

LSC Use Only
Number: _____
Submission Date: _____
Action-Date: _____



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Number: _____
Submission Date: _____
Action-Date: _____

CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. **CONTACT**

Contact Person Bartley Butler Phone X 2147
Department Biology

II. **PROPOSAL TYPE (Check All Appropriate Lines)**

☒ **COURSE** Great Ideas in Sci.
Suggested 20 character title

☒ **New Course*** SC 201 Great Ideas in Science
Course Number and Full Title

☐ **Course Revision** _____
Course Number and Full Title

☒ **Liberal Studies Approval +** SC 201 Great Ideas in Science
for new or existing course Course Number and Full Title

☐ **Course Deletion** _____
Course Number and Full Title

☐ **Number and/or Title Change** _____
Old Number and/or Full Old Title

_____ New Number and/or Full New Title

☐ **Course or Catalog Description Change** _____
Course Number and Full Title

☐ **PROGRAM:** _____ **Major** _____ **Minor** _____ **Track**

☐ **New Program*** _____
Program Name

☐ **Program Revision*** _____
Program Name

☐ **Program Deletion*** _____
Program Name

☐ **Title Change** _____
Old Program Name

III. **Approvals (signatures and date)**

[Signature]
Department Curriculum Committee

[Signature]
Department Chair

[Signature]
College Curriculum Committee

[Signature]
College Dean

[Signature] - approved 4/23/98
*Director of Liberal Studies (where applicable)

*Provost (where applicable)

[Signature]
CHAIR, HONORS COLLEGE COMMITTEE

JAN 30 2003

COURSE SYLLABUS

I. CATALOG DESCRIPTION

SCI 201 Great Ideas in Science

3 lecture hours
0 lab hours
3 credits
(3c-0l-3cr)

Prerequisites: No majors in Physics, Chemistry, Geoscience, Biology, Biochemistry or Natural Science

Corequisite: None

Introduces students to the great ideas in the fields of Physics, Chemistry, Geoscience and Biology at a level designed to deepen their understanding of the natural world around them and allow them to address intelligently those public issues that are based on science.

II. COURSE OBJECTIVES

As a result of taking this course, students will achieve "scientific literacy" across the whole field of the natural sciences at a level that will enable them to think and act as educated citizens in the 21st century. It is not intended to replace courses in specific sciences nor will it convey large amounts of specific information from the individual sciences. Rather, it will teach students to understand and use major ideas or "laws" of science. The major questions that this course proposes to address are:

1. What is science and how does it differ from "pseudoscience"?
2. What are the basic ideas or "laws" of physics, chemistry, geoscience and biology that govern the natural world?
3. How can we use these laws to understand modern technology and analyze contemporary science-based problems or issues?

III. COURSE OUTLINE

An introduction followed by 13 great ideas to be presented in one or two class periods each with additional periods devoted to discussing examples, problems or topics in terms of these basic ideas.

- A. Introduction:(1 week)
Why is science important?
What is the scientific method and how does science differ from "pseudoscience"?
- B. Thirteen great ideas that answer the following questions.
(1 week each)
 1. What are Newton's laws that describe all motion in the universe and how did their discovery lead to an understanding that the universe is regular, predictable and quantifiable?
 2. What laws govern the flow of energy in the world?
 3. What are electricity and magnetism, what do they have in common and what do they have to do with radio, TV and the working of the human eye?
 4. What are atoms?
 5. What holds atoms together and how can so many millions of compounds be made from so few of them?
 6. What is nuclear energy and how is it used to make nuclear reactors, atomic bombs and treat cancer?
 7. Where did the universe, the stars and our solar system come from?
 8. How does the earth continue to change and how do the continents move?

9. How has the earth been recycling long before we did?
10. How do we get from chemistry to living cells and organisms?
11. What is a gene and what do the genes of all living things have in common?
12. How did life on earth evolve to go from no life to all the species we see around us today?
13. How is all life on earth interconnected and why should we care about "ecology"?

Students will work in groups of 2-4 in this course in various ways.

The text to be used is clear and focuses on ideas without getting lost in detail. For each group of related ideas, one or more class periods will be devoted to insuring that students understand the idea(s) under discussion. This will be done with a minimum of lecture and a focus on response to student questions about the text. Students could be involved here by presenting (orally and/or in writing) their own summaries of the main idea(s) either within small groups or to the entire class.

Subsequent class periods will be devoted to applications of the idea(s) under discussion. Students (individually or in groups) will be assigned problems (practical or political) to analyze in terms of these ideas. These will be discussed in class and some will be discussed in oral presentations and/or papers of various lengths.

IV. EVALUATION METHODS (The balance and details will vary as the course is taught and evolves.)

The final grade for the course will be based on the following:

- 10% Class participation as judged by both instructor and peers.
- 30% Group projects: oral and/or written presentations of key points from reading material (text, New York Times Tuesday science section, etc.) and of problems.
- 30% Individual and/or small group exams: These will test understanding and be in the form of brief problems to be analyzed in terms of the ideas already presented.
- 30% Final group/individual project: This will be an analysis of some more comprehensive topic or problem that will require an understanding of several ideas from the course. Problems will be assigned to groups with individual responsibility within the group for specific parts of the project thus allowing both individual and group portions of the grade.

V. GRADING SCALE

This course will be graded on the basis of total points received with the following scale; 90-100% = A, 80-89% = B, 70-79% = C and 60-69% = D.

VI. ATTENDANCE POLICY (Sample)

This course will only work if you all attend class regularly and arrive on time. You are allowed excused absences for a verifiable illness, emergency or participation in an official university activity as defined in the IUP Handbook. More than two unexcused absences will result in your grade being reduced by one letter grade for each additional unexcused absence. Two incidents of tardiness will count as one unexcused absence.

VII. REQUIRED TEXTBOOKS, SUPPLEMENTAL BOOKS AND READINGS

Textbook: Trefil, James and Hazen, Robert M., The Sciences: An Integrated Approach, 3rd Edition, John Wiley & Sons, Inc. NY, 2000.

Required Reading: The New York Times Tuesday science section.

Outside Readings:

Watson, J.D., The Double Helix, New American Library edition, 1968

Sayre, Anne, Rosalind Franklin and DNA, W.W. Norton & Company, 1978

Additional Possibilities:

Maddox, Brenda, Rosalind Franklin: The Dark Lady of DNA, Harper Collins, 2002

Hazen, Robert M., Why Aren't Black Holes Black?, Anchor Books, 1997

Maddox, John, What Remains to be Discovered, Simon & Schuster, 1999

VIII. SPECIAL RESOURCE REQUIREMENTS

None

IX. BIBLIOGRAPHY

Giancoli, Douglas C., Physics: Principles with Applications, 4th edition, Prentice Hall, 1995

Cole, J.C., Thompson, D.J. & Moses, L.L., Earth Science: A Holistic Approach, Wm. C. Brown Publishers, 1994

Tarbuck, E.J. & Lutgens, F.K., Earth Science, 8th edition, 1997

Chiras, Daniel D., Environmental Science, 6th edition, Jones and Bartlett, 2001

Brown, T. L. & LeMay, H.E. Jr., Chemistry: The Central Science, 2nd edition, Prentice-Hall, 1981

Campbell, N.A. and Reece, J.B., Biology, 6th edition, Benjamin Cummings, 2002

Raven, P.H. and Johnson, G.B., Biology, 6th edition, McGraw Hill, 2002

Colinvaux, P.A., Introduction to Ecology, John Wiley & Sons, 1973

Carey, J., Ed., Eyewitness to Science, Harvard University Press, 1995

Ross, A., Ed., Science Wars, Duke University Press, 1996

Gross, P.R., Levitt, N., & Lewis, M.W., Eds., The Flight from Science and Reason, The New York Academy of Sciences, 1996

Moore, John A., Science as a Way of Knowing: The Foundations of Modern Biology, reprint edition, Harvard University Press, 1999

Lightman, Alan, Great Ideas in Physics, 3rd edition, McGraw-Hill, 2000

Holland, John H., Emergence: From Chaos to Order, Perseus Books, 1998

COURSE ANALYSIS QUESTIONNAIRE

A. DETAILS OF THE COURSE

A1 This course is intended as an Honors Course for inclusion in the Liberal Studies program as an elective especially for those Honors College students choosing Option II (one laboratory plus two nonlaboratory courses). It will be the only course in the college providing students with an overview of all of the natural sciences. Although written as an Honors Course, with the addition of the new Science Core to the Honors College curriculum A Great Ideas in Science may also be offered as a conventional non-laboratory Liberal Studies science course.

A2 This course does not require changes in any other courses or programs in the college.

A3 This course follows the format of other non-laboratory courses in the college. It differs from any other course in the college in being multi disciplinary in content.

A4 This course was offered as a Special Topic three times, spring 1999, 2000 and 2001.

A5 This course is not intended to be dual level.

- A6 This course is not to be taken for variable credit.
- A7 This course is closely modeled after one developed and being taught at George Mason University.
George Mason University: Great Ideas in Science
- A8 No professional society, accrediting authority, law or other external agency requires or recommends this course.
- B. INTERDISCIPLINARY IMPLICATIONS
- B1 Despite being multi disciplinary, this course will be taught by a single instructor. This is the procedure advocated and successfully followed by the originators of the course at George Mason University and I plan to follow it here. We cannot expect students to be literate across the scientific disciplines if we do not display such literacy ourselves.
- B2 By its very nature, this course overlaps with introductory courses in Biology, Chemistry, Physics and Geoscience. Because it is a survey course, however, it lacks the depth of any one of these courses and should inspire students to pursue some one or more of these disciplines in depth rather than competing with any one of them.
- B4 No seats in this course will be reserved for students in the School of Continuing Education.
- C. IMPLEMENTATION
- C1. Faculty Resources
These are adequate.
- C2 Other Resources
- a. Current space allocations are adequate to offer this course.
 - b. No additional equipment is required to teach this course.
 - c. No supplies are required to teach this course.
 - d. Library holdings are adequate to teach this course.
 - e. No travel funds are required to teach this course.
- C3 No grant funds are associated with this course.
- C4. This course is most likely to be offered in spring semesters and possibly also in the summer.
- C5 Initially no more than one section of this course is likely to be offered in a single semester.
- C6 When taught as an Honors College course it will be limited to twenty students, the maximum for an Honors College course. When taught for all students it will accommodate 48.
- C7 No professional society recommends this course.
- D. MISCELLANEOUS

The unique feature of this course is that it is multi disciplinary. It is dedicated to the proposition that, as its

originators state, "The basic ideas underlying all science are simple." (Hazen & Trefil, Science Matters p. xvii). It is being proposed by a Professor in the Biology Department simply because Drs. Butler and Prezant had the idea for such a course and then saw that such a course actually existed, complete with text, at another university. This syllabus and course proposal have been developed following the model of Hazen and Trefil at George Mason University who have shown a willingness to help people at other universities develop similar courses. Dr. Butler participated in the review of a revised and expanded version (The Sciences: An Integrated Approach) of the text they originally wrote for this course, Science Matters. In developing and initiating this course, the plan is to continue to seek advice and inspiration from these two and others working with similar courses.

GREAT IDEAS IN SCIENCE
SCI 201

ANSWERS TO PART IV

A. This is not designed to be a multiple-section course. It is being developed by Dr. Butler and who will initially teach it. The course may be taught by others in the future and the official syllabus and course syllabi used in teaching it initially should provide sufficient guidance to assure essential equivalency over time.

B. Great Ideas in Science will deal only with the most basic and sweeping discoveries in the physical and biological sciences and will place more emphasis on the ideas than on the persons who developed them. Most of these discoveries were made over a period when these fields were dominated by white males of European descent. Where women played parts in these discoveries; Marie Curie in the early work on radioactivity and the discovery of radon and Rosalind Franklin in the discovery of the structure of DNA for example, their work will be described and discussed. Two outside readings will be used to focus attention on the key roles of a male and female scientist in one of the key discoveries of 20th century biology, the structure of DNA. A *The Double Helix*, by J.D. Watson and A *Rosalind Franklin and DNA* by Anne Sayre are accounts of this discovery and the latter addresses A what it is like to be a gifted woman in an especially male profession.

C. Students will read two books in addition to the text for this course. The books will vary from year to year, but initially will be the two mentioned in A B above: A *The Double Helix*, by J.D. Watson and A *Rosalind Franklin and DNA* by Anne Sayre. These have been chosen to offer illuminating insights into how scientists work and illustrate that science is a *human* endeavor.

D. This course will be multi disciplinary, but not multi departmental. As a non-laboratory science course, it will be taken by students who will also have to take a 4-credit laboratory course and a second 3-credit non-laboratory course. Students in these other science courses will be exposed to some of the ideas presented in this course, specifically those central to the science(s) they study, but no single course requires the breadth that this course offers. It is not designed to introduce a specific discipline, but rather to introduce students to the major ideas of all of the physical and biological sciences. There will be no conflict for any science major, since it is limited to students who are not majors in the departments of Physics, Chemistry, Geoscience or Biology

To: Honors College, Liberal Studies, UWCC
From: Barkley Butler *BB*
Date: March 31, 1998
Subject: New Course Proposal
Honors College and Liberal Studies Non-Laboratory Science Course

The attached proposal is being submitted for approval as SC-201, Great Ideas in Science. Approval is requested as an Honors College course and as a Liberal Studies Non Laboratory science course.

The course has been approved by the Curriculum Committees of the Department of Biology and the College of Natural Sciences and Mathematics. Letters of support from the departments of Chemistry, Geoscience and Physics are attached.

It is my hope that this course can be approved in time that it can be taught in the spring of 1999.

I will be glad to answer any questions or do anything else I can to expedite the progress toward approval of this course.

HONORS COLLEGE COURSE PROPOSAL QUESTIONS

1. Upon what definition of an honors student is this course description built?

Honors students should be persons of wide curiosity about the world and how it works. They should be open to appreciating the interrelatedness of various disciplines and eager to apply their knowledge to real world problems.

2. How is this course different from a regular (non-honors) section of this course?

This is a new course and, in its present form, is being designed explicitly as an honors course.

3. How does this course demonstrate a commitment to the development of critical thinking skills as a primary objective?

Almost all of the grade in this course will be based on the student's ability to apply the great ideas of science to specific problems or situations. An understanding of the ideas will be only the starting point for their use in understanding and analyzing complex problems.

4. Description of the interactive and student-centered nature of the pedagogy of this course.

The instructor in this course will be there to explain or clarify ideas as necessary but to lecture as little as possible. Students will be encouraged and helped to obtain the basic information content of the course from their reading and the structure of most class periods will be organized to encourage and facilitate that end. Students will be given wide latitude in choosing problems or topics of interest to them to research or analyze. Extensive use will be made of small (2-4) groups.

5. How does this course reflect high expectations for self-initiated student learning?

If all goes as planned, there will be few lectures and these will be designed to model drawing central themes from the text or a reading. The expectation is that students will get most of their basic information from the text on their own or with help from each other and only rely on the instructor to clarify or explain when they are confused. It is the hope that this will free us to spend the majority of class time applying the knowledge learned from the text, not simply repeating it.

6. How does the course provide an integrative or synthetic approach to knowledge?

In considering the great ideas of four major sciences, physics, chemistry, geoscience and biology and applying them to contemporary systems and issues, this course is integrative by its very nature.

7. How does this course move at a pace appropriate for honors students while recognizing that, though honors students may be bright, they do not necessarily come with preexisting skills?

The course will move, during the semester, from a greater dependence on the instructor to highlight and explain the ideas presented to a greater dependence on the student to draw information from the text and readings independently. The fact that the course also moves from physics and chemistry, which are traditionally difficult for students, toward biology, which they seem more comfortable with, may facilitate the transition to more independence.

8. How does this course demonstrate concern for students' affective and moral/ethical as well as cognitive growth?

As stated above, students will move from greater to less dependence on the instructor as they learn to read the text and take from it the main themes. The application of themes, particularly in the areas of atomic energy and biology,

to contemporary problems such as energy, population and environmental issues will help students learn to relate science to the world of moral and ethical choices in which they live.

9. How does this course provide opportunities for students to enhance written and oral communication skills?

All graded course work will be written or oral presentations of ideas or applications of ideas to problems.

10. Describe your likely response to a group of students from the proposed honors class coming to you and indicating that this class is not being taught in an appropriate manner for an honors course.

I have always solicited feedback from students about courses I have taught, particularly small courses. I try to listen to any and all comments and criticisms. In this case, I would ask them to discuss with me the Honors College Course Proposal Questions listed above and, if we agreed that the course was not appropriate in some area, solicit suggestions for improving it.

Geoscience Department
Indiana University of Pennsylvania
114 Walsh Hall
Indiana, Pennsylvania 15705-1087
(412) 357-2379



March 30, 1998

TO: Barkley Butler
 Biology Department

FROM: Frank W. Hall, Chair *FW Hall*
 Geoscience Department

SUBJECT: Geoscience Department support for SC 201 Great Ideas In Science

The Geoscience Department reviewed the proposal of SC 201 Great Ideas In Science as an Honors College course. We discussed the course, especially its interdisciplinary nature and how it may overlap with other Geoscience department courses. There were some concerns about sufficient depth in the overlap areas to be considered an honors course. However, your recent discussion with me about the course and the proposed text (especially the fact that one of the authors is in the field of Earth Science), and that the course being for non-science majors only, indicates that there should be no depth/overlap/conflict problems in the Geoscience area. The Geoscience Department therefore supports the proposal.

March 17, 1998

TO: Dr. Barkley Butler
Dept. Of Biology

FROM: Dr. Pothan Varughese, Chair
Dept. Of Chemistry



SUBJECT: SC 201, Great Ideas in Science

The Chemistry Department Curriculum Committee reviewed your honors course proposal and it is my pleasure to report to you that both the committee and I found the proposal to be innovative and appropriate for a sophomore level honors course. We are in support of this course and recommend that it be approved. We understand that the faculty complement to cover this course does not come from the College of Natural Sciences and Math.

Return-path: <rroberts@oak.grove.iup.edu>
Date: Wed, 11 Feb 1998 16:38:56 +0300
From: Richard Roberts <rroberts@oak.grove.iup.edu>
Subject: SC 201~GREAT IDEAS IN SCIENCE
To: BBUTLER@grove.iup.edu

Barkley,

The Physics Department faculty discussed your course proposal at our faculty meeting yesterday. The consensus was that the course does not overlap in a serious way with any course in our department.

One of the faculty members who is familiar with the book that you plan to use and is currently teaching some honors students in an honors section was concerned about the level of the material in the course. According to him, the students that he has are quite verbal and bright but their science and mathematics background is quite weak. Other comments included the thought that there should be more readings in the course; the faculty in the course should have a broad experience with different faculty presenting different aspects of the proposed course.

Because I am currently serving on the Senate Curriculum Committee, I know that you will need to rewrite the Course Objectives so that they answer the question "What is it that students will achieve as a result of taking this course?" Also in the Course Outline you will need to indicate how much time will be spent on each part of the course.

Richard D. Roberts
Chair, Physics Department
357-2371

Mary Sadler

From: "Rick Kutz" <rdkutz@iup.edu>
To: "Mary Sadler" <msadler@iup.edu>
Sent: Tuesday, January 28, 2003 9:31 AM
Subject: Re: Great Ideas in Science

As I recall Barkley ran it as a 281, and it was approved as an Honors course. I think he intended to submit the number as 201, but I'm not sure where it went from there.

Rick

----- Original Message -----

From: "Mary Sadler" <msadler@iup.edu>
To: "Rick" <RDKutz@iup.edu>
Sent: Tuesday, January 28, 2003 8:26 AM
Subject: Great Ideas in Science

> Dear Rick,
 > Was this course of Barkley Butler's ever approved by the Honors College?
 It
 > dates back from 1997-98. It received LSC approval in April 98, but never
 > received UWUCC approval (there were some minor revisions that were
 required
 > that were never addressed --so the course has been sitting on a back
 > burner). Barkley now has some time to devote to the proposal and we are
 > getting it ready for UWUCC approval -- will you check your records to see
 if
 > you approved it for an Honors course? Thanks, Mary
 > -----
 > Mary E. Sadler, PhD
 > Director Liberal Studies
 > 110 Gordon Hall
 > Professor, Nursing & Allied Health
 > 214 Johnson Hall
 > Indiana University of PA, Indiana, PA 15705
 > 724 357-5715
 >
 >

April 28, 1998

To: Barkley Butler, Biology Department
From: Darlene Richardson, Director
Subject: SC 201 Great Ideas in Science

At its April 23, 1998, meeting the Liberal Studies Committee approved your proposal to include SC 201 Great Ideas in Science as a course in the non-laboratory science category. We have a few questions/concerns:

- the syllabus is not in the UWUCC format
- what is the format of the final group project (written/oral/both?)
- please detail the specifics of how group and individual grades will be determined
- we also note an inconsistency in resource issues between what you write and what appears to be the Chemistry Department's understanding about complement (see Chemistry's letter of support).

You do not need to respond to the Liberal Studies Committee on these issues—but you may wish to consider them as your course makes its way through the University-wide Undergraduate Curriculum Committee (UWUCC).

We enjoyed reading your proposal and wish you well with this new course offering. I have reported this approval to the University-wide Undergraduate Curriculum Committee (UWUCC), but this course will not be sent to Senate for approval until the UWUCC forwards it.

Copy: Robert Prezant, Chair, Biology
 John Eck, Dean, College of Natural Sciences and Mathematics