



Syllabus

Proteins: Alignment, Analysis and Structure

Course Dates: Aug 21st – Oct 16th 2017

Course Description

Proteins play a very important role in all organisms. In fact, most of the work that happens inside every cell happens because a specific protein is employed for a specific task. Often the three-dimensional shape of a protein plays a major role in its function. As such, it is important to know the structure of all proteins to have an idea of what function they perform.

One of the jobs of a bioinformatician is to predict the three-dimensional structure of a protein using only the DNA sequence that encodes it as well as determining the effects of any mutations in the DNA on the three-dimensional structure/function.

In this course, part of the Bioinformatics MicroMasters program, you will learn about protein structure and its impact on function, practice aligning protein sequences to discover differences, and generate model structures of proteins using web and software-based approaches.

Course Learning Outcomes

In this course, which is a part of the [Bioinformatics MicroMasters program](#), you will learn the following:

- The different types of protein structures: primary, secondary, tertiary & quaternary structures
- Describes the gene expression from DNA to amino acids
- Discusses the different types of EC codes

- Outlines the features of Structural and Cell Skeleton proteins
- Highlights the different functions of Adhesive and Cell Motor proteins
- Illustrates the process of Glycosylation
- Demonstrates the process involved with chromatography & spectroscopy
- Highlights the different aspects of X-Ray diffraction, electron microscopy, protein structure predictions & splicing
- Describes the various steps involved in enzyme kinetics, protein-protein interaction networks and Proteomics

Course Information

This is a self-paced online course. All course materials are presented in English. Learners new to edX are recommended to take the [DemoX course](#), which is designed to show new students how to take a course on edx.org.

Pre-Requisite

An Undergraduate degree in Biology is a pre-requisite for this course which is also stated in the [Course About Page](#).

Course Materials

All materials are freely available within the course. Additional references, resources, and optional readings can be easily accessed and downloaded from the References, Resources, and Optional Readings sections of this course.

Course Schedule & Due Dates

The course will open on **Aug 21, 2017** and run for eight weeks. As this is a self-paced course, all content will be available in Week 1 including weekly knowledge checks and discussions. The **course ends Oct 16, 2017 at 14:00 UTC** however, to be awarded a certificate you will need to have completed all the assessments, discussions and knowledge checks by **Oct 16th, 2017 at 14:00 UTC**. Students should plan to spend between 4-6 hours each week to fully complete each module. Now let's review the topics listed for this course for each week along with the optional readings & activities associated with each week.

Important Note:

Release dates and times are set in **Coordinated Universal Time (UTC)**. You might want to verify that you have specified the time that you intend by using a time zone converter such as [Time and Date Time Zone Converter](#).

Learners who have specified a time zone in their account settings see course dates and times converted to their specified time zone. Learners who have not specified a time zone in their account settings see course dates and times on their dashboards, in the body of the course, and on their Progress pages in the time zone that their browsers specify. Learners see other course dates and times in UTC.

Week	Topics by Week	Optional Reading	Activities
1	<ul style="list-style-type: none"> • Introduction to Proteins • Transcription & Translation • Protein Structure 	Amino Acid Structures	<ul style="list-style-type: none"> • Week 1 Discussion • Week 1 Knowledge Check
2	<ul style="list-style-type: none"> • Glycolysis • EC Codes & Structural Proteins • Enzymes & Diseases 	Glycolysis	<ul style="list-style-type: none"> • Week 2 Discussion • Week 2 Knowledge Check
3	<ul style="list-style-type: none"> • Adhesive Proteins • Cell Motor Proteins • Transmembrane Proteins 	BSCB Membrane Proteins Glycosylation	<ul style="list-style-type: none"> • Week 3 Discussion • Week 3 Knowledge Check
4	<ul style="list-style-type: none"> • PAGE, Protein Blots & ELISA • Chromatography & Spectroscopy • Protein Sequencing & Analysis 	Protein Purification Practical application of Protein Identification	<ul style="list-style-type: none"> • Week 4 Discussion • Week 4 Knowledge Check • Mid Term Assessment
5	<ul style="list-style-type: none"> • Multiple Sequence Alignments • Protein Domains • Phylogenetics 	Protein Domain/Motif Protein Domain Evolution	<ul style="list-style-type: none"> • Week 5 Discussion • Week 5 Knowledge Check
6	<ul style="list-style-type: none"> • Protein Structure Prediction • Protein Function Prediction • Protein Docking Prediction 	Protein Structure Prediction Protein Docking	<ul style="list-style-type: none"> • Week 6 Discussion • Week 5 Knowledge Check
7	<ul style="list-style-type: none"> • Protein Modification • Protein-Protein Binding • Protein-NABinding 	Post Translational Modification Hidden Markov Models	<ul style="list-style-type: none"> • Week 7 Discussion • Week 7 Knowledge Check
8	<ul style="list-style-type: none"> • Enzyme Kinetics • Protein-Protein Interaction Networks • Proteomics 	Enzyme Kinetics Proteomics	<ul style="list-style-type: none"> • Week 8 Discussion • Week 8 Knowledge Check • Final Assessment

Course Grading and Policy

You will be able to view all material and take any knowledge checks, or participate in discussions at any time during the course. However, to be awarded a certificate you will need to have completed all the assessments, discussions and knowledge checks by **Oct 16th, 2017**.

The course score for BIF002x is determined from two components: a Mid Term Assessment (50%) and a Final Assessment (50%).

Mid-Term Assessment

At the end of the material for Week 4, there is Mid-Term assessment, which accounts for 50% of your overall score in the course. The Mid-Term contains 25 randomly generated questions based on the topics covered from Week 1 to 4. These questions are multiple choice and are two points each.

Final Assessment

At the end of the material for Week 8, there is a Final assessment, which accounts for 50% of your overall score in the course. The Final assessment contains 25 randomly generated questions based on the topics covered from Week 5 to 8. These questions are multiple choice and are two points each.

Certification

For those students working to obtain the [MicroMasters certificate](#), you must register for the verified track before the deadline and obtain a total score of **80% or greater** in the class. For those verified students who receive an edX certificate, it will appear on their edX dashboard after the course ends. As of December 7, 2015, edX no longer offers certificates for students who audit a course.

Discussion Forum Guidelines and Expectations

Each week's material has two discussion forum questions. Each student must respond to at least one, but, of course, you are welcome to reply to both. **Course staff (TAs and Instructors)** will monitor the discussions, highlight important posts and clarify concepts as and when needed on a **weekly** basis throughout the duration of this course. Discussion responses will not be graded, but everyone must participate in at **least one question per week** of material.

To increase the likelihood of the class staff finding and therefore answering your question about any content in the course, we have generated a **Class Questions** Discussion forum (see link below).

[Class Questions](#) Discussion Forum

The discussions provide a place for a wide variety of viewpoints, and a place where everyone can learn something from their fellow classmates. As such, we want to take full advantage of this diversity in our discussions. So, to ensure that discussions are positive for all and to help you successfully navigate and interact on the Discussion forum, please adhere to the following set of guidelines:

- Be respectful of everyone. Rudeness and attacks on the forum will not be tolerated, and you will be removed from the course.

- Be concise - limit your posts/responses to 200 words or less. If you write a novel, fewer people will read what you have to say.
- Do not post solutions to graded problems before the deadline. This is a violation of the honor code.
- Be active in upvoting your fellow classmates' posts. The more upvotes a post has the more it is likely to be seen so this is a great way to highlight what you think is important.
- If you need help, remember to first use the search function. Many of your classmates are likely to have the same questions and by using the search feature first, you may find the question and answer without needing to post it yourself.
- If your help question has not already been asked, remember to be very specific in the title and body of your post about what you need help with.
 - o Are you stuck on a particular part of the problem?
 - o Do you need help understanding a particular concept?
 - o What have you tried doing so far?
- Use "netiquette," or common writing practices for online communication. This will especially help your peers who have a different native language than you do.
- Active participation is critical. We are all learning together and you will get out of the discussions what you put into them.
- Posts should be written in your own words. If you include a quote or reference, be sure to include a proper citation as well. If you need some help with this please visit the [UMUC Library citation example page](#).
- Absolutely avoid the following:
 - o TYPING IN ALL CAPS. Some people read this as shouting, even if that is not what you mean to convey.
 - o Avoid unnecessary symbols, abbreviated words, texting shorthand, and replacing words with numbers (e.g. Pls don't rplce wrds w/#s).
 - o Avoid repeating letters or characters like this: reeepeeaattingggg
chaacterrrrss
 - o Avoid excessive punctuation if possible (e.g. !!!!!!! or ???????)
 - o If you see an inappropriate post, flag it for the class staff. Do not add your own commentary.

Bioinformatics MicroMasters Program

Frequently asked questions can be found on the [Program's description page](#) but have also been placed below for your convenience.

How to Earn the MicroMasters Credential

Complete all three courses with a grade of 80% or better and earn a Verified Certificate in each course to earn the MicroMasters credential.

Take Your Credential to The Next Level

Through this program, you can combine your MicroMasters Credential with additional online learning through UMUC to earn a Master of Biotechnology with a specialization in Bioinformatics degree. Learners who successfully earn the MicroMasters Credential are eligible to apply to the Master of Biotechnology with a specialization in Bioinformatics degree at UMUC. If accepted to the UMUC Master's program, learners who have earned a MicroMasters Credential will be credited with 12 academic units (36 units are required for graduation with the Biotechnology with a specialization in Bioinformatics degree). How many credits will I be eligible for after completing the MicroMasters program? Learners who successfully earn the MicroMasters Credential are eligible to apply to the Master of Biotechnology with a specialization in Bioinformatics degree at UMUC. Learners who have earned a MicroMasters Credential will be credited with 12 academic units (36 units are required for graduation with the Biotechnology with a specialization in Bioinformatics degree).

Who is the MicroMasters Program intended for?

The Bioinformatics MicroMasters Program is designed for individuals who want to learn about the information and meaning hidden in an organism's genome and proteome to apply in their research or communicate more fluently with bioinformaticians.

Will I earn a separate certificate for each course or just one for the entire MicroMasters Program?

You will receive an individual verified certificate for each Bioinformatics MicroMasters Program course that you pass as a verified student. Students passing all three Bioinformatics MicroMasters Program courses on a verified track will receive a MicroMasters Credential (certificate).

What is considered a passing grade in the MicroMasters Program courses?

Students must achieve a grade of 80% or higher in each of the courses in the Program.

Do I need to be a verified student to earn the Bioinformatics MicroMasters Credential?

Yes. If you are interested in the Bioinformatics MicroMasters Credential, you must successfully pass and receive a verified certificate in each of the three Bioinformatics

MicroMasters Program courses (DNA Sequences: Alignments and Analysis; Proteins: Alignment, Analysis, and Structure; and Statistical Tools in Bioinformatics).

What is considered a passing grade in the MicroMasters Program courses?

Students must achieve a grade of 80% or higher for a passing grade in each of the courses in the MicroMasters Program.

Along with the three Bioinformatics MicroMasters Program classes, are there any other requirements in order to be eligible for the UMUC Master's Degree?

Yes. You need to be admitted to the Master's program. The MicroMasters Credential does not guarantee admission. You will need to complete the application process to UMUC and meet all entrance requirements for The Graduate School.

For more information visit: <https://www.umuc.edu/admissions/admission-requirements/graduate-admissions.cfm>

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How many credits will I be able to transfer into the Master's Degree program at UMUC?

You will get credit for four classes: BIOT 640, BIOT 630, BIFS 614 and BIFS 619, which account for 12 credits (i.e. 33% of the program).

Is there any way to reduce the time needed to take and pass the three online courses?

No. To earn the MicroMasters Credential you need to successfully earn a verified certificate in all three MicroMasters Program courses when they are scheduled. The courses are on an instructor-paced schedule rather than self-paced, so there is no way to reduce the time to complete them.

Important Note:

To learn more about the Bioinformatics MicroMasters Program click here:

<https://www.edx.org/micromasters/bioinformatics>