Course Syllabus

Credits: (0-0:3-0)3

Description:
This course studies cereal grains used for human food. Because the range of products that can be made from cereal grains is so diverse, the major focus will be on wheat in order to be comprehensive in terms of chemistry, functionality and utilization. In that regard, the course covers topics related to the biophysical and biochemical basis for the functionality of intrinsic wheat constituents including starch, and gluten proteins, as well as extrinsic baking ingredients such as yeast, chemical leaveners, fats, oxidants, enzymes and other modern improvers, and inter-relationships among intrinsic and extrinsic factors. Additionally, the course will provide details on the different quality requirements of flours for various products, the scientific and practical explanations for these differences, and the desired quality characteristics of the finished products themselves. Particular emphasis will be on reviewing the scientific literature to gain an understanding of current concepts pertaining to the chemistry and composition of wheat constituents along with physical properties, and their relationships to end-use quality.

Prerequisites: FOOD 2500, CHEM 2360 or CHEM 2770 or equivalents.

Instructor: Dr. Harry D. Sapirstein, Room 264 Ellis; Phone: 474-6481; e-mail: harry_sapirstein@umanitoba.ca)

Textbook: Chapter selections (~ 6-8 of 18) from the following text will be distributed to students: R.C. Hoseney. Principles of Cereal Science and Technology, 2nd Edition, 1994, American Association of Cereal Chemists (AACC) or from the 3rd edition (2010) of the same text by Delcour and Hoseney. As required, literature from scientific papers and/or review articles will be also distributed as reading material.

Learning Objectives:
- Students will develop a critical understanding of the uniqueness of wheat as a cereal grain in the world food supply and the scientific nature of the functionality and inter-relationships of the key constituents in wheat for food utilization.
- Students will learn to appreciate the complex nature of flour and the intricacies of modern baking technology.
- Students will develop competency to critically evaluate quality of finished baked products in terms of underlying properties of flour, dough/batter, ingredient function, product formulation and processing, and molecular mechanisms.

Reading Outline (note – a majority, but not all sections/topics listed below will be covered each year; number of lectures in parentheses are estimates):

A. Introduction (3 lectures)
1. course philosophy and goals, learning objectives, course administration
2. brainstorming exercise: explore factors explaining why bread and sponge cake are different
3. global importance of wheat in relation to other cereal grains; economic value of the North American milling and baking industry
4. origin of wheat and history of breadmaking

5. classification of Canadian and other wheats of commercial importance

B. Principal wheat type and end-use quality determining factors (2 lectures)
- **1.** protein/starch content, grain hardness, dough strength, grain colour (group exercise)
- **2.** milling, enzyme and protein quality

C. Structure of the wheat kernel and chemical composition of major component tissues (germ, bran, and endosperm) and their nutritional value (2 lectures)

D. Wheat dry milling (2 lectures)
- **1.** process and equipment: tempering, break and reduction, purifiers and sifters, flour blending
- **2.** comparison of milling of hard common wheat, soft wheat and durum wheat
- **3.** flour classification and grading
- **4.** nutritional consequences of flour milling and flour enrichment

E. Gluten wet milling and functionality for food and industrial use (2 lectures)
- **1.** properties and baking and industrial uses of gluten
- **2.** laboratory and industrial methods of gluten extraction from flour

F. Chemistry and functionality of flour constituents (8 lectures)
- **1.** starch (3 lectures)
  - **a.** starch granule morphology (comparison of wheat, barley, oats and rice)
  - **b.** chemical composition; amylose and amylopectin
  - **c.** functionality: hydration, gelatinization, retrogradation and staling
  - **d.** resistant starch as dietary fibre
- **2.** proteins (3 lectures)
  - **a.** classification: albumins, globulins, gliadins, glutenins
  - **b.** structure and molecular properties: amino acid compositions, monomers and polymers, glutenin subunits, molecular size distribution
  - **c.** molecular models of dough
  - **d.** chemistry and functionality: solubility, viscosity, elasticity, gas retention
  - **e.** health issues: gluten protein intolerance and celiac disease
- **3.** lipids (esp. in relation to volume potential) and non-starch polysaccharide's (esp. in relation to water absorption) (1 lecture)
- **4.** enzymes (esp. amylases) and minor constituents (esp. friabilin and end-product texture) (1 lecture)

G. Chemistry and functionality of baking ingredients (3 lectures including group exercise explaining functionality of selected ingredients)
- **1.** Water
- **2.** Salt
- **3.** sugars and sweeteners
- **4.** fats and oils

5. dough strengtheners, crumb softeners and emulsifiers
6. enzymes
7. eggs and egg products
8. milk and milk products
9. starches and gums
10. yeast foods
11. oxidants and reductants
12. miscellaneous ingredients (malt products, soy and potato flour, vital wheat gluten, fibre)

H. Yeast and fermentation (1 lecture)

I. Breadmaking (6 lectures)

1. breadmaking systems (2 lectures)
   - **a.** comparison of biological leavening, chemical leavening, and physical leavening
   - **b.** product types around the world, basic properties, and typical formulations (variety pan breads, hearth breads, hard and soft rolls, bagels)
2. commercial breadmaking equipment: dough mixers, dividers, sheeters and moulders, proofers, ovens, pans (1 lecture)
3. commercial processing methods, schedules, objectives and rationales (3 lectures)
   - **a.** dough mixing and fermentation systems (straight dough, sponge & dough, liquid ferment, short- and no-time bulk fermentation baking)
   - **b.** dough processing (floor time, dividing, rounding, intermediate proof, sheeting/moulding, panning)
   - **c.** baking, cooling, slicing and packaging
   - **d.** comparison of commercial bread processing systems
   - **e.** bread scoring - external and internal bread characteristics, fault analysis
   - **f.** consumer breadmaking, breadmaking machines and flour quality considerations (1 lecture

J. Examples of diverse utilization of wheat: flat and steamed breads (2 lectures)

1. flour requirements and quality considerations
2. ingredients and formulations
3. processing

K. High value-added products from soft wheat (3 lectures)

1. flour requirements for various products
2. chemistry of chemical leavening systems
3. cake baking technology (cake types, ingredients, mixing methods, baking, miscellaneous aspects including high - altitude considerations)
4. pastries (dough lamination and puff pastry processing)
5. doughnuts
6. cookies and biscuits
7. saltines/snack crackers

L. Frozen and refrigerated dough production for yeast-leavened baked goods (1 lecture)

1. economic rationale
2. industrial problems: yeast death, gluten weakness, low product volume
3. formulation optimization
4. fermentation and cold storage dough stability
5. freezing and thawing conditions for optimum product quality

Assignments and Evaluations:

Assignments and evaluations are based on the following:

- four quizzes (10-15 min each)
- written answers to review questions at the end of selected chapters of textbook (see below)
- 1 literature review (see below)
- Class lecture on literature review
- Participation

Written Answers to Review Questions at End of Selected Chapters of Textbook, "Principles of Cereal Science and Technology"

The course textbook has been written to provide a foundation of knowledge for cereal science and technology. As such, information in these chapters nicely complement course material. In 2004, eight chapters of the textbook will be assigned reading during the course (approximately one chapter per week):

Chapter 1. Structure of Cereals
Chapter 2. Starch *(answer even or odd-numbered questions as instructed)*
Chapter 3. Proteins of Cereals
Chapter 4. Minor Constituents of Cereals
Chapter 6. Dry Milling of Cereals
Chapter 10. Gluten Proteins
Chapter 12. Yeast Leavened Products *(answer even or odd-numbered questions as instructed)*
Chapter 13. Soft Wheat Products *(answer even or odd-numbered questions as instructed)*

The readings should be very straightforward for graduate students with the required prerequisites. Each chapter has a set of review questions at the end. Students are required to answer these questions in writing, and submit responses to the instructor within one week after being assigned. There should be no guesswork to answering the questions, as answers are all clearly addressed in the text of the chapters. Answers to questions should be brief but sufficient; point form may be used. For a few chapters that contain over 30 review questions, the number of questions that students need to answer are reduced, as noted above.

Each set of answers will be given a letter grade based on the following criteria:

A+	> 90% correct	C+	61-66% correct
A	80-90% correct	C	56-60% correct
B+	75-79% correct	D	50-55% correct
B	67-74% correct	F	< 50% correct

Literature Review and Related Responsibilities

Students will be responsible for the preparation of one literature review paper, due in class on or

before the official last day of class. Accordingly, the paper has been allocated approximately 15 weeks for completion. The subject of the review paper must be approved by the instructor. Suggested topics are listed below. Expectations and requirements of the review paper are explained below.

A review paper is usually long for good reason, and this assignment is no exception. Each paper will be in the range of 8,000 to 10,000 words (excluding references), double spaced and printed on a laser printer, using 12 point font, and 1 inch margins. A serif font style should be used; a suitable style is Times New Roman. A Table of Contents (TOC) is required at the beginning of the paper. A good example is provided below on page 8. Students should make use of the Numbered Outline tool in Microsoft Word to automatically create the TOC. References should be cited in the text of the paper and listed in the Literature Cited section using the *name and year* system. A hanging indent style should be used to list the references. Students will also submit, along with the review paper, a three ring binder containing copies of all the research articles cited in the review, arranged in the *name and year* order.

The main product of the paper is the literature review. However, more than an annotated bibliography or uncritical review is expected. The paper should include tables and illustrations of key information and/or noteworthy discoveries and results. These tables and illustrations (all appropriately referenced) should be embedded in the text of the paper as soon as possible after each has been referred to. Most importantly, critical evaluation of the published literature is expected, reflecting independent thinking on the part of the student. The student will also provide important conclusions based on the literature.

Each paper will be given a letter grade based on sound organization (see below), comprehensive and critical content, clarity of style, and correct citations of references. Good grammar and correct spelling in the paper are mandatory. The paper should be polished and professional looking to obtain full marks. In this regard, each review paper should be written with a view to potential publication in an appropriate journal. In the past, one student has in fact succeeded to publish the review paper; this should be your goal.

In addition to the literature review document itself, students are responsible for preparing and delivering one lecture on the topic of the review, including a 300 word abstract (plus references). The lecture should be presented as a Powerpoint slide show. Students will be assigned a letter grade for the lecture reflecting the following criteria: organization, knowledge of material, appropriate content depth and scope, and quality of visual aids.

Preparation of the review paper

Once topics have been selected, each student should soon proceed to carry out a computerized literature search on appropriate keywords related to the topic. Relevant data bases include the following:

1. Web of Science (available online – UM Libraries)
2. Food Science and Technology Abstracts (available online – UM Libraries)
3. Biosys Previews (available online – UM Libraries)
4. AGRICOLA (available online – UM Libraries)
5. CAB Abstracts (available online – UM Libraries)
6. Cereal Chemistry Abstracts - Cereal Source data base at the AACC International internet site (http://www.aaccnet.org/)

The organization of the review paper is very important. It is a general truism that the writing will

take care of itself if the paper is well organized. Unfortunately, there is no standard organization of a review paper. This situation differs from research articles which follow a traditional sequence, i.e. Introduction, Materials and Methods, Results and Discussion, and Conclusion. Day[1] (1994) suggests that a good starting point for the organization of a review paper is to visualize it as a research paper with the following changes: greatly expand the Introduction, delete the Material and Methods, delete the Results, and expand the Discussion. Refer to articles in Advances in Food Research or Advances in Cereal Science and Technology for style and format.

Special attention should be given to the quality and clarity of writing of the first paragraph of each major section. This will encourage readers to read on (as opposed to skip to the next section), which will help their comprehension of the subject. A conclusion section is preferred, as opposed to a summary (which is more difficult to write given the typical broad review). The conclusion should especially emphasize your own thoughts on the subject including prospects for future research and realized or potential benefits to industry.

A carefully prepared outline is the best place to start organizing your review paper. The outline should be prepared before you start writing, but after you have collected and carefully read the majority of papers you intend to include in your review. The outline will be essential for your review in at least two ways: 1) it will define the scope of the review allowing the parts to fit together in logical sequence, and 2) it will provide a convenient table of contents to be listed at the beginning of the paper.

Your review should provide a good balance between critical evaluation of the literature and bibliographic completeness. History of science in the literature review is also important; appropriate coverage of the historical foundations of the review subject is expected. Finally, because review papers are more likely to be read by a wide and varied audience, the style of writing should be more general compared to that used in a published research paper. Avoid jargon terms or special abbreviations, or carefully explain them. An example of a well constructed outline follows on page 8. This outline style (with numbered outline) should be used for the paper's table of contents.

Marking

10-15 min quizzes, 4@ 3%	12%
Textbook Review Questions (6@ 3%)	18%
Literature Review	40%
Class lecture of Literature Review using Powerpoint	10%
Participation in class sessions[2]	10%
Total	100%

[1]Day, R.A. 1994. How to Write and Publish a Scientific Paper. Fourth Edition. Oryx Press, Phoenix.

What Does Class Participation Mean[2]?

Class attendance is required and students are strongly encouraged to contribute to class discussion. Participation is the key to a lively class. What matters is the quality of one's contributions to the class discussion, not necessarily the number of times one speaks, although both factors will be considered in determining the participation mark. Note that even asking a question represents a participation "event". Accordingly, students are encouraged to ask questions, ideally based on prior preparation, e.g. reading of assigned and/or distributed information, lecture notes, etc. Below are guidelines that will be used to assess participation.

Outstanding Participation: Contributions reflect exceptional preparation. Ideas offered or questions asked are always substantive and provide one or more major insights as well as lead to additional discussion by the class.

Good Participation: Contributions reflect thorough preparation. Ideas or questions offered are usually substantive, provide good insights and sometimes direction for class discussion.

Adequate Participation: Contributions in class reflect satisfactory preparation. Ideas or questions offered are sometimes substantive, provide generally useful insights but seldom offer a new direction for discussion.

Non-Participant: This person says little or nothing in class. Hence, there is not an adequate basis for evaluation.

Policy on Plagiarism and Cheating

Plagiarism in term assignments or any other form of cheating in examinations or tests or quizzes is subject to serious academic penalty (e.g., suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty.

To plagiarize is, to take ideas or words of another person and pass them off as one's own. In short, it is stealing something intangible rather than an object. Obviously, it is not necessary to state the source of well known or easily verifiable facts, but students are expected to acknowledge the sources of ideas and expressions they use in their written work, whether quoted directly or paraphrased. This applies to diagrams, statistical tables and the like, as well as to written material, and materials or information from Internet sources. To provide adequate documentation is not only an indication of academic honesty but also a courtesy which enables the reader to consult these sources with ease. Failure to do so constitutes plagiarism. It will also be considered plagiarism and/or cheating if a student submits a term paper written in whole or in part by someone other than him/herself, or copies the answer or answers of another student in any test, examination, or take-home assignment.

An assignment which is prepared and submitted for one course should not be used for a different course. This is called "duplicate submission" and represents a form of cheating because course requirements are expected to be fulfilled through original work for each course.

[2]Adapted in part from:
http://www.brown.edu/Departments/Italian_Studies/dweb/pedagogy/particip-assessm.shtml

When in doubt about any practice possibly related to plagiarism, ask your instructor

Example of an Outline or Table of Contents of a Review Paper [Source: Day (1994)]

Pathophysiological Effects of *Vibrio cholerae* and Enterotoxigenic *Escherichia coli* and Their Exotoxins on Eucaryotic Cells

Karen L. Richards and Steven D. Douglas

Departments of Microbiology and Medicine, University of Minnesota Medical School, Minneapolis, Minnesota 55455

Suggested Term Paper Topics

- The Molecular Basis of Dough Strength in Breadmaking and the Effects of Salt
- Molecular and Physical Nature of Flour Water Absorption in Wheat Quality for Breadmaking
- Unique Functionality of Soft Wheats for Cake and Pastry Products
- Uniqueness of Durum Wheat for Pasta Products
- Molecular and Physical Nature of Adverse Effects of Whole Wheat Flour in Breadmaking
- Bread Staling and Preservation of Fresh Product Texture using Ingredients
- Models of Gluten/Dough Structure
- The Physical and Chemical Basis of Wheat Hardness
- Molecular and Physical Basis of Dough Development and Breakdown During Mixing
- Optimizing Whole Wheat Flour for Breadmaking
- Pre-harvest Sprouting in Wheat and its Effect on Breadmaking Properties
- Microscopy as an Aid in Understanding Wheat Functionality
- Enzymes in Wheat Technology
- The Functionality of Flour Maturing and Oxidizing Agents
- Frozen Doughs for Yeast-Leavened Bakery Products
- Effects of Growing Environment on Wheat Quality for Breadmaking

INFORMATION SOURCES

Books

- AACC. Approved methods of the American Association of Chemists. (S 588.C4 A45)
- Barnes, P.J. Lipids in Cereal Technology. 1983. (TX 557.L56)
- Bushuk, W. Rye, Production, Chemistry and Technology. 1976. (SB 191.R9R84 1976)
- Bushuk, W. and Rasper, V.F. (eds). Wheat : production, properties and quality. 1994. (SB 191 W5 W48)
- Christensen, C.M. Storage of Cereal Grains and Their Products. 1982. (SB 190.S47 1982)
- CIGI: Canadian International Grains Institute. Grains and Oilseeds: Handling, Marketing, Processing. 4th ed. 1993. Volumes I and II (HD 9030.5 C35 1993).
- Eliasson, A.-C., and Larsson, K. Cereals in Breadmaking: A Molecular Colloidal Approach. 1993. (TX 558 B7 E45)
- Fabriani, C.L. Durum Wheat: Chemistry and Technology. 1988. (TX 558.W5D87 1988)
- Faridi, H. Rheology of Wheat Products. 1985. (TX 558.W5R48 1985).
- International Conference on Cereals for Food and Beverages, Copenhagen, 1979. Cereals for Food and Beverages: Recent Progress in Cereal Chemistry and Technology. 1980. (TX 557.I57 1979)
- International Cereal and Bread Congress, 6th, Winnipeg, 1978. Cereals '78 - Better Nutrition for the World's Millions: A Commemorative Book. 1978. (TX 393.I57 1978)
- Juliano, B.O. Rice: Chemistry and Technology. 1985. (TX 558.R5R53 1985)
- Kent, N.L. Technology of Cereals: An Introduction for Students of Food Science and Agriculture. 1983. (TS 2145.K36 1983)
- Kent-Jones, D.W. and Amos, A.J. Modern Cereal Chemistry. 1967. (SB 189.K37 1967)
- Kruger, J.E. Enzymes and Their Role in Cereal Technology. 1987. (TP 434.E58 1987).
- Olson, R.A. and Frey, K.J.: Nutritional Quality of Cereal Grains: Genetic and Agronomic Improvement. 1987. (SB 189 .N78 1987)
- Pomeranz, Y. (editor). Advances in Cereal Science and Technology. Vol. 1, 1976 - Vol. 10, 1990. (TP 434.A37); refer to list of contents below.
- Pomeranz, Y. Wheat: Chemistry and Technology. 2nd ed. 1971. (TX 558.W5 W46 1971)
- Pomeranz, Y. Wheat: Chemistry and Technology. 3rd ed. 1988. Vols. I and II. (TX 558.W5 W46 1988)
- Pomeranz, Y. Modern Cereal Science and Technology. 1987. (SB 189.P65 1987)
- Pomeranz, Y. (editor). Wheat is Unique: Structure, Composition, Processing, End-Use Properties, and Products. (TP 435 W48 W48 1989)
- Pyler, E.J. Baking Science and Technology. Third Edition, 2 volumes. 1988. (TX 763 P98).
- Rasper, V.F. Cereal Polysaccharides in Technology and Nutrition. 1984. (TX 557.C38 1984)
- Salunkhe, D.K. Postharvest Biotechnology of Cereals. 1985. (EN SB 189.7S24 1985)
- World Cereal and Bread Congress. (7th: 1982, Prague). Progress in Cereal Chemistry and Technology. 1987. (TP 434.W66 1982)
- Yamazaki, W.T. Soft Wheat: Production, Breeding, Milling, and Uses. 1981. (SB 191.W5S6)

Journals

- Cereal Chemistry, Vol. 1 (1924) - present, (Sci 660 C335 Ch)
- Journal of Cereal Science, Vol. 1 (1980) to present (Sci 660 J826 CerSc)
- Journal of the Science of Food and Agriculture, Vol. 1 to present (Sci 641.05 J826)
- Cereal Foods World, Vol. 25 (1980) to present (Sci 660 C3345 Fo)
- Bakers' Digest, Vol. 14 (1940) to present (Sci 660 B178 Di)
- Cereal Science Today (Agriculture & Agri-Food Canada Research Station library, Campus)
- Milling and Baking News (Periodical; last 2 years, William R. Newman Library)

Advances in Cereal Science and Technology
Contents: Vol. 1, 1976 - Vol. 10, 1990.

Volume 1

1. **Grain Marketing**. Lowell D. Hill and P. J. Van Blokland.
2. **Cereal Grain Handling System**. L. T. Fan, F. S. Lai, and R. H. Wang.
3. **Starch**. C. T. Greenwood.
4. **Wheat Proteins**. Donald D. Kasarda, John E. Bernardin and Charles C. Nimmo.
5. **Malting and Brewing**. G.H. Palmer and G.N. Bathgate.
6. **Chemistry and Technology of Soybeans**. W.J. Wolf.
7. **Protein Methods for Cereal Breeders as Related to Human Nutritional Requirements (PAG guideline No. 16--Cereal Breeders' Protein Methods)**. Protein-Calorie Advisory Group (PAG) Of The United Nations System.

Volume 2

1. **Cereal Grain Drying**. F.W. Bakker-Arkema, R.C. Brook and L.E. Lerew.
2. **Insects and Microorganisms in Stored Grain and Their Control**. L.A. Bulla, Jr., K.J. Kramer, and R.D. Speirs.
3. **Corn and Sorghum Grain Proteins**. Joseph S. Wall and Jerrold W. Paulis.
4. **Cereal Lipids**. William R. Morrison.
5. **Composite Flours**. D. De Ruiter.
6. **Wheat in China**. Y. Pomeranz.
7. **West German Bread**. Wilfried Seibel, Juergen-Michael Bruemmer, and Hans Stephan.

Volume 3

1. **Cereal Science and Technology at the Turn of the Decade**. Y. Pomeranz.
2. Genetic Control of Polysaccharide and Storage Protein Synthesis in the Endosperms of Barley, Maize, and Sorghum. O.E. Nelson.
3. **The Rice Kernel**. D. B. Bechtel and Y. Pomeranz.
4. **Triticale: Production, Chemistry, and Technology**. W. Bushuk and E. N. Larter.
5. **Mycotoxins**. C.J. Mirocha, S.V. Pathre, and C.M. Christensen.
6. **Advances in Milling Technology**. J.A. Shellenberger.
7. **Physicochemical Aspects of Some Problems in Wheat Research**. F. MacRitchie.
8. **Documentation and Information in Cereal Science and Technology in Europe**. R. Schneeweiss.

Volume 4

1. **Yeast--A Microbe for All Seasons**. Gerald Reed.
2. **Morphological and Biochemical Development of the Wheat Endosperm**. D. H. Simmonds and T. P. O'Brien.
3. **Sorghum and Millets**. R. C. Hoseney, E. Varriano-Marston, and D. A. V. Dendy.
4. **High-Temperature, Short-Time Extrusion Cooking**. P. Linko, P. Colonna, and Christiane Mercier.
5. **Status of Research on Grain Dust**. F. S. Lai, Y. Pomeranz, B. S. Miller, C. R. Martin, D. F. Aldis, and C. S. Chang.

Volume 5

1. **Chromosomal Locations of Genes That Control Wheat Endosperm Proteins**. F. Garcia-Olmedo, P. Carbonero, and B. L. Jones.
2. **Oats**. V. L. Youngs, D. M. Peterson, and C. M. Brown.
3. **Enzymes in Wheat, Flour, and Bread**. P. F. Fox and D. M. Mulvihill.
4. **Buckwheat: Description, Breeding, Production, and Utilization**. H. G. Marshall and Y. Pomeranz.
5. **Identification of Cereal Varieties by Gel Electrophoresis of the Grain Proteins**. C. W. Wrigley, J. C. Autran, and W. Bushuk.
6. **Rapeseed**. F. W. Hougen and B. R. Stefansson.

Volume 6

1. **Nitrate Uptake and Assimilation and Grain Nitrogen Accumulation**. Yash P. Abrol, P. Ananda Kumar, and T. V. Ramachandran Nair.
2. **Swelling, Pasting, and Gelling of Wheat Starch**. H. N. Dengate.
3. **Cereal and Dental Caries**. Klaus Lorenz.
4. **Emulsifiers as Additives in Bread and Fine Baked Products**. G. Schuster and W. F. Adams.
5. **Allergies to Cereals**. B. A. Baldo and C. W. Wrigley.
6. **Amaranthus: A Potential Food and Feed Resource**. R. M. Saunders and R. Becker.

Volume 7

1. **Seed Storage Proteins of Economically Important Cereals**. P. R. Shewry.
2. **Phospholipases of Cereals**. L. Acker.
3. **Changes in Rice During Parboiling, and Properties of Parboiled Rice**. Kshirod R. Bhattacharya and S. Zakiuddin Ali.
4. **Dietary Fiber in Cereals**. E. Wisker, W. Feldheim, Y. Pomeranz, and F. Meuser.
5. **Sprouted Grain**. Peter Meredith and Yeshajahu Pomeranz.
6. **Starch Damage**. A. D. Evers and D. J. Stevens.

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Volume 8

1. **International Cooperation in Cereal Research**. Donald L. Plucknett and Nigel J. H. Smith.
2. **Yeasts: Their Role in Modified Cereal Fermentations**. Tilak W. Nagodawithana.
3. **High-Performance Liquid Chromatography of Cereal Proteins**. Jerold A. Bietz.
4. **Effects of Sulfur Supply on the Yield, Composition, and Quality of Grain from Cereals, Oilseeds, and Legumes**. P. J. Randall and C. W. Wrigley.
5. **Cell Walls and Their Components in Cereal Grain Technology**. G. B. Fincher and B. A. Stone.
6. **The Genetic Organization of Zein**. Irwin Rubenstein.
7. **Traditional Foods from Sorghum: Their Production, Evaluation, and Nutritional Value**. L. W. Rooney, A. W. Kirleis, and D. S. Murty.

Volume 9

1. **Crispness of Cereals**. Z. M. Vickers.
2. **Importance of Cross-Linking Reactions in Proteins**. Robert E. Feeney and John R. Whitaker.
3. **Immunochemistry of Cereal Enzymes**. J. Daussant and D. Bureau.
4. **Intermediate-Moisture Foods**. P. S. Taoukis, W. M. Breens, and T. P. Labuza.
5. **Regulation of the Expression of Hydrolase Genes in Cereal Seeds**. S. Muthukrishnan and G. R. Chandra.
6. **Lipoxygenase Pathway in Cereals**. H. W. Gardner.
7. **Cereal a-Amylases in Grain Research and Technology**. R. D. Hill and A. W. MacGregor.
8. **Immunochemistry of Cereal Grain Storage Proteins**. John H. Skerritt.

Volume 10

1. **Structural Studies of Cereal Prolamins, Including Wheat Gluten**. Arthur S. Tatham, Peter R. Shewry, and Peter S. Belton.
2. **Flour Polypeptides Related to Wheat Quality**. F. MacRitchie, D. L. du Cros, and C. W. Wrigley.
3. **Food Legumes: Chemistry and Technology**. S. S. Deshpande and Srinivasan Damodaran.
4. **Technology, Chemistry, and Nutritional Value of Alkaline-Cooked Corn Products**. S. O. Serna-Saldivar, M. H. Gomez, and L. W. Rooney.
5. **Phytic Acid in Cereal Technology**. R. Lasztity and L. Lasztity.
6. **Fusarium Head Blight (Scab) in Cereal Grains**. Y. Pomeranz, D. B. Bechtel, D. B. Sauer, and L. M. Seitz.
7. **Cereals and Schizophrenia**. K. Lorenz.
8. **Wheat Hardness: Its Genetic, Structural, and Biochemical Background, Measurement, and Significance**. Y. Pomeranz and P. C. Williams.