Syllabus

Food 7160

FOOD CARBOHYDRATES

(FALL 2023)

Faculty of Agricultural & Food Sciences

University of Manitoba

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FOOD 7160 FOOD CHEMISTRY

COURSE DETAILS

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

Description:

The major purpose of this course is to study the structure, physicochemical properties and functionality of food carbohydrates. Discussions will focus on behaviour of carbohydrates in heterogeneous food systems including serving as functional ingredients and bases of many foods, that is, sweeteners, thickeners, structural elements and nutrients. Nutritional classification, physiological effects and analysis of food carbohydrates will also be discussed. Concepts in these areas will be presented, discussed and integrated into new approaches and perspectives. Topics will also include engineering the functional properties of food polysaccharides by chemical and biochemical methods; carbohydrate polymers for intelligent and sustainable packaging; carbohydrate polymers in 3D printing; dietary fibers consumption and its influence on the gut microbiome.

Instructor:

Dr. Trust Beta

Department Office Location: 226 Ellis Building

E-mail: Trust.Beta@umanitoba.ca

Phone: (204)474-8214

Guest Instructors: Francis Adjetey, Dr. Gasparre, Dr. Zogona, Dr. L. Malunga

Classes: 108 Animal Science Building (Tuesdays & Thursdays 10:00 –11:15 am)

Lab demo sessions: 200 Ellis Building (Tuesdays & Thursdays 10:00 –11:15 am)

Consultations, Email Communications, Use of UM Learn & iClicker

Individual consultation meetings can be scheduled on Tuesdays and Thursdays between 11:30 am to 12:30 pm. UM Learn will be used for hybrid/ virtual lectures (if necessary), posting lecture notes, lab data, term paper assignments, discussions and announcements for the FOOD 7160 course. iClicker may be used for review quizzes. Use your University of Manitoba email account for all communication between yourself and the university. All communication must comply with the Electronic Communication with Student Policy:

http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html.

Texts/References/Topics

References:

Carbohydrate Chemistry for Food Scientists. 3rd edn. J.N. BeMiller. 2019 Elsevier. N. Carbohydrate Chemistry for Food Scientists (3rd Edition) - Knovel (oclc.org)

Nondigestible Carbohydrates and Digestive Health. T. M. Paeschke 2011. Wiley-Blackwell, Hoboken, NJ. QP 144 F52 2011 (Elizabeth Dafoe Library) Nondigestible Carbohydrates and Digestive Health | Wiley Online Books (oclc.org)

Advanced Dietary Fibre Technology. B. v. McCleary, and L. Prosky (eds.) 2000. Oxford Malden, MA Blackwell Science. QP 144 F52 A285 2001 (Sciences and Technology Library). Advanced Dietary Fibre Technology | Wiley Online Books (oclc.org)

Starch, Chemistry and Technology. J. N. BeMiller, R.L. Whistler, L. Lester (eds.), 3rd edn. 2009. San diego: Elsevier Science & Technology. Starch | ScienceDirect (oclc.org)

Food Carbohydrate Chemistry. R. E. Wrolstad 2012. Wiley-Blackwell, Hoboken, NJ, USA. QD 321.W88 2012 Food Carbohydrate Chemistry | Wiley Online Books (oclc.org)

Cereal Grain-based Functional Foods: Carbohydrate and Phytochemical Components. T. Beta and M. E. Camire (ed.) 2019. Royal Society of Chemistry, London, England, UK. Cereal Grain-Based Functional Foods - Carbohydrate and Phytochemical Components - Knovel (oclc.org)

Food Carbohydrates: Chemistry, Physical Properties, and Applications. S. W. Cui (ed.) 2005. CRC Press, Boca Raton, FL. TX 553 C28 F64 2005 (Sciences and Technology Library). [on loan till 16/12/2021]

Dietary Fibre: Bio-active Carbohydrates for Food and Feed. N.-G. Asp, J. Miller Jones, G. Schaafsma, and J. W. van der Kamp (eds.) 2004. AACC, St. Paul, MN. QP 144 F52 D54 2004 (Sciences and Technology Library)

Current literature from research papers or review articles will also be suggested as reading materials throughout the course. Log on to UM Learn & check for posted items.

FOOD 7160 Topics:

Introductions; evaluation criteria; sources & classes of food carbohydrates; monosaccharides - configuration, nomenclature, conformation & projections, sugar alcohols

Oligosaccharides and **Cyclodextrins**

Starch

Starch physical chemistry, structure and biosynthesis
Fractionation of starch
Other components in starch
Physical properties of starch: gelatinization, pasting & retrogradation
Interaction between starch and other chemicals
Analyses of starch: DSC, X-ray, HPAEC, HPSEC, NMR, IR
Starch modification & starch degrading enzymes

Fibre | Nonstarch polysaccharides

Types and composition
Methodology
Functionality

Carbohydrate sweetness

Sweeteners, taste and functionality
Sweeteners from corn wet milling, cane and beets
Alternative sweeteners

Special topics

Critical abstracts
Presentation of research papers (Term Paper (TP) assignments)

Lab demo sessions

Starch labs

- Microscopy
- Wet milling
- Pasting properties
- Thermal properties

*No reports are to be handed in. However, questions related to the exercises will be included in the comprehensive exam.

Overall Objectives

At the end of the course, students are able to:

- Discuss the nutritional classification and analysis of food carbohydrates
- Describe the structural, physical, and chemical properties of carbohydrates
- Discuss the major functional properties of carbohydrates
- Explain the principles of the methods employed in characterizing carbohydrates
- Discuss the effects of environment on physicochemical and functional properties of carbohydrates

Grading

COURSE EVALUATION

	Marks	% of Final Grade
Class attendance & participation	100pts	5
Exam	100pts	40
Critical abstracts & class handout	75pts	20
Oral discussion of critical abstracts (15 min)	25pts	5
Term paper	80pts	25
Oral report of term paper (20 min)	20pts	5
Total	**400pts**	**100**

Grades:

A+ 90 - 100%

A 80 - 89%

B+ 75 - 79%

B 67 - 74%

C+ 61 - 66%

C 56 - 60%

D 50 - 55%

F Under 50%

Course Policies on Missed Labs, Missed Exams, Missed Assignments, Late Assignments & Class Participation

Missed Exams or Missed Assignments: No marks will be earned. Accommodation will onlybe provided for medical reasons or other emergency upon submission of satisfactory documentation. Whenever possible, give prior notification.

Late Assignments: Late assignments attract a penalty of 5% of total marks per business day.

Class participation: Up to 5% can be earned through participation in quizzes given in class as part of discussions relevant to enhancement of understanding of food carbohydrate concepts.

Course Technology

Regarding student use of technology (i.e., tablets, cellphones, laptops, etc.) in the classroom - It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner.

Recording Class Lectures

No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission {from Dr. Trust BETA.} Course materials (both paper and digital) are for the participant's private study and research.

Academic Integrity

Each student in this course is expected to abide by the University of Manitoba Academic Integrity principles. Always remember to reference the work of others that you have used. Also be advised that you are required to complete your assignments independently unless otherwise specified. If you are encouraged to work in a team, ensure that your project complies with the academic integrity regulations.You must do your own work during exams. Inappropriate collaborative behavior and violation of other Academic Integrity principles, will lead to the serious disciplinary action. Visit the Academic Calendar, Student Advocacy, and Academic Integrity web pages for more information and support.

Policy on Plagiarism and Cheating (quote from university calendar):

"To plagiarize is to take ideas or words of another person and pass them off as one's own. Obviously, it is not necessary to state the source of well-known or easily verifiable facts, but students are expected to acknowledge the source 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 written material.

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 himself or herself, or copies the answer or answers of a fellow studentin any test, examinations or take-home assignments. Plagiarism or any other form of cheating in examinations or term tests is subject to serious academic penalty."

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. I have ensured that the contentI use is appropriately acknowledged and is copied in accordance with copyright laws and university guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at http://umanitoba.ca/copyright/ or contact um_copyright@umanitoba.ca.

Student Accessibility Services

The University of Manitoba is committed to providing an accessible academic community. Students Accessibility Services (SAS) offers academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

StudentAccessibility Services

520 University Centre

Phone: (204) 474-7423

Email: Student_accessibility@umanitoba.ca

2023 Date || Course Schedule

07-Sep	Introduction and evaluation criteria
12-Sep	Carbohydrate classification and nomenclature
14-Sep	Mono- and oligosaccharides, reducing and non-reducing sugars, cyclo- and maltodextrins
19-Sep	Composition and functionality of sugars and oligosaccharides in foods
21-Sep	Starch physical chemistry, structure and biosynthesis
26-Sep	Starch microscopy: observe variation from different botanical sources (Lab demonstration)
28-Sep	Cereal grain starches: extraction and analyses (Lab demonstration)
03-Oct	Starch gelatinization, pasting & retrogradation (DSC & RVA Labs)
05-Oct	Starch modification, starch degrading enzymes (Dr. Gasparre)
10-Oct	Fibre classification and composition (TP topics due 12-Oct)
12-Oct	Fibre methodology including Megazyme assays
17-Oct	Fibre functionality in food and health
19-Oct	Fibre physiological effects (Dr. Zogona)
24-Oct	Review & follow guidelines to compile critical abstracts due
26-Oct	Chemical characterization of arabinoxylans and hydrolysates (Dr. Malunga)
31-Oct	Preparation for comprehensive exam ‖Compilation of critical abstracts
02-Nov	Sweeteners: sources, taste and functionality
07-Nov	Comprehensive Exam (Monosaccharides, oligosaccharides, starch, fibre, sweeteners)
09-Nov	Discussion of critical abstracts
14-Nov	Fall Break
16-Nov	Fall Break
21-Nov	Discussion – critical abstracts
23-Nov	Discussion – critical abstracts
28-Nov	Finalize full paper due 29-Nov @ 12 noon
30-Nov	Presentations of full term paper assignments
05-Dec	Presentations of full term paper assignments
07-Dec	Presentations of full term paper assignments

***Note:**
Fall Term Break Nov 13 to 17, 2023
Last day for voluntary withdrawal is Nov 21, 2023.

Term Paper Project including Critical Abstracts

Guidelines for Term Paper Project

The purpose of preparing **critical abstracts**, a **full paper** and **presentations** of one topic is for you to improve your communication skills and for you to learn more about one area of Food Carbohydrates. Any topic addressing the dynamic, interactive chemical and/or physical properties or health-related effects of carbohydrates or carbohydrate-based foods can be selected. Use your curiosity and areas of interest to choose a subject that intrigues you the most.

Here are some examples of general topics for literature search to 1) select critical abstracts, 2) write a full paper, and 3) make presentations:

- Resistant oligosaccharides (definitions, formation, analytical & physiological aspects, functionality)
- Resistant starch (definitions, formation, analytical & physiological aspects, functionality)
- Functional dietary fibre ingredients (pectin, wheat bran, guar gum, alginate, oat fibre, psyllium, barley bran, rice bran, etc.)
- Beta-glucans or arabinoxylans (sources, isolation, analytical & physiological aspects, functionality)
- Starch-based fat replacers (chemistry and functionality, physiological aspects)
- Chemical modification of cereal carbohydrates to improve functionality
- Source, chemistry and functionality of raffinose family of oligosaccharides in foods
- Dietary fibre – associated compounds: chemistry, analysis, and nutritional effects of polyphenols
- Engineering the functional properties of food polysaccharides by chemical and biochemical methods
- Carbohydrate polymers for intelligent and sustainable packaging
- Carbohydrate polymers in 3D printing
- Dietary fibers consumption and its influence on the gut microbiome

Plus other topics of your choice (diverse topics are encouraged as duplication of the same subject is not permitted)

CRITICAL ABSTRACTS

Find 3 **critical** articles in the area of your topic [dynamic, interactive chemical and/or physical properties of carbohydrates or carbohydrate-based foods]. Recent means within the last 10 years; for some topics this means within the last 15 to 25 years. **Critical** means the research presented in the paper is a major contribution to the field and hence, the paper is highly cited. These articles should provide the basis of your full paper; and therefore, you should be well on your way with your review paper by the time you compile the critical abstracts. Please TYPE (single space) the abstract on one side of a sheet of paper and insert tables / figures on the back of the sheet (total 10 pages) using this format:

[**Authors**] Beta, T.
[**Title**] Instructions to Prepare Critical Abstracts
[**Source**] Food Carbohydrates. 70: 198-204 (2021) {note full pagination}
[**Location of Research**] Food Carbohydrates Laboratory, Department of Food & Human Nutritional Sciences, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2. Phone 204-474-8214
[**Abstract**] The abstract should provide enough detailed information about what was done that you do not need to go back to the original paper. (Avoid selecting a review article) [1]
(1) Start with a summary statement of the general area and approach of the article. [2]
(2) Describe important materials and methods necessary to understand the data. [2]
(3) The results should include data, summary tables, and figures. [5]
(4) Summarize the significant contributions of the research article. [4]
(5) Evaluate / criticize what was done right and what was done wrong. [3]
(6) State how the research could have been improved and / or supplemented. [2]

(7) Suggest follow up experiments. [1]

For class discussion, prepare a handout (about 1-2 pages) containing the key points from the four critical papers that you will use to lead the discussion. [5]
You can use PowerPoint slides for the discussion limited to 15 minutes each.

FULL TERM PAPER

The paper needs to present technical information about the dynamic, interactive, chemical and/or physical properties or health-related effects of carbohydrates or carbohydrate-based foods. The paper should be organized and presented in a logical and orderly manner with an abstract, introduction, body, and conclusion. The paper should be subdivided to help focus the reader's attention. The typed paper should be no more than 20 pages in length [double-spaced lines, 1 inch margins, Times New Roman font]. The content of the paper is considerably more important than the length of the paper. Print the abstract on a separate page along with the title, author and address [of the author] (these do not count toward the 300 word limit of the abstract). The abstract of the paper should be 300 words providing a summary of what is in the paper.

Term paper format

Title [2]
Abstract or Summary [10]
Introduction or Background [8]
Objectives [2]
Body of the report (subdivided) [40]
Conclusion [10]
References (follow style of the journal *Critical Reviews in Food Science & Nutrition*) [8]

Term paper presentation

Each person will present the topic of his or her paper in front of the class. Technical information from your review paper should be presented in an organized, logical manner. The presentation will be 12 minutes long and an additional 3 minutes for questions and answers. Your presentation will be evaluated for: content, organization, style, and mannerisms. Fellow students can provide constructive suggestions. Laptop and computer projection equipment will be available for your presentation which will preferably be completed using PowerPoint

UNIVERSITY SUPPORT OFFICES & POLICIES

For information on university support offices and policies, see Schedule "A"

Schedule "A"

Section (a) sample re: A list of academic supports available to Students, such as the Academic Learning Centre, Libraries, and other supports as may be appropriate:

Writing and Learning Support

The Academic Learning Centre (ALC) offers services that may be helpful to you throughout your academic program. Through the ALC, you can meet with a learning specialist to discuss concerns such as time management, learning strategies, and test-taking strategies. The ALC also offers peer supported study groups called Supplemental Instruction (SI) for certain courses that students have typically found difficult. In these study groups, students have opportunities to ask questions, compare notes, discuss content, solve practice problems, and develop new study strategies in a group-learning format.

You can also meet one-to-one with a writing tutor who can give you feedback at any stage of the writing process, whether you are just beginning to work on a written assignment or already have a draft. If you are interested in meeting with a writing tutor, reserve your appointment two to three days in advance of the time you would like to meet. Also, plan to meet with a writing tutor a few days before your paper is due so that you have time to work with the tutor's feedback.

These Academic Learning Centre services are free for U of M students. For more information, please visit the Academic Learning Centre website at: http://umanitoba.ca/student/academiclearning/

You can also contact the Academic Learning Centre by calling 204-480-1481 or by visiting 205 Tier Building.

University of Manitoba Libraries (UML)

As the primary contact for all research needs, your liaison librarian can play a vital role when completing academic papers and assignments. Liaisons can answer questions about managing citations, or locating appropriate resources, and will address any other concerns you may have, regarding the research process. Liaisons can be contacted by email or phone, and are also available to meet with you in-person. A complete list of liaison librarians can be found by subject: http://bit.ly/WcEbA1 or name: http://bit.ly/1tJ0bB4. In addition, general library assistance is provided in person at 19 University Libraries, located on both the Fort Garry and Bannatyne campuses, as well as in many Winnipeg hospitals. For a listing of all libraries, please consult the following: http://bit.ly/1sXe6RA. When working remotely, students can also receive help online, via the Ask-a-Librarian chat found on the Libraries' homepage:www.umanitoba.ca/libraries.

Section (b) sample: re: A statement regarding mental health that includes referral information:

For 24/7 mental health support, contact the Mobile Crisis Service at 204-940-1781.

Student Counselling Centre
Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling. *Student Counselling Centre:* http://umanitoba.ca/student/counselling/index.html
474 University Centre or S207 Medical Services
(204) 474-8592

Student Support Case Management
Contact the Student Support Case Management team if you are concerned about yourself or another student and don't know where to turn. SSCM helps connect students with on and off campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.
Student Support Intake Assistant http://umanitoba.ca/student/case-manager/index.html
520 University Centre
(204) 474-7423

University Health Service
Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation.
University Health Service http://umanitoba.ca/student/health/
104 University Centre, Fort Garry Campus
(204) 474-8411 (Business hours or after hours/urgent calls)

Health and Wellness
Contact our Health and Wellness Educator if you are interested in peer support from *Healthy U* or information on a broad range of health topics, including physical and mental health concerns, alcohol and substance use harms, and sexual assault.
Health and Wellness Educator https://umanitoba.ca/student/health-wellness/welcome-about.html
britt.harvey@umanitoba.ca

Live Well @ UofM
For comprehensive information about the full range of health and wellness resources available on campus, visit the Live Well @ UofM site:
http://umanitoba.ca/student/livewell/index.html

Section (c) sample: re: A notice with respect to copyright:

All students are required to respect copyright as per Canada's *Copyright Act*. Staff and students play a key role in the University's copyright compliance as we balance user rights for educational purposes with the rights of content creators from around the world. The Copyright Office provides copyright resources and support for all members of the University of Manitoba community. Visit http://umanitoba.ca/copyright for more information.

Section (d) sample: re: A statement directing the student to University and Unit policies, procedures, and supplemental information available on-line:

Your rights and responsibilities

As a student of the University of Manitoba you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

The Academic Calendar http://umanitoba.ca/student/records/academiccalendar.html is one important source of information. View the sections *University Policies and Procedures* and *General Academic Regulations*.

While all of the information contained in these two sections is important, the following information is highlighted.

- If you have questions about your grades, talk to your instructor. There is a process for term work and final **grade appeals**. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including appeal deadline dates and the appeal form http://umanitoba.ca/registrar/

- You are expected to view the General Academic Regulation section within the Academic Calendar and specifically read the **Academic Integrity** regulation. Consult the course syllabus or ask your instructor for additional information about demonstrating academic integrity in your academic work. Visit the Academic Integrity Site for tools and support http://umanitoba.ca/academicintegrity/ View the **Student Academic Misconduct** procedure for more information.

- The University is committed to a respectful work and learning environment. You have the right to be treated with respect and you are expected conduct yourself in an appropriate respectful manner. Policies governing behavior include the:

  Respectful Work and Learning Environment

  http://umanitoba.ca/admin/governance/governing_documents/community/230.html

  Student Discipline
  http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html and,

  Violent or Threatening Behaviour
  http://umanitoba.ca/admin/governance/governing_documents/community/669.html

- If you experience **Sexual Assault** or know a member of the University community who has, it is important to know there is a policy that provides information about the supports available to those who disclose and outlines a process for reporting. The **Sexual Assault** policy may be found at:
  http://umanitoba.ca/admin/governance/governing_documents/community/230.html

More information and resources can be found by reviewing the Sexual Assault site http://umanitoba.ca/student/sexual-assault/

- For information about rights and responsibilities regarding **Intellectual Property** view the policy https://umanitoba.ca/governance/sites/governance/files/2021-06/Intellectual Property Policy - 2013_10_01 RF.pdf

For information on regulations that are specific to your academic program, read the section in the Academic Calendar and on the respective faculty/college/school web site http://umanitoba.ca/faculties/

Contact an **Academic Advisor** within our faculty/college or school for questions about your academic program and regulations http://umanitoba.ca/academic-advisors/

Student Advocacy

Contact Student Advocacy if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.
http://umanitoba.ca/student/advocacy/
520 University Centre
204 474 7423
student_advocacy@umanitoba.ca