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Course Description: Food Microbiology (II) Microbiology, contamination, preservation and spoilage of different kinds of foods of foods; food poisoning; sanitation, control and inspection, microbiology of water and standard methods for official food and public health laboratories. Corequisite: FDSC 4120; Prerequisite: BIOL 2013 and BIOL 2011L and CHEM 1123 and CHEM 1121L

Textbooks: Montville, Thomas J. and K.R. Matthews. 2005. Food Microbiology: An Introduction, 1st ed., ASM Press, Washington, DC. ISBN 1-55581-308-9. (Note: This new book is a condensation of selected chapters from an earlier textbook by Doyle, M.P., L.R. Beuchat, and T.J. Montville. 2001, Food Microbiology: Fundamentals and Frontiers, 2 ed, ASM Press, Washington, DC ISBN- 1-55581-208-2) **Required**
(Recommended supplemental ref text for those who will work in food processing industry is:
Jay, James M., M.J. Loessner, & D.A. Golden. 2005 Modern Food Microbiology, 7th ed, Springer Science +Business Media, New York, NY. ISBN 0 387 23180 3.)

Deibel, Robert H., and Jon A. Lindquist. 1981. General Food Microbiology Laboratory Manual. Alpha Editions, Burgess Publishing Company, Inc. Minneapolis, Minn ISBN 0-8087-5559-5 **Required**

Goff, James H., Robert P. Story and M.G. Johnson. 2008 Food Microbiology Laboratory Manual, 14th Edition to supplement above Deibel and Lindquist 1981 manual. **Required**

Course Goals: For student to gain an understanding and working knowledge of:

1. How to set up a good experiment in food microbiology with the proper biological and chemical negative and positive controls to test a hypothesis.
2. Physical and chemical factors limiting survival and growth of microbes during processing and manufacturing of food and dairy products.
3. Standard methods used for sampling, enumerating and identifying indicator bacteria , yeasts and molds producing food spoilages and foodborne illnesses.
4. Mechanisms by which microbes and their toxins can cause foodborne illnesses.
5. Starter cultures and how they are used in food and dairy fermentations.
6. Use of microbiological specifications / standard / guidelines in quality assurance / quality control programs.
7. Food plant sanitation.

Schedules for Lectures, Labs, Hour and Final Exams:

Lect.: W,F Period 02, 8:30-9:20 a.m. Rm L-133, POSC

Lab.: W,F Period 34, 9:30-11:20 a.m. Rm L-201, POSC

Last FDSC / BIOL 4124 Class Meeting is Wed., April 30; Study Day is Fri May 03 2008

[Spring Break is March 17-21, 2008]

Hour Exams: On Fridays on: February 15, March 14, April 18, 2008.

Note: Hour exams will include lect and lab material through the Wed. meeting prior to the Friday Exam date.

Lab Reports: Reports, type written, are due the Wed. after the Friday the data for a lab exercise are collected. See 2nd page for " Lab Report Format " , which gives guidelines and details for preparing reports.

Final Exam: Wednesday, May 07, 2008 from 12:30 p.m. to 2:30 p.m.

Class Attendance and Exam Policies:

Attendance: Attendance is expected at each scheduled lecture and laboratory meeting. A student who has to miss a regular class meeting for a bonafide reason [e.g., a class scheduled field trip, or a valid medical excuse] should call my Voice Mail work number or give me prior written notice. Inclement weather policy of our university applies. We are not to endanger ourselves to come to class. I will be there unless the university officially closes-check KUAF 91.3 FM for notice. Students with any special needs should contact instructor early.

Exams: No make up exams will be given unless the student obtains permission in advance for a valid reason to be absent from a scheduled exam.

Disabilities: Students with disabilities should contact the instructor in first week of classes so that suitable arrangements can be made.

Class Grading Format:

		Total Points per Item:	% of Total _____
<u>Lecture:</u>	Hour Exams [3] at 150 pts each:	450	45
	Final	<u>250</u>	<u>25</u>
		700	[70 %]
<u>Team Projects:</u>	<u>Teams:</u> Food Processing & Other Microbiology Feasibility Projects	50	5
	<u>Pairs:</u> Writing Across the Curriculum [Short typed papers in both technical and layman languages	<u>50</u>	<u>5</u>
		100	[10 %]
<u>Extra Projects Required for all Graduate Students</u>	Additional home work sets assigned by instructor	100	
	Additional term paper assigned by instructor	<u>100</u>	
		200	
<u>Laboratory:</u>	Learning Pop Quizzes on lect & lab material [Each lab mtg.]	00	00
	Lab techniques & housekeeping	100	10
	Lab notebook [Reports to be typed]	<u>100</u>	<u>10</u>
		200	[20 %]
	TOTAL: Undergraduate Students	1,000	[100 %]
	Graduate students	1,200	(100 %)

Grading by new plus and minus system adopted fall 2005 by UAF campus faculty will be as follows:

93-100	=	A
90-92	=	A-
87-89	=	B+
83-86	=	B
80-82	=	B-
77-79	=	C+
73-76	=	C
70-72	=	C-
67-69	=	D+
63-66	=	D
60-62	=	D-
<60	=	F

Lab Report Format: Each lab report, typed, is due the Wed. after the Fri. the final data are collected. Each Report will consist of the following sections:

Note: See sample typed report by Bwalya Lungu for Total Counts for style to follow for this course.

1. Student's Name:

2. Title of Lab Exercise and Date:

[Do not repeat the sections titled "Objectives, Basis of the Exercise, Materials & Methods"; State in your report these are covered in the manual --Do not repeat in your report.]

3. Results: Use extra copies of the tabular sheets provided in lab for each exercise to report your pair- wise and whole lab's data for rest of the pairs..

4. Discussion:. What do the data mean ?

5. Conclusions: What worked and did not work, why ??

6. Retype the Questions posed at the ends of each exercise in both Goff's et al & Deibel's et al lab books and give typed answers to each question posed.

7. Note: Problem sets that follow some sections of the early labs are to be done and turned in separately from the regular lab write ups at the due dates assigned..

NOTE: 8. Incomplete reports will not be graded and late reports will be penalized 10 % for each day late.

9. Note: Lab partners will be expected to have different typed write ups in reporting and discussing the data collected. Any close similarities in write ups for a given lab exercise will result in a grade of " 0 " for all lab reports involved..

Lecture Topics and Tentative Schedule using Montville & Matthews 2005 textbook, Spring 2008 :
Reading assignments for lecture topics:

<u>Week:</u>	<u>Topics:</u>	<u>Montville & Matthews 2005</u>
1	1. Introduction, 2. Factors influencing growth; Detection and Enumeration	Chap 1 Glossary, 361-6 Chap 2, 4
2.	1. Chemical and physical factors 2. “	Chap 2 “
3.	1. Spoilage Organisms overview 2. Rapid & Automated Methods	Chap 19 Chap 5
4.	1. Microbial indices of spoilage & safety 2. HACCP and sampling plans	Chap 6 Chap 25 & Chap 6
5.	1. Physical Methods of Food Preservation ; Spores Hour exam # 1	Chap 24 , Chap 3 ;
6.	1. Drying and Water activity cont'd 2. Low temperature and psychrotrophs	Chap 24 Chap 24
7.	1. Low temperature cont'd 2. High temperature	Chap 24 Chap 24
8.	1. High temperature 2. High temperature	“ “
9.	1. Irradiation, resistances and effectiveness 2. Preservation by high pressure, modified atm	Chap 24 Handouts
10.	1. Chemicals preservatives; Fermentation & Biopreservatives 2 Hour exam # 2	Chap, 22; 18 & 23
11.	1. Foodborne infections and intoxications 2. “	Chap 7-17 “
12.	1. Foodborne infections and intoxications 2. “	Chap 7-17 “
13.	1. Foodborne infections and intoxications 2. “	Chap 7-17 “
14.	1. Foodborne infections and intoxications 2.	Chap 7-17 “
15.	1. Molds, viruses, prions 2 Hour exam # 3	Chap 20, 21
16.	Final exam	

Your team is to evaluate the problems and possible strategies to solve these problems for the following commercial food processing goals given to you by your management. You are to consider food spoilage and food safety in each of these food product development goals. Any technology can be proposed as long as your marketing and management team says it can be used. If they say it cannot be used because of product definition, then it cannot be used.

Your company motto is: "The hard to do, we will today. The impossible we will do in a few more days."

- Project Title: Sun-Brewed tea versus conventional boiling water brewed tea.
Product to be distributed in clear glass bottles under refrigeration at 40-50 °F and to have a shelf-life of at least 90 days.

- Project Title: High protein salads (chicken or surimi =seafood analog) to be distributed at 40-50 °F., shelf-life to be a minimum of 60-90 days.
[Management wants a "clean" label so preservatives like K benzoate, sorbic acid, Na lactate or Na diacetate are not to be used.]

- Project Title: Sterilized egg in shell product in which the albumin = egg white and yolk remain liquid, not heat-coagulated. The primary microbial concern is the pathogen Salmonella enteritidis which can be laid down inside the shell of eggs as they are formed in the oviduct of infected hens.
[Management does not want to use anything that is considered to not be food grade approach so use of antibiotics is not a permitted strategy.]

- Project Title: Oven-cooked solid muscle foods such as marinated pork or chicken chunks heated to that maximum internal temperatures of the chunks never goes above 180-200 ° F. Product will be vacuum packed and distributed at 40 degrees F
Chief theoretical concern is that under above conditions it is theoretically possible to have contaminating viable C. botulinum spores survive such process conditions.
Use of sodium nitrite and or sodium lactate and Na diacetate could help inhibit growth of surviving spores but management does not want to use any of these agents because of they want a "clean label ", meaning want to make the claim of "no added preservatives". Note: Armour has such a sliced turkey product on the market-how do they do it?

- Project Title: Ready-to-cook meat and cheese filled ravioli pasta pieces with spinach florentine coating. Product to be marketed in see through plastic box fabricated out of materials impervious to oxygen gas. Product to have a shelflife of 120-180 days at 40-50 °F
[Management does not want to use any preservatives in this food product per se.]

- Project Title: Through Internet and World-Wide Web set up a home page for our course and down load information on food safety bulletin boards covering food microbiology/food safety regulations and standards in:
 - USA:
 - Europe:
 - South America
 - South Africa
 - Australia and New Zealand

- Project Title: Italian salami product fermented and heat processed such that a starting contamination level of as high as 1 million enterohemorrhagic E. coli CFU / g of raw materials would be reduced to levels in finished ready-to-eat product of less than 1 CFU / 100 g of salami.
[This was USDA-FSIS mandated research project]

- Project Title: By consulting FDA/USDA and related literature, develop the proper protocols to determine the effectiveness of over-the counter sanitizers intended for:
 - kitchen counter / sink use.
 - hand use.

- Project Title: Survey refereed literature for pubs on efficacy of the available over the counter cleaning / sanitizing agents to kill human bacterial pathogens and viruses on food contact surfaces, like kitchen counter made of stainless steel

- Project Title: Survey refereed literature for pubs on the efficacy of the available over the counter cleaning / sanitizing agents for ability to kill human bacterial pathogens and viruses on human hands

- Project Title: Explore and identify three different physical and chemical methods to reduce and or eliminate Salmonella on fresh cantaloupe and E. coli O157:H7 on fresh spinach and still keep these foods as fresh status, i.e. not cooked.

- Project Title: Find reasons in referred literature to explain the following observation:
For two milks, one skim with 0 % fat and the other with 1 % fat, and processed the same day in the same plant and showing the same use by date on the container and held at the same temperature of 40 degrees F, the 1 % fat milk in ½ gal size container will spoil faster (= develop a sour or proteolytic of flavor taste) than will the skim milk in a 1 gal size container.

- Project Title: Explore some practical, commercially feasible methods to remove, reduce E. coli O157:H7 from fresh spinach and leaf lettuces and still conserve the texture and flavors of these foods
(Rationale: FDA/CDC reports that in the last ten years there have been 19 outbreaks of EHEC caused foodborne illnesses associated with fresh leaf lettuces and 1 with fresh spinach (last Sept-Oct 2006)
The FDA has previously ruled that fresh raw ground beef contaminated with EHEC is legally an “adulterated product” and illegal to sell across state lines.
Using this logic, it is only a matter of time before similar rules will be applied to fresh produce that is normal consumed raw without a cooking kill step.)

Use of the computer and Internet to survey what is available on the net about Food Safety and Food Recalls in USA..

Three very useful web sites are:

www.fda.gov Find A Bad Bug Book and FDA food recalls here

www.cfsan.fda.gov This stands for the U.S. Food and Drug Administration's Center for Food Safety and Applied Nutrition. Find here also the Bad Bug Book and the FDA's methods manual, Bacteriological Analytical Manual covering methods for most foods not covered by USDA and also cosmetic products. The Bad Bug Book also has some very useful tables hyperlinked for pH values of many foods and conditions limiting growth of microbes in foods. I will ask you to print off two sets, keep one set for your records and reference through out this course and had in other set to me.

www.fsis.usda.gov Find FSIS food recalls and Microbiology Laboratory Guidebook covering methods for microbiological tests of meat and poultry products.

www.cdc.gov Find posted each Thursday-Friday a new Centers for Disease Control and Prevention weekly report titled Morbidity Mortality Weekly Reports. This site covers back issues also. Recent issues have covered hepatitis A cases linked in Pennsylvania to green onion tops, BSE in a dairy cow in Washington State, SARS, and other food related case reports as well as many other reports about communicable diseases not transmitted through foods such as influenza, West Nile Fever and others. Note at the end of each issue there is a weekly summary of recent reported cases of microbially causes illnesses, only part of them food-or water-borne organized by state , and region of the USA.

Q: What illnesses related to foods have been showing up in Arkansas in 2003 and 2004, according to this source ?

One of our team projects for the term will be to build a catalog of all the food safety data bases we can find on the net. Q: What is available in USA , Europe (Great Britain, Germany), South America Australia, New Zealand, Japan (in English) ? What food products do these data bases cover ? What else should we ask ??

A project required of all graduate students is to build an index typed list covering all food recalls listed by the FDA, FSIS or CDC from above links that occur this Spring Semester 2008, January 1-May 1, 2008 .

The list will have these heading:

Recall date: Recall Agency: State(s) involved: Food(s) involved: Microbes suspected:

The terms/concepts listed below will be presented and explained in class.

These items are to be memorized and understood before the first major hour exam and retained for use through out the course and the final exam.

List of critical factors controlling pathogen growth in foods-

Adapted , modified by MGJ from James Jay's 7th ed, Modern Food Microbiology, 2005:

“ Intrinsic factors “

FACTORS INSIDE FOODS:

temperature

water activity, a_w

oxygen (oxidation/reduction potential)

acidity (pH)

nutrient content

natural antimicrobial chemicals present

presence of other competitive microflora

natural outer barriers (Shell, peel , etc.)

“ Extrinsic factors “

FACTORS OUTSIDE FOODS:

temperature

relative humidity, RH

gases (modified or active atmosphere packaging)

food packaging films (Do they let oxygen in or not ?? So what ??)

other competitive microbes