Emnerapport for BIO216 – Toksikologi, våren 2018

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Om kurset: BIO216 er et 10 studiepoengs-kurs som skal gi studentene en generell innføring i toksikologi. Kurset omhandler ulike aspekter innen toksikologifaget, og tar for seg emner som historie, absorpsjon, distribusjon og utskilling av fremmedstoffer, biotransformasjon, kreftfremkallende stoffer, organtoksikologi, nevrotoksikologi, næringsmiddeltoksikologi, industriell toksikologi, økotoksikologi, toksisitetstesting, og risikovurdering. BIO216 er sammen med BIO316 obligatoriske kurs i masterprogrammet for miljøtoksikologi på BIO.

Undervisningen i kurset var satt sammen av forelesninger (en dobbelttime i uken), laboratorieoppgave (over to dager), en prosjektoppgave, kollokvieoppgaver, to bedriftsbesøk (Statoil og NIFES/HI), samt en midtsemestereksamen. Laboratorieoppgaven, prosjektoppgaven og midtsemestereksamen er obligatoriske, mens deltakelse på de andre aktivitetene er frivillig. Kurset har også en andel av eksterne forelesere med ekspertise innen ulike deler av toksikologifaget.

I 2018 var karaktersettingen i BIO216 basert på 4 evalueringer; 1 prosjektoppgave i grupper (2 eller 3 studenter i hver gruppe) som fremføres som muntlig presentasjon for klassen (teller 10%), laboratoriejournal (teller 10%), midtsemestereksamen (teller 20%), samt avsluttende skriftlig eksamen (teller 60%). Både midtsemestereksamen og endelig eksamen gis som langsvarsoppgaver. BIO216 har en digital avsluttende eksamen.

Oppfølging av tidligere emneevalueringer: I tidligere evalueringer av emnet har studentene gitt tilbakemeldinger på at de oppfatter læreboken som komplisert, tunglest, uoversiktlig, og å gi litt for lite bakgrunnsinformasjon og støtte til det som presenteres på forelesning. Dette semesteret ble læreboken derfor byttet ut til ”An introduction to toxicology” (Springer) av Philip C. Burcham. Det har også tidligere blitt gitt tilbakemeldinger fra studentene om at forberedelsene til laboratorieoppgaven ikke er tilstrekkelig grundig slik at studentene ikke føler seg nok forberedt til det som skal utføres på laboratoriet. Det ble dette semesteret i samarbeid med BIOCEED og Teach to Learn (TE2LE)-prosjektet laget en undervisningsvideo om beskriver hvordan laboratorieeksperimentet skal utføres og prinsippene bak metodikk og assays (https://teach2learn.w.uib.no/category/biolab/bio216-toxicology/). Både den nye læreboken og undervisningsvideoen beskrives i mer detalj nedenfor.

Undervisningsmateriell: Læreboka foreligger i papirutgave og formidles gjennom Akademia. Tilleggslitteratur, forelesningsnotater, samt supplerende litteratur ble gjort tilgjengelig elektronisk som pdf-filer via Canvas/MittUiB.

Lærebok: An introduction to toxicology” (Springer) av Philip C. Burcham. ISBN 978-1-4471-7256-7

Tilleggslitteratur: Kapittel 10 (Biomarkers) og kapittel 15 (Extrapolating from molecular interactions to consequent effects at the population levels) i Principles of Ecotoxicology, 3. utgåve, av C.H. Walker, S.P. Hopkin, R.M. Sibly, and D.B Peakall, Taylor & Francis, 2006. AMAP 2009, Arctic Pollution 2009. pp 83

Forelesningsnotater : PDF-filer over PPT-presentasjonene til foreleserne ble gjort tilgjengelige for studentene på MittUiB av emneansvarlig.

Kursstatistikk: 30 studenter søkte opptak til BIO216. 14 studenter møtte på første forelesning og registrerte seg til eksamen. Karaktefordeling (samlet endelig karakter):
A: 5
B: 5
C: 3
D: 0
E: 0
F: 1 (ikke møtt på avsluttende skriftlig eksamen og ikke gjennomført obligatoriske aktiviteter)

Undervisnings- og vurderingsformer: Som i 2017 ble det videreført virkemidler innen aktiv undervisning som ble først introdusert i emnet våren 2016 (se vedlegg). Dette inkluderer blant annet bruk av elektroniske responssystemer (PollEv) for å repetere sentrale elementer fra forelesningene, pair-share avbrudd for å få i gang diskusjoner og øke studentaktiviteten i timene, regneøvelser med felles gjennomgang på tavlen for å øke forståelsen og få alle "med", tematisk gruppearbeid med quiz på slutten av forelesningen, samt utførelsen av et organisert eksperiment i forelesningstiden for å illustrere og praktisk vise toksikologiske prinsipper og metoder hvor studentene selv deltar aktivt.

I BIO216 gis det skriftlige tilbakemeldinger (begrunnelse for karakteren) på prestasjonene til studentene gjennom semesteret. Dette inkluderer gjennomføringen/fremføringen av prosjektoppgaven, labjournalen, samt midtsemestereksamen. Vurderingen i BIO216 er på den måten til dels formativ ved at tilbakemeldingene åpner rom for justering av studentenes arbeidsmetoder og bevissthet for egen læring, samt at detaljnivået som kreves for å score godt i faget blir gjort kjent (f. eks. kan tilbakemeldingen på midtsemstereksamen gir en føring på hva som forventes av en besvarelse til den avsluttende eksamen).

Læringsutbytte til BIO216 (https://www.uib.no/emne/BIO216) ble gått gjennom på første forelesning. Undervisningsaktivitetene ble lagt opp for at læringutbyttene skulle oppnås. Per i dag er det ingen krav til forkunnskaper for å ta BIO216, men anbefalte emner blant BIO- og MOL-fag er oppgitt på BIO216 sin emneside hos UiB.

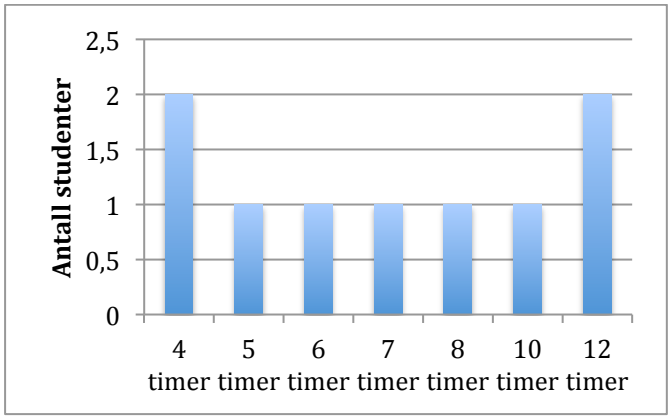
Rammevilkår: Tilgang til undervisningsrom, laboratoriefasiliteter og udervisningsassistanse var tilfredsstillende dette semesteret.

Studentevalueringer: Evalueringsskjema av emnet ble delt ut på siste forelesning dette semesteret, samt at det ble send ut til studentene på mail slik at de som ikke var tilstede kunne gi sin tilbakemelding. Av 14 studenter som var registrert til eksamen responderte 9 stk. På evalueringen. Evalueringsskjemaet var delt inn i tredeler; **1.** Om studenten; **2.** Evaluering av emnet; **3.** Evaluering av underviser. Det samlede resultatet fra evalueringsskjemaet er gitt under.

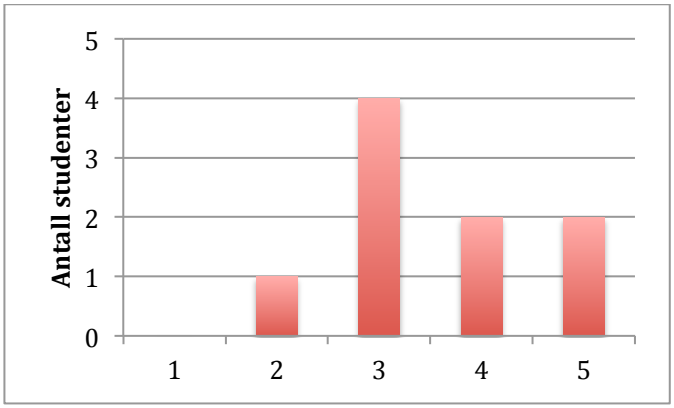
1. Om studenten

- Er du?
  - Bachelorstudent: 3 stk
  - Masterstudent: 5 stk
  - Annet: 1 integrert master (lektor utdanning)

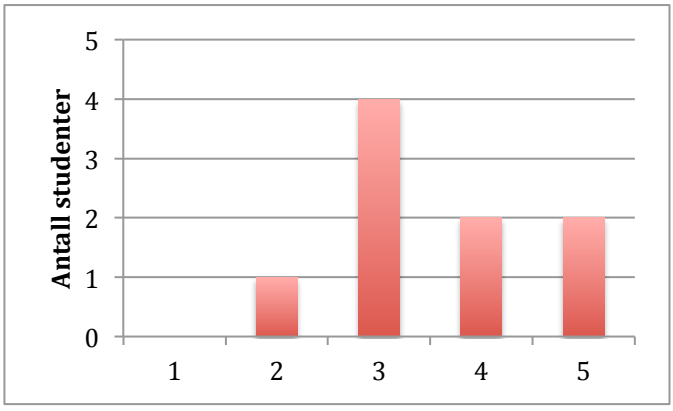
- Hvor mye gjennomsnittlig arbeidstid *per uke* har du brukt totalt på dette emnet (inkludert forelesninger, gruppeøvelser, lab/felt, egenstudier)?



- Hvor mye teoretisk kunnskap har du tilegnet deg på dette emnet? (1=ingen, 5=mye)



- Hvor mye praktisk kunnskap har du tilegnet deg på dette emnet? (1=ingen, 5=mye



2. Generell evaluering av emnet

Vurder disse påstandene:

	Veldig uenig	*Uenig*	*Nøytral*	*Enig*	*Veldig enig*	*Vet ikke*
Det var tydelige læringsmål for dette emnet	0	0	0	**5**	**4**	0
Det faglige innholdet stemte med læringsmålene	0	0	0	**2**	**6**	**1**
Det faglige innholdet var oppdatert og relevant	0	0	0	0	**8**	**1**
Det var lagt opp til passe mengde med lesing som egenarbeid i dette emnet	0	0	0	**3**	**5**	**1**
Det var lagt opp til passelig mengde skriving som egenarbeid i dette emnet	0	0	0	**3**	**5**	**1**
Emnet virker viktig for min utdanning	0	0	**1**	**3**	**5**	0

Vurder disse påstandene om pensum:

	Veldig uenig	*Uenig*	*Nøytral*	*Enig*	*Veldig enig*	*Vet ikke*
Pensum var aktuelt	0	0	**1**	**4**	**4**	0
Pensum var relevant	0	0	0	**4**	**5**	0
Mengden pensum var passelig	0	0	0	**5**	**4**	0

- Er du kjent med hva som er eksamensrelevant pesum i emnet?
    - Ja: 9
    - Nei: 0
    - Usikker: 0
- Hvor mye av pensum leste du?
    - Ingenting:
    - Mindre enn halvparten: 2
    - Ca halvparten: 2
    - Mer enn halvparten: 3
    - Alt: 2
- Hvilken karakter vil du gi dette emnet?
    - F:
    - E:
    - D:
    - C:
    - B: 6
    - A: 3

Hva likte du mest ved emnet? (kommentarer fra studenter)

-"Det at det ga meg grunnleggende forståelse av hvordan stoffer påvirker kroppen"
-"Bredt og aktuelt innhold om toksiner i dag. Mye bra fra gjesteforeleserne"
-"Praktisk info om arbeidslivet"
-"At det var variert og ulike måter å lære på"
-"Forelesningene og lab"
-Teorien, forelesningene, kollokvier"
-"Lab-arbeid, midtsemestereksamen, gruppeoppgaven. Mye variert undervisning"
-"Spennende og interessant fag"
-"Likte veldig godt faget. Fikk veldig smak for toksikologi. Kjekt med liten klasse.
-"Spennende å få besøk av ulike "fagfelt" innen toksikologi"
-"Veldig bra! Mye variert arbeid og forelesninger"
-"Skulle gjerne hatt flere kollokvier"
-"Jeg synes at emnet har vært veldig bra. Vi har hatt mange gode måter å lære på slik som fremføring, lab, bedroftsbesøk og gode forelesninger som har vært med på at det er mye man har lært"

Hva likte du minst ved emnet? (kommentarer fra studenter)

-"Pensumboka var avansert og veldig mye detaljert"
-"At det var mye å sette seg inn i og mye detaljer som er viktig"
-"Tok litt tid med rettinger"
-"Bredt og detaljert, mye som må læres om mye forskjellig"
-"Mange kjemiske uttrykk og stort krav til forståelse av kjemi"

Har du forslag til hvordan emnet kan forbedres? (kommentarer fra studenter)

-"Flere kollokvier og enda mer variasjon i læringen. OA var flinkest på dette"
-"Kanskje ikke legge midtsemestereksamen over en helg"
-"Egentlig ikke"

Evaluering av praktisk undervisning/øvelser (kommentarer fra studenter)

-"Lagt opp bra. God kommunikasjon mellom studenter og foreleser/veiledere."
-"Veldig bra – oversiktelig. God introduksjon (PP + video). Flinke assistenter"
-"Har gått fint. Forståelig. Fikk god hjelp"
-"Veldig bra!"
-"Meget bra og interessant"
-"Bra at fokuset ikke var mot lab-teknikker og mer mot det som faktisk ble gjort"
-"Jeg synes den praktiske undervisningen var god"

3. Evaluering av underviser(e)

	Aldri	*Noen ganger*	*Som oftest*	*Mesteparten av tiden*	*Alltid*
Fikk du klare svar på spørsmål du stilte til underviseren?	0	0	0	**4**	**5**
Var underviseren hensynsfull ovenfor deg?	0	0	0	**4**	**5**
Var undervisningen godt strukturert?	0	0	**1**	**4**	**4**
Viste underviseren engasjement for undervisningen?	0	0	**1**	**1**	**7**
Var underviseren en god formidler?	0	0	**1**	**3**	**5**

Kommentarer:

-"Flink. Engasjert. Lyttande"
-"OA var den mest varierte og dermed best. De besøkende kunne vært mer aktive med oss, ble lit mye avlesning av powerpoint"
-"Jeg er svært fornøyd med underviser"

Har du forslag til hvordan underviserne kan forbedre sin undervisning? (kommentarer fra studenter)

-"Nei, fortsett slik du gjorde det"
-"Stille mer spørsmål underveis. Mer quiz. 15 min på slutten forelesningene. Oppsummering"
-"Ha flere varierte aktiviteter. Quiz var amazing"
-"Bittelitt mer engasjement, men er ganske engasjert til forskjell fra resten av foreleserne på mol"
-"Ingen ting konkret. Ganske fornøyd"

Kommentar: I all hovedsak virker studentene å være godt fornøyd med gjennomføringen av BIO216. Fra studentevalueringen fremgår det at de aller fleste synes at kurset er faglig interessant og spennende, og at studentene setter pris på variasjonen i form av de ulike kursaktivitetene. Selv med en rekke ulike aktiviteter gjennom semesteret, betrakter studentene arbeidsmengden som tilfredsstillende og at det er en god struktur på kurset. Det kom opp et ønske om enda flere kollokvier og økt bruk av aktiv læring, som f. eks. Quizer i slutten av hver forelesning. Dette er absolutt noe som kan vurderes frem mot neste gang emnet skal undervises. Generelt scorer foreleserne godt når det gjelder tilbakemelding fra studentene, og det er også en positiv tilbakemelding når det gjelder å hente inn eksterne forelesere med spesifikk kompetanse. Med unntak av en kommentar, ble det ikke uttrykt noen misnøye ovenfor den nye læreboken fra studentenes side. Noen studenter tar opp at det er mange detaljer som må læres og forstås, samt at en viss bakgrunn i kjemi fra tidligere er fordelaktig. Majoriteten av studentene ser imidlertid ikke ut til å ha noen problem med dette. Det kan vurderes om man bør ha kjemi/biologi/mol som krav til forkunnskaper for å kunne ta emnet.

Fra studentevalueringen virker det også å være generell oppfatning om at det er et godt samsvar mellom innholdet i kurset og det som uttales som læringsmål og læringsutbytte.

Vurdering av lærebok: "An introduction to toxicology" (Springer) av Philip C. Burcham, ble forsøkt for første gang som lærebok i BIO216 dette semesteret. Boken er relativt lettlest og forklarer deler av toksikologifaget på god og enkel måte for nybegynnere. I forhold til den forrige læreboken er den største innvendingen at den ikke omhandler like mange temaer innen toksikologi, også temaer som er viktige og som er, og bør, være en del av pensum. Noe tilleggslitteratur i form av kapitler fra den gamle boken ble derfor gjort tilgjengelig på MittUiB og gått igjennom i mer detalj på forelesninger. Dette var spesielt aktuelt i forbindelse med enkelte av gjesteforeleserne hvor deres tematikk ikke ble dekket godt nok i den nye læreboka. Læreboka fremstår foreløpig derfor ikke som helt fullgodt alternativ som alenepensum, men den fungerer sammen med støttelitteratur. Denne læreboka blir derfor videreført i BIO216 fremover, men egnede alternative lærebøker vil også vurderes ved anledning.

Video i undervisningen: I tidligere evalueringer av BIO216 har studentene gitt tilbakemelding på at de ønsket å stille enda bedre forberedt til laboratoriekurset. Det har tidligere i forkant av selve laboratorieoppgaven blitt gitt en egen kort presentasjon av bakgrunn, metoder og prinsipper bak forsøkene. Det er tidligere vist at uforberedte studenter ikke lærer så mye som de burde fra feltarbeid og laboratoriekurs dersom de stiller uforberedt. Samtidig kan undervisningsvideoer gjøre at foreleser unngår å måtte forklare det samme gjentatte ganger til forskjellige studenter. Dette semesteret ble det i tillegg til en felles gjennomgang i forkant av laboratorieøvelsen i samarbeid med TE2LE (BIOCEED) laget en video som detaljert beskriver og demonstrerer forsøkene studentene skal utføre og forklarer samtidig prinsippene bak observasjonene som skal gjøres (https://teach2learn.w.uib.no/category/biolab/bio216-toxicology/). Studentene ble pålagt å se videoen før labkurset, og måtte via MittUiB svare på noen spørsmål fra videoen for å bekrefte at dette var gjort. Den umiddelbare tilbakemeldingen fra studentene indikerer at dette var vellykket og informativt, og var til hjelp for studentene til å forberede seg til undervisningen. En grundigere undersøkelse av effekten av bruk av video i BIO216 undervisningen ble gjort av Anne-Laure Simonelli (BIOCEED) og skal inngå i en publikasjon, men de endelige resultatene fra disse undersøkelsene foreligger ikke da denne emneevalueringen ble skrevet.

Samlet vurdering: I all hovedsak virker studentene fornøyd med gjennomføringen av BIO216 våren 2018. Virkemidler innen aktiv undervisning som ble introdusert tidligere ble videreført dette semesteret, i tillegg til at bruk av video ble utprøvd i undervisningen i forbindelse med forberedelsene til laboratoriekurset. De foreløpige tilbakemeldingene fra studentene tyder på at dette var til god hjelp, og vil videreføres neste semester. En mer detaljert undersøkelse av effekten av dette vil bli vurdert og presentert i en egen undersøkelse (Anne-Laure Simonelli). Skifte av lærebok virker å bli tatt godt imot fra studentene sin side, men siden den har noen mangler i forhold til hva som er pensum holdes muligheten åpen for å gjøre forandringer på læreboken også i fremtiden. Dette for å unngå for mye bruk av tilleggspensum. Det nåværende undervisningsopplegget for BIO216 vil bli videreført i 2019. Det vil imidlertid bli vurdert om enda flere elementer av aktiv undervisning skal introduseres i kurset, blant annet mer utstrakt bruk digitale responssystemer for oppsummere og trekke sammen viktige deler av pensum, samt å fremme mer diskusjoner omkring relevante temaer i klasserommet.

Odd André Karlsen, førsteamanuensis
Emneansvarlig

Introducing active learning strategies in toxicology teaching

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1. Introduction

In the traditional lecture, the students are passive receivers of information that is communicated by the lecturer (Walczyk and Ramsey 2003). However, accumulating evidence from the last decades of pedagogical research strongly suggest that this classical approach for learning is not very effective and do not stimulate for deeper learning and understanding (Felder, Woods et al. 2000, Prince 2004, Michael 2006). On the other hand, by introducing active learning strategies into the classroom where the students themselves are engaged in the learning process during class time, it has been shown that the retention of the material increases, the students become more motivated, and develop their skills in both thinking and writing (Freeman, Eddy et al. 2014). Furthermore, when a student catches interest in a subject, it is likely that this promotes self-motivation and self-regulation. When this is combined with the ability to be proactive and reflective, the student is also more likely to acquire deep knowledge and develop advanced analytical skills.

Although the term "active learning" is interpreted differently in the literature, it is in general defined as an instructional approach that both includes and engages students in the learning process (Bonwell and Eison 1991). This includes the introduction of activities such as class discussions, think-pair-share discussions, "clicker questions", problem-based learning, peer-learning, and Socratic dialog, but does not refer to traditional activities like homework (Lyman 1992, Crouch and Mazur 2001, Bruff 2009).

BIO216 is a 10-credit toxicology course lectured at the University of Bergen (http://www.uib.no/emne/BIO216). It encompasses several aspects regarding toxicology, such as historical perspectives, absorption, distribution, and secretion of toxic compounds, biotransformation of xenobiotics, toxicant induced carcinogenesis, organ toxicology, toxicity testing, and risk assessment. The course includes various learning activities besides lecturing, including a lab course, colloquiums, graded project assignments with oral presentations, and company visits.

However, the lectures have traditionally been given in a conventional approach, i.e. the students are passive recipients of information. In order to promote an active learning environment and stimulate to student engagement and deeper learning also in the classroom, several active learning strategies were explored during the spring semester 2016. This report describes the learning activities that were introduced, and present reflections from the lecturer upon the experiences from these activities in light of student responses obtained from a questionnaire after the course ended.

2. Class setting and active learning strategies

BIO216 is usually lectured in a rather small class with a typical number of students between 10 and 25. It is assumed that active learning is particularly beneficial for small classes, and BIO216 should therefore be a well-suited course for implementing active learning strategies (Freeman, Eddy et al. 2014). In the spring semester 2016, 19 students were signed up for the course. The educational backgrounds of the students were mixed, but most of them were bachelor students in biology, molecular biology, pharmacology, or nano-technology, with no or very little experience within the field of toxicology. The active learning activities that were introduced in BIO216 were think-pair-share discussions, use of digital response systems, a collective calculation exercise during class, thematic groupwork with oral presentations, and an organized lab-experiment during classroom teaching for illustrating toxicological principles.

2.1 Think-pair-share discussions

Lyman introduced think-pair-share as an active cooperative learning technique in 1981 (Lyman 1981). It is a three-step process where in the first step the students individually, and for a limited amount of time, reflect about a question or problem given by the lecturer. After organizing their thoughts, they move on to the next step where they discuss their answers in pairs. In the final step, the students share their answers with the whole class. This learning technique gives the students the opportunity to identify what they know and, importantly, what they do not know. Furthermore, it stimulates to interaction between the lecturer and the students, and the students can reflect on their own ideas in a very active manner. Working in pairs can also reduce stress and anxiety students may have when it comes to answering questions posed by the lecturer (Wichadee 2010). An example of a think-pair-share question that was used in the BIO216 course is: “What is the endocrine system, and how does an endocrine disruptor act?”

2.2 Digital response systems

Electronic response systems are technology that promotes and implement active

learning by interactivity (Bruff 2009). More specifically, it is software and hardware systems that provide an interface where students can submit answers to questions via a transmitter, such as a smartphone or a laptop, or a dedicated "clicker". It allows students to anonymously commit to instructor-posed questions during class, and provides immediate feedback to both the instructor and the students. Several reports suggest that electronic response systems promote a more dynamic and interactive classroom, and importantly, may stimulate to an increase in student attendance, participation, and learning outcome (Fies and Marshall 2006, Caldwell 2007). One version of electronic response systems is Poll Everywhere, which has a free-to-use open license for up to 25 responses per poll that is created. Poll Everywhere was used in an integrated manner with PowerPoint, and students used their smartphones for answering the polls. Usually, such systems are implemented in larger classes than BIO216, but also positive results in smaller classrooms have been documented (Draper 2002). Multiple-choice polls for emphasizing important parts of the curriculum were used frequently throughout the semester, and each poll included 5 to 10 questions.

2.3 Exercises during the class (individual exercise)

Another mean of active learning that was introduced, was a calculation exercise given to the students during class. This exercise was part of the curriculum that dealt with toxicokinetics, and specifically, different calculations should be performed around an example where a person had consumed a significant amount of windshield washer fluid. The students were left to work with the different calculations individually, and provided sufficient time to reflect about the questions and attempt to identify the approach to solve them. Some clues and necessary mathematical formulas used in toxicokinetics were provided on a slide together with the exercise, and the students were allowed to ask questions when struggling or needing some hints to move on. After approximately 30 minutes, the exercises were solved on the blackboard in plenary and the students were encouraged to volunteer (no one was forced) to come up and demonstrate their approach for reaching their answers. It is assumed that the act of solving exercises forces students to engage and learn the material, and by going through the exercises together, it increases the chance for the students to absorb the curriculum and possibly obtain a more comprehensive understanding of the material presented in the lecture.

2.4. Group work with presentations (cooperative learning)

Group work can be an effective method to motivate students, encourage active learning, and develop their skills in critical-thinking, communication, and decision-

making (Jaques 2000). Furthermore, through peer-instruction, students are able to teach each other by clarifying misconceptions and addressing misunderstandings. Students were in this case randomly put together in groups consisting of three students per group. The groups were then given different subjects within organ toxicology, such as toxicology of the heart, the kidneys, the liver, and so on. The group´s tasks were to find information covering some specific areas within their assigned organ, such as cell types, toxicants, and toxicological responses. These keywords were given by the lecturer and should be specifically addressed by the groups. After working in groups in the first half of the lecture, all groups presented their findings as a PowerPoint presentation to the class during the second half of the lecture.

2.5. Classroom experiments

Classroom experiments are activities were students work in groups, or individually, and collect data through interaction with typical laboratory materials and data simulation tools, combined with a series of questions that lead to discovery-based learning. In contrast to a classroom demonstration, the students themselves are involved in collecting data or observations. Classroom experiments can help the students learn more about the material they are studying by testing hypothesis derived from the material contained in the course curriculum (Farrell, Moog et al. 1999). The lecturer can act as a facilitator by asking leading questions and draw attention to interesting results, but it is important that the students make their own predictions and reflect upon their observations. In the BIO216 course, an imaginary situation within ecotoxicology was made up by the lecturer, but communicated to the students as a true case. The case was as follows: Male Atlantic cods were recently sampled from different locations in the Bergen area, i.e. from Store Lungegårdsvann, Øygarden, and Askøy. Store Lungegårdsvann is a highly polluted area containing quite large amounts of legacy contaminants, such as PCBs. Øygarden is considered to be far less polluted, and may be considered as a reference site. The fish sampled from Askøy were caught close to a sewage drain. The research-question was if the fish that were caught in these locations were exposed to pollutants that acted as endocrine disruptors. To answer this, students were divided into groups, and pipettes, tubes with cod plasma, and a “dipstick” (almost like a pregnancy test) were handed out. The “dipstick” is used for detecting the presence of a protein called vitellogenin in fish plasma. Vitellogenin is normally not present in male fish, but when exposed to estrogenic compounds (endocrine disruptors), the production of vitellogenin can be initiated through activation of the estrogen receptor, leading to egg production and feminization in males, which can have devastating effect on fish populations. Before the practical

part of the exercise was performed, the students were given time to make predictions of what they expected to find based on the locations for fish sampling. The results and observations made by the different groups were discussed in plenary, and the molecular mechanisms and principles behind their observations were described in detail.

3. Reflections on the experience with active learning strategies

After the BIO216 course ended in spring 2016, a web survey about the course (course evaluation) was emailed to the attending students. Several questions regarding the active learning strategies were included in the survey, and some of the reflections made by the students, and the lecturer, are presented here. Of 19 students that followed the course, 9 students responded to the web survey (the full version of the course evaluation can be found at (https://kvalitetsbasen.app.uib.no).

3.1 Think-pair-share discussions

Eight out of nine students responded that their engagement increased during the lecture with the think-pair-share activity. Two of the students also commented that they prefer the discussion with another student before answering, avoiding the anxiety that can occur when the lecturer points directly at someone. This is also in agreement with other reports stating that cooperative learning approaches can reduce learning anxiety (Wichadee 2010). Five of the students also reported that this activity increased their learning outcome, where one of these students emphasized that the best way to learn is to discuss the curriculum with others, because then you have to structure and express the material yourself. As the lecturer, I enjoyed this activity because it was a very nice tool for making the students talk, both to fellow students and to the lecturer. It has previously been reviewed in the literature that cooperative learning promotes a friendly teaching/learning atmosphere, which I think also was the case for this course (Johnson, Johnson et al. 1998). Think-pair-share discussions worked also as a nice break during the lecture, and with the correct questions it is possible to emphasize important parts of the curriculum, and with easy means engage the students in the material that is lectured.

3.2 Digital-response systems

Nine out of nine students answered that their engagement and activity increased with the use of Poll Everywhere. However, only four of the students thought that this activity increased their learning. Possible reasons for this, which also was pointed out by some of the students, may be related to distractions resulting from some technical issues and that the correct answers to the quizzes were not sufficiently explained. It was also mentioned in the survey that in such a small class as in the BIO216 course, it

could be more beneficial to rather have open discussions covering the same questions as presented in the quiz. This is a good point, but it is also possible to couple digital-response technology to other active learning approaches, such as classroom experiments or cooperative learning, providing many opportunities for combining teaching pedagogies. Among the positive experiences noted by the students was that the curriculum is memorized well when you are allowed to reflect upon different questions. Importantly, the course evaluation provided constructive feedback from the students that may help to improve the learning outcome when using digital response systems. One of these suggestions was to further extend the use of such systems and present a quiz in every lecture that repeat, refresh, and emphasize the most important parts of the curriculum.

3.3 Calculation exercise

The majority of the students replied that the calculation exercise performed during the lecture improved both their activity and their learning outcome. There was also positive feedback regarding this exercise since it demonstrated the use of mathematics in toxicology and how mathematics can be used to something useful (as expressed by a student). One of the students commented that he/she would have appreciated more time for solving the exercises. One alternative would be to hand out the exercises beforehand so the students have more time to prepare for this activity. Furthermore, the lecturer noticed some reluctance among students in volunteering to demonstrate how they solved the exercise in front of the other students. To reduce the anxiety, maybe it would be better to promote a cooperative learning situation by organizing the students into pairs and make the students explain their strategies to each other. The session can be ended with the lecturer going through the exercises on the blackboard with input and suggestions from the students.

3.4 Group work with presentations

Near all students responded that the group work increased their activity in the lecture. However, only 50% of the students that responded to the survey replied that this activity increased their learning outcome. Notably, group work was the exercise where this lecturer was least satisfied with the implementation of the active learning activity. The activity could probably be significantly improved by e.g. being more specific about what type of information that should be gathered and presented to the other students. This can be achieved by preparing an even more detailed template for the student presentations, assuring that the essential parts of the curriculum are covered. It may also be beneficial to hand out the group exercise in some time beforehand, so the students have more time to research information and prepare more

informative presentations. Some of the students also reported that they struggled to comprehend the other student presentations, and that many students appeared to be more focused on working with their own presentation rather than listening to the others. However, numerous reports exist where the benefits of cooperative learning have been demonstrated, especially with regard to reasoning and critical thinking skills (Johnson and Johnson 1989). Thus, more careful design of this activity could possibly enhance its usability in the BIO216 course. Among the positive feedbacks was that this activity was a good arena for practicing presentation skills.

3.5 Classroom experiment

As reflected in the course survey, the students appreciated and welcomed the practical experiment that was performed during class. All students were activated, and everyone reported that the exercise increased their learning outcome (while having fun at the same time). This activity can be categorized as learning by doing, and the impression is that this practical exercise significantly enhanced the students' willingness to learn and increased their understanding of how biomarkers can be used to trace effects of environmental pollutants. However, the lecturer made one mistake during this exercise. Never(!) unveil for the students that the story and the exercise they were introduced to were just a fabrication (preferably not even after the exercise is finished). Their engagement persists much longer when they strongly believe that they have contributed to an important discovery.

4. Concluding remarks

This was the first time this author introduced active learning strategies in classroom teaching of toxicology. Different activities were implemented, including think-pair-share discussions, use of digital response systems, a calculation exercise during class, thematic group work with oral presentations, and an organized lab-experiment during classroom teaching. As revealed by the course survey, the overall response from the students in this course was very positive. Students appreciated the variety in how the curriculum was lectured and reported that the introduced activities increased their participation and their activity during the lectures. Furthermore, the impression of the lecturer is that the added engagement during class also increased their motivation to learn, which should facilitate higher learning, better retention of the material, and the development of advanced analytical skills. Among the different activities that were tested, especially the think-pair-share and the classroom experiment stand out as valuable tools for both activating and motivating the students in a small class. Active learning strategies will be further developed and used in future toxicology

teaching in BIO216. In this regard, the fashion for obtaining the student´s evaluations of the different learning activities must be reconsidered. The student responses presented in this report are based on a questionnaire that was distributed to the students after the course had ended. Only 50% of the students responded to this survey, which of course could introduce a bias when assessing such evaluations. A possible approach could be to organize separate evaluations of the different activities at the end of each lecture (or in the beginning of the next lecture) to assure that as many students as possible respond to the survey, also while they still have in mind a clear impression of the activity as well.

5. References

Bonwell, C. C. and J. J. Eison (1991). Active learning: Creating excitement in the classroom. ASHE-ERIC Higher Education Report No. 1. Washington, DC.

Bruff, F. (2009). Teaching with classroom response systems: Creative active learning environments. San Francisco, CA, Jossey-Bass.

Caldwell, J. E. (2007). "Clickers in the large classroom: Current research and best-practice tips." Life Sciences Education **6**(1): 9-20.

Crouch, C. H. and E. Mazur (2001). "Peer Instruction: Ten years of experience and results." American Journal of Physics **69**(9): 970-977.

Draper, S. W. (2002). "Evaluating effective use of PRS: results of the evaluation of the use of PRS in Glasgow University, October 2001-June 2002." (accessed 27 February 2010), from http://www.psy.gla.ac.uk/~steve/ilig/interim.html

Farrell, J. J., R. S. Moog and J. N. Spencer (1999). "A guided inquiry General Chemistry course." Journal of Chemical Education **76**(4): 570-574.

Felder, R., D. Woods, J. Stice and A. Rugarcia (2000). "The future of engineering education: II. Teaching methods that work." Chemical Engineering Education **34**: 26-39.

Fies, C. and J. Marshall (2006). "Classroom response systems: A review of the literature." Journal of Science Education and Technology **15**(1): 101-109.

Freeman, S., S. L. Eddy, M. McDonough, M. K. Smith, N. Okoroafor, H. Jordt and M. P. Wenderoth (2014). "Active learning increases student performance in science, engineering, and mathematics." Proceedings of the National Academy of Sciences of the United States of America **111**(23): 8410-8415.

Jaques, D. (2000). Learning in Groups: A Handbook for Improving Group Work, 3rd ed. London, Kogan Page.

Johnson, D. W. and R. T. Johnson (1989). Cooperation and Competition: Theory and Research, Interaction Book Company Edina.

Johnson, D. W., R. T. Johnson and K. A. Smith (1998). "Cooperative Learning Returns to College: What Evidence Is There that it Works?" Change **20**(4): 26-35.

Lyman, F. (1981). The Responsive Classroom Discussion. Mainstreaming Digest. University of Maryland, College Park, MD.

Lyman, F. (1992). Think-Pair-Share, Thinktrix, Thinklinks, and Weird Facts: An interactive system for cooperative thinking. Enhancing thinking through cooperative learning. N. Davidson and T. Worsham. New York, Teachers College Press**:** 169-181.

Michael, J. (2006). "Where's the evidence that active learning works?" Advances in Physiology Education **30**(4): 159-167.

Prince, M. (2004). "Does active learning work? A review of the research." Journal of Engineering Education **93**(3): 223-231.

Walczyk, J. J. and L. L. Ramsey (2003). "Use of learner-centered instruction in college science and mathematics classrooms." Journal of Research in Science Teaching **40**(6): 566-584.

Wichadee, S. (2010). "Cooperative Learning Approach: A Successful Way of Reducing Learning Anxiety in an EFL Class." International Journal of Education **33**(3): 3-7.

Report on BIO300A, Autumn 2018

This is a summary of the BIO300A course Academic writing, during autumn 2018. We first describe the course design (Appendix 1), the learning activities and the assessment, and our own and the student's interpretations (Appendix 2 and 3) about what worked or not, including some thoughts on how to change the course next time.

Course responsible: Florian Berg and Øyvind Fiksen

Teaching assistants: Sissel Norland, Rebecca Marie Ellul, Heidi Kristina Meyer; Patrik Tang; Hilde Strand Dybevik; Martine Røysted Solås

The course design. We redesigned the course from earlier versions, and developed new learning outcomes:

After completing the course, you should be able to:

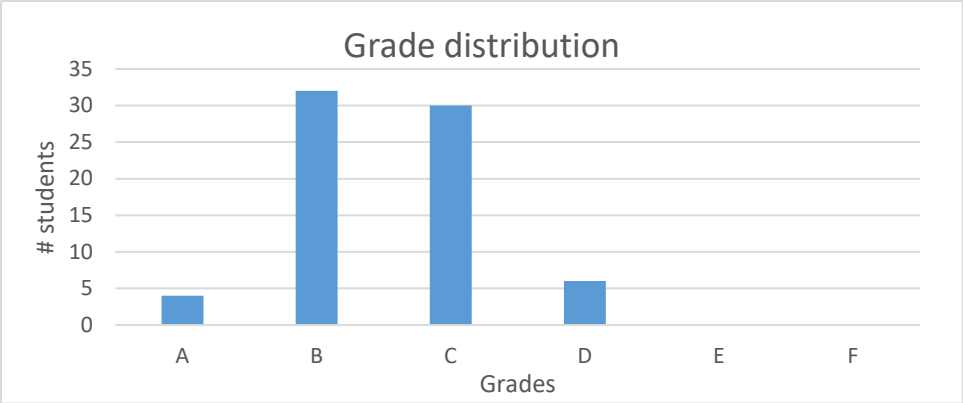
1. plan and carry out all stages of your own MSc research project
2. present their research results effectively in an oral presentation
3. write up their own research projects in a thesis or article format
4. draw conclusions from results (e.g. graphs of data)

We attach a detailed overview of the course activities and schedule below (Appendix 1, Outline BIO300A). The main elements are summarized here:

Learning activity	**#**	**Time factor**	**Hours**	**Grading weight**
Class meetings	14	2,0	28	
Group report	1	34,0	34	30,0%
Field work	1	8,0	8	
Term paper	1	40,00	40	40,0%
Peer review	2	5,0	10	15,0%
Presentation	1	10,0	10	15,0%

In total			**130**	**100,0%**

The assessment led to this final grading pattern:



What did we do? How did it go?

We started out in late August by going through the course plan and divide students into groups, and introduced them to writing the section Materials and methods in a thesis. The groups were sorted by study direction, with 4-5 students in each. Then we let the groups out to find data for their report, from publically available databases. Some collected their own data during other courses (marine biologists, microbiology). We had a long period early in the course when students focused on the course in statistics and R (BIO300B). We encouraged the students to use and analyse in this course, but we did not provide a plan for this, and our impression was that the two courses did not connect very well.

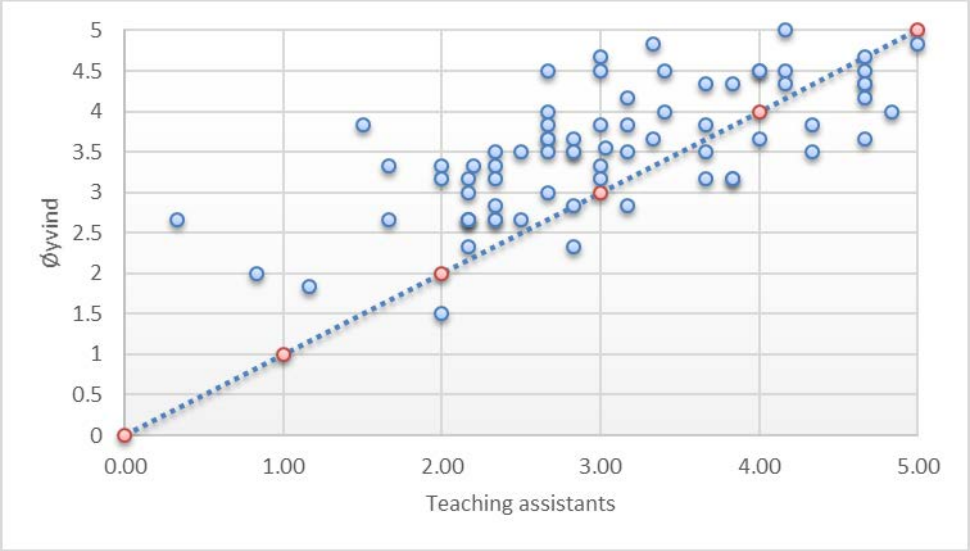
In the first place, we underestimated the struggle students would have in defining their own research question and further collect appropriate data to answer this question. All groups were assigned to one teaching assistant who should assist them with writing up their group report. Even though, background information on essential aspects for the “Material & Methods” as well as “Results” part of a scientific report were provided via lectures, most student groups struggled to meet the basic criteria. These problems might arise due to the large break of 6 week between the two introductory lectures and the following lectures on “How to write results”. For the next year, the plan should be to have more regular lectures and focus more on the essential parts, rather than given a large overview. In addition, the connection between BIO300A and 300B needs to be re-evaluated.

We met the students again in late October, and then had a series of lectures on academic writing, IMRAD, scientific process, finding and using scientific literature, supervision, science-policy interface and similar. We had not aligned these lectures with any assessment activity or exams, assuming that master students would attend the classes despite the absence of relevance to assessment. However, these lectures were quickly abandoned by the students, and soon only about 10-20 students out of 85 showed up. In the evaluation form, students point at the early morning lecture time as one possible reason for this, but given that other courses with 08:15 lectures do not experience the same, we suspect the lack of relevance to grading is the main explanation.

The other main activity was an individual written assignment, as training in writing an introduction to a thesis, of 2-3000 words in total. The students could choose their topic, and were encouraged to use their thesis-topic to save total workload. However, few had planned a specific topic within the time limit. Still, our impression was that this did trigger some more

thinking about where they were heading for the master project. The term paper was uploaded to MittUiB, and then redistributed for peer review by two students, then a comment by one TA and the teacher in the end. Both the introductions and the peer-reviews were quite good, and this seems to be an efficient way to get massive feedback from others. We should have included a revision process as well, but it is quite intensive both to the students and the teachers with the time this takes as it is.

All of the term papers was assessed and scored by Øyvind Fiksen, but TA's were asked to score the text they commented as well, independently, as a check on the reproducibility of the assessment. Here are the data that emerged from this:



The line in this diagram represent the target where assessments made by different teachers are equal. Clearly, the teacher (Øyvind) provides higher scores than the TA's (more points above the line), but there is a clear correlation in the assessment. Some individual differences between the TAs were also evident in the data (not shown).

What should we do differently next time?

The feedback from the students are generally positive, but many pointing out that the course is intensive for 5 ECTS. Possibly is the group project and the written assignment underestimated in our time-estimates, especially since students struggled to make use of their own master projects for the writing. Here are some ideas for next time/future courses:

1) Reduce the length of the term paper to maximum 1000 words, and let it be only introduction.
2) Reduce the peer-review and presentation part to count 10% each, the term paper to 30% and then have 20% left to a few short assignment connected to the lecturing. For instance, short specific writing exercises to be handed in, and an assignment about science, supervision, master project, or other issues that is treated in there. Alternatively, some individual/team scratch-card quizzes in class that count a small fraction of the final grade.
3) Work with bioWrite and bioST@AT to develop relevant resources. Focus more on descriptive statistics, developing good figures, and less on statistical hypothesis testing?

4) Integrate better with BIO300B, have a dedicated BIO300B-component directed towards the data presentation and analysis that is part of BIO300A. Spread the lectures in both courses over a longer period in time to make it possible.
5) Alternatively – take the whole group out of town for 1-3 days and dropping the lectures? A more intense and social event that covers it all? This requires some funding and organization. Or just three full day seminars – with student activities included, distributed over the semester, including pizza or lunch? This could be combined with some group activities/tutorials where students meet before they submit smaller assignments like rewriting a poorly written piece of text, plot a figure of data and figure text, write an abstract etc. – possibly connected to the report assignment?
6) Make one single report with all elements in place? One possibility is that students write an individual introduction and discussion, and a group MM and results - all on the same topic. First, the groups have to decide on a question, then they can write an introduction individually, find the data, develop a joint MM and results section, and finally an individual discussion. This model reduce the free rider problem. The peer review could be done on a draft version, with a possibility to revise and reply to comments, before the final version is delivered for assessment. This require an early decision on topic, and streamlining of data, so that the report is ready in time for peer review and revision.
7) We need to train students in group work, and emphasise the importance of this skill. Perhaps will we also be allowed to let students assess each other's contribution to the group activity? Maybe we should give students active roles in the group also, have one group leader, the lead author of the report. A challenge here is that teachers need to strengthen our knowledge in cooperative learning – but our ambition of making teamwork an integral part of BIO300A remains.
8) We noticed that students in general had gaps in their it-competence related to interactions with the UiB resources. For instance, many did not seem to know that they had access to servers with regular backup through their student login, or that the UiB resources could be accessed with VPN connection. We need to make sure that all students are aware of this, and include a module in MittUiB with all necessary information.

Suggestions from one of the TA's.

1. I think it is super important for them to learn how to write an intro and conclusion, but perhaps instead of splitting the group report and individual essay, combine them so they only have one big assignment rather than 2 and they can get the experience from writing a whole report rather than the disjunction. This was one of the biggest comments I had when I met with all of my groups. That and the fact that there was a disproportionate amount of work between group members, but none of them wanted to 'publically' mark down who did not contribute enough during the process (in the order of the co-author list) on hand-in. I understand it is important for them to learn how to work in groups since that will happen in their career, but I think the assignments should be combined to one big assignment in more of the AIMRD style, either as a group or an individual report instead of having the two assignments. Then peer-review process could be longer and we could have two/three days for presentation/poster session rather than just one half-day.

2. The students are already complaining that there is too much workload, adding more short assignments is not going to help, even if you reduce the word limit. I do think it could be useful to have short assignments based on lectures though, but instead of them handing it in to us to grade, make it more of a discussion activity on mittuib where we have like three discussion points people can participate in each week or every other week based on the lectures and the students have to comment on at least one of them. I did this during my bachelor's degree for a few of my classes, and it was a good way to get students involved and to pay attention. Or have short quizzes at the end of the lecture and the students would only be able to miss like 3 or 5 of the lectures (depending on how long they are).

3. There really should be a tie-in point between BIO300B and BIO300A, but it should also be emphasized to the students that they do not have to actually use R for their stats, just a suitable statistical program.

4. I am not sure how a 1-3 day trip out of town will really help? Unless they all collect their data/work on their project together then.

BIO 300 autumn 2018

Aim and content

The course aims to give students the knowledge needed to plan a basic scientific study, carry out appropriate statistical analyses, interpret results and report these in written and oral formats. The course is an introduction to the formulation of hypotheses, design of research projects, and scientific writing. Students will get practice with scientific reporting through keeping a record of methods and results based on their own field project data sets.

Learning outcomes

After completing the course, you should be able to:

1. plan and carry out all stages of your own MSc research project
2. present your research results effectively
3. write up your own research projects in a thesis or article format
4. draw conclusions from results (e.g. graphs of data)

General info

First meeting: Thursday 16th of August, 12:15. Thormøhlens gate 51 (VilVite), Auditorium. At VilVite, two stairs up.

Class activity: We prefer student-active learning, and the time in class include much group discussions, and some tutorials related to the group assignments and projects. You will only encounter a few traditional lectures. It is more engaging and fun to talk and discuss with others than to just sit and listen, and you learn and remember more. Therefore, attend classes and prepare for it.

Work in groups: At the beginning of the semester, we split all of you into groups of 4-6 students. You work in these groups throughout the course, in class and within the group projects. Parts of the class activities are preparations for the projects, and you can work with the projects in some of the class time, with supervision from the teachers and teaching assistants. Working with others is an important skill. In fact, employers are looking for collaborative employees, and your ability to function within a group is a key success factor in academic life.

Teachers: Florian Berg (post doc, course leader) and Øyvind Fiksen (professor, course leader).

Required reading: We use no specific textbook for this course. However, we recommend looking into library web pages for some general writing advice (e.g. “Guides to Better Science” by the British ecological Society, or the “Ten Simple Rules” series published by PLOS Computational Biology. In addition, you are going to read several scientific articles during the course.

Workload & assessment

Assessment: Various individual and group assignments. See the table below for more details. We provide the exact criteria and rubrics for all assessment activities as the course progresses, on MittUiB.

Workload: Approximately 130 hours is the standard workload for 5 ECTS. The table below specifies the estimated workload on each learning activity, and its particular weight in the final assessment.

Learning activity	**#**	**Time factor**	**Hours**	**Grading weight**
Class meetings	14	2,0	28	
Group report	1	34,0	34	30,0%
Field work	1	8,0	8	
Term paper	1	40,00	40	40,0%
Peer-review	1	10,0	10	15,0%
Presentation	1	10,0	10	15,0%

In total			**130**	**100,0%**

Learning activities and outcomes

Class meetings/lectures: We will meet regularly and work our way through the course content. You find the schedule for these meetings in the table below. We announce changes or deviations at MittUiB, so make sure you follow the information there.

A central goal of the course is to learn to 'think, read and write critical' in a scientific world. In the written assignments and presentation, you have to demonstrate this knowledge, and during class meetings, we will prepare for it through organized group discussions and tutorials.

Learning outcomes developed here: 1, 2, 3, 4.

Group work: The group work involves planning and conducting your own research/field project. The main goal for this is to conduct the fieldwork and to present you results in an efficient way, both written and oral. For the group work and report, each group will be assigned to one teaching assistant who will help you during the semester.

Learning outcomes: 1, 2.

Term paper and peer-review: You also get training in writing a scholarly text on a scientific biological issue. There will be two options to choose the topic for the term paper: (1) your own master project or (2) we will provide you data. Start thinking about a theme early – you can suggest a theme in MittUiB and receive comments and suggestions from the teachers until 25th of October, which is the deadline to decide on a topic.

You also have to read and comment on two another student assignment (peer-review). This peer-review is part of the final grading (15%). In addition, you will receive comments and feedback from other students and the teachers on your own assignment. Revising these comments is optional, but can be beneficial.

One of the core academic values and an inherent element of a scholarly text is to give credits to your sources and earlier work, and to be able to separate own contributions from others. We routinely check all assignments for plagiarism. Remember, plagiarism includes copying text (including translating) word by word from other sources, even if you refer to them. The art of the game is to write well referenced, but *independent* texts – where you develop your own perspective on the topic.

Learning outcomes: 3, 4.

Detailed work plan BIO300 2018:

Week	Date Time	Who	Theme	Place
33	16.08 12:15	FB	Introduction. Forming groups. Learning activities.	VilVite aud.
33	17.08 12:15	FB	Writing I: Material and methods	VilVite aud.
34-41	20.08 12.10	ST	Fieldwork	
43	22.10 08:15		Writing II: Results	VilVite aud.
43	23.10 12:00	ST	Submission I: Material and methods to TAs	
43	25.10 08:15		Writing III: Introduction	VilVite aud.
43	25.10 12:00	ST	Deadline topic selection "Term paper"	
43	26.10 16:00	TA	Feedback I: Material and methods from TAs	
44	29.10 08:15	FB	Plagiarism	VilVite aud.
44	30.10 12:00	ST	Submission II: Results to TAs	
44	01.11 08:15		Critical reading I	VilVite aud.
44	02.11 16:00	TA	Feedback II: Results from TAs	
45	05.11 08:15	HF	How to cite: using the right references	VilVite aud.
45	08.11 08:15	ØF	Writing IV: Discussion	VilVite aud.
45	09.11 16:00	ST	Submission III: Final report	
46	12.11 08:15	VV	Scientific misconduct: What is it, why does it matter & how do we deal with it?	VilVite aud.
46	15.11 08:15		Critical reading II	VilVite aud.
47	19.11 08:15	FB	What is peer-review?	VilVite aud.
47	22.11 08:15		How to present: Presentation vs. poster? Or something else?	VilVite aud.
47	23.11 16:00	ST	Submission IV: Term paper for peer-review	
48	26.11 08:15	VV	How to be successful supervised!	VilVite aud.
48	29.11 08:15		Open session	VilVite aud.
48	30.11 16:00	ST	Feedback III: Review of term paper	
49	07.12 08:15	ST	Final presentations	HiB – Stort aud.
49	07.12 18:00	ST	Submission V: Response letter to review	

FB = Florian Berg
ST = Students
HF = Hege Folkestad
ØF = Øyvind Fiksen
TA = Teaching assistant
VV = Vigdis Vandvik

Lecture
Optional
Mandatory

Appendix 2. Feedback from students after the course

What did you expect to learn from this course before you started? What generic skills did you think you needed to do your Master project and thesis?	What I liked about the course	Things that should be changed or improved	We included a series of lectures as part of the course, mainly on topics that should make it easier for you to succeed in writing your thesis. However, we had very low attendance. Our colleagues tell us to make these lectures mandatory, because now they have to give all this information to you one by one. What was the main reasons for not attending? Anything (besides making it mandatory) we could have done to increase attendance?
I expected to get a brief introduction to academic writing and reading. These skills were required mostly before this course, and not during or after it.	I liked the individual assignment and the feedback/review process	My grade was severely affected by the group report. My group suffered from several students "not bothering" to work continously through the semester. The group was disfunctional, though i tried to gather the other group memebers for sessions, it was impossible. The group task suffered severely from this and it affected my grade towards the final grade.	Decrease number of lectures or attendance based work. that would litterally solve your problem. I think students attended the amount they felt they could without it getting in the way of other subjects. This course had far too much going on, it seemed unstructured and messy at times.
I think that the name of the course is completely inappropriate and in the description of the course, it is little explained that the main scope of the course is literally how to write a scientific paper, peer-review and make a presentation/poster.	1) the course touched topics that personally I've never heard before. Lectures like the process of peer reviewing, ethic, critical reading, and scientific methods were all very useful. These are topic that no one ever talks about in an informative way, but that are super important in the everyday life of a researcher. 2) I liked how different professors/people were involved in giving lectures. 3) I liked how the professors followed the students with emails and descriptions of the ongoing assignments.	1) citation platform lecture: I think it is really important to ask the class what are the most used programs for citing before to do a lecture about them. The lecture on EndNote was little useful if Mendeley or other programs are more used instead. After obtaining what is the most used program by the students in the course, organize a lecture on it to describe how it works would be the best. 2) Sometimes the scope of the writing was mixed between writing a master thesis/report and writing an article. I think would be best to focus on how to write an article more than how to write a report or a master thesis in general, as it was done for most of the time during the lectures. 3) Maybe a lecture to learn how to interpret the results of a research would have been very very useful. 4) I understand that working in a group can be useful and the amount of work for professors are less, but I find that having a grade depending on other people is very little convenient. 5) very very important, maybe at the beginning, saying how figures and tables should look like.	
The course surpassed positively all my expectations and the topics explained during the lectures will be useful and hopefully sufficient to perform a good Master project.	4) I loved the last lecture when presentations and poster were showed together with some food and all the people.	6) Of little importance, but still... The course required continuous attention and effort for the duration of the whole semester, apart from the lectures. The load of work was way over 5 credit points even more if someone wants to achieve high scores. 7) way too much importance to plagiarism and copyright.	I personally think that the lectures were great... Obviously a bit heavy to have at 8.30 in the morning, but definitely worth it for the motivations I stated before.
I had no expectations of the course, only took it since it is mandatory. The purpose of the course was quite unclear. To do my master project I think I would need to practice writing, finding literature and get some tips on where to look for a project.	I liked that although the workload is a bit high with two assignments, they are quite small and the essays are quite doable. I liked that there was extensive help and quick responses from teachers and assistants. I liked the presentation day. It's interesting to get a view of everybodys project and see how and what other poeple has done. Thanks for the coffee and cake, much appreciated.	Instead of (or in addition to) having peer review on term paper, assing group reports that groups can peer review. This will help the discussion after presentations as the reviewer naturally can start up the questioning and feedback. Talk to eachother. It's hard too understand the assignment and peer review criteria when teachers assistants doesn't have the same view on the assignments or if the two head teachers promote two different styles of writing. Try to make power points and assignment criteria understandable on their own. You need to be able to read and understand your powerpoints and criteria without asking questions if you're not able to meet up. Try to set deadlines a bit earlier and make use of the four weeks of nothing in the beginning. At least get criteria for term paper up early so you can lay out the work on your own. Students ,who haved not started on their final Master project and thesis, should be barred from attending the course. The work load without being able to piggy back on the Master project or thesis is way more than the 5 points of study credit. Drop the group task and make a two step submission of the individual task, pre- and post peer-review.	Have to get up at 6 to make to 8.15 lecture and my motivation don't get higher when my friends tell me they are useless. Didn't attend lectures so can't say anything about the content, but if I was going to attend them they need to be earliest 10 am. Since you have all of the master students in this course and scheduling the course in hours when everybody can attend is probably impossible, you might wanna post powerpoints which are understandable and clear without an oral presentation to get your message across.
	A lot of good tips about scientific writing and how to work with the Master project and thesis.	The presentation day should have been held prior to the start of the exam period or at the start of next semester (not a problem if the students only have this subject and the Master project/thesis.	Probably because a lot of the students have followed other subjects or that the few lectures that they did attend were about topics that have already been covered in lectures in lower level subjects. Because it is sometimes unnecessary like the first lecture: get to know each other..wast of time - group work in the lecture ...boring - Florian never seem happy with us, while Øyvind was more nice to us and optimistic - that both of lectures started at 8:15 - the information given in lectures you could easily know before or just read the pp.
How to write master project and thesis. Knowledge about the topic and how to write	Nothing	Less assigmenets	I think you should give more credits because this course had a lot of work compared to other subjects at 5 credits or the same amount of work as 10 credits subject...
From this course i expected to learn the correct way to write a scientific text, how to handle data and general advice as to how I should proceed with developing a master thesis. Besides the related knowledge on the subject and laboratory techniques, I thought I would also need a better understanding of source siting, proper writing techniques and master creative thinking when it came to developing my thesis.	The course was very informative on how to master scientific writing, and I really liked that the course was not a streamlined process and forces us as students to be independent in our work. The lectures were very good and the TA's were very helpful (Big shout out to Patrick).	One of my biggest issues with the course was that there were no lectures for an entire month. I know that this was due to overlapping courses(bio325?), but maybe there could have been extra lectures for the students which were unable to attend due to this course? The group project was in many ways a challenge, as it was quite hard to find relevant raw data. I can see the value in having to interpret other peoples raw data, but due to the lack of data relevant to our masters direction we had to go for something which was not quite relevant. Maybe there could be raw data produced from the university available so that all students got to analyze data relevant for their masters? This part of the course may have actually been really good for everyone else and me and my group just kinda did a bad job. I would also have liked it if we had written two term papers in this subject and then had two peer reviews. I personally did not feel like i got the most out of my peer reviews by not trying to fix the issues which they had with my paper. Would be nice to have another chance to learn from my mistakes and thus improve my scientific writing. This also applies to the other students as well, as the peer-review process really did demonstrate that some students could use an extra guiding hand in order to become better at writing. (Probably applies to me as well) To criticize the teaching staff, I will say that it is quite odd that the main teachers Florian and Øyvind were not in agreement over how several things should be done. I understand that there is not really a "correct" answer all the time and things can come down to personal opinion and preference, but the teaching staff being in disagreement over certain matters makes it quite hard for us students to know what is right and what is wrong.	Tried to attend most of the lectures, but had to skip some due to overlapping lectures, sickness and the like. There is also the concept the 8 am Monday lecture which i know for a fact that neither me or most of my colleagues are too fond of and was probably a good reason for there being such low attendance on these days. I believe that a big problem with attendance was that many people believed they already "knew" what was being spoken about in the lecture, due to writing in previous courses. Maybe make it more clear to people that what they learn in these lectures is not the same as what they have had in previous courses because it was rather obvious that some students did not "know" how to write As you have said, people skipping lectures means that TA's and supervisors will have extra work on their hands. Making it mandatory would in my opinion be a good way to go forward, this is a matter of great importance to the rest of the students master projects and if people are willing to dedicate thousands of hours to their master projects, they should also be willing to dedicate a couple of hours a week to lectures. All in all I will say that the course was a very valuable experience and I believe it will be very helpful in my future work with a master thesis

From the course I expected to:

-learn how to structure a thesis in a good manner
-use litterature in a correct way
-develop my critical thinking skills
-present results in forms of tables and figures in an appropriate way

Skills I thought I needed:

-good scientific writing skills
-good referencing technique
-able to illustrate my findings in a good way

-your effort to redesign this course
-the group project + presentation

I see were you wanted to go with this course design, and I get how important it is to begin thinking about our writing early in the masters. I guess the supervisors will thank you for this effort! However, the workload of this course is huge. Even if you considered the regulations for 5 ECTs, it was intense.

I found it very OK to include the group work with optional deadlines to give us an idea of how it is to receive feedback during the writing process. Our group got to conduct active sampling and got a good idea of how a big project like our master thesis might be like. I found it nice to combine this work with posters and presentations since this is a relevant part of our thesis.

The individual term paper, on the other hand, was challenging in combination with deadlines in BIO325. I know that your aim was to introduce us to the world of peer-reviewing, but there must be another way to this.

-every lecture was at 08.15. I understand that it might be hard to fit everyone's schedule but this is very early. I am a semi-earlybird but found it hard to motivate myself going
-interactive sessions are a nice thought and can be very relevant, but maybe not at 08.15
-sometimes I felt intimidated by the way the lecture was hold. A serious topic can be presented in a nice and interactive way without scaring us students ;) Introduce us slowly to this scientific battlefield....
-the semester itself was very intense and I was very busy with the other courses in addition to this one - sometimes I just did not prioritise lectures

About making the lectures mandatory: Please don't. It is really hard to get through this semester and I feel everyone benefits from this course one way or another. We have the lecture notes and I will definetely use these when starting my writing process. Mandatory lectures are old school - try to schedule them a bit later and motivate rather than scare us to write :)

Appendix 3

From the 'open channel' (Two student responses)

"I have never had such a heavy workload in a subject, and this is not a regular workload for a 5stp subject. The group report itself + lectures would be enough to make a 5stp subject from what I am used to. Second of all, it is really unfair of you to allocate ""30 hours"" to one task and ""40 hours"" to another. This is not how it works. We spent way more than 34 hours on our group report, because it was very demanding. Doing the codes took most of the hours (about 15), and I don't even know if that was something that was taken into consideration when allocating time. Or the fact that making a presentation was an additional 2-5 hours spent on this task.

Regarding this, I was not the only one to react when asked not to attend R club for help. We too understand that this is not what the club is for, but we had no other way of making our codes. The group report calls for things we have no way of doing without help or spending countless hours working on it and struggling our way to a solution, which again makes the time allocation useless and unfair to the students. If I can make a suggestion for next year it would be to hire in TAs with experience in R, and preferably have your own R club or writer's club. That way you can show students how you want them to make their graphs, as we spent hours making graphs that we were later told wasn't very publishable. I don't think it's very constructive to show this to us long after the group report is submitted.

I did not find that the course leaders were very lenient about offering help when asked, as they would mainly just refer to pages/things that had already been said (and as a fourth year one would of course have done this research before actually asking a question, so this is neither helpful nor constructive). I understand that it is necessary that we do our own research, but when presenting a question in a way that makes it clear that one has done the necessary research, it seems almost insulting to just refer back to something that was the background for my question.

The scientific essay was a very diffuse exercise which many of us have never done before, and you would barely tell us how to write it or give examples, which I believe would have helped a great deal. Now that I have gotten feedback from the course leader I can obviously see that he had something different in mind than what I wrote. Interestingly, the people who did the peer review applauded the same parts of the essay that he criticized, which indicates that they didn't know how to write a scientific essay either.

I was initially happy with the peer review exercise because I felt like I learned something from telling others what was good and lacking from their text, but with the paragraph above in mind, I obviously had no business correcting someone else's essay because I apparently did it wrong myself. I think for next year you could benefit from uploading an example of a scientific essa so that students may actually understand what it is, and what they are supposed to include. I think that way they can learn a lot more because they also know what to look for in their own text and in other people's text.

I also disagree on your choice not to allow us to submit our essays to TAs during writing, if needed. The point of the class is to learn how to write those things, and if you won't allow us to get feedback underway so that we can make adjustments accordingly, there's really no point. I could take suggestions and learn from the people who did the peer review for my paper, but I really don't see the point when they have much of the same background and prerequisites as I have for writing the paper. So instead, I have pretty much only the feedback from the teacher so far, that I can use to make changes. But I think I would have learned so much more if I had gotten some of this feedback during the writing process, so that I could adjust my essay accordingly.

TAs and course leaders gave very different feedback on the report submissions. Things were moved between different sections by one person who reviewed the paper, and then moved back to its original place by the next person reviewing it. This was very confusing and in the end we decided to go with the feedback of the course leader, but I feel like this indirectly undermines/invalidates the TA's feedback. I guess that a lot of the feedback is based on acquired taste, but we're here to learn and we often got so confused that we ended up deleting entire paragraphs because different feedback said different things about it.

That being said: I have learned a bit about what is expected to be included in the different sections of a thesis, but this is the bare minimum of what I would have expected as a takeaway from this subject. When considering the amount of lectures and the workload, I would evaluate the learning as being inefficient. A lot more time than necessary was spent on struggling with R or similar, and I feel like if we had been allowed to attend R groups or had our own collective study group for the course, our takeaway from the subject could have been so much higher."

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"there should be an option for peer evaluation of your group members and yourself after the report is handed in but before the grading (and if there already is: my bad). for example, contribution to discussion/writing, attending study group meetings, and doing homework that has been agreed upon in study group.

We're experiencing that not everyone in the group is pulling their load (or doing work at all), and should this continue, then getting the same grade as them sucks"

Emnerapport BIO301 vår 2018

Tittel: BIO301, Current topics in Biodiversity, Ecology and Evolution, vår 2018
Undervisarar: Øyvind Fiksen (emneansvarleg, 40%), Anders O Opdal (assistent, 30%), Selina Våge (assistent, 30%)

Gjennomføring
Kursdesign: Ein detaljert oversikt over emnedesignet, læringsaktivitetar, og vurderingsformer er lagt ved her (Vedlegg A).
Oppfølging av eventuelle tidligere evalueringer: Emnet gjekk i omtrent samme format som i 2017, med tre gruppeoppgåver med studentpresentasjonar og ein skriftleg innlevering av ein prosjektsøknad, med peer-review. Vi er ganske godt fornøgd med opplegget, men har forsøkt å gi meir systematisk, kriteriebasert tilbakemelding undervegs enn i fjor. Dette kan enda bli betre, det er relativt krevjande å sette kriterier for vurdernig for enkelte aktivitetar, som studentpresentasjonar, på dette nivået.
Kursstatistikk: Det var 8 studentar påmeldt, to trakk seg undervegs, og vi gav 2 A og 4 B til dei som fullførte.
Studentevaluering: Vi la ut eit skjema der studentane kunne gi oss tilbakemelding kontinuerleg gjennom emnet, men her kom det ingen kommentarar. Vi har diskutert opplegget muntleg med studentane undervegs, og generelt så er det relativt arbeidskrevjande å finne og sortere, og lese seg opp på eit ukjent felt. Men vi har samtidig inntrykk av at det er god trening og læring i det.

Emneansvarlig sin samlede vurdering, med eventuelle forslag til endringer

Dette er eit lite emne, med bare 6 studentar i år, så ein kan sjølvsagt vurdere å legge det ned. Vi har lagt det opp som trening i å finne litteratur om tre utvalgte tema i evolusjon og økologi, for å trene opp evnen til å oppsummere eit felt og presentere for andre, og øving i å utforme eit forskingsprojekt, skrive ein søknad, og å gi/få tilbakemelding til andre. Emnet legg altså meir vekt på generiske ferdigheiter, kritisk lesing, evne til å sette seg inn i eit tema, arbeide i grupper, formidle.

Vedlegg A. Emnedesign

BIO 301 Spring 2018, Current topics in Biodiversity, Ecology and Evolution

In this course students learn how to find, interpret, present, and write about selected themes in ecological, evolutionary and biodiversity research. Themes can vary from year to year, and students work both individually and in groups to address questions, solve problems and develop recommendations. For each theme, students have to develop an overview of important papers, debates and research questions, and collaboratively report it back to the other students and/or develop a recommendation for policy or future research based on the scientific literature. Students will discuss and interpret research articles in the field, and conduct assignments including writing assignments, mini-literature reviews and exercises. A key component of the course will be the development of a small research proposal, an introduction or a literature review, which will be peer reviewed by other members of the group, and resubmitted in revised form.

After the course, you should be able to:

1. Achieve an overview of ecological/evolutionary questions based on the scientific literature and databases
2. Critically reflect upon research methods, conclusions and statements in the discipline
3. Summarize and present advanced ecological/evolutionary themes
4. Develop, assess and give feedback on scientific texts, reviews or project proposals
5. Identify research needs and develop projects and applications

First meeting: 16th of January in room K1 at BIO, ground floor, A-building
Class meetings: see schedule below, and Mitt UiB, where information will be given
Teachers: Anders F Opdal (postdoc), Selina Våge (postdoc), Øyvind Fiksen (prof.)

Assessment: The course is inspired from Team Based Learning, where students work in groups parts of the time. Portfolio assessment, where all or selected elements of documented work (assignments, group projects, presentations etc) are included in the final assessment.

Required reading: As a part of the course, students search for and select relevant scientific literature on their own, using ISI Web of Knowledge or similar databases.

Learning outcomes and activities

- To be demonstrate abilities to **achieve an overview of ecological/evolutionary questions based on the scientific literature and databases** you need to
  - Select 3 themes or topics with your group, one from each teacher's list of alternatives
  - For each topic – search scientific databases. Develop an extensive list of relevant papers (10-20), and select a subset of key research papers, reviews or opinions (about 70 pages per topic). Justify the selected reading list with one sentence each. Explain and discuss the selection with teachers. Read papers and collaborate to establish your interpretation of the state-of-the-art, contemporary discussion themes, etc. and develop a presentation to for the class based on the selected literature.

- To be able to **Critically reflect upon research methods, conclusions and statements in the discipline:**
  - Include critical reflections on current research approaches, methods and conclusions (for selected themes) in portfolio elements.

- **Summarize and present advanced ecological/evolutionary themes**
  - Presentations in class, write research proposal

- **Develop, assess and give feedback on scientific texts, reviews or project proposals**
  - Review proposals individually.

- **Identify research needs and develop projects and applications**
  - Write and review proposal, select some applications for funding with limited budget.

Workload: Each of the learning activities involve a certain number of hours of work. Remember, 260 hours is the standard workload for 10 ECTS. Summary of workload and assessment weight:

Learning activity	#	Time factor	Hours	Assessment
Contact meetings	10.0	2.0	20.0	
Reading selected papers	210.0	0.4	73.5	
Tutorials	3.0	2.0	6.0	
Search and select literature (group)	3.0	15.0	45.0	15.0%
Presentation of theme (group)	3.0	15.0	45.0	30.0%
Write proposal individually	1.0	45.0	45.0	30.0%
Review proposals (ind)	2.0	10.0	20.0	15.0%
Select proposals (group)	1.0	10.0	10.0	10.0%
In total			**265**	**100.0%**

Elements of assessment criteria (first part)

Literature selection: It is challenging to define exact evaluation criteria for the literature search and selection exercise, but we will be looking for some specific elements. You must agree on one long list of relevant papers (max 20) and from this list select papers constituting ca 70 pages in total, and justify your selection of each with one sentence. The selected papers should be (a mix of):

- important in defining the research in the field (citations, reviews)
- cutting edge research, representing state-of-the-art approaches
- pointing at the historical origin and development of the field
- balanced if there are controversies
- papers with strong scientific basis, powerful methods, clarity & elegance

Oral presentation of theme: Each group select three themes to present from the alternatives given by each teacher and according to the schedule in the table below. All participants in the group must be prepared to present on behalf of the group, and we draw two presenters from each group randomly each time (one for the first part and one for the second part). We will also find one day where those who are not present get a chance to present. In the presentations, we will be looking for:

- Scientific relevance to the questions asked
- A reflective and objective attitude, where statements and conclusions are firmly backed by references to observations and theory
- Ability to give an overview and summarize while at the same time point out the details in some selected papers
- Clarity of the presentation, that it can be understood and followed by the audience
- … to be discussed with the students.

Peer assessment of student contributions in the group. The score of the group for the literature selection and the group presentation includes an element of peer assessment. At the end of the group

project, all students distribute a score to all other group members based on how they have contributed to the group project. The weight of the peer assessment is open for discussion.

Research proposal, review and evaluation: We will present and discuss the criteria for these elements later in the course.

Themes and schedule for Current topics in biodiversity, ecology and evolution
We propose some alternative themes from each teacher, and your group must select one from each.

1. Øyvind Fiksen
   Microplastic in the ocean – how harmful is it to marine ecosystems and seafood quality? The occurrence of small plastic particles in the ocean is a topic that make news headlines regularly. Researchers have now measured or monitored concentrations in coastal and oceanic regions, and exposed organisms to microplastic in the lab to study the effects on both individuals and systems. Here you set out to review the growing literature on microplastics in the ocean. First, summarize the issues raised in the scientific papers, what do we know and what is still uncertain or unknown? What is the concentration of microplastics? Then, as critical researchers, can you identify any bias in how results are presented in the papers? Based on your reading of the papers, discuss within the group and present your own views on microplastic as pollution in the ocean, how severe is the problem?

2. Selina Våge
   On the origin of (simple and complex) life. Search for theories and discussions on the origin of life (focus on prokaryotes), and how life developed in its early stages. What do we know about this? Are there controversies? Further, explore the origin of complex (eukaryote) life. UiB will mark this year's Darwin Day (20. February) with a Horizon lecture by Nick Lane, a leading scientist in the field of origin of complex life. You are strongly encouraged to attend his lecture; Why is complex life the way it is? Could there in theory be different types of complex life? Or, is complex life as we know it predictable from first (physical and chemical) principles? What makes sex and suicide so interesting? Use primary literature to explain how particular (bioenergetic) constraints may give some answers to these fascinating questions. You are free to choose how much you want to focus on the origin of simple life (first part) or complex life (second part), but you need to briefly introduce both themes, using primary literature.

3. Anders Opdal
   a. *Human induced evolution*. In 1859, when Charles Darwin presented his theory on evolution by natural selection, evolution was understood as a rather slow process typically requiring thousands to millions of years before materializing as visible adaptations or in speciation (i.e. the Galapagos fiches). However, to explain his theory, Darwin frequently used examples from pigeon breeding and the domestication of farm animals to illustrate how selection works. At the time it was well known that by selecting for certain desirable traits, one could over a few generations greatly magnify this trait in a population. For example as ornamentation on pigeons, or the amount of milk a diary cow could produce. In the wild, evolution would work similarly, but because selection is natural and not planed, it would be slow. What Darwin did not predict was the potential effect humans could have on the course of evolution, also in the wild – known as human induced evolution. What is this, and how can humans influence evolution? Do you see similarities to Darwin's breeding examples? Find a few examples of fields where human induced evolution is a major concern. What are the major challenges

there? Often, human induced evolution is considered something we should avoid, but can there also be upsides?

b. *The evolution of life histories*. Up until the mid 1900s, evolutionary theory was primarily focused on the natural selection for various physical traits, such as function, shape and size of various bodily structures like jaws, limbs, skin, eyes etc. However, apart from species having elaborate and diverse sets of body parts and functionality, evolutionary biologist came to appreciate that species also exhibit diverse and complex ways of living life (life histories), which again must also be subject to natural selection. Through literature searches, try to identify some key articles or books that addressed this new addition to evolutionary theory. In what ways does life history evolution broaden our view of evolution, and how does it connect to the previous views of evolutionary processes? Can the theory be used for any practical purposes?

Schedule BIO301 Spring 2018.

Date	Teachers	Learning activity and deadlines	Student work
Monday 15.01 14:15 K1	ØF	Introduction to the course. Establish teams. About working in teams. Presentation of themes by teachers	Start searching for relevant literature for each theme.
Tuesday 16.01 12:15 K2	ØF	Searching for research – how we do it. How to navigate in scientific literature	Discuss in groups – decide on 3 themes to focus on
Thursday 18.01 10:15 K1		Groups meet – teachers available	Develop literature list. Read papers.
Monday 22.01		Groups meet – teachers available	Develop literature list. Read papers.
Tuesday 23.01		Groups meet – teachers available	Develop literature list. Read papers.
Thursday 25.01		Groups meet – teachers available	Develop literature list. Read papers.
Monday 05.02		Groups meet – teachers available Final reading list Theme 1	Prepare presentation Submit literature list Theme 1
Tuesday 06.02		Groups meet – teachers available	Prepare presentation
Thursday 08.02		Present Theme 1	Presentations in class
Monday 19.02		Groups meet – teachers available	Develop literature list. Read papers.
Tuesday 20.02		Groups meet – teachers available NB! Why is life the way it is?	Develop literature list. Read papers.
Thursday 22.02		Groups meet – teachers available	Submit literature list Theme 2 Prepare presentation
Monday 05.03		Present Theme 2	Presentations in class
Tuesday 06.03		Groups meet – teachers available	Develop literature list. Read papers.
Thursday 08.03		Groups meet – teachers available	Develop literature list. Read papers.

Monday 19.03		Groups meet – teachers available Final reading list Theme 3	Submit literature list Theme 3 Prepare presentation
Tuesday 20.03	ØF	Present Theme 3	Presentations in class
Thursday 22.03	AFO, SV, ØF	Writing proposals, planning science	Lecture/Tutorial/Discussion
Monday 03.04		No meeting	Work on your research proposal
Monday 16.04		No meeting	Work on your research proposal
Tuesday 17.04		No meeting	Work on your research proposal
Thursday 03.05		No meeting	Work on your research proposal
Monday 07.05		Deadline submitting research proposal	
Wednesday 16.05		Deadline review of proposals	
TBD	AFO, SV, ØF	Board meeting: shortlisted proposals. Justification of selection	Groups present their decisions on funding to research proposals