



**Minnesota State University, Mankato** HOLD and CLEAR buttons only compatible with Acrobat V. 4 and 5.  
**Curriculum Proposal**

08-34 ✓

Please type or select the requested information. Print completed forms, add appropriate paper attachments, and route through MSU's curricular process for recommendations and decisions.

(Check all that apply):		Proposal # <u>204</u>
College: <u>Science, Engineering and Technology</u>	<input checked="" type="checkbox"/> Undergraduate	Effective Date of Change:
Department: <u>Biological Sciences</u>	<input checked="" type="checkbox"/> Graduate	Academic Year <u>07-08</u>
Program: _____	CIP # _____	(For Office Use Only)
Type of Change: <u>COURSE PROPOSALS</u>		<b>Course Designator</b> <b>Number of</b>
Proposed: <u>Change in Credits and Number Description</u>		<b>and Number</b> <b>Credits</b>
Title Current: <u>Plant Biotechnology</u>		Biol 451 - <u>3</u>
Title Proposed: <u>Plant Biotechnology</u>		Biol 551 <u>BIOL451</u> <u>4</u>
24-Char. Abbrev: <u>Plant Biotechnology</u>		(if applicable)

Include a course or program description for the Bulletin (30-40 words maximum for courses, 100 for programs):  
 Lecture/laboratory course that presents an integrated view of plant biology, crop science, and current issues in biotechnology. Course focuses on issues of global concern such as sustainable food production, biofuels, genetically modified crops, molecular pharming, and tissue culture..

**Rationale or Justification for change:**  
 There are two changes. First, we are adding a laboratory component which is increasing the number of credits from 3 to 4. The laboratory is needed to provided the students with hands-on experiences related to the content of the lecture. The second change is to make a new course--a graduate level course. Thus, we are asking for a new course Biology 551 Plant Biotechnology which would be co-listed with the modified Biology 451.

**\*\*\*For General Education or Cultural Diversity Courses Only\*\*\***

<b>General Education Course:</b>		<b>Cultural Diversity Course:</b> (Please check one.) <input type="checkbox"/> Core (At least 75% devoted to topics of race, gender, sexual orientation, age, class, and disabilities as they occur in United States Society.) <input type="checkbox"/> Related (At least 25% devoted to the above topics or to a global perspective on topics related to African American, Asian, Hispanic, and Native American inhabitants of the United States.)
GE Category #	GE Category Name (Maximum of 3 Categories)	
<u>N/A</u>		
<u>N/A</u>		
<u>N/A</u>		

? For Writing Intensive Courses, attach a description of the kind and quantity of writing.  
 ? For Upper Division Courses, include a description of the respects in which it is broad and general rather than narrow and specific, and so suitable as GE.

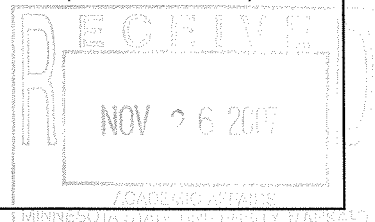
Attach paper copies of the following:  
 a. Syllabus or course outline.  
 b. Course's student learning outcomes associated with each GE competency or CD designation.  
 c. List of strategies to be used to assess students' achievement of each GE competency or CD designation.

**\*\*\*For New Courses\*\*\***

(Check all that apply.)	Instructional Type: <u>Lecture/Lab</u>	Course will be offered:
<input checked="" type="checkbox"/> Course is an elective.	Grading Format: <input checked="" type="checkbox"/> Grade <input type="checkbox"/> P/N	<input checked="" type="checkbox"/> Fall Semester
<input checked="" type="checkbox"/> Course is required for program	<u>Biotechnology</u>	<input type="checkbox"/> Spring Semester
<input checked="" type="checkbox"/> Pre- or Co-requisites:	<u>Biology 105, Biology 106</u>	<input type="checkbox"/> Summer Session
<input type="checkbox"/> Other courses are being changed or eliminated. (Explain.) _____		

Course content or title is similar to courses in other departments. (Attach copy of letter of agreement with other program(s) contacted. Indicate the nature of the discussions and/or resolution of differences or potential conflicts.)

Attach paper copies of the following:  
 a. Syllabus or course outline.  
 b. Course's student learning outcomes.  
 c. A list of resources required to offer and support this course.  
 d. A description of how teaching this course will affect department staffing.  
 e. If 400/500 level course, an explanation of added expectations of graduate students.





Minnesota State University, Mankato  
Curriculum Proposal

\*\*\*Signature Page\*\*\*

**Department**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*Angie A. Gray* 10/15/07  
Department Chair Date

Comments:

**College Curriculum Committee**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*[Signature]* Nov-9, 2007  
Committee Chair Date

Comments: *please see attached note*

**College Dean**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*[Signature]* 11/21/07  
Dean Date

Comments:

**General Education Subcommittee**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

\_\_\_\_\_  
General Education Subcommittee Chair Date

Comments:

**Undergraduate Curriculum and Academic Policy Committee**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*[Signature]* 3/4/08  
UCAP Faculty Chair Date

Comments:

**Faculty Association Graduate Committee**

Recommended  
 Not Recommended

\_\_\_\_\_  
Faculty Association Graduate Chair Date

Comments:

**Graduate Dean**

Recommended  
 Not Recommended

\_\_\_\_\_  
Graduate Dean Date

Comments:

**Academic Affairs Council**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*[Signature]* 4/28/08  
Assistant Vice President Date

Comments:

**Senior Vice President and Vice President for Academic Affairs**

Approved (Category/ies \_\_\_\_\_)  
 Not Approved (Category/ies \_\_\_\_\_)

*[Signature]* 4/28/08  
Sf. Vice President / Vice Pres. Academic Affairs Date

Comments:

## Course Proposal - Plant Biotechnology (BIOL 451/551)

I. Course Syllabus: – See attached

II. Student Learning Outcomes:

**KNOWLEDGE**--Demonstrate a basic understanding of biological principles (biological literacy)

a. Demonstrate a basic understanding of chemical basis of biology including metabolism

Explain how water availability limits food production.

Describe how changes in climate are likely to influence global and regional productivity.

Explain the mode of action of herbicides on crop plants.

Explain how herbicide resistance has been developed in genetically modified crops.

Diagram the synthesis of lipids, fatty acids etc and describe why they are important in the diet of human and animal nutrition.

Describe the synthesis of all major vitamins.

b. Demonstrate a basic understanding of cell biology

Explain how differences at the cellular level (lignin, cellulose content, carbohydrate synthesis etc) influences consumption of foods.

Explain the role of nitrogen as a fertilizer.

Understand the cellular basis for Bt corn.

Describe the role of viral resistance in genetically modified crops.

Discuss how the “Second Green Revolution” and plant biotechnology is being utilized in today’s global market.

c. Demonstrate a basic understanding of genetics

Discuss different mechanism for incorporating foreign genes into crop plants.

Diagram how *Agrobacterium tumefaciens* can be used to incorporate foreign genes into a plant’s genome.

Discuss the role of the *CRY* genes in insect resistant organisms.

Discuss the role of hormones in plant biotechnology and tissue culture.

Describe major gene families that are important for growth and development in the *Arabidopsis* model (*GURKE*, *FACKEL*, *MP*, *GN*, *WOL*, *SCR*, *SHR*, *PIN*, *CUC* etc....)

Illustrate the role of the *CKI*, *CRE* and *AHK* gene family are important for cytokinin production.

Diagram the auxin signal transduction pathway and the role of auxin in plants.

Describe how the “terminator” gene works in seed biotechnology. Why is it controversial?

Discuss the role of plant mutations for plant biotechnology.

d. Demonstrate a basic understanding of evolution and natural selection

Discuss the first “Green Revolution” and how artificial selection has helped food supplies.

e. Demonstrate a basic understanding of ecology

Use demography to explain problems with food distribution to the human population.

Give examples of ecological Malthusianism versus productionist Malthusianism

Outline which areas of the world are likely to experience changes in crop productivity in response to climate change.

List the causes for food insecurity

Describe advantages and disadvantages for cropping techniques used in different parts of the world (sub-Saharan Africa, Tropical regions, China, United States etc.)

f. Demonstrate a basic understanding of physiology

Explain the difference between production and yield.

Explain how regional climate influences plant production and crop yield.

List the minimum dietary requirements outlined by the Food and Agricultural Organization.

Give examples how improvements in photosynthetic (and water-use and nitrogen-use) efficiency can improve crop yield.

g. Demonstrate a basic understanding of development

Diagram plant development in a typical angiosperm.

Explain why totipotency is important for plant tissue culture.

Diagram the role of plant tissue culture and how it is used in plant development.

Outline the steps of vegetative organogenesis and the development of the shoot apical and root apical meristems.

Describe plant apoptosis.

Describe how plants can be used as “molecular pharms” - including the production of vaccines, plastics, oils, gelling agents, etc.

h. Demonstrate a basic understanding of diversity of life

List the important crop plants (the “trinity of food”) and where they are utilized on the global market

**SKILLS**--Demonstrate the ability to apply scientific method to a biological problem.

i. The students will be able to read about a biological phenomenon and develop a testable hypothesis

Students read several peer-reviewed publications over the course of the semester.

j. The students will be able to evaluate the design of a controlled experiment to that answers a biological question

k. The students will be able to evaluate the design of a field study that answers an ecological question

l. The students will be able to evaluate the design of an experiment that answers a cell biology question using techniques such as gel electrophoresis

Students learn the foundations for plant tissue culture and how it is utilized in modern plant biotechnology.

m. The students will be able to analyze the experimental results and apply the analysis to the problem being studied

III. A list of resources required to offer and support this course:

Since the lab is currently being offered as an independent study, the current resources are adequate as a starting point. Eventually we will need a large chamber (or room) which is both temperature and light controlled.

IV. Description on how this course will affect Departmental Staffing:

Again, since the lecture and lab are currently being taught as a course and an independent study, the staffing resources are already available.

V. Added expectations of 500 level students:

Graduate students will write an additional paper dealing with their Special Topics presentation on Plant Biotechnology (see syllabus). This paper will be worth 100 points and must rely upon primary literature as a source of information.

VI. Course Description/Bulletin Copy:

Lecture/laboratory course that presents an integrated view of plant biology, crop science, and current issues in biotechnology. Course focuses on issues of global concern such as sustainable food production, biofuels, genetically modified crops, molecular pharming, and tissue culture.

Fall 200X

## BIO 451: PLANT BIOTECHNOLOGY

Instructor: Dr. Christopher T. Ruhland Email: [christopher.ruhland@mnsu.edu](mailto:christopher.ruhland@mnsu.edu)  
Office & Phone: TS -272 389-1323  
Office Hours: MWF 11am - 12pm; 2-3pm (or by appointment)

**COURSE:** This course serves as an introduction to plant biotechnology. The course will present an integrated view of plant biology, crop science and current issues in biotechnology. The topic is very broad and there is no general consensus on what constitutes "biotechnology." The course will primarily focus on issues of global concern, mainly sustainable food production for the growing population on this planet.

**TEXT:** Chrispeels, Martin J. and Sadava, David E. *Plants, Genes and Crop Biotechnology*. Second Edition. Jones and Bartlett Publishers, Sudbury MA. 562 pp. ISBN: 0-7637-1586-7

*Note: This text is endorsed and published in partnership with the American Society of Plant Biologists (ASPB).*

**TESTS:** Three equally weighted tests worth 100 points each will be given during the semester. The final exam will be worth 100 points. It will cover the last third of the course ( $\approx 70\%$ ) and overview questions related to major topics covered throughout the semester ( $\approx 30\%$ ). Tests will consist of multiple choice, fill in the blanks along with short answer essay questions.

**CASE STUDY:** Over the course of the semester students will be expected to give a 50-minute presentation that focuses on one *specific aspect* of plant biotechnology. Since the topic is so broad, I am pretty open to any aspect of the field, as long as it is pre approved. The presentation should give specific examples of the issue at hand along with proposed solutions, economic and social implications etc. The presentation must draw from primary and secondary literature and the student must provide the class a list of references for further reading on the subject material (No webpages will be accepted.) The reference list must provide at least 10 primary literature references. We will discuss what is expected during this presentation at further length in class. Students will be responsible for information covered during these presentations on exams. Each presentation is worth 50 points.

**READINGS:** On occasion there will be assigned readings of primary literature, book chapters, news articles etc. These readings will either be available electronically, distributed in class or on reserve in the library. Students will be held responsible for these materials.

**LAB:** 100 points will come from laboratory activities. These lab activities include formal lab reports (80 points) and lab participation (20 points)

**BIO 551:** Graduate students will be expected to write a review paper dealing with the special topic. Papers will be worth an additional 100 points.

**POLICY:** All policies of Minnesota State University will be strictly followed. If you are impaired in any way, or feel the learning experience can be enhanced, please do not hesitate to see the instructor or contact Ms. Julie Snow from disability services at 507 389-1819 ([julie.snow@mnsu.edu](mailto:julie.snow@mnsu.edu))

## TENTATIVE LECTURE SCHEDULE

(Note: Chapters in bold)

Week	Day	Date	LECTURE TOPIC
1	M	Aug 27	Introduction
	W	Aug 29	<b>1. Population Growth &amp; Demography</b>
	F	Aug 31	<b>2. Global Productivity</b>
2	M	Sep 3	NO CLASS - LABOR DAY
	W	Sep 5	<b>3. Sustainability of Crop Production</b>
	F	Sep 7	<b>4. Food Security and Malnutrition</b>
3	M	Sep 10	<b>5. Sub-Saharan Africa</b>
	W	Sep 12	Crop Biotechnology in the United States
	F	Sep 14	Crop Biotechnology in China
4	M	Sep 17	<b>6. Molecular Basis of Gene Modification</b>
	W	Sep 19	<b>7. Human Nutrition and Animal Feed</b>
	F	Sep 21	<b>EXAM I</b>
5	M	Sep 24	<b>8. Growth and Development</b>
	W	Sep 26	<b>9. Seed Technology</b>
	F	Sep 28	<b>10. Photosynthesis and Energy Transfer</b>
6	M	Oct 1	<b>11. Crop improvement in Adverse Soils</b>
	W	Oct 3	<b>12. Life underground</b>
	F	Oct 5	SPECIAL TOPIC #1
7	M	Oct 8	Genetic Modification and Drought and Salt Tolerance
	W	Oct 10	<b>13. Ten thousand years of Crop Evolution</b>
	F	Oct 12	SPECIAL TOPIC #2
8	M	Oct 15	<b>14. Classic Plant Breeding and Modern Improvements</b>
	W	Oct 17	Transformation Technology
	F	Oct 19	SPECIAL TOPIC #3
9	M	Oct 22	Enhanced Nutritional Value and Fatty Acids
	W	Oct 24	Improvement in Cereal Crops and Starch
	F	Oct 26	NO CLASSES
10	M	Oct 29	<b>EXAM II</b>
	W	Oct 31	<b>15. Crop Diseases and their Control</b>
	F	Nov 2	SPECIAL TOPIC #4
11	M	Nov 5	Fungal Resistance
	W	Nov 7	<b>16. Controlling Insects, Mites and Nematodes</b>
	F	Nov 9	SPECIAL TOPIC #5

12	M	Nov 12	17. Weed Control
	W	Nov 14	18. Toward a Greener Agriculture
	F	Nov 16	SPECIAL TOPIC #6
13	M	Nov 19	19. Plants and Vaccines
	W	Nov 21	Food Allergens
	F	Nov 23	NO CLASS - THANKSGIVING
14	M	Nov 26	Gene Flow
	W	Nov 28	Risk Assessment and Regulation
	F	Nov 30	SPECIAL TOPIC #7
15	M	Dec 3	20. Concerns about GM crops (WRAP UP)
	W	Dec 5	Course Review and Catchup
	F	Dec 7	SPECIAL TOPIC #8
16	TBA		FINAL EXAM

### TENTATIVE LABORATORY SCHEDULE

(subject to change)

LAB 1:	Aug	Intro to Tissue Culture - Sterile Technique
LAB 2:	Sep	Light Regimes and Cropping
LAB 3:	Sep	Collection of Native Prairie Plants for Cellulosic Ethanol
LAB 4:	Sep	FIELD TRIP - Southern Research and Outreach Center - WASECA - Alternative Biofuels in Southern Minnesota
LAB 5:	Sep	Determination of Holocellulose content - BIOFUELS
LAB 6:	Oct	Determination of Lignin content - BIOFUELS
LAB 7:	Oct	FIELD TRIP - Southern Research and Outreach Center - LAMBERTON - Herbicide Resistance in Minnesota Crops
LAB 8:	Oct	Start Tissue Culture - Carrot Callus Induction
LAB 9:	Oct	Mechanisms for Herbicide Resistance
LAB 10:	Nov	Tissue Culture - Root Induction
LAB 11:	Nov	Protoplast Isolation
LAB 12:	Nov	Protoplast Culture
Lab 12:	Nov	NO LAB - THANKSGIVING BREAK
Lab 13:	Dec	Tissue Culture - Shoot Induction
Lab 14:	Dec	TBA

Grading Policy:

Your grade will be based upon your performance on lecture exams, the issue paper and your ozone hole report. There will be no extra credit given assignments.

<u>Points available:</u>	<u>Bio 451</u>	<u>Bio 551</u>	<u>Guaranteed Grading Scale:</u>	
Exam I	100	100	90 - 100%	A
Exam II	100	100	80 - 89%	B
Final Exam	100	100	70 - 79%	C
Paper	-	100	60 - 69%	D
Case Study	50	50	<60%	F
Lab Reports	80	80		
Lab Participation	<u>20</u>	<u>20</u>		
Total:	450	550 points		

**Absence Policy:** If you must miss an exam due to illness of family emergency, you must notify the instructor **PRIOR TO THE EXAM**. Make-up exams will be available to the student if a doctor's excuse or some other form of evidence is given for the absence.

**Cheating:** It should go without saying that all work submitted should be the product of the individual student. Students will receive a grade of "0" for the assignment and possible failure for the course. If you are unsure about plagiarism, please ask the instructor.

*Note that this syllabus is not a binding contract between the student and the instructor, but is meant as a general guideline for expectations in the Plant Biotechnology course.*



To: UCAP and Graduate Committee members  
From: Youwen Xu, Chair of CSET Curriculum Committee *Y. Xu*  
RE: Proposal 08-34. Biol 451/551  
Date: Nov. 7, 2007

On the cover page of CSET proposal 08-34 from the Department of Biological Sciences it stated: "change credit hours and change course number". It actually is proposing to change the current Biol 451, Plant biology, from 3 credit hours to 4 credit hours and **to add a new course: Biol 551 which does not exist at the present.** The CSET Curriculum Committee believed that the proposal is confusing and voted to request that two proposals be submitted: one for the change of credit hours of the existing Biol 451, and the other for the new course Biol 551. Dr. Gregg Marg, the Chair of Biology Department considered our request as unnecessary except to generate paperwork. He also said that he had consulted with the members of UCAP and Graduate Committee and that the proposal as submitted is acceptable by both committees; and it serves the purpose of both changing credit hours and proposing a new course.

This proposal is thus forwarded to you without our Committee's consent. If this form of combined proposal is acceptable, we will use it as a precedent for our future proposal reviews and submissions.

Please feel free to contact me if you have any questions. Thank you for your time.

cc:  
Dr. John Frey, Dean of CSET  
Dr. David Haglin, Associate Dean of CSET



To: UCAP and Graduate Committee members  
From: Youwen Xu, Chair of CSET Curriculum Committee *Y. Xu*  
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