for a systemwide policy after an RA filed a lawsuit against the UW System because a UW System institution prohibited him from leading a Bible study group in his room. Two UW System institutions at that time prohibited RAs from leading religious study groups in their rooms.

The goal of the workgroup was to create a systemwide policy that balanced the responsibilities that RAs have as university employees, with their rights as students to participate in campus activities. The workgroup's report noted that RAs, like all university employees, are subject to certain restrictions. For example, state statutes restrict university employees from engaging in certain kinds of political speech or political activities while on the job. State law also prohibits the university from engaging in discriminatory behavior against students. Although all employees are free to exercise their religious beliefs, university employees may not proselytize or otherwise exercise their religious beliefs in the workplace in a way that would imply that the university, as their employer, endorses a particular religious viewpoint in violation of the Establishment Clause of the United States Constitution. Similarly, s. 11.1207, Wis. Stats., prohibits university employees from participating in political activity during work hours or while the employee is engaged in official duties. Beyond legal restrictions on the behavior of university employees, RAs are also responsible for creating an open, inclusive, and supportive residential community as part of their official job duties.

While acknowledging the responsibilities of RAs as university employees, the workgroup's final report noted that RAs occupy a unique position at a university, different from other university employees. According to the report, a "resident assistant's room functions as both an office and a campus home, and resident assistants are considered 'on call' almost any time they are in their room or assigned residence hall." The report noted that while RAs are university employees, they are students, too. The report further notes that as long as an RA does not overstep legal and ethical bounds, they are "entitled to receive a comprehensive education, including the freedom to participate in and lead both on-campus and off-campus groups to the same extent as other students." In March 2006, the Board adopted a policy statement, included as Attachment A, which became RPD 06-1 and was later renumbered as RPD 24-4, affirming this perspective.

Since the Board adopted the policy, Resident Assistants became subject to new timekeeping requirements to maintain compliance with the Affordable Care Act. As a result, RAs are no longer expected to be on-call 24 hours a day, seven days a week. Nonetheless, the provisions of RPD 24-4 continue to provide a useful statement reflecting the appropriate role of RAs.

This proposal retains the UW System's Board of Regents policy regarding the role of RAs in residence halls with a few minor modifications to simplify the policy's wording. This proposal also reformats RPD 24-4 to meet the standards for Board of Regent Policies as described in RPD 2-3, "Standards and Protocol for Regent Policy Documents."

At the time the Board adopted the policy, the Board and UW System administrators determined that UW System institutions should provide training to RAs about the policy and should establish procedures student residents of UW System residence halls may use to seek redress if a student believes that the policy has not been followed. This revision incorporates those implementation procedures as part of the policy.

Related Policies

- Regent Policy Document 4-21, "Commitment to Academic Freedom and Freedom of Expression"
- Regent Policy Document 14-6, "Discrimination, Harassment, and Retaliation"

ATTACHMENTS

A) RPD 24-4, "University of Wisconsin System Policy on the Role of Resident Assistants in Residence Halls" (Formerly 06-1) – Current
B) RPD 30-7, "Role of Resident Assistants" – Proposed

ATTACHMENT A-Current

24-4 POLICY ON THE ROLE OF RESIDENT ASSISTANTS IN RESIDENCE HALLS (Formerly 06-1)

That, upon recommendation of the President of the University of Wisconsin System, the Board of Regents approves the following, UW System Policy on the Role of Resident Assistants in Residence Halls:

Resident Assistants (RAs) are expected to work with student residents to create an open, inclusive, and supportive residential community. At the same time, because RAs are students themselves, they are encouraged to participate in campus activities and organizations. As such, RAs may participate in, organize, and lead any meetings or other activities, within their rooms, floors or residence halls, or anywhere else on campus, to the same extent as other students. However, they may not use their positions to pressure, coerce, or inappropriately influence student residents to attend or participate.

History: Res. 9145 adopted 3/10/06

ATTACHMENT B-Proposed

30-7 ROLE OF RESIDENT ASSISTANTS (Formerly 24-4)

Scope

This policy applies to Resident Assistants (RAs) in UW System residence halls.

Purpose

The policy seeks to balance the rights of RAs as students with the expectations and legal obligations placed on RAs as university employees.

Policy Statement

Resident Assistants (RAs) are expected to work with student residents to create an open, inclusive, and supportive residential community. However, as students, RAs are also encouraged to participate in campus activities and organizations. RAs may participate in, organize, and lead any meeting or other activity, in their rooms, on their floors or in their residence halls, or anywhere else on campus, to the same extent as other students. However, RAs may not use their positions to pressure, coerce, or inappropriately influence student residents to attend or participate in those meetings or activites.

Oversight, Roles, and Responsibilities

Each UW System institution shall provide appropriate information and training to all RAs about the provisions of this policy. Each UW System institution shall also establish procedures by which any student in a UW System residence hall may seek redress if the student believes an RA has acted in a manner contrary to this policy.

The UW System Office of Academic and Student Affairs and the UW System Office of General Counsel may provide consultation to UW System institutions, as needed, to ensure compliance with this policy.

Related Regent Policy Documents and Applicable Laws

- Section 11.1207, Wis. Stats., "Political solicitation involving public officials and employees restricted."
- Section 36.12, Wis. Stats., "Student discrimination prohibited."
- UWS 18.11 (8), Wis. Admin. Code, "Selling, Peddling and Soliciting"
- Regent Policy Document 4-21, "Commitment to Academic Freedom and Freedom of Expression"
- Regent Policy Document 14-6, "Discrimination, Harassment, and Retaliation"

History: Res. 9145, adopted 03/10/2006, created Regent Policy Document (RPD) 06-1, subsequently renumbered RPD 24-4. Res. xxxxx, adopted xx/xx/xxxx, amended RPD 24-4 and renumbered the policy as RPD 30-7.

Education Committee **Item C.**
October 10, 2019

UW SYSTEM APPOINTMENTS TO THE NATURAL AREAS PRESERVATION COUNCIL

REQUESTED ACTION

Approval of Resolution C., authorizing the reappointments of Dr. Sharon Dunwoody and Dr. Kenneth Rhoads Bradbury as University of Wisconsin System representatives to the Natural Areas Preservation Council.

Resolution C. That, upon the recommendation of the President of the University of Wisconsin System, the Board of Regents approves the reappointments of Dr. Sharon Dunwoody and Dr. Kenneth Rhoads Bradbury for three-year terms, effective immediately and ending July 1, 2022, as University of Wisconsin System representatives to the Natural Areas Preservation Council.

SUMMARY

The Regents are asked to approve the reappointments of two council members to the Natural Areas Preservation Council (NAPC) for three-year terms, Dr. Sharon Dunwoody and Dr. Kenneth Rhoads Bradbury. If approved, they will serve for three years as University of Wisconsin System representatives to the Natural Areas Preservation Council, and their terms will expire on July 1, 2022. Professor Dunwoody is Professor Emeritus of the Department of Journalism and Mass Communication at the University of Wisconsin-Madison. Dr. Rhoads Bradbury is Director and State Geologist of the Wisconsin Geological and Natural History Survey in Madison, Wisconsin. Attached are their curricula vitae.

BACKGROUND

Established by statute in 1951, the Natural Areas Preservation Council (NAPC) advises the Wisconsin Department of Natural Resources' State Natural Areas Program on issues relating to the establishment, protection, and management of Wisconsin's natural areas. It is composed of eleven members with backgrounds in conservation biology, botany, zoology, ecology, and geology.

Recognizing the critical role that State Natural Areas (SNAs) play in protecting Wisconsin's natural heritage and pursuant to ss. 23.26, Wis. Stats., the Natural Areas Preservation

Council's mission is to: (1) advocate for a strong SNA program; (2) promote research and education on SNAs; and (3) encourage scientifically-based management of and decision making for SNAs. More information on the NAPC is available at: http://dnr.wi.gov/topic/lands/naturalareas/council.html

Council members are appointed for three-year terms by their respective appointing institutions. The UW System is one of five appointing institutions, and it makes four of these appointments, which must be approved by the Board of Regents. The other appointing institutions include: the Wisconsin Department of Natural Resources; the Wisconsin Academy of Sciences, Arts, and Letters; the Wisconsin Department of Public Instruction; and the Milwaukee Public Museum.

ATTACHMENTS

A) Dr. Sharon Dunwoody Curricula Vitae
B) Dr. Kenneth Rhoads Bradbury Curricula Vitae

Biography
Sharon Dunwoody

Sharon Dunwoody is Evjue-Bascom Professor Emerita in the School of Journalism and Mass Communication at the University of Wisconsin-Madison, where she served on the faculty for more than 30 years. She was also active in the Nelson Institute for Environmental Studies throughout her career. In addition to teaching science/environmental writing, she studies both how mediated science and environmental messages are produced and how people use those messages to make judgments about issues; those emphases have produced more than 60 peer-reviewed journal articles. She has both written and co-edited a number of books, as well as many book chapters.

Dunwoody has served as a Fulbright Distinguished Lecturer in Brazil, as a visiting journalism fellow at Deakin University in Australia, as Bonnier Guest Professor at Stockholm University and as Visiting Professor at Nanyang Technological University in Singapore. She is a Fellow of the American Association for the Advancement of Science, of the Midwest Association for Public Opinion Research, and of the Society for Risk Analysis. In 2011, she received the Paul J. Deutschmann Award for Excellence in Research at the annual meeting of the Association for Education in Journalism and Mass Communication (AEJMC), and in 2013 she received the Hilldale Award for "distinguished professional accomplishments" at UW-Madison.

She has served two stints as head of the section on General Interest in Science and Engineering of the American Association for the Advancement of Science and is past president of the Midwest Association for Public Opinion Research and of AEJMC. For 10 years, she served as the Associate Dean for Social Studies in the Graduate School at UW-Madison, where she was responsible for both graduate education and science policy. She currently serves as chair of the Board of Directors of the Aldo Leopold Foundation and as co-chair of the Science Advisory Board of the Wisconsin Initiative on Climate Change Impacts.

A former science writer, she earned the BA in journalism at Indiana University in 1969, the MA in mass communication from Temple University in 1975, and the Ph.D. in mass communication from Indiana University in 1978. Before joining the UW-Madison faculty in 1981, she was on the faculty of the Ohio State University School of Journalism.

CURRICULUM VITAE

Sharon Dunwoody
School of Journalism and Mass Communication
1306 Seminole Highway
Madison, WI 53711
dunwoody@wisc.edu

EDUCATION

Indiana University	Ph.D. mass communication 1978
Temple University	MA mass communication 1975
Indiana University	BA journalism 1969

SCHOLARLY AFFILIATIONS

University of Wisconsin-Madison	Director, 1998-2003
School of Journalism	Evjue-Bascom Professor Emerita, 2013-
And Mass Communication	Evjue-Bascom Professor, 1989-2013
	Associate Professor, 1985-89
	Assistant Professor, 1981-85
Graduate School	Interim Associate Dean for Graduate Education, 2010-11
	Associate Dean for Social Studies, 2003-2010
	Interim Associate Dean, 2001-2003
Center for Environmental Communications and Education Studies	Head, 1985-98
Gaylord Nelson Institute for Environmental Studies	Chair of Academic Programs, 1995-98
	Chair, Executive Committee, 2007-08
Ohio State University	Assistant Professor, 1978-81
School of Journalism	Instructor, 1977-78
Indiana University	Associate Instructor, 1975-77
School of Journalism	
University of Texas at Arlington	Instructor, Summer 1975
Institute of Urban Studies	
Temple University	Teaching Assistant, 1973
Department of Journalism	

HONORS

2017 Presidential Award, Association for Education in Journalism and Mass Communication
2017 Fellow, International Communication Association
2016 Wayne A. Danielson Award for Excellence in Mass Communication Research, University of Texas at Austin
2016 Marion High School (IN) Hall of Distinction Inductee
2014 Indiana University School of Journalism Distinguished Alumna award
2013 Hilldale Award, University of Wisconsin-Madison
2011 Paul J. Deutschmann Award for Excellence in Research, Association for Education in Journalism and Mass Communication
2008 Fellow, Society for Risk Analysis
2008 Inductee, 2008-09 Gallery of Success, Temple University, Philadelphia, PA
2008 Bonnier Guest Professor, Department of Journalism, Media and Communication, Stockholm University, May-June.
2005 Fellow, Midwest Association for Public Opinion Research
2004 Fellow, University of Wisconsin-Madison Teaching Academy
1995 Fellow, American Association for the Advancement of Science
1994 UW-Madison Fellow, CIC Academic Leadership Program
1994 Participant, UW-Madison Administrative Development Program
1994 Participant, 10th Annual Leadership Institute for Journalism and Mass Communication Education, The Freedom Forum Media Studies Center, New York
1993 Graduate School Guest Scholar, Colorado State University
1991 Edward Wilson Fellow in Journalism, Deakin University, Geelong, Victoria, Australia,
1989 Evjue-Bascom Professorship, University of Wisconsin-Madison
1986 Hillier Krieghbaum Under-40 Award, Association for Education in Journalism and Mass Communication.
1981 Fulbright Scholar, Brazil
1979 Nominee, Alumni Award for Distinguished Teaching, Ohio State University.
1973 Top paper award in the Contest on Mass Media Studies of the Association for Education in Journalism
1973 Annual Report for Presbyterian-University of Pennsylvania Medical Center, Philadelphia, received the MacEachern Citation in the category of hospitals under 500 beds in national competition sponsored by the Academy of Hospital Public Relations.
1971 Award from the Texas-Louisiana Region of the American Society for Photogrammetry for excellence in science writing.

BOOKS

Sharon Dunwoody, Lee B. Becker, Douglas McLeod & Gerald Kosicki, eds. *The Evolution of Key Mass Communication Concepts. Honoring Jack M. McLeod*. Cresskill, NJ: Hampton Press, 2005.

Sharon Friedman, **Sharon Dunwoody** and Carol Rogers, eds. *Communicating Uncertainty: Media Coverage of New and Controversial Science*. Erlbaum, 1999.

Exposure of the American People to Iodine-131 from Nevada Nuclear-Bomb Tests. Co-written by the Committee on Thyroid Screening Related to I-131 Exposure and the Committee on Exposure of the American People to I-131 from the Nevada Atomic Bomb Tests. Washington, DC: National Academy Press, 1999.

Sharon Dunwoody, *Reconstructing Science for Public Consumption: Journalism as Science Education*. Geelong, Australia: Deakin University, 1993.

Sharon M. Friedman**, Sharon Dunwoody** and Carol L. Rogers, eds., *Scientists and Journalists: Reporting Science as News*. New York: Free Press, 1986.
Reprinted in 1989 by American Association for the Advancement of Science, 1989.

Lee B. Becker, Jeffrey W. Fruit and Susan L. Caudill with **Sharon Dunwoody** and Leonard Tipton, *The Training and Hiring of Journalists in the United States* (Norwood, NJ: Ablex, 1986).

JOURNAL ARTICLES – REFEREED

Fung, T., Griffin, R. & **Dunwoody, S.** 2018. Testing the links among uncertainty, affect and attitude toward a health behavior. *Science Communication* 40(1): 33-62.

Dunwoody, S. and Kohl, P.A. 2017. Using weight-of-experts messaging to communicate accurately about contested science. *Science Communication* 39(3): 338-357.
DOI: https://doi.org/10.1177/1075547017707765

Allgaier, J., Peters, H.P., Brossard, D., **Dunwoody, S.** & Lo, Y-Y. 2017. Neurowissenschaftler schätzen „neue Medien" wie Blogs und Facebook in der öffentlichen Wissenschaftskommunikation noch als weniger bedeutsam ein als journalistische Medien. *Neuroforum* 19(2): 75-78.
DOI:https://doi.org/10.1515/nf-2013-0209

Spartz, J.T., Su, Leona Y.F., **Dunwoody, S**., Griffin, R., Brossard, D. 2017. YouTube, Social Norms and Perceived Salience of Climate Change in the American Mind. *Environmental Communication: A Journal of Nature and Culture* 11:1, 1-16. DOI: 10.1080/17524032.2015.1047887

Koh, E. J., **Dunwoody, S.**, Brossard, D., & Allgaier, J. 2016. Mapping neuroscientists' perceptions of the nature and effects of public visibility. *Science Communication* 38(2): 170-196.

Kohl, P.A., Kim, S.Y., Peng, Y., Akin, H., Koh, E.J., Howell, A. & **Dunwoody, S**. 2016. The influence of weight-of-evidence strategies on audience perceptions of (un)certainty when media cover contested science. *Public Understanding of Science* 25(8): 976-991. **DOI:** 10.1177/0963662515615087

Griffin, R.J. & **Dunwoody, S.** 2016. Chair support, faculty entrepreneurship, and the teaching of statistical reasoning to journalism undergraduates in the United States. *Journalism*, *17*(1), 97-118. **DOI:** 10.1177/1464884915593247

Liang, X., Tsai, J-Y, Konieczna, M., Mattis, K. & **Dunwoody, S**. 2014. Exploring attribution of responsibility in a cross-national study of TV news coverage of the 2009 global climate meeting in Copenhagen. *Journal of Broadcasting & Electronic Media*, *58*(2), 253-271. **DOI:** 10.1080/08838151.2014.906436

Konieczna, M., Mattis, K., Liang, X., Tsai, J-Y & **Dunwoody, S.** 2014. Global journalism in decision-making moments: A case study of Canadian and American television coverage of the 2009 United Nations Framework Convention on Climate Change in Copenhagen. *Environmental Communication* 8(4): 489-507. **http://www.tandfonline.com/eprint/kKmzWXYyFGPyK3rDpC54/full**

Allgaier, J., **Dunwoody, S**., Brossard, D., Lo, Y-Y & Peters, H.P. 2013. Medialized science? Neuroscientists' reflections on their role as journalistic sources. *Journalism Practice* 7(4): 413-429. **DOI**: 10.1080/17512786.2013.802477

Allgaier, J., **Dunwoody, S**., Brossard, D., Lo, Y-Y & Peters, H.P. 2013. Journalism and social media as means of observing the contexts of science. *Bioscience* 63(4): 284-287.

Griffin, R. J., **Dunwoody, S**. & Yang, Z. J. 2013. Linking risk messages to information seeking and processing. In C. Salmon (Ed.) *Communication Yearbook 36*. New York: Routledge Taylor & Francis, 323-362.

Dunwoody, S. 2012. Quand les journalists couvrent les controverses scientifiques (When journalists cover contested science). *Cahiers du* journalisme No. 24: 32-49.

Crone, W.C., **Dunwoody, S.L.,** Rediske, R.K., Ackerman, S.A., Zenner, G.M., & Yaros, R.A. 2011. Informal science education: A practicum for graduate students. *Innovative Higher Education* 36(5): 291-304.

Dudo, A., **Dunwoody, S**. & Scheufele, D.A. 2011. The emergence of nano news: Tracking thematic trends and changes in U.S. newspaper coverage of nanotechnology. *Journalism & Mass Communication Quarterly* 88(1): 55-75.

Dunwoody, S., Brossard, D., & Dudo, A. 2009. Socialization or rewards? Predicting U.S. scientist-media interactions. *Journalism & Mass Communication Quarterly* 86(2): 299-314.

Peters, H.P., Brossard, D., de Cheveigne, S., **Dunwoody, S**., Kallfass, M., Miller, S. & Tsuchida, S. 11 July 2008. Interactions with the mass media. *Science* 321: 204-205.

Griffin, R.J., Zheng, Y., ter Huurne, E., Boerner, F., Ortiz, S., & **Dunwoody, S.** 2008. After the flood: Anger, attribution and the seeking of information. *Science Communication* 29(3): 285-315.

Scheufele, D.A., Corley, E. A., **Dunwoody, S**., Shih, T., Hillback. E. & Guston, D. December 2007. Scientists worry about some risks more than the public. *Nature Nanotechnology* 2: 732-734.

Powell, M., **Dunwoody, S**., Griffin, R.J., & Neuwirth, K. 2007. Exploring lay uncertainty about an environmental health risk. *Public Understanding of Science* 16(3): 323-343.

Kahlor, L., **Dunwoody, S**., Griffin, R.J. & Neuwirth, K. 2006. Seeking and processing information about impersonal risk. *Science Communication* 28(2): 163-194.

Kahlor, L., **Dunwoody, S**. & Griffin, R.J. 2004. Predicting knowledge complexity in the wake of an environmental risk. *Science Communication* 26(1): 5-30.

Eveland, W.P., Cortese, J., Park, H. & **Dunwoody, S**. 2004. How web site organization influences free recall, factual knowledge, and knowledge structure density. *Human Communication Research* 30(2):208-233.

Griffin, R.J., Neuwirth, K., **Dunwoody, S**. & Giese, J. 2004. Information sufficiency and risk communication. *Media Psychology* 6(1): 23-61.

Kahlor, L., **Dunwoody S**., Griffin, R.J., Neuwirth, K. & Giese, J. 2003. Studying heuristic-systematic processing of risk communication. *Risk Analysis* 23(2): 55-368.

Griffin, R.J., Neuwirth, K., Giese, J. & **Dunwoody, S**. 2002. Linking the heuristic-systematic model and depth of processing. *Communication Research* 29(6): 705-732.

Kahlor, L., **Dunwoody, S**. & Griffin, R. 2002. Attributions in explanations of risk estimates. *Public Understanding of Science* 11(3): 243-257.

Eveland, W.P. & **Dunwoody, S.** 2002. An investigation of elaboration and selective scanning as mediators of learning from the web versus print. *Journal of Broadcasting & Electronic Media* 46(1): 34-53.

Tremayne, M. & **Dunwoody, S**. 2001. Interactivity, information processing, and learning on the World Wide Web. *Science Communication* 23(2): 111-134.

Dunwoody, S. 2001. Studying Users of The Why Files," *Science Communication* 22(3): 274-82.

Eveland, W.P. & **Dunwoody, S.** 2001. User control and structural isomorphism or disorientation and cognitive load? Learning from the web versus print. *Communication Research* 28(1): 48-78.

Neuwirth, K., **Dunwoody, S.** & Griffin, R.J. 2000. Protection motivation and risk communication. *Risk Analysis* 20(5): 721-734.

Eveland Jr., W.P. & **Dunwoody, S.** 2000. Examining information processing on the World Wide Web using think aloud protocols. *Media Psychology* 2(3): 219-243.

Griffin, R.J., **Dunwoody, S**., Dybro, T. & Zabala, F. 2000. The relationship of communication to risk perceptions and preventive behavior related to lead in tap water. *Health Communication* 12(1): 81-107.

Griffin, R.J., **Dunwoody, S.** & Neuwirth, K. 1999. A proposed model of the relationship of risk information seeking and processing to the development of preventive behaviors. *Environmental Research* 80: 230-245.

Eveland, W.P. & **Dunwoody, S.** 1998. Users and navigation patterns of a science World Wide Web site for the public. *Public Understanding of Science* 7(4): 285-311.

Griffin, R.J., **Dunwoody, S.** & Zabala, F. 1998. Public reliance on risk communication channels in the wake of a Cryptosporidium outbreak. *Risk Analysis* 18(4): 367-375.

Trumbo, C.W., **Dunwoody, S.** & Griffin, R.J. 1998. Journalists, cognition, and the presentation of an epidemiologic study. *Science Communication* 19(3): 238-265.

Griffin, R.J. & **Dunwoody, S.** 1997. Community structure and science framing of news about local environmental risks. *Science Communication* 18(4): 362-384.

Griffin, R.J., **Dunwoody, S.** & Gehrmann, C. 1995. The effects of community pluralism on press coverage of health risks from local environmental contamination. *Risk Analysis* 15(4): 449-458.

Griffin, R.J. & **Dunwoody, S.** 1995. Impacts of information subsidies and community structure on local press coverage of environmental contamination. *Journalism & Mass Communication Quarterly* 72(2): 271-284.

Dunwoody, S. & Peters, H.P. 1992. Mass media coverage of technological and environmental risks: A survey of research in the United States and Germany. *Public Understanding of Science* 1(2): 199-230.

Dunwoody, S., Neuwirth, K., Griffin, R.J. & Long, M. 1992. The impact of risk message content and construction on comments about risks embedded in "letters to friends." *Journal of Language and Social Psychology* 11(1&2):9-33.

Ryan, M., **Dunwoody, S.** & Tankard, J. 1991. Risk information for public consumption: Print media coverage of two risky situations. *Health Education Quarterly* 18(3): 375-390.

Rossow, M. & **Dunwoody, S.** 1991. Inclusion of "useful" detail in newspaper coverage of a high level nuclear waste siting controversy. *Journalism Quarterly* 68(1/2): 87-100.

Neuwirth, K. & **Dunwoody, S.** 1989. The complexity of AIDS-related behavioral change: The interaction between communication and noncommunication variables. *AIDS & Public Policy Journal* 4:20-30.

Neuwirth, K., Liebler, C.M., **Dunwoody, S.** & Riddle, J. 1988. The effect of "electronic" news sources on news production. *Journalism Quarterly* 65: 85-94.

Dunwoody, S. & Ryan, M. 1987. The credible scientific source. *Journalism Quarterly* 64: 21-27.

Beam, R.A., **Dunwoody, S.** & Kosicki, G.M. 1986. The relationship of prize-winning to prestige and job satisfaction. *Journalism Quarterly* 63: 693-699.

Dunwoody, S. & Shields, S. 1986. Accounting for patterns of topic selection in statehouse reporting. *Journalism Quarterly* 63: 488-496.

Shields, S. & **Dunwoody, S.** 1986. The social world of the statehouse pressroom. *Newspaper Research Journal* 8:43-51.

Dunwoody, S. & Ryan, M. Winter 1985. Scientific barriers to the popularization of science in the mass media. *Journal of Communication* 35:26-42.

Dunwoody, S. 1984. Mass media coverage of the social sciences: Some new answers to old questions. *Equid Novi* 5:85-94.

Dunwoody, S. 1984. Scientists and journalists: A shared culture?" *Etudes de Radio-Television*, No. 33, pp. 17-27.

Rogers, C.L. & **Dunwoody, S.** 1984. Using mass media science materials in the classroom. *Journal of College Science Teaching* 8:340-349.

Dunwoody, S. & Ryan, M. 1983. Public information persons as mediators between scientists and journalists. *Journalism Quarterly* 60:647-656.

Becker, L.B., **Dunwoody, S.** & Rafaeli, S. 1983. Cable's impact on use of other news media. *Journal of Broadcasting* 27: 127-140.

Dunwoody, S. 1982. A question of accuracy. *IEEE Transactions on Professional Communication*, PC-25: 196-199.

Dunwoody, S. & Scott, B.T. 1982. Scientists as mass media sources. *Journalism Quarterly* 59:52-59.

Becker, L.B. & **Dunwoody, S.** 1982. Media use, public affairs knowledge and voting in a local election. *Journalism Quarterly* 59:212-218, 255.

Dunwoody, S. 1980. The science writing inner club: A communications link between science and the lay public. *Science, Technology, &Human Values* 5:14-22.

Reprinted in Wilhoit, G. C. & and de Bock, H. eds. 1981. *Mass Communications Review Yearbook*, vol. 2. Beverly Hills, CA: Sage, pp. 351-359.

Reprinted in Friedman, S.M., **Dunwoody, S**. & Rogers, C.L. eds. 1986. *Scientists and Journalists: Reporting Science as News*. New York: Free Press, pp. 155-169.

Dunwoody, S. 1979. News-gathering behaviors of specialty reporters: A two-level comparison of mass media decision-making. *Newspaper Research Journal* 1:29-39.

Dunwoody, S. & Wartella, E. 1979. A survey of the structure of science and environmental writing courses. *The Journal of Environmental Education* 10:29-39.

Dunwoody, S. 1978. Putting context into mass media science writing. *The English Journal* 67:44-47.

Ryan, M. & **Dunwoody, S.** 1975. Academic and professional training patterns of science writers. *Journalism Quarterly* 52:239-246, 290.

Ryan, M. & **Dunwoody, S.** 1975. Specialized training and the science writer. *Journal of Technical Writing and Communication* 5:83-90.

BOOK CHAPTERS

Dunwoody, S. (in press). Science journalism. In Dascal, M., Leßmöllmann, A. & Gloning, T. (eds.) *Handbook of Communication Science*, vol 17. Berlin/Boston: de Gruyter. https://doi.org/10.1515/9783110393212-020

Dunwoody, S. (2019) Environment, health and science coverage. In Vos, T.P. & Hanusch, F. (eds.) *The International Encyclopedia of Journalism Studies*. John Wiley & Sons, Inc., https://www.onlinelibrary.wiley.com/doi/book/10.1002/9781118841570

Griffin, R.J. & **Dunwoody, S.** 2017. Teaching statistical reasoning (or not) in journalism education: findings and implications from surveys with US j-chairs. In Nguyen, A. (ed.) *News, Numbers and Public Opinion in a Data-Driven World*. UK: Bloomsbury Academic, pp. 242-259.

Dunwoody, S. & Griffin, R.J. 2015. Risk information seeking and processing model. In Cho, H., Reimer, T. & McComas, K. (eds.) *The SAGE Handbook of Risk Communication*. Thousand Oaks, CA: SAGE, 102-116.

Dunwoody, S. 2015. Environmental scientists and public communication. In Hansen, A. and Cox, R. eds. *Handbook of Environment and Communication*. London: Routledge, pp. 63-72.

Dunwoody, S. 2014. Science journalism: prospects in the digital age. In Bucchi, M. and Trench, B., eds. *Handbook of Public Communication of Science and Technology*, 2nd ed. London: Routledge, pp. 27-39.

Dunwoody, S. & Griffin, R.J. 2014. The role of channel beliefs in risk information seeking. In J. Arvai & L. Rivers III (Eds.) *Effective Risk Communication*, Oxfordshire, UK: Routledge-Earthscan, pp 220-233.

Peters, H.P.; Allgaier, J.; **Dunwoody, S**.; Lo, Y.-Y.; Brossard, D.; Jung, A. 2013. Medialisierung der Neurowissenschaften: Bedeutung journalistischer Medien für die Wissenschafts-Governance. In: Grande, E.; Jansen, D.; Jarren, O.; Rip, A.; Schimank, U.; Weingart, P. (ed.), *Neue Governance der Wissenschaft: Reorganization, externe Anforderungen, Medialisierung*. Bielefeld: transcript, pp. 311-335.

Griffin, R. J. & **Dunwoody, S.** (2013) Promises and challenges of teaching statistical reasoning to journalism undergraduates: Twin surveys of department heads, 1997 and 2008. In B. Brennen (Ed.) *Assessing Evidence in a Postmodern World*. Milwaukee, WI: Marquette University Press, pp. 169-196.

Peters, H. P., Allgaier, J., **Dunwoody, S**., Lo, Y.-Y., Brossard, D., & Jung, A. (2013). Medialisierung der Neurowissenschaften: Bedeutung journalistischer Medien für die Wissenschafts-Governance [Medialization of the neurosciences: The relevance of journalistic media for science governance]. In E. Grande, D. Jansen, O. Jarren, A. Rip, U. Schimank & P. Weingart (Eds.), Neue Governance der Wissenschaft: Reorganisation - externe Anforderungen - Medialisierung. Bielefeld: transcript, pp. 236-257.

Dunwoody, S. & Konieczna, M. (2013). The role of global media in telling the climate change story. In Ward, S.J. ed. *Global Media Ethics: Problems and Perspectives*. Malden, MA: Wiley-Blackwell, pp. 171-190.

Dunwoody, S. 2010. Science Communication (journal). In Priest, S.H. ed., *Encyclopedia of Science and Technology Communication*. Thousand Oaks, CA: Sage, 695-697.

Dunwoody, S. 2010. Foreword: Building a context for the next century of science communication research. In Kahlor, L. and Stout, P.A. eds. *Communicating Science: New Agendas in Communication.* New York: Routledge, ix-xi.

Peters, H.P., Brossard, D., de Cheveigne, S., **Dunwoody, S.**, Heinrichs, H., Jung, A., Kallfass, M., Miller, S., Petersen, I., Tsuchida, S., Cain, A., & Paquez, A-S. 2009. Medialization of science and its relevance for the relationship with politics. In Peters, H.P. ed. *Medienorientierung biomedizinischer Forscher im internationalen Vergleich: die Schnittstelle von Wissenschaft & Journalismus und ihre politische Relevanz* (*Orientation of Biomedical Researchers Towards the Media in International Comparison: The Interface of Science & Journalism, and Its Political Relevance*). Jülich: Forschungszentrum Jülich, pp. 9-43.

Peters, H.P., Brossard, D., de Cheveigne, S., **Dunwoody, S.**, Kallfass, M., Miller, S., Tsuchida, S., Cain, A., & Paquez, A-S. 2009. Contacts of biomedical researchers with journalists and public: International comparison of experiences and attitudes in Germany, France, Great Britain, Japan and the USA. In Peters, H.P. ed. *Medienorientierung biomedizinischer Forscher im internationalen Vergleich: die Schnittstelle von Wissenschaft & Journalismus und ihre politische Relevanz* (*Orientation of Biomedical Researchers Towards the Media in International Comparison: The Interface of Science & Journalism, and Its Political Relevance*). Jülich: Forschungszentrum Jülich, pp. 45-99**.**

Griffin, R. J. & **Dunwoody, S**. 2008. "Environmental Communication." The International Encyclopedia of Communication. Donsbach, Wolfgang (ed). Blackwell Publishing. Blackwell Reference Online. Updated entry 10 September 2015. http://www.communicationencyclopedia.com/subscriber/tocnode.html?id=g9781405131995_yr2015_chunk_g978140513199510_ss32-1

Dunwoody, S. 2008. Science journalism. In Bucchi, M. and Trench, B., eds. *Handbook of Public Communication of Science and Technology*. London: Routledge, pp. 15-26.

Dunwoody, S. 2007. Journalistic practice and coverage of the social and behavioral sciences. In Welch, M.K. and Fasig, L.G., eds. *Handbook on Communicating and Disseminating Behavioral Science*. Thousand Oaks, CA: Sage, pp. 57-71.

Dunwoody, S. 2007. United States: Focus on audience. In Bauer, M.W. and Bucchi, M.,eds. *Journalism, Science and Society: Science Communication between News and Public Relations*. London: Routledge, pp. 241-245.

Dunwoody, S. & Griffin, R.J. 2007. Risk communication, risk beliefs, and democracy," in D. Brossard, J. Shanahan & C. Nesbitt, eds. *The Media, the Public and Agricultural Biotechnology: An International Casebook*. Wallingford, UK: CABI Publishing, 264-286.

Dunwoody, S. 2007. The challenge of trying to make a difference using media messages. In Susi Moser and Lisa Dilling, eds. *Creating a Climate for Change*. Cambridge, MA: Cambridge University Press, 89-104.

Dunwoody, S. & Griffin, R.J. 2002. Judgmental heuristics and news reporting. In M.V. Rajeev Gowda and Jeffrey C. Fox, eds., *Judgments, Decisions, and Public Policy*. UK: Cambridge University Press, 177-198.

Eveland, W.P. & **Dunwoody, S.** 2001. Applying research on the uses and cognitive effects of hypermedia to the study of the World Wide Web. In W.B. Gudykunst, ed. *Communication Yearbook 25*. Mahwah, NJ: Erlbaum, 79-113.

Dunwoody, S. 1999. Scientists, journalists and the meaning of uncertainty. In Sharon Friedman, Sharon Dunwoody and Carol Rogers, Eds. *Communicating Uncertainty*. Mahwah, NJ: Erlbaum, 59-79.

Dunwoody, S. & Griffin, R.J. 1998. Community structure and media accounts of risk. In David P. Demers and K. Vishwanath, eds., *Mass Media, Social Control, and Social Change*. Ames, Iowa: Iowa State University Press, pp.139-158.

Dunwoody, S. 1998. Media coverage of risks – overviews and appraisals of research results: The American perspective. In Winfried Gopfert and Renate Bader, eds., *Risikoberichterstattung und Wissenschaftsjournalismus* (Risk Communication and Science Journalism). Germany: F.K. Schattauer Verlagsgesellschaft,, pp. 13-22.

Griffin, R.J., Neuwirth . K. & **Dunwoody, S.** 1995. Using the theory of reasoned action to examine the impact of health risk messages. In Brant R. Burleson, ed., *Communication Yearbook 18*. Thousand Oaks, CA: Sage, pp. 201-228.

Dunwoody, S. 1994. Telling public stories about risk,. In June Fessenden MacDonald, ed., *Agricultural Biotechnology: A Public Conversation About Risk*. Ithaca, NY: National Agricultural Biotechnology Council, pp. 97-106.

Dunwoody, S. & Griffin, R.J. 1993. Journalistic strategies for reporting long-term environmental issues: A case study of three Superfund sites. In Anders Hansen, ed., *The Mass Media and Environmental* Issues. Leicester: Leicester University Press, pp. 22-50.

Dunwoody, S. & Peters, H.P. 1993. Massenmedien und risikowahrnehmung,. In *Risiko ist ein Konstrukt*. Munich: Knesebeck, pp. 317-341.

English language version: **Dunwoody, S.** & Peters, H.P. 1993. The mass media and risk perception. In *Risk Is a Construct*. Munich: Knesebeck, pp. 293-317.

Dunwoody, S. 1992. The media and public perceptions of risk: How journalists frame risk stories. In Daniel W. Bromley and Kathleen Segerson, eds. *The Social Response to Environmental Risk*. Boston: Kluwer Academic Publishers, pp. 75-100.

Dunwoody, S. & Neuwirth, K. 1991. Coming to terms with the impact of communication on scientific and technological risk judgments. In L. Wilkins and P. Patterson, eds. *Risky Business: Communicating Issues of Science, Risk, and Public Policy*. Westport, CT: Greenwood Press, pp.11-30.

Dunwoody, S. 1989. Comments. In S.J. Doorman, ed., *Images of Science***.** Great Britain: Gower Publishing, pp. 212-218.

Dunwoody, S. & Rossow, M. 1989. Community pluralism and newspaper coverage of a high-level nuclear waste siting issue. In Larissa A. Grunig, ed., *Environmental Activism Revisited,* Monographs in Environmental Education and Environmental Studies, vol. 5 Troy, OH: North American Association for Environmental Education, pp. 5-21.

Dunwoody, S. 1988. The practitioners are interested...But they are not journalists. In Nancy Weatherly Sharp, ed., *Communications Research*. Syracuse, NY: Syracuse University Press, pp. 172-174.

Dunwoody, S. 1986. When science writers cover the social sciences. In Jeffrey H. Goldstein, ed., *Reporting Science: The Case of Aggression*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc., pp. 67-81.

Dunwoody, S. & Stocking, S.H. 1985. Social scientists and Journalists: Confronting the stereotypes. In Eli Rubinstein and Jane Brown, eds., *The Media, Social Science, and Social Policy for Children: Different Paths to a Common Goal*. Norwood, NJ: Ablex Publishing Corporation, pp. 167-187.

Stocking, S.H. & **Dunwoody, S**. 1982. Social science in the mass media: Images and evidence. In Joan Sieber, ed., *The Ethics of Social Research: Fieldwork, Regulation and Publication*. New York: Springer-Verlag, pp. 151-169.

OTHER PUBLICATIONS/REPORTS

AAPOR Ad Hoc Committee on Attacks on Surveys. *Report of the AAPOR Ad Hoc Committee on Attacks on Surveys*. 2018. American Association for Public Opinion Research.

Allgaier, J., Peters, H.P., Brossard, D., **Dunwoody, S.** & Lo, Y-Y. 2017. Neurowissenschaften in den Medien: Die Sicht neurowissenschaftlicher Experten. 18(4): 304, 306, 308.
DOI:https://doi.org/10.1515/nf-2012-0406

Peters, H. P. & **Dunwoody, S.** 2016. Scientific uncertainty in media content: Introduction to this special issue. *Public Understanding of Science* 25(8): 893-908. DOI: 10.1177/0963662516670765
Introduction to special issue on media representations of uncertainty that we co-edited.

Dunwoody, S. 2016. Communicating uncertainty in our mediated world: A preface. *Communications: The European Journal of Communication Research* 41(3): 231-237.

Office hours with **Sharon Dunwoody**. 2016. *The Open Notebook*. Q&A edited by TON editors. http://www.theopennotebook.com/2016/05/17/office-hours-with-sharon-dunwoody/.

Dunwoody, S. 2015. Commentary. *Journalism & Communication Monographs*. 17(2): 87.

Dunwoody, S. 2015. Scientist/journalist interactions in the 21st century. *SMC*. A publication of the China Research Institute for Science Popularization.
http://mp.weixin.qq.com/s?__biz=MzA4NTI0MTg2Mg==&mid=208157580&idx=1&sn=197961538863988c023de8a6671c53cd#rd

Dunwoody, S. 2014. Let's change how we report truth in science journalism. *SciDev.Net*.
http://www.scidev.net/global/journalism/opinion/report-truth-science-journalism.html

Peters, H.P., **Dunwoody, S**., Allgaier, J., Lo, Y-Y and Brossard, D. 2014. Public communication of science 2.0 *EMBO reports*.
http://embor.embopress.org/content/early/2014/06/10/embr.201438979

Allgaier, J.; Peters, H.P.; Brossard, D.; **Dunwoody, S**. and Lo, Y.-Y. 2013. Neurowissenschaftler schätzen "neue Medien" wie Blogs und Facebook in der öffentlichen Wissenschaftskommunikation

noch als weniger bedeutsam ein als journalistische Medien (Neuroscientists perceive "new media" such as blogs and facebook in public science communication as still being less impactful than journalistic media). *Neuroforum* 19 (2): 75-78.

Dunwoody, S. & Griffin, R.J. 2013. Statistical reasoning in journalism education. *Science Communication* 35(4): 528-538. DOI: 10.1177/1075547012475227.

Allgaier, J., **Dunwoody, S.,** Peters, H. P., Brossard, D., & Lo, Y.-Y. 2012. Neurowissenschaften in den Medien: Die Sicht neurowissenschaftlicher Experten. Neuroforum, 18(4), 304-308.

Dunwoody, S. 2011. Science Communication. In Patricia Moy, ed. *OBO: Communication*. Oxford Bibliographies Online. New York: Oxford University Press.

Scheufele, D., Brossard, D., **Dunwoody, S.**, Corley, E.A., Guston, D. & Peters, HP. 4 August 2009. Are scientists really out of touch? *The Scientist*. Accessed at http://www.the-scientist.com/news/print/55875/.

Crone, W.C., Rediske, R., Ackerman, S. & **Dunwoody, S.** 2009. Engaging science and engineering graduate students with informal science education. *ASEE Annual Conference and Exposition, Conference Proceedings*, 2009, pp. 1-9.

Peters, H.P., Brossard, D., de Cheveigne, S., **Dunwoody, S**., Kallfass, M., Miller, S. & Tsuchida, S. 2008. Science-media interface: It's time to reconsider. *Science Communication* 30: 266-275.

Peters H.P., Heinrichs, H., Jung, A., Kallfass, M., Petersen, I., Brossard, D., de Cheveigné S., **Dunwoody, S.**, Miller, S., Tsuchida, S., Cain, A. & Paquez, A-S. 2008. Das Verhaltnis von Wissenschaft und Massenmedien und die politische Relevanz offentlicher Kommunikation uber Wissenschaft am Beispiel der Biomedizin (The Science-Media Relationship and the Political Relevance of Public Communication of Science in the Biomedical Field). Final report. German Federal Ministry of Education and Research. Project number: 07 SPR 30, Forschungszentrum Juelich..

Dunwoody, S. 2005. Weight-of-evidence reporting. What is it? Why use it? *Nieman Reports* 59(4):89-91, Winter..

Dunwoody, S. 2004. How valuable Is formal science training to science journalists?" *Comuniçãcao e Sociedade* (Communication and Society) 6: 75-87.

Dunwoody, S. 2004. Q&A in a book: A. Ekstrom, ed. *Den mediala vetenskapen* (Mediated Science). Sweden: Bokforlaget Nya Doxa, 323-334. I respond here to a series of questions posed by the editor and Anders Carlsson about science journalism for a section of the book titled "The Politics of Participation: Discussions and Prognoses."

Dunwoody, S. 2003. Teaching as research. *Journalism & Mass Communication Educator* 58(3):219-222.

Dunwoody, S. 2003. New media. In Toby Ten Eyck & George Gaskell, eds. *Comparative Research on Biotechnology and the Public*. Report to the US-EC Task Force on Biotechnological Research.

Dunwoody, S. Summer 2000. Resisting the pull of election polls. *On Wisconsin* 101(2): 18-19.

Dunwoody, S. & Eveland, W. 2000. The wild, wild web. *Wisconsin Academy Review* 46 (3): 21.

Dunwoody, S. & Harp,D., compilers, *Directory of Science Communication Courses & Programs in the United States*. http://www.murrow.journalism.wisc.edu/dsc. (no longer available)
Hard copy versions of this directory have been produced since 1989.

Eveland, W.P. & **Dunwoody, S.** May 1998. Surfing the web for science: Early data on the users and uses of The Why Files. *NISE Brief*, vol. 2, no. 2.

Dunwoody, S. 1997. What's a journalist to do? Challenges and approaches to reporting scientific assessment. In S.J. Hassol and J. Katzenberger, eds. *Elements of Change 1996*. Aspen, CO: Aspen Global Change Institute, 147-152.

Dunwoody, S. 1997. Why is it so hard for the public to evaluate risks? The case of reformulated gas. In Dan Jaffee, ed. *Strategies to Manage Pesticides: Conference Proceedings*. Madison, WI: Nutrient and Pest Management Program, pp. 15-21.

Dunwoody, S. Research on reporting. Intermittent column in *ScienceWriters*, beginning volume 43, No. 4, Winter 1995-96.

Dunwoody, S. 1995. Science writing offers model for critical thinking. *CT&M Concepts* 25(1):1,5. Reprinted in *SEJournal* 6(1):1,10, Spring 1996.

Dunwoody, S. 1995. How do everyday people evaluate evidence? In Sara Johnson, ed., *Strategies to Manage Pesticides: Conference Proceedings*. Madison, WI: Nutrient and Pest Management Program, pp. 11-15.

Dunwoody, S. Summer 1994. Community structure and media risk coverage. *Risk* 5(3):193-201.

Griffin, R.J. & **Dunwoody, S.** 1993. *Community Structure and Press Coverage of Health Risks from Environmental Contamination*. Report funded by U.S. EPA Cooperative Agreement CR-817599-01-0. Washington, DC: U.S. Environmental Protection Agency.

Dunwoody, S., Baldrica, C. & Long, M. 1993. *Annotated Bibliography of Research on Mass Media Science Communication*, 2nd ed. Madison, WI: Center for Environmental Communications and Education Studies.

Dunwoody, S. 1993. Relationships between scientists and journalists in the 21st century. *Proceedings: The First World Conference of Science Journalists*. Tokyo: National Federation of UNESCO Associations in Japan, p. 53.

Dunwoody, S. 1992. The challenge for scholars of popularized science communication: Explaining ourselves. *Public Understanding of Science* 1(1): 11-14.

Tankard, J.W., **Dunwoody, S**. & Ryan, M. 15 April 1991. After environmental accidents, public deserves full candor. *The Scientist* 5(8):11, 13.

Dunwoody, S. 1991. Do people really learn about risk from the mass media? In Sharon M. Friedman and Carol L. Rogers, eds., *Environmental Risk Reporting: The Science and The Coverage*. Proceedings of a workshop. Bethlehem, PA: Lehigh University, pp. 25-27.

Reprinted in *NAPEC Quarterly* 2(3): 11, September 1991.

Dunwoody, S. 1990. Addressing statistical illiteracy. *CT&M* (newsletter of the Communication Theory and Methodology Division of the Association for Education in Journalism and Mass Communication) 19(1): 1-2.

Dunwoody, S. September 1989. What's different about science writing? *The Coaches' Corner* (a quarterly exchange on coaching newspaper writers) 4:1, 6, 10.

Dunwoody, S. 1979-1993. Annotated bibliography. *Sciphers* (a quarterly newsletter for teachers of science writing).

Dunwoody, S. 1989. News flash! Scientist speaks with reporters. *1990 Yearbook of Science and the Future*. Chicago: Encyclopaedia Britannica, pp. 222-236.

Dunwoody, S. February 1989. Doctoral education in communication is gaining in disciplinary rigor. *Insights*, pp. 13-14.

Dunwoody, S. April 1989. The rest of the story (about risk). *Wisconsin Natural Resources*, pp. 29-30.

Dunwoody, S. & Rogers, C.L. 1988/89. Meet the press. *MS/PhD* 2:18.

Dunwoody, S. & Rossow, M. 1988. *Science Writing: An Annotated Bibliography of Commentary, Research and Resources*. Washington, DC: Council for the Advancement of Science Writing.

Dunwoody, S. 1985. Research on science journalism--an overview. In Stephan Russ-Mohl, ed., *Wissenschaftsjournalismus in den USA*. Stuttgart, West Germany: Robert Bosch Foundation, pp. 67-75.

Dunwoody, S., Patrusky, B. & Rogers, C.L. 1985. The gatekeepers: The inner circle in science writing. In Virginia Carter Smith and Patricia LaSalle Alberger, eds., *Communicating University Research*, 2nd ed. Washington, D.C.: Council for the Advancement and Support of Education, pp. 96-101.

Dunwoody, S. October 1983. Scientists talk to the press to help themselves, not the public. *Newsletter of the National Association of Science Writers* 31: 6-7.

Dunwoody, S. 1981. Annotated bibliography on mass media science communication research in the United States. In Carol L. Rogers and Sharon Dunwoody, *Science, the Media, and the Public: Selected Bibliographies*. Washington, DC: American Association for the Advancement of Science.

Updated and reprinted in Stephan Russ-Mohl, ed., *Wissenschaftsjournalismus in den USA* (Stuttgart, West Germany: Robert Bosch Foundation, 1985), pp. 176-193.

Updated and condensed version printed in Virginia Carter Smith and Patricia LaSalle Alberger, eds., *Communicating University Research*, 2nd ed., (Washington, DC: Council for the Advancement and Support of Education, 1985) pp. 130-137.

Updated and reprinted in Sharon M. Friedman, **Sharon Dunwoody** and Carol L. Rogers, eds., *Scientists and Journalists: Reporting Science as News* (Washington, DC: American Association for the Advancement of Science, 1989), pp. 296-312.

Dunwoody, S. November/December 1980. Why is scientific writing unintelligible?" *Cosmic Search* 2: 8-9.

Dunwoody, S. November 1979. Science writing study finds: AAAS Is master of what makes news at its sessions. *Newsletter of the National Association of Science Writers* 28:1-3.

Dunwoody, S. 1978. *Science Writers at Work*. Research Report No. 7, Center for New Communication Research, Indiana University School of Journalism, Bloomington, IN.
Reprinted in Patricia L. Alberger and Virginia L. Carter, eds., *Communicating University Research* (Washington, D.C.: Council for the Advancement and Support of Education, 1981) pp. 209-216.

Weaver, D. H., Wilhoit, G.C., **Dunwoody, S.** & Hagner, P. 1977. Senatorial news coverage: Agenda-setting for mass and elite media in the U.S. In *Senate Communications with the Public*. Washington, D.C.: U.S. Government Printing Office, pp. 41-62.

BOOK REVIEWS

Review of the documentary film *Swarms: The Intelligence of the Masses* (Films for the Humanities & Sciences, 2010) for *Science Books & Films* 48(10): 287, 2012.

Review of Olson, R., Don't Be Such a Scientist: Talking Substance in an Age of Style, published in 2010 by Island Press, in *Science Books and Films*.

Review of Siegrist, M., Earle, T.C, & Gutscher, H., eds, Trust in Cooperative Risk Management: Uncertainty and Scepticism in the Public Mind, and F. Boulder, D. Slavin & R.E. Lofstedt, eds, The Tolerability of Risk: A New Framework for Risk Management, both published in 2007 by Earthscan, in *Science Communication* 29(2): 271-273.

Review of Kennedy, D., ed. (2006) *Science Magazine's State of the Planet 2006-2007*. In *Science Communication* 28(4): 522-523, 2007.

Review of Vest, C. M. (2004) *Pursuing the Endless Frontier: Essays on MIT and the Role of Research Universities*. In *Science Books & Films* 41(2):62-63.

Review of Levi, R. *Medical Journalism: Exposing Fact, Fiction, Fraud* (Ames, IA: Iowa State University Press, 2001) in *The Review of Communication*, an online journal (http:www.natcom.org/roc)

Review of Lofstedt, R., and Frewer, L., eds. *The Earthscan Reader in Risk &Modern Society* (London: Earthscan Publications, 2000) in *Risk Analysis* 20(5):755, October 2000.

Review of Fripp, J., Fripp, M. & Fripp, D. *Speaking of Science: Notable Quotes on Science, Engineering, and the Environment.* (Eagle Rock, VA: LLH Technology, 2000) in *Science Books & Films* 36(5): 215, September/October 2000.

Review of Mary McGuire, et.al., *The Internet Handbook for Writers, Researchers, and Journalists* (Guildford, 1997), in *Science Books & Films* 34(6): 169.

Review of Alan Cromer, *Connected Knowledge: Science, Philosophy, and Education* (New York: Oxford University Press, 1997) in *Science Books & Films* 33(7):197-198.

Review of William J. Gonzenbach, *The Media, the President, and Public Opinion: A Longitudinal Analysis of the Drug Issue, 1984-1991* (Hillsdale, NJ: Erlbaum, 1996) in *Science Books & Films* 32(4): 101.

Review of Frank Biocca and Mark R. Levy, eds. *Communication in the Age of Virtual Reality* (Hillsdale, NJ: Erlbaum, 1995) in *Science Books & Films* 31(7): 197.

Review of Jimmie L. Reeves and Richard Campbell's *Cracked Coverage: Television News, the Anti-Cocaine Crusade, and the Reagan Legacy* in *Journalism Quarterly* 72(2): 464-465, Summer 1995.

Review of Larry Gonick's *The Cartoon Guide to (Non)Communication* (New York: HarperPerennial, 1993) in *Science Books & Films* 29(6):163.

Review of Michael Shortland and Jane Gregory's *Communicating Science: A Handbook* (New York: Longman, 1991) in *Science Books & Films* 27(6):166-167, August/September 1991.

Review of William David Sloan's *Makers of the Media Mind* (Hillsdale, NJ: Erlbaum, 1990) in *Journalism Educator* 46:86-88, Spring 1991.

Review of Peter M. Sandman, David B. Sachsman, Michael R. Greenberg and Michael Gochfeld's *Environmental Risk and the Press* (New Brunswick, NJ: Transaction Books, 1987) in *Journalism Quarterly* 65:537-738, Summer 1988.

Review of Dorothy Nelkin's Selling Science: *How the Press Covers Science and Technology* (New York: W.H. Freeman & Co., 1987) in *Chemical & Engineering News* 65:47-49, November 16, 1987.

Excerpted in Sharon Dunwoody, "Don't Ask Us to Educate the Masses," *American Scientist* 76:448, September-October 1988.

Review of Warren Burkett, *News Reporting: Science, Medicine, and High Technology* (Ames, IA: Iowa State University Press, 1986), in *Journalism Quarterly* 63: 870-871.

Review of Maurice Goldsmith, The Science Critic (New York: Methuen, 1986), in *Science Books & Films* 22: 291, May/June 1987.

Review of Barbara Gastel, *Presenting Science to the Public* (Philadelphia: ISI Press, 1983), in *The Quarterly Review of Biology*, 60:133, March 1985.

Review of the journal *Science, Technology, & Human Values* for *Critical Studies in Mass Communication*, 1:449-450, December 1984.

Review of Barbara Gastel, *Presenting Science to the Public* (Philadelphia: ISI Press, 1983), in *Science Books & Films* 19:278-279, May/June 1984.

Review of June Goodfield, *Reflections on Science and the Media* (Washington, D.C.: American Association for the Advancement of Science, 1981), in *4S Newsletter,* published by the Society for the Social Studies of Science, 7:52-54, Fall 1982.

Review of Doris A. Graber, *Crime News and the Public* (New York: Praeger Publishers, 1980), in *Journalism Quarterly* 58:661-662, Winter 1981.

Review of Laura Lederer, ed., *Take Back the Night: Women on Pornography* (New York: William Morrow and Company, Inc., 1980), in *Journalism Quarterly* 58:327-328, Summer 1981.

Review of Edward Diener and Rick Crandall, *Ethics in Social and Behavioral Research* (Chicago: The University of Chicago Press, 1978) in *Journalism Quarterly* 56:198-199, Spring 1979.

CONFERENCE PRESENTATIONS

Dunwoody, S. When more is *not* better. 2018. Presented at the Public Communication of Science and Technology conference, April, Dunedin, New Zealand.

Dunwoody, S. & Kohl, P. 2016. Using weight-of-experts messaging to communicate accurately about contested science. Presented at the annual meeting of the Association for Education in Journalism and Mass Communication, August, Minneapolis, MN. Second-place faculty paper in the Communication of Science, Health, Environment, and Risk Division.

Fung, T., Griffin, R. & **Dunwoody, S.** Testing links among uncertainty, affect and attitude toward a health behavior in a risky setting. 2015. Presented at the annual AEJMC meeting, August, San Francisco. Second-place faculty paper in the Communication Theory & Methodology Division.

Koh, E.J., Pfeiffer, L., **Dunwoody, S**., Brossard, D. & Peters, H.P. 2014. Medialization of science as a predictor of scientists' participation in public engagement. Presented at the annual meeting AEJMC, August, Montreal, Canada.

Kohl, P., Kim, S-Y, Peng, Y. & **Dunwoody S.** 2014. Testing an alternative to false balance in media coverage of controversial science. Poster presented at the annual meeting of AEJMC, August, Montreal, Canada.

Peng, Y., Kohl, P., Kim, S-Y, Akin, H., Koh, E.J., Howell, A. & **Dunwoody, S.** 2014. The impact of information on what majority scientists believe in a dual-processing world. Paper presented at the annual meeting of AEJMC, August, Montreal, Canada.

Dunwoody, S. 2014. Weight-of-evidence messages and contested science. Presented at the biannual meeting of the Public Communication of Science and Technology (PCST), May, Salvador, Brazil.

Dunwoody, S. & Peters, H.P. 2014. Do the media play a role in the governance of science? Presented at the biannual meeting of the Public Communication of Science and Technology (PCST), May, Salvador, Brazil.

Lee, E & **Dunwoody, S**. 2013. Information processing modes and risk judgment quality. Presented at the Society for Risk Analysis annual meeting, December, Baltimore.

Koh, E. J., Brossard, D., **Dunwoody, S.,** Allgaier, J. 2013. Neuroscientists, media and the public. Presented at the Midwest Association for Public Opinion Research, November, Chicago.

Su, Y-F, Spartz, J., Brossard, D. Griffin, R.J. & **Dunwoody, S.** 2013. Closing the partisan gap for national policy on climate change: The power of social norms. Presented at the Midwest Association for Public Opinion Research, November, Chicago.

Griffin, R.J. & **Dunwoody, S.** 2013. Global warming and the Wisconsin political climate. Presented at the Midwest Association for Public Opinion Research, November, Chicago.

Dunwoody, S., Griffin, R., Brossard, D., Spartz, J. & Su, Y-F. 2013. Cueing attitudes about global warming using characteristics of new media channels. Presented at the biannual conference of the International Environmental Communication Association, June, Uppsala, Sweden.

Spartz, J., Su, Y-F, Brossard, D., **Dunwoody, S.** & Griffin, R.J. 2012. Influence of social norms on perceived salience of climate change in a new media environment. Presented to the Midwest Association for Public Opinion Research, November, Chicago.

Dunwoody, S. 2012. Motivating publics to attend to complicated science. Presented at a joint workshop of the DFG Priority Program "Science and the General Public" and CERN titled "Is a Public Understanding of Abstract Physics Concepts Feasible? Aspects of the Nature of Matter Investigated at the Large Hadron Collider at CERN," Geneva, Switzerland, February.

Allgaier, J., Brossard, D., **Dunwoody, S.**, Lo, Y.-Y., and Peters, H.P. 2011. Mediennutzung und einschätzung von medieneffekten durch neurowissenschaftler in Deutschland und den USA: Ergebnisse einer online-befragung.. Public Science und Neue Medien: Die Rolle der Web 2.0 Kultur in der Wissenschaftsvermittlung. Zentrum für Kunst und Medientechnologie Karlruhe, Germany, December.

Konieczna, M., Mattis, K., Liang, X., Tsai, J-Y, & **Dunwoody, S.** 2011. Domesticity versus global journalism: A two-country comparison of coverage of the Copenhagen Climate Change Conference. Paper presented at the annual meeting of MAPOR, November, Chicago.

Allgaier, J., Brossard, D., **Dunwoody, S.**, Lo, Y.-Y., and Peters, H.P. 2011. Neuroscientists as media sources: Media content and sources' strategies. "A Question of Power: Conflict, Agreement and Negotiation between Journalists and Their Sources." Rijksuniversiteit Groningen, The Netherlands, September.

Mattis, K., Konienczna, M., Liang, X., Tsai, J-Y., & **Dunwoody, S.** 2011. Uncertainty rhetoric in U.S. television news coverage of the Copenhagen climate change conference. Paper presented at the annual meeting of the Association for Environmental Studies and Sciences, Burlington, VT.

Tsai-Y, Liang, X, Mattis, K., Konieczna, M., Li, N & **Dunwoody, S.** 2011. Rethinking attribution of responsibility in a cross-national study of TV news coverage of the 2009 global climate meeting in Copenhagen. Paper presented at the annual meeting of the International Communication Association, May, Boston.

Hillback, E.D., Dudo, A. D., Tsai, J-Y, **Dunwoody, S.**, Brossard, D. & Scheufele, D. 2010. Tracking online behavior after exposure to news of a local nanotechnology risk: A RISP model approach. Paper presented at the annual meeting of the Society for Risk Analysis, Salt Lake City.

Dudo, A., **Dunwoody, S.** & Scheufele, D. 2009. The emergence of nano news: Tracking thematic trends and changes in media coverage of nanotechnology. Paper presented at the annual conference of the Association for Education in Journalism and Mass Communication, August, Boston.

Griffin, R. & **Dunwoody, S**. 2009. Promises and challenges of teaching statistical reasoning to journalism undergraduates: Twin surveys of department heads. Paper presented at the annual conference of AEJMC, August, Boston.

Crone, W.C., Rediske, R., Ackerman, S., **Dunwoody, S.** 2009. Engaging science and engineering graduate students with informal science education. Paper presented at the annual conference of the American Society for Engineering Education, June, Austin, TX.

Wijaya, R., Hillback, E., Dudo, A., Brossard, D. & **Dunwoody, S.** 2008. Selection and use of news sources in media coverage of stem cell research. Paper presented at MAPOR, November, Chicago.

Brossard, D., Dudo, A. & **Dunwoody, S.** 2008. The utility of popular print science news for American scientists. Paper presented at "The Culture of Print in Science, Technology, Engineering, and Medicine, September, Madison, WI.

Hillback, E., Dudo, A., Wijaya, R., **Dunwoody, S.** & Brossard D. 2008. News leads and news frames in stories about stem cell research. Paper presented at the AEJMC conference, Chicago, August.

Dunwoody, S., Brossard, D. & Dudo, A. 2008. Socialization or rewards? Predicting American scientist-media interactions. Paper presented at the AEJMC conference, Chicago, August.

Dunwoody, S. & Brossard, D. 2008. United States: Scientists' experiences with the media. PCST conference, Malmo, Sweden, June.

Brossard, D., **Dunwoody, S**., Dudo, A., Hillback, E.. & Wijaya, R. 2007. Distinguishing between focus and frame in journalistic storytelling about stem cell research. Paper presented to the Midwest Association for Public Opinion Research, Chicago, November.

Scheufele, D. A., Corley, E. A., Hillback, E., Shih, T., **Dunwoody, S.,** & Guston, D. 2007. Nano attitudes among scientists and the public. Paper presented to the annual convention of the Society for Social Studies of Science, Montreal, October.

Griffin, R.J., Yang, J., ter Huurne, E., Boerner, F., Ortiz, S. & **Dunwoody, S.** 2006. After the flood: Anger, Attribution and the Seeking of Information. Presented at the annual meeting of the Association for Education in Journalism and Mass Communication, San Francisco, CA, August. Cited as best faculty paper for the Science Communication Interest Group.

Griffin, R.J., Yang, Z., Borner, F., Bourassa, S., Darrah, T., Knurek, S., Ortiz, S. & **Dunwoody, S.** 2005. Applying an information seeking and processing model to a study of communication about energy. Presented at the annual meeting of the AEJMC, San Antonio, August.

Griffin, R.J., Powell, M., **Dunwoody, S**., Neuwirth, K., Clark, D. & Novotny, V. 2004. Testing the robustness of a risk information processing model. AEJMC, Toronto, August.

Eveland, W. P., Cortese, J., Park, H. & **Dunwoody, S.** 2002. How web site organization influences free recall, factual knowledge, and knowledge structure. Presented at the annual meeting of the National Communication Association, New Orleans, November.

Tremayne, M. & **Dunwoody, S.** 2001. Interactivity as a cognitive process. AEJMC, Washington, DC, August.

Eveland, W.P & **Dunwoody, S**. 2001. An investigation of elaboration and selective scanning as mediators of learning from the Web versus print. ICA, Washington, DC.

Kahlor LA, **Dunwoody, S.** & J. Griffin, R.J. 2000. Accounting for the complexity of causal explanations in the wake of an environmental risk. AEJMC, August, Phoenix.

Eveland, W.P. & **Dunwoody, S.** 2000. A test of competing hypotheses about the impact of the World Wide Web versus traditional print media on learning. ICA, Acapulco, Mexico.

Dunwoody, S. 2000. Studying users of The Why Files. AAAS, February, Washington, DC.

Griffin, R.J., Neuwirth, K., Giese, J. & **Dunwoody, S**. 1999. The relationship of risk information processing to consideration of behavioral beliefs. AEJMC, August, New Orleans.

Eveland, W.P. & **Dunwoody, S.** 1999. Processing on the World Wide Web using think aloud protocols. AEJMC, August, New Orleans.

Griffin, R.J., **Dunwoody, S**., Neuwirth, K. & Giese, J. 1999. The relationship of information sufficiency to seeking and processing risk information. ICA, May, San Francisco.

Griffin, R.J., **Dunwoody, S**. & Neuwirth, K. 1998. Audience seeking and processing of information about risks to the Great Lakes ecosystem. SRA, December, Phoenix.

Griffin, R.J., Neuwirth, K. & **Dunwoody, S**. 1998. Information sufficiency and risk communication. AEJMC, August, Baltimore.

Kahlor, LA, **Dunwoody, S**. & Griffin, R.J. 1998. The role of attribution and framing in rationalizing about risk estimates. AEJMC, August, Baltimore.

Eveland, W.P. & **Dunwoody, S.** 1997. Communicating science to the public via 'The Why Files' world wide web site," International Conference on the Public Understanding of Science and Technology, Chicago.

Eveland, W.P. & **Dunwoody, S.** 1997. Applying research on the uses and effects of hypermedia to the study of the world wide web. AEJMC, August, Chicago.

Dunwoody.S. & Griffin, R.J. 1997. Community structure and mass media accounts of risk. AEJMC, August, Chicago.

Dunwoody, S., Godfrey, R. Kanarek, M. & Bro, K. 1997. Partner communication patterns and their effects on knowledge of a low-level risk. ICA, May, Montreal.

Dunwoody, S. Bro, K. Kanarek, M., Godfrey, R. & Dhume, N. 1997. Communicating risk to women in angling households. Health Conference 97: Great Lakes/St. Lawrence, May, Montreal.

Godfrey, R., **Dunwoody, S**., Bro, K. & Kanarek, M. 1997. The salience of a risk message and the motivation to respond: Closing the knowledge gap. Health Conference 97: Great Lakes/St. Lawrence, May, Montreal.

Griffin, R.J., Neuwirth, K. & **Dunwoody, S**. 1997. Great Lakes risk communication study: Development of an audience-based perspective. Health Conference 97: Great Lakes/St. Lawrence, May, Montreal.

Neuwirth, K., **Dunwoody, S.** & Griffin, R.J. 1996. Learning from news stories about risk. MAPOR, November, Chicago.

Dunwoody, S., Godfrey, R., Bro, K. & Kanarek, M. 1996. Strategic risk communication. AEJMC, August, Anaheim.

Trumbo, C., **Dunwoody, S**. & Griffin, R.J. 1996. Trouble in the tank or trouble in the head? Television news coverage of the reformulated gasoline health study in Milwaukee. AEJMC, August, Anaheim.

Griffin, R.J., **Dunwoody, S**. & Neuwirth, K. 1996. A proposed model of the relationship of risk information-seeking and processing to the development of preventive behaviors. ICA, May, Chicago.

Neuwirth K., Griffin, R.J. & **Dunwoody S**. 1995. The relationship of access difficulty and informational usefulness to public reliance on risk communication channels. SRA, December, Honolulu.

Dunwoody, S., Neuwirth, K. & Griffin, R.J. 1995. The impact of information channels and message attributes on dimensions of risk judgment. MAPOR, November.

Neuwirth, K., **Dunwoody, S.** & Griffin, R.J. 1995. The influence of severity, vulnerability, and response efficacy on information seeking and behavioral intention. AEJMC, August, Washington, DC.

Dhume, N., **Dunwoody, S.,** Kanarek, M. & Bro, K. 1995. Predictors of channel exposure and of topic-specific attention to messages about risk. AEJMC, August, Washington, DC.

Dunwoody S., Dhume, N., Bro, K. & Kanarek, M. 1995. Does information channel matter when anglers and women in angling households judge the risk of eating sport-caught fish? ICA, May, Albuquerque, NM.

Griffin, R.J., **Dunwoody, S**., Zabala, F. & Kamerick, M. 1994. The relationship of hazard experience, perception and worry to public reliance on risk communication channels in the wake of a Cryptosporidium outbreak. SRA, December, Baltimore.

Neuwirth, K. & **Dunwoody, S**. Channel access cost and perceived utility as predictors of exposure and attention to HIV information. MAPOR, November, Chicago.

Griffin, R.J., **Dunwoody, S**., Dybro, T. & Zabala, F. 1994. The relationship of communication to risk perceptions and preventive behavior related to lead in drinking water. AEJMC, August, Atlanta.

Griffin, R.J. & **Dunwoody, S.** 1994. Community structure and science framing of news about local environmental risks. ICA, July, Sydney, Australia.

Dunwoody, S. & Griffin, R.J. 1993. Telling stories about Superfund sites. AEJMC, August, Kansas City.

Griffin, R.J., **Dunwoody, S.** & Gehrmann, C. 1993. Pluralism, the press, and the framing of risk information: Theoretical directions and practical applications. ICA, May, Washington, DC.

Griffin, R.J. & **Dunwoody, S.** 1993. Impacts of information subsidies and community structure on local press coverage of environmental contamination. ICA, May, Washington, DC.

Griffin, R.J., **Dunwoody, S.** & Gehrmann, C. 1992. The effects of community pluralism on press coverage of health risks from local environmental contamination. AEJMC, August, Montreal.

Coleman, C-L, Neuwirth, K., **Dunwoody, S.** & Griffin, R.J. 1992. The Influence of risk message cues on cognitive complexity. ICA, May.

Dunwoody, S. & Kalter J. 1991. Daily information choices among mass media science reporters. AEJMC, August, Boston.

Dunwoody, S., Griffin, R.J. & Russ-Mohl, S. 1990. Journalists' construction of scientific and technological risk stories as a function of individual and occupational frames. International Association for Mass Communication Research, August, Bled, Yugoslavia.

Dunwoody, S., Neuwirth, K., Griffin, R.J. & Long, M. 1990. The impact of content and frame of risk messages on comments about those risks embedded in "letters to friends." AEJMC, August, Minneapolis.

Griffin, R.J., Neuwirth, K. & **Dunwoody, S.** 1990. Applying the Fishbein-Ajzen Theory of Reasoned Action to a study of message impacts on responses to a health risk. ICA, June, Dublin, Ireland.

Dunwoody, S. & Neuwirth, K. 1988. The impact of information on AIDS risk judgments and behavioral change among young adults. AEJMC, July, Portland, OR.

Rossow, M. & **Dunwoody, S**. 1988. Inclusion of "useful" detail in newspaper coverage of a high-level nuclear waste siting controversy. AEJMC, July, Portland, OR.

Neuwirth, K. & **Dunwoody, S**. 1988. Interactions and models of AIDS behavioral change. ICA, May, New Orleans.

Dunwoody, S. & Rossow, M. 1987. Community pluralism and newspaper coverage of a high-level nuclear waste siting issue. North America Association for Environmental Education, October, Quebec City, Canada.

Dunwoody, S. Friestad, M. & Shapiro M.A. 1987. Conveying risk information in the mass media. ICA, May, Montreal.

Shapiro, M.A., **Dunwoody, S**. & Friestad, M. 1987. The use of signal detection measures of memory in mass communication: Criterion shift in recognition memory for news stories about risk. ICA, May, Montreal.

Dunwoody, S., Tankard Jr., J.W. & Ryan, M. 1986. Risk Aanalysis for public consumption: Media coverage of the Ginna nuclear reactor accident. AEJMC, August, Memphis.

Neuwirth, K., Liebler, C.M., **Dunwoody, S**. & Riddle, J. 1986. The effect of "electronic" news sources on news production. AEJMC, August, Memphis.

Kosicki, G.M., **Dunwoody, S**. &. Beam, R. A. 1985. Individual and organizational predictors of journalistic prize-seeking. AEJMC, August, Memphis.

Dunwoody, S. & Shields, S. 1984. Accounting for patterns of topic selection in statehouse reporting. AEJMC, August, Gainesville, FL.

Dunwoody, S. & Ryan, M. 1984. Who are the media spokespersons for science?" AEJMC, August, Gainesville, FL.

Dunwoody, S. 1984. The risks and benefits of dealing with the mass media. American Association for Public Opinion Research, May, Delavan, WI.

Dunwoody, S. 1983. Mass media coverage of the social sciences: Some new answers to old questions. AEJMC, August, Corvallis, OR.

Dunwoody, S. 1982. The relationship between the science journalist and his/her source. "Seminar on Scientific Journalism," sponsored by Fulbright/CAPES in Brasilia, Brazil, September.

Dunwoody, S. & Ryan, M. 1982. Factors influencing scientists as journalistic sources. AEJMC, July, Athens, OH.

Dunwoody, S. & Ryan, M. 1982. Public information personnel and scientists. AEJMC, July, Athens, OH.

Dunwoody, S. & Becker, L.B. 1981. A bottle bill referendum: Exploring the links between knowledge and voting intentions. MAPOR, October, Chicago.

Dunwoody, S. 1980. Tracking newspaper science stories from source to publication: A case-study examination of the popularization process. Society for the Social Studies of Science, October, Toronto.

Dunwoody, S. 1979. The news-gathering behaviors of specialty reporters: A comparison of two levels of analysis in mass media decision-making. AEJMC, August, Houston.

Dunwoody, S. & Scott, B. 1979. Scientists and the press: Are they really strangers?" AEJMC, August, Houston.

Dunwoody, S. 1978. A cross-methodological study of factors affecting the selection of news at a scientific meeting. MAPOR, October, Chicago.

Dunwoody, S. & Wartella, E. 1978. A survey of the structure of science writing courses. AEJMC, August, Seattle.

Dunwoody, S. 1976. Criteria utilized by college-educated women to select newspaper science news AEJMC, August, College Park, MD.

Weaver, D.H., Wilhoit, G.C., Hagner, P. & **Dunwoody, S**. 1976. Senatorial news coverage: Agenda-setting for mass and elite media in the United States. AEJMC, August, College Park, MD.

Dunwoody, S. 1975. Woodhull & Claflin's Weekly: Origin and content. The Popular Culture Association, March, St. Louis, MO.

A SAMPLING OF RECENT TALKS

"Telling Stories about Climate Change." Earth Day celebration, Madison, WI, April 2019.

"How Scientists Deal with Uncertainty and What That Means for the Audience." Public Understanding of Science and Technology conference, Dunedin, NZ, April 2018

"Risk Communication: What Have We Learned from RISP?" Marquette University, April 2018.

"Talking about Climate Change: Strategies to Reach Beyond the Choir." Door County Climate Change Forum, Sturgeon Bay, WI, 2017.

Podcast interview on communicating about climate change risk, October 2016:
http://www.dailycardinal.com/article/2016/11/sciencecast-climate-change-series-episode-4

"Writing Wisconsin's Climate." Wisconsin Academy of Sciences, Arts & Letters, Madison, WI 2016.
http://www.wisconsinacademy.org/video/writing-wisconsins-climate

"It's How You Tell the Story: Cueing Attitudes and Behaviors Using Social Norms." Wisconsin Wetlands 20th anniversary Science Conference, Madison, WI, 2015.

"You Don't Do Rocket Science; You Just Explain It." Sharing Science: Writing and Communication Skills for the 21st Century, University of Wisconsin-Madison, 2014.

"The Visible Scientist." Wednesday Night at the Lab, University of Wisconsin-Madison, 2014.
http://video.wpt.org/video/2365314534/

GRANTS RECEIVED

2010-13 (with Dominique Brossard) Grant from the German Ministry of Education and Research to study neuroscientists' reactions to mass media coverage of their field: $70,000

2006-10 (with Dietram Scheufele) National Science Foundation in support of "NSEC: Center for Nanotechnology in Society at Arizona State University" (Award # SES-0531194, $6.2 million) UW-Madison budget: $185,309

2004 (with Dominique Brossard) Grant from the German Ministry of Education and Research to study media use of scientific expertise in science stories: $32,000

2002 Center for the Integration of Research, Teaching and Learning, funded by NSF. $10 million for 5 years. Co-director of the Informal Science Learning team.

2000 (with Mark Tremayne) Grant from NASA to study internet-based science sites: $10,000

1996-99 National Institute for Science Education, funded by NSF: Study of individuals' use of The Why Files, a web site that explains the science behind the news. Funding sufficient to hire a full-time researcher and research supplies: Approximately $70,000 per year

1996 (with Robert Griffin) Grant from the American Statistical Association to study inclusion of statistical reasoning in journalism education in the United States: $3,000

1995-99 (with Robert Griffin and Kurt Neuwirth) Grant from the Agency for Toxic Substances and Disease Registry, CDC, to explore how individuals use information to make judgments about eating contaminated fish from the Great Lakes: $300,000 over three years

1994-96 (with Kim Bro, Wisconsin Division of Health, and Marty Kanarek, Preventive Medicine) Grant from the National Sea Grant College Program to evaluate the effectiveness of ways of communicating about the risk of eating sport-caught fish to women in angling households: $101,237

1993 (with Robert Griffin, Marquette University) Grant from the National Science Foundation to study Milwaukee residents' use of information to inform their understanding of a recent parasitic outbreak in the water supply: $24,000

1992-94 (with Kim Bro, Wisconsin Division of Health, and Marty Kanarek, Preventive Medicine) Grant from the National Sea Grant College Program to study anglers' use of information to inform their judgments of the risk of eating sport-caught fish from the Great Lakes and inland waters in Wisconsin: $92,229

1992 (with Sharon Friedman, Lehigh University) Grant from the U.S. Environmental Protection Agency to fund a series of workshops for journalists and journalism professors on how to evaluate risk estimates: $26,100

1991 Grant from the Council for the Advancement of Science Writing to support production of 1991 Directory of University Science Communication Courses and Programs in the United States: $650

1990 (with Robert Griffin, Marquette University) Grant from the U.S.Environmental Protection Agency for a two-year study: "Press Coverage of Risk from Environmental Contaminants": $34,192

1987 Grant from the Council for the Advancement of Science Writing for preparation of an annotated bibliography of science communication research and commentary for distribution to science reporting students: $1300.

1986 -94 Grant from the Brittingham Trust to establish a "Science-Writer-in- Residence Program" at the University of Wisconsin-Madison: $10,000 per year. Co-sponsor is the UW Office of News and Public Affairs.

1982-83 Research support from the University of Wisconsin-Madison Graduate School Research Committee for a study of factors affecting the information- selection behaviors of mass media science reporters. Grant money covered summer salary and supplies.

1982 Grant from the Commission for Educational Exchange between the United States of America and Brazil to participate as a Distinguished Lecturer in a Fulbright/CAPES Seminar on Scientific Journalism in Brazil. The seminar, which took place in September, was designed to help train Brazilian newspaper reporters in science communication techniques. Grant money covered travel, per diem expenses and an honorarium.

1979 (with Lee Becker) Scripps-Howard Foundation grant to study the effects of university journalism training on journalists' on-the-job performance: $1,000 (matched with a $1,000 grant by the Ohio State University School of Journalism).

1979 (with Lee Becker) Scripps-Howard Foundation grant to study the effects of the QUBE interactive cable system in Columbus, Ohio, on residents' use of more traditional mass media: $4,862.

1977 Gannett Newspaper Foundation research grant via the Center for New Communications, School of Journalism, Indiana University, for a study of factors affecting the selection of news by science writers at a scientific meeting: $3,000.

PRIMARY ADVISER (in alphabetical order)

Cory Armstrong, University of Alabama
Randy Beam, University of Washington
Cynthia-Lou Coleman, Portland State University
Michael Dahlstrom, Iowa State University
Anthony Dudo, University of Texas at Austin
Ed Frederick, University of Wisconsin-Whitewater
Eileen Gilligan, SUNY Oswego
Robert Godfrey, Strategic communication consultant
LeeAnn Kahlor, University of Texas at Austin

Gerald Kosicki, Ohio State University
Sun-Young Lee, Hallym University, Korea
Kurt Neuwirth, University of Cincinnati (retired)
Linda Pfeiffer, Purdue University
Marshel Rossow, Minnesota State University
Steven Shields, University of North Georgia Mark
Tremayne, University of Texas at Arlington Jiun-
Yi Tsai, Northern Arizona University
Ron Yaros, University of Maryland at College Park

>55 Master's thesis advisees

PROFESSIONAL AFFILIATIONS

American Association for the Advancement of Science
- Chair, Section Y: General Interest in Science and Engineering, 2012-13, 1992-93
- Member, Committee on the Public Understanding of Science & Technology, 2006-09, 1992-98
- Member, Committee on Sections, 2013-14

American Association for Public Opinion Research
Association for Education in Journalism and Mass Communication
- President, 2005-06
- Chair, Publications Committee, 2008-10
- Chair, Standing Committee on Research, 1985-86
- Chair, Committee on the Status of Women in Journalism Education, 1983-85
- Head, Communication Theory & Methodology Division, 1988-89

Association of Schools of Journalism and Mass Communication
- Member, Executive Committee, 1999-2002

International Communication Association
- Fellow Book Award Committee, 2019-2021

International Environmental Communication Association
Midwest Association for Public Opinion Research
- President, 1989-90
- Program Co-Chair, 1986-88

The National Academies (Science, Medicine, Engineering)
- Member, Communications Advisory Committee, 2001-05
- Member, Nuclear and Radiation Studies Board, 2005

National Research Council
- Member of the Commission on Life Sciences, 1996-99

National Association of Science Writers, Inc.
Society of Environmental Journalists
Society for Risk Analysis
Society for the Social Studies of Science

UNIVERSITY ACTIVITIES

School of Journalism and Mass Communication
- Director, 1998-2003

Head of Graduate Studies, 1992-95
Numerous committees

Gaylord Nelson Institute for Environmental Studies
Chair of Academic Programs, 1995-98
Numerous committees

University of Wisconsin-Madison
2009 Reaccreditation Project
Member of Team 1, "Rethinking the Public University"
Commission on Faculty Compensation and Benefits, 1985-88
Chair, 1987-88
Committee on the University of Wisconsin Press, 1999-2009
Delta program, 2003 -
Advisory Board, Delta's Bridging the Achievement Gap Project, 2011-13
Dean Gary Sandefur College of Letters & Science, 5-Year Review Committee, 2010
Faculty Senator, 1982-87
Holtz Center for Science and Technology Studies
Member, Steering Committee 2002-05
College of Letters & Science
Graduate Education Committee, 1996-97
Personnel Committee, 1994-98
Faculty Appeals Committee, 1988-
Licensing & Sponsorship Advisory Committee, 2004-2005
Named Professorships Advisory Committee, 2001
Planning Committee on Tenured Faculty Review and Development, 1992-93
Research Committee (Graduate School), 1995-98, 2003-2011
Chair, 2003-2011
Search & Screen Committees
Provost (chair), 1993
Director of the Waisman Center (member), 2002
Director of the Gaylord Nelson Institute for Environmental Studies (member), 2002-03
Associate Dean for Research Policy, Graduate School (chair), 2005
Associate Dean for Graduate Education, Graduate School (chair), 2011
Assistant Dean for Finance, Graduate School (chair), 2010
Social Sciences Division Executive Committee, 1989-92
Chair, 1991-92
University Academic Planning Council, 1993-95

University of Wisconsin System:
Co-Chair, Biennial Advisory Group on Faculty and Academic Staff Compensation, 1988

STATE, REGIONAL ACTIVITIES

Dane County Office of Energy and Climate Change
Member, Public Engagement Work Group, 2018-
Wisconsin Department of Natural Resources
Member, Natural Areas Preservation Council, 2013-
Vice-chair, 2018-

Wisconsin Initiative on Climate Change Impacts, 2007-
Member, Science Committee, 2007-14
Co-chair, Science Advisory Board, 2014 -
Member, Outreach Advisory Committee

NATIONAL ACTIVITIES

Member:
Advisory Committee, Aldo Leopold Leadership Program, 2003-
Board of Directors, Aldo Leopold Foundation, 2013-
Vice Chair, 2015-2017
Chair, 2017-
Board of Directors, The Biodiversity Project, 2003-2010
Chair, 2008-2010
External Science Advisory Committee, UC Center for Environmental Implications of Nanotechnology, UCLA, 2009-

Selected past activities:
Committee on the Public Understanding of Science and Technology, American Association for the Advancement of Science, 1992-98, 2006-09
Committee on Exposure of the American People to I-131 From Nevada Atomic-Bomb Tests: Implications for Public Health, National Academy of Sciences, 1998
Advisory panel, Decision, Risk and Management Sciences Program, National Science Foundation, 2007-09
Advisory panel, Societal Dimensions of Engineering, Science, and Technology, National Science Foundation, 1998-2001

PROFESSIONAL COMMUNICATIONS EXPERIENCE

1979-81	Part-time commentator and reporter, WOSU-AM's "Morning Edition"
1975-77	Free-lance manuscript editor, Indiana University Press Co-editor, Bloomington (IN) Sierra Club bimonthly newsletter
1972-74	Free-lance science writer, Philadelphia, PA
1971-72	Director of Publications, Presbyterian-University of Pennsylvania Medical Center, Philadelphia, PA
1969-71	Science writer, *The Light*, San Antonio, TX
Summer 1966	General reporter, *The Marion Chronicle-Tribune*, Marion, IN

SERVICE TO THE INTELLECTUAL LANDSCAPE

Editorial board member:
Communication Yearbook
Environmental Communication: A Journal of Nature and Culture
Journalism and Communication Monographs
Journalism & Mass Communication Quarterly

Mass Communication & Society
Public Understanding of Science
Risk Analysis
Science Communication

Senior Advisory Editor, *Encyclopedia of Science and Technology Communication*. Editor: Susanna Priest. Published by SAGE, 2010.

Reviewer, *HealthNewsReview.org*, 2015-2019

Updated July 2019

KENNETH RHOADS BRADBURY

CURRENT POSITION

Director and State Geologist (*2015-present*)
Wisconsin Geological and Natural History Survey
University of Wisconsin - Extension
3817 Mineral Point Road
Madison, WI, USA 53705

608-263-7921; ken.bradbury@wgnhs.uwex.edu

EDUCATION

University of Wisconsin - Madison - Ph.D., 1982, Hydrogeology
Indiana University - M.A., 1977, Geology
Ohio Wesleyan University - B.A., 1974, Geology

RECENT POSITIONS

Assistant Director for Science (2013-2015), Wisconsin Geological and Natural History Survey/University of Wisconsin-Extension

Wisconsin Geological and Natural History Survey/University of Wisconsin-Extension, 1994-present, *Research Hydrogeologist/Professor* (with Tenure); 1988-1994, *Associate Professor* (with Tenure); 1982-1988, *Assistant Professor*

Program Leader, Water and Environment Programs, Wisconsin Geological and Natural History Survey, 1997-2014

Affiliate Faculty, Department of Geoscience , University of Wisconsin-Madison, 1989-present

Short Course Leader, Midwest Geosciences Group, 2001-2014

RESEARCH INTERESTS

Regional groundwater modeling, groundwater flow in fractured media, aquitard hydrogeology, virus transport in groundwater, groundwater/surface water interaction, groundwater recharge

PROFESSIONAL AFFILIATIONS

Geological Society of America (elected *Fellow*, 2003)
American Water Resources Association (Wisconsin Section)
National Ground Water Association
International Association of Hydrogeologists
Association of American State Geologists
Licensed Professional Hydrologist in Wisconsin (license #29)

Dr. Kenneth R. Bradbury

PROFESSIONAL SERVICE

National Academies Panel Review on USGS Water Programs, *2017-present*
Water Quantity working group, Wisconsin Land and Water Association, 2017
AASG STATEMAP review panel, *2016-present*
Wisconsin Natural Areas Preservation Council, *2013-present;*
Wisconsin Geographic Names Council, *2014-2015;*
Research Subcommittee, Wisconsin Groundwater Coordinating Council, *1987-2015*
Groundwater Research Advisory Council, University of Wisconsin System, *1987-present*
Advisor to the Editor-in-Chief, *Journal of Ground Water, 2001-2010*
Water Science and Technology Board, National Research Council, *2002-2004*
Committee on USGS Water Resources Research, National Research Council, *1996-2000; Chair, 1998-2000*
Joint Board of Wisconsin Professional Geologists, Hydrologists, and Soil Scientists, *(Chair, Hydrology Section, 2014-present)*
Advisor to the Miller/Black Groundwater Work Group, *2009-2010*
Technical Subcommittee, Wisconsin Groundwater Advisory Committee, *2008-2009*
SE Wisconsin Regional Water Supply Advisory Committee, *2008-2010*
Agrichemical Technical Advisory Council, Wisconsin Dept. of Agriculture, Trade, and Consumer Protection, *2010-present*
NE Wisconsin Karst Task Force, *2006-2007*
Technical Advisory Committee, Madison Water Utility, *2010-present*
Distinguished Service Award Committee, Hydrogeology Division, Geological Society of America, *2003-2004*
Awards Committee, National Groundwater Association, *2013-2014*

AWARDS

Chancellor's Award, University of Wisconsin-Extension, *2013*
2013 Research Award, Wisconsin Water Association, *2013*
Distinguished Service Award, American Water Resources Association (Wisconsin Section), *2007*
Fulbright Senior Specialist Grant, Cape Town, South Africa, *2007*

SERVICE TO THE UNIVERSITY

University of Wisconsin-Madison, Chair, review committee for the Water Resources Management Program, *2017*
University of Wisconsin-Madison, review committee for Nelson Institute Director, *2016-2017*
UW-Extension (UWEX) Innovative Funding Center Team, *2015-2017*
UWEX Faculty Tenure Advisory Committee (FTAC), *2002-2003; 2004-2005 (chair); 2009-2011*
UWEX Department of Environmental Sciences past offices: Chair, Secretary, Chair of Tenure Mentoring Committee, Chair of Post-Tenure Review committee
Chair, WGNHS search and screen committees for hydrogeologist and outreach manager
Member, graduate committees for numerous MS and PhD students in the Departments of Geosciences, Civil Engineering, Soil Science, and the Nelson Institute
Fellow, Nelson Institute, UW-Madison, *2014-present*
Guest lectures, UW-Madison Dept of Geosciences and the Nelson Institute

Dr. Kenneth R. Bradbury

RECENT INVITED LECTURES

Michigan Wetlands Association Annual Meeting, *Groundwater and wetlands:the hidden links, 9/27/17*
Wisconsin Wetlands Association Annual Meeting, *Groundwater and wetlands:the hidden links, 3/1/17*
UW-Madison Wednesday Night at the Lab, *Wisconsin's Geoheritage, 10/12/16*
Indiana Geological Survey, *Engaging groundwater issues in Wisconsin, 10/17/16*
Wisconsin Potato and Vegetable Growers Association, *Little Plover groundwater project, 2/4/15*
Wisconsin Farmers Union, *Little Plover groundwater project, 1/24/15*
Clean Lakes Alliance: Yahara Lakes 101, *Dane County Groundwater, 10/9/14*
Illinois Geological Survey, *Viruses in Groundwater, 8/25/14*
Wisconsin Water Association, *Viruses in Groundwater, 8/19/13*
Green Bay Geology Club – Neville Museum, *Viruses in Groundwater, 4/24/13*
Wisconsin Wetlands Association, *Mink River Project, 2/14/13*
Midwest Groundwater Conference, *Groundwater Science and Policy in Wisconsin, 10/1/12*
UW-Madison Wednesday Night at the Lab, *Viruses in Groundwater, 8/1/12*
Wisconsin Water Association, *Viruses in Groundwater, 5/22/12*

INTERNATIONAL EXPERIENCE

Brisbane, Australia, 2013. Presented short course on advanced aquifer testing and hydrogeologic analysis, sponsored by the Australian National center for Groundwater Research and Training and Midwest geosciences Group.

Sydney and Melbourne, Australia. 2008, 2011. Presented short course on improving hydrogeologic analysis of fractured bedrock systems, sponsored by Midwest Geosciences Group.

Cape Town, South Africa, 2009. Invited lecturer for short course on fractured rock hydrogeology, sponsored by UNESCO.

South Africa and Zimbabwe, 2008. 6-week professional visit as a Fulbright Senior Scholar to the University of the Western Cape in Cape Town, with field work in Zimbabwe.

Cape Town, South Africa, 2007. Invited delegate (sole US represengtative) to UNESCO workshop/conference on groundwater protection for the African continent.

Riga, Latvia, 1996. Presented short course on groundwater modeling to scientists from Latvia, Lithuania, and Estonia. Sponsored by USEPA.

Dublin, Ireland, 1995. Geological Survey of Ireland. 6-week professional visit and presentation of short course on fractured rock hydrogeology.

PUBLICATIONS

Peer-reviewed publications

Dr. Kenneth R. Bradbury

Fienen, M.N., K.R .Bradbury, M. Kniffin, and P.M. Barlow. 2018. Depletion mapping and constrained optimization to support managing groundwater extraction. *Groundwater*. V 56, no 1, p 18-31.

Bradbury, K.R., M.N. Fienen, M.L. Kniffin, J.J. Krause, S.M. Westenbroek, A.T. Leaf, and P.M.Barlow. 2017. A groundwater flow model for the Little Plover River in Wisconsin's Central Sands. Bulletin 111. Wisconsin Geological and Natural History Survey, 82 p.

Parsen, M.J., K.R. Bradbury, R.J. Hunt, and D. T. Feinstein. 2016. A new groundwater flow model for Dane County, Wisconsin. Bulletin 110, Wisconsin Geological and Natural History Survey, 56 p.

Rayne, T.W., K.R. Bradbury, and C. Zheng. 2014. Correct delineation of capture zones using particle tracking under transient conditions. *Ground Water*. V. 52, no 3, p 332-334.

Hunt, R.J., M.A. Borchardt, and K.R. Bradbury. 2014. Viruses as tracers; Using ecohydrology to characterize short travel times in aquifers. *Ground Water*. V. 52, no 2, p 187-193.

Gellasch, C. A.; Wang, H.F., Bradbury, K. R.; Bahr, J. M., and Lande, L.L. 2014. Reverse water-level fluctuations associated with fracture connectivity. *Ground Water*. V 52, No. 1, p 105-117.

Bradbury, K.R., M.A. Borchardt, M. Gotkowitz, S.K. Spencer, J. Zhu, and R J. Hunt. 2013. Source and transport of human enteric viruses in deep municipal water supply wells. *Environmental Science & Technology*. 47 (9), 4096-4103.

Gellasch, C. A.; Bradbury, K. R.; Hart, D. J.; Bahr, J. M., 2012. Characterization of fracture connectivity in a siliciclastic bedrock aquifer near a public supply well (Wisconsin, USA). *Hydrogeol J* 2012, 1-17

Bradbury, K.R., and A.C. Runkel, 2011. Recent Advances in the Hydrostratigraphy of Paleozoic Bedrock in the Midwestern United States. *GSA Today*, v.21, no. 9. p. 10-12.

Rayne, T.W., and K.R. Bradbury. 2011. Evaluating impacts of subdivision density on shallow groundwater in southeastern Wisconsin, U.S.A. *Journal of Environmental Planning and Management.* Vol 54, N0. 5, p. 559-575.

Borchardt, M. A., K R. Bradbury, E. Calvin Alexander Jr., R. J. Kolberg, S. C. Alexander, J. R. Archer, L. A. Braatz, B. M. Forest, J. A. Green and S. K. Spencer. 2011. Norovirus Outbreak Caused by a New Septic System in a Dolomite Aquifer *Ground Water*, Vol. 49, No.1, p. 85–97.

Wilcox, J.D., M.B. Gotkowitz, K.R. Bradbury, and J.M. Bahr. 2010. Using groundwater models to evaluate strategies for drinking-water protection in rural subdivisions. *Journal of the American Planning Association*. Vol 76, No 3. P 295-304.

Xu, Y., T. Kanyerere, E. Braune, J. Nel, P. Hobbs, K.R. Bradbury, and N. Robins. 2010. Best practice for groundwater quality protection. In: *Sustainable Groundwater Resources in Africa* , edited by Y. Xu, and E Braune. Paris, CRC Press/Balkema., p 49-85.

Dripps, W.R., and K.R. Bradbury. 2010. The spatial and temporal variability of groundwater recharge in a forested basin in northern Wisconsin. *Hydrological Processes*, 24, 383-392.

Bradbury, K.R., and Y. Xu. 2010. Foreword to the Special Section: Groundwater in Africa. *Ground Water*. Vol 48, No 2, p 227-228.

Dr. Kenneth R. Bradbury

Westenbroek, S., Kelson, V., Dripps, W., Hunt, R. and Bradbury, K., 2009, SWB – A modified Thornthwaite-Mather soil-water-balance code for estimating groundwater recharge: *U.S. Geological Survey Techniques and Methods*, 6-A31, 67 p.

Swanson, S.K., K.R. Bradbury, and D.J. Hart. 2009. Assessing the vulnerability of spring systems to groundwater withdrawals in southern Wisconsin. Geoscience Wisconsin, vol. 20, part 1. Published online at http://www.uwex.edu/wgnhs/pdfs/geoscipdf/1_GS20.pdf. Wisconsin Geological and Natural History Survey. 14 p.

Wilcox, J.D, J.M. Bahr, C.J. Hedman, J.D.C. Hemming, M.A.E. Barman, and K.R. Bradbury. 2009. Removal of organic wastewater contaminants in septic systems using advanced treatment technologies,. *Journal of Environmental Quality*. 38:149–156.

Bradbury, K.R., and T.W. Rayne. 2009. Shallow Groundwater Quantity Sustainability Analysis Demonstration for the Southeastern Wisconsin Region. *Technical Report 48*. Southeastern Wisconsin Regional Planning Commission. 38 p.

Hart, D.J., P. Schoephoester, K.R. Bradbury. 2008. Groundwater recharge in southeastern Wisconsin estimated by a GIS-based water-balance model. *Technical Report 47*, Southeastern Wisconsin Regional Planning Commission. 23 p.

Hart, D. J., K.R. Bradbury, M.B. Gotkowitz. 2008. Is One an Upper Limit for Natural Hydraulic Gradients? *Ground Water*. Volume 46, Issue 4, Date: July–August 2008, Pages: 518-520

Wilcox, J. D.; Bahr, J. M.; Hedman, C. J.; Hemming, J. D. C.; Barman, M. A. E.; Bradbury, K.R. 2009. Removal of organic wastewater contaminants in septic systems using advanced treatment technologies. *Journal of Environmental Quality* vol:38 iss:1 pg:149 -156

Eaton, T.E, M.P. Anderson, and K.R. Bradbury. 2007. Fracture control of ground water flow and water chemistry in a rock aquitard. *Ground Water* v 45, no 5., p. 601–615.

Borchardt, M. A.; Bradbury, K.R.; Gotkowitz, M. B.; Cherry, J. A.; Parker, B. L.. 2007. Human enteric viruses in groundwater from a confined bedrock aquifer. *Environmental Science and Technology*. 41(18); 6606-6612.

Dripps, W., and Bradbury, K.R.. 2007. A simple, daily soil-water balance model for estimating the spatial and temporal distribution of groundwater recharge in temperate humid areas. *Hydrogeology Journal*. v15, p 433-444.

Hart, D.J., Bradbury, K.R., and Feinstein, D.T. 2006. The vertical hydraulic conductivity of an aquitard: an evaluation of the Maquoketa Formation at two spatial scales. *Ground Water*. v 44, no 2. p 201-211.

Swanson, S.K., J.M. Bahr, K.R. Bradbury and K. M Anderson. 2006. Evidence for preferential flow through sandstone aquifers in Southern Wisconsin. *Sedimentary Geology*, v 184, p. 331–342.

Lathrop, R., K. Bradbury, B. Halverson, K. Potter, and D. Taylor. 2005. Responses to urbanization: Groundwater, stream flow, and lake level responses to urbanization in the Yahara Lakes basin: *LakeLine*, v. 25, no. 4.

Wilcox, J.D., Bradbury, K.R., Bahr, J. M., and Thomas, C.L. 2005. Assessing background ground water chemistry beneath a new unsewered subdivision. *Ground Water*, v 43, no 6, p 787-795.

Muldoon, M.A. and Bradbury, K.R. 2005. Site Characterization in Densely Fractured Dolomite: Comparison of Methods. *Ground Water*, v. 43, no. 6. p. 863-876.

Dr. Kenneth R. Bradbury

Feinstein, D.T., T.T. Eaton, D.J. Hart, J.T. Krohelski and K.R. Bradbury. 2005. Numerical simulation of shallow and deep groundwater flow in southeastern Wisconsin - Report 1: Data collection, conceptual model development, numerical model construction and model calibration. Wisconsin Geological and Natural History Survey Bulletin, 73 p.

Feinstein, D.T., D.J. Hart, J.T. Krohelski, T.T. Eaton and K.R. Bradbury. 2005. Numerical simulation of shallow and deep groundwater flow in southeastern Wisconsin - Report 2: Model results and interpretation. Wisconsin Geological and Natural History Survey Bulletin, 57 p.

Eaton, T.T. and K.R. Bradbury. 2003. Hydraulic transience and the role of bedding fractures in a bedrock aquitard, southeastern Wisconsin, USA, *Geophysical Research Letters* 30 (18), doi:10.1029/2003GL017913.

Bradbury, K.R. 2003. A circuitous path: Protecting groundwater in Wisconsin. *Geotimes*. P 18-21.

NRC Committee on USGS Water Resources Research, 2002. *Estimating water use in the United States*. National Academy Press, 176 p. (Bradbury was one of several authors, and chaired the committee for part of the report preparation).

Muldoon, M.A., J.A. Simo, and K.R. Bradbury. 2002. Correlation of hydraulic conductivity with stratigraphy in a fractured-dolomite aquifer, northeastern Wisconsin, USA. *Hydrogeology Journal*, v9, 570-583.

Eaton, T.T., K.R. Bradbury, and H.F. Wang, 2001. Verification and characterization of a fracture network within the Maquoketa shale confining unit, southeastern Wisconsin. Open-File Report 2001-04, Wisconsin Geological and Natural History Survey, 35 p.

Rayne, T.W., Bradbury, K.R., and Muldoon, M.A., 2001, Delineation of capture zones for municipal wells in complex fractured carbonate rock. *Hydrogeology Journal*, v. 9(6), p. 432-450.

Hunt, R.J., K.R. Bradbury, and J.T. Krohelski. 2001. The effect of large-scale pumping and diversion on the water resources of Dane County, Wisconsin. Fact sheet FS-127-01, U.S. Geological Survey. 4 p.

Bradbury, K. R., and W. S. Logan. 2001. Investigating groundwater systems at regional and national scales, *Eos* Trans. AGU, 82(8), p. 98-98

NRC Committee on USGS Water Resources Research. 2000. *Investigating groundwater systems on regional and national scales*. National Academy Press. 143 p. (Bradbury was one of 13 co-authors and chaired the committee).

Krohelski, J.T, K.R. Bradbury, R.J.Hunt, and S.K. Swanson. 2000. Numerical model of groundwater flow in Dane County, Wisconsin. Wisconsin Geological and Natural History Survey, Bulletin 98, 31 p.

NRC Committee on USGS Water Resources Research. 1997. *Watershed research in the U.S. Geological Survey*. National Academy Press. 86 p. (Bradbury was one of 13 co-authors on the committee).

NRC Committee on USGS Water Resources Research. 1996. *Hazardous Materials in the Environment-the Role of the U.S. Geological Survey*. National Academy Press. 109 p. (Bradbury was one of 12 co-authors on the committee).

Rayne, T.W., K.R. Bradbury, and D.M. Mickelson. 1996. Variability of hydraulic conductivity in uniform sandy till, Dane County, Wisconsin. Wisconsin Geological and Natural History Survey, Information Circular 74. 19 p.

Dr. Kenneth R. Bradbury

Bradbury, K.R., and M.A. Muldoon, 1994. Effects of fracture density and anisotropy on delineation of wellhead protection areas in fractured-rock aquifers. *Journal of Applied Hydrogeology*, 3/94. p 17-23.

Bradbury, K.R., and M.A. Muldoon, 1993. Discussion of "Delivery of chloride and nitrate to the Great Lakes: Case study for the Door Peninsula, Wisconsin" by Cherkauer, McKereghan, and Schalch. *Ground Water*, v. 31, no. 6., p. 1030-1031.

Simpkins, W.W., and K.R. Bradbury. 1992. Groundwater flow, velocity, and age in a thick, fine-grained till unit in southeastern Wisconsin. *Journal of Hydrology*, 132(1992) 283-319.

Bradbury, K.R., M.W. Stoertz, and J. Faustini. 1992. Groundwater flow systems and recharge in the Buena Vista Basin, Portage and Wood Counties, Wisconsin. Information Circular 72, Wisconsin Geological and Natural History Survey, 31 p.

Zheng, C., K.R. Bradbury, and M.P. Anderson, 1992. A computer model for calculation of groundwater paths and travel times in transient three-dimensional flows. Information Circular 70, Wisconsin Geological and Natural History Survey, 21 p.

Stoertz, M.W., M.P. Anderson, and K.R. Bradbury. 1991. Field investigations and numerical studies of groundwater recharge through unsaturated sand: A methodology applied to central Wisconsin. Information Circular 71, Wisconsin Geological and Natural History Survey, 52 p.

Bradbury, K.R. 1991. Tritium as an indicator of ground-water age in central Wisconsin. *Ground Water*, 29(3): 398-404.

Dalton, M.G., B.E. Huntsman, and K.R. Bradbury. 1991. Acquisition and interpretation of water-level data. In: *Practical Handbook of Ground-Water Monitoring*, D.M. Nielsen, ed. Lewis Publishers, Chelsea, Mi. p 367-395.

Bradbury, K.R., and M.A. Muldoon. 1990. Hydraulic conductivity determinations in unlithified glacial and fluvial materials. In: *Ground Water and Vadose Zone Monitoring*, ASTM STP 1053, D.M. Nielsen and A.I. Johnson, Eds., American Society for Testing and Materials, Philadelphia, p 138-151.

Zheng, C., M.P. Anderson, and K.R. Bradbury. 1989. Effectiveness of hydraulic methods for controlling groundwater contamination. In: *Groundwater Contamination* (Proceedings, Third IAHS Scientific Assembly, Baltimore, May, 1989). IAHS Publication No. 185, p. 173-179.

Kendy, E., and K.R. Bradbury, 1988. Hydrogeology of the Wisconsin River Valley in Marathon County, Wisconsin. Information Circular 64, Wisconsin Geological and Natural History Survey, 66 p.

Toran, L., and K.R. Bradbury, 1988. Ground-water flow model of drawdown and recovery near an underground mine. *Ground Water*, 26(6): 724-733.

Zheng, C., K.R. Bradbury, and M.P. Anderson, 1988. Role of interceptor ditches in limiting the spread of contaminants in ground water. *Ground Water*, 26(6): 734-742.

Stoertz, M.W. and K.R. Bradbury, 1989. Mapping recharge areas using a ground-water flow model--a case study. *Ground Water*, 27(2): 220-228.

Zheng, C., H. Wang, M.P. Anderson, and K.R. Bradbury, 1988. Analysis of interceptor ditches for control of

groundwater pollution. *Journal of Hydrology*, 98 (1988): 67-81.

Cherkauer, D.S., R.W.Taylor, and K.R. Bradbury, 1987. Relation of lake bed leakance to geoelectric properties. *Ground Water*, 25(2): 135-140.

Blanchard, M.C., and K.R. Bradbury, 1987. A comparison of office-derived vs.field-derived water table maps for a sandy unconfined aquifer. *Ground Water Monitoring Review*, 7(2): 74-78.

Bradbury, K.R., and E.R. Rothschild. 1985. A computerized technique for estimating the hydraulic conductivity of aquifers from specific capacity data. *Ground Water*, 23(2):240-246.

Bradbury, K.R., and R.W. Taylor. 1984. Determination of the hydrogeologic properties of lake beds using offshore geophysical surveys. *Ground Water*, 22(6): 690-695.

Reports and Conference Proceedings

Hart, D.J., P.R. Schoephoester, and K.R. Bradbury. 2012. Groundwater recharge in Dane County, Wisconsin. Estimating recharge using a GIS-based water-balance model. WGNHS Bulletin B107. 11 p.

Bradbury, K.R., M.A. Borchardt, and M. Gotkowitz. 2010. Human viruses as tracers of wastewater pathways into deep municipal wells. WGNHS Open-file report 2010-04. 40 p.

Muldoon, M.A., and K.R. Bradbury. 2010. Assessing seasonal variations in recharge and water quality in the Silurian aquifer in areas with thicker soil cover. Final report to the Wisconsin Department of Natural Resources. 45 p.

Bradbury, K.R., and W.G. Batten. 2010. Groundwater susceptibility maps, diagrams, and report for the Town of Byron, Fond du Lac County, Wisconsin. WGNHS Open-File Report 2010-02.

Bradbury, K.R. 2009. *Technical criteria for delineating groundwater attention areas in Wisconsin.* Unpublished white paper prepared for the Miller/Black Legislative Groundwater Study Committee. 2 p.

Bradbury, K.R. 2009. *Technical criteria for delineating groundwater management areas in Wisconsin*. Unpublished white paper prepared for the Miller/Black Legislative Groundwater Study Committee. 7 p.

Hart, D., P. Schoephoester, and K.R. Bradbury. 2009. Groundwater recharge in Dane County, Wisconsin, estimated by a GIS-based water-balance model. WGNHS Open-file report 2008-07. 16 p

Hooyer, T., D.J. Hart, K.R. Bradbury, and W.G. Batten. 2008. Investigating groundwater recharge to the Cambrian-Ordovician aquifer through fine-grained glacial deposits in the Fox River Valley. WGNHS Open-file report 2008-07. 48 p.

Bradbury, K.R., M.A. Borchardt, M. Gotkowitz, and R.J. Hunt. 2008. Assessment of Virus Presence and Potential Virus Pathways In Deep Municipal Wells. WGNHS Open-file report 2008-08. 48 p.

Bradbury, K.R. and M. K. Cobb. 2008. Delineation of areas contributing groundwater to springs and wetlands supporting the Hine's Emerald Dragonfly, Door County, Wisconsin. WGNHS Open-file report 2008-04. 17 p. + 17 color p.

Dr. Kenneth R. Bradbury

Hart, D., K. Bradbury, D. Feinstein, and B. Tikoff. 2008. Mechanisms of groundwater flow across the Maquoketa Formation. . WGNHS Open-file report 2008-03. 39 p. + 12 color p.

Gaffield, S.J, T.W. Rayne, L. Wang, and K.R. Bradbury. 2007. Impacts of land use and groundwater flow on the temperature of Wisconsin trout streams. WGNHS Open-file report 2007-09. 23 p

Bradbury, K.R., and D.J. Hart. 2006. Groundwater flow model for the city of West Bend, Washington County, Wisconsin. WGNHS Open-file report 2006-05. 23 p.

LePain, D.L., K. R. Bradbury, and M. K. Cobb. 2005. Hydrostratigraphy of west-central Wisconsin: A new approach to groundwater management. Administrative report to the University of Wisconsin Water Resources Institute. 10 pages plus appendices on CD-ROM. (Also listed as WGNHS open-file report 2005-04).

Bradbury, K.R., J.M. Bahr, and J. D. Wilcox. 2005. Monitoring and predictive modeling of subdivision impacts on groundwater in Wisconsin. Administrative report to the Wisconsin Department of Natural Resources. 17 p.

Bradbury, K.R., Gotkowitz, M.G., Cherry, J.A., Hart, D.J., Eaton, T.T., .Parker, B.L., and Borchardt, M.A. 2004. Assessing Contaminant Transport through Aquitards: Technical Guidance for Water Supply Managers, Project completion report, American Water Works Association Research Foundation. 109 p.

Cherry, J.A., Parker, B.L., Bradbury, K.R., Eaton, T.T., Gotkowitz, M.G., Hart, D.J., and Borchardt, M.A. 2004. Role of aquitards in the protection of aquifers from contamination: a "state of the science" report. Project completion report, American Water Works Association Research Foundation. 176 p.

Wilcox, J.D., Bradbury, K.R., Bahr, J.M., Pederson, J.A., and Thomas, C.L. 2004. Pharmaceuticals and hormones as potential groundwater contaminants from on-site wastewater treatment systems. Proceedings, NGWA Conference on Pharmaceutical in Ground Water, Minneapolis. 13 p.

Bradbury, K.R., and J. D. Wilcox. 2003. Impacts of privately-sewered subdivisions on groundwater quality in Dane County, Wisconsin. Final report to the Wisconsin Groundwater Research Advisory Council. 16 p.

Gaffield, S. J., T. W. Rayne, L. Wang, and K. R. Bradbury. 2003. Impacts of Land Use and Groundwater Flow on the Temperature of Wisconsin Trout Streams. Final Report to the Wisconsin Water Resources Institute. 19 p.

Chapel, D.M., K.R. Bradbury, and R.J. Hunt. 2003. Delineation of five-year zones of contribution for municipal wells in La Crosse County, Wisconsin. Open-file Report 2003-02. Wisconsin Geological and Natural History Survey. 41 p.

Eaton, T.T., K.R. Bradbury, M.P. Anderson and T.W. Rayne. 2002. Equivalent porous medium simulation of fracture heterogeneity: importance of conceptual models, discretization and scale. MODELCARE2002, 4th International Conference on Calibration and Reliability in Groundwater Modeling, Prague, Czech Republic, June 17-20.

Bradbury, K.R., and T.W. Rayne. 2002. The Sturgeon Bay wellhead-protection project: Delineation of contributing areas for municipal wells in fractured dolomite. In Proceedings, NGWA Conference on Fractured Rocks, Denver, Colorado, March 2002.

Dr. Kenneth R. Bradbury

Bradbury, K.R. 2002. How important are horizontal fractures?, International Ground Water Modeling Center Newsletter, vol XX, Issue 1., June, 2002. p 4.

S. Gaffield, M. Gotkowitz, and K. R. Bradbury, 2002. Delineation of zones of contribution for municipal wells in Rock County, Wisconsin: Final report, WGNHS Open-File Report 2002-02, 47 p. plus 1 color page.

K.R. Bradbury, T.W. Rayne, and M.A Muldoon, 2002. Field Verification of Capture Zones for Municipal Wells at Sturgeon Bay, Wisconsin: Final Report to the Wisconsin Department of Natural Resources-Wisconsin Geological and Natural History Survey, Open-file Report WOFR 2001-01, 20 p. plus 10 color pages.

Eaton, T.T, K.R. Bradbury, and H.F. Wang. 2001. . Verification and Characterization of a Fracture Network within the Maquoketa Shale Confining Unit, Southeastern Wisconsin. Wisconsin Geological and Natural History Survey, Open-file Report WOFR 2001-04, 35 p.

Bradbury, K.R., Dripps, W., Hankley, C., Anderson, M.P., and Potter, K.W. 2000. Refinement of two methods for estimation of groundwater recharge rates. Final Project Report to the Wisconsin Department of Natural resources. 84 p.

T.T. Eaton, K.R. Bradbury, and T.J. Evans. 1999. Characterization of the hydrostratigraphy of the deep sandstone aquifer in southeastern Wisconsin. Wisconsin Geological and Natural History Survey, Open File Report WOFR 1999-02. 30 p. + 15 color p. + 1 CDROM.

K.R. Bradbury, S.K. Swanson, J.T. Krohelski, and A.K. Fritz. 1999. Hydrogeology of Dane County, Wisconsin. , 1999. Wisconsin Geological and Natural History Survey, Open-file Report WOFR 1999-04. 66 p. + 2 color plates.

Eaton, T. T. and K R. Bradbury, 1998. Evaluation of the Confining Properties of the Maquoketa Formation in the SEWRPC Region of Southeastern Wisconsin., Open-file report 1998-11, Wisconsin Geological and Natural History Survey. ii + 34 p.

Bradbury, K.R., T.W. Rayne, M.A. Muldoon, and P.D. Roffers, 1998. Application of a discrete fracture flow model for wellhead protection of Sturgeon Bay, Wisconsin. Open-file report 1998-4, Wisconsin Geological and Natural History Survey, vi + 62 p

Muldoon, M. A. and K R. Bradbury , 1998. Tracer study for characterization of groundwater movement and contaminant transport in fractured dolomite. 1998-2, Wisconsin Geological and Natural History Survey, vii + 85 + 2 p.

Gianniny, G. L., Maureen A. Muldoon, J. Antonio Simo, Kenneth R. Bradbury. 1996. Correlation of high-permeability zones with stratigraphic features in the silurian dolomite, Sturgeon Bay, Wisconsin. Open-file report 1996-7, Wisconsin Geological and Natural History Survey, 102 p. with 1 plate.

K. R. Bradbury, M. Muldoon, A. Klein, D. Misky, and M. Strobel, 1995. Water-table map of Dane County., Open-file report 1995-1, Wisconsin Geological and Natural History Survey. 6 p. with 18 plates.

Mudrey, M.G., and K.R. Bradbury, 1993. Evaluation of NURE hydrogeochemical data for use in Wisconsin groundwater studies. Open-file report 93-2, Wisconsin Geological and Natural History Survey. 57 p.

Bradbury, K.R., and M.A. Muldoon, 1993. Preliminary comparison of a discrete fracture model with a continuum model for groundwater movement in fractured dolomite. Final administrative report to the Wisconsin Department of natural Resources in fulfillment of DNR Contract # NRB96011. 39 p.

Bradbury, K.R., and M.A. Muldoon, 1993. Effects of fracture density and anisotropy on wellhead protection area delineation in fractured-rock aquifers. In: Memoires of the XXIVth Congress, International Association of

Hydrogeologists, I.A.H. Memoires, Vol XXIV, Part 1, Shiela and David Banks, Editors, p. 169-179.

Bradbury, K.R., and R.W. McGrath. 1992. Field study of atrazine contamination of groundwater in Dane County, Wisconsin. Final Administrative Report to the Wisconsin Dept of Ag, Trade, and Consumer Protection and the Wisconsin department of Natural Resources, 71 p.

Bradbury, K.R., and M.A. Muldoon, 1991. Hydrogeology and groundwater monitoring of fractured dolomite in the Upper Door Priority Watershed, Door County, Wisconsin: Final report to the Wisconsin Department of Natural Resources. Wisconsin Geological and Natural History Survey. 74 p.

Bradbury, K.R., M.A. Muldoon, J. Levy, and A. Zaporozec. 1991. Wellhead protection strategies in unconfined fractured-rock aquifers. In: Proceedings, First USA/USSR Joint Conference on Environmental Hydrology and Hydrogeology, J.A. Moore, R.A. Kanivetsky, J.A. Rosenshien, C. Zenone, and S.A. Csallany, eds., American Institute of Hydrology/Kendall-Hunt Publishing, p. 112-119.

Zaporozec, A., K.R. Bradbury, J. Levy, and M.A. Muldoon. 1990. Methods for delineating wellhead protection areas in fractured rocks. In: Minimizing Risk to the Hydrologic Environment, A. Zaporozec, ed. American Institute of Hydrology/Kendall-Hunt Publishing, p. 174-181.

Bradbury, K.R., M.A. Muldoon, A. Zaporozec, and J. Levy. 1991. Delineation of wellhead protection areas in fractured rocks. Technical Completion Report, EPA 570/9-91-009, U.S. Environmental Protection Agency. 144 p.

Bradbury, K.R. 1989. Door County's groundwater; An asset or a liability? In: Proceedings, Conference on Door County and the Niagara Escarpment, Wisconsin Academy of Sciences, Arts, and Letters. p. 36-44.

Simpkins, W.W., K.R. Bradbury, and D.M. Mickelson. 1989. Methods for evaluating large-scale heterogeneity in fine-grained glacial sediment. In: Proceedings, Conference on new field techniques for quantifying the physical and chemical properties of heterogeneous aquifers, F.J. Molz, J.G. Melville, and O. Guren, ed. National Water Well Assoc. p. 53-75.

Muldoon, M.A., K.R. Bradbury, D.M. Mickelson, and J.W. Attig. 1988.Hydrogeologic and geotechnical properties of Pleistocene materials in north-central Wisconsin. Wisconsin Water Resources Center, Technical Report WIS WRC 88-03. 58 p.

Bradbury, K.R., M.C. Blanchard, and M.A. Muldoon. 1988. Hydrogeology and groundwater geochemistry in fractured dolomite, northeastern Wisconsin. In: Proceedings, International Association of Hydrogeologists, Symposium on the Hydrogeology of Fractured Rocks, Atlanta Ga. p. 23-27.

Rodenbeck, S.A., W.W. Simpkins, K.R. Bradbury, and D.M. Mickelson, 1987. Merging geotechnical data with Pleistocene lithostratigraphy: Examples from eastern Wisconsin. In: Proceedings, 10th Annual Madison Waste Conference, UW-Madison Dept of Professional Development. p.454-476.

Toran, L. and K.R. Bradbury, 1985. Hydrogeologic and geochemical evolution of contaminated groundwater near abandoned mines. Technical Completion Report G-878-03. University of Wisconsin Water Resources Center. 34 p.

Bradbury, K.R., D.S. Desaulniers, D.E. Connell, and R.G. Hennings, 1985. Groundwater movement through clayey till, northwestern Wisconsin, USA. In: Memoirs, International Association of Hydrogeologists, v. XXII, Hydrogeology of Rocks of Low Permeability. p. 405-416.

Dr. Kenneth R. Bradbury

Bradbury, K.R., 1985. Major ion and isotope geochemistry of groundwater in clayey till, northwestern Wisconsin, U.S.A. In: Proceedings, First Canadian/American Conference on Hydrogeology--Practical Applications of Ground Water Geochemistry B. Hitchon and E.I. Wallick, editors. National Water Well Association, pp. 284-289.

Abstracts (only 1st author abstracts are listed)

Bradbury, K.R., M.N. Fienen, M. Kniffin, J.J. Krause, and D.W. Feinstein. 2015. Addressing water-management issues in Wisconsin's central sand plain using a groundwater flow model. Geological Society of America, North-Central meeting, Madison, WI.

Bradbury, K.R., T.W. Rayne, J.J. Krause, J.W. Wilcox, and C.J. Ptacek. 2014. Impacts of a rural subdivision on groundwater quality: Documenting a transition from agriculture to residential land use. Geological Society of America Abstracts with Programs. Vol. 46, No. 6, p.64

Bradbury, K.R., C.A. Gellasch, M.B. Gotkowitz, and D.J. Hart. 2013. Fracture occurrence and connectivity in a siliclastic aquifer near public supply wells in southern Wisconsin. NGWA conference on groundwater in fractured rock and sediments, Burlington, Vt.

Bradbury, K.R., M.B. Gotkowitz, D.J. Hart, and M.J. Parsen. 2012. Vulnerability of water supply wells beneath regional aquitards in an urban setting. International Association of Hydrogeologists, 39th Congress, Niagara Falls, Ontario.

Bradbury, K.R., D.J. Hart, M.B. Gotkowitz, and M.A. Muldoon. 2011. The significance of hydraulic and thermal gradients in boreholes (invited). Geological Society of America Abstracts with Programs, Vol. 43, No. 5, p. 341

Bradbury, K.R., M.A. Borchardt, M.B. Gotkowitz, J. Zhu, C.A. Gellasch, S.K. Spencer, and R.J. Hunt. 2011. Hydrogeological and statistical evidence for wide-spread enteric virus contamination of deep municipal wells. Geological Society of America Abstracts with Programs, Vol. 43, No. 5, p. 665

Bradbury, K.R. M.A. Borchardt, M.B. Gotkowitz, R. Hunt, and S.K. Spencer. 2010. Presence of human enteric viruses in deep urban groundwater (abstract). Geological Society of America Abstracts with Programs, Vol. 42, No. 5, p. 378

Bradbury, K.R. 2010. Groundwater Science Meets Public Policy in Wisconsin (abstract). AWRA-Wisconsin Section Annual Meeting, Middleton, WI.

Bradbury, K.R.; M. Borchardt, M. Gotkowitz, and R. Hunt. 2009. Human Viruses in Water Supply Wells in Madison, WI. (Abstract), AWRA annual meeting, Stevens Point.

Bradbury, K.R., and T.W. Rayne. 2009. Sustainability of Shallow Groundwater In Southeastern Wisconsin, USA (abstract). Geological Society of America, North-Central Section. Abstracts with Programs, Annual Meeting, Rockford.

Bradbury, Kenneth R., M. Gotkowitz, and David Hart, 2009. Regional groundwater flooding in southern Wisconsin. (Abstract, poster), AWRA annual meeting, Stevens Point.

Dr. Kenneth R. Bradbury

Bradbury, K.R., J. Nel L.M. Raitt M. El Kahloun T. Masvopo, T. Nhiwatiwa L. Brendonck 2008. Hydroecologic studies in the Save Valley Conservancy, southeastern Zimbabwe. (abstract, poster). AWRA (Wisconsin Section) Annual Meeting, Brookfield.

Bradbury, K.R., and T.W. Rayne. 2008. Sustainability of Shallow Groundwater In the SEWRPC region (abstract, poster). (abstract, talk). AWRA (Wisconsin Section) Annual Meeting, Brookfield.

Bradbury, K.R., and T.W. Rayne. 2008. Sustainability of Shallow Groundwater In Southeastern Wisconsin, USA (abstract, poster). Geological Society of America *Abstracts with Programs*, Annual Meeting, Houston.

Bradbury, K.R., D.J. Hart, and D. Feinstein. 2007. Where is the deep groundwater divide in southeastern Wisconsin (abstract)? Geological Society of America *Abstracts with Programs*, Annual Meeting, Denver.

Bradbury, K.R. 2005. Regional hydrogeology and groundwater flow modeling in southeastern Wisconsin (abstract). Straddling the Divide Conference: Water Supply in the lake Michigan Region, Abstracts, p 16.

Bradbury, K.R., and D.J. Hart. 2005. Regional hydrogeology and groundwater flow modeling in southeastern Wisconsin (abstract). Lake Michigan State of the Lake/Great Lakes Beach Association 4th Biennial Conference, Green Bay. p 20.

Bradbury, K.R., M.B. Gotkowitz, D.J. Hart. 2005. Field comparison of methods for collecting hydraulic head profiles across an aquitard (abstract). AWRA (Wisconsin section), 29th Annual Meeting, Delavan, WI.

Bradbury, K.R., R.J. Hunt, and T. W. Rayne. 2005. Are recharge-area maps useful for land-use planning in humid settings? (abstract). Geological Society of America *Abstracts with Programs*, Vol. 37, No. 7, p. 32

Bradbury, K.R., D.J. Hart, and D. T. Feinstein. 2005. Current trends in groundwater use in southeastern Wisconsin are not sustainable (abstract). Geological Society of America *Abstracts with Programs*, Vol. 37, No. 5, p. 21

Bradbury, K.R., Hart, D.J., and Gotkowitz, M.G. 2004. Field comparison of methods for collecting hydraulic head profiles across an aquitard. Abstract for GSA Annual Meeting, Denver.

Bradbury, K. R., Cherry, J. A., Parker, B. L. Eaton, T. T., Hart, D. J., Gotkowitz, M. B., and Borchardt, M. A. 2003. Measures of aquitard integrity. Abstract for GSA Annual Meeting, Seattle

Bradbury, K.R. 2002. Characterizing thin horizontal bedrock discontinuities using borehole geophysical logging and hydraulic testing. Abstract for GSA Annual Meeting, Denver.

Bradbury, K.R., and M.A. Muldoon. 2002. Delineation of wellhead protection areas in fractured rock – advances during the last ten years. Abstract for GSA Annual Meeting, Denver.

Bradbury, K.R. 2001. Refining estimates of aquifer characteristics using dynamic flow logging in deep water-supply wells. Abstract for GSA annual meeting, Boston.

Bradbury, K.R. 2000. Stochastic analysis of uncertainty in well capture zones using a regional groundwater model. GSA Abstracts with Programs, v 32, no. 7, p. A-336.

Bradbury, K.R., and Rayne, T.W., 1998. Estimating lateral water movement in the unsaturated zone above capture zones in fractured dolomite. GSA Abstracts with Programs, v30, no 7.

Dr. Kenneth R. Bradbury

Bradbury, K.R., and T.W. Rayne. 1998. A comparison of simple and complex models for delineation of capture zones in fractured dolomite. EOS, v 79, no 17, p S104.

Bradbury, K.R., and T.W. Rayne. 1996. Groundwater modeling for delineation of well capture zones in a fractured dolomite aquifer GSA Abstracts with Programs.

Bradbury, K.R., and T.W. Rayne. 1996. Delineation of capture zones for municipal wells in complex fractured carbonate rock. EOS, v 77, no 46, p F242.

Bradbury, K.R., 1993. Field-based comparison of discrete fracture and porous media models for capture-zone delineation in fractured rock. Abstracts with Programs, Geological Society of America, 1993 Annual Meeting, v.25, no. 6, p A487.

Bradbury, K.R. 1992. Application of a discrete fracture model to simulate groundwater movement in fractured carbonate terrain. Abstracts with Programs, Geological Society of America, 1992 Annual Meeting, v.24, no. 7, p A252.

Bradbury, K.R., and M.A. Muldoon. 1992. The distribution of hydraulic conductivity in fractured till at two sites in northwestern Wisconsin. Abstracts with Programs, North-Central Section, Geological Society of America, v.24, no. 4, p 6.

Bradbury, K.R., and M.A. Muldoon. 1992. Practical approaches to wellhead protection in fractured rocks. Abstracts, 29th International Geologic Congress, Kyoto, Japan, Vol III., p 906.

Bradbury, K.R., and M.A. Muldoon. 1991. The distribution of hydraulic conductivity in fractured till at two sites in northwestern Wisconsin. EOS, v 72, no. 44. p 165-166.

Bradbury, K.R., M.A. Muldoon, J. Levy, and A. Zaporozec. 1989. Delineating wellhead protection areas in a fractured dolomite aquifer. EOS, v. 70, No. 43, p. 1079.

Bradbury, K.R., 1982. Application of a groundwater parameter estimation model to a lake-aquifer flow system. Geological Society of America, Abstracts with Programs, v. 14, no. 7, p. 450.

Bradbury, K.R., 1982. Use of a parameter estimation model to predict rates of groundwater flow into Lake Michigan. EOS, v. 63, no. 45, p. 926. (invited)

Bradbury, K.R., 1981. Evidence of hydraulic connection between Green Bay and a fractured dolomite aquifer. Geological Society of America, Abstracts with Programs. 13(7): 415.

Bradbury, K.R., 1980. Regional suitability analysis for hazardous waste management in Wisconsin. Abstract, 4th Annual Meeting, Wisconsin Section, American Water Resources Association.

Theses

Bradbury, K.R. 1977. Sedimentation and soil alteration, Monroe Reservoir, Indiana. Unpublished A.M. Thesis, Indiana University, Bloomington, Indiana.

Bradbury, K.R., 1982. Hydrogeologic relationships between Green Bay of Lake Michigan and onshore aquifers in Door County, Wisconsin. Ph.D. Dissertation, University of Wisconsin-Madison. 270 p.

Education Committee **Item D.**
October 10, 2019

NEW PROGRAM AUTHORIZATION (IMPLEMENTATION) BACHELOR OF SCIENCE IN COMPUTER ENGINEERING, UW-LA CROSSE

REQUESTED ACTION

Adoption of Resolution D., authorizing the implementation of the Bachelor of Science in Computer Engineering at UW-La Crosse.

Resolution D.: That, upon the recommendation of the Chancellor of UW-La Crosse and the President of the University of Wisconsin System, the Chancellor is authorized to implement the Bachelor of Science in Computer Engineering at the University of Wisconsin-La Crosse.

SUMMARY

The University of Wisconsin-La Crosse submits this request to establish a Bachelor of Science in Computer Engineering.

Program Description

The University of Wisconsin (UW)-La Crosse proposes to establish a Bachelor of Science (B.S.) in Computer Engineering. This program responds to extremely strong growth in technology fields, as well as strong interest from incoming students, as well as local and national employers. This occurs because technological advancement is not only increasing demand for computer engineers, but is also expanding the types of systems that are being created. The ability to embed computational power, sensors, and wireless connectivity in small devices has created a whole new range of devices that connect our world. This has significantly changed the range and scale of devices that computer engineers design. Increasingly, companies are forming interdisciplinary teams that blur the boundaries between hardware and software engineers and require new skills from each. Establishing this degree program will provide students with both technical breadth and depth in a wide variety of computer systems. Graduates will be equipped to develop novel technical solutions to real-world challenges, because they will have developed the ability to engineer computer hardware systems, develop low-level software solutions, and carry out the integration of electrical and physical systems.

Mission

The proposed Computer Engineering program aligns with UW-La Crosse's mission as it will provide a challenging, dynamic and diverse learning environment to students within an undergraduate science program. The proposed program will also enhance the existing programs in Computer Science, Mathematics, and Physics, key programs at UW-La Crosse that also align with the university's mission. The proposed program is also responsive to UW-La Crosse's Sustaining Excellence: Advancing Transformational Education strategic plan as it will provide students experiences in high-impact practices such as a capstone experience, undergraduate research, internships, group collaboration, and exposure to real-world applications.

Student and Market Demand

The Computer Science department at UW-La Crosse overall is experiencing extremely strong growth within its programs, with an increase of 82% in undergraduate student enrollment over the past five years. This enrollment trend is being driven by unprecedented demand for graduates from both local and national employers.

Presently, incoming students to UW-La Crosse can declare their program of interest as the 3+2 Computer Science and Engineering dual degree program with UW-Madison. This program requires that students complete three years at UW-La Crosse, followed by two years at UW-Madison. Upon completion of the 3+2 program, students receive both a Bachelor of Science degree (computer science major) from UW-La Crosse, and a Bachelor of Science degree (engineering major) from UW-Madison.

Analysis of four years of student cohort data showed that **none** of the students within the Computer Science and Engineering dual degree program completed the 3+2 program. This is likely due, in part, to the fact that admission to the UW-Madison portion of the degree program is not guaranteed. Instead, students may be selected for admission to UW-Madison based on their GPA in all coursework; their GPA in the chemistry, computer science, mathematics, and physics coursework required by the program; and the positive recommendation of the UW-La Crosse Computer Science department chair. In addition, students are required to demonstrate Wisconsin resident status, and they must have enrolled in UW-La Crosse from high school, rather than transferring to UW-La Crosse from another university or college.

The apparent barriers to progress and completion of the current transfer model, as well as increased student demand, support the creation of the proposed Computer Engineering program at UW-La Crosse. The proposed program will provide a cohesive, continuous, and student-centered academic pathway for students to start and complete a Computer Engineering degree at UW-La Crosse.

The U.S. Bureau of Labor Statistics projects that the job outlook for computer engineers is expected to grow by 5 percent from 2016 to 2026, and by 10 percent within Wisconsin during this same 10-year time span. Beyond market demand, computer hardware engineers have a high earning potential, as they are the second highest earning among engineering occupations, with a mean annual wage of $114,600.

At UW-La Crosse, the Computer Science department is responding to increased interest from employers for graduates with experience in embedded systems and hardware design, which are skills developed in a Computer Engineering degree. Both local and national employers have also indicated an interest in Computer Engineering students. These employers include local manufacturers, such as Trane U.S. Inc., a manufacturer and marketer of heating and air ventilation equipment based in La Crosse, start-up companies, and national technology leaders including Apple Inc. In addition, UW-La Crosse anticipates the planned Foxconn manufacturing facility will provide immediate opportunities for Computer Engineering students and will expand the range of technology companies moving to Wisconsin.

Credit Load and Tuition

The program requirements are comprised of 127 credits, including 42 credits in general education program coursework. The program curricula for the major includes 33 credits of program prerequisites and support courses, as well as 63 credits in the Computer Engineering major, including a culminating capstone course. The capstone course will require students to complete a computer engineering group project, which involves design, implementation, and demonstration, followed by a written project report and oral examination by a project evaluation committee.

The projected time to degree is four years for full-time students who enter the program with adequate preparation in mathematics. For the 2019-20 academic year, residential tuition and segregated fees total $4,563.15 per semester for a full-time student enrolled in 12 to 18 credits per semester. Of this amount, $3,792.36 is attributable to tuition, and $770.79 is attributable to segregated fees. Students at freshman- and sophomore-level status (up to 60 earned credits) will pay this tuition rate. Students in junior status or higher within the Computer Engineering program will pay an engineering tuition rate of $5,263.15, which is $700 per semester above the resident tuition rate. Nonresident tuition and segregated fees total $8,972.91 per semester for a full-time student enrolled in 12 to 18 credits per semester. Of this amount, $8,202.12 is attributable to tuition and $770.79 is attributable to segregated fees. Nonresident students at freshman- and sophomore-level status (up to 60 earned credits) will pay this tuition rate. Nonresident students within the Computer Engineering program in junior status or higher will pay an engineering tuition rate of $5,263.15, which is $700 per semester above the nonresident tuition rate.

BACKGROUND

This proposal is presented in accord with the procedures outlined in Academic Planning and Program Review (SYS 102, revised July 2016, available at https://www.wisconsin.edu/program-planning/).

Related Policies

- Regent Policy Document 4-12, "Academic Program Planning, Review, and Approval in the University of Wisconsin System"
- UW System Administrative Policy 102: Policy on University of Wisconsin System Array Management: Program Planning, Delivery, Review, and Reporting

ATTACHMENTS

A) Request for Authorization to Implement a Bachelor of Science in Computer Engineering at UW-La Crosse
B) Cost and Revenue Projections
C) Provost's Letter

REQUEST FOR AUTHORIZATION TO IMPLEMENT A BACHELOR OF SCIENCE IN COMPUTER ENGINEERING AT UNIVERSITY OF WISCONSIN-LA CROSSE PREPARED BY UW-LA CROSSE

ABSTRACT

The University of Wisconsin (UW)-La Crosse proposes to establish a Bachelor of Science (B.S.) in Computer Engineering. The development of the program responds to the extremely strong growth in technology fields. The Department of Computer Science at UW-La Crosse has recently established an Embedded Systems emphasis to respond to this trend. Interest from both incoming students and local and national employers demonstrate the need for further expanding the department's offerings into Computer Engineering. Establishing the program will provide students with both technical breadth and depth in a wide variety of computer systems. Graduates will be better equipped to develop novel technical solutions to real-world challenges with their ability to engineer computer hardware systems, develop low-level software solutions, and carry out the integration of electrical and physical systems. The program requirements are comprised of 127 credits including 42 credits in general education program coursework, 11 credits of which satisfy other program requirements. The program curricula for the major includes 33 credits of program prerequisites and support courses and 63 credits in the Computer Engineering major.

PROGRAM IDENTIFICATION

Institution Name
University of Wisconsin-La Crosse

Title of Proposed Program
Computer Engineering

Degree/Major Designations
Bachelor of Science

Mode of Delivery

UW-La Crosse will deliver the majority of the curriculum, with the potential for advanced elective courses to be delivered through partnerships with UW-Platteville and/or UW-Stout. UW-La Crosse courses will initially be delivered face-to-face, with the potential of future distance delivery offerings, while partner courses would be offered via distance delivery. Note that the curriculum provided by the partner institutions would comprise less than 25% of the program.

Projected Enrollments and Graduates by Year Five

Table 1 represents enrollment and graduation projections for students entering the program over the next five years. By the end of Year 5, it is expected that 78 students will have enrolled in the program and 12 students will have graduated from the program. It is anticipated that 72% of the students within the Computer Engineering program will continue in the program from freshman to sophomore year. This is based on the current program retention rate for students from freshman to sophomore year in UW-La Crosse's Computer Science program. Additionally, enrollment projections are based on an estimate that 79% of students within the program will continue in the program from sophomore to junior year and 92% from junior to senior year.

Table 1: Five-Year Degree Program Enrollment Projections

Students/Year	Year 1	Year 2	Year 3	Year 4	Year 5
New Students	8	13	15	20	20
Continuing	2	7	15	23	30
Total Enrollment	10	20	30	43	50
Graduating			1	4	7

Tuition Structure

For the 2019-20 academic year, residential tuition and segregated fees total $4,563.15 per semester for a full-time student enrolled in 12 to 18 credits per semester. Of this amount, $3,792.36 is attributable to tuition and $770.79 is attributable to segregated fees. Students at freshman- and sophomore-level status (up to 60 earned credits) will pay this tuition rate. Students within the Computer Engineering program in junior status or higher will pay an engineering tuition rate of $5,263.15, which is $700 per semester above the resident tuition rate. Nonresident tuition and segregated fees total $8,972.91 per semester for a full-time student enrolled in 12 to 18 credits per semester. Of this amount, $8,202.12 is attributable to tuition and $770.79 is attributable to segregated fees. Nonresident students at freshman- and sophomore-level status (up to 60 earned credits) will pay this tuition rate. Nonresident students within the Computer Engineering program in junior status or higher will pay an engineering tuition rate of $5,263.15, which is $700 per semester above the nonresident tuition rate. Furthermore, various support and major courses required within the Computer Engineering program include course fees totaling $265. There may be additional individual course fees depending on the specific elective courses taken by the student.

Department or Functional Equivalent

Department of Computer Science

College, School, or Functional Equivalent

College of Science and Health

Proposed Term and Year of Implementation
Fall 2020

DESCRIPTION OF PROGRAM

Overview of the Program

The program requirements are comprised of 127 credits including 42 credits in general education program coursework, 11 credits of which satisfy other program requirements. The program curricula for the major includes 33 credits of program prerequisites and support courses and 63 credits in the Computer Engineering major, which includes a culminating capstone course. The capstone course will require students to complete a computer engineering group project that involves design, implementation, and demonstration, followed by a written project report and oral examination by a project evaluation committee. The projected time to degree is four years for full-time students who enter the program with adequate preparation in mathematics.

Student Learning Outcomes and Program Objectives

The proposed Computer Engineering program will provide students with the knowledge and skills needed for successful careers in computer engineering, related engineering professions, and other career paths. Upon completing the Computer Engineering degree program, students will have attained the following outcomes defined by the Accreditation Board for Engineering and Technology, Inc. (ABET):

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Additionally, graduates of the proposed Computer Engineering program will develop the skills necessary to design digital hardware systems and the associated control software. This involves a breadth of knowledge spanning topics in computer science, digital

circuits, and engineering. This knowledge can be summarized in four broad areas with associated student learning outcomes.

- Software Design including Embedded and Real-Time Systems - Students will be able to design and implement software using fundamental programming constructs and data structures in both high- and low-level languages.
- Circuit Analysis - Students will be able to solve problems in analog and digital circuits.
- Systems Architecture, Modeling and Simulation - Students will be able to evaluate architectural tradeoffs and estimate performance by modeling systems.
- Digital Signal Processing - Students will be able to solve problems involving processing of signals both in hardware and software.

Program Requirements and Curriculum

Table 2 illustrates the program curriculum for the proposed program. The program requirements are comprised of 127 credits including 42 credits in general education program coursework, 11 credits of which satisfy other program requirements. The program curricula for the major includes 33 credits of program prerequisites and support courses and 64 credits in the Computer Engineering major. Within these 63 credits, students must complete at least 15 computer engineering technical credits. Up to 10 of these elective credits may be taken from the collaborating partner institutions, UW-Platteville and/or UW-Stout.

Table 2: Bachelor of Science in Computer Engineering Program Curriculum

General education courses required for graduation (31 of 42 unique):		
ENG110	College Writing	3 credits
CST110	Communicating Effectively	3 credits
FYS100	First-Year Seminar	3 credits
	Mathematics/Logical Systems[a]	7 credits
	Science[a]	4 credits
	Arts	4 credits
	Minority/Multiracial	3 credits
	Self & Society	3 credits
	Health & Physical Well Being	3 credits
	International/Multicultural	6 credits
	Humanistic Studies	3 credits
Program prerequisites or support courses (33 credits):		
MTH207	Calculus I	5 credits
PHY203	General Physics I	4 credits
MTH208	Calculus II	4 credits
CS120	Software Design I	4 credits
PHY204	General Physics II	4 credits

CS220	Software Design II	4 credits
MTH309	Linear Algebra w/ Differential Eq.	4 credits
STAT245	Probability and Statistics	4 credits

Academic program or major course requirements (63 credits):

CPE105	Intro to the Computing Environment	1 credit
CS225	Discrete Computational Structures	3 credits
PHY334	Electrical Circuits	4 credits
CS270	Intro to Assembler Prog, C Prog, and Computer Org	3 credits
CS340	Software Design III	4 credits
PHY335	Electronics	3 credits
CPE212	Digital Logic	3 credits
CS370	Computer Architecture	3 credits
CPE309	Systems Development	3 credits
CPE321	Intro to Digital Signal Processing	3 credits
CS441	Operating Systems Concepts	3 credits
CS351	Simulation	3 credits
CS372	Digital Circuit Design for Microcontrollers II	3 credits
CPE481	Professionalism in Engineering	1 credit
CPE483	Engineering Project Management	1 credit
CPE478	Virtual Machines	3 credits
	Technical Electives[b]	15 credits
CPE498	Senior Capstone	4 credits
Total Credits		127 credits

[a] Denotes courses that are also covered by program requirements. Duplicate credits not counted toward total.

[b] Ten of these elective credits may be taken from UW-Platteville and/or UW-Stout.

Assessment of Outcomes and Objectives

The proposed Computer Engineering program will have a comprehensive assessment plan that will meet ABET requirements and ensure program quality. Student learning outcomes for the program will be assessed on a three-year cycle. The main assessment activities will include strategically placed direct assessment tasks, such as specific exam questions and course-embedded projects, along with indirect assessment measures such as senior exit surveys and alumni surveys conducted after graduation. Program faculty will be responsible for gathering information from these assessment activities, analyzing achievement of learning outcomes, and making continual program improvements based on assessment results. Assessment plans and reports will be reviewed by the University Program Assessment Committee, which will provide feedback to help program faculty refine the program assessment process.

Diversity

The faculty of the Department of Computer Science are diverse in age, gender, and ethnicity and actively work to promote student diversity in academic programs housed in the department. The department primarily supports this effort through outreach. Historically, the Women in Computer Science student club at UW-La Crosse was used to attract and promote women in computer science – a group that has traditionally been underrepresented. More recently, the department has renamed the club to CODERS and expanded in two ways: (1) broadening to include all underrepresented groups and (2) focusing the club on outreach activities. This outreach effort has the intent to reach students before they apply to and enroll in universities, and even before they consider what interests they might have and might turn into a career. In the future, the department plans to continue these efforts to also capture early interest in computer engineering. Computer engineering also has the potential to attract a different demographic than computer science, thereby broadening diversity of the collective.

UW-La Crosse has several programs designed to support diverse students in the fields of Science, Technology, Engineering, and Math (STEM), including FYRE (First Year Research Exposure), WiscAMP (Wisconsin Alliance for Minority Participation), and a McNair Scholars program. These programs illustrate the commitment of UW-La Crosse to Inclusive Excellence in serving diverse and underserved students. Of particular note is the McNair program, which aims to prepare low-income, first-generation undergraduate students for graduate school. Furthermore, the FYRE program provides first-year underrepresented students of color exposure to the wide variety of majors and careers within the STEM and health science fields. Day-long exploratory research experiences in several STEM disciplines, extensive information regarding graduate programs, and active participation in an undergraduate research symposium are cornerstones of the program.

UW-La Crosse's current strategic plan includes a pillar of "Achieving Excellence through Equity and Diversity." As part of this pillar, the Equity Liaison Initiative has been developed. This is a strategic, institution-wide effort to engage and support members of all departments and units in identifying and measuring equity gaps in the rates of access, retention, and achievement for people of all demographic groups (including, but not limited to, race, gender, and disability), and implementing evidence-based strategies to remedy equity and inclusion issues in educational and work environments. The Department of Computer Science currently has a faculty member serving as an equity liaison. This individual is devoted to identifying equity issues in the department, determining appropriate strategies and resources to address any issues, and serving as an advocate for these efforts within the department.

UW-La Crosse regularly offers professional development opportunities for faculty and staff related to diversity and inclusion. Workshops are presented collaboratively by the Center for Advancing Teaching and Learning, Campus Climate, Counseling and Testing, and various other campus units. Computer Science faculty have regularly attended these

sessions. In addition, UW-La Crosse will be implementing the LawRoom training module, Diversity: Inclusion in the Modern Workplace, in fall 2019. Faculty and staff who undergo this training will be more versed in diversity-related issues, such as privilege, inclusivity, identity, and general respect in a work environment.

In fall 2017, UW-La Crosse added a Vice Chancellor for Diversity and Inclusion to the Chancellor's Cabinet to improve, in part, campus initiatives on diversity and inclusivity. The Diversity and Inclusion division includes several units who support underrepresented students at UW-La Crosse. The Office of Multicultural Student Services provides supplementary services in the areas of academic advising, subject tutoring, leadership development, sponsorship of cultural events, and pre-college programs. Furthermore, the Office of Student Support Services supports students who are first generation, low income, and may have a disability, by providing opportunities for these students to enhance their academic skills, increase financial literacy, and increase career readiness.

Collaborative Nature of the Program

The Computer Science department plans to leverage existing expertise within the UW System by collaborating with other campuses. Two other comprehensive UW System universities offer computer engineering programs – UW-Platteville and UW-Stout. Currently the University of Wisconsin-Platteville offers several courses in a distance delivery format. The proposed Computer Engineering program will allow students to take some of these courses to satisfy the proposed program's technical electives. Students enrolling in the collaborative electives will be granted a waiver of the residency policy requiring the last 24 credits to be earned at UW-La Crosse. Course collaboration with UW-Stout is also likely once courses relevant to the Computer Engineering curriculum are offered in a distance delivery format.

Projected Time to Degree

Full-time students who declare a Computer Engineering major, and have adequate preparation in mathematics, will be able to complete the degree in four years.

Program Review

The first internal review of the Computer Engineering program will occur five years after program implementation. Thereafter, the program will be reviewed, along with the other programs in the Department of Computer Science, on a seven-year cycle. These internal reviews include reviews by external consultants, the Dean of the College of Science and Health, the UW-La Crosse Undergraduate Program Review Committee, the Faculty Senate, and the Provost. Evaluations of program curriculum, assessment of student learning, degree of program success, new initiatives, personnel, and program support are all included in these reviews. Based on the reviews, recommendations will be generated to facilitate continuous program improvement.

Accreditation

UW-La Crosse will seek accreditation by the Accreditation Board for Engineering and Technology, Inc. (ABET). ABET requires that at least one student has graduated from the program before accreditation may be pursued. UW-La Crosse anticipates pursuing ABET accreditation three years after the program implementation date.

UW-La Crosse will seek approval by the Higher Learning Commission (HLC) if the degree is approved by the Board of Regents.

JUSTIFICATION

Rationale and Relation to Mission

The proposed Computer Engineering program is being developed in response to the 2017-19 UW System biennial budget's new state funding specifically targeted for outcomes-based funding. Under the newly created state law (Wis. Stats. §36.112), the Wisconsin Legislature established the following goals for the UW System:

- Growing and ensuring student access,
- Improving and excelling at student progress and completion,
- Expanding contributions to the workforce, and
- Enhancing operational efficiency and effectiveness.

A specific metric within the Expanding Contributions to the Workforce goal is graduates within STEM disciplines. The Computer Engineering graduates would contribute to this specific metric. New outcomes-based funds to UW-La Crosse will be used to specifically develop and support the proposed Computer Engineering program.

The proposed Computer Engineering program aligns with UW-La Crosse's mission as it will provide a challenging, dynamic and diverse learning environment to students within an undergraduate science program. The proposed program will also enhance the existing programs in Computer Science, Mathematics, and Physics, key programs at UW-La Crosse that also align with the university's mission. The proposed program is also responsive to UW-La Crosse's Sustaining Excellence: Advancing Transformational Education strategic plan as it will provide students experiences in high-impact practices such as a capstone experience, undergraduate research, internships, group collaboration, and exposure to real-world applications.

Institutional Program Array

The Computer Engineering program will be developed by, and housed within, the Department of Computer Science. The department has a fifty-year history of offering programs in computer science and software engineering. The current Computer Science undergraduate major combines a strong software design sequence with a broad range of upper-level coursework. The department currently offers a two-year Master of Software

Engineering degree, as well as a five-year track for completing both the B.S. in Computer Science and the Master of Software Engineering degrees.

The department has recently begun offering coursework in embedded systems and the Internet of Things, in part due to interest from local employers. This coursework provides an excellent basis for moving towards a full Computer Engineering program.

Other Programs in the University of Wisconsin System

Among the public universities in Wisconsin, four currently offer a bachelor's-level Computer Engineering program including UW-Madison, UW-Milwaukee, UW-Platteville, and UW-Stout. The UW-La Crosse-proposed Computer Engineering program aligns with these established programs in that the curriculum contains the core elements of a computer engineering program such as calculus, physics, computer programming, circuits, electronics, computer architecture, and digital logic.

UW-La Crosse's Department of Computer Science has a historically strong emphasis in software engineering. The expertise of computer engineers lies at the intersection of hardware and software. Computer engineers weigh trade-offs to determine whether functionality is best implemented in hardware or software, and how the interface between the two should be designed. The curriculum of the proposed Computer Engineering program was designed to precisely meet these needs - the graduates will be equally versed in software development as they will be in hardware design. The proposed curriculum implements this balance in the required courses, while also allowing students to specialize with technical electives. This approach also reflects the employment options available to computer engineers upon graduation. Graduates can expect to fill roles in low-level software development, for example in systems software found in device drivers, firmware, operating systems and virtual machines. Likewise, graduates will be equally prepared for roles in hardware design, including digital circuit design and verification, computer architecture, control systems and signal processing.

Need as Suggested by Current Student Demand

The Computer Science department at UW-La Crosse overall is experiencing extremely strong growth within its programs, with an increase of 82% in undergraduate student enrollment over the past five years. This enrollment trend is being driven by an unprecedented demand for graduates. Within this enrollment growth is an increase in students interested in Computer Engineering. Currently, incoming students to UW-La Crosse can declare their program of interest as the 3+2 Computer Science and Engineering dual degree program with UW-Madison. This program requires that students complete three years at UW-La Crosse, followed by two years at UW-Madison. At UW-La Crosse, students complete a minimum of 86 credits, including general education requirements and specific math and science courses in preparation for the engineering program. Students who pursue the dual degree program may be selected for entrance into the UW-Madison portion of the program based on their GPA in all coursework, their GPA in the chemistry,

computer science, mathematics, and physics coursework required by the program, and the positive recommendation of the UW-La Crosse Computer Science department chair. The dual degree engineering agreement with UW-Madison has additional requirements for eligibility, including Wisconsin resident status and that students must have enrolled in UW-La Crosse from high school (rather than transferring to UW-La Crosse). Admission to UW-Madison is not guaranteed. Upon completion of the 3+2 program, students receive both a Bachelor of Science degree (computer science major) from UW-La Crosse and a Bachelor of Science degree (engineering major) from UW-Madison.

The number of first-year students per year who declared this 3+2 program has increased from 2010 (n=5) to 2017 (n=16), with an average of 15 students declaring this program of study as first-year students in the past four years.[1] This indicates that there is a significant interest in Computer Engineering by students entering UW-La Crosse. However, unlike other dual degree engineering programs between UW-La Crosse and partner institutions, data suggest that students within the dual degree 3+2 Computer Science and Engineering program do not complete this program. Analysis of four years of student cohort data showed that none of the students within the Computer Science and Engineering dual degree program completed the 3+2 program.[2] Of those students who stayed at UW-La Crosse and who subsequently graduated within five years, 64% continued study within the computer science field at UW-La Crosse, with 47% completing a bachelor's degree in Computer Science and 17% completing the Computer Science/Software Engineering dual degree and earning a master's degree in Software Engineering.[1]

The apparent barriers to progress and completion of the current transfer model as well as the increased student demand supports the creation of the proposed Computer Engineering program at UW-La Crosse. The proposed program will provide a cohesive, continuous, and student-centered academic pathway for students to start and complete a Computer Engineering degree at UW-La Crosse.

Need as Suggested by Market Demand

The U.S. Bureau of Labor Statistics projects that the job outlook for computer engineers is expected to grow by 5 percent from 2016 to 2026,[3] and by 10 percent within Wisconsin during this same ten-year time span.[4] A search on September 5, 2019, on Indeed.com, showed 177 full-time jobs for computer engineers, 40 of those within the

[1] University Wisconsin – La Crosse Instructional Research. Data accessed January 25, 2019.
[2] National Student Clearinghouse. (2019). *StudentTracker aggregate report: Analysis of initial transfers for University of Wisconsin – La Crosse (003919-00) submission ID #347650* [Data file]. Retrieved from https://studentclearinghouse.org/
[3] Bureau of Labor Statistics, retrieved from https://www.bls.gov/ooh/architecture-and-engineering/computer-hardware-engineers.htm
[4] CareerOneStop by the U.S. Department of Labor, retrieved from https://www.careeronestop.org/Toolkit/StateAndLocal/ProjectedEmployment.aspx?soccode=172061&location=Wisconsin

Madison area and 99 in the Milwaukee area,[5] with an additional 160 full-time jobs for computer engineers in the Minneapolis, MN area.[6] Beyond market demand, computer hardware engineers have a high earning potential as they are the second highest earning among engineering occupations with a mean annual wage of $114,600.[7] Technological advancement is not only increasing demand for computer engineers but is also expanding the types of systems that are being created. The ability to embed computational power, sensors, and wireless connectivity in small devices has created a whole new range of devices that connect our world. This has significantly changed the range and scale of devices that computer engineers design. Increasingly, companies are forming interdisciplinary teams that blur the boundaries between hardware and software engineers and require new skills from each.

The Computer Science department is seeing increased interest from employers for graduates with experience in embedded systems and hardware design, which are skills developed in a Computer Engineering degree. Both local and national employers have also indicated an interest in Computer Engineering students. These employers include local manufacturers, such as Trane U.S. Inc., a manufacturer and marketer of heating and air ventilation equipment based in La Crosse, start-up companies, and national technology leaders including Apple Inc. In addition, UW-La Crosse anticipates the planned Foxconn manufacturing facility will provide immediate opportunities for Computer Engineering students and will expand the range of technology companies moving to Wisconsin.

[5] Indeed.com. Data accessed September 5, 2019 https://www.indeed.com/jobs?q="computer+engineering"&l=wisconsin&radius=25

[6] Indeed.com. Data accessed September 5, 2019 https://www.indeed.com/jobs?as_and=&as_phr=%22computer+engineering%22&as_any=&as_not=&as_ttl=&as_cmp=&jt=fulltime&st=&as_src=&salary=&radius=25&l=Minneapolis%2C+MN&fromage=any&limit=10&sort=&psf=advsrch

[7] Bureau of Labor Statistics, retrieved from https://www.bls.gov/ooh/architecture-and-engineering/home.htm

University of Wisconsin - La Crosse
Cost and Revenue Projections For Newly Proposed Program: Bachelor of Science in Computer Engineering

	Items	Projections				
		2020	2021	2022	2023	2024
		Year 1	Year 2	Year 3	Year 4	Year 5
I	**Enrollment (New Student) Headcount**	8	13	15	20	20
	Enrollment (Continuing Student) Headcount	2	7	15	23	30
	Enrollment (New Student) FTE	8	13	15	20	20
	Enrollment (Continuing Student) FTE	2	7	15	23	30
II	**Total New Credit Hours**	13	7	10	3	0
	Existing Credit Hours	63	76	83	93	96
III	**FTE of New Faculty/Instructional Staff**	0	0	0	0	0
	FTE of Current Fac/IAS	3	3	3	3	3
	FTE of New Admin Staff	1	0	0	0	0
	FTE Current Admin Staff	0.1	1.1	1.1	1.15	1.15
IV	**Revenues**					
	From Tuition	$60,678	$145,510	$228,357	$380,867	$445,734
	From Fees	$468	$967	$1,585	$2,453	$2,841
	Program Revenue (Grants)					
	Program Revenue - Other					
	GPR (re)allocation					
	Total New Revenue	$61,146	$146,477	$229,942	$383,320	$448,575
V	**Expenses**					
	Salaries plus Fringes					
	Faculty/Instructional Staff					
	Other Staff	$80,640	$82,253	$83,898	$85,576	$87,287
	Other Expenses					
	Facilities					
	Equipment	$60,000	$30,000	$10,000		
	Other (materials and supplies)	$468	$967	$1,585	$2,453	$2,841
	Other (please list)					
	Total Expenses	$141,108	$113,220	$95,483	$88,029	$90,128
VI	**Net Revenue**	-$79,962	$33,257	$134,459	$295,291	$358,446

Submit budget narrative in MS Word Format

Provost's Signature:	**Date:**
	8/26/2019

UNIVERSITY OF WISCONSIN–LA CROSSE
COST AND REVENUE PROJECTIONS NARRATIVE
BACHELOR OF SCIENCE (B.S.) IN COMPUTER ENGINEERING

Introduction

The B.S. in Computer Engineering (CPE) program is designed for full-time students completing primarily face-to-face courses, with all required courses being available in a face-to-face format. The program requirements are comprised of 127 credits including 42 credits in general education program coursework, 11 credits of which satisfy other program requirements. The program curricula for the major includes 33 credits of program prerequisites and support courses and 63 credits in the CPE major. A total of 3.0 faculty FTE will be required to deliver the program.

Section I – Enrollment

Program enrollment projection numbers are based upon anticipated interest by students who will enroll at UW-La Crosse to pursue the program, along with interest from current UW-La Crosse students who are expected to change their major to pursue the CPE program. New student enrollment numbers are based on the current student interest in UW-La Crosse's Computer Science and Engineering dual degree program with UW-Madison. An average of 15 new students enter UW-La Crosse each year declaring this program of study. UW-La Crosse anticipates that many of these students will instead enter UW-La Crosse declaring the stand-alone CPE program. In Year 1, it is expected that eight new students will enroll in the CPE program, along with two current UW-La Crosse students. In Year 2, it is expected that 13 new students will enroll in the program, and in Year 3, it is anticipated that there will be 15 new students, with the number of new students increasing to 20 per year in Years 4-5.

It is anticipated that 72% of the students within the CPE program will continue in the program from freshman to sophomore year. This is based on the current program retention rate for students from freshman to sophomore year in UW-La Crosse's Computer Science program. Additionally, enrollment projections are based on an estimate that 79% of students within the program will continue in the program from sophomore to junior year and 92% from junior to senior year. At the end of Year 3, the first student who switched into the CPE program in Year 1 will graduate from the CPE program. By the end of Year 5, it is expected that 78 students will have enrolled in the CPE program and that 12 students will have graduated with a B.S. in Computer Engineering.

Table 1: Student Enrollment Projections within the CPE Program

	Year 1	Year 2	Year 3	Year 4	Year 5
Freshman	8	13	15	20	20
Sophomore	2	6	9	11	14
Junior		1	5	7	9
Senior			1	5	6
5th Year				0	1
Graduated			1	4	7
Total Headcount	**10**	**20**	**30**	**43**	**50**

Section II – Credit Hours

The proposed B.S. in CPE is a 127-credit major and requires 96 credits in core, elective, and support courses, along with additional courses needed to fulfill UW-La Crosse's general education program. In Year 1, all current science and mathematics courses, totaling 63 credits that are needed to support the CPE program, will be offered. These courses are routinely offered at least once a year to support other science and mathematics programs at UW-La Crosse. During Years 1-4, there will be 13 new CPE core and elective courses, totaling 33 new credit hours, that will be phased into the curriculum. These consist of the addition of eight new core courses, totaling 18 credits, which will be phased into the curriculum during Years 1-3, and five new advanced elective courses, totaling 15 credits, which will be phased into the curriculum during Years 1-4. Additionally, new elective courses may be phased in dependent on student enrollment and demand. All core program courses will typically be delivered at least once each academic year, and supporting science and mathematics classes will typically be offered each semester.

Section III – Faculty and Staff Appointments

Current UW-La Crosse instructional resources will be utilized to deliver the necessary physics, mathematics, and computer science support courses for the proposed CPE program. Delivery of computer engineering courses will be provided by three faculty members within the Computer Science Department. Outcomes-based funding, provided within the 2017-19 UW System biennial budget's new state funding, will be used to specifically support the new CPE program. A new Network Support position will be added in Year 1 to help support the additional technical needs related to this program. Current staff within this existing large department will be sufficient to absorb the additional administration needs.

Section IV - Program Revenues

<u>Tuition Revenues</u>

Tuition revenue assumes that all students will be enrolled full-time during the academic year, and that students at the freshman and sophomore level will pay a tuition rate of $7,584.72 per year and that students in junior status or higher will pay a tuition rate of $8,984.72 per year. The additional $1,400 per year ($700 per

semester) is necessary to support the additional expenses of delivering an engineering program.

In Year 1, it is assumed that eight new students (freshmen) will enroll at the university to pursue computer engineering and that two existing students (sophomores) will move into the program, so the tuition revenue is based on 8 FTE x $7,584.72.

In Year 2, it is assumed that one of the above-mentioned existing students will continue with the program in junior status, six of the eight freshmen will continue to sophomore status, and 13 new students will enroll. Tuition revenue for freshmen and sophomores is based on 19 FTE x $7,584.72. Since the student in junior status was an existing UW-La Crosse student, the tuition revenue only factors in the additional $1,400 specific to that student being enrolled in the computer engineering program.

In Year 3, it is assumed that the one above-mentioned existing UW-La Crosse student will continue to senior status and that there will be a total of 29 students in freshman, sophomore, and junior status. Tuition revenue is therefore based on 24 FTE x $7,584.72, 5 FTE x $8,984.72, and 1 FTE x $1,400.

By Years 4 and 5, it is assumed that all students in the program have enrolled at the university to pursue the CPE major. In Year 4, tuition is based on 31 FTE x $7,584.72 and 12 FTE x $8,984.72. In Year 5, tuition is based on 34 FTE x $7,584.72 and 16 FTE x $8,984.72. It is also anticipated that by Year 4 the program will attract international students. As a result, tuition revenue is calculated based on 10% of total FTE (new and continuing) paying nonresident undergraduate tuition and 90% of total FTE (new and continuing) paying resident undergraduate tuition.

Other Fees

Students within the CPE program will be required to take several courses that have associated special course fees. Freshman-level students will have course fees of $46, sophomore-level students will have course fees of $50, junior-level students will have course fees of $69, and senior-level students will have course fees of $100. In Year 1, it is anticipated that eight students with freshman status and two students with sophomore status will be enrolled in the program. Therefore, course fee revenue of $468 (8 student FTE x $46 per student plus 2 student FTE x $50 per student) will result from this enrollment. In Year 2, the special course fee revenue increases to $967 based on the assumption that 13 students with freshman status, six students with sophomore status, and one student with junior status will be enrolled in the program. The revenue generated from special course fees increases to $1,585 in Year 3, $2,453 in Year 4, and $2,841 in Year 5 based on the enrollment projections shown in Table 1.

Since this is an on-campus program, students will incur segregated fees, but those have been excluded from the tuition revenue since those fees will ultimately go towards supporting traditional student services and/or activities.

Section V – Program Expenses

Expenses – Salary and Fringe

As noted in Section III, the Department of Computer Science was allocated 2.0 faculty FTE through outcomes-based funding in the 2017-19 biennial budget. The program would look to add a Network Support position to help support the additional technical needs related to this program. A 2% annual increase has been applied to the cost of this position, and a 44% fringe rate was used. The fringe rate is based on a current campus average for academic staff classifications. Administrative support will be provided by current staff.

Other Expenses

Equipment expenses include the purchase of laboratory equipment to support the capstone project workspace; computer engineering-specific equipment to support digital signal processing, digital logic, and digital courses; and software licenses for analog circuit simulators and software tools for the engineering-specific equipment. The costs for these needs will be spread over several years as the program increases in size and as new core and electives courses are offered. Other material and supply expenses will primarily be covered by the special course fees as outlined in Section IV.

Section VI – Net Revenue

By Year 5, with a full cohort of 20 new students enrolling each year, it is estimated that the program will generate net revenues of $358,446. These funds will be reinvested at the institution to support new program development, to support student support services that will further strengthen the retention and success of current students, and to offset unforeseen enrollment shortfalls in other programs on campus.

UNIVERSITY of WISCONSIN
LA CROSSE

July 23, 2019

Dr. Ray Cross, President
University of Wisconsin System Administration
1720 Van Hise Hall
1220 Linden Drive
Madison, WI 53706

Dear President Cross,

I am writing to express my support for the University of Wisconsin-La Crosse's proposed Bachelor of Science in Computer Engineering. The Computer Science Department has a 50 year history of offering exceptional programs in computer science and software engineering. The department is experiencing extremely strong growth in students seeking computer science-based degrees, with an 82% increase in undergraduate enrollment over the past five years. Based on feedback from employers and alumni, the department has recently begun offering coursework in embedded systems and the Internet of Things. This new coursework helps provide an excellent basis for development of the Computer Engineering program.

The proposed Bachelor of Science in Computer Engineering program is being developed in response to the 2017-19 UW System biennial budget's new state funding specifically targeted for outcomes-based funding. Under the newly created state law (Wis. Stats. §36.112), the Wisconsin Legislature established several goals for the UW System including expanding contributions to the workforce. A specific metric within this goal is graduates within STEM disciplines. Graduates from the proposed Computer Engineering program will contribute to this specific metric. Outcomes-based funds to UW-La Crosse will be used to specifically develop and support the proposed Computer Engineering program. Furthermore, the program will enhance the existing programs in Computer Science, Mathematics, and Physics. The proposed program is also responsive to UW-La Crosse's mission and strategic plan. UW-La Crosse's strategic plan "Sustaining Excellence" contains a pillar associated with "Advancing Transformational Education" that focuses on providing students experiences in high-impact practices such as a capstone experience, undergraduate research, internships, group collaboration, and exposure to real-world applications. UW-La Crosse's proposed Computer Engineering program has been designed to capitalize on providing students with hands-on experiences. The program also reflects themes from another pillar within the UW-La Crosse strategic plan "Enhancing Community Engagement" as local employers and prospective UW-La Crosse students have both indicated a strong interest in engineering academic programs offered by UW-La Crosse.

There is university-wide support for the Bachelor of Science in Computer Engineering. The program has received approval by the Department of Computer Science, the College of Science and Health, the University Curriculum and Academic Planning committees of the Faculty Senate, and the Chancellor. UW-La Crosse has the necessary financial and human resources in place to implement and sustain the program in the form of a well-established Computer Science department consisting of strong faculty with a long history of improving and refining the curriculum and responding to trends within the field.

UW-La Crosse will seek accreditation by ABET for the Bachelor of Science in Computer Engineering program. The program will also undergo regular program evaluation through both college and university-wide review. These internal reviews will include evaluations by the Dean, Faculty Senate, and the Provost, focusing on program curriculum, assessment of student learning, degree of program success, new initiatives, personnel and program support. Based on the review, recommendations will be generated to facilitate continual program improvement.

Thank you for your consideration.

Sincerely,

Betsy Morgan
UW-La Crosse Provost and Vice Chancellor for Academic Affairs

OFFICE OF THE PROVOST and VICE CHANCELLOR FOR ACADEMIC AFFAIRS
227 Graff Main Hall
1725 State St. | La Crosse, WI 54601 USA

phone 608.785.8042
fax 608.785.8046
www.uwlax.edu

Education Committee **Item E.**
October 10, 2019

NEW PROGRAM AUTHORIZATION (IMPLEMENTATION) BACHELOR OF ARTS AND BACHELOR OF SCIENCE IN DATA SCIENCE, UW-MADISON

REQUESTED ACTION

Adoption of Resolution E., authorizing the implementation of the Bachelor of Arts and the Bachelor of Science in Data Science at UW-Madison.

Resolution E.: That, upon the recommendation of the Chancellor of UW-Madison and the President of the University of Wisconsin System, the Chancellor is authorized to implement the Bachelor of Arts and the Bachelor of Science in Data Science at the University of Wisconsin-Madison.

SUMMARY

The University of Wisconsin-Madison submits this request to establish a Bachelor of Arts and a Bachelor of Science in Data Science.

Program Description

The University of Wisconsin (UW)-Madison proposes a Bachelor of Arts/Bachelor of Science (B.A./B.S.) in Data Science. This program will meet substantial student interest and rapidly increasing data science employment opportunities, which are available across multiple professional fields. Students will develop abilities in computational, mathematical, and statistical thinking combined with knowledge to apply these abilities to data-rich problems across a variety of subject matter disciplines. Graduates will be prepared to think critically about data and to employ methods from computer science, mathematics, and statistics to manage, process, and model data and to gain meaning from data. They will be prepared to conduct data science activities and to use data in responsible and ethical ways. Graduates may seek employment as data analysts and data scientists, or may pursue further education in data science, statistics, applied or computational mathematics, computer science, or related quantitative and computational fields.

Mission

The B.A./B.S. in Data Science will contribute directly to the mission of the UW System by developing students who will "serve and stimulate society" by gaining "scientific, professional and technological expertise, and a sense of purpose." The UW-Madison mission states that students will learn to "discover, examine critically, preserve and transmit the knowledge, wisdom and values," and will "develop an understanding and appreciation for the complex cultural and physical worlds in which they live." The proposed B.A./B.S. in Data Science program supports the institutional mission of UW-Madison by educating students who will develop the knowledge and technical skills to critically examine data in an ethical manner to better understand the world, the environment, and society, and to communicate to others the meaning produced through the full data science process.

Market and Student Demand

Data science is one of the fastest growing areas for jobs in the nation and in Wisconsin. The Occupational Outlook Handbook (OOH) from the Bureau of Labor Statistics shows the national job outlook in the period 2016 to 2026, for Mathematicians and Statisticians to be 33%, which is much faster than average, and for Computer and Information Research Scientists to be 19%, which also is much faster than average. A snapshot of employment listings from March 14, 2019, shows that Data Scientist is the #1 job on the website Glassdoor, with over 27,000 jobs listed nationally; Monster.com lists over 18,000 jobs in data science nationally; and in the state of Wisconsin, Indeed.com has over 270 job listings for data scientists, as well as more than 1,200 jobs for data analysts.

At UW-Madison, the growing demand from students for skills in the quantitative and computing fields is evident from the growth of enrollment in majors such as Computer Sciences, Mathematics, and Statistics. In the past five years, enrollments in these majors have steadily increased. Between 2014 and 2018, undergraduate declared majors in Computer Sciences grew 316% to 1,565 students. Declared majors in Statistics grew 241% to 294 students, and the number of students enrolled in Mathematics grew by 170% to 547 students. The proposed B.A./B.S. in Data Science major will meet the demand from both students and employers and will provide training that prepares students to enter the field.

The assumption is that the new B.A./B.S. in Data Science major will attract students who might have otherwise declared majors in Computer Sciences, Mathematics, or Statistics, but the program is also expected to attract students that might not otherwise have considered majoring in a STEM discipline. Furthermore, many students are anticipated to use the B.A./B.S. in Data Science major to add to and enrich study in an existing major. Enrollments in Computer Sciences and Statistics may decline, but overall enrollments in these majors, plus that of the new B.A./B.S. in Data Science major, are expected to increase.

Credit Load and Tuition

The 120-credit B.A./B.S. degree will include 37 credits in the major, including 19 foundational data science and 18 elective credits. The Data Science major is designed to be completed in four academic years by full-time students. Core courses will be offered on a regular schedule with enrollment priority given to declared majors. Students who choose to pursue the degree part-time, who need additional time to complete the program, or who wish to pursue an accelerated time-to-degree will work with the B.A./B.S. in Data Science major advisor to outline a plan that accounts for individual need and timely progress toward completion of the degree.

Standard tuition and fee rates will apply. For the 2019-20 academic year, residential tuition and segregated fees total $5,362.66 per semester for a full-time student enrolled in 12-18 credits. Of this amount $4,636.68 is attributable to tuition, and $725.98 is attributable to segregated fees. Wisconsin residents enrolled with fewer than 12 credits will pay tuition of $386.39 per credit, segregated fees of $108.66 for the first credit, and $56.12 for each additional credit. Full-time, nonresident undergraduate tuition and segregated fees for the 2019-20 academic year total $18,892.54 per semester. Of this amount, $18,166.56 is attributable to tuition and $725.98 is attributable to segregated fees.

BACKGROUND

This proposal is presented in accord with the procedures outlined in Academic Planning and Program Review (SYS 102, revised July 2016, available at https://www.wisconsin.edu/program-planning/).

Related Policies

- Regent Policy Document 4-12, "Academic Program Planning, Review, and Approval in the University of Wisconsin System"
- UW System Administrative Policy 102: Policy on University of Wisconsin System Array Management: Program Planning, Delivery, Review, and Reporting

ATTACHMENTS

A) Request for Authorization to Implement a Bachelor of Arts and a Bachelor of Science in Data Science at UW-Madison
B) Cost and Revenue Projections
C) Provost's Letter

REQUEST FOR AUTHORIZATION TO IMPLEMENT A BACHELOR OF ARTS AND BACHELOR OF SCIENCE IN DATA SCIENCE AT UNIVERSITY OF WISCONSIN-MADISON PREPARED BY UW-MADISON

ABSTRACT

The University of Wisconsin (UW)-Madison proposes a Bachelor of Arts/Bachelor of Science (B.A./B.S.) in Data Science. This program will meet the substantial student interest and rapidly increasing data science employment opportunities that are available across fields. Students will develop abilities in computational, mathematical, and statistical thinking combined with knowledge to apply these abilities to data-rich problems from a variety of disciplines. Graduates will be prepared to think critically about data and to employ methods from computer science, mathematics, and statistics to manage, process, and model data and to gain meaning from data. They will be prepared to conduct data science activities and to use data in responsible and ethical ways. Graduates may seek employment as data analysts and data scientists, or may pursue further education in data science, statistics, applied or computational mathematics, computer science, or related quantitative and computational fields. The 120-credit B.A./B.S. degree will include 37 credits in the major including 19 foundational data science and 18 elective credits.

PROGRAM IDENTIFICATION

Institution Name
University of Wisconsin-Madison

Title of Proposed Program/Major
Data Science

Degree Designation(s)
Bachelor of Arts and Bachelor of Science

Mode of Delivery
Single institution, face-to-face

Projected Enrollments and Graduates by Year Five

Table 1 represents student enrollment and graduation projections over the first five years of the program. All anticipated enrollments are classified as continuing student headcount and FTE, because enrollments will draw from currently enrolled UW-Madison undergraduates who can choose this major from more than 100 programs. For planning purposes, enrollment projections assume that students will enter the program in their second year, though students may declare the major before then. Strong enrollment is expected in Year 1 based on indications of student demand, and student interest is

anticipated to grow as the program becomes established. By the end of Year 5, it is projected that 930 students will have enrolled in the program, more than 500 will have graduated, and about 150 students will graduate each year. Student retention estimates align with UW-Madison's 95% persistence rate.

Table 1: Five-Year Degree Program Enrollment Projections

Students/Year	2020-21	2021-22	2022-23	2023-24	2024-25
New Students	0	0	0	0	0
Continuing Students	240	393	467	490	499
Total Enrollment	240	393	467	490	499
Graduating Students	0	81	129	141	150

Tuition Structure

For students enrolled in the B.A./B.S. in Data Science, standard tuition and fee rates will apply. For the 2019-20 academic year, residential tuition and segregated fees total $5,362.66 per semester for a full-time student enrolled in 12-18 credits. Of this amount $4,636.68 is attributable to tuition and $725.98 is attributable to segregated fees. Wisconsin residents enrolled with fewer than 12 credits will pay tuition of $386.39 per credit, and segregated fees of $108.66 for the first credit and $56.12 for each additional credit. Full-time nonresident undergraduate tuition and segregated fees for the 2019-20 academic year total $18,892.54 per semester for a full-time student; $18,166.56 is attributable to tuition and $725.98 is attributable to segregated fees.

Department or Functional Equivalent

Department of Statistics

College, School, or Functional Equivalent

College of Letters & Science

Proposed Date of Implementation

Fall 2020

DESCRIPTION OF PROGRAM

Overview of the Program

The B.A./B.S. in Data Science program is designed to provide students with the tools necessary to think critically, to compute efficiently, to model effectively, and to behave ethically with data. Students must complete the UW-Madison general education requirements. In addition to these foundational requirements, Letters & Science students complete B.A. or B.S. degree requirements, including the requirement to complete at least one major and to complete at least 120 credits. The B.A./B.S. in Data Science will require 37 credits to be completed in the major. These credits will be divided between two areas: foundational data science courses (19 credits) and electives (18 credits). As students

complete these requirements, they gain competence in three areas of foundational mathematics: calculus, probability, and linear algebra. Because the computational and critical thinking abilities students acquire are applicable to multiple domains and disciplines, the B.A./B.S. in Data Science is designed as an L&S major that can be completed as a student's sole program of study, or combined with another major in computational, quantitative, and physical science, biological science, social science, or programs in the humanities. Although internships are not a structured part of the curriculum, Data Science students will have access to internships, research with faculty members, and other experiential learning opportunities available broadly to students. For example, Letters & Science has an internship course *Internship in the Liberal Arts and Sciences* (INTER-LS 260) offered online to allow students with such internships or workplace experiences to earn academic credit connected to their work experience.

The Data Science (DS) Program Committee will provide oversight for the B.A./B.S. in Data Science program. This interdisciplinary program committee will be housed in the Department of Statistics, which will provide necessary administrative functions such as student advising, curricular services, and human resources operations for personnel responsible for these functions. The DS Program Committee will be responsible for decisions about curriculum and courses used to meet requirements, assessment of student learning, and academic program review. The committee will be comprised of faculty members appointed by the chair from each of the departments of Computer Sciences, Mathematics, and Statistics, and from the Information School. To ensure good communication with the administrative home for the major, the Department of Statistics may also appoint an additional *ex officio* member to serve as a liaison to the departmental curriculum committee. Up to four additional members may be elected by faculty and academic staff who have taught a course in the program, or who have individually advised or mentored B.A./B.S. in Data Science students within the most recent three years. One or two academic staff advisors will serve on the DS Program Committee as *ex officio* members. The program director will be elected by faculty serving on the committee. The actions and responsibilities of the DS Program Committee will be governed by program bylaws, which are on file with the participating departments and with the College of L&S.

Student Learning Outcomes and Program Objectives

The B.A./B.S. in Data Science integrates computational, mathematical, and statistical thinking about data with areas of application to train students to be knowledgeable and competent with all aspects of the data science process, including data acquisition, management, processing, analysis, and communication, while maintaining an ethical approach to the entire process. Students who complete the program will be prepared for a large variety of jobs in companies and organizations that need employees with data science skills. Furthermore, there are pathways through the B.A./B.S. in Data Science program that can prepare students for graduate work in areas such as applied and computational mathematics, bioinformatics, biostatistics, computer science, statistics, and other related fields.

The learning objectives for students in the proposed B.A./B.S. in Data Science major are consistent with recommendations by the National Academies of Science, Engineering, and Medicine.[1] Students who successfully complete the B.A./B.S. in Data Science program will:

1. integrate foundational concepts and tools from mathematics, computer science, and statistics to solve data science problems;
2. demonstrate competencies with tools and processes necessary for data management and reproducibility;
3. produce meaning from data employing modeling strategies;
4. demonstrate critical thinking related to data science concepts and methods;
5. conduct data science activities aware of and according to policy, privacy, security and ethical considerations; and
6. demonstrate oral, written, and visual communication skills related to data science.

Program Requirements and Curriculum

There are no specific courses or test scores that must be completed before students can be admitted to this program. Students may enroll in the major upon admission to the university as a new freshman, or as a transfer student, or they may declare the major any time prior to completing 86 credits of undergraduate study (senior status). The two 200-level required foundational data science courses are open to all students who have satisfied the Quantitative Reasoning (QR)-A General Education Requirement (GER). Students will be informed about the major through an entry in the undergraduate *Guide*, new student advising at SOAR, and participation in campus-wide recruitment activities such as UW Visit Day and the majors fair. To reach current UW-Madison students who may have an interest in the major, advisors in the program will coordinate with advisors in L&S Academic Advising Services and Cross College Advising Service, and will share information with advising units outside L&S.

Table 2 illustrates the curriculum for the proposed program. Major requirements are completed in the context of the university-wide GER and the College of Letters & Science (L&S) specific baccalaureate degree requirements. Within this L&S context, courses taken in the major may also be used to meet these general degree requirements. Consistent with other L&S majors, the major governs no more than 60 of the minimum 120 credits required for a B.A. or B.S. degree. This format is intended to allow students to pursue breadth of study across the *ways of knowing* essential to undergraduate study in the arts and sciences. Additional residence and quality of work requirements apply to the major. Fifteen (15) credits in major courses must be taken on the UW-Madison campus. In addition, students must maintain a 2.000 GPA in all major courses and a 2.000 GPA on at

[1] Envisioning the Data Science Discipline: The Undergraduate Perspective, Interim Report.

least 15 upper-level credits in the major. LIS 461 and any course taken Beyond the Core (see Table 2) are considered upper-level courses.

The curriculum includes five foundational data science courses including a two-course data modeling sequence taught in the Department of Statistics (STAT 240 and STAT 340), a two-course data programming sequence taught in the Department of Computer Sciences (COMP SCI 220 and COMP SCI 320), and a data ethics course taught in the Information School (LIS 461). The 18 elective credits must include a course in machine learning, a course in advanced computing, a course in advanced modeling, and a course in linear algebra. It is possible for a single course to satisfy two of these elective category requirements. Calculus (MATH 221 and MATH 222) are requisites to every set of courses that satisfy the major requirements and MATH 234 is a requisite to most, but not all, linear algebra elective courses.

Table 2: B.A. or B.S. in Data Science Program Curriculum

UNIVERSITY GENERAL EDUCATION REQUIREMENTS (GER)	**22-30 credits**
Humanities/Literature/Arts, 6 cr., Natural Science, 4-6 cr., Social Studies, 3 cr.; Communication Part A & Part B, 3-6 cr.; Ethnic Studies, 3 cr.; Quantitative Reasoning Part A & Part B, 3-6 cr.	
L&S B.A. / B.S. BREADTH AND DEGREE REQUIREMENTS	**39 credits**
MATHEMATICS: Met either by GER QRA and QRB (BA), or by two additional 3+ cr. courses of intermediate/advanced level MATH, COMP SCI, or STAT courses (BS).	
WORLD LANGUAGE: Met by completion of the 4th unit of a foreign language OR by completion of the 3rd unit of a foreign language and the 2nd unit of an additional foreign language (for BA); OR by completion of the 3rd unit of a foreign language (BS).	
L&S BREADTH: Humanities, 12 cr.; Social Sciences, 12 cr.; Natural Sciences, 12 cr.	
ADDITIONAL CREDITS TO MEET THE 120 CR. DEGREE REQUIREMENT	**2-18 credits**
DATA SCIENCE MAJOR REQUISITE MATHEMATICS COURSES	**4-12 credits**
Calculus I: MATH 221 (included as part of GER QR-B, discussed above)	4 credits
Calculus II: MATH 222, requisite for all linear algebra courses	4 credits
Calculus III: MATH 234, requisite for many linear algebra courses	0-4 credits

DATA SCIENCE MAJOR REQUIREMENTS	**37 credits**
Core: Data Science Foundations (19 credits)	
STAT 240 Introduction to Data Modeling I	4 credits
STAT 340 Introduction to Data Modeling II	4 credits
COMP SCI 220 Data Programming I	4 credits
COMP SCI 320 Data Programming II	4 credits
LIS 461 Data & Algorithms: Ethics & Law	3 credits
Beyond the Core: Data Science Applications (18 credits)	
<u>Machine Learning:</u> ECE COMP SCI ME 532 Matrix methods in machine learning *or* COMP SCI 539 Intro to Neural Networks *or* COMP SCI 540 Introduction to Artificial Intelligence	3 credits
<u>Advanced Computing:</u> COMP SCI 400 Programming III *or* COMP SCI 412 Introduction to Numerical Methods *or* STAT COMP SCI 471 Introduction to Computational Statistics *or* MATH COMP SCI 513 Numerical Linear Algebra *or* COMP SCI MATH 514 Numerical Analysis *or* COMP SCI E C E I SY E 524 Introduction to Optimization *or* COMP SCI 564 Database Management Systems: Design and Implementation	3 credits
<u>Statistical Modeling:</u> STAT MATH 309 Introduction to Probability and Mathematical Statistics I *or* STAT MATH 310 Introduction to Probability and Mathematical Statistics II *or* STAT 311 Introduction to Theory and Methods of Mathematical Statistics I *or* STAT 312 Introduction to Theory and Methods of Mathematical Statistics II *or* STAT 349 Introduction to Time Series *or* STAT 351 Introductory Nonparametric Statistics *or* STAT 421 Applied Categorical Data Analysis *or* STAT ME 424 Statistical Experimental Design *or* MATH 431 Introduction to the Theory of Probability *or* STAT 456 Applied Multivariate Analysis *or* STAT 461 Financial Statistics *or* MATH 531 Probability Theory *or* MATH 632 Introduction to Stochastic Processes *or* MATH 635 An Introduction to Brownian Motion and Stochastic Calculus	3 credits
<u>Linear Algebra:</u> MATH 320 Linear Algebra and Differential Equations *or* MATH 340 Elementary Matrix and Linear Algebra *or* MATH 341 Linear Algebra *or* MATH 375 Topics in Multi-Variable Calculus and Linear Algebra *or* E C E COMP SCI M E 532 Matrix methods in machine learning (Note that E C E COMP SCI M E 532 may count for both machine learning and linear algebra electives requirements.)	0-3 credits

Electives in the Major: Any course over and above what is required above, plus any of: E C E 203 Signals, Information, and Computation *or* I SY E 323 Operations Research-Deterministic Modeling *or* I SY E 412 Fundamentals of Industrial Data Analytics *or* COMP SCI I SY E MATH 425 Introduction to Combinatorial Optimization *or* I SY E 512 Inspection, Quality Control, and Reliability *or* COMP SCI I SY E MATH STAT 525 Linear Programming Methods *or* COMP SCI E C E 533 Image Processing *or* COMP SCI 559 Computer Graphics *or* COMP SCI B M I 567 Medical Image Analysis *or* I SY E 575 Introduction to Quality Engineering *or* COMP SCI B M I 576 Introduction to Bioinformatics *or* COMP SCI 577 Introduction to Algorithms *or* I SY E 612 Information Sensing and Analysis for Manufacturing Processes	6-9 credits
DEGREE TOTAL	**120 credits**

Assessment of Outcomes and Objectives

The assessment strategy for this program will rely on evidence provided by student work that is drawn from foundational and elective course assignments with direct relevance to learning objectives. Post-degree outcomes and attainment of career and academic objectives will also be surveyed. During implementation, the program committee will monitor course access and capacity to meet student demand. These data will inform program, course and instructional design. Appendix A includes a table of assessment routines relative to specific student learning outcomes. Data collection for the annual review will be orchestrated by the DS program chair with support from the DS program committee and Statistics faculty and staff. Data collection for the annual review will include (a) a review of key assignments from the foundational B.A./B.S. in Data Science courses and selected elective courses using a rubric designed around the program learning goals, (b) a review of student evaluations of teaching for the most recent academic year, (c) an annual graduating student survey, and (d) a periodic comprehensive alumni survey.

In consultation with the DS program committee, the chair will prepare an annual report including data summaries and recommendations for program improvement. An abbreviated report will be provided to the Office of the Provost, in accordance with UW-Madison institutional guidelines on student learning assessment.[2] Committee members will serve as liaisons to the participating departments in reviewing and implementing recommended changes to the program. Assessment reports will contribute to the more extensive reviews of program outcomes that will occur after five years and then at 10-year (maximum) intervals, as part of the Academic Program Review Process.

[2] See https://assessment.provost.wisc.edu/institutional-plan-for-assessing-student-learning/

Diversity

Science, Technology, Engineering and Mathematics (STEM) fields, such as Data Science, have historically been and are currently lacking in representation of underserved populations. This includes both ethnic minorities and women. Table 4 shows the number of students who graduated in the spring semesters of 2016, 2017, and 2018, from undergraduate statistics, computer sciences, and mathematics majors, and illustrates the percentage of graduates who were women or from an underrepresented minority group (URM).[3]

Table 4: Diversity of Graduates in majors related to Data Science

Major	Total	URM %	Female %
Statistics	112	8.9%	50.0%
Computer Sciences	676	13.0%	14.4%
Mathematics	438	8.2%	34.3%

Increasing representation of women and students from URM groups in the B.A./B.S. in Data Science major will be important. The B.A./B.S. in Data Science major plans to partner with several existing programs on campus to move this initiative forward. These include: (1) working directly with programs through UW-Madison's Division of Diversity, Equity, and Educational Achievement (DDEEA) to make students aware of the major and discuss ways to make the major an inviting program for students; (2) encouraging and reaching out to students participating in Wisconsin Emerging Scholars (WES) both through mathematics and computer sciences; (3) offering STAT 240 and COMP SCI 220 in a summer program specifically oriented for students from URM groups; (4) working with units like the Center for Academic Excellence (CAE) and other programs that focus on student success for diverse groups of students; and (5) outreach to Wisconsin high schools with high underrepresented minority populations about opportunities in data science at UW-Madison.

It is expected that the sequencing of courses and prerequisites may attract students who might otherwise be disinclined to pursue a STEM major to explore the field. The first- and second-year B.A./B.S. in Data Science courses have only QR-A prerequisites (similar to College Algebra) and can be taken prior to calculus. Through these early B.A./B.S. in Data Science courses, students will be given the opportunity to begin developing practical skills in data analysis and discovery with minimal background and, in the process, may be motivated to pursue the necessary requirements to advance further in data science. Students who need assistance to build skills in calculus will have access to college-supported tutorial programs and other resources.

[3] Information taken from https://registrar.wiscweb.wisc.edu/wp-content/uploads/sites/36/2017/09/report-degree-diversity-major-fiscalyear-term.pdf

Issues regarding diversity and inclusiveness will be addressed within the curriculum. A growing concern about the field of data science is ethical practices in data science and the ethical use of data. Some of these concerns can relate to issues such as low samples of certain populations or human biases appearing in machine learning applications. The requirement of LIS 461 will encourage open discussions around these and other complex social issues.

Faculty recruitment into this program will follow campus recommendations for ensuring diverse pools from which qualified candidates are selected. Per College of Letters & Science policy, search committee chairs participate in training sponsored by the Women in Science and Engineering Leadership Institute (WISELI). WISELI is a national leader in higher education, conducting research and education concerning evidence-based practices for conducting searches in an environment that understands and minimizes implicit bias. The College also participates in, and benefits from, campus-wide faculty diversity initiatives, including *Target of Opportunity* hiring programs that encourage departments to be strategic in seeking out promising new faculty. Other campus programs will support faculty diversity, develop the recruitment pipeline as well as provide salary and other supplemental support to encourage hiring a diverse faculty, and support faculty research and teaching in areas related to diversity and inclusion. Finally, because the program is designed to leverage the interests of students across many disciplines where the acquisition, analysis, and responsible stewardship of data are increasingly important, the program and steering committees are expected to be inclusive of the diversity of disciplinary thought that is made available through these connections, and will be inclusive of the diverse array of faculty in those disciplines.

Collaborative Nature of the Program

The B.A./B.S. in Data Science major will be a collaboration among four UW-Madison departments – Statistics, Mathematics, Computer Sciences, and the Information School. This program will not involve collaboration with other UW System institutions.

Projected Time to Degree

The B.A./B.S. in Data Science major is designed to be completed in four academic years by full-time students. The B.A./B.S. in Data Science core courses will be offered on a regular schedule with enrollment priority given to declared majors. The B.A./B.S. in Data Science major, as required by all L&S majors, will have an example of a four-year plan available in the *Guide*. Students who choose to pursue the degree part-time, who need additional time to complete the program, or who wish to pursue an accelerated time-to-degree will work with the B.A./B.S. in Data Science major advisor to outline a plan that accounts for individual need and timely progress toward completion of the degree.

Program Review

Consideration of assessment information will be initiated by the DS program committee chair annually, with assistance from the committee. This work will be

incorporated into program reviews that are conducted every 10 years. Like other new programs, the B.A./B.S. in Data Science major will undergo an initial, formal program review (chaired by a member of UW-Madison's University Academic Planning Council) approximately five years after the implementation date (i.e., during the 2025-26 academic year), followed by regular reviews initiated by the dean to be conducted at 10-year intervals. These regular program reviews will follow UW-Madison's Academic Program Review Guidelines, which include the preparation of a self-study by program faculty, a site visit by a review committee comprised of university faculty and (optionally) outside experts, and a written report from the review team with recommendations to be shared with the dean and with program faculty. Like the annual review, the committee will take the lead in addressing recommendations arising from these periodic formal reviews and will act as liaisons to the participating department chairs, as needed, to implement changes to program policies and practices.

Accreditation

There are no special accreditation requirements for this program.

JUSTIFICATION

Rationale and Relation to Mission

The B.A./B.S. in Data Science will contribute directly to the mission of the UW System[4] by developing students who will "serve and stimulate society" by gaining "scientific, professional and technological expertise, and a sense of purpose." The UW-Madison mission[5] states that students will learn to "discover, examine critically, preserve and transmit the knowledge, wisdom and values" and will "develop an understanding and appreciation for the complex cultural and physical worlds in which they live." The proposed B.A./B.S. in Data Science program supports the institutional mission of UW-Madison by educating students who will develop the knowledge and technical skills to critically examine data in an ethical manner to better understand the world, the environment, and society, and to communicate to others the meaning produced through the full data science process.

Additionally, the B.A./B.S. in Data Science major speaks directly to a number of points in the UW-Madison Chancellor's Strategic Framework 2015-2019,[6] including the goals to "promote the application of research and teaching to issues of importance for the state, the nation, and the world," "place learning and discovery in the service of political, economic, social, and cultural progress," "leverage our distinctive interdisciplinary strength to address complex problems in the state and the world," and "scale Wisconsin Experience opportunities through innovative classroom environments and active learning, locally and

[4] https://www.wisconsin.edu/about-the-uw-system/#missions

[5] https://www.wisc.edu/about/mission/

[6] https://chancellor.wisc.edu/strategicplan2/

globally, to prepare students for successful careers and lives." By its very nature, the field of data science is one that teaches novel and cutting-edge ways to engage in the "continual sifting and winnowing by which alone the truth can be found."[7]

Institutional Program Array

At UW-Madison, the undergraduate major programs most closely aligned with the proposed B.A./B.S. in Data Science are Computer Sciences and Statistics. However, neither major requires the combination of courses across the full range of topics that a data scientist should learn. Several other major research universities, including UC Berkeley, Michigan, Purdue, and Penn State, have added undergraduate majors in data science.

The Department of Statistics will serve as the home of the B.A./B.S. in Data Science major, but the DS program committee membership will represent multiple departments and takes responsibility for offering a high-quality program. The B.A./B.S. in Data Science major will leverage existing campus coursework and faculty expertise in foundational and advanced mathematics. New foundational data science courses have been developed within Computer Sciences, the Information School, and Statistics. These departments, as well as the Department of Mathematics, are working to develop additional elective courses to add to the array of options. Additional upper-level electives will come from a wider range of departments including Electrical and Computer Engineering, and Industrial and Systems Engineering to start. Because this is a rapidly developing field, the curriculum will evolve, and suitable new courses will be added to the curriculum as they become available.

Other Programs in the University of Wisconsin System

Within the UW System, UW-River Falls has an undergraduate program in Data Science and UW-Stevens Point has an undergraduate program in Data Analytics. UW-Platteville has recently circulated a Notice of Intent to offer an undergraduate major in Data Science. With the intense demand and interest in data science and the employment opportunities for graduates, the creation of multiple new data science and related undergraduate programs across the UW System, tailored for the specific needs of students at each institution, is warranted. Given the broad applicability of the program curricular content and student learning to multiple disciplines, fields, and industries, students may choose to complete the major as a sole program of study or combine the major with another major.

Need as Suggested by Current Student Demand

Demand for a major and expertise in the B.A./B.S. in Data Science is very high. For example, in Fall 2018, when UC Berkeley launched a new major in data science, 780 students enrolled in the first year of the program.[8] At UW-Madison, the growing demand from students for skills in the quantitative and computing fields is evident from the growth

[7] https://kb.wisc.edu/page.php?id=10452

[8] https://data.berkeley.edu/news/uc-berkeleys-data-science-major-takes

of enrollment in majors such as Computer Sciences, Mathematics, and Statistics. In the past five years, enrollments in these majors have steadily increased.[9] Between 2014 and 2018, undergraduate declared majors in Computer Sciences grew 316% to 1,565 students. Declared majors in Statistics grew 241% to 294 students, and the number of students enrolled in Mathematics grew by 170% to 547 students. The proposed B.A./B.S. in Data Science major will meet the demand from both students and employers and will provide training that prepares students to enter the field.

The assumption is that the new B.A./B.S. in Data Science major will attract students who might have otherwise declared majors in Computer Sciences, Mathematics, or Statistics, but the program is also expected to attract students that might not otherwise have considered majoring in a STEM discipline. Furthermore, many students are anticipated to use the B.A./B.S. in Data Science major to add to and enrich study in an existing major. Enrollments in Computer Sciences and Statistics may decline, but overall enrollments in these majors, plus that of the new B.A./B.S. in Data Science major, are expected to increase.

Need as Suggested by Market Demand

Data science is one of the fastest growing areas for jobs in the nation and in Wisconsin. A snapshot of job listings from March 14, 2019, shows that Data Scientist is the #1 job on the website Glassdoor,[10] with over 27,000 jobs[11] listed. Monster.com[12] lists over 18,000 jobs in data science nationally. Indeed.com has over 270 job listings for data scientists[13] and over 1,200 jobs for data analysts,[14] just in the state of Wisconsin. Additionally, the Occupational Outlook Handbook (OOH) from the Bureau of Labor Statistics shows the job outlook in the period 2016 to 2026, for Mathematicians and Statisticians to be 33% (much faster than average)[15] and for Computer and Information Research Scientists to be 19% (much faster than average).[16] There is no specific category titled Data Scientist in the OOH.

[9] https://dataviz.wisc.edu/views/TrendsinStudentEnrollments/Degree-MajorEnrollmentComparison
[10] https://www.glassdoor.com/List/Best-Jobs-in-America-LST_KQ0,20.htm
[11] https://www.glassdoor.com/Job/data-scientist-jobs-SRCH_KO0,14.htm
[12] https://www.monster.com/jobs/search/?q=data-scientist
[13] https://www.indeed.com/jobs?q=data+scientist&l=Wisconsin
[14] https://www.indeed.com/jobs?q=data+analyst&l=Wisconsin
[15] https://www.bls.gov/ooh/math/mathematicians-and-statisticians.htm
[16] https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm

Appendix A: B.A./B.S. in Data Science Assessment Plan

Learning Outcome	**Method for Assessing Learning** *(direct methods are italicized)*	**Activity Timetable**
Goal 1: integrate foundational concepts and tools from mathematics, computer science, and statistics to solve data science problems	-course material review -*evaluation of student work*	every 3 years every 3 years
Goal 2: demonstrate competencies with tools and processes necessary for data management and reproducibility	-course material review -*evaluation of student work* -job continuing education placement data -graduating student survey -comprehensive alumni survey	every 3 years every 3 years yearly yearly every 5 years
Goal 3: produce meaning from data employing modeling strategies	-course material review -*evaluation of student work*	every 3 years every 3 years
Goal 4: demonstrate critical thinking related to data science concepts and methods	-course material review -*evaluation of student work*	every 3 years every 3 years
Goal 5: conduct data science activities aware of and according to policy, privacy, security and ethical considerations	-*evaluation of student work* -graduating student survey	every 3 years yearly
Goal 6: demonstrate oral, written and visual communication skills related to data science	-*evaluation of student work*	every 3 years

University of Wisconsin - Madison
Cost and Revenue Projections For BA/BS Data Science

	Items	Projections				
		2019-20	2020-21	2021-22	2022-23	2023-24
		Year 1	Year 2	Year 3	Year 4	Year 5
I	**Enrollment (New Student) Headcount**	0	0	0	0	0
	Enrollment (Continuing Student) Headcount	240	393	467	490	499
	Enrollment (New Student) FTE	0	0	0	0	0
	Enrollment (Continuing Student) FTE	240	393	467	490	499
II	**Total Credit Hours in DS major courses**	2960	4847	5760	6043	6154
III	**FTE of Faculty**	3.00	4.50	5.00	5.50	5.50
	FTE of Instructional Staff	1.50	2.00	2.50	2.50	2.50
	FTE of Advisors	1.00	1.50	1.50	1.50	1.50
	FTE of Administrative Staff	1.00	1.00	1.00	1.00	1.00
	FTE of Teaching Assistants	4.00	6.50	7.50	8.00	8.00
IV	**Revenues**					
	From Tuition (DS credit hours x $386.39/credit)	$1,143,714	$1,872,832	$2,225,478	$2,335,084	$2,377,973
	From Fees	$0	$0	$0	$0	$0
	GPR Reallocation	$60,291	-$50,665	-$125,841	-$51,493	-$49,007
	Total Revenue	$1,204,005	$1,822,167	$2,099,637	$2,283,591	$2,328,966
V	**Expenses**					
	Salaries plus Fringes					
	Faculty	$450,000	$688,500	$780,300	$875,497	$893,007
	Instructional Staff	$112,500	$153,000	$195,075	$198,977	$202,956
	Advisors and Administrative Staff	$100,000	$127,500	$130,050	$132,651	$135,304
	Teaching Assistants	$176,000	$291,720	$343,332	$373,545	$381,016
	Fringe benefits - est at 33% applied to all salaries	$276,705	$416,038	$478,090	$521,621	$532,053
	Other Expenses					
	Instructional Supplies and expenses	$88,800	$145,410	$172,790	$181,300	$184,630
	Total Expenses	$1,204,005	$1,822,168	$2,099,637	$2,283,590	$2,328,966
VI	**Net Revenue**	$0	$0	$0	$0	$0

Submit budget narrative in MS Word Format

Provost's Signature: Jamer Henderson **Date:** **7/22/2019**

UNIVERSITY OF WISCONSIN-MADISON
COST AND REVENUE PROJECTIONS NARRATIVE
BACHELOR OF ARTS / BACHELOR OF SCIENCE IN DATA SCIENCE

Introduction

The proposed Bachelor of Arts / Bachelor of Science (B.A./B.S.) in Data Science will be comprised of 120 credits, with 37 credits specifically in the major. All the courses are currently offered at UW-Madison. By 2024-25, the fifth year of the program, enrollment is expected to be approximately 500 full-time students.

The costs and revenues of the proposed program will be managed as part of the UW-Madison instructional/tuition pool (Fund 101), rather than a non-pooled, program revenue-based offering. All tuition revenues collected from students enrolled in this program will be pooled at the institution-level. Tuition revenues will be allocated from the fund to the College of Letters & Science to support the faculty and staff for instructional, advising, and administration within the regular budget allocation process. As the program grows, the College will allocate funding from these revenues to the departments as appropriate to support this program.

Section I – Enrollment

All anticipated enrollments are classified as continuing student headcount and FTE, because student enrollments in the major will draw from currently enrolled UW-Madison undergraduates. Undergraduates who are enrolled at UW-Madison will elect to pursue the proposed major in Data Science as a choice among UW-Madison's more than 100 undergraduate programs. For planning purposes, assumptions include the expectation that all students enter the program as sophomores, except for 90 juniors in the initial year (2020-21), reflecting pent-up demand for the program. In addition, projections assume a 95% persistence rate from year to year, corresponding to the overall persistence rate at UW-Madison. This projection implies that 930 students will enter the major and 501 students will graduate over the first five years. This is a conservative estimate to support planning, and enrollments may be higher.

Section II – Credit Hours

All courses for this major are currently offered at UW-Madison. Program enrollment is projected to be high, enrolling about 499 students out of approximately 30,000 undergraduate students. The major curriculum consists of core and elective credits offered by the collaborating departments and the College of Letters & Science, totaling 37 credits. For the purposes of the credit-hour estimate, students are assumed to enroll in the major in their second year and complete the required credits over the following three years. Projections make a simplifying assumption that students will enroll in and distribute these credits evenly over their 2nd, 3rd, and 4th years of study. Therefore, the total number of credits attributed specifically to the majors each year is estimated to be the number of enrolled students x 37 / 3 years. By the fourth year of the program, as enrollment grows,

the total number of credits attributed specifically to the major is projected at 6,154 student credit hours.

Section III – Faculty and Staff Appointments

The major in Data Science is projected to reach peak enrollment in 2024-25, in the fifth year of implementation. There is current capacity for the program because the new Data Science major is expected to draw students who would otherwise have majored in Computer Sciences, Statistics, or Mathematics. For planning purposes, it is assumed that all instructional personnel will be redirected from their current teaching assignments in those departments. Projected FTEs reflect the current ratios of credit hours to FTEs in these departments, and projected expenses reflect the average salaries in those departments. Projections include allocation of advising resources to support the major. To the extent that the new major increases (rather than merely displaces) enrollments in the participating departments, the College of Letters & Science will reallocate budget from other departments to those departments participating in the new major.

Section IV – Program Revenues

The major in Data Science will draw on the existing pool of UW-Madison undergraduates and will not directly generate new program revenues for the institution. No additional funding specifically for this program will be provided to the College of Letters & Science; however, budget allocation may be somewhat influenced by the enrollment and student credit-hour formula followed by UW-Madison's academic year budget model.

For the purposes of illustrating the amount of tuition revenue that may be attributable to students enrolled in the proposed program, the revenue projections include a simple estimate of revenues based on estimated student major credit hours taken annually at $386.39 per credit tuition (excluding segregated fees). The per-credit tuition estimate was based on the 2018-19 Wisconsin resident undergraduate rate. The estimate does not account for tuition collected for credits taken above the credit plateau, credits taken outside of the major requirements, or tuition based on nonresident tuition rates.

Section V – Program Expenses

Salary estimates are based on current salary schedules and anticipate a 2% increase each fiscal year. Fringe is calculated at 33% for all positions. Salary and fringe expenses also include those attributable to current FTE faculty appointments noted in Section III. No new additional expenses will be incurred to implement the new major. Promotion and marketing will be incorporated into the general promotional materials (i.e., website; brochures) prepared for all majors. Because the program uses existing courses, most of the costs already exist. To support renewal and growth, the budget format estimates $30 per year per student credit hour in additional instructional supplies and expenses.

The GPR reallocation line is included to illustrate that the tuition revenues from enrolled students will be insufficient to cover estimated costs in Year 1. Beginning in Year 2,

the negative values indicate that tuition revenue will contribute to more general academic costs that are funded from the GPR pool such as general education instruction, advising and so on.

Section VI – Net Revenue

The major in Data Science will be revenue-neutral. The cost and revenue projections illustrated in this authorization show a negative net revenue in early years and a positive net revenue by Year 3 of the program. Actual tuition revenues collected from students enrolled in this program will be pooled at the institution-level. Student instruction and support will be funded from the Fund 101 instructional/tuition pool. Students enrolled in the major will partake of a range of courses and student services across campus beyond the 37 credits of instruction and direct advising allocated in this budget.

WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

Date: July 22, 2019

To: Karen Schmitt, Interim Vice President for Academic and Student Affairs
University of Wisconsin System
Via email: apei@uwsa.edu

From: James Henderson, Interim Provost and Vice Chancellor for Academic Affairs

RE: Authorization Proposal: BA/BS in Data Science

In keeping with UW System and Board of Regent Policy, I am sending you a proposal for a BA/BS in Data Science at the University of Wisconsin–Madison.

The program will continue to meet UW–Madison's definition and standards of quality and to make a meaningful contribution to the institution's overall academic plan and program array. Students will be required to meet all the requirements and standards for a bachelor's degree at UW–Madison.

In keeping with UW–Madison policy, this program proposal has been endorsed by the faculty of the offering departments. The dean and the academic planning council of the College of Letters & Science have approved the proposal and support this program. The proposal has been approved by the University Academic Planning Council. I send you this proposal with wide support.

The program faculty have established a robust plan for curriculum delivery, student support, assessment of student learning, and program review. The College of Letters & Science is committed to the necessary financial and human resources required to continue the program. Assuming Board of Regent approval, the faculty plan to implement the new program in Fall 2020.

We are requesting that this proposal be scheduled for consideration at the October 10-11 Board of Regents meeting. The proposal, budget and a budget narrative are attached. Please contact Jocelyn Milner (jocelyn.milner@wisc.edu) with any questions about these materials.

Attachments – Authorization Proposal
Budget Narrative
Budget Spreadsheet

Copies:
Rebecca Blank, Chancellor, UW-Madison
Carleen Vande Zande, Associate Vice President of Academic Programs and Educational Innovation
Diane Treis Rusk, Director of Undergraduate Education, UW System Administration
Karl Scholz, Dean, College of Letters & Science
Gloria Mari-Beffa, Associate Dean, College of Letters & Science
Elaine Klein, Associate Dean, College of Letters & Science
Jocelyn Milner, Vice Provost, Academic Planning and Institutional Research
Laurent Heller, Vice Chancellor for Finance and Administration
Jennifer Klippel, Madison Budget Office

Office of the Provost and Vice Chancellor for Academic Affairs
150 Bascom Hall University of Wisconsin-Madison 500 Lincoln Drive Madison, Wisconsin 53706
608/262-1304 Fax: 608/265-3324 E-mail: provost@provost.wisc.edu www.provost.wisc.edu

Education Committee **Item F.**
October 10, 2019

NEW PROGRAM AUTHORIZATION (IMPLEMENTATION) BACHELOR OF BUSINESS ADMINISTRATION IN BUSINESS ANALYTICS, UW-WHITEWATER

REQUESTED ACTION

Adoption of Resolution F., authorizing the implementation of the Bachelor of Business Administration in Business Analytics at UW-Whitewater.

Resolution F.: That, upon the recommendation of the Chancellor of UW-Whitewater and the President of the University of Wisconsin System, the Chancellor is authorized to implement the Bachelor of Business Administration in Business Analytics at the University of Wisconsin-Whitewater.

SUMMARY

The University of Wisconsin-Whitewater submits this request to establish a Bachelor of Business Administration in Business Analytics.

Program Description

The University of Wisconsin (UW)-Whitewater proposes to establish a Bachelor of Business Administration (B.B.A.) degree in Business Analytics. This multi-disciplinary degree program responds to regional and national demand for more college graduates with talent in business analytics, and in transforming raw business data into actionable business solutions.

The new Business Analytics major will include a multi-disciplinary sequence of courses that cover the full range of topics in business analytics, as well as elective courses from various programs in the College of Business and Economics. Coursework will address a full range of topics in business analytics, including organizing, cleaning and transforming data; the role of data in decision making; limitations in handling data; basic business analytical tools and algorithms; and an examination of non-structured data analytics methods. The program also will include elective courses in business analytics from various programs in the College of Business and Economics, such as marketing and economics.

The UW-Whitewater faculty who currently offer Business Analytics courses have active research agendas that frequently involve undergraduate students, so this new degree program will support and expand undergraduate research opportunities. The program also will provide new opportunities for students to engage with local businesses and the community through experiential learning, including internships, business-oriented projects, and community-based learning.

Mission

The new B.B.A. in Business Analytics will contribute to UW-Whitewater's mission to offer high-quality undergraduate degree programs and prepare students from all backgrounds for successful careers. The new program supports UW-Whitewater's core values by supporting students' personal and professional development as they master the foundations of Business Analytics. Specifically, the program supports Goal 2, Objective 1 of the UW-Whitewater 2017-2022 Strategic Plan, which presents the charge to transform lives and impact society.

The program also is aligned with the current UW-Whitewater Academic plan. In particular, the program supports Goal 1 to "[d]evelop programs to meet the growing needs and changing demographics of the region," Goal 4 to "[p]rovide professional and graduate programs that offer students the opportunity to develop into professional leaders within specific fields of expertise," and the Anticipated Academic Growth Areas which include applied professional programs. Support for this program has been expressed by internal stakeholders, including the Dean of the UW-Whitewater College of Business and Economics as well as the UW-Whitewater IT Advisory Board.

Market and Student Demand

Significant occupational growth is projected in job areas related to business analytics. According to the Bureau of Labor Statistics (BLS) latest Occupational Outlook Handbook, nationally between 2018 and 2028, growth is expected in three related occupations: Operational Research Analysists (26%), Market Research Analysists (20%) and Management Analysts (14%). In Wisconsin, for the period 2014 to 2024, comparable growth is anticipated in these same job categories. Operational Research Analysists openings are expected to grow by 33.0%, Market Research Analysists openings by 19.0%, and Management Analysts openings by 14.2%.

Moreover, based upon a labor market analysis that was completed by Emsi, a data and impact analysis firm, there exist strong job growth projections for these occupational areas. Emsi utilized a Q1 2019 data set of Wisconsin job postings from various sources with keywords relevant to the occupation titles alongside state data from the Wisconsin Department of Workforce Development and the Bureau of Workforce Information. The

Emsi analysis found that there were 6,059 unique job postings relevant to business analytics occupation titles from May 2017 to July 2018, and nearly two-thirds (65%) of those postings were within 50 miles of UW-Whitewater (e.g., in Dane, Milwaukee, and Waukesha counties).

Locally, the UW-Whitewater IT Advisory Board (IT Board) has corroborated these projections. The IT Board is comprised of industry representatives in a variety of job roles, titles, and responsibilities. All members of the IT Board indicated that a priority need is professionals with business analytical skills. In addition, both employer needs and student demand are expected to grow at an accelerated pace as the Foxconn facility begins operations in southeastern Wisconsin, and the economy in general becomes ever more reliant on effective uses of data.

Given the increased interest in business analytics offerings, both within the UW-Whitewater campus and the broader business community, there is growing student demand for a stand-alone major in Business Analytics. It is anticipated that some students will move from the B.B.A. in IT with no emphasis to the new program and that the B.B.A. in Data Analytics will be a popular second major for marketing and accounting students, among others.

Credit Load and Tuition

The program will be comprised of 120 credits including 27 major credits, 48 credits in core business areas required for all B.B.A. majors, and 45 general education credits required of all UW-Whitewater students. The program will take a full-time student four years to complete.

For students who choose to complete the program via the face-to-face option, standard undergraduate tuition rates will apply, which include differential tuition. Based on Fall 2019 rates, full-time resident tuition and fees for students enrolled in 12-18 credits per semester is $3,847.20, of which $3,259.44 are attributable to tuition. Full-time nonresident student tuitions and fees are $8,208, of which $7,620.24 are attributable to tuition. Fees for both full-time residents and nonresidents include $505.20 for segregated fees and $82.56 for textbook rentals. For students enrolled with fewer than 12 credits, tuition is $271.62 per credit for Wisconsin residents and $635.83 for nonresidents. For each credit, part-time resident and nonresident students pay an additional $42.10 for segregated fees and $6.88 for textbook rentals.

Students who choose to complete the online version of the program will pay $389 per credit in tuition and fees, which is the College of Business and Economics online B.B.A. tuition rate. This rate applies to both resident and nonresident students and includes textbook rental fees. Online students do not pay segregated fees or differential tuition.

BACKGROUND

This proposal is presented in accord with the procedures outlined in Academic Planning and Program Review (SYS 102, revised July 2016, available at https://www.wisconsin.edu/program-planning/).

Related Policies

- Regent Policy Document 4-12, "Academic Program Planning, Review, and Approval in the University of Wisconsin System"
- UW System Administrative Policy 102: Policy on University of Wisconsin System Array Management: Program Planning, Delivery, Review, and Reporting

ATTACHMENTS

A) Request for Authorization to Implement a Bachelor of Business Administration in Business Analytics at UW-Whitewater
B) Cost and Revenue Projections
C) Provost's Letter

REQUEST FOR AUTHORIZATION TO IMPLEMENT A BACHELOR OF BUSINESS ADMINISTRATION IN BUSINESS ANALYTICS AT UNIVERSITY OF WISCONSIN-WHITEWATER PREPARED BY UW-WHITEWATER

ABSTRACT

The University of Wisconsin (UW)-Whitewater proposes to establish a Bachelor of Business Administration (B.B.A.) degree in Business Analytics. The development of this program responds to the regional and national need for more college graduates with talent in business analytics. Establishing the program will provide students with the skills necessary to transform raw business data into actionable insights. The new Business Analytics major will be a multi-disciplinary program and will include a sequence of courses that cover the full range of topics in business analytics as well as elective courses from various programs in the College of Business and Economics. The program will be comprised of 120 credits including 27 major credits, 48 credits in core business areas required for all B.B.A. majors, and 45 general education credits required of all UW-Whitewater students. The program will take a full-time student four years to complete.

PROGRAM IDENTIFICATION

Institution Name
University of Wisconsin-Whitewater

Title of Proposed Program/Major Designation
Business Analytics

Degree
Bachelor of Business Administration

Mode of Delivery
Single institution. Students can complete the degree in either face-to-face or fully online delivery formats.

Projected Enrollments and Graduates by Year Five

Table 1 represents enrollment and graduation projections for students entering the program over the next five years. By the end of Year 5, it is expected that 254 students will have enrolled in the program and 65 students will have graduated. UW-Whitewater currently offers a minor in Business Data Analytics designed for non-Information Technology (IT) majors as well as an emphasis in Data Analytics within an IT major. In the first year, it is expected that at least 50 students will switch from the B.B.A. in Information Technology program, which enrolled 225 students in the last academic year, to the proposed B.B.A. in Business Analytics, or will represent students who opt for a second

B.B.A. major. These students are listed as continuing students in Year 1. It is anticipated that 30 new students enrolling the first year, with moderate (15%) growth in new student enrollment over the next four years. An 80% retention rate in the major is assumed from year-to-year, based on the main campus retention rates across all majors.

Table 1: Five-Year Degree Program Enrollment Projections

Students/Year	Year 1	Year 2	Year 3	Year 4	Year 5
New Students	30	35	40	46	53
Continuing Students	50	64	73	80	80
Total Enrollment	80	99	113	126	133
Graduating Students	0	8	13	26	18

Tuition Structure

For students who choose to complete the program via the face-to-face option, standard undergraduate tuition rates will apply, which include differential tuition. Based on Fall 2019 rates, full-time resident tuition and fees for students enrolled in 12-18 credits per semester is $3,847.20, of which $3,259.44 are attributable to tuition. Full-time nonresident student tuitions and fees are $8,208, of which $7,620.24 are attributable to tuition. Fees for both full-time residents and nonresidents include $505.20 for segregated fees and $82.56 for textbook rentals. For students enrolled with fewer than 12 credits, tuition is $271.62 per credit for Wisconsin residents and $635.83 for nonresidents. For each credit, part-time resident and nonresident students pay an additional $42.10 for segregated fees and $6.88 for textbook rentals.

Students who choose to complete the online version of the program will pay $389 per credit in tuition and fees, which is the College of Business and Economics online B.B.A. tuition rate. This rate applies to both resident and nonresident students and includes textbook rental fees. Online students do not pay segregated fees or differential tuition.

Department or Functional Equivalent

Department of Information Technology and Supply Chain Management (ITSCM)

College, School, or Functional Equivalent

College of Business and Economics

Proposed Term and Year of Implementation

Fall 2020

DESCRIPTION OF PROGRAM

Overview of the Program

The new Business Analytics major will be a multi-disciplinary program and will include a sequence of courses that cover the full range of topics in business analytics, including organizing, cleaning and transforming data; the role of data in decision making; limitations in handling data; basic business analytical tools and algorithms; and an examination of non-structured data analytics methods. Students will develop skills and utilize various tools (e.g., visualization tools) that will enable them to communicate with the business community and interpret the findings in business settings. The program will also include elective courses in business analytics from various programs in the College of Business and Economics, such as marketing and economics. If approved, the new major will be a multi-disciplinary program that helps prepare UW-Whitewater students for rewarding careers in the business analytics area.

Student Learning Outcomes and Program Objectives

As a B.B.A. major, the program will include curricular elements to advance the core learning goals expected of all B.B.A. degree programs at UW-Whitewater. Graduates will be (1) ethical and able to identify ethical issues, (2) globally aware, 3) sound decision makers, and 4) analytical. Upon completion of the B.B.A. in Business Analytics, students will be able to:

1. demonstrate an understanding of source data and the role of information in business,
2. exhibit critical thinking in the analysis of business data and decision-making,
3. demonstrate hands-on skills in using business analytics tools and techniques,
4. effectively communicate findings using business analytics tools and techniques, and
5. approach handling of business data and decision-making in an ethical manner.

Program Requirements and Curriculum

No additional requirements for admission to the program will be added beyond the existing requirements for the Bachelor of Business Administration program, which include admission to the university and a minimum GPA (less than 24 credits=2.0 combined GPA; 24-72 credits=2.5 combined GPA; 73+ credits=2.8 GPA).

Table 2 lists the unique program curriculum for the proposed program consisting of 45 general education credits, 48 credits of business foundation and upper-division coursework, and 27 major credits. The general education credits assist students in the development of skills and knowledge that are needed for success in a dynamic, increasingly diverse and interconnected world. The business foundation courses establish groundwork in technology, accounting, economics, and statistics necessary before becoming a business major. Upper-division coursework incorporates the baseline knowledge gained in the foundation courses and expands that knowledge through more advanced financial,

marketing, business law, organizational behavior, operations and management topics. Courses in the major prepare students for career opportunities related to business analytics.

Table 2: B.B.A. in Business Analytics Program Requirements and Curriculum

General Education Requirements The general education requirements include communication and calculation skills (12-13 credits), quantitative and technical reasoning (7-11), cultural heritages (6 credits), communities (6 credits), and personal health and fitness (1 credit), and breadth electives (8-12 credits)	**45 credits**
Business Foundation Requirements	**48 credits**
BEINDP 101: Business and Society	3 credits
MATH 143: Finite Mathematics for Business and Social Sciences	3 credits
ECON 201: Principles of Microeconomics	3 credits
ECON 202: Principles of Macroeconomics	3 credits
International Requirement	3 credits
ACCOUNT 244: Introduction to Financial Accounting	3 credits
ACCOUNT 249: Introduction to Managerial Accounting	3 credits
BEINDP 288: Career Information	1 credit
BEINDP 290: Business Writing	2 credits
ECON 245: Business Statistics	3 credits
ITSCM 280: Introduction to Information Systems	3 credits
FNBSLW 341: Business and Commercial Law	3 credits
FNBSLW 344: Business Finance	3 credits
MANGEMNT 301: Organizational Behavior	3 credits
ITSCM 306: Operations Management	3 credits
MARKETNG 311: Principles of Marketing	3 credits
MANGEMNT 489: Strategic Management	3 credits
Major Course Requirements	**18 credits**
ITSCM 180: Introduction to Programming for Business Applications	3 credits
ITSCM 314: Database Design and Administration	3 credits
ITSCM 380: Business Intelligence: Concepts, Methods and Technologies	3 credits
ITSCM 410: Business Process Management & Simulation	3 credits
ECON 345: Econometrics *or* MATH 342: Applied Statistics	3 credits
ITSCM 384: Data Mining for Business Analytics *or* ITSCM 414: Mining Unstructured Data	3 credits
Major Electives *(select three of the following courses)*	**9 credits**
ITSCM 382: Visualization, Infographics, and Technical Documentation	3 credits
ITSCM 384: Data Mining for Business Analytics	3 credits
ITSCM 414: Mining Unstructured Data	3 credits
ECON 446: Advanced Econometrics *or* MATH 420: Applied Regression Analysis	3 credits

ITSCM 444: IT Security Analytics	3 credits
ITSCM 471: Introduction to Supply Chain Analytics	3 credits
MARKETNG 353: Advanced Digital Marketing	3 credits
MARKETNG 445: Marketing and Retail Analytics	3 credits
ITSCM 493: IT Internship	3 credits
ITSCM 498: Independent Studies	1-3 credits
Total Credits	**120 credits**

Assessment of Outcomes and Objectives

The proposed B.B.A. in Business Analytics will be regularly assessed according to the Department of ITSCM procedures, as overseen by the department's Assessment Committee. Direct measures to assess outcomes and objectives will include quiz questions, individual projects, collaborative projects, and case studies embedded within courses. Upon completion of their degree, students will complete an exit survey, including items related to the achievement of student learning objectives, as an indirect assessment of the program. The results will be disseminated to the ITSCM department as well as the College of Business and Economics Assurance of Learning Committee by the end of the spring semester every year, with appropriate pedagogical, curriculum, and program changes implemented and documented within the subsequent academic year. A comprehensive program self-study will be completed every five years following the University of Wisconsin-Whitewater audit and review process.[1]

Diversity

The Department of ITSCM supports the Inclusive Excellence Goals and Diversity Objectives within the UW-Whitewater's Strategic Plan. The curriculum for the proposed B.B.A. in Business Analytics will maintain several tenants of the existing programs offered by the department that advance inclusive excellence. High-Impact Educational Practices (HIPs), like collaborative projects and experiential learning with community partners, are integrated within the curriculum. These curricular practices have been shown to be beneficial for college students from many backgrounds and create an inclusive learning environment.

Inclusive excellence is emphasized in the recruitment and retention efforts of faculty, staff, and students. The ITSCM department upholds the UW-Whitewater Value of Diversity, which states, "We believe in the dignity of all individuals and we cultivate an accessible, inclusive, and equitable culture where everyone can pursue their passions and reach their potential in an intellectually stimulating and respectful environment." All programs and support services provided or recommended by the department are available to all students regardless of race, ethnicity, gender, religious beliefs, socioeconomic status, disability, or any other demographic characteristic, and the department is involved in and

[1] UW-Whitewater Audit & Review Process. https://www.uww.edu/assessment/audit-and-review

supports the campus-wide strategic priority to reduce equity gaps in student success.[2] The ITSCM department is guided by the Chancellor's statement on Equal Opportunity,[3] "At the University of Wisconsin-Whitewater, we are committed to a campus community that is free of all forms of discrimination, whether based on race, gender, age, color, religion, disability, sexual orientation or gender status, veteran status or national origin."

Inclusive excellence is also integrated within the selection of the proposed learning outcomes. The Association of American Colleges & Universities' (AAC&U) Liberal Education and America's Promise (LEAP) campaign emphasizes an inclusive curriculum and informed the proposed learning outcomes. The LEAP campaign is structured around Essential Learning Outcomes (ELOs) designed to prepare students for twenty-first-century challenges. Several ELOs are directly aligned with the proposed Student Learning Outcomes and Program Objectives. Intellectual and Practical Skills, like information literacy, critical thinking, and communication, are consistent with Student Learning Objective 1 (SLO 1), Student Learning Objective 2 (SLO 2), and Student Learning Objective 4 (SLO 4), respectively. Personal and Social Responsibility, namely ethical reasoning and action, is consistent with Student Learning Objective 5 (SLO 5).

The integration of the Rock County branch campus with UW-Whitewater provides opportunities to expand the program's reach into the Janesville and Beloit areas. Developing transfer articulation agreements with IT programs at Blackhawk Technical College and creating a curricular pathway to the B.B.A. in Business Analytics for students who complete the Associate of Arts and Sciences degree at UW-Whitewater at Rock County will enhance access to the program by lower-income, first-generation, and underrepresented minority students. Related to gender equity, while enrollment in business-related degrees (including data science) tend to be disproportionately male, there is evidence that courses on data analytics (a topic that is more applied than is data science) draws slightly more interest from females than from males.[4] The Department of ITSCM has for years reached out to attract more women into technology careers through outreach activities such as CyberGirlz and CyberHigh, annual technology camps encouraging middle school and high school girls to explore technology. The department views this new major in Business Analytics as extending existing efforts toward bringing more diversity into STEM-related and business disciplines.

---

[2] UW-Whitewater 2017-2022 Strategic Plan. https://www.uww.edu/strategic-plan/goal-1

[3] UW-Whitewater (2015). Chancellor's Statement on Equal Opportunity. Retrieved 4/12/2019 from: http://www.uww.edu/Documents/adminaffairs/HR%20Diversity/2015%20AAD%20statement_final.pdf

[4] Forbes, September 28, 2017, retrieved from https://www.forbes.com/sites/priceonomics/2017/09/28/the-data-science-diversity-gap/#59065a795f58

Collaborative Nature of the Program

The program will be a single institution program. However, UW-Whitewater will communicate and collaborate with other UW System universities as is consistent with current practice. Also, program faculty and staff will explore opportunities to develop transfer articulation agreements with technical colleges in the area and will continue to look for those synergies across all of the business degree programs.

Projected Time to Degree

It is anticipated that full-time undergraduate students can complete the B.B.A. in Business Analytics within four years.

Program Review

Program review of the B.B.A. in Business Analytics will be conducted according to the UW-Whitewater audit and review process. This process requires five-year reviews of all academic programs. Faculty and staff in the program participate in creating a program self-study that is then reviewed by the Audit and Review Committee and discussed with the program, audit and review evaluation team, Dean, and Provost. The program coordinator (ITSCM Department Chair) will coordinate the review process and disseminate the results to stakeholders according to the standard five-year cycle.

Accreditation

As part of the College of Business and Economics, the B.B.A. in Business Analytics will participate in the Association to Advance Collegiate Schools of Business (AACSB) accreditation process. Additionally, the program will participate in UW-Whitewater's Higher Learning Commission accreditation process. No discipline specific accreditation exists for Business Analytics.

JUSTIFICATION

Rationale and Relation to Mission

The new B.B.A. in Business Analytics will contribute to UW-Whitewater's mission to offer high-quality undergraduate degree programs and prepare students from all backgrounds for successful careers. The new program supports UW-Whitewater's core values by supporting students' personal and professional development as they master the foundations of Business Analytics. Specifically, the program supports Goal 2, Objective 1 of the UW-Whitewater 2017-2022 Strategic Plan, which presents the charge to transform lives and impact society. The ITSCM faculty members who currently offer Business Analytics courses have active research agendas that frequently involve undergraduate students, so the new program will support and expand undergraduate research opportunities. The program will also provide new opportunities for students to engage with local businesses and the community through experiential learning, including internships, business-oriented projects, and community-based learning. This program is aligned with the current UW-

Whitewater Academic plan.[5] In particular, the program supports Goal 1 to "[d]evelop programs to meet the growing needs and changing demographics of the region," Goal 4 to "[p]rovide professional and graduate programs that offer students the opportunity to develop into professional leaders within specific fields of expertise," and the Anticipated Academic Growth Areas which include applied professional programs. Support for this program has been expressed by internal stakeholders, including the Dean of the UW-Whitewater College of Business and Economics as well as the UW-Whitewater IT Advisory Board.

Institutional Program Array

The UW-Whitewater program array was reviewed at the onset of the planning process. The ITSCM department currently offers an undergraduate emphasis in Data Analytics as well as a Business Data Analytics minor. The addition of the Business Analytics major will provide students with a deeper understanding of analytics material while leveraging existing classes from those programs. In addition, as new courses for the program are developed, more course options will become available for the students in the Information Technology major and minor and in the Data Analytics minor. The Data Analytics major will emphasize skills that are part of the campus baccalaureate learning outcomes (the LEAP essential learning outcomes), particularly those related to intellectual and practical skills such as inquiry and analysis, critical and creative thinking, quantitative literacy, information literacy, and teamwork and problem solving.

Other Programs in the University of Wisconsin System

While UW-Whitewater and four other UW institutions (UW-Eau Claire, UW-Madison, UW-Milwaukee, and UW-Oshkosh) offer a B.B.A. in information systems or information technology, no UW System institution offers a B.B.A. degree with a major in Business Analytics or Data Analytics. Only a few undergraduate analytics programs exist among other UW System institutions. UW-River Falls offers a B.S. in Data Science in its College of Business and Economics. The UW-River Falls program emphasizes technical skills and data science. Except for one course in Econometrics, business courses are offered as electives but are not required. UW-Stevens Point offers a B.S. in Data Analytics in its School of Business and Economics, which requires 15 credits of business courses and emphasizes the technical side of data science. UW-Madison will be requesting approval of a new B.A./B.S. in Data Science; however, the curriculum will focus on computational and statistical analyses and application, and does not include business courses. Furthermore, none of these programs are available via distance education, whereas students enrolled in the proposed program may complete coursework requirements for the proposed program either face-to-face or online.

[5] The UW-Whitewater Academic Plan is available at http://www.uww.edu/Documents/acadaff/Academic%20Planning%20ApprovedFeb132018.pdf

Need as Suggested by Current Student Demand

The department currently offers a stand-alone minor in Business Data Analytics designed for non-Information Technology (IT) majors. Within the B.B.A. in IT program, which enrolled 225 students in the last academic year, an emphasis in Data Analytics was first offered in fall 2018. The department also has an analytics emphasis in the M.B.A. program and offers a graduate certificate. Table 3 includes enrollments for these programs and illustrates significant enrollment increases in the Business Data Analytics minor and the M.B.A. emphasis in Data Analytics, which have increased significantly in their first two years of offering (see Table 3). Given the increased interest in business analytics offerings, both within the UW-Whitewater campus and the broader business community, there is growing demand for a stand-alone major in Business Analytics. It is anticipated that some students will move from the B.B.A. in IT with no emphasis to the new program and that the B.B.A. in Data Analytics will be a popular second major for marketing and accounting students, among others.

Table 3. Data Analytics Enrollment at UW-Whitewater

Fall Academic Semesters	Fall 2016	Fall 2017	Fall 2018
Information Technology BBA: Data Analytics Emphasis			2
Undergraduate Minor: Business Data Analytics	13	22	25
MBA: Data Analytics Emphasis	17	38	60
Graduate Certificate: Business Data Analytics	6	9	14

Source: Institutional Research and Planning, UW-Whitewater 1/2019

Need as Suggested by Market Demand

Significant occupational growth is projected in job areas related to business analytics. According to the Bureau of Labor Statistics (BLS) latest Occupational Outlook Handbook, nationally between 2018 and 2028, growth is expected in three related occupations: Operational Research Analysists[6] (26%), Market Research Analysists[7] (20%) and Management Analysts[8] (14%). In Wisconsin, for the period 2014 to 2024, comparable growth is anticipated in these same job categories. Operational Research Analysists openings are expected to grow by 33.0%, Market Research Analysists openings by 19.0%,

[6] Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Operations Research Analysts,
on the Internet at https://www.bls.gov/ooh/math/operations-research-analysts.htm (visited *September 04, 2019*).

[7] Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Market Research Analysts,
on the Internet at https://www.bls.gov/ooh/business-and-financial/market-research-analysts.htm (visited *September 04, 2019*).

[8] Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Management Analysts,
on the Internet at https://www.bls.gov/ooh/business-and-financial/management-analysts.htm (visited *September 09, 2019*).

and Management Analysts openings by 14.2%. A labor market analysis was completed by Emsi, a data and impact analysis firm. Findings of the study supported job growth projections for these occupational areas. Using a Q1 2019 data set of Wisconsin job postings from various sources with keywords relevant to the occupation titles alongside state data from the Wisconsin Department of Workforce Development and the Bureau of Workforce Information, the Emsi analysis found that there were 6,059 unique job postings relevant to business analytics occupation titles from May 2017 to July 2018, and nearly two-thirds (65%) of those postings were within 50 miles of UW-Whitewater (e.g., in Dane, Milwaukee, and Waukesha counties).

An Academic Program Demand Analysis (APDA) report was prepared by Ruffalo Noel Levitz to assess the market share of current academic offerings at UW-Whitewater against the demand for similar programs. Five-year trends were analyzed using data from all Wisconsin academic institutions and northern Illinois academic institutions with occupational projections (2014 to 2024) for both Wisconsin and northern Illinois. The APDA report revealed current program offerings at UW-Whitewater that have the greatest growth potential and competitors to current and new proposed programs. The APDA report identified Information Technology degrees as one of the highest-ranked programs for growth potential at UW-Whitewater indicating an *above average* market (student) demand and share for Information Technology degrees as well as an *above average* employer demand for those degrees.

Locally, the UW-Whitewater IT Advisory Board (IT Board) has corroborated these projections. The IT Board is comprised of industry representatives in a variety of job roles, titles, and responsibilities. All members of the IT Board indicated that a priority need is professionals with business analytical skills. As shown above in Table 3, the minor, the M.B.A. emphasis, and the graduate certificate have grown significantly in their first years, demonstrating a growing interest in programs that emphasize business analytical knowledge, skills, and experience. Both employer needs and student demand are expected to grow at an accelerated pace as the Foxconn facility begins operations in southeastern Wisconsin and the economy in general becomes ever more reliant on effective uses of data.

University of Wisconsin-Whitewater
Cost and Revenue Projections For B.B.A. Business Analytics

	Items	Projections				
		2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
		Year 1	Year 2	Year 3	Year 4	Year 5
I	**Enrollment (New Student) Headcount**	30	35	40	46	53
	Enrollment (Continuing Student) Headcount	50	64	73	80	80
	Enrollment (New Student) FTE	28.20	32.90	37.60	43.24	49.82
	Enrollment (Continuing Student) FTE	47.00	60.16	68.62	75.20	75.20
II	**Total New Credit Hours**	528.8	1180.9	1815.4	2220.8	2344.1
	Existing Credit Hours	881.3	0.0	0.0	0.0	0.0
III	**FTE of New Faculty/Instructional Staff**	0.5	0.5	1	1.25	1.25
	FTE of Current Fac/IAS	0	0	0	0	0
	FTE of New Admin Staff	0	0	0	0	0
	FTE Current Admin Staff.	0.1	0.1	0.1	0.1	0.1
IV	**Revenues**					
	From Tuition	$140,622	$314,056	$482,803	$590,613	$623,425
	From Fees	$0	$0	$0	$0	$0
	Program Revenue (Grants).	$0	$0	$0	$0	$0
	Program Revenue - Other.	$0	$0	$0	$0	$0
	GPR (re)allocation	$0	$0	$0	$0	$0
	Total New Revenue	$140,622	$314,056	$482,803	$590,613	$623,425
V	**Expenses**					
	Salaries					
	Faculty/Instructional Staff	$15,000	$15,000	$105,000	$108,150	$111,395
	Other Staff	$5,000	$5,000	$5,000	$0	$0
	Fringe	$7,800	$7,800	$42,900	$42,179	$43,444
	Other Expenses					
	Facilities	$0	$0	$0	$0	$0
	Software & Equipment	$20,000	$20,000	$20,000	$20,000	$20,000
	Other (Website and Social Media).	$1,000	$1,000	$1,000	$1,000	$1,000
	Other (Printed and Promo Materials)	$2,000	$2,000	$2,000	$2,000	$2,000
	Other (Recruitment Events including Travel)	$2,000	$2,000	$2,000	$2,000	$2,000
	Total Expenses	$52,800	$52,800	$177,900	$175,329	$179,838
VI	**Net Revenue**	$87,822	$261,256	$304,903	$415,284	$443,586

Provost's Signature: G. Cook **Date:** 9-18-19

UNIVERSITY OF WISCONSIN-WHITEWATER
COST AND REVENUE PROJECTIONS NARRATIVE
BACHELOR OF BUSINESS ADMINISTRATION IN BUSINESS ANALYTICS

Introduction

The proposed Bachelor of Business Administration (B.B.A.) in Business Analytics will be comprised of 120 credits including 27 major credits, 48 credits in core business areas required for all B.B.A. majors, and 45 general education credits. The major will be a multi-disciplinary program and will include a sequence of courses that cover the full range of topics in business analytics as well as elective courses from various programs in the College of Business and Economics. Graduates will be prepared to transform raw business data into actionable insights.

Section I – Enrollment

The B.B.A. in Business Analytics will be offered by the department of Information Technology and Supply Chain Management (ITSCM). The Information Technology program has 225 students and the Supply Chain and Operations Management program has 134 students. In Year 1, it is anticipated that 30 new students will enroll in the proposed program and 50 existing students will switch from the current Information Technology program to the new Business Analytics major. These existing students are listed as continuing students in Year 1. It is expected that the 50 students will include 20 freshmen, 20 sophomores, and 10 juniors. The five-year enrollment projection for the B.B.A. in Business Analytics major reflects moderate (15%) growth in new student enrollment over the next four years. An 80% retention rate in the major from year-to-year is assumed. By the end of Year 5, it is expected that 254 students will have enrolled in the program and 65 students will have graduated. The variance between Years 4 and 5 in the enrollment headcount of continuing students (Year 4 = 80, Year 5 = 80) and in graduating students (Year 4 = 26, Year 5 = 18) is due to the projected proportion of continuing students in Year 1 (50), described above, matriculating through the program. Since 12% of UW-Whitewater undergraduates enroll part-time, the enrollment FTE was adjusted to show .5 FTE for 12% of the student headcount and 1.0 FTE for 88% of the headcount.

Section II – Credit Hours

The Business Analytics program is designed so that students can graduate in four years. Students will need to take 120 credits to graduate; therefore, UW-Whitewater expects each student FTE to yield 30 credits per year, on average. The 75 credits in the College of Business and Economics (48 business requirement credits + 27 major credits) represent 62.5% of the 120 credits needed to graduate. The total credits are calculated as FTE x 30 credits x 0.625.

In Year 1, credits for continuing students are counted as existing credits since it is assumed that in their first year these students will switch from their existing program emphasis into the new program. After Year 1, all credits are counted as new credit hours.

Section III – Faculty and Staff Appointments

To accommodate the anticipated student enrollment, the program will need to hire 1.25 new faculty (or instructional staff) by Year 5. An additional 1.25 faculty would allow the program to maintain course sizes of 35 students, given the anticipated increase in student credit hours. Additional sections of existing courses will need to be offered in Years 1 and 2 (0.5 new faculty or instructional staff), growing to additional sections for Years 3, 4, and 5 (with 1.0 new faculty or instructional staff). An FTE of 0.1 is attributed to an administrative staff person needed to support this program, as is done with all other programs in the department.

Section IV – Program Revenues

The tuition revenue calculations and enrollment projections are based solely on traditional face-to-face enrollments. Tuition is $271.62 per credit for resident students and $635.83 for nonresidents. At UW-Whitewater, 83.3% of undergraduate students are residents and 16.7% are nonresidents, with 77.2% of nonresidents coming from Illinois. Therefore, the adjusted (combined) tuition rate of $332.44 per credit was used. As well, the number of credit hours was adjusted by .8 since the tuition plateau is in effect from 12-18 credits so revenue is generated for only 80% of the 30 credits per year.

V – Expenses

Adjuncts will be hired in Years 1 and 2 to free up faculty resources to accommodate the anticipated student enrollment included as another staff expense of $15,000. Faculty and Instructional Academic Staff (IAS) salaries were determined based on an average faculty salary within the department of $105,000, with a 3% per year salary increase to accommodate faculty promotion and new hires. The program includes a program coordinator as another staff expense of $5,000, for Years 1, 2, and 3. The program will require one 0.25 teaching reassignment for a faculty program coordinator in Years 4 and 5. A fringe benefit rate of 39% was used.

Other costs will include software and equipment expenses of approximately $20,000 per year through Year 5. In addition, $3,000 per year was included for marketing materials including website, social media, and printed and promotional material. These reflect costs beyond the marketing expenditures already planned for the college and the institution. Finally, $2,000 per year was included so that program faculty and staff can participate in one national conference trade show per year for recruiting purposes.

VI – Net Revenue

Positive net revenue is projected from Year 1 and thereafter, and will be reinvested to expand course offerings, support faculty development, expand recruiting activities, support general education courses, and otherwise support the college and the institution.

University of Wisconsin
Whitewater

Provost and Executive Vice Chancellor for Academic Affairs

16 August 2019

Dr. Raymond Cross
President, UW System
1720 Van Hise Hall
1220 Linden Drive
Madison, WI 53706

Dear President Cross:

Please accept this as UW-Whitewater's Letter of Commitment for our new Bachelor of Business Administration (BBA) program in Business Analytics. This is a new multi-disciplinary program that responds to the need for college graduates with knowledge in the growing area of business analytics. We are proud of the achievements of our students, faculty, and staff in our College of Business and Economics, and with this new program the College will be able to provide another level of educational opportunity to support workforce development in Wisconsin and the surrounding region.

With this letter, I assert and make a firm commitment to the following:

1. The BBA program in Business Analytics has been designed to meet UW–Whitewater's definition and standards of quality and to make a meaningful contribution to our select mission, overall academic plan, and our program array. This program is built from an academic department and college that has already demonstrated high standards of quality. As the proposal was developed, faculty and staff consulted with our Director of Academic Assessment and their college assessment leaders to assure a high level of quality in curriculum and program assessment. Our campus is currently engaged in strategic planning and campus academic planning activities. As part of these processes, we have been intensively reviewing all of our academic programs. It is clear that this new program will provide a meaningful addition to our campus program array, and our College of Business and Economics is poised for a successful launch of this new program.

2. We have institution-wide support and approval for this new program through every phase of our campus governance process. The proposal was approved by the Department of Information Technology & Supply Chain Management, the Curriculum committee in the College of Business and Economics, the Dean of the College of Business and Economics, the University Curriculum Committee, and the Faculty Senate. All required approvals have been obtained on campus, with enthusiastic support.

Office of the Provost | Hyer Hall Suite 420 | 800 West Main Street
Whitewater, WI 53190-1790 | www.uww.edu | p 262-472-1672 | f 262-472-1670

3. The necessary financial and human resources are in place or have been committed to implement and sustain this new bachelor's program. Department and college staff have thoroughly considered and provided for all of the resources needed to launch and maintain the program. A financial plan is in place to support and sustain the program.

4. A high-quality system for program evaluation is in place. As soon as the new program is implemented, it will enter our 5-year campus cycle for audit and review to support continuous evaluation and improvement. The program proposal includes a fully defined list of student learning outcomes and a well-designed plan for assessment of those outcomes. As noted above, these plans have been reviewed and approved by our Director of Academic Assessment who also supports the Audit and Review Committee for undergraduate programs. Members of the college curriculum committee and the University curriculum committee have also reviewed the program's assessment plan as an integral part of the curriculum proposal. I am confident this new program has the plans in place for successful program evaluation that will assure a high level of quality and continuous improvement.

The proposal for the new BBA program in Business Analytics was developed using a very thorough and careful process. We have all of the necessary resources in place or firmly planned, and I am confident this program will be a success. This program will be a significant addition for UW-Whitewater, an attractive offering for students, and a benefit for workforce development in Wisconsin and the surrounding region. I am proud to recommend this new program for your approval and approval by the members of the Board of Regents. I believe this is a strong and needed addition to the University of Wisconsin System program array.

Sincerely,

Greg Cook

Greg Cook, Ph.D.
Interim Provost and Executive Vice Chancellor for Academic Affairs

GC/akh
Encl.

cc: Dwight Watson, Chancellor
Kristin Plessel, Interim Associate Vice Chancellor for Academic Affairs
Angela Harlan, Special Assistant to the Provost
John Chenoweth, Dean, College of Business and Economics
Carleen Vande Zande, interim AVP of APEI, UW System

UW STUDENT BEHAVIORAL HEALTH WORKGROUPS

REQUESTED ACTION

For information only.

SUMMARY

This presentation will provide an update on the recent launch of the UW Student Behavioral Health Workgroups which took place on September 20, 2019. Specifically, the presentation will provide a brief summary of the topics discussed during their inaugural convening as well as some of the potential recommendations currently under consideration. The presentation will also include a recap of the workgroup timeline and next steps.

Presenter

- Harry Anderson, Dean of Students, UW-Superior

Education Committee **Item G.2.**
October 10, 2019

ANNUAL REPORTS ON UW SYSTEM ACADEMIC PROGRAM ARRAY AND REMEDIAL EDUCATION

REQUESTED ACTION

Review and discussion of the Annual Reports on UW System Academic Program Array and Remedial Education.

SUMMARY

This presentation will provide an overview of the academic program array actions across the UW System over the past academic years. Specifically, the presentation will focus on the growth and either elimination or suspension of academic degree programs. The report will also include highlights from the most recent UW System Remedial Education report.

Presenter

- Carleen Vande Zande, UW System Associate Vice President for Academic Programs and Educational Innovation

BACKGROUND

Each year the Office of Academic Programs and Educational Innovation reports on the current state of the academic program array across the UW System. The Provosts report on program changes in the Annual Academic Program Planning and Review Array Management Report which consists of program additions, program changes, program suspensions and eliminations. Regent policy states that the Board will receive an update on remedial education programs every three years. These reports fulfill the System's responsibility as stated in Regent Policy Document 4-12, "Academic Program Planning, Review, and Approval in the University of Wisconsin System" and Regent Policy Document 4-8, "Remedial Education Policy."

Related Policies

- Regent Policy Document 4-12, “Academic Program Planning, Review, and Approval in the University of Wisconsin System”
- UW System Administrative Policy 102: Policy on University of Wisconsin System Array Management: Program Planning, Delivery, Review, and Reporting
- Regent Policy Document 4-8, “Remedial Education Policy”

Education Committee **Item H.**
October 10, 2019

FRESHWATER COLLABORATIVE OF WISCONSIN

REQUESTED ACTION

For information only.

SUMMARY

This presentation will provide an update on the status of planning for the Freshwater Collaborative of Wisconsin (FCW). This initiative builds upon the collective assets of all 13 campuses to collaborate on freshwater research, training, innovation and economic development. Specific aspects of advocacy, the search for a director, and the research program will be addressed.

Presenters

- Chancellor Mark Mone, UW-Milwaukee
- Dr. Phyllis King, Associate Vice Chancellor for Academic Affairs, UW-Milwaukee

BACKGROUND

At the June 6, 2019 meeting of the UW System Board of Regents, the 13 campuses of the University of Wisconsin System (UWS) launched the Freshwater Collaborative of Wisconsin (FCW). The purpose of the Freshwater Collaborative is to:

- Establish the nation's most significant, integrated, multi-institutional higher education program serving the freshwater economy, allowing students to traverse disciplines and focus areas across all 13 UW System campuses;
- Attract local, regional and global talent to Wisconsin, securing Wisconsin's role as the "Silicon Valley of Water;"
- Fill the global, regional, and local demand for a water workforce through explicit structuring of curriculum, training, and workplace experience;
- Solve local, regional, and global water resource problems through collaborative research across the natural science, agriculture, engineering, social science, economics and policy arenas; and

- Solidify Wisconsin's world leadership in freshwater science, technology, entrepreneurship, and economic growth.

Previous Action or Discussion

- At its June 6, 2019, the Board of Regents requested periodic updates on the Freshwater Collaborative. This presentation is the first in a series of such updates.

Education Committee **Item I.**
October 10, 2019

HOST CAMPUS PRESENTATION
SMALL BUT MIGHTY: EMBEDDED INFLUENTIAL LEARNING EXPERIENCES AT UW-SUPERIOR

REQUESTED ACTION

For information only.

SUMMARY

This presentation will highlight not only the institution's transformative role in the region, but also the powerful, personal experiences in teaching and learning that UW-Superior provides to its students. The unique approach of UW-Superior, as well as the success of its students, will be demonstrated by exploring the pathways to academic success on campus—from pre-start to launch, to real-world learning engagements, such as Academic Service-Learning and internships, to mandatory capstone experiences. As a result, UW-Superior will describe how these learning experiences, which are embedded in the curriculum, lead to student success and engender regional dynamism.

Presenter

- Dr. Maria Stalzer Wyant Cuzzo, Interim Provost and Vice Chancellor for Academic Affairs, UW-Superior