BIOTECHNOLOGY IN AGRICULTURE:
APPLICATIONS AND ETHICAL ISSUES
Fall 2014
HRT 486 / PHL 486 / CSS 486 / FOR 486
Tuesday, Thursday 10:20-11:40; Rm 186 Plant and Soil Sciences

Rebecca Grumet
Horticulture Department
342 Plant and Soil Sciences
355-5191 ext. 1431
grumet@msu.edu
Office Hours: Tu/Th following class and by appointment

Paul Thompson
Philosophy Department
526 South Kedzie
432-0136
thomp649@msu.edu
Office Hours: T, Th 1:00-2:30 330 Nat. Res.

Texts: Biotechnology in Agriculture Coursepack 2014 and web materials
(Coursepack is available at Ned’s)

Course Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essays</td>
<td>20%</td>
</tr>
<tr>
<td>Discussion/Class participation/debate</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm</td>
<td>20%</td>
</tr>
<tr>
<td>Final</td>
<td>20%</td>
</tr>
<tr>
<td>Term Paper</td>
<td>20%</td>
</tr>
</tbody>
</table>

Course Objective:
This course will explore the current uses and emerging biotechnology applications in agriculture and will critically address both the scientific and policy issues involved. The emphasis will be on the scientific basis for the technologies, specific applications, and various associated health, environmental, social and ethical concerns.
<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
</table>
| 1     | 8/28 | Overview of course  
Introduction to biotechnology and the controversies surrounding it  
Ethical basis for concerns (rights, utilitarianism)  
How can concerns be addressed (science, legal system)  
  Readings: Harmon, Haspel, Institute for Responsible Technology, Johnson  
Introduction to dialectical structure of argument  
  *Essay #1 assigned: Should genetically engineered foods be labeled* |
| 2     | 9/2  | Plant breeding, crop evolution and the molecular basis of heredity  
  (Genes, chromosomes, mitosis and meiosis)  
  Readings: Chrispeels and Sadava  
Introduction to ethical reasoning – rights and utilitarianism  
  Readings: Rachels, Sanger, Regan |
| 3     | 9/4  | Molecular basis of phenotype: genes to proteins, proteins to traits.  
  (Transcription, translation, gene expression, and regulation)  
  Readings: Chrispeels and Sadava, Gallo and Flynn, Doebley et al.  
Industry groups assignment 1  
  ***Essay #1 due*** |
| 4     | 9/9  | Discussion 1: Industry groups - product choice |
| 5     | 9/11 | Molecular genetic and genomic tools  
  Readings: Barnum, Varshney, Bolger, Liu, Draxler  
Term paper format, guidelines, and topics, referencing, plagiarism |
| 6     | 9/16 | Approaches to risk management: cost-benefit analysis and precautionary principle  
  Readings: Stich p. 94-115, Foster et al., Hoffmann-Riem and Wynne, Gaskell et al., Bagla and Stone  
  *Essay #2 assigned: Should golden rice be released for production?*  
  Readings: Nash, Shiva, Greenpeace, Grusak, Potrykus, goldenrice.org |
7  9/18  Food safety: factors influencing food safety; food safety evaluation and regulations
     Readings: WHO, Parrot et al., Segarra, Millstone, Johnson

8  9/23  Environmental safety: environmental release of engineered organisms; scientific evidence
        concerning release
     Readings: Keeler, Sanvido, Strong and Pemberton, Marvier, Leford

***Essay #2 due

9  9/25  Discussion 2: What is natural? Harmony with nature
     Readings: Siipi, Sagoff

10 9/30  Plant transformation technologies
     Readings: Finer and Dhillon
     Conceptual issues in risk assessment of transgenic crops
     Readings: Thompson

11 10/2  Biotechnology and the first wave; engineered insect, disease, herbicide resistance
     India cotton, Brazil soybean
     Readings: McHughen, James, Brookes and Barfoot, Marvier et al., Carpenter, Lu et al., Farm Industry News

12 10/7  Discussion 3: Large-scale vs. small-scale farming; Where does biotechnology fit in?
     Readings: Comstock, Comstock

13 10/9  GE crops nearing release and products on the horizon
     Readings: Shelton, Jones, Chen, Jia, Lybbbert and Bell

***Industry groups 2 assignment – SHARK TANK
    (some examples of products in Shark Tank Folder)

14 10/14  ***MIDTERM EXAM***

15 10/16  Microbial biotechnology
     Guest lecturer: Dr. Wei Laio, Biosystems Engineering
     Readings: Ahmad
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>October 21</td>
<td>Intellectual property rights, patenting living organisms, personal benefit, information exchange&lt;br&gt;Readings: Buffinger, Bently et al., Rifkin, Ergenzinger and Williams</td>
</tr>
<tr>
<td>17</td>
<td>October 23</td>
<td>Biofuels&lt;br&gt;Guest lecturer: Dr. Jonathan Walton, MSU-DOE Plant Research Laboratory&lt;br&gt;Readings: Chang, Henry, Buyx and Tait, Mortimer, Thompson</td>
</tr>
<tr>
<td>18</td>
<td>October 28</td>
<td>Discussion 4: Industry groups – Shark Tank&lt;br&gt;Product development</td>
</tr>
<tr>
<td>19</td>
<td>October 30</td>
<td>Germplasm diversity, preservation, ownership&lt;br&gt;Readings: Damania, Pollack, Gepts</td>
</tr>
<tr>
<td>20</td>
<td>November 4</td>
<td>Sustainable and organic agriculture&lt;br&gt;Guest lecturer: Sieg Snapp, Plant, Soil and Microbial Sciences&lt;br&gt;Readings: IFOAM, Biernbaum, Pollan, Hendrix, Ervin et al.</td>
</tr>
<tr>
<td></td>
<td>Essay #3 Assigned: Do GE crops have a role to play in feeding the future world population?&lt;br&gt;Readings: Wu, Azadi, BigGav, Naam, Antoniou</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>November 6</td>
<td>Impact of biotechnology on developing countries&lt;br&gt;Panel of foreign scientists&lt;br&gt;Prepared questions&lt;br&gt;Readings: Flora, Tonukari and Omotor</td>
</tr>
<tr>
<td>22</td>
<td>November 11</td>
<td>Food aid and GE crops&lt;br&gt;Readings: Paarlberg, Weiss, Itano, Paarlberg, du Venage, Jones, Olembo et al., Shiva, Morris, Zerbe, Mpofu</td>
</tr>
<tr>
<td></td>
<td>Essay #4 assigned: Is it appropriate for the US to send GE food as food aid?</td>
<td></td>
</tr>
</tbody>
</table>

***Essay #3 Due***
23 11/13 Animal agriculture, animal biotechnology
   Case study: BST
   Guest lecturer: Dr. Michael Vandehaar, Dept. Animal Science
   Readings: Vandehaar

24 11/18 Animal rights/animal welfare
   Readings: Benjamin, Pollan, Warkentin, Hopkins, Frewer, Schafer, Metcalf

   *** Essay # 4 Due ***

25 11/20 Animal cloning and transgenic animals
   Guest lecture: Dr. Jason Knott, Dept. Animal Science
   Readings: Dave, Miao, Clarren

26 11/25 Discussion 5: Animal welfare/animal rights
   Readings: Benjamin; Pollan, Warkentin, Hopkins, Frewer, Schafer, Metcalf

-- 11/27 THANKSGIVING

27 12/2 Molecular assisted breeding/genomic selection for farm animals
   Guest lecture: Dr. Cathy Ernst, Dept. Animal Science
   Readings: Forabosco, Whyte and Prather, Strauss, Hayes et al.

28 12/4 Biotechnology and globalization of agriculture/vertical integration, role of multinational corporations
   Readings: Dibden, Brant, Whorisky, Economist, Neuman

   ****TERM PAPER DUE****

FINAL EXAM - Tuesday, Dec. 11, 7:45
**Summary of assignments by week:**

<table>
<thead>
<tr>
<th>Week</th>
<th>Class</th>
<th>Date</th>
<th>Assignment</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>9/4</td>
<td>Essay 1 due</td>
<td>labeling</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>9/9</td>
<td><em>Discussion 1</em></td>
<td>industry groups</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>9/23</td>
<td>Essay 2 due</td>
<td>food safety</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>9/25</td>
<td><em>Discussion 2</em></td>
<td>what is natural</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>10/7</td>
<td><em>Discussion 3</em></td>
<td>family farm</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>10/9</td>
<td><em>Industry groups 2 assignment</em></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>14</td>
<td>10/14</td>
<td>MIDTERM</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>16</td>
<td>10/21</td>
<td><em>Industry groups prep meeting</em></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td>10/28</td>
<td><em>Discussion 4</em></td>
<td>shark tank</td>
</tr>
<tr>
<td>11</td>
<td>21</td>
<td>11/6</td>
<td><em>Prepared questions</em></td>
<td>developing countries panel</td>
</tr>
<tr>
<td>12</td>
<td>22</td>
<td>11/11</td>
<td>Essay 3 due</td>
<td>GE and world food production</td>
</tr>
<tr>
<td>13</td>
<td>24</td>
<td>11/18</td>
<td>Essay 4 due</td>
<td>African food aid</td>
</tr>
<tr>
<td>14</td>
<td>26</td>
<td>11/25</td>
<td><em>Discussion 5</em></td>
<td>animal welfare/animal rights</td>
</tr>
<tr>
<td>15</td>
<td>27</td>
<td>12/2</td>
<td><strong><strong>TERM PAPER DUE</strong></strong></td>
<td></td>
</tr>
</tbody>
</table>

Final Exam: Tuesday December 11, 7:45-9:45 a.m