Faculty:

Dr. George M. Carman  
Food Science Building, Rm 203E  
Phone: 848-932-5407  
Email: carman@aesop.rutgers.edu  
Http://foodsci.rutgers.edu/carman/index.html

Mr. Jose Maldonado  
Food Science Building, Rm 220A  
Email: josemald@rutgers.edu

Course Description:

The course applies basic scientific principles to food systems and practical applications. Chemical/biochemical reactions of carbohydrates, lipids, proteins, and other constituents in fresh and processed foods are discussed with respect to food quality. Reaction conditions and processes that affect color, flavor, texture, nutrition, and safety of food are emphasized. Students are given a role in the learning experience through research by student groups and class presentations and discussions related to real world problems associated with both the private and public sectors of the world. Students take an active role in development and learning of course content (presented via Power Point presentations).

Student groups are given experiments that reinforce class discussions that are conveniently performed in the laboratory. These include activation and control of enzymatic reactions in fruits and vegetables; consequences of water migration on food quality; gelatinization-retrogradation in starch-based foods (e.g., pudding, bread, and rice); initiation and control of non-enzymatic browning (e.g., pretzels, meat); and food emulsions (e.g., salad dressings, commutated meats products).

Learning Outcomes:

Students are expected to understand and be able to control the major chemical/biochemical (enzymatic) reactions that influence food quality with emphasis on home and food industry applications. To understand how the properties of different food components and interactions among these components modulate the specific quality attributes of food systems, and to understand the principles that underlies the biochemical/enzymatic techniques used in food analysis.

Learning Assessments:

Course content is assessed through written examinations, the depth and quality of formal class presentations, and class participation. Emphasis is placed on problem solving related to real life situations. Group projects are assessed through professionally prepared oral presentations and written reports. Teamwork is critical to the project and grading. Lecture/discussion will count for 75% of the final grade. Laboratory reports will count for 25 % of the final grade. Class participation will be factored into the final grade.

Prerequisites:

Principles of Food Science and Organic Chemistry
Reference book and readings:

Fennema’s Food Chemistry, fourth edition, edited by S. Damodaran, K.L. Parkin, and O. R. Fennema, 2007, published by CRC Press may be used as a reference. Students are responsible for reading articles that are found in the library and on the Internet.

Class/Laboratory Outline:

<table>
<thead>
<tr>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cellular basis of foods (animal, plant, and microbial sources)</td>
</tr>
<tr>
<td>• Water activity and water migration; basis for controlling biochemical reactions (concepts emphasized in a laboratory experiment)</td>
</tr>
<tr>
<td>• Enzymes: basic principles and roles in food production, processing, and quality attributes (concepts emphasized in a laboratory experiment)</td>
</tr>
<tr>
<td>• Fruits and vegetables; ripening and storage quality (concepts emphasized in a laboratory experiment)</td>
</tr>
<tr>
<td>• Protein: biochemical influences on controlling structure, color, flavor, and texture (concepts emphasized in a laboratory experiment)</td>
</tr>
<tr>
<td>• Carbohydrates: biochemical influences on controlling structure, color, flavor, and texture (concepts emphasized in a laboratory experiment)</td>
</tr>
<tr>
<td>• Lipids: biochemical influences on food structure, color, flavor, and texture (concepts emphasized in a laboratory experiment)</td>
</tr>
<tr>
<td>• Browning reactions: biochemical influences on color, flavor, and texture (concepts emphasized in a laboratory experiment)</td>
</tr>
<tr>
<td>• Color: biochemical influence on development and loss of pigments</td>
</tr>
<tr>
<td>• Flavor: biochemical influences on desirable and undesirable</td>
</tr>
</tbody>
</table>

Product Development Project:

The class will be divided into groups of 4 students. Each group will be responsible for the development of a novel food. The novel food should be developed and characterized with an emphasis on the principles of food chemistry. Each group will be responsible for an oral presentation and for a typed written report. The oral and written reports should consist of the elements below. The oral report should be presented in a professional manner using computer projections. The written report should be typed. Each student in the group will receive a grade commensurate with their contribution to the group as a whole. Teamwork (i.e., cooperation) is critical to the project and grading. Group presentations will be made during the last week of the semester. The written report is due on the last day of class.

Elements of the Oral and Written Reports:

Introduction of the novel food, the components and processing of the food, biochemical, chemical, and physical interactions of food components, packaging and shelf life of the food, discussion, and citations throughout the text and references listed at the end (use the format of the Journal of Food Science).
**Laboratory:**

Due to space limitations in the Food Chemistry laboratory (Rm. 309 – Food Science building), the class will be divided into two groups, which will meet on alternate weeks in the following days:

**Group 1:**  
September 11  
October 25  
October 9  
October 23

**Group 2:**  
September 18  
October 2  
October 16  
October 30

The group assignments will be made during the first week of classes, if you haven’t received yours please contact the laboratory instructor immediately.

Within 1 week of each laboratory exercise the student must submit a report, the deadline being the end of the laboratory period the Thursday afterwards. The students can hand the report at the beginning of the other group’s laboratory exercise, after the end of it, or in room 220A before 12:15 pm. The report submission is responsibility of the student, leaving the report under the door or to anyone else other than the instructor in room 220A doesn’t guarantee that the report will be considered submitted. If a report is not submitted it will be graded as zero.

Laboratory reports are personal. They should be typed and prepared in a professional manner following the format used for publications in the Journal of Food Science.

**Laboratory report format:**

**Abstract:**

Provide a summary of the lab experiment, purpose, and results (quarter of a page).

**Introduction:**

Write no more than one page of background about the topic that leads to the hypothesis. State the hypothesis and objectives of the work. Make sure you cite the literature when making statements about the topic. Explain how the concept explored in the experiments applies to the food industry. Use commercial food products as an example.

**Materials and Methods:**

Describe the procedure followed for each experiment, indicating the materials used on each step. Briefly explain analytical methods to describe the experiment, in a way that the experiment could be replicated. Do not copy/paste from the laboratory handout. It is not necessary to make a list of the materials used.
Results:

When describing the results, give a one sentence preamble as to why you did the experiment, how you did the experiment, and what you found. Do this for each experiment. If you performed an experiment where you examined the effects of something on a food quality, include the results in a table, bar chart, or line drawing as appropriate. Include pictures if they add to the explanation.

Discussion:

In the first paragraph, repeat the rationale for doing the experiment. Summarize the results, and then discuss why you think they happened. You should consult the literature to back your discussion. Present your conclusions in the last paragraph. The conclusions should respond to the objectives and should not refer to literature. This is the most important section of the report!

References:

Provide a list of citations that were used in the main body of the report. Use the format for citing papers according to the Journal of Food Science.

Length:

The length of the laboratory report should be no more than 5 typed pages (double space) excluding figures, tables, pictures, and references.