Course analysis

BB2165 Biomolecular Structure and Function HT22-1

Course name: Biomolecular structure and function	Cycle: 2
Course code: BB2165	ECTS credits: 7,5
Term: HT22	Study period: P1
Course coordinator: Christina Divne	Examiner: Christina Divne
Number of new students 2022: 85	Passed students when the course ends: 84
Degree of examination: 98.8% (as of 2022-12-13)	Answer frequency LEQ: 48%

About the course

The course is the first course in the two master tracks "Medical Biotechnology", and "Industrial and Environmental Biotechnology". Structural biology of biomolecules is a cornerstone in modern biotechnology. Students are offered theoretical and practical knowledge and insight about the foundations of biomolecular structure, and how the structure relates to function. The contents range from fundamentals in structural biology to contemporary research, and the precise topics are subjects of change to appropriately reflect the research frontier. Instructive computer-based exercises and a "real-life" project based on contemporary cutting-edge research offer a teaching concept that is highly interactive and practical to increase and deepen the perception and understanding of biomolecular structure-function relationships. The students acquire skills and tools to retrieve, use, understand, and validate structural biology information available in 3D structure databases. They acquire expertise about the interaction of biomacromolecules with ligands and how to predict the 3D structure of a protein with unknown experimental structure. The course has a high content of computer-based learning and makes extensive use of the Canvas learning platform.

1. Changes made before this course offering (based on analysis 2021)

- Since the pandemic 2020-2021 all lectures are now recorded and given on campus).
- A few students mentioned that they would like to work on the project in groups and to have more information about the project early in the course. Students were allowed to work in groups 2021, but to examine this module the projects need to be individual, which means that the project topics still need to be individual even if students work together.
- For 2022, the project has been described in more detail, and there are progression check-ups during the first two project meetings (P1 and P2) in the form of small hand-ins, to make sure students are on track.
- Regarding course topics the students are satisfied and find then relevant. One student suggested that we could expand on AI and machine learning. While these topics are not fully within the scope of the course, the course content relating to AI-based structure prediction is likely to be gradually expanded as the softwares develop with time.
- Most suggestions concerned having more relevant example exams. For 2022 we have two representative example exams to practise on, and the number will increase for 2023.
- Suggestion to open the quizzes in the morning was suggested but is not a good idea. We had that earlier but since most students have lectures and practicals on other courses during the day, they became stressed by not being able to devote time to quizzes. As last year, quizzes open at 17 and are open for 48 hours, which is more than enough to complete the quizzes on time.
- Last year it was a recurrent problem that students did not finish quizzes on time because they started too late. This year I am emphasizing in the course information the importance of the quizzes as part of the exam module TEN1 and that starting early with the quizzes is critical. Hopefully adherence to the rules will improve.
- Emphasized information that all quizzes (part A of TEN1) must be passed before the final exam (part B of TEN1), and that the part A is valid for one year, until the date of the regular exam the next year.

2. Summary of the course evaluation (LEQ) 2022

From LEQ and comments, the 2022 course round was greatly appreciated and well received.

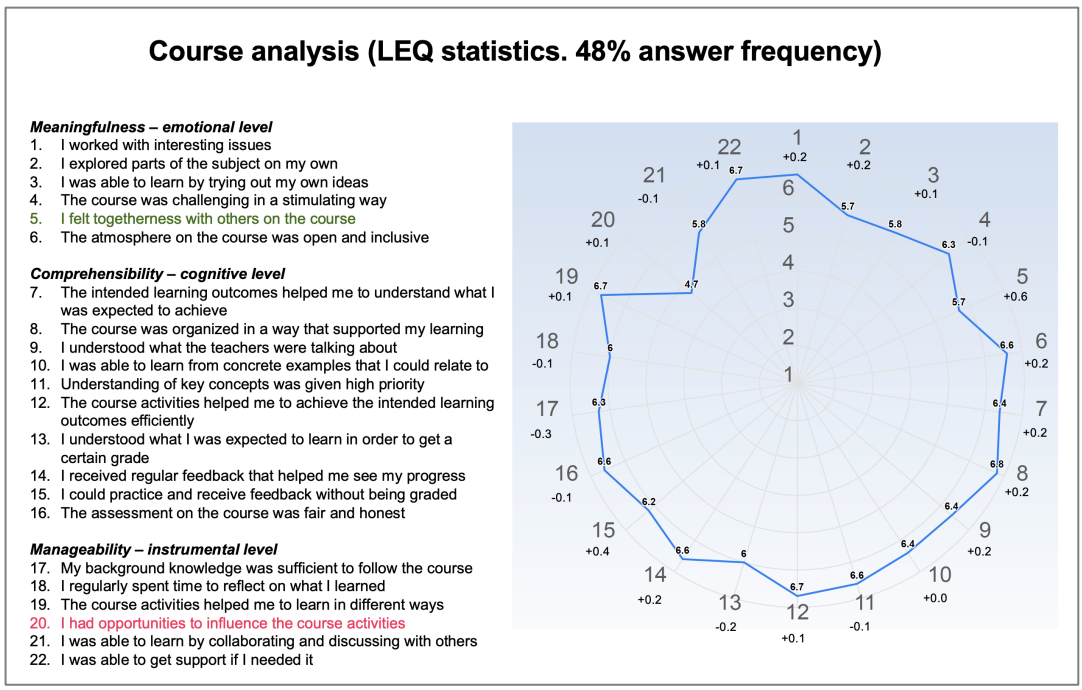

Figure 1. LEQ questions and spider diagram for 2022.

The reception of the course round 2022 is very similar to that recorded for 2021 (Fig. 2) and shows that the development actions implemented 2021 are reflecting a real and consistent over time. The feeling of togetherness was slightly higher this year, which is a positive observation but difficult to assess since it is highly dependent on the precise composition of the student group. As for 2021, the students understood what they were expected to learn for a particular grade (13) and felt the assessment was fair (16). This shows that the information, concretized learning outcome and continuous examination have provided important development in the positive direction.

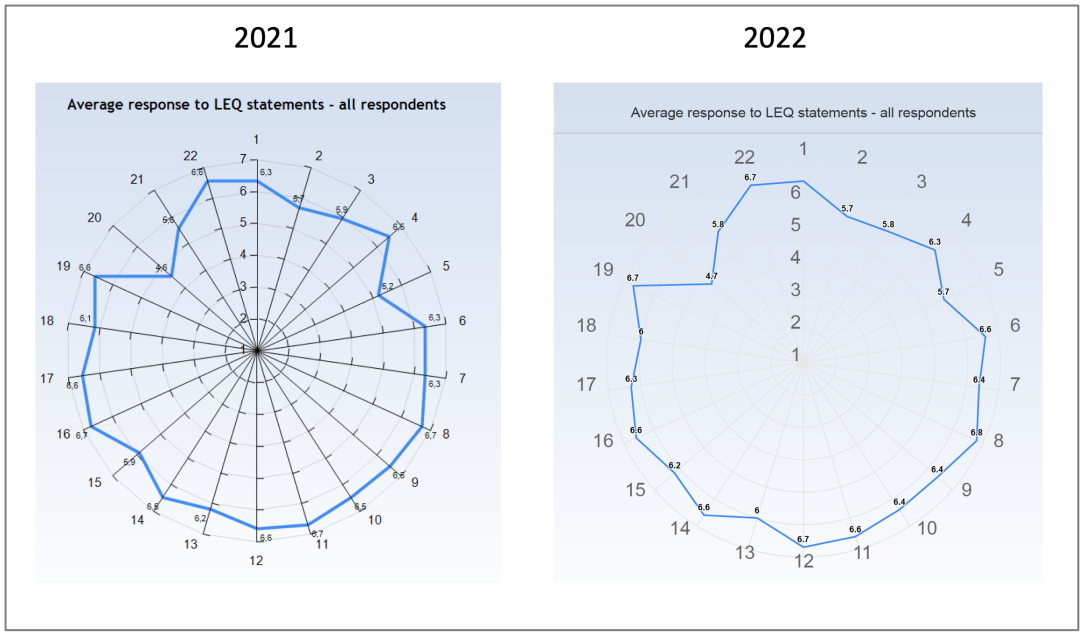

Figure 2. Comparison LEQ statistics 2021 and 2022.

The positive development is further highlighted by the many positive comments and constructive suggestions from the students for further improvement (see Appendix 1). The process of continuous examination is pictured below in Figure 3.

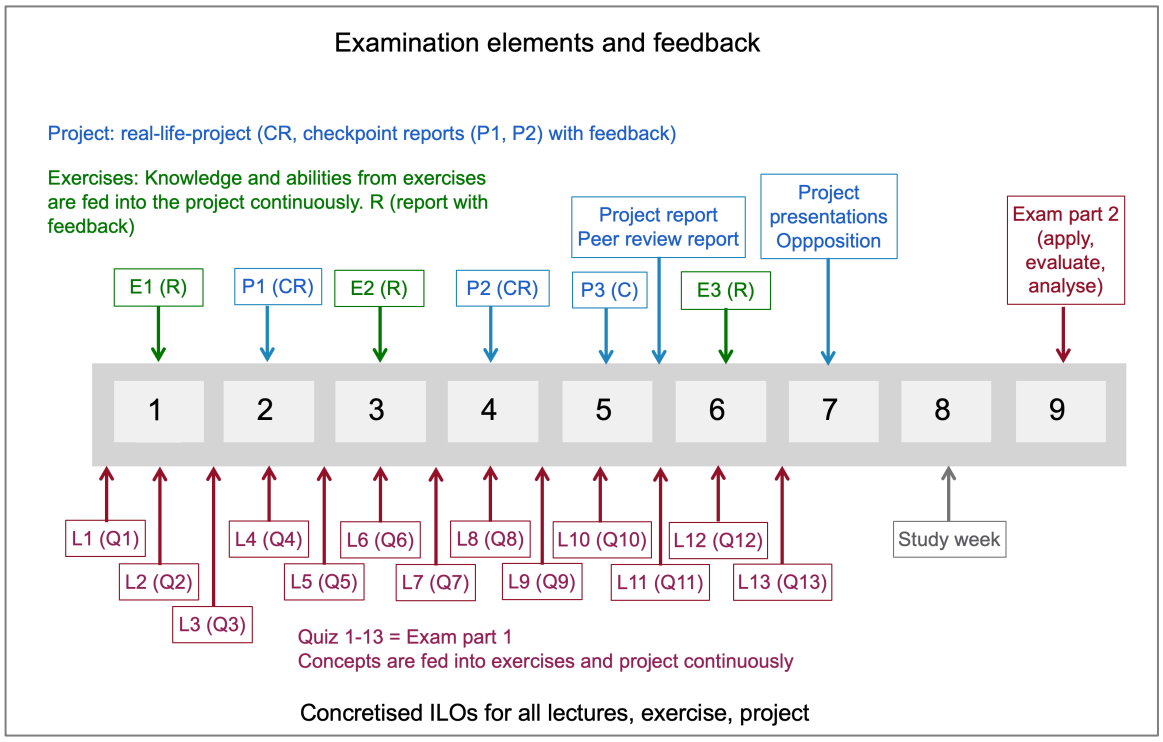

Figure 3. Scheme showing the process of continuous examination. The course weeks are numbered, and examination activities indicated by arrows. L=lectures, Q=lecture quiz, E=exercises, P=project, R=hand-in report. All examination activities have concretized intended learning outcomes that align constructively with the course's ILOs.

3. Reflections on execution and results 2022

   a. *Strengths of the course:*

   - Most of the strengths were mentioned also 2021, which shows that the development implemented 2021 is consistently positive over time.
   - Continuous examination (Fig. 3) was greatly appreciated. All elements (lectures, exercises, and project) have concretized learning outcomes.
   - The students appreciate the course topics, and their continued constructive criticism paves the way for effective course development towards an improved learning experience.
   - The course's interactive setup with coupled lectures exercises and project.
   - Real-life practical training to understand (project), validate and use biomolecular structure data.
   - Close connection to the research front of the topics covered, and implementation in the project.
   - Study sheets and study kinemages.
   - Improved information during the course information (on the first day) regarding the importance of quizzes as part of the examination Module TEN1 and to finish them on time within 48 hours during paid off. All students withsome isolated exception adhered to the quiz rules.
   - As intended, the addition of hand.in reports during project sessions P1 and P2 made it possible to pick up students that risked lagging behind in the project, which is very positive since those students could receive help in time.

   b. *What to improve in the course for next course round 2023 (based on student suggestions):*

   - There was a misunderstanding regarding whether the students needed to remember the amino acids for the final exam. The intended message was that they should know the principal properties

of the amino acids, but not at the level that they can draw them. Unfortunately, the message was not sufficiently clear and the students tought they did not need to remember any aspects of the amino acids. While this was unfortunate it did not negatively affect the students' results on the final exam. However, this must be more clearly communicated 2023.

- As for 2021, the students want more interaction with each other. While this is to a large extent the students' own doing, it is acknowledged that increasing the possibilities for such interactions would be helpful. Students who want to can already work in groups on the computer exercises and during the project (although all reports and examinations are individual), and I will need to think about if, and what, extra course activities can be added to further increase student interactions.
- As previous years, the students want more examples of exam questions (part B). The final exam was completely changed 2021 and therefore time has been too short to accumulate many relevant exams. For 2023 we will have exam examples for two years (2021 and 2022), which is an improvement.
- One suggestion was to have small exercises/tasks associated with the lectures. While this is an excellent suggestion it was only one student that suggested this, and it needs to be further evaluated during 2023 if there is a general interest among the students.
- Another suggestion was to have a question session before the exam. I implemented exam Q&A sessions earlier years, both in BB2160 and BB2165, but the result was disappointing. It turned out maybe a handful of students turned up for the sessions. Instead, I decided to provide extended personal email support before the exam, which worked better. Due to the poor interest earlier years, this needs to be brought up during the course information 2023. A possibility is to schedule a Q&A via zoom during the study week.
- The answer frequency for LEQ remains on the low side (48%) despite keeping it open for three weeks and recurrent reminders from the LEQ system and myself. The importance of the LEQ needs to be emphasized during the course information on the first day, and also discussed with the students what the reasons for low answering frequency is and how to improve it. My experience is that the frequency is close to 100% when the LEQ is handed out at the time of the final exam, but considerably lower when offered electronically. One possibility is to give the LEQ during scheduled hours where all students attend, for instance the last computer exercise. This will then only include the continuous examination elements that have been completed, but a follow-up question concerning poart B of TEN1 can be given after the final exam.
- During the course meeting the student representative mentioned that students had raised the interest to learn more about and use PyMOL during the course since other courses uses PyMOL. There are however well-motivated reasons for my choice to only use one software (KiNG).

  First, KiNG is a dedicated teaching software developed specifically for teaching structural biology. It comes with the possibility to create kinemages (kinetic images) that follow the textbook in a pedagogical way. This functionality is not present in PyMOL, and thus the pedagogical aspect suffers.

  Second, PyMOL was used earlier in the course (2018-2020) and students felt that the software was too user-unfriendly (which is correct). It would probably take at least a full week working to get everyone to a level that is useful for the tasks in the course. The students also wanted to learn fewer softwares since they felt that the time to learn several new softwares meant a lot of frustration and less time to learn about the actual topic of the course.

  Third, PyMOL is a licensed software that requires installation. While students can use the software for a limited time free of charge, the full version is not available without payment. It is important that any software used in the course is free of charge. In that sense the software Chimera X would be a better alternative to PyMOL, however that software is also not very user-friendly and does not have a teaching focus or kinemage compatibility.

  That said, one possibility could be to prepare a "starting-with-pymol" guide for those who want to learn the basics (although there are excellent tutorials online). This would be a summary of

commands and scripts (with examples) that address visualisations that would be useful for the project. Of all the student comments in the LEQ (see Appendix 1), only one single student wanted more PyMOL in the course. Thus, before it is justified to expand the use and support for PyMOL (which would require additional time and resources), this needs to be further discussed with students in the 2023 course offering. If indeed there is a general interest, additional PyMOL at a basic level can be implemented from autumn 2024.

Appendix 1: Students' LEQ comments 2022 (all comments included)

Comments on "What was the best aspects of the course?"

- The course is very well organised, teacher was kind enough and willing to go an extra mile to clarify doubts we had.
- The project work that we were given, the research articles were quite interesting and helped with understanding the course better.
- The hands-on experience getting to know how to navigate, manipulate, and understand different models.
- Video lecture available. Project was fun and informative as well.
- The project and the quizzes.
- Great organization Clear and informative lectures. The project and exercises actually contributed to understanding the material. Even though it does not apply to me I like how you focused on accessibility for color blindness.
- Lectures were conducted on campus and lectures video were also posted on canvas. The teacher responds to email as quickly as possible, and feedbacks from exercises and projects were helpful.
- To me the best aspect of the course was to actually be able to apply the knowledge taught during the lecture at the exercise session. I felt the course was heavy in the sense that there was a lot of known information in the form of facts and details; however, using these in a more practical way made it much easier to understand them.
- The course dealt with interesting topics. There was constant feedback for the assignments which gave us opportunities for revision and improvement.
- The fact that we had real examples for everything we learn and that we could experiment by ourselves during the 3 exercices.
- very well structured regarding information, nice structured on canvas where every topic had its own page, for instance everything regarded lectures had its own page, and then everything regardes exercise, projects, examination had their own. That was nice - instructions on everything were quite clear as well, for instance the videos on how to maneuver King, that was really helpful, especially when you were writing your own report afterwards, if you forgot a commando, you could go back to the video. - you're quick at responding at emails which is very appreciated - you are very considerate about us students and our situation which is appreciated as well - the instructions for exercise and project are very clear. I almost never asked for any help because I did not need it since everything was stated in the instructions.
- The laboratory exercises.
- It was a fun course that was well structured.
- The engagement from our professor.
- The recorded videos aided a lot in the understanding of the course.
- The exercises really made sure you were prepared for the exam. It was a good opportunity to understand the learning material.
- The quizzes made sure I was on schedule for most of the course which I probably would not have been had they not been mandatory.
- The structure was perfect and it was really helpful to have to recorded lectures available. It was great to have the concretised intended learning outcomes.

- That the course was very well structured, in terms of canvas page, lecture order, quizzes, lecture content and what to do in excercises and project. + I also really liked the mandatory quizzes which really helped you stay on track.
- The structure of the course was one of the best I've experienced - a lot to do but it really helped me to achieve the ILOs. I really like that the recorded lectures are provided as well.
- I think the best thing was how it felt like the lectures, exercises and project all connected and helped learning.
- Really liked the exercises, they were very useful for the exam. Also good with quizzes to confirm understanding of other facts, since there was a lot of it, and would have been a lot to memorize for the exam.
- Exercises with king.
- I liked how it was organized and structured. The lectures were interesting with good examples and the excersices/project was really informative where the instructions was detailed and easy to follow.
- The quizz are a really great way to understand the key concepts.
- How well structured it was, with rehearsal with the quizzes, and exercises, project and final exam going well hand in hand. I also liked that we could sign up for the exercises and project sessions and that all lectures were pre-recorded, so it was possible to structure your days as you please. Overall, one of the best structured courses i have taken.
- The very clear structure of the course was awesome. The fact that earlier prerecorded lectures were available was very nice. The labs had very clear instructions and interesting premises when they pointed out the errors in published structures. The quizzes that forced one to keep up with the course were very useful and nice.
- It was good. I liked the quizzes and how the exams were organized.
- Upplägget! Det var bra att vi hade quiz efter varje föreläsning för det gjorde både att man inte hamnade efter och att man fick sätta det man lärt sig på prövning.
- The exercises! They helped me understand better what was seen during lectures. And also the relatedness of the topics to current situations, helped me understand current importance of structural biology, protein engineering, among other topics, and their future development!
- I liked the overall structure of the lectures, intro to the main motifs/structures and then a more zoomed in perspective.
- The organization of the course, the project and the interesting topics.
- I thought that the "structure" of the course was brilliant (haha). The canvas page was very good and nice that everything was already uploaded. If I found time to do something else, I could look at the upcoming lecture slides to get me more familiar with the material before the lecture. Overall a fun and interesting course!
- I really like applying the knowledge learned in the lecture into the exercises and the project
- Well organised by Christina.
- I think the clearly-defined structure of the course was its greatest strength. The lectures were good, and had relevant and interesting examplesin them as well. The project was a good way to incorporate the skills learned in the computer lab into a practical example. Even though the whole individual nature of the project was daunting at first, I agree with the professor in that it helped to get a clearer grasp on how to tackle a problem on our own.
- The pre-recorded lectures were real helpful, also the quizzes.
- Overall the whole layout of the quizzes, exercises and projects were grate. It was all well put together and what we needed to to for each part was super clear. Also the concept of the quizzes being a part of the exam where the details were examined. And to have the exam more with more questions fore

reasoning and not memorising. I felt that was different from outer exams I have had but so much more giving.

Comments on aspects that can be improved

- We were told that memorising the amino acids isn't important but it turned out to be quite important and so it should be mentioned in the beginning classes.
- Nothing this course is one of the most perfectly organized courses I've taken.
- The lectures were very good in explaining the topics that were asked about in the quiz. However, the lectures did not provide a lot of examples on how to reason regarding how different amino acids interact, considering how important that knowledge was in the exam. I.e. the student should have more time to practice the types of questions that are on the exam during the course, or at least be provided examples of how to think.
- I would have liked to have more exercise sessions or more extensive exercise sessions instead of the project sessions. While it was nice to get help with the project, I felt most of it was covered in the exercise sessions, and the rest cleared up with the extensive instructions and example reports. Personally, the best part of the course was actually seeing and analyzing using KiNG.
- I would have preferred to have a bit more interactions with the other students. Maybe doing “random” pairs of students during the exercices could helped. The design of the Canvas page was not so easy to handle (we had to “enter” the page every time we wanted to check something). I was always struggling when looking for the page with inscriptions for the exercices for example.
- Even though the instructions on everything were very clear, there is one thing I would want to point out. The instruction for every exercise is very detailed, however I found it unclear on what should be included in every exercise report, I did not feel like that message was clear enough. However what every exercise included was very clear. Very good instructions.
- No nothing that I have thought of.
- More old exams to practise on.
- A would create some more lectures which talks about uncommon Protein structures like special cases.
- For me personally, the lectures were sometimes a little general. I would have liked to go into the details of certain subjects instead of just the basics that I have heard in previous courses.
- I feel like some of the slides during the lectures had excessive text that I didn't notice being brought up, making it difficult sometimes to match what was being said to what was written.
- I liked every aspect of the course, I can't think of anything that could approve.
- Quizzes open directly after the course and then be open a bit longer.
- I don’t have something in my mind really.
- Reading a bit less from the slides during the course.
- Broadly no. I think this was an incredibly well structured course.
- More clarity on the final exam. Either emphasise that knowing all amino acid structures and their abbreviations by heart is important or giving achart like (https://en.wikipedia.org/wiki/Amino_acid#/media/File:ProteinogenicAminoAcids.svg) would be nice. Biochemistry 1 where we learned the structures by heart was 3 years ago, and as such ones, memory is not perfect.
- Jag tyckte det var svårt att veta hur jag skulle förbereda mig till tentamen och vad jag skulle fokusera att plugga på inför den.
- Have just tiny exercises during lecture, for reasoning, at the level of exams exercises perhaps.
- A question session before the exam

- I felt that some lectures had maybe a bit too many slides at some occasions, which made the end of the lectures a bit too fast especially as everyone gets more tired towards the end. I also thought that figure 1 on the exam was difficult to count all the strands/helices. When I left the exam I felt most unsure if I counted the correct amount of beta-strands and helices and I think that should not be the case.
- Another day to finish quizes.
- Maybe make the goals for the exam a bit clearer, or establish a Q&A session to ask questions about the exam. More old-exam examples available through Canvas would also be a good study resource, since with the exams only being 3 questions each, the study material felt relatively short.
- To be honest noting, I felt the corse was well put together and interesting.

Students' advice to future course participants

- Be thorough with the previous knowledge of structure of proteins as it enhances what you learn in the classes if you are able to co relate it to what you studied earlier.
- Don't procrastinate please.
- Don't fall behind with deadlines and have fun. Don't be afraid to ask questions since the lecturer is very open when it comes to discussions.
- Hang in there during the course - tenta p is very chill for this course.
- I would want to say that one should not try and stress too much with the quizzes. If you listen and look through the lectures most questions arestraightforward, and it's also a great way to make you think about the course content more. If something is unclear maybe that's a good reminder to go back and take a second look. Furthermore, both projects and exercises were the most beneficial for exam prep and I reviewed these a lot beforehand as well as previous exams.
- Make sure you do the assignment and quizzes religiously. Doing that would help you with preparation for your exam.
- Read the exercices before going to the labs so that it would be easier to ask questions during the session!
- Revise the material , do active learning, and take the exercises and project seriously because holy shit that was helpful for the exam. I spent a lot of time on exercise and project and I almost got that part for free later for the exam because I already knew everything.
- To keep studying regularly
- Focus on the exercise and project parts. They will help you for the project report BUT also the exam. Start with the quiz when they are published, then you won't have to stress with them. If you do all of that, the amount you have to study for the exam is minimal.
- Stay on top of thing.
- Start early to study your course materials.
- Focusing on the structural Information in your Project and exercise is more important than the lecture but the canvas question system is relay good for removing the hard parts of the learning so you only have to focus on the concept of the lecture.
- Try to make the exercises on your own and understand the principles of it. It is good practise for your exam.
- The exam seemed to be different to much of the course material, if you want a high grade, look through previous exams early and focus on the general thought process instead of the particular technologies. That is in what way different amino acids interact to generate structures and what interactions occur to cause these structures.

- Learn the amino acids! It makes things easier if you know their properties and structures. Check the concretised intended learning outcomes (ILOs) after each lecture - it helps to understand what you have to know/learn.
- Start with the project early, spend much time in king and study the strucures (I feel like I learnt alot from that), do each quiz as soon as possible so that you encapsulate the knowledge.
- Study hard from the beginning and the exam period will be a lot more easy.
- Work continuously during the period and start working on the project early. It's possible to write the introduction before the KiNG part of the project properly begins.
- Be active on exercises and listen during the lectures. It is not critical to take notes on what is said during lectures cause as good as all relevantinfo can be found in the slides, and the videos was also very good to look at in case you missed a lecture.
- Focus on the main principles and don't get lost in details.
- Preparar yourself for the excersises, maybe look at the questions the day before so you can get the most out of it and really learn.
- Do the quizzes in time and try to get as much out from the excercise and project sessions as possible. Go for the later ones, as they are more chill, and carfully red Christinas feedback on the assignments.
- Keep up with the course. Go on the lectures. Have fun with the project. Learn aminoacids.
- Försök alltid vara i fas och läs feedbacken som fås efter labbarna.
- Don't leave everything for the last moment, it won't work out for you!
- Work from the first day and it is not going to be hard.
- I would say that exercises and project exercises/report was important for the exam, therefore important to bring the knowledge from them into the exam. If the student is unsure with the amino acids and their properties since it might had been a while, I recommend re-studying them for the exam.
- They should really try to understand the course instead of memorizing, and they should know the amino acids.
- Learn your amino acids!
- Study the amino-acids. We were told at the beginning of the semester that we would have learned them by the end of the course, but that washonestly not really true. You learn to recognize a few of them due to how different they look (like Tryptophan or Tyrosine), but you don't really learn the charges or shapes of other amino-acids based on the lectures and project alone. The amino-acids are the cornerstone to doing well on the final exam, so make sure you learn them.
- Try to really do the quizzes and not brut force them. And use the exercises to discuss and try to use the thing you have learned.

Is there anything else you would like to add?

- The course responsible is very helpful and friendly.
- I think PyMol is a much easier and nicer way to analyze the molecules, the resolution for one is much better, and even loading and handling the molecules is simpler. While I started with KiNG I did swap to PyMol during the course.
- Thank you very much for this course, it was super clear and interesting!
- Just wanted to say thank you for keeping this course interesting. I've been studying at KTH for 4 years and even though I've found my time here very fun and interesting, no course (except one) has actually felt interesting or fun to me. Not that I haven't liked any of the other courses,but I haven't felt like

damn this is fun to study for for the exam. I actually genuinely enjoyed study for your course and for the exam, and I want to say thank you for that.

- Nice course!
- I am very glad that Christina has been so understanding with deadlines (especially since there were so many ;)) and other concerns, it really helps us out!
- This is definitely one of my favourite courses I've taken on KTH. I loved how well structured it was and it felt very focused on learning without judgement.
- Nope, very interesting course!
- The need to know the amino acids, especially their one letter abbreviation. On the final exam i felt like a missed potential points (or got stressed) by knowing the name and structure of the amino acids abut not their one letter code. A table with their name and one letter code at the end of the exam, or clear instructions that knowing the one letter code is a requirement would have been nice.
- Great course!
- Enjoyed every lecture and the way you could speak so eloquently about every topic, even during ML when you mentioned you were not an expert. Your confidence on the topics made me feel relaxed, feeling like my professor knew exactly what she was saying and made every answer very digestible for everyone to understand. Thank you for your time and patience!
- Great job with the course, impressive being quick with reading through all of the exercises and project reports as the only "teacher" on the course.
- Overall one of the best and most comprehensive corses I have read. I'm amazed that you were able to correct the exercises and project reports so fast and still with good feedbacks. You have really out together a super core, great job Christina!!

Comments related to aspects of gender, equality, and disability

Comments related to gender/equality (I am: Kvinna)

- I have felt equal to others in terms of gender perspective.
- Really neat to see prosperous science women in the academia. Most courses I have had have been run by men, although the majority of the students often are female.
- Our lecturer was very organized and coordinated
- I didn't feel any difference regarding this aspect
- I liked to see a female teacher giving the course. In my home university, most of my courses were given by male teachers.

Comments related to gender/equality (I am: Man)

- Noting is different I feel from this perspective

Comments related to disability

- I have dyslexia but this did not affect me in any way during the course. There was enough time during the exam and also to finish the report.
- I didn't feel this effect my ability to preform in any way

Comments related to type of student

Comments related to being an internationell master or exchange student

- Took me some time to adjust with Swedish students and other international students here, i felt little hard to make friends with them. Since we meet only 2 hours a day- there isn't much time to interact with others.

- Everything was great
- I had similar course in xxx but this course was retrospective the best about protein structure because the project part and ex. was the important part and showed you how the since of protein structure is relay working, because in xxx the courses were more on the theor. side not on the practitial.
- The course structure is different than what I'm normally used to. I'm used to a lot of lectures and an exam at the end of the period. However, this course had a lot of deadlines (quizzes, reports, exercises) during the period. This made sure I did something during the period and did not start at the end of the period. This was actually quite nice and led to less stress in the end.

Comments related to being a Swedish student (year 4-5)

- A super course
- I did not get to take my master yet however I am studying this course as a part of my future master

Comments related to the study workload in the course

- The course structure was demanding, but it was fun.
- I only participated in the lab and the project part of the course.
- The course consist of both theoretical and practical aspects, hence the studies the amount of study hours.
- Did not put in much more time except doing the lectures and answering quizzes. Only time consuming part that was not scheduled was writingthe project. However, I did use some time to more inactively reflect on the content and discus this, if this is defined as course work I suppose I spend more like 9-11 hours per week.
- I haven't calculated and I don't know what is reasonable either, however I did spend a lot of time revising the lectures every week to prepare myself for the quiz, so I looked at the prerecorded lectures ones after the lecture you held, and then took the quiz, so quite a lot of hours just here.
- It was a great learning experience although I'd prefer for it to be more interactive. Sometimes for the questions asked, the answer is not what we expect it to be. More clarity perhaps in the explaining of answers.
- A well structured course, from start to end. I don't think I've ever taken a course that is so well designed and where you learn with out having to study for hours and hours outside of the pre-planned lectures and labs.
- It makes the learning a continuous one.
- The workload was entirely reasonable for my situation, I probably worked less self study than many others but the material was still easily absorbed.
- It felt like an appropriate ammount of workload.
- I mostly spent the time outside of lectures and exercises to do the quizzes and working on the project.
- We have a lot of classes per week but the work outside is reasonnable.
- I think the ammount of time spent on the course was reasonble.
- Well balanced between in site lectures and exercises, quizzes, and project.
- I felt that I spent the amount of time that I was supposed to spend during this course.
- The course was demanding but the workload and study time was very suitable.
- A lot of mandatory tasks to be submitted. While I prefer to plan my studies on my own (based on how I balance workload), I think it was ok for this course since it would be difficult to organise it on myself.

- I think the distribution of the workload was good. The project was evidently the bulk of the work, but was manageable, even if it was daunting at first. The quizzes are also a good help as a study resource after each class. The overall time spent on the course was therefore fine.
- I felt that the time needed for the corse every week was reasonable considering the material. And I never felt overwhelmed.

Comments to specific LEQ questions

1. I worked with interesting issues
   - Everything was up to date and very focused on present reality (e.g. COVID-19).
   - Even though the lectures slides were heavy they really helped with the understanding of the importance of biomolecular structures.
   - I found the entire course really interesting and the project was a good way to actually use what was taught in the lectures.
   - The entire course subject was interesting to begin with but specifically to delve into relevant articles through the project was very interesting.
2. I explored parts of the subject on my own
   - To some extension during the project.
   - Mostly to concretize specific points that I was afraid to ask during lectures.
   - Thee project was very helpful.
   - I feel like self exploration was a great way to better understand what to do in the project by reading some similar articles.
   - Discussed with classmates too.
   - Mostly checking some things on Wikipedia, not necessarily very deep. On most lecturures there was something which I explored further.
3. I was able to learn by trying out my own ideas
   - The project gave a lot of opportunities to play around and test ideas.
4. The course was challenging in a stimulating way
   - A lot of effort had to be put in - watch all lectures, do all quizzes, take part in all sessions, but if all this was done with a good level of engagement I felt like the study for the examination was relatively easy.
   - Sometimes I felt like things seemed hard but but everything felt manageable when I actually did it which I think is good.
   - The project mostly was nice.
5. I felt togetherness with others on the course
   - Felt like I'm doing many work alone.
   - The part where I felt like this was during the project's presentation, as it required us to interact. But even if the lectures where on site, everyone was in their own bubble of friends, so not much togetherness during lectures or exercises.
   - Especially during the exercises and project work in the computer labs when you cold ask and help others.
   - Mostly because of the on site elements.
   - Hard to say, I like to study on my own.
7. The intended learning outcomes helped me to understand what I was expected to achieve
   - They especially helped in studying for the final exam.
   - With the addition of old exams to pinpoint the level of detail expected of me.
   - I clearly understood what I was supposed to understand and learn for each lecture.
   - Did not read these.
8. The course was organized in a way that supported my learning
   - I think it's brilliant to separate theory over practice, specially when evaluating!
   - Very well organised, it makes it very easy.
   - I appreciate that we were able to apply the theoretical knowledge practically on the laborations.

- This is the best organised course I've taken on kth. Everything felt super clear and well structured which made it really easy to keep on track and focus my time on learning.

9. I understood what the teachers were talking about
   - Sometimes not the details.
   - Took me some time to adjust to accent, but now I'm used to it.
   - I feel like I learned a lot each lecture and I always left feeling that I understood.
   - Yes basically all parts except the crystallography method explanation.
10. I was able to learn from concrete examples that I could relate to
   - Even if I don't understand concept- looking at concept was helpful to clear my doubts that I had.
   - Very good that we had many practical examples of the theory, during the lectures.
11. Understanding of key concepts had high priority
   - You did have learning outcomes but I never read them but I know that you had them, I just did not read them.
12. The course activities helped me to achieve the intended learning outcomes efficiently
   - I felt prepared for the exam thanks to the activities, it felt like another exercise session.
   - All activities together gave a very good understanding as it felt like they built of eachother.
   - I think the excessive was very good.
13. I understood what I was expected to learn in order to obtain a certain grade
   - I though it was not required to know all the amino-acids but in the final exam, it could have really helped…
   - But then again i did not read the intended learning outcomes.
   - The exam didn't cover much of the technical course material.
   - I was quite confused by the grading but because I've never had an A,B,C grading system and can't quite understand the reasoning behind it yet.
   - Very clear on past exam examples etc, although I would have appreciated if the actual exam example answers were more thorough :)
14. I received regular feedback that helped me to see my progress
   - Your feedback during exercises is key to understand the depth of analysis we should aim for!
   - Not regular feedbacks, but feedback whenever I requested for.
   - Very good and clear feedback on everything we handed, that made me understand topics further.
   - Again, I really enjoyed the exercises and project sessions.
   - I think the feedback was great and I especially appreciated E1 when we had to watch videos and point out our wrong answers. I learned so much from that and got a much better understanding.
   - I really learned from the feedback from the project and ecersices!
   - Yes very nice feedback on my reports.
15. I could practice and receive feedback without being graded
   - Some extra example exams or just eamle descriptions of proteins would be nice.
   - You had lots of oppertunities to ask questions and recieve help without being graded.
   - All feedback I got was very goodand it felt like it always focused on how I could improve things which I found very helpful.
   - I guess the quizzes, you allowed corrected resubmission.
16. The assessment on the course was fair and honest
   - I enjoyed the fact that details were examined during the quizzes and applied core concepts during the exam, it made it easier to focus what to study during different times and I feel we were able to gain deeper knowledge about the core (and most important) concepts for the exam.
17. My background knowledge was sufficient to follow the course
   - I felt like my own background knowledge did not help much, especially in terms of amino-acid knowledge. However, the lectures are well-planned to allow everyone to be on equal footing.
   - Threre should have been a clearer statement that knowing all of the aminoacids by heart was important.

- Even though I come from a chemistry bachelor programme I think the course content was easily absorbed. During the project I had to do some extra reading to gain knowledge that I was lacking.
- Mostly the part about the Fourier space and the convolutions was very confusing for me.
- I think the course started at a great level and builds understanding from there.

18. I regularly spent time to reflect on what I learned
    - This behaviour was induced by the exercise and project sessions.
    - The quizzes were a great way to reflect on the lecture.
    - This was encouraged through the quizzes both making sure one was on schedule and to reflect on course material.
19. The course activities enabled me to learn in different ways
    - There was a good variation! I did not get "bored".
20. I had opportunities to influence the course activities
    - Not really, everything was fixed and it had very less scope to change around. But I wouldn't have wanted anything to change.
    - I wouldn't say we could influence the course activities other than deciding when to participate in each activity.
    - Good course structure, not that much we could change but you were very open to my late assignments.
    - Not sure in what way, but I appreciated that we could use other softwares during the excercises!
21. I was able to learn by collaborating and discussing with others
    - Felt like I was doing a lot of stuff alone.
    - Not much discussion-driven in this course, but I don't think that's necessarily a bad thing in a subject like this.
    - Exercises and project sessions were again very good.
    - The computer lab gave good opportunities to discuss questions about the project.
    - I like to study on my own.
22. I was able to get support if I needed it
    - Christina was very supportive and available both in person and online.