

# **Chemistry and Technology of Dairy Products, Spring Semester 2007**

## **FS 511, FS 611**

**Lectures: MWF 11:00-11:50 119 Babcock Hall**

**Monday 12.00-1.15 pm 119 Babcock Hall discussion session (unless changed by agreement with class)**

Product/process demo/lab sessions will be scheduled during the semester in the Friday lecture time slot, these sessions generally last about 2 hrs. You will be informed when they are scheduled to start (usually later in Feb).

**Content and level:** Graduate students take this course at the FS 611 level and undergraduates can take it at the FS511 level for 3 credits. There will be common lectures but the assignments and examinations will be different for the two groups.

**Objectives:** to introduce students to an understanding of the chemistry of milk constituents. Milk and various dairy products are discussed from the perspective of the chemical, physical and biological changes that occur during processing.

**Prior Knowledge:** Students should be familiar with the food components (proteins, fats, carbohydrates, salts), their properties (e.g. autoxidation, fat crystallization, protein denaturation, functionality), as well as basic food processing operations (e.g. evaporation, homogenization/emulsions, spray drying, membrane processing). A brief review of some of these concepts will be done, especially in the context of dairy systems.

### **Learning Outcomes:**

- Students will be able to describe the composition of milk and identify the approx. content, individual types present and main features of the main components.
- Students will integrate their knowledge of food chemistry, physical properties and microbiology to understand the processing of dairy products
- Students will be able to use their knowledge of the chemistry of dairy components (proteins, fats, lactose, salts) to evaluate the impact of processing conditions (e.g. heat, pH) on milk and dairy products.
- Students will be able to describe the contribution of dairy foods to the diet including milk constituents with possible physiological roles
- After successful completion of this course the student should be able to explain how dairy products (such as fluid milk, yogurt, butter, powder, cheese) are made and the key functions of the processing steps involved
- Students will be able to conduct independent library research on current topics of importance to the dairy industry and students will be able to critically evaluate literature (including research articles and patents), justify the selection of approaches, frame the selections based on the physico-chemical properties of milk and put the discussion in the context of implications for the dairy industry. More emphasis on be placed on these aspects of the independent research for the graduate level students; more of the content for the undergraduate students will come from material covered in the lectures and the textbook with some additional independent research required.

**Required Texts:**

*Dairy Science and Technology*, Second Edition (2005). P. Walstra, J. T. M. Wouters and T. J. Geurts. Taylor & Francis (classroom price \$89.95).

Lectures Notes will be provided on a CD as pdf files at the start of the semester. Supplemental reading material will be provided on CD as a pdf file for the demo/lab sessions.

**Supplementary Texts: (on reserve in Steenbock library)**

*Dairy Processing Handbook* (1995). Tetra Pak, Lund, Sweden

*Dairy Chemistry and Biochemistry* (1998). Fox, P. F. & McSweeney, P.L.H. Blackie Academic & Professional

**Instructors:** Dr J. A. Lucey, Rm A203A Babcock hall, 265-1195, e-mail: jaluacey@facstaff.wisc.edu. Dr Mark E. Johnson, Rm A219A Babcock Hall 262-0275, e-mail: jumbo@cdr.wisc.edu (Dr Johnson will give lectures on dairy micro, starter cultures and basic cheesemaking operations). Instructors for the lab sessions are Food Science/Center for Dairy Research staff.

**Prerequisites:** FS 310 or cons instr.

**Course format and requirements:**

Apart from lectures, in this course we will emphasize active learning approaches including: weekly discussion sessions/presentations in groups about topics from lectures, 4-individual assignments, 5 in-classes quizzes (specific objectives will be provided in advance for each quiz and quizzes will focus on lab/demo sessions and readings from the relevant sections in the required textbook), 8 demonstrations of dairy product or processing in the UW dairy plant and a field trip to two local dairy factories.

The points will be distributed as follows:

Exam 1 (mid-term)	120 pts
Discussion Sessions	80 pts
Final exam	120 pts (Date: 12:25 P.M. THU. MAY 17)
Individual assignments	100 pts
Quizzes	80 pts
Total	500 pts

*Late assignments: 10% of the maximum points will be deducted for each day after the due date.*

Discussion sessions will be done in groups and students will be assessed on keeping to the allotted time (with time for questions), clarity of presentation and ability to answer questions from the class.

*Grading system:*

*A: 90-100%*

*AB: 88-89%*

*B: 77-87%*

*BC: 75-76%*

*C: 64-74%*

*D: 53-63%*

*F: < 53%*

**Tentative Outline** The course is divided into two main sections: (1) *Milk and its Components* and (2) *Milk Processing and Dairy Products*.

**Topics: (relevant chapters/sections in the textbook are indicated in bold numbers)**

- Topic 1: Introduction to milk composition, physical/chemical properties (**1, 2.7 and 4**)
- Topic 2: Lactose (**2.1**)
- Topic 3: Milk Salts (**2.2**)
- Topic 4: Lipids (**2.3 and 3.2**)
- Topic 5: Proteins (**2.4 and 3.3**)
- Topic 6: Fluid milk operations (**16.1, 7.4, 8, 9**)
- Topic 7: Nutritive value of milk and impact of processing (**16.5**)
- Topic 8: Dairy microbiology (**5**)
- Topic 9: Starter cultures (**13**)
- Topic 10: Cultured milk products (**22**)
- Topic 11: Evaporation, spray drying, milk powders and their functionality (**19.1, 20, 21**)
- Topic 12: Butter (**18**)
- Topic 13: Membrane processing (**12**)
- Topic 14: Ice Cream (**17.3**)
- Topic 15: Cheese: part 1. Coagulants and coagulation (**24.3, 24.4**)
- Topic 15: Cheese: part 2. Ripening (**25**)
- Topic 15: Cheese: part 3. Chemistry & functional properties (**25.6**)
- Topic 15: Cheese: part 4. Basic cheese making (cheesemaking 101) (**23, 24.1, 27**)

Plant visits: at end of the semester we usually go to two local plants making butter & ice cream

### **Who should take this course?**

Senior undergraduate food science students who want to have a single course on the main integrated aspects of dairy foods (chemistry, microbiology, processing aspects) to prepare themselves for a job in the dairy industry or in the many other industries that use dairy ingredients (e.g. meat and confectionary).

Undergraduate students in dairy or animal science who want to learn about milk/milk products.

Graduate students who have an interest in dairy products (e.g., doing dairy-related research), or would like to do one of their minor courses on the chemistry (and other aspects) of milk systems.

### **Useful websites:**

- University of Guelph, Dairy Technology website  
<http://www.foodsci.uoguelph.ca/dairyedu/home.html>
- Useful website on dairy technology and milk products.  
[http://www.dairyconsultant.co.uk/pages/Dairy\\_products.htm](http://www.dairyconsultant.co.uk/pages/Dairy_products.htm)
- Dairy Management Inc. Website with a lot of dairy product and ingredients information.  
<http://www.doitwithdairy.com/>
- Milk Ingredient Canada, Website with a lot of dairy product and ingredients information.  
[http://www.milkingredients.ca/DCP/index\\_e.asp](http://www.milkingredients.ca/DCP/index_e.asp)
- Website developed by Dr. Kalab, with many high-quality images of milk/dairy products  
<http://www.magma.ca/~scimat/>