



Course information for


## Fundamentals of Microbial Cell Biotransformations

[Syllabus-FMCB.pdf](#)

<b>Course #</b>	<b>MB 420/520</b>
<b>Semester</b>	Fall 2020
<b>Instructor</b>	<p>José Manuel Bruno-Bárcena    Phone: 919-513-1495          4554 Thomas Hall Addition    Fax: 919-515-7867          North Carolina State University    email: jbbarcen@ncsu.edu          Raleigh, NC 27695    Web Site: <a href="http://www4.ncsu.edu/~jbbarcen">http://www4.ncsu.edu/~jbbarcen</a></p> <p>Jace Natzke    Phone: 919-513-3834          4554 Thomas Hall Addition    Fax: 919-515-7867          North Carolina State University    email: jmnatzke@ncsu.edu          Raleigh, NC 27695</p>
<b>Requisite</b>	Pre-requisite MB 352
<b>Credit Hours</b>	2
<b>Restrictions</b>	Students who have completed MB 420 may not take MB 520 for credit.
<b>GEP Status</b>	None
<b>Location</b>	Room 00206 Marie Anne Fox Science
<b>Date</b>	September 29th - November 13th, 2020
<b>Class Hours</b>	<p>Lecture -Room 00206 Marye Anne Fox Science          Tuesdays, 12:50 PM -2:40 PM</p> <p>Laboratory – Room #1518 Small scale Fermentation Lab Thomas Hall Building          Thursdays, 12:50 PM- 5:40 PM - Section MB 420L/520L</p>
<b>Office Hours</b>	Tuesday, 14:50-15:30
<b>Course Website</b>	<a href="http://wolfware.ncsu.edu/">http://wolfware.ncsu.edu/</a>
<b>Delivery Format</b>	<p>Please be aware that the situation regarding COVID-19 is frequently changing, and the delivery mode of this course may need to change accordingly, including from in-person to online. Regardless of the delivery method, we will strive to provide a high-quality learning experience.</p> <p>This is a half-semester class. Students are required to attend weekly lectures and laboratories during the weeks the course is taught. However, your course might not have a traditional meeting schedule in Fall 2020. Be sure to pay attention to any updates to the course schedule as the information in this syllabus may have changed. Please discuss any questions you have with the instructor.</p>
<b>Classroom Seating</b>	To support efficient, effective contact tracing, please sit in the same seat when possible and take note of who is sitting around you; instructors may also assign seats for this purpose.
<b>Course Description</b>	This is a half-semester course. Basic microbial cell culture theory and practice: cell physiology, mass balances, and metabolic control as seen in a dynamic bioreactor process to be scalable, consistent, and robust. The lab portion of the course provides students with hands-on experience in culture techniques using bioreactors.
<b>Technology Requirements</b>	<p>In order to complete the course, all students will be required to have access to an active internet connection. If you do not have Adobe Acrobat Reader installed on your computer, you will need to go to the following web site and follow the instructions to download a free version.</p> <p><a href="http://www.adobe.com/products/acrobat/readstep2.html">http://www.adobe.com/products/acrobat/readstep2.html</a></p> <p>This course may require particular technologies to complete coursework. Be sure to review</p>

	<p>the syllabus for these expectations, and see <a href="http://go.ncsu.edu/syllabus-tech-requirements">go.ncsu.edu/syllabus-tech-requirements</a> to find out more about technical requirements for your course. If you need access to additional technological support, please contact the Libraries' Technology Lending Service: <a href="https://www.lib.ncsu.edu/devices">https://www.lib.ncsu.edu/devices</a>.</p>
<b>Course Structure</b>	<p>This course will consist of two blocks of Lecture and Laboratory. Each of the blocks will cover theory and practice of fermentation at bench scale. After completion of each laboratory experience students will be required to submit written reports describing objectives of the laboratory exercise, detailed experimental procedures, and results and discussion of the experiment. During the course of the semester students will be regularly tested on their understanding of the theoretical portion of the laboratory (textbook reading assignments and additional reading assignments provided by instructor) in form of quizzes (35% of total grade). Students will be evaluated on their laboratory safety, laboratory skills, and individual documentation skills (25% of total grade).</p> <p>At the end of the course students will complete a final exam that will cover all the topics discussed during the course (40% of total grade).</p> <p>Students taking MB 520 will have the additional requirement of a major term paper. The subject of this final paper will be to search and select from the patent database an experimental upstream approach to produce one active pharmaceutical ingredient (API) using cells (GMO or non-GMO). The paper should be written following the ASM journal instruction (<a href="http://jb.asm.org/misc/ifora.shtml">http://jb.asm.org/misc/ifora.shtml</a>) for authors. It should contain at least five written pages, font 12, single paragraph. The references pages will not be counted as the written pages. The graduate students will be graded as described below.</p>
<b>Text Requirements</b>	<p>All required reading material is contained within the module or is available through a World Wide Web link provided within the module content. At present, all laboratory-reading materials will be provided. The class links page is also available as a source of the following references for the module:</p> <p>1. Shuler, M.L., Kargi, F., editors 2002. <i>Bioprocess Engineering: Basic Concepts</i>. Prentice-Hall of India (ISBN0130819085)</p> <p>This reference will also be available in the Reserve Room of the D. H. Hill Library.</p>
<b>Learning Outcomes</b>	<p>At the end of this course, students will:</p> <ul style="list-style-type: none"> <li>• explain key fundamental biotechnology concepts</li> <li>• interpret culturing processes used in traditional and in modern biotechnology;</li> <li>• demonstrate laboratory and cell culture techniques using small scale bioreactors while observing standard safety practices</li> <li>• interpret and explain results of laboratory experiments as well as demonstrate the importance of the interdisciplinary effort required for product development</li> </ul>
<b>Lecture Outlines by Topical Areas</b>	<p><b>Week 1.</b> History of traditional and modern biotechnology. Pure culture philosophy– <i>Reading assignment provided by the instructor. Quiz #1</i></p> <p><b>Week 2.</b> Cell Nutrition – <i>Reading assignment provided by the instructor. Quiz #2</i></p> <p><b>Week 3.</b> Microbial cell culture and selecting the cultivation system – <i>Reading assignment provided by the instructor. Quiz #3</i></p> <p><b>Week 4.</b> Elemental composition and stoichiometry of cells – <i>Reading assignment provided by the instructor. Quiz #4</i></p> <p><b>Week 5.</b> Microbial growth and production rate – <i>Reading assignment provided by the instructor. Quiz #5</i></p> <p><b>Week 6.</b> Microbial physiology and metabolic control: Adaptability of cells – <i>Reading assignment provided by the instructor. Quiz #6</i></p>

	<p><b>Week 7.</b> Introduction to process instrumentation, monitoring and supervision – <i>Reading assignment provided by the instructor. Quiz #7</i></p>
<b>Laboratory Topical Areas</b>	<p><b>Week 1.</b> Lab safety (equipment &amp; policies). A review of the aseptic and analytical techniques. <i>Reading assignment provided by the instructor. Safety Quiz</i></p> <p><b>Week 2.</b> Continuous reactor cultures. Sampling and storage. <i>Reading assignment provided by the instructor. Quiz #1</i></p> <p><b>Week 3.</b> Transitory pulse feed. Glucose repression or Crabtree effect. <i>Reading assignment provided by the instructor. Quiz #2</i></p> <p><b>Week 4.</b> Setting dilution rate. Substrate, product, and biomass analysis. <i>Reading assignment provided by the instructor. Quiz #3</i></p> <p><b>Week 5.</b> Calculation of maximum specific growth rate by the wash-out and by unrestricted growth methods. Distribute the stored data of the process from the computer. <i>Reading assignment provided by the instructor. Quiz #4</i></p> <p><b>Week 6.</b> TFF cell harvest and UF/DF step. <i>Reading assignment provided by the instructor Quiz #5</i></p> <p><b>Week 7.</b> Reactor cleaning, Reactor and probe preparation and Control unit set-up for operation. <i>Reading assignment provided by the instructor Quiz #6</i></p>
<b>Course Grading</b>	<p>For Students Taking MB 520</p> <ol style="list-style-type: none"> <li>1. Weekly Lab quizzes (10 questions/15 minutes) and Lab reports (25%)</li> <li>2. Skills demonstration and Notebook organization (20%)</li> <li>3. Research Paper (25%)</li> <li>4. Final Test (30%)</li> </ol> <p>Attendance at ALL laboratories is mandatory and unexcused absence from lab will result in failure of the course. Lecture attendance is also required, and non-attendance will result in a reduction of 10 points in the final grade.</p> <p>Students are not allowed to take this course for "credit only". In order to receive recognition for an audit, graduate students are required to complete all assignments and earn a grade of C- or better. Conversion from letter grading to audit grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details, refer to <a href="http://www.ncsu.edu/policies/academic_affairs/pol_reg/REG205.00.5.php">http://www.ncsu.edu/policies/academic_affairs/pol_reg/REG205.00.5.php</a></p> <p><b>Grading/Scheduling Changing Options Related to COVID-19</b>  If the delivery mode has a negative impact on your academic performance in this course, the university has provided tools to potentially reduce the impact:  Enhanced S/U Grading Option: <a href="https://studentservices.ncsu.edu/your-resources/covid-19/spring2020-sat-grading/">https://studentservices.ncsu.edu/your-resources/covid-19/spring2020-sat-grading/</a>  Late Drop: <a href="https://studentservices.ncsu.edu/your-resources/covid-19/spring2020-latedrop/">https://studentservices.ncsu.edu/your-resources/covid-19/spring2020-latedrop/</a>  In some cases, another option may be to request an incomplete in the course. Before using any of these tools, discuss the options with your instructor and your academic advisor. Be aware that if you use the enhanced S/U, you will still need to complete the course and receive at least a C- to pass the course.</p> <p><b>Other Important Resources</b>  Keep Learning: <a href="https://dasa.ncsu.edu/students/keep-learning/">https://dasa.ncsu.edu/students/keep-learning/</a>  Protect the Pack FAQs: <a href="https://www.ncsu.edu/coronavirus/frequently-asked-questions/">https://www.ncsu.edu/coronavirus/frequently-asked-questions/</a></p>

<b>Grading Scale</b>	<table border="0"> <tr><td>A+</td><td>=</td><td>97.0-100%</td></tr> <tr><td>A</td><td>=</td><td>92.0-96.9%</td></tr> <tr><td>A-</td><td>=</td><td>89.0-91.9%</td></tr> <tr><td>B+</td><td>=</td><td>86.0-88.9%</td></tr> <tr><td>B</td><td>=</td><td>82.0-85.9%</td></tr> <tr><td>B-</td><td>=</td><td>79.0-81.9 %</td></tr> <tr><td>C+</td><td>=</td><td>76.0-78.9%</td></tr> <tr><td>C</td><td>=</td><td>72.0-75.9%</td></tr> <tr><td>C-</td><td>=</td><td>69.0-71.9%</td></tr> <tr><td>D+</td><td>=</td><td>66.0-68.9%</td></tr> <tr><td>D</td><td>=</td><td>62.0-65.9%</td></tr> <tr><td>D-</td><td>=</td><td>59.0-61.9%</td></tr> <tr><td>F</td><td>=</td><td>&lt; 59.0%</td></tr> </table>	A+	=	97.0-100%	A	=	92.0-96.9%	A-	=	89.0-91.9%	B+	=	86.0-88.9%	B	=	82.0-85.9%	B-	=	79.0-81.9 %	C+	=	76.0-78.9%	C	=	72.0-75.9%	C-	=	69.0-71.9%	D+	=	66.0-68.9%	D	=	62.0-65.9%	D-	=	59.0-61.9%	F	=	< 59.0%	
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<b>Late Assignments</b>	Late assignments without a valid excuse will not be accepted and will receive a score of zero.																																								
<b>Incomplete Grades</b>	<p>Incomplete as a course grade will be awarded only for work not completed during the course due to conditions deemed by the instructor to be beyond the reasonable control of the student.</p> <p>For undergraduate students, unless an extended deadline is authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The University policy on incomplete grades is located at <a href="http://www.ncsu.edu/policies/academic_affairs/grades_undergrad/REG02.50.3.php">http://www.ncsu.edu/policies/academic_affairs/grades_undergrad/REG02.50.3.php</a></p> <p>For graduate students, if an extended deadline is not authorized by the Graduate School, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions) or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The University policy on incomplete grades is located at <a href="http://www.ncsu.edu/policies/academic_affairs/grades_undergrad/REG02.50.3.php">http://www.ncsu.edu/policies/academic_affairs/grades_undergrad/REG02.50.3.php</a></p> <p>Additional information relative to incomplete grades for graduate students can be found in the Graduate Administrative Handbook in Section 3.18.F at: <a href="http://www.fis.ncsu.edu/grad_publicns/handbook/">http://www.fis.ncsu.edu/grad_publicns/handbook/</a>.</p>																																								
<b>Academic Integrity Statement</b>	<p>It is expected that each student will complete his/her own homework, quizzes, and exams with academic integrity. Students shall follow the <a href="http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php">NCSU Code of Student Conduct</a> (<a href="http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php">http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php</a>)</p> <p>In addition, your signature on any test or assignment means that you neither gave nor received unauthorized aid. In other words, your signature on to-be-graded work in this course communicates an understanding of, and adherence to, the University Honor Pledge: "I have neither given nor received unauthorized aid on this test or assignment."</p>																																								
<b>Attendance Policy</b>	<p>NC State attendance policies can be found at: <a href="https://policies.ncsu.edu/regulation/reg-02-20-03-attendance-regulations/">https://policies.ncsu.edu/regulation/reg-02-20-03-attendance-regulations/</a> . Please refer to this course's attendance, absence, and deadline policies for additional details. If you are quarantined or otherwise need to miss class because you have been advised that you may have been exposed to COVID-19, you should not be penalized regarding attendance or class participation. However, you will be expected to develop a plan to keep up with your coursework during any such absences. If you become ill with COVID-19, you should follow the steps outlined in the health and participating section above. COVID 19-related absences will be considered excused; documentation need only involve communication with your instructor.</p>																																								

<b>Laboratory Safety</b>	<p>Due to the Coronavirus pandemic, public health measures have been implemented across campus. Students should stay current with these practices and expectations through the Protect the Pack website (<a href="https://www.ncsu.edu/coronavirus/">https://www.ncsu.edu/coronavirus/</a>). The sections below provide expectations and conduct related to COVID-19 issues.</p> <p>Each student is expected to observe proper laboratory procedures as outlined below for each laboratory period and in the Lab Safety Plan to be presented at the first laboratory meeting.</p>
<b>Personal Protective Equipment</b>	<p>As a member of the NC State academic community you are required to follow all university guidelines for personal safety with face coverings, physical distancing, and sanitation. Face coverings are required in this class and in all NC State buildings. Note that face coverings must meet safety specifications, be worn correctly, and be socially appropriate as per the Code of Student Conduct (<a href="https://studentconduct.dasa.ncsu.edu/code/">https://studentconduct.dasa.ncsu.edu/code/</a>) and Free Speech Guidelines (<a href="https://www.ncsu.edu/free-speech/">https://www.ncsu.edu/free-speech/</a>). In addition, students are responsible for keeping their course/work area clean. Please follow the cleaning guidelines described by your instructor.</p>
<b>Health and Participation in Class</b>	<p>We are most concerned about your health and the health of your classmates and instructors/TAs.</p> <ul style="list-style-type: none"> <li>● If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, please work with your instructor on health accommodations and follow other university guidelines, including self-reporting: <a href="https://healthypack.dasa.ncsu.edu/coronavirus/">https://healthypack.dasa.ncsu.edu/coronavirus/</a>. Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus.</li> <li>● If you feel unwell, even if you have not been knowingly exposed to COVID-19, please do not come to class.</li> <li>● If you are in quarantine, have been notified that you may have been exposed to COVID-19, or have a personal or family situation related to COVID-19 that prevents you from attending this course in person (or synchronously), please connect with your instructor to discuss the situation and make alternative plans, as necessary.</li> <li>● If you need to make a request for an academic consideration related to COVID-19, such as a discussion about possible options for remote learning, please talk with your advisor for the appropriate process to make a COVID-19 request.</li> </ul>
<b>Health and Well-Being Resources</b>	<p>These are difficult times, and academic and personal stress is a natural result. Everyone is encouraged to take care of themselves and their peers. If you need additional support, there are many resources on campus to help you:</p> <ul style="list-style-type: none"> <li>● Counseling Center (<a href="https://counseling.dasa.ncsu.edu/">https://counseling.dasa.ncsu.edu/</a>)</li> <li>● Health Center (<a href="https://healthypack.dasa.ncsu.edu/">https://healthypack.dasa.ncsu.edu/</a>)</li> <li>● If the personal behavior of a classmate concerns or worries you, either for the classmate's well-being or yours, we encourage you to report this behavior to the NC State CARES team: (<a href="http://go.ncsu.edu/NCSUcares">go.ncsu.edu/NCSUcares</a>).</li> <li>● If you or someone you know are experiencing food, housing or financial insecurity, please see the Pack Essentials Program (<a href="https://dasa.ncsu.edu/pack-essentials/">https://dasa.ncsu.edu/pack-essentials/</a>).</li> </ul>
<b>Community Standards Related to COVID-19</b>	<p>We are all responsible for protecting ourselves and our community. Please see the community expectations</p>
<b>Students with Disability Policy</b>	<p>Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students ( <a href="http://www.ncsu.edu/dso/">http://www.ncsu.edu/dso/</a> ) at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at (<a href="http://www.ncsu.edu/policies/academic_affairs/courses_undergrad/REG02.20.1.php">http://www.ncsu.edu/policies/academic_affairs/courses_undergrad/REG02.20.1.php</a> )</p>
<b>Anti-Discrimination Statement</b>	<p>NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work</p>

	<p>environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <a href="http://www.ncsu.edu/policies/campus_environment">http://www.ncsu.edu/policies/campus_environment</a> or <a href="http://www.ncsu.edu/equal_op">http://www.ncsu.edu/equal_op</a>. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 515-3148."</p>
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