



## Course analysis

<b>Course title: Applied Gene Technology and Large Scale Data Analysis</b>	
<b>Course code: CB2040</b>	<b>Points: 7,5hp</b>
<b>Course is part of program: Master's program in molecular techniques in life science</b>	
<b>Semester: 3</b>	<b>Period: 1</b>
<b>Course responsible: Patrik Ståhl</b>	<b>Examiner: Patrik Ståhl</b>
<b>Number of registered students: 25</b>	<b>Number of passed students to date: 23</b>
<b>Reply frequency to course evaluation (%): 83%</b>	

### 1. Introduction and description of applied changes before this course offering

#### Background

The course is running its second year as a free-standing course in the SciLifeLab master's program in Molecular Techniques in Life Science. It has been previously featured in a similar format in the KTH master's program in Medical Biotechnology, under a different course code (BB2255). Patrik Ståhl is the course responsible and examiner for CB2040.

The course is composed of three main parts: the main theoretical lectures, the project work and the bioinformatics part with its own lectures and labs. This year the course has also incorporated an ethics in gene technology workshop.

For this year's course offering we set out to improve the pedagogics in the bioinformatics part of the course, specifically we wanted to make sure that all students, regardless of background experience, were able to follow the course and execute the bioinformatics labs. Last year some students found this part stressful.

#### Course analysis 2020

The course was run in 2020 for 25 students. The course evaluation form was distributed in paper, and was answered anonymously.

Below is a summary of the course evaluation given to the students, showing their scores to the different statements, as their general comments about the course at the end. For the first two parts of the course "main lectures and project work" the "My comments" paragraphs are written by the teacher of this part of the course, Patrik Ståhl, and for the third part of the course "bioinformatics" the "Our comments" paragraphs are written by the teachers of the part of the course, Stefania Giacomello and Olof Emanuelsson, together with the course responsible, Patrik Ståhl.

At the end there is also a section titled "Final comments and conclusions, and further plans" where we summarize our analysis and reflect on the course development for future course offerings. These comments constitute our course analysis.



## 2. Summary of the students' course evaluations

### Course Evaluation CB2040 (HT-20)

Evaluate different aspects of the course by using grade-scale 1-5, where 1 is the lowest and 5 is the highest.

My comments: We have received 20 evaluation forms out of 24 students who attended the first exam where the forms were distributed. This is a response rate of 83%. Some questions lacked replies on some forms, hence a lower number of total reported replies (i.e. 19 instead of 20) to some questions.

Presented below are the scores of the students to the different statements, at the end we have also collected the students' written general comments about the course.

Average score Q1-Q25: 4,6

#### Main lectures and project work (bioinformatics part follows on next page)

##### Average score Q1-Q15: 4,7

1. The course was interesting and I worked with interesting subjects

1      2      3      4 4      5 16      Avg.= 4,8

2. The course was challenging in a stimulating way

1      2 1      3 3      4 4      5 12      Avg.= 4,4

My comments to 1. and 2.: The students score on average 4,8 that they found the course interesting, and 4,4 that they found the course stimulating. I'm happy to see that the students liked the subjects and felt stimulated!

3. I explored parts of the subject on my own

1      2 1      3 2      4 2      5 15      Avg.= 4,6

4. I could learn by trying out my own ideas

1      2 1      3 5      4 8      5 6      Avg.= 4,0

My comments to 3. and 4: The students score on average 4,6 that they explored the subject on their own and 4,0 that they could learn by trying out their own ideas. This is the lowest scoring section of the course evaluation for the main lectures and project work. The course is focused on teaching key concepts and technologies from the field of gene technology to the students over a limited time period, this impacts the time for the students to explore on their own. The students were however allowed to wish which project, and focused subject, they would work in. One could try to increase the students' freedom by allowing them to incorporate a paper of their choice into the project work.

5. The atmosphere in the course was open and inclusive

1      2      3      4      5 20      Avg.= 5,0

My comment to 5: Before the course I made a decision to try hard and make everyone feel like they were participating, creating a welcoming atmosphere that would open up for questions and a sentiment of inclusion. I also explicitly set up rules together with the students during the first lecture to how we will behave and respect each other in the class room. I'm happy to see that all the replying students' share my sentiment of an inclusive atmosphere. Mean score 5,0.

6. I understood what the teacher was talking about

1      2      3      4 2      5 17      Avg.= 4,9

7. What do you think about the teacher's pedagogic and scientific competence?

1      2      3      4 3      5 17 (one 5+) Avg.= 4,9

8. I could learn from concrete examples that I was able to relate to

1      2      3      4 5      5 14      Avg.= 4,7

9. Understanding of key concepts was given high priority

1      2      3      4 2      5 18      Avg.= 4,9

10. The course activities helped me to learn efficiently

1      2      3 2      4 3      5 15      Avg.= 4,7

11. I understood what I was expected to learn

1      2      3      4 3      5 17      Avg.= 4,9

12. The teacher spent time to listen to my questions, answer them properly and comment my work

1      2      3      4 3      5 17      Avg.= 4,9

13. The project activity helped me to learn more effectively

1      2 1      3      4 4      5 15      Avg.= 4,7

My comments to 6, 7, 8, 9, 10, 11, 12, 13: Mean scores 4,9; 4,9; 4,7; 4,9; 4,7; 4,9; 4,9; 4,7. I'm very happy to see the students' high remarks regarding the pedagogics of this part of the course. I have strived to be very clear in my explaining of theoretical concepts, while listening to the students' questions and remarks and trying to adapt to create a flexible learning environment. I have also tried to be clear on the requirements on students' regarding what they should learn. Question 11 scored 4,6 last year which increased to 4,9 this year. Since last year I have strived to requirements even clearer, including oral and written reminders throughout the course. This has also been helped by the students having access to previous exams of this course from last year.

14. My background knowledge was sufficient to follow the course

1      2 1      3 1      4 3      5 15      Avg.= 4,6

My comments to 14: Mean score 4,6. The SciLifeLab master's program attracts students with varying backgrounds where some are likely to have been more exposed to the subjects of the course in their previous studies than others. Yet the main lectures and project work part of the course is built so that the main lectures cover the essential topics, but with added depth compared to less advanced level courses, adding skills even for students with background knowledge in the subject area. And the project work covers state of the art technologies which most students in the master's program do not have any previous detailed knowledge about. In this way the course tries to allow for varying backgrounds without losing momentum and allowing for advanced level learning.

15. I regularly spent time to reflect on what I learned

1      2      3 5      4 6      5 9      Avg.= 4,2

My comment to 15: Mean score 4,20. The students have reflected on their learning to a high degree, however they could be encouraged to do so even more. Since time is limited for the course and the students have other courses in parallel, allowing more time for reflection also needs to come from the students' own scheduling. The students are already tasked with formulating opponent questions for the project work presentations, however this concept could perhaps be expanded to allow the students to formulate questions individually instead of in groups. Additional reflection has been added this year due to the ethics in gene technology workshop where the students are given the chance to discuss the application of the different technologies from an ethical and societal perspective.



### Bioinformatics part of the course

#### Average score Q16-Q25: 4,5

16. I worked with interesting subjects

1      2      3      4 8      5 11      Avg.= 4,6

Our comments to 16: Mean score 4,45. We are happy to see that the students found the bioinformatics topics to be interesting!

17. The course was challenging in a stimulating way **Our interpretation: Was the course too easy? Was the course stimulating?**

1      2      3 2      4 7      5 10      Avg.= 4,4

Our comments to 17: Mean score 4,4. We perceived that the background knowledge of the students group varied quite a bit. It is important to take measures to counteract this variation as it could otherwise lead to stress. This year we have added a possibility for students to get help with installation of the R software. The goal is to adapt to the students' needs.

18. The atmosphere in the course was open and inclusive

1      2      3      4 4      5 15      Avg.= 4,8

Our comments to 18: Mean score 4,8. This is a great improvement from last year (4,3). The students perceive the climate as inclusive, however it is important that all students share this sentiment. To further underline the goal of inclusiveness and openness in this course we have clarified throughout the course our core values including an open and equal discussion climate in the course, and our openness to any concerns, questions or comments. To exemplify this we have stated on first lecture and throughout the course that we are aware of the students' varying bioinformatics backgrounds and happy to help out.

19. I understood what the teachers were talking about

1      2      3      4 9      5 10      Avg.= 4,5

Our comments to 19: Mean score 4,5. This is a great improvement from last year (3,9). It is of utmost importance that the key points in the course are conveyed adequately to the students. Given the varying bioinformatics backgrounds of the student group, for this year we adjusted the information content. We need to make sure that all students are able to follow what is conveyed during and outside classes.

20. The teachers (and course assistants) spent time to listen to my questions, answer them properly and comment my work

1      2      3      4 3      5 16      Avg.= 4,8

Our comments to 20: Mean score 4,8. This is a great improvement from last year (4,3). To improve on the pedagogics and efficiency of communication between teachers and students we have switched to doing the computer labs in a lecture room instead of a computer room, and also on Zoom. Almost all, if not all, students use their own laptops to follow the labs, and the lecture rooms and Zoom has allowed teachers and teaching assistants to use the blackboard or slides to convey pedagogical replies to questions to the whole class instead of answering common questions from the student group to each student individually (as is most often the case when in a computer room). Everyone in the teaching staff also discussed how to improve the pedagogics of the bioinformatics part of the course, which has made a great difference this year.

21. My background knowledge was sufficient to follow the course

1      2 2      3 1      4 4      5 12      Avg.= 4,4

Our comments to 21: Mean score 4,4. This is a great improvement from last year (3,9). Because of the varying background of the students it is crucial that we adapt the bioinformatics part of the course to meet



the varying demands. To do this we have cut some content to free up time to go deeper into key topics. We have also added the possibility of letting the students get help with installing the R software. In addition the teachers and laboratory assistants have been aware of the varying backgrounds and have tried to help out as much as needed. Other means of being better prepared for the students' background is to coordinate with earlier courses in the master's program, as well as to make sure key topics are reiterated throughout the course.

22. The teaching approach (i.e. blackboard instead of slides) was effective

1      2 1      3 3      4 4      5 11      Avg.= 4,3

Our comments to 22: Mean score 4,3. To improve on the pedagogics we will use slides in addition to the blackboard. The slides will serve the purpose of background information, as well as a document for the students to refresh their memory throughout the course.

23. The study material was exhaustive Our interpretation: Did the study material cover the lecture content?

1 1      2 1      3 4      4 8      5 4      Avg.= 3,7

Our comments to 23: Mean score 3,7. We will work on clarifying this question for next year. Also, we will make sure that the study material well matches the lecture content, to this end we will add lecture slides for background information and reference for the students throughout the course, as well as a summary to keep in the future. It is our aim that this together with the scientific papers that are distributed will make a full circle of study material.

24. Computer labs covered practical examples of the bioinformatics aspects treated during the course

1      2      3 1      4 3      5 15      Avg.= 4,7

Our comments to 24: Mean score 4,7. We are happy to see that the students found the labs relevant in relation to the rest of the course. We will make sure that the topics treated stay relevant.

25. Computer lab instructions were clear

1      2      3 1      4 3      5 14      Avg.= 4,7

Our comments to 25: Mean score 4,7. The students find the instructions clear. Some of the instructions were updated for this year, as a part of the overall pedagogics overhaul of the bioinformatics part of the course. We are happy to see that this is reflective in the positive feedback from the students.

Please, reflect your thoughts on positive/negative parts of the course. What can be done to improve the quality of the course?

Statements compiled from all evaluation forms (copied as is, including spelling etc)

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I think this course is well organized and good. I think it could be useful to have more literature, instead of articles I think the possibility of a book would be good. Otherwise everything is very good.

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I may say that the bioinformatics part of the course can be improved. I mean, it would be nice if questions comes from lab session that will give "bonus point" in overall point. On the other hand, the director of course, prof. Patrik, was really helpful and supportive during the whole course.

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Patrik was great!

5+ (regarding question 7: teacher's pedagogic and scientific competence)

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MIPs for life!

Journal club for bioinf

1-week deadline for the labs was tight, yet the feedback was sufficient & the teachers were always up to replying everything

This course should've been in VT of 1<sup>st</sup> year after genetics

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There were some technical glitches in the bioinformatics lectures (Stefania) that made it difficult to follow on zoom. Either the camera was not working/ the slide presenter did not change (alternating problems). But the content of both the theory part and the bioinformatics lectures + practicals were very interesting and enjoyable.

Patriks lectures were amazing.

I learnt a lot of critical thinking and analyzing skills from this course.

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It looks a lot, but I am trying to be picky to make this super nice course even better =).

The bioinformatics lecture slightly lost connection to the gene technology part of the course. Maybe a bioinfo activity control/bonus point question on exam (even if I do not like theoretical bioinfo assessment it might help tying things together).

Single cell transcriptomics: extremely repetitive with previous knowledge, weak bioinfo focus, due to zoom the blackboard was more of a challenge than improvement. The short info at the beginning of the labs seemed sufficient to get insight into field.

Labs were really interesting, level wise doable for everyone and the lab-assistants were very nice and super helpful – also highly appreciated that comments were done right on code suggesting optional approaches.

Deadlines were nicely distributed and not all clustered towards the very end of the course. Thanks for generally not a “straight-into-burnout”-workload which seems to be pursuit of some other courses in the program =).

Generally great teaching – very inclusive of the students, focus on important aspects – great opportunity to have zoom and on site (esp. on-site teaching was great) – it sometimes did not feel like strictly a lecture but more a group learning process esp. with the questions – boosted my motivation to follow and also follow up on the material.

Ethics discussion was great, nice topics (I wish it was longer – maybe better time with CB2021 ethics debate (mine was the next day) – possibly earlier in the course? – for ex. when first mentioning the golden state killer case regarding microsatellites).

Overall super happy with the course. I wish more would be designed and executed like this.

This is our first KTH exam – would it be possible to introduce the principle of the cover sheet and pages itself during the presentation day? – I think we were a bit lost/ overwhelmed – KI/SU just gave us an exam to fill in, nothing really formal though – thanks (mini improvement) =)

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I think Patrik's part of the course was amazing. He is a really good teacher/ professor & knows very much + how to explain what he knows.

Stefania's lectures were nice, but a little too simple at times (e.g. count matrix in such detail). Olof's part looked a lot like Sam's (SU; bioinformatics). Maybe more coordination? Bioinfo labs were nice, good TA's!

All in all, might be the best course I've ever had!

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Some bioinfo lectures were mainly on the blackboard which was problematic when following over zoom especially as the camera often did not work (only during bioinfo lectures, no problem in the main lectures)

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Very interesting course, good pedagogical skill from everyone involved!

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Not much needs to be improved best course in the whole program!

Our comments:

The main themes of the general comments for the whole course are:

Pros:

- +The students seem to like the course, two students say it's the best course on the master's program or that it is the best course they ever had.
- +Several students say they find the teaching very good
- +Overall very good
- +Students liked the new ethics workshop (some students made this statement orally as a complement to this evaluation)

Cons:

- Some technical glitches due to zoom format combined with classroom teaching

### **3. Reflections on the course execution and results and 4. Suggestions of changes for upcoming course offerings**

Please see reflections related to the different questions in the course evaluation above, and our related actions in the summary below.

#### **Final comments and conclusions, and further plans**

We are of course very happy that many students express strongly that they like the course. On a further positive note, the course evaluation reflects very limited negative effects from the Covid-19 pandemic.

For this year's course offering we set out to improve the pedagogics in the bioinformatics part of the course, specifically we wanted to make sure that all students, regardless of background experience, were able to follow the course and execute the bioinformatics labs. Last year some students found this part stressful.

Based on the student's comments this year we seem to have achieved a lot of what we set out to do. The average score for the questions on the bioinformatics part of the course was improved from 4,1 last year to 4,5 this year. This is a great improvement due to a clearly directed effort involving all teachers and teaching assistants.

Specifically for the bioinformatics part we will continue to work on the pedagogics, and make sure the study material adheres well to the lecture and lab content.

Specifically for the main lectures and project part we will explore of the students them can influence the content of their project work more.

Generally for the course we will continue to work especially hard on the inclusiveness and openness experience of the students in the course. This is key to having a positive learning experience. The varying background knowledge of the students, primarily in bioinformatics, needs to continuously be paid attention to in order to create a positive learning experience. We will also continue developing the ethics in gene technology part of the course, potentially expanding the discussions over one additional seminar for next year.