FORMAT 1

Submit original with signatures + 1 copy + electronic copy to Faculty Senate (Box 7500).

See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/ for a complete description of the rules governing curriculum & course changes.

TRIAL COURSE OR NEW COURSE PROPOSAL

SUBMITTED BY:

Department	**Chemistry and Biochemistry**	**College/School**	**CNSM**
Prepared by	**Sarah Hayes**	**Phone**	**907-474-7118**
Email Contact	**s.hayes@alaska.edu**	**Faculty Contact**	**Sarah Hayes**

1. ACTION DESIRED (CHECK ONE):	Trial Course	X	New Course		
2. COURSE IDENTIFICATION:	Dept	**CHEM**	Course #	**294**	No. of Credits **2**
Justify upper/lower division status & number of credits:	**This course is designed to introduce mid-level undergraduates to research. The course will consist of 1 hour lecture and 3 hours lab per week.**				
3. PROPOSED COURSE TITLE:	**Introduction to Chemical Research**				
4. To be CROSS LISTED? *YES/NO*	**no**	If yes, Dept:		Course #	

NOTE: Cross-listing requires approval of both departments and deans involved. Add lines at end of form for additional required signatures.

5. To be STACKED? *YES/NO*	**no**	If yes, Dept.		Course #
How will the two course levels differ from each other? How will each be taught at the appropriate level?:				

Stacked course applications are reviewed by the (Undergraduate) Curricular Review Committee and by the Graduate Academic and Advising Committee. Creating two different syllabi—undergraduate and graduate versions—will help emphasize the different qualities of what are supposed to be two different courses. The committees will determine: 1) whether the two versions are sufficiently different (i.e. is there undergraduate and graduate level content being offered); 2) are undergraduates being overtaxed?; 3) are graduate students being undertaxed? In this context, the committees are looking out for the interests of the students taking the course. Typically, if either committee has qualms, they both do. More info online – see URL at top of this page.

6. FREQUENCY OF OFFERING:	**Every spring**
	Fall, Spring, Summer (Every, or Even-numbered Years, or Odd-numbered Years) — or As Demand Warrants
7. SEMESTER & YEAR OF FIRST OFFERING (AY2013-14 if approved by 3/1/2013; otherwise AY2014-15)	**AY 2014-15**

8. COURSE FORMAT:

NOTE: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, **any core course compressed to less than six weeks must be approved by the Core Review Committee**.

COURSE FORMAT: (check all that apply)		*1*		*2*		*3*		*4*		*5*	X *6 weeks to full semester*
OTHER FORMAT (specify)											
Mode of delivery (specify lecture, field trips, labs, etc)	**1 hour lecture, 3 hours lab per week**										

9. CONTACT HOURS PER WEEK:	**1**	LECTURE hours/weeks	**3**	LAB hours /week		PRACTICUM hours /week

Note: # of credits are based on contact hours. 800 minutes of lecture=1 credit. 2400 minutes of lab in a science course=1 credit. 1600 minutes in non-science lab=1 credit. 2400-4800 minutes of practicum=1 credit. 2400-8000 minutes of internship=1 credit. This must match with the syllabus. See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/guidelines-for-computing-/ for more information on number of credits.

OTHER HOURS (specify type)	

10. COMPLETE CATALOG DESCRIPTION including dept., number, title, credits, credit distribution, cross-listings and/or stacking (50 words or less if possible):

Example of a complete description:

FISH F487 W, O Fisheries Management

3 Credits Offered Spring
Theory and practice of fisheries management, with an emphasis on strategies utilized for the management of freshwater and marine fisheries. ***Prerequisites: COMM F131X or COMM F141X; ENGL F111X; ENGL F211X or ENGL F213X; ENGL F414; FISH F425; or permission of instructor.*** **Cross-listed with NRM F487. (3+0)**

CHEM 294 Introduction to Research
2 Credits Offered Spring
Scientific research is creative and engaging when properly planned and executed. This course introduces students to the process of planning and executing a research project. We will begin with an idea, review primary literature, brainstorm project ides, pose a testable hypothesis, plan experiments, and execute a small research project.
Pre-requisites: CHEM 212 or CHEM 321

11. COURSE CLASSIFICATIONS: Undergraduate courses only. Consult with CLA Curriculum Council to apply S or H classification appropriately; otherwise leave fields blank.

H = Humanities		S = Social Sciences	

Will this course be used to fulfill a requirement for the baccalaureate core? **If YES, attach form.**	**YES:**		**NO:**	X

IF YES, check which core requirements it could be used to fulfill:

O = Oral Intensive, **Format 6**		W = Writing Intensive, **Format 7**		X = Baccalaureate Core	

11.A Is course content related to northern, arctic or circumpolar studies? If yes, a "snowflake" symbol will be added in the printed Catalog, and flagged in Banner.

YES		**NO**	X

12. COURSE REPEATABILITY:

Is this course repeatable for credit?	**YES**	X	**NO**	

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time).	**Topical areas for potential research areas vary each semester depending on areas of research expertise of mentors enrolled in CHEM 694**

How many times may the course be repeated for credit?	1	**TIMES**
If the course can be repeated for credit, what is the maximum number of credit hours that may be earned for this course?	4	**CREDITS**
If the course can be repeated with variable credit, what is the maximum number of credit hours that may be earned for this course?		**CREDITS**

13. GRADING SYSTEM: Specify only one. Note: Changing the grading system for a course later on constitutes a Major Course Change – Format 2 form.

LETTER:	X	**PASS/FAIL:**	

RESTRICTIONS ON ENROLLMENT (if any)

14. PREREQUISITES	**CHEM 212 or CHEM 321**

These will be *required* before the student is allowed to enroll in the course.

15. SPECIAL RESTRICTIONS, CONDITIONS	**none**

16. PROPOSED COURSE FEES	**$100**
Has a memo been submitted through your dean to the Provost for fee approval? **Yes/No**	**yes**

17. PREVIOUS HISTORY

Has the course been offered as special topics or trial course previously? **Yes/No**	**no**
If yes, give semester, year, course #, etc.:	

18. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

This course requires 1-2 credits of workload for the instructing faculty (shared with proposed 694).

19. LIBRARY COLLECTIONS

Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No	X	Yes			Current library collection is adequate for the course. This course will rely heavily on electronic subscriptions to primary literature.

20. IMPACTS ON PROGRAMS/DEPTS

What programs/departments will be affected by this proposed action?
Include information on the Programs/Departments contacted (e.g., email, memo)

The only department affected is Chemistry and Biochemistry.

21. POSITIVE AND NEGATIVE IMPACTS

*Please specify **positive and negative** impacts on other courses, programs and departments resulting from the proposed action.*

This course provides the opportunity for mid-level students to participate in chemical research earlier in their academic career. The focus of the course is on building the skills (literature review and experiment design) that students need to move from an idea to a successful experiment. After this course, students will likely be much better prepared for the experiment-focused CHEM 488 Research. Students will also provide mentoring opportunities for the professional development of students enrolled in CHEM 694.

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

CHEM 294 will focus on building mid-level undergraduate student skills and confidence in planning and executing an independent research project. This course will provide students training in the process of doing research at an earlier in their career as well as providing skills that will help students be more successful in CHEM 488 Research.

APPROVALS: Add additional signature lines as needed. SEE ATTACHED SIGNATURES

	Date	
Signature, Chair, Program/Department of:		

	Date	
Signature, Chair, College/School Curriculum Council for:		

	Date	
Signature, Dean, College/School of:		

Offerings above the level of approved programs must be approved in advance by the Provost.

	Date	
Signature of Provost (if above level of approved programs)		

18. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

This course requires 1-2 credits of workload for the instructing faculty (shared with proposed 686).

19. LIBRARY COLLECTIONS

HAVE YOU CONTACTED THE LIBRARY COLLECTION DEVELOPMENT OFFICER (KLJENSEN@ALASKA.EDU, 474-6695) WITH REGARD TO THE ADEQUACY OF LIBRARY/MEDIA COLLECTIONS, EQUIPMENT, AND SERVICES AVAILABLE FOR THE PROPOSED COURSE? IF SO, GIVE DATE OF CONTACT AND RESOLUTION. IF NOT, EXPLAIN WHY NOT.

No [X] Yes [ ]

CURRENT LIBRARY COLLECTION IS ADEQUATE FOR THE COURSE. THIS COURSE WILL RELY HEAVILY ON ELECTRONIC SUBSCRIPTIONS TO PRIMARY LITERATURE.

20. IMPACTS ON PROGRAMS/DEPTS

WHAT PROGRAMS/DEPARTMENTS WILL BE AFFECTED BY THIS PROPOSED ACTION?

INCLUDE INFORMATION ON THE PROGRAMS/DEPARTMENTS CONTACTED (E.G., EMAIL, MEMO)

21. POSITIVE AND NEGATIVE IMPACTS

PLEASE SPECIFY POSITIVE AND NEGATIVE IMPACTS ON OTHER COURSES, PROGRAMS AND DEPARTMENTS RESULTING FROM THE PROPOSED ACTION.

This course provides the opportunity for mid-level students to participate in chemical research. The focus of the course is on building the skills (literature review and experiment design) that students need to move from an idea to a successful experiment. After this course, students will likely be much better prepared for the experiment-focused CHEM 488 Research. Students will also provide mentoring opportunities for the professional development of students enrolled in CHEM 686.

JUSTIFICATION FOR ACTION REQUESTED

THE PURPOSE OF THE DEPARTMENT AND CAMPUS-WIDE CURRICULUM COMMITTEES IS TO SCRUTINIZE COURSE CHANGE AND NEW COURSE APPLICATIONS TO MAKE SURE THAT THE QUALITY OF UAF EDUCATION IS NOT LOWERED AS A RESULT OF THE PROPOSED CHANGE. PLEASE ADDRESS THIS IN YOUR RESPONSE. THIS SECTION NEEDS TO BE SELF-EXPLANATORY. USE AS MUCH SPACE AS NEEDED TO FULLY JUSTIFY THE PROPOSED COURSE.

CHEM 288 will focus on building mid-level undergraduate student skills and confidence in planning and executing an independent research project. This course will provide students training in the process of doing research at an earlier stage in their career as well as providing skills that will help students be more successful in CHEM 488 Research.

APPROVALS: *ADD ADDITIONAL SIGNATURE LINES AS NEEDED.*

	Date	20 Feb 2014
SIGNATURE, CHAIR, PROGRAM/DEPARTMENT OF:	Chemistry + Biochemistry	
	Date	2-21-14
SIGNATURE, CHAIR, COLLEGE/SCHOOL CURRICULUM COUNCIL FOR:	CNSM	
	Date	2/21/14
SIGNATURE, DEAN, COLLEGE/SCHOOL OF:	CNSM	

OFFERINGS ABOVE THE LEVEL OF APPROVED PROGRAMS MUST BE APPROVED IN ADVANCE BY THE PROVOST.

	Date	

SIGNATURE OF PROVOST (IF ABOVE LEVEL OF APPROVED PROGRAMS)

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE

	Date	

Signature, Chair

Faculty Senate Review Committee: ___Curriculum Review ___GAAC

___Core Review ___SADAC

***ADDITIONAL SIGNATURES:** (As needed for cross-listing and/or stacking)*

	Date	

Signature, Chair, Program/Department of:

	Date	

Signature, Chair, College/School Curriculum Council for:

	Date	

Signature, Dean, College/School of:

ATTACH COMPLETE SYLLABUS (as part of this application). This list is online at:
http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/uaf-syllabus-requirements/
The Faculty Senate curriculum committees will review the syllabus to ensure that each of the items listed below are included. If items are missing or unclear, the proposed course (or changes to it) may be denied.

SYLLABUS CHECKLIST FOR ALL UAF COURSES
During the first week of class, instructors will distribute a course syllabus. Although modifications may be made throughout the semester, this document will contain the following information (as applicable to the discipline):

1. Course information:

❑Title, ❑ number, ❑credits, ❑prerequisites, ❑ location, ❑ meeting time (make sure that contact hours are in line with credits).

2. Instructor (and if applicable, Teaching Assistant) information:

❑ Name, ❑ office location, ❑ office hours, ❑ telephone, ❑ email address.

3. Course readings/materials:

❑ Course textbook title, ❑ author, ❑ edition/publisher.
❑ Supplementary readings (indicate whether ❑ required or ❑ recommended) and
❑ any supplies required.

4. Course description:

❑ Content of the course and how it fits into the broader curriculum;
❑ Expected proficiencies required to undertake the course, if applicable.
❑ Inclusion of catalog description is *strongly* recommended, and
❑ Description in syllabus must be consistent with catalog course description.

5. ❑ Course Goals (general), and (see #6)

6. ❑ Student Learning Outcomes (more specific)

7. Instructional methods:

❑ Describe the teaching techniques (eg: lecture, case study, small group discussion, private instruction, studio instruction, values clarification, games, journal writing, use of Blackboard, audio/video conferencing, etc.).

8. Course calendar:

❑ A schedule of class topics and assignments must be included. Be specific so that it is clear that the instructor has thought this through and will not be making it up on the fly (e.g. it is not adequate to say "lab". Instead, give each lab a title that describes its content). You may call the outline Tentative or Work in Progress to allow for modifications during the semester.

9. Course policies:

❑ Specify course rules, including your policies on attendance, tardiness, class participation, make-up exams, and plagiarism/academic integrity.

10. Evaluation:

❑ Specify how students will be evaluated, ❑ what factors will be included, ❑ their relative value, and ❑ how they will be tabulated into grades (on a curve, absolute scores, etc.) ❑ Publicize UAF regulations with regard to the grades of "C" and below as applicable to this course. (Not required in the syllabus, but is a convenient way to publicize this.) Link to PDF summary of grading policy for "C":
http://www.uaf.edu/files/uafgov/Info-to-Publicize-C_Grading-Policy-UPDATED-May-2013.pdf

11. Support Services:

❑ Describe the student support services such as tutoring (local and/or regional) appropriate for the course.

12. Disabilities Services: Note that the phone# and location have been **updated.** http://www.uaf.edu/disability/ The Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials.

❑ State that you will work with the Office of Disabilities Services (208 WHITAKER BLDG, 474-5655) to provide reasonable accommodation to students with disabilities.

REVISED 4/22/2014

Introduction to Chemical Research
CHEM 294; Spring 2015

Course Name: CHEM 294: Introduction to Chemical Research, 2 credits
Prerequisites: CHEM 212 or CHEM 321
Location:
Meeting Time: 1 hr lecture, 3 hrs lab per week

Instructor: Dr. Sarah Hayes
Office: Reichardt 188
Phone: 907-474-7118
Email: s.hayes @alaska.edu
Office Hours: By appointment, or drop by when my door is open

Blackboard Link: http://classes.uaf.edu
Course website: http://chemresearch.community.uaf.edu **Now Active, but Developing**
Required materials: On Being A Scientist: A Guide to Responsible Conduct in Research, 3rd ed. The National Academies Press: Washington DC. ISBN: 978-0-309-11970-2

Catalogue Course Description: Scientific research is creative and engaging when properly planned and executed. This course introduces students to the process of planning and executing a research project. We will begin with an idea, review primary literature, brainstorm project ideas, pose a testable hypothesis, plan experiments, and execute a small research project.
Pre-requisites: CHEM 212 or CHEM 321

Expanded Course Description: Experience first hand how creative and engaging scientific research can be. In this course, mid-level chemistry majors will be introduced to the process of planning a research project. Students in this course will begin with an idea, then review primary literature to survey ongoing research in that field, brainstorm project ideas, pose a testable hypothesis, then plan an experiment and execute a small research project. The emphasis of this course is to increase research readiness for students entering CHEM 488 by focusing on the research planning skills, although students will also have supervised hands-on lab experience. Students will have individualized support from graduate students enrolled in CHEM 694 Research Mentoring throughout the semester as they discover the research process.

Instructional Methods: Undergraduate students will be paired with graduate student mentors enrolled in CHEM 694 Research Mentoring to develop and execute a research project. The emphasis of this course is on planning a research project through mentoring interactions with graduate students and faculty. Lectures will provide information on topics relevant to project planning while the actual planning and execution will occur during lab time.

Course Goals: Students will learn and practice the process of developing an idea into a testable hypothesis and planning a research project to address their hypothesis. At the conclusion of this course, students will present their research plan and the results of preliminary investigations at the Department

Poster Session as well as have a research proposal to potentially submit for funding to continue their project.

Student Learning Outcomes: Students will be prepared to plan and execute their future research projects. Upon successful completion of this course, students will:

- Complete all required safety trainings to work in labs in the UAF chemistry department.
- Propose an area of research, perform a literature review, and pose a testable hypothesis.
- Develop a realistic, statistically valid research plan.
- Execute preliminary experiments to provide preliminary data or proof of concept.
- Create a poster to share the research project and present at the department poster session.
- Identify appropriate funding sources and write a proposal.

Example Student Projects: Student project topics will vary based on the expertise of graduate students enrolled in CHEM 694 and vary each semester.

- Investigation of toxic metals present in mine tailings as a function of particle size, which affects transportability, solubility, and bioaccessibility. This would involve drying soils, size separation using sieves and settling rate in water. Each size fraction could then be analyzed for elemental composition using bulk X-ray Fluorescence by preparing a pressed pellet.
- Investigation of chemical moieties present in size fractionated aerosol particulate samples by acid digestion and subsequent analysis by Inductively Coupled Plasma- Mass Spectrometry. Determining the size fractions metals are associated with is a critical component of determining the distance traveled by particulate matter.

Course Evaluation:

There are **1000 total points available** in this class. Grades are assigned as follows: 1000-900 A, 900-800 B, 800-700 C, etc.

Assignment	**Points**
Completion of safety training	50
Proposal format, proposal topic	30
Lab rotation summaries	20
Project ideas	100
Literature review	100
Research Project plan	100
Revised Research Project plan	50
Research proposal drafts	150
Proposal peer reviews	50
Research Proposal II	50
Poster	100
Mentor and instructor evaluation	100
Final research proposal	100
Total	**1000**

Safety training- Students will perform all safety trainings required by the Department of Chemistry.

Lab shadowing summaries- Undergraduate students will participate in shadowing opportunities with graduate students. The students will then write a summary of their experiences.

Introduction to Chemical Research
CHEM 294; Spring 2015

Students will progressively work toward developing a research plan. Assignments will include:

Research topic: 1-2 paragraph summary of the direction students are interested in pursuing.

Project idea: 1-2 page summary of literature related to the research topic proposed (incorporating faculty and mentor feedback), clearly state a student-generated testable hypothesis, and briefly outline proposed experiments. These will require students to articulate their plans and serve to nucleate student-mentor-faculty discussions aimed toward helping student to refine their ideas.

Literature review: 3-5 page summary of pertinent literature with appropriately formatted citations. This should be written to both report breadth of research in the area as well as the findings of a few of the most relevant studies. The last paragraph will clearly identify the need for the project idea previously proposed and refined through feedback from faculty and CHEM 694 mentors.

Project plan: The student will propose a specific plan for preliminary experiments as well as larger-scale potential follow-on experiments. A clear link between the testable hypothesis, . Required components: purpose, step-by-step instructions for performing preliminary lab experiments, plan for statistical analysis of data, expected outcomes and how the results will be related back to the hypothesis, and potential large-scale follow-on experiments.

Research Proposal- Students will generate and revise an original research proposal with preliminary data that can be submitted for funding to continue the research project. The format and length of the proposal depends on where the proposal will be submitted, one possibility is URSA, which currently limits proposals to 3 pages.

Poster- Students will present their research plan and the preliminary results at the Department Poster Session and Potluck.

Mentor and instructor evaluation- Students will have periodic feedback on their progress in their research progress with their mentor and instructor.

Course Policies:

Classroom Behavior and Late work - Students are expected to conduct themselves in a professional manner at all times. Disrespect of the classroom learning environment, instructors or mentors, and fellow students will not be tolerated! Late work is accepted at a 10% per day reduction of the points possible. This is in an effort to keep the entire class moving though the projects efficiently. Continued attendance to class indicates each student agrees to the policies set forth in this syllabus.

Honor code and Academic integrity- Students are expected to conduct themselves in accordance with the UAF Honor code. The Chemistry Department policy states: *Any student caught cheating will be assigned a course grade of F. The students' academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.*

Disability Services- I will work with the Office of Disabilities Services (208 Whitaker Bldg, 474-5655) to provide reasonable accommodation to students with disabilities. It is the student's responsibility to make an appointment with me to discuss appropriate accommodations within the first two weeks of the first class meeting. A letter from disabilities services must be provided for discussion at that time.

Revised 4/22/2014

Analysis of Environmental Samples
CHEM 294/694; Spring 2015 **Tentative Schedule**

Week	Lecture	Reading	Items due 288	Items due 686
1-15	Introduction to course, Research interests			Lecture signup
	Graduate student overviews 288- Safety training, 686- Mentor training			Research introduction, lab rotation ideas Mentoring Training
1-19	The process of planning research	OBS, Ch. 1-2	Research topic	Lab rotation plan
	Safety in a research lab	OBS, Ch. 8	All safety trainings complete	
1-26	Funding your project			
	Lab rotations			
2-2	Keeping Records	Dunnivant, 2004, Ch 1. *"Record keeping"*	Proposal format	
	Lab rotations			
2-9	Surveying Primary Literature		Rotations summaries	Rotation self reflection
	Literature review			
2-16	Stating a testable hypothesis	Sneider, 2009, Ch 5. *"Questions Drive Research"*		
	Literature review			
2-23	Experimental design	Cox, 1958, *"Planning of Experiments"*	Project ideas	
	Brainstorming project ideas			
3-2	IRB and compliance	OBS, Ch. 7 UAF IRB website	Literature review	Brainstorming notes
	Project planning			
3-9	Writing a research plan		Project plan	Literature review reviews
	288: Write research plan; 686: review project plans			Project plan reviews, mentee evaluations
3-16	Spring Break			
3-23	What is science	Sneider, 2009, Ch 2. "What is Science?"	Revised project plans	
	Reviewing project plans w faculty			
3-30	Statistical treatment of data	Dunnivant, 2004, Ch 2.	Research Proposal Draft 1	

Analysis of Environmental Samples
CHEM 294/694; Spring 2015 **Tentative Schedule**

		"Statistical Analysis of Data"		
	Research Project			
4-6	Making an Effective Poster	Presentation Zen	Research Proposal Peer Reviews	Research Proposal Reviews (mentees)
	Research Project			
4-13	Ethics in Research	OBS, Ch. 3-6; 9-12	Poster Draft 1	
	Research project			
4-20	Science and Society	OBS, Ch. 13	Revised Proposals Draft 2	
	Research project			
4-27	Careers in Science	Tobias, Ch 1.	Poster Draft 2	Proposal Reviews (non-mentees)
	Exit Interviews, poster practice		Mentor evaluations	Mentee evaluations, self evaluations
4-30	Students present at department potluck			
Finals			Final research proposal (due 5-8)	

Key to readings (* pertinent excerpts available on course website)

OBS- On Being A Scientist: A Guide to Responsible Conduct in Research, 3rd ed. The National Academies Press: Washington DC.

* Dunnivant, F.M. Environmental Laboratory Exercises for Instrumental Analysis and Environmental Chemistry. Wiley-Interscience: New Jersey, 2004.

* Snieder,R., Larner, K. The Art of Being a Scientist: A Guide for Graduate Students and their Mentors. Cambridge University Press: New York, 2009.

* Cox, D.R. Planning of Experiments. Wiley and Sons: London, 1958.

* Reynolds, G. Presentation Zen: Simple Ideas on Presentation Design and Delivery. New Riders: Berkeley, CA, 2008.

* Tobias, S., Chubin, D.E., Aylesworth, K. Rethinking Science as a Career: Perceptions and Realities in the Physical Sciences. Research Corporation. Pgs 15-27. ISBN: 0-9633504-3-9