Building and Sustaining Hygienic Design for Food Processing

-Perspectives for the new generation of food scientists-

3-A SSI Annual Meeting – Milwaukee, May 16th-19th, 2016

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Outline of Presentation

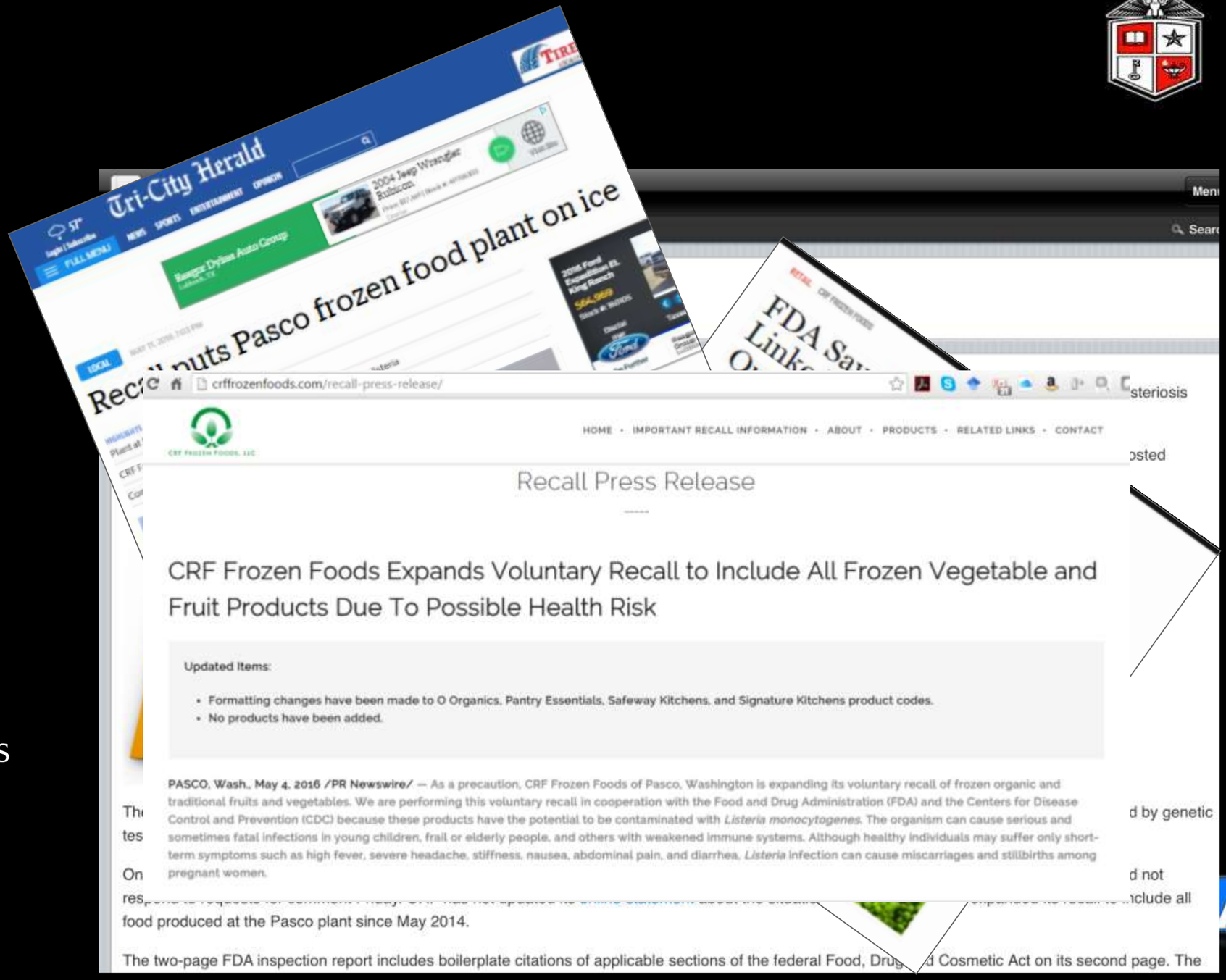
1. Introduction
2. Everyone needs to help
3. Current programs/syllabus in food science
4. Future professionals
5. Suggestions

1. Introduction

Hygienic Design……

What's the importance?

1. Listeria Outbreak
2. 2 deaths
3. >350 Products; 42 brands
4. 250 people layoff



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2. Everyone needs to help!

1. Who is going to help us?
   - HACCP TEAM, of course!!!!!!!!!!
     - *Food Technologists*
     - *Food Scientist*
     - *Ind. Microbiologists/Food Microbiologist*
     - *Meat Scientists*
     - *Dairy Scientists*
     - *R&D*
     - *Nutritionists*
     - *Food /Agricultural Engineers*

What they need to know:

1. Metallurgy / Materials
2. Process engineering
3. Safety Engineering
4. Production Engineering
5. Maintenance
6. Mechanical Engineering
7. Thermal processes
8. Rheology
9. Fluid Mechanics
10. Quality Assurance

3. Schools with Food Engineering/related Programs (Undergraduate)

College/University
Auburn University
Brigham Young University
Clemson University
Iowa State University
Kansas State University
Louisiana State University
Ohio State University
Michigan State University
University of Minnesota-Twin Cities
University of Wisconsin-Madison

Different Areas of Emphasis:

- Biosystems Engineering | Forest engineering
- Manufacturing
- Packaging Science
- Agricultural Engineering
- Bioproducts and Biosystems
- Dairy/Meat/Grains/Poultry/Vegetables

Source: http://study.com/articles/Food_Engineering_Colleges_and_Degree_Programs_How_to_Choose.html

3. Example – Auburn University

- BSEN 3240 Process Engineering
- BSEN 3530 Agricultural Production and Processing Facility Technology
- BSEN 5550 Principles of Food Engineering
- BSEN 7280 Food Thermal Processing

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3. Example – Clemson University

Food Science / Packaging Sciences

CLEMSON
FOOD, NUTRITION, AND PACKAGING SCIENCES

FDSC 4030* Food Chemistry and Analysis 2 (1) Principles of analytical procedures and techniques used to quantitatively and qualitatively determine chemical composition of foods, and elucidate the physio-chemical properties of food materials. Laboratories provide experience in critical thinking, performing food analysis, and analyzing data. *Preq:* BCHM 3050 and BIOL 4340 and FDSC 2140; and Food Science major or minor. *Coreq:* FDSC 4031.

FDSC 4031* Food Chemistry and Analysis Laboratory 0 (3) Non-credit laboratory to accompany FDSC 4030. *Coreq:* FDSC 4030.

FDSC 4040* Food Preservation and Processing 3 (3) Principles of food preservation applied to flow processes, ingredient functions, and importance of composition and physical characteristics of foods related to their processing; product recalls and product development concepts. *Preq:* Food Science major or minor or Packaging Science major or minor; and BCHM 3050; and either FDSC 2140 or FDSC 3010; and one of PHYS 1220 or PHYS 2000 or PHYS 2070.

FDSC 4060* Food Preservation and Processing Laboratory I 1 (3) Laboratory exercises on preservation methods, equipment utilized, and processes followed in food manufacture. *Preq:* FDSC 4040.

FDSC 4070* Quantity Food Production 2 (1) Principles of the production of food in quantity for use in food service systems. Emphasizes functions of components of foods and of ingredients in food, and focuses on the quality of the final product, on safe production of food, and on proper use of equipment. *Preq:* Food Science major or minor, or Packaging Science major or minor. *Coreq:* FDSC 4071.

FDSC 4071* Quantity Food Production Laboratory 0 (3) Non-credit laboratory to accompany FDSC 4070. *Coreq:* FDSC 4070.

FDSC 4080* Food Process Engineering 4 (3) Study of basic engineering principles and their application in food processing operations. Emphasizes the relation between engineering principles and fundamentals of food processing. *Preq:* Food Science major or minor; and CH 1020 and FDSC 2140; and one of MATH 1020 or MATH 1060; and one of PHYS 1220 or PHYS 2000 or PHYS 2070. *Coreq:* FDSC 4081.

FDSC 4081* Food Process Engineering Laboratory 0 (3) Non-credit laboratory to accompany FDSC 4080. *Coreq:* FDSC 4080.

FDSC (PKSC) 4090* Total Quality Management for the Food and Packaging Industries 3 (3) Introduction to the principles of modern quality management emphasizing quality standards and issues and the practices necessary for food processing and packaging companies to survive in a customer-driven marketplace. May also be offered as PKSC 4090.

FDSC 4101* Food Product Development Laboratory 0 (3) Non-credit laboratory to accompany FDSC 4100. *Coreq:* FDSC 4100.

FDSC 4170 Seminar 1 (1) Literature research and oral presentation of a current food science topic. *Preq:* Food Science major.

FDSC 4180 Seminar 1 (1) Literature research and oral presentation of a current food science topic.

FDSC 4200 Special Topics in Food Science 1-3 (1-3) Special topics in food science not covered in other courses. May be repeated for a maximum of 12 credits, but only if different topics are covered. Includes Honors sections. *Preq:* Consent of instructor.

FDSC 4210 Special Problems in Food Science 1-4 (1-4) Independent research investigation in food science areas not conducted in other courses. May be repeated for a maximum of 12 credits. Includes Honors sections. *Preq:* Consent of instructor.

FDSC 4300* Dairy Processing and Sanitation 3 (2) Processing, manufacture and distribution of fluid, frozen, cultured and other dairy products. Emphasizes sanitation in a commercial food processing plant environment, chemical and microbiological aspects, processing procedures, equipment operation, ingredient applications, formulation and functional properties. *Preq:* BIOL 1040 and BIOL 1060 and CH 1020. *Coreq:* FDSC 4301.

FDSC 4301* Dairy Processing and Sanitation Laboratory 0 (3) Non-credit laboratory to accompany FDSC 4300. *Coreq:* FDSC 4300.

FDSC 4500 Creative Inquiry—Food Science 1-6 (1-6) Individual or small team research experience in close collaboration with a faculty member. Expands undergraduate learning by application of the scientific method. Research is selected by the student with approval of faculty. May be repeated for a maximum of ten credits.

FDSC 4910 Practicum 1-4 (1-4) Supervised experiential opportunities in the food industry. May be repeated for a maximum of 12 credits. *Preq:* Food Science major and Junior standing and consent of department chair.

- FDSC 4080 Food Process Engineering
- FDSC 4300 Dairy Processing and Sanitation

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3. Example – Iowa State University

Agricultural and Biosystems Engineering – F.E. Option

IOWA STATE UNIVERSITY
College of Engineering
College of Agriculture and Life Sciences

Agricultural and Biosystems Engineering

Undergraduate Curriculum in Biological Systems Engineering
Food Engineering Option
2016-2017 Catalog
Total Credits 128

First Year (32 cr.)

	Semester 1 (16 cr.)			**Semester 2 (16 cr.)**	
R	Engr 101	Orientation (FS)	1	A B E 110	Experiencing BSE (S)
3	A B E 170	Graphics and Design (FS)	3	A B E 160	Engineering Problems (FS)
4	Math 165	Calculus I (FSSS)	4	Math 166	Calculus II (FSSS)
4	Chem 167	General Chemistry (FS)	5	Phys 221	Classical Physics I (FSSS)
1	Chem 167L	General Chemistry Lab (FS)	3	Engl 250	Writ/Oral/Vis/Elec Composition (FSSS)
3	Engl 150	Crit. Think. and Comm.(FSSS)			
1	Lib 160	Information Literacy (FSSS)			

Second Year (34 cr.)

	Semester 3 (17 cr.)			**Semester 4 (17 cr.)**	
3	A B E 216	Fund. Ag. and Biol. Engineering (F)	2	A B E 218	Project Mgmt/Design Ag & Bio Engr (S)
3	EM 274	Statics of Engineering (FSSS)	1	A B E 201	Preparing for the Workplace (FS)
3	Stat 305	Engineering Statistics (FSSS)	3	EM 324	Mechanics of Materials (FSSS)
5	Phys 222	Classical Physics II (FSSS)	4	Math 267	Differential Equations (FSSS)
3	Biol 212	Principles of Biology II (FSSS)	3	Chem 231	Organic Chemistry (FSSS)
			1	Chem 231L	Organic Chemistry Lab (FSSS)
			3	ME 231	Thermodynamics (FSSS)

Third Year (31 cr.)

	Semester 5 (15 cr.)			**Semester 6 (16 cr.)**	
3	A B E 316	Applications and Systems Modeling (FS)	3	A B E 380	Principles of BSE (S)
4	A B E 363	Electric Power and Electronics (FS)	3	→	Mass/Transport Sequence I
3	A B E 451	Food Engineering (F)	3	Micro 302	Biology of Microorganisms (FSSS)
1	EM 327	Mechanics of Materials Lab (FSSS)	1	Micro 302L	Microbiology lab (FSSS)
3	FSHN 311	Food Chemistry (F)	3	→	SS&H Elective (FSSS)
1	FSHN 311L	Food Chemistry Lab (F)	3	→	SS&H Elective (FSSS)

Fourth Year (31 cr.)

	Semester 7 (14 cr.)			**Semester 8 (17 cr.)**	
2	A B E 415	Ag & Biosystems Engr. Design I (FS)	2	A B E 416	Ag & Biosystems Engr. Design II (FS)
3	A B E 404	Instrumentation for Ag and Bio Engr (F)	3	A B E 469	Grain Processing and Handling (S)
3	A B E 480	Engineering Analysis of Bio Systems (F)	3	→	Heat/Mass Transport Sequence II
3	FSHN 420	Food Microbiology (F)	3	→	Communication Elective (FSSS)
3	FSHN 471	Food Processing (F)	3	→	International Perspective Elective (FSSS)
			3	→	U. S. Diversity Elective (FSSS)

**Please check the current catalog and Schedule of Classes for most recent offerings*

- EM 324 Mechanics of Materials
- ABE 415 Ag & Biosystems Eng. design

3. Example – Kansas State University

Food Science Program

Food Science Core Courses (30–32 credit hours)

Must have a 2.0 GPA average.

- FDSCI 101 – Foundations in Food Science & Industry **Credits**: (1)
- GENAG 200 – Topics in Agriculture **Credits**: (0–3) College Careers **Credits**: (0)
- FDSCI 302 – Introduction to Food Science **Credits**: (3)
- FDSCI 305 – Fundamentals of Food Processing **Credits**: (3)
- FDSCI 500 – Food Science Seminar **Credits**: (1)
- FDSCI 501 – Food Chemistry **Credits**: (3)
- FDSCI 600 – Food Microbiology **Credits**: (2)
- FDSCI 601 – Food Microbiology Lab **Credits**: (2)
- FDSCI 690 – Principles of HACCP and HARPC **Credits**: (3)
- FDSCI 727 – Chemical Methods of Food Analysis **Credits**: (2)
- FDSCI 728 – Physical Methods of Food Analysis **Credits**: (2)
- GRSC 540 – Engineering Applications to Grain/Food Products **Credits**: (3)
- GRSC 541 – Engineering Applications to Grain/Food Products Laboratory **Credits**: (1)

Select one

- ASI 318 – Fundamentals of Nutrition **Credits**: (3)
- FNDH 132 – Basic Nutrition **Credits**: (3)

Select one

- FDSCI 695 – Quality Assurance of Food Products **Credits**: (3)
- FDSCI 740 – Research and Development of Food Products **Credits**: (4)

- FDSCI 305 Fundamentals of Food Processing
- GRSC 540/541 Engineering applications for grain/food products

3. Example –University of Minnesota

Bioproducts and Biosystems Engineering

UNIVERSITY OF MINNESOTA
Driven to Discover℠

Department of Bioproducts and Biosystems Engineering

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Food Engineering

Addressing the growing need for safe and healthy foods and healthy lives

Food engineers design and develop processes and products that address the world's growing demand for safe and healthy foods and healthy lives. From developing new and innovative bioprocessing solutions to food processing, machinery, packaging, ingredients, instrumentation, and control, food engineers create important cost-effective systems and solutions.

Food engineering students can tailor their education to their personal interests and career objectives. Graduates will be prepared for careers in the food processing and related agricultural products industry. Graduates will also be prepared for continuing their education at the graduate level in engineering, science, medicine, law, and business.

Degree

Students in this program will graduate from the College of Science and Engineering with a Bachelor of Bioproducts and Biosystems Engineering (BBE) with an emphasis (or major sub-plan) in Food Engineering (which will appear on the official transcript). Students can apply for admission to BBE through either the College of Science and Engineering or through the College of Food, Agricultural and Natural Resource Sciences (listed as "Pre-BBE").

COLLEGE OF Science & Engineering
UNIVERSITY OF MINNESOTA

CSE Academic Advising
College of Science and Engineering
105 Lind Hall • 207 Church Street SE
Minneapolis, MN 55455
612-624-2890 • CSEAdvising@umn.edu
cse.umn.edu

BBE - Food Engineering

Rev. Date: 6/2015

Freshman Year				Sophomore Year			
Fall Semester		Spring Semester		Fall Semester		Spring Semester	
BBE 1001 BP Orientation	1	Chem 1062/66 Chem Princ II (1061/1065)	4	Biol 1009 General Biology	4	Math 2373 or 2243 Lin Al/Dif Eq. (1372)	4
Chem 1061/65 Chem Princ I (placement into course, or 1015)	4	Math 1372 Calculus II (1371)	4	Math 2374 or 2263 Multi Calc (1372)	4	BBE 3033 Material & Energy Balance in Biol Systems (Math 1372, Phys 1302, Chem 1062/66)	3
Math 1371 Calculus I (placement into course, or pre-req)	4	Phys 1302W Intro Physics II (1301, &Math 1372)	4	BBE 2001 Mech. & Struct. Des. (Math 1372, Phys 1301)	4	Chem 2301 Organic Chem I (1062/66)	3
Phys 1301W Intro Physics I (&Math 1371)	4	Lib Ed or Writ 1301/1401	3/4	BBE 2002 Intro to Eng Design (Math 1371, Chem 1061/65, Writ 1301)	3	BBE 3043 Biol/Enviro Thermo (Biol 1009, Chem 1061/65, Phys 1302, Math 1372)	3
CSE 1001: 1st Yr Experience	1					Liberal Education course	3/4
Lib Ed or Writ 1301/1401	3/4						

Junior Year				Senior Year			
Fall Semester		Spring Semester		Fall Semester		Spring Semester	
BBE 3013 Engr Prin Cell Proc (Biol 1009, Math 1372, BioC 2011 or Chem 2301)	3	BBE 4013 Transport in Biol Sys (UD, BBE 3013, 3043, 3012)	3	BBE 4023W Proc. Cont. & Instr. (UD)	3	BBE 4502W Capstone Design (BBE 3062)	4
BBE 3012 Transport Biol I (BBE 2001, 3033, Math 2373, 2374, Physics 1302)	4	BBE 4402 BP Engineering Lab I (UD, Chem 2301)	1	Technical Elective I	3/4	BBE 4723 Food Proc. Eng. (BBE 4013 or &4013)	3
Stat 3021 Intro to Prob/Stat (Math 1372)	3	BBE 4713 Biol Process Engr (BBE 4013 or &4013)	3	Technical Elective II	3/4	Technical Elective III	3/4
Liberal Education course	3/4	VBS 2032 General Microbiology with Lab	5	Emphasis course I	3/4	Emphasis course III	3/4
BioC 3021 Biochemistry	3	BBE 4303 Into Bio-bsed MatSci (UD, BBE 2001)	3	Emphasis course II	3/4	Liberal Education course	3/4

About This Plan **Department Contact Information**

- BBE Mechanical and Structural Design

Electives cover other topics:

- IE 5513 Engineering Safety
- FSCN 4332 Food Processing Operations

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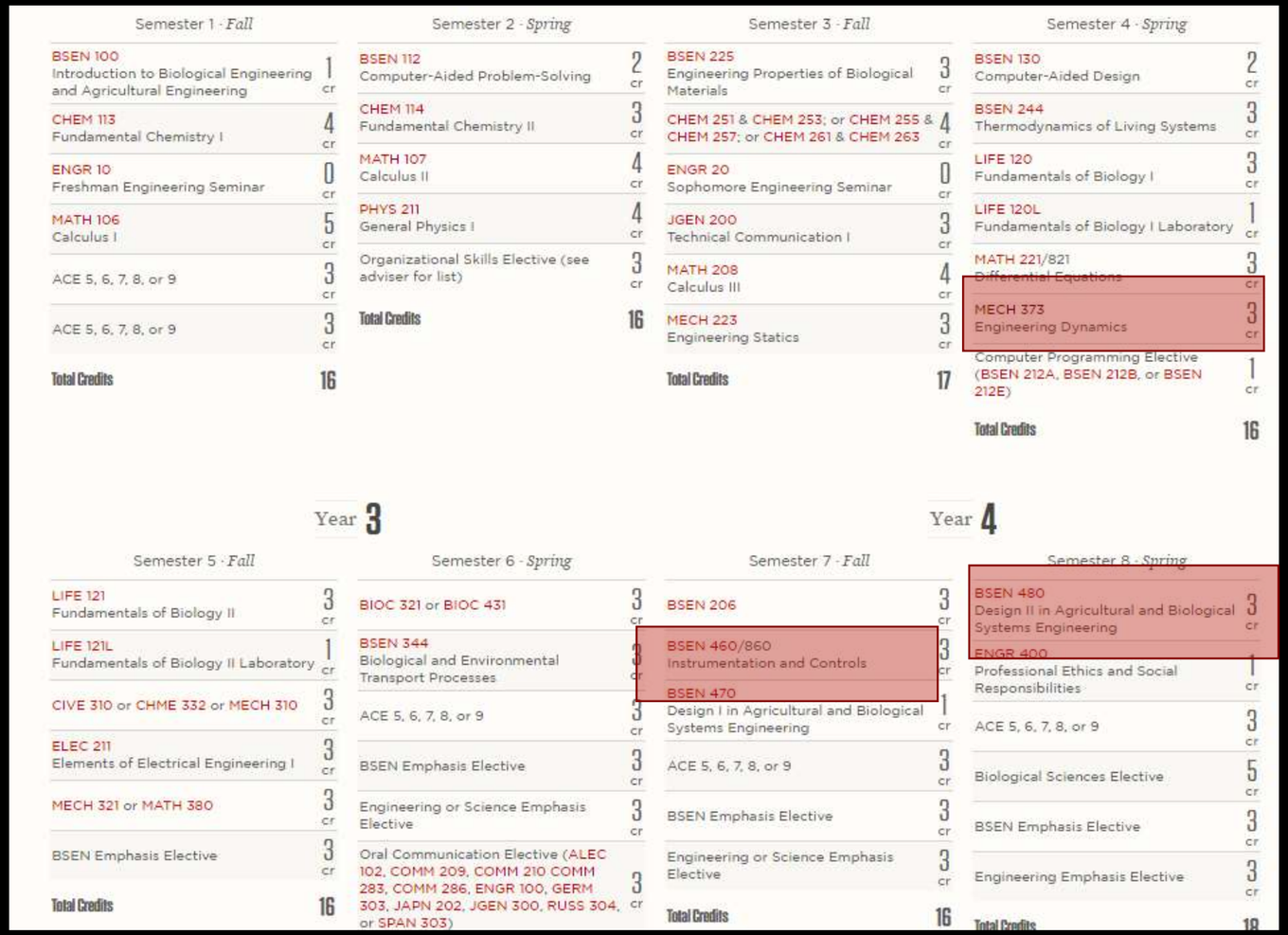
3. Example –University of Nebraska-Lincoln

Food Science Program & Biological Systems Engineering



Semester 1 · *Fall*		Semester 2 · *Spring*	
BSEN 100 Introduction to Biological Engineering and Agricultural Engineering	1 cr	BSEN 112 Computer-Aided Problem-Solving	2 cr
CHEM 113 Fundamental Chemistry I	4 cr	CHEM 114 Fundamental Chemistry II	3 cr
ENGR 10 Freshman Engineering Seminar	0 cr	MATH 107 Calculus II	4 cr
MATH 106 Calculus I	5 cr	PHYS 211 General Physics I	4 cr
ACE 5, 6, 7, 8, or 9	3 cr	Organizational Skills Elective (see adviser for list)	3 cr
ACE 5, 6, 7, 8, or 9	3 cr	**Total Credits**	16
Total Credits	16		

Semester 3 · *Fall*		Semester 4 · *Spring*	
BSEN 225 Engineering Properties of Biological Materials	3 cr	BSEN 130 Computer-Aided Design	2 cr
CHEM 251 & CHEM 253; or CHEM 255 & CHEM 257; or CHEM 261 & CHEM 263	4 cr	BSEN 244 Thermodynamics of Living Systems	3 cr
ENGR 20 Sophomore Engineering Seminar	0 cr	LIFE 120 Fundamentals of Biology I	3 cr
JGEN 200 Technical Communication I	3 cr	LIFE 120L Fundamentals of Biology I Laboratory	1 cr
MATH 208 Calculus III	4 cr	MATH 221/821 Differential Equations	3 cr
MECH 223 Engineering Statics	3 cr	MECH 373 Engineering Dynamics	3 cr
Total Credits	17	Computer Programming Elective (BSEN 212A, BSEN 212B, or BSEN 212E)	1 cr
		Total Credits	16

Year 3

Semester 5 · *Fall*		Semester 6 · *Spring*	
LIFE 121 Fundamentals of Biology II	3 cr	BIOC 321 or BIOC 431	3 cr
LIFE 121L Fundamentals of Biology II Laboratory	1 cr	BSEN 344 Biological and Environmental Transport Processes	3 cr
CIVE 310 or CHME 332 or MECH 310	3 cr	ACE 5, 6, 7, 8, or 9	3 cr
ELEC 211 Elements of Electrical Engineering I	3 cr	BSEN Emphasis Elective	3 cr
MECH 321 or MATH 380	3 cr	Engineering or Science Emphasis Elective	3 cr
BSEN Emphasis Elective	3 cr	Oral Communication Elective (ALEC 102, COMM 209, COMM 210 COMM 283, COMM 286, ENGR 100, GERM 303, JAPN 202, JGEN 300, RUSS 304, or SPAN 303)	3 cr
Total Credits	16		

Year 4

Semester 7 · *Fall*		Semester 8 · *Spring*	
BSEN 206	3 cr	BSEN 480 Design II in Agricultural and Biological Systems Engineering	3 cr
BSEN 460/860 Instrumentation and Controls	3 cr	ENGR 400 Professional Ethics and Social Responsibilities	1 cr
BSEN 470 Design I in Agricultural and Biological Systems Engineering	1 cr	ACE 5, 6, 7, 8, or 9	3 cr
ACE 5, 6, 7, 8, or 9	3 cr	Biological Sciences Elective	5 cr
BSEN Emphasis Elective	3 cr	BSEN Emphasis Elective	3 cr
Engineering or Science Emphasis Elective	3 cr	Engineering Emphasis Elective	3 cr
Total Credits	16	**Total Credits**	18

- Mech 373 Engineering Dynamics
- BSNE Instrumentation and Control
- BSEN 470 Design in Agricultural and Biological Systems Engineeering

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3. Example –Brigham Young University (Utah)

Manufacturing Engineering Technology

BS in Manufacturing Engineering Technology (75–78 hours*)

Show All Course Desc
Hide All Course Desc

Program Requirements | View MAP | View Program Outcomes

1. Students must have a minimum of 124 total hours to graduate with this major.

2. Complete the following manufacturing core courses:
   - MFG 130 : Modern Manufacturing. (3:2:2)
   - MFG 220 : Material Removal. (3:2:3)
   - MFG 230 : Computer-Aided Manufacturing. (3:2:3)
   - MFG 291 : Manufacturing Leadership. (1:1:1)
   - MFG 331 : Metals Processes. (4:3:3)
   - MFG 340 : Quality Systems in Manufacturing. (3:2:3)
   - MFG 355 : Plastics Materials and Processing. (3:2:3)
   - MFG 431 : Tool Design. (3:2:3)
   - MFG 434 : Introduction to Manufacturing Automation. (3:2:2)
   - MFG 480 : Process Planning and Systems Design. (3:3:0)
   - MFG 491 : Professional Seminar. (1:1:0)

3. Complete 3 hours of the following:
   - MFG 399R : International Internship. (1-3:0:0)

4. Complete the following supporting courses:
   - CE EN 103 : Engineering Mechanics--Statics. (3:3:0)
   - CE EN 203 : Engineering Mechanics--Mechanics of Materials. (3:3:0)
   - CHEM 105 : General College Chemistry. (4:5:0)
   - ENGL 316 : Technical Communication. (3:3:0)
   - ENG T 231 : Foundations of Global Leadership. (3:3:0)
   - IT 318 : Electronics, Computers, and Manufacturing. (3:2:3)
   - ME EN 172 : Engineering Graphics--Principles and Applications. (3:2:2)
   - ME EN 250 : Science of Engineering Materials. (3:3:0)
   - STAT 201 : Statistics for Engineers and Scientists. (3:3:0)
   - TECH 312 : Exploration in Innovation Design Techniques. (1:1:0)

5. Complete the following:
   - MATH 112 : Calculus 1. (4:5:0)

6. Complete one of the following options:
   - **Either**
     - PHSCS 105 : General Physics 1. (3:3:0)
     - PHSCS 107 : General Physics Lab 1. (1:0:3)
   - **Or**
     - PHSCS 121 : Introduction to Newtonian Mechanics. (3:3:1)

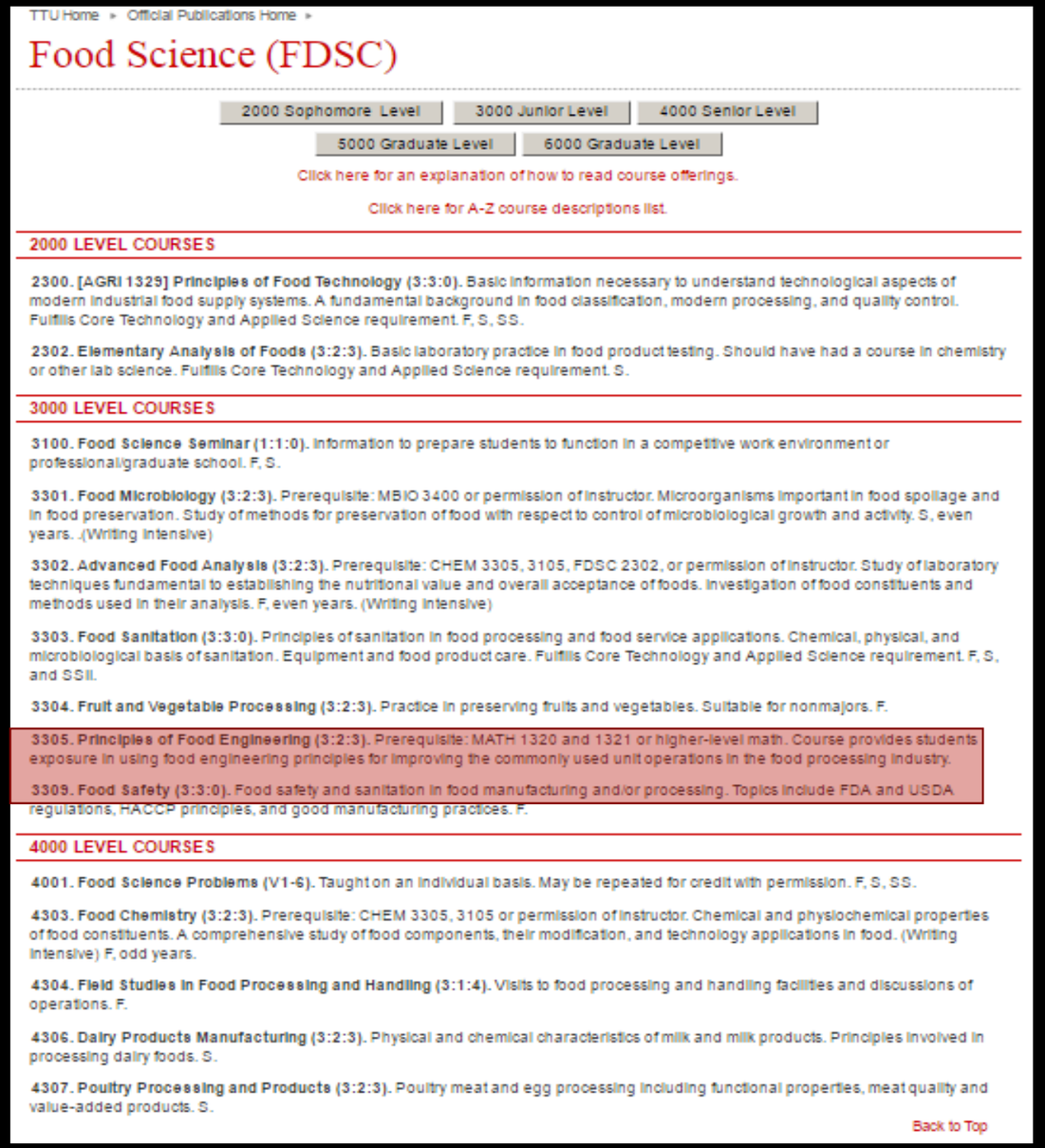
7. Complete the following:
   - MFG 479 : Innovation and Entrepreneurship. (3:3:0)
   - ME EN 475 : Integrated Product and Process Design 1. (3:2:3)
   - ME EN 476 : Integrated Product and Process Design 2. (3:2:3)

- MFG 331: Metals Processes
- MFG 355: Plastic Materials and Processing
- MFG 431: Tool Design
- CE EN 203: Engineering Mechanics – Mechanic of Materials
- ME EN 250: Science of Engineering Materials

3. Current Programs – TTU's Food Science (Undergraduate)

B.S. in Food Science

TEXAS TECH UNIVERSITY
Department *of* Animal & Food Sciences™



TTU Home ▸ Official Publications Home ▸

Food Science (FDSC)

2000 Sophomore Level | 3000 Junior Level | 4000 Senior Level | 5000 Graduate Level | 6000 Graduate Level

Click here for an explanation of how to read course offerings.

Click here for A-Z course descriptions list.

2000 LEVEL COURSES

2300. [AGRI 1329] Principles of Food Technology (3:3:0). Basic information necessary to understand technological aspects of modern industrial food supply systems. A fundamental background in food classification, modern processing, and quality control. Fulfills Core Technology and Applied Science requirement. F, S, SS.

2302. Elementary Analysis of Foods (3:2:3). Basic laboratory practice in food product testing. Should have had a course in chemistry or other lab science. Fulfills Core Technology and Applied Science requirement. S.

3000 LEVEL COURSES

3100. Food Science Seminar (1:1:0). Information to prepare students to function in a competitive work environment or professional/graduate school. F, S.

3301. Food Microbiology (3:2:3). Prerequisite: MBIO 3400 or permission of instructor. Microorganisms important in food spoilage and in food preservation. Study of methods for preservation of food with respect to control of microbiological growth and activity. S, even years. (Writing Intensive)

3302. Advanced Food Analysis (3:2:3). Prerequisite: CHEM 3305, 3105, FDSC 2302, or permission of instructor. Study of laboratory techniques fundamental to establishing the nutritional value and overall acceptance of foods. Investigation of food constituents and methods used in their analysis. F, even years. (Writing Intensive)

3303. Food Sanitation (3:3:0). Principles of sanitation in food processing and food service applications. Chemical, physical, and microbiological basis of sanitation. Equipment and food product care. Fulfills Core Technology and Applied Science requirement. F, S, and SSII.

3304. Fruit and Vegetable Processing (3:2:3). Practice in preserving fruits and vegetables. Suitable for nonmajors. F.

3305. Principles of Food Engineering (3:2:3). Prerequisite: MATH 1320 and 1321 or higher-level math. Course provides students exposure in using food engineering principles for improving the commonly used unit operations in the food processing industry.

3309. Food Safety (3:3:0). Food safety and sanitation in food manufacturing and/or processing. Topics include FDA and USDA regulations, HACCP principles, and good manufacturing practices. F.

4000 LEVEL COURSES

4001. Food Science Problems (V1-6). Taught on an individual basis. May be repeated for credit with permission. F, S, SS.

4303. Food Chemistry (3:2:3). Prerequisite: CHEM 3305, 3105 or permission of instructor. Chemical and physiochemical properties of food constituents. A comprehensive study of food components, their modification, and technology applications in food. (Writing Intensive) F, odd years.

4304. Field Studies in Food Processing and Handling (3:1:4). Visits to food processing and handling facilities and discussions of operations. F.

4306. Dairy Products Manufacturing (3:2:3). Physical and chemical characteristics of milk and milk products. Principles involved in processing dairy foods. S.

4307. Poultry Processing and Products (3:2:3). Poultry meat and egg processing including functional properties, meat quality and value-added products. S.

Back to Top

- FDSC 3305 Principles of Food Engineering

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4. Future Professionals….what can we do for them?

- Include and reinforce the need for Hygienic design in as many courses as you can
- Topics might need to be food product-specific
- Adapt available reference materials
- Create new classes!

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New Class: Hygienic Design of Food Processing Plants

- Equipment and Process Needs
- Regulations
- Prevention of Deliberate contamination
- Minimum Hygienic Design Requirements
- Factory Layout Impact
- Segregation

Specific Areas:

- Airflow
- Wall Finishes
- Ceilings
- Floors
- Drains
- Electricity supply
- Piping
- Lightning
- Exhaust & Dust Control
- Entries and Exits
- Steam Production
- Storage Areas

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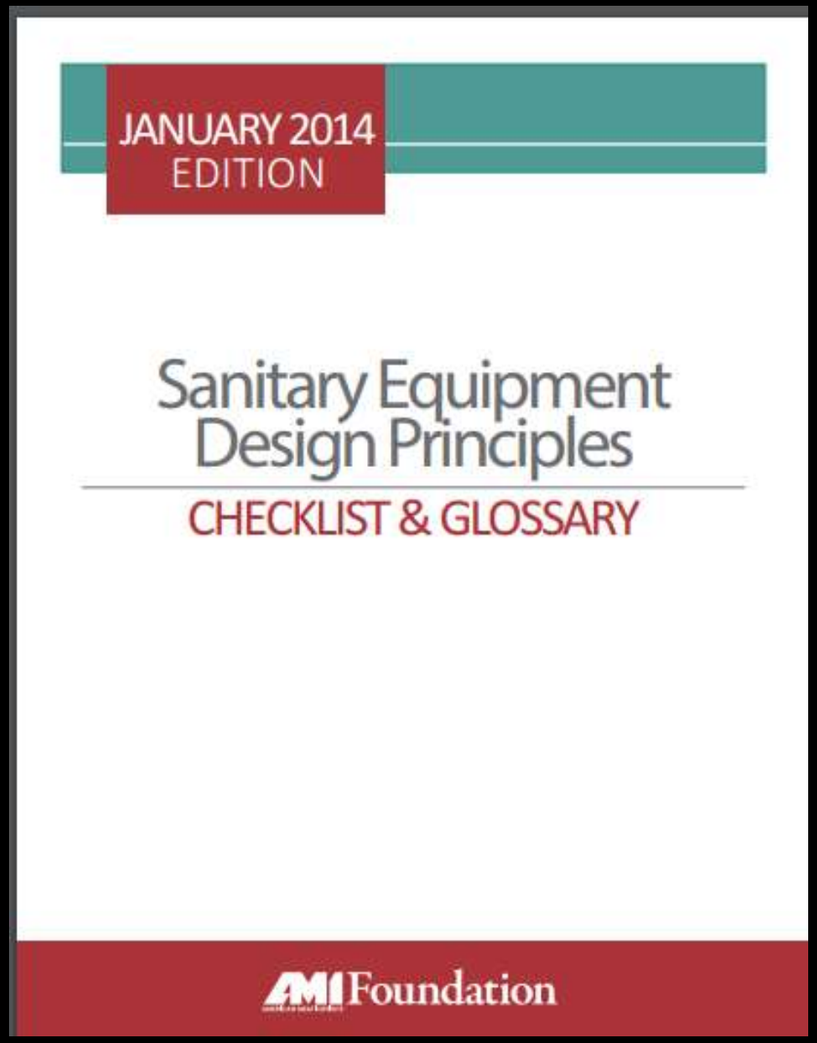
4. Use of Reference Materials in Class



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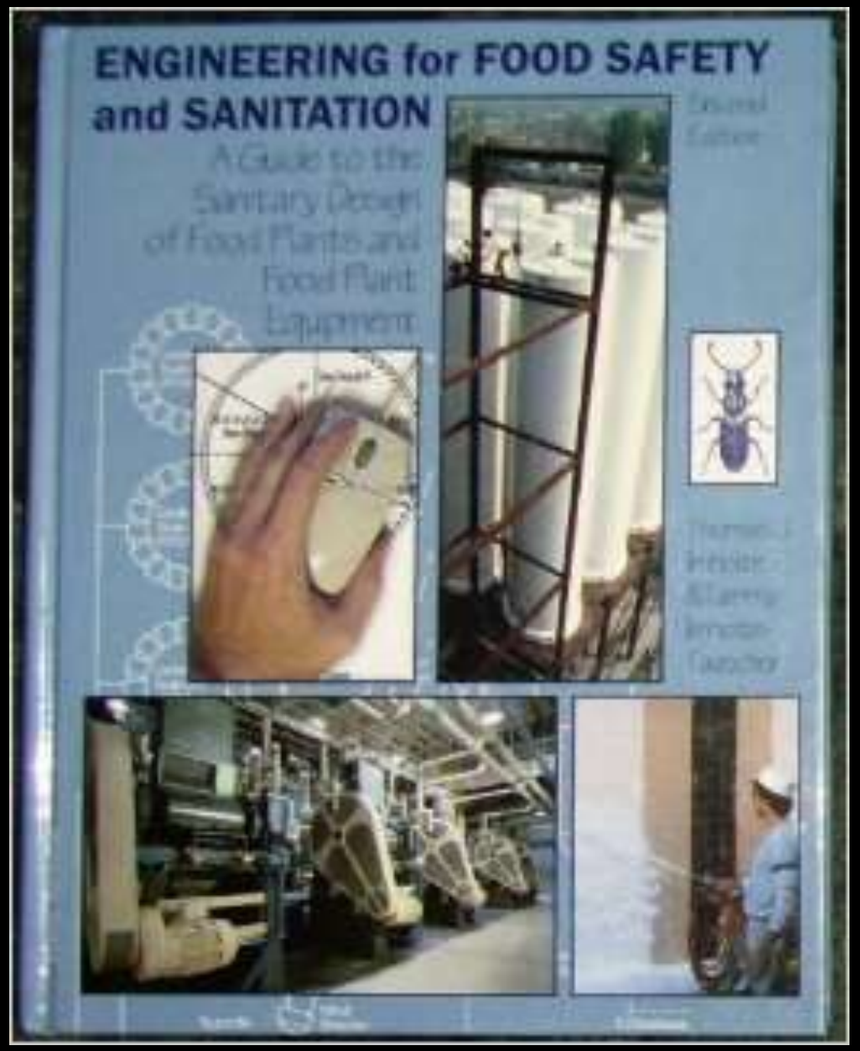
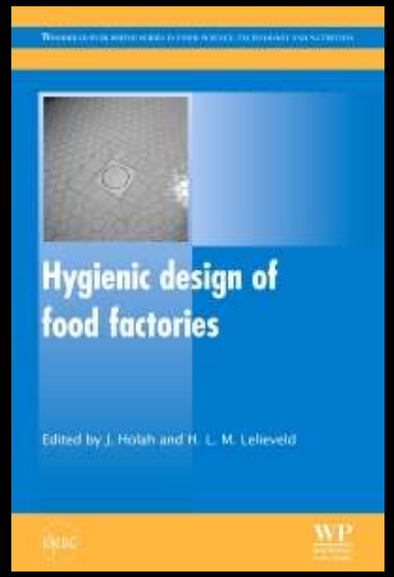
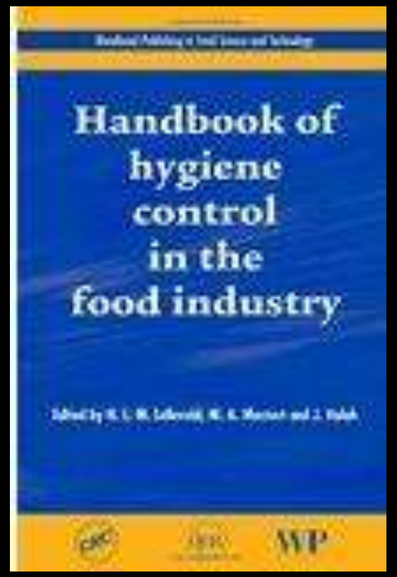
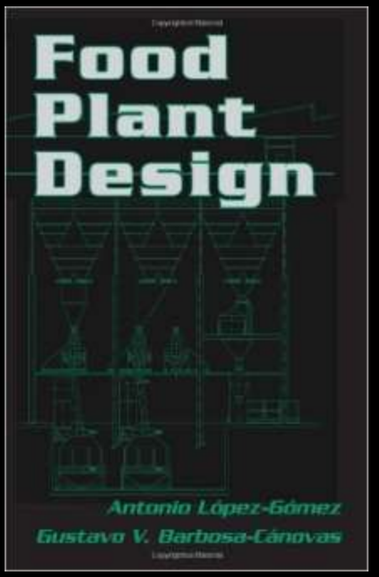
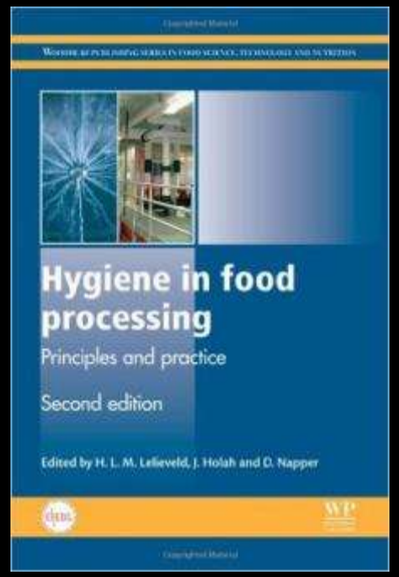
4. Use of Reference Materials in Class

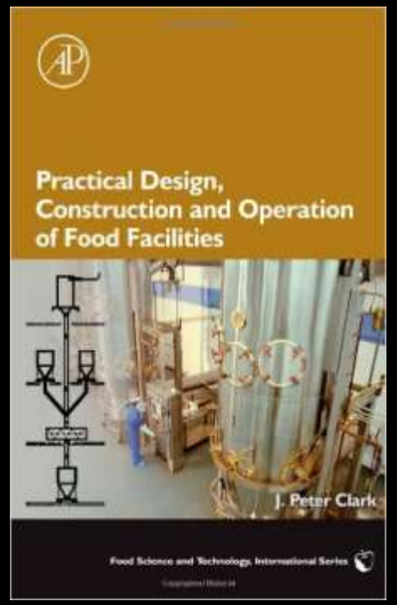


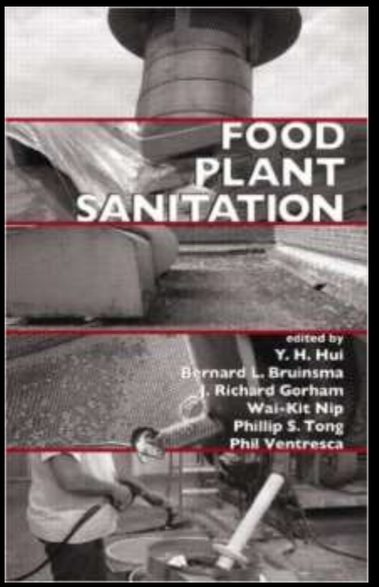




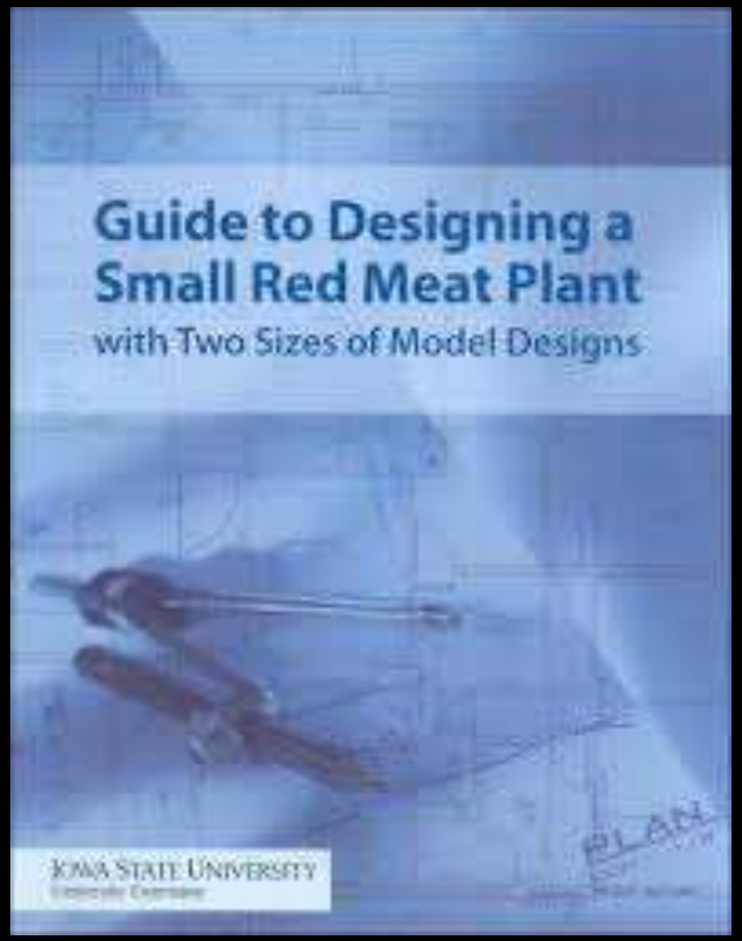


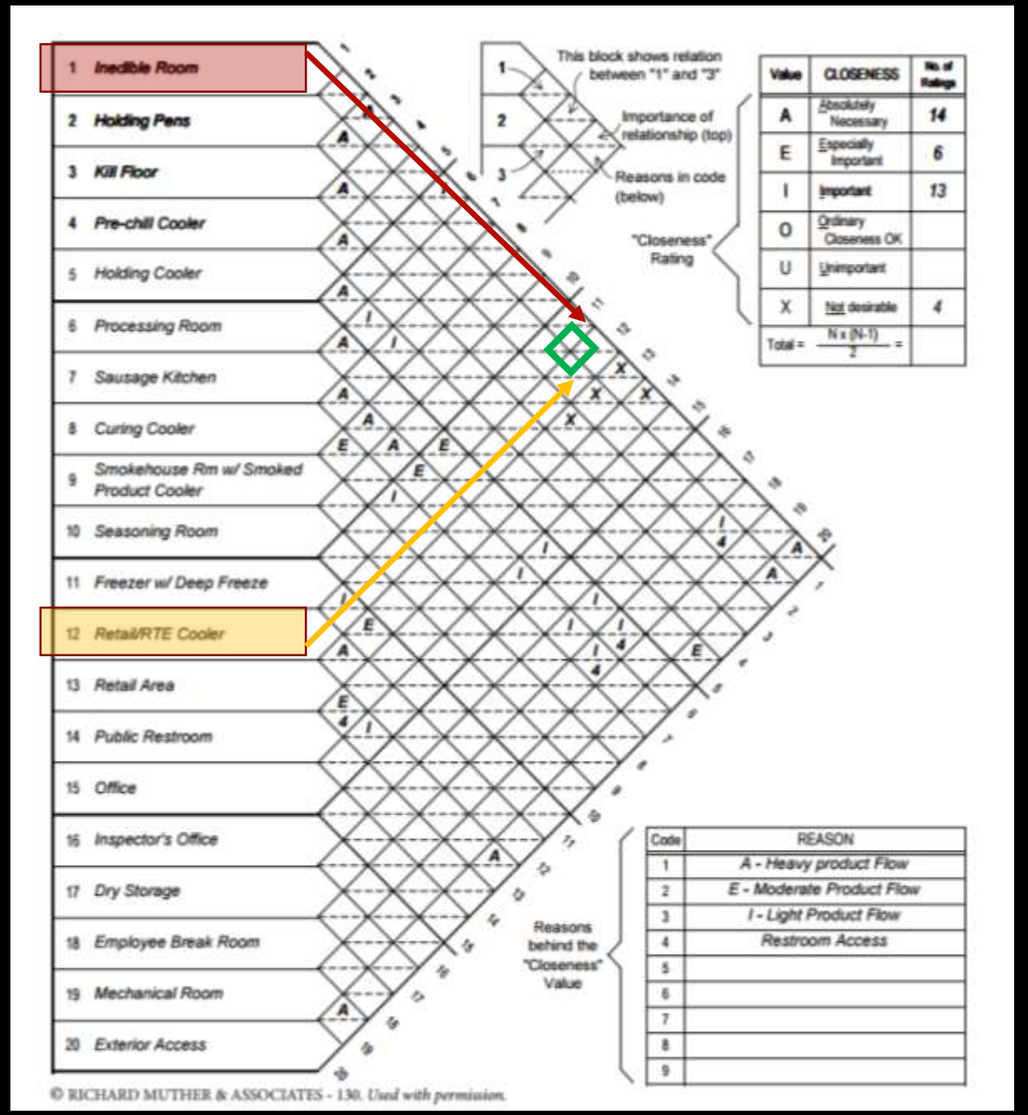






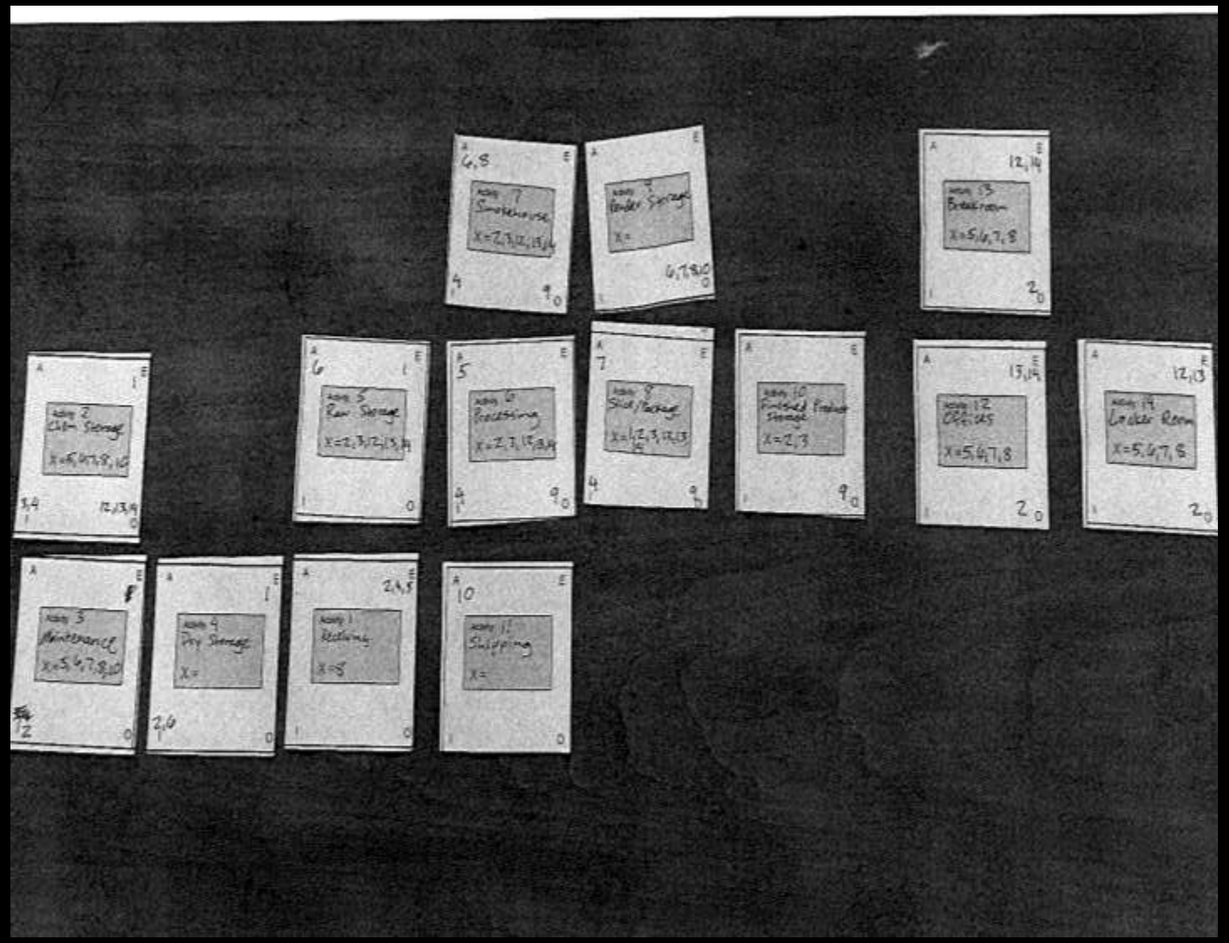
4. Use of Reference Materials in Class – Adapt guides to other food products



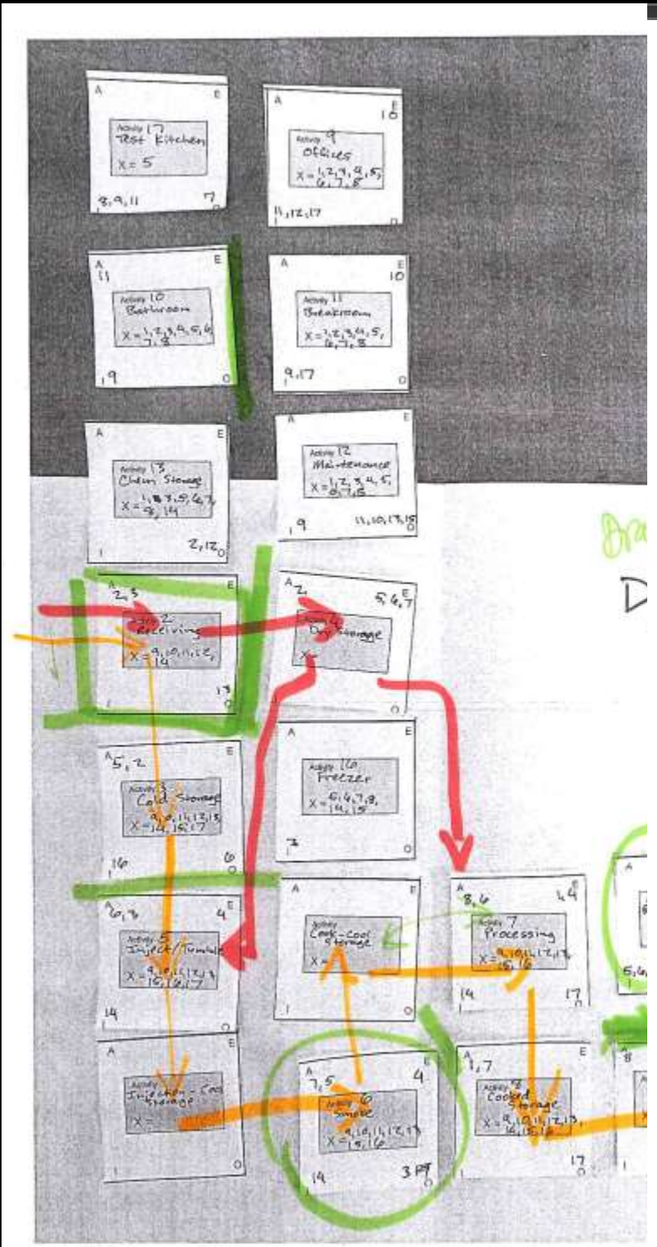


Flow Analysis – Dimensionless Block Diagram

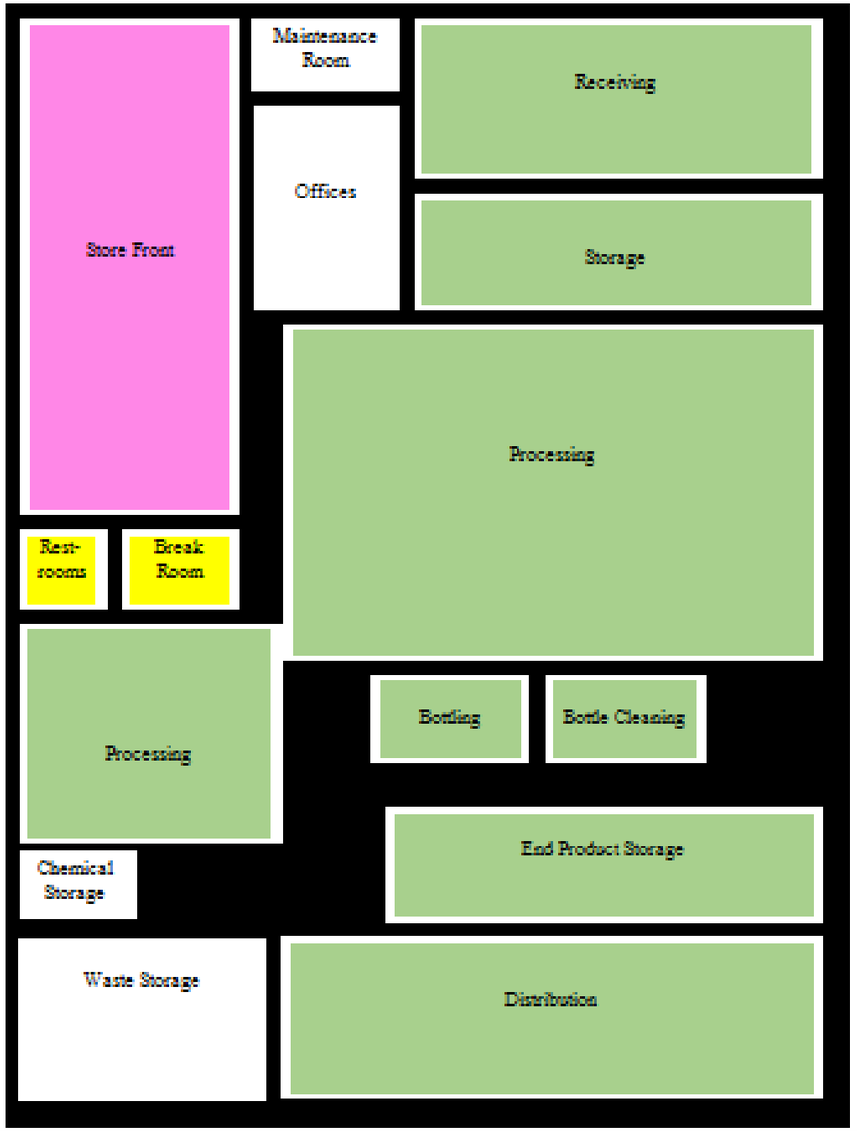
6 **5 X=8** 14	1,5 **6** 2,3,14 9 4	11 **10** 12 1	10 **11** 1 9,14
1,3 **2** 6 5,9,13	2,6 **1** 9,11,13,14 4,5,12 3,10	7 **8** 14 9,12,13 4	
2,4 **3** 6 9,12,13 12,13	3,7 **4** 9,12,13,14 5 6,8	4,8 **7 X=6** 14	
	9 **9** 1,4 2,3,5,6,8,10 13,14	9 **12** 4 1,2,3,5,8 13	
	9,13 **14** 4,5,6,8 7,11	9,12,14 **13** 1,4 2,3,5,8	



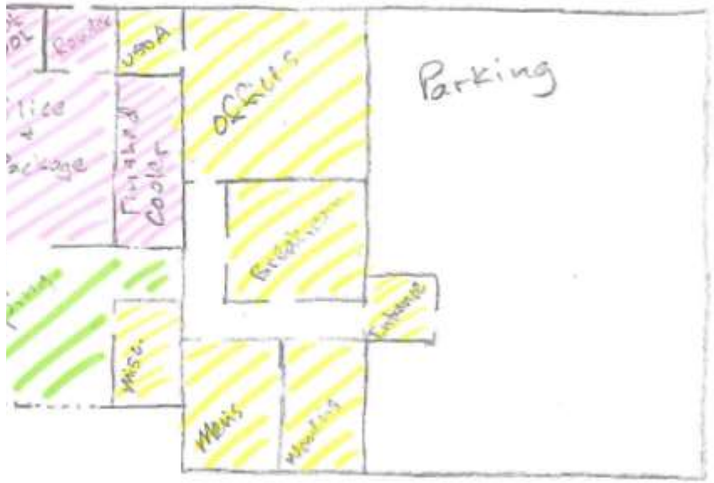
Flow Analysis – Dimensionless Block Diagram



7.6 Segregation – Allergen Areas



e Profiles



What NOT to do with students…..

Requirement for plant "X":

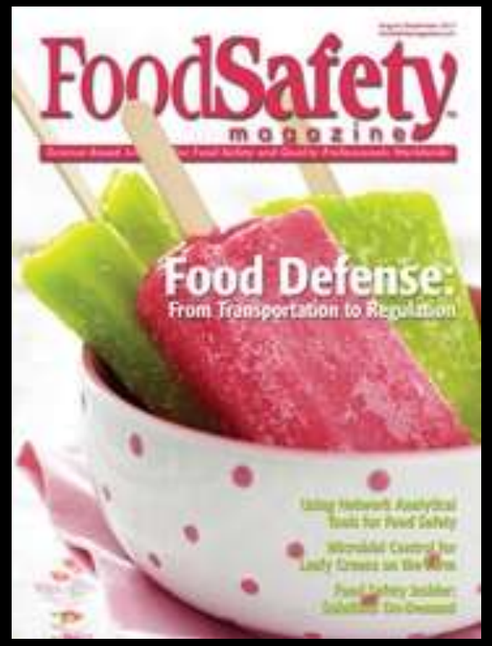
- " *"18-8 stainless Steel shall be AISI 300 series or better…"*
- It's a designation given by the American Iron and Steel Institute to *stainless steel…."*
- "The AISI 300 series stainless steels are all variations on the *original 18-8 alloy*…"
- You know, 18% chromium, 8% nickel….

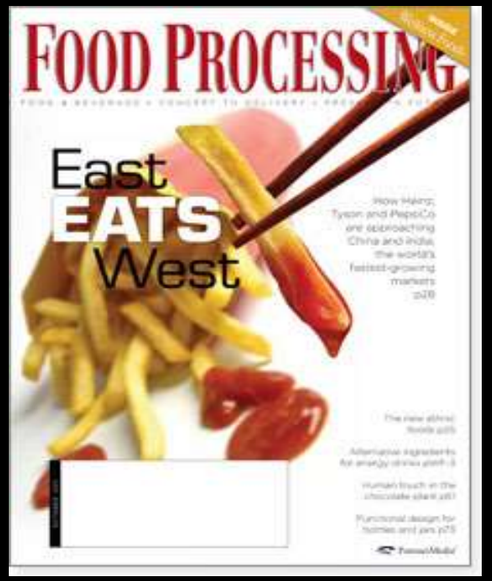
Alejandro Echeverry, Ph.D

5. Suggestions

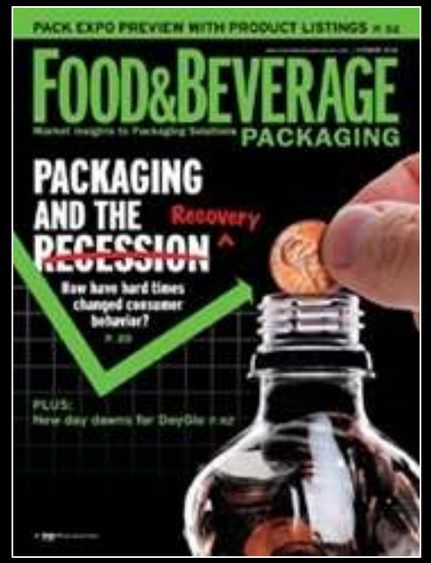
Academia:

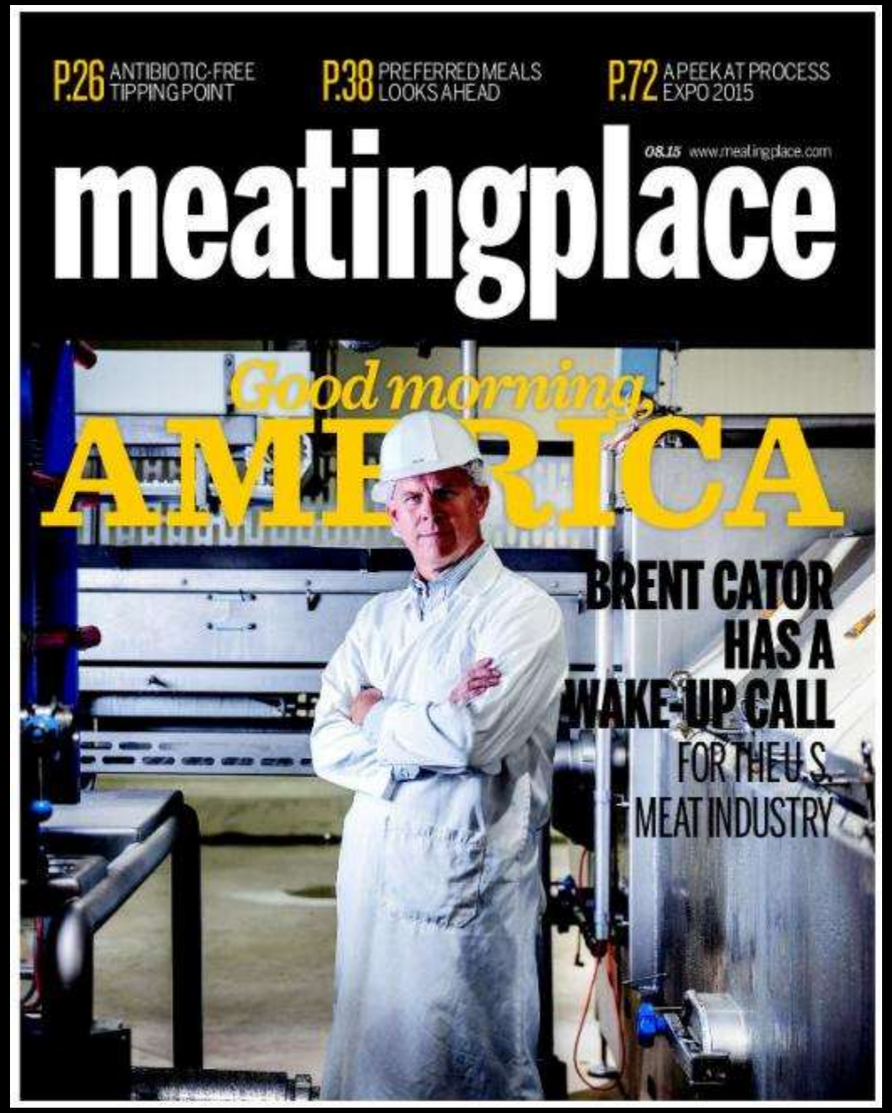
1. Encourage students subscription to trade magazines





5. Suggestions





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5. Suggestions

Academia:

2. Encourage students to become members of professional organizations and to participate and volunteer in their groups and committees

Dairy Quality & Safety Professional Development Group

Mission Statement: To promote the production and processing of safe, high quality dairy products and to develop program topics and symposia for presentation at the IAFP Annual Meetings.

Sanitary Equipment and Facility Design Professional Development Group

Mission Statement: To serve as a forum for the advancment of hygienic design and construction of food processing equipment and facilities.

Food Hygiene & Sanitation Professional Development Group

Mission Statement: To provide information on the developments in hygiene and sanitation in the food industry

5. Suggestions

Academia:

2. Encourage students to become members of professional organizations and to participate and volunteer in their groups and committees

Dairy Foods

Concerned with quality control, compositional standards, product and process development, equipment and plant design, sanitation, sensory evaluation, biotechnology of dairy cultures, and development and implementation of marketing strategies.

5. Suggestions

Industry & Trade Organizations:

1. Increase access to students
2. Internship Experience
3. RFP / RFA
    - White Papers / Guides
    - Evaluation / validation of Materials (biofilm formation, cleanability)
    - Sponsor Hygienic Design Series in trade magazines / case studies
4. Support Programs / Endowed Positions

5. Suggestions

Industry & Trade Organizations:

2. Provide scholarships for educational events
3. Follow up & request feedback / experience / current projects

http://www.stopfoodborneillness.org/

Stop Foodborne Illness

The Voice for Safe Food

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