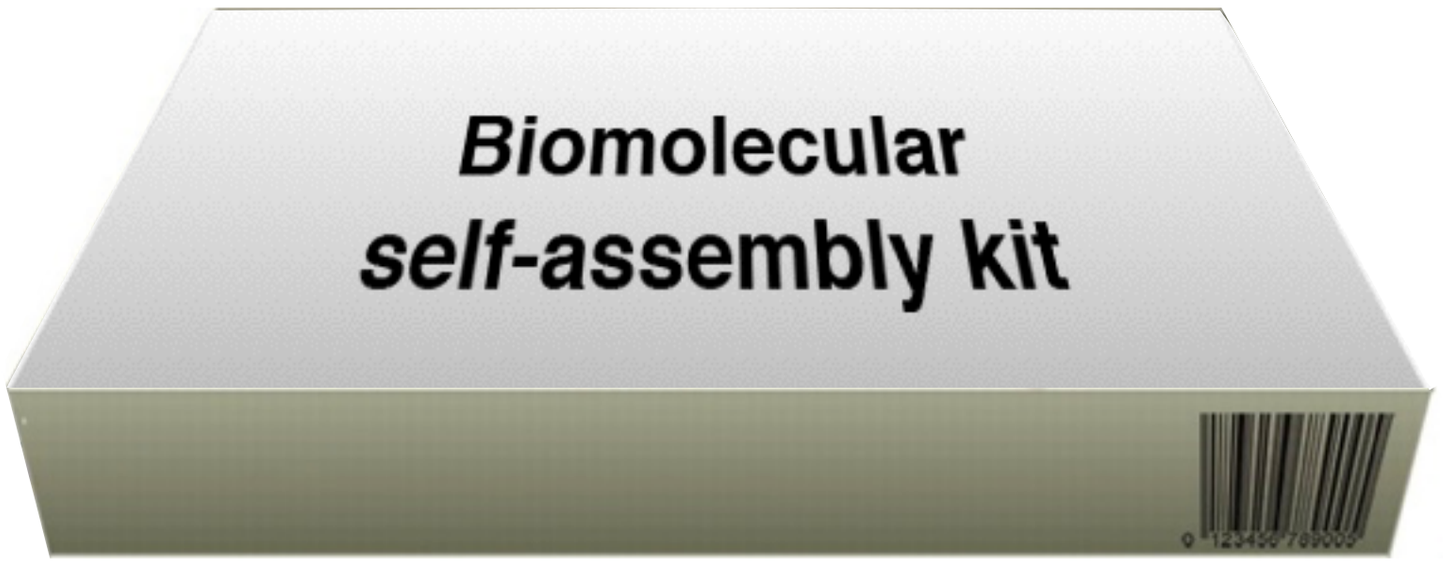
Learning modules

as used in the Bionanotechnology MSc course

Ebbe Sloth Andersen
Interdisciplinary Nanoscience Center
Aarhus University

MSc course on

BIONANOTECHNOLOGY



5 ECTS = 125-150 hours

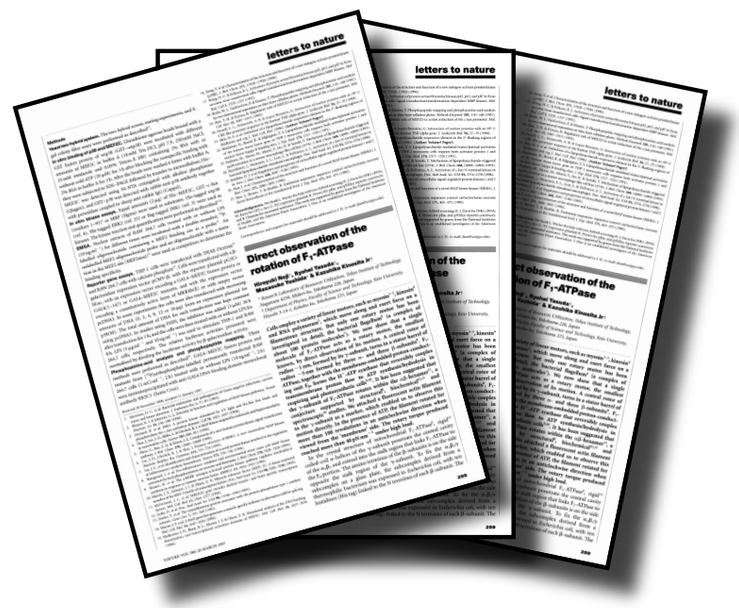
TIMETABLE

Learning Centre
F Block
Otago Polytechnic
Learningcentre@tekotago.ac.nz

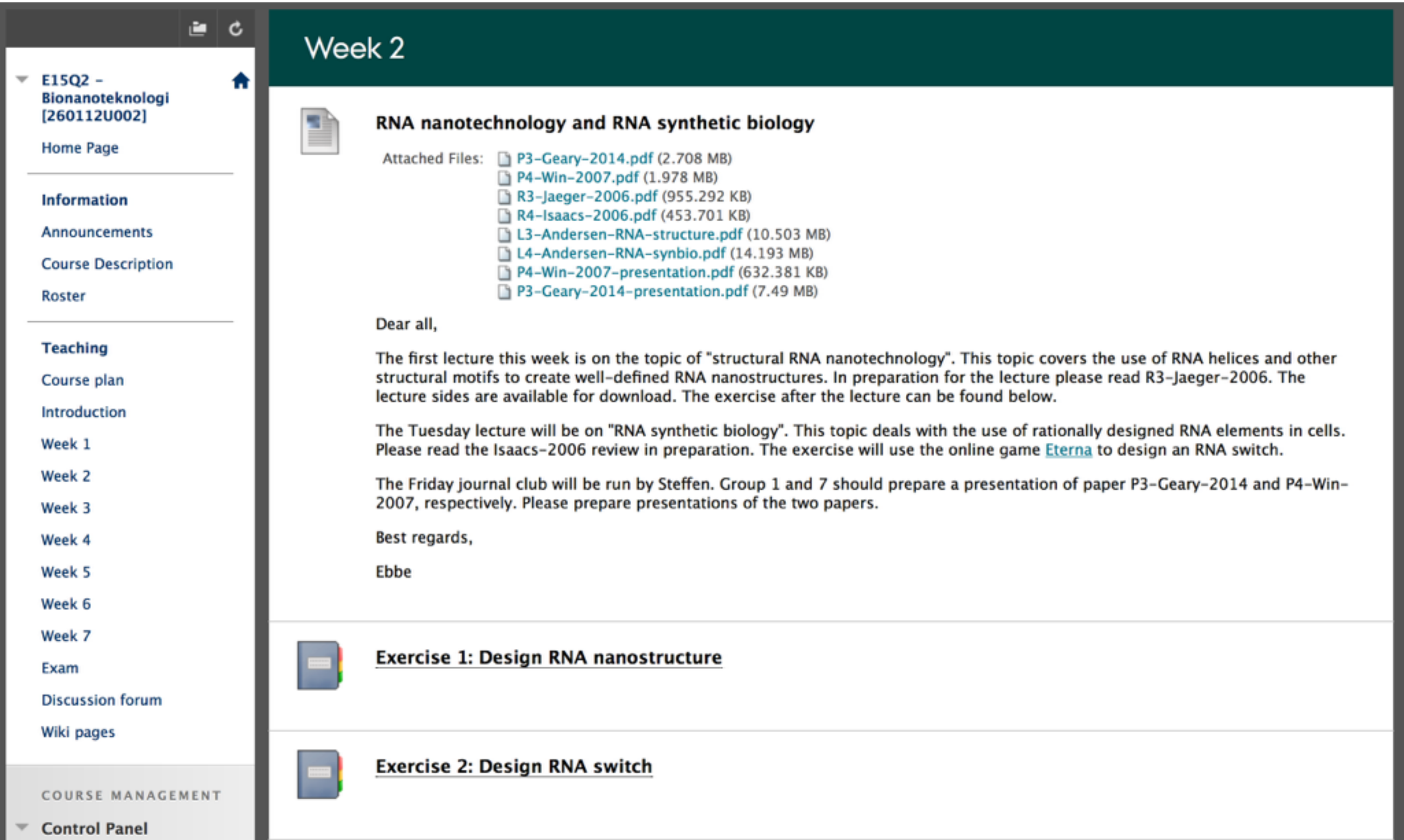
Date: _____

		MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	
AM	7								7
	8								8
	9								9
	10								10
	11								11
PM	12								12
	1								1
	2								2
	3								3
	4								4
	5								

Lectures
Exercises
Journal clubs



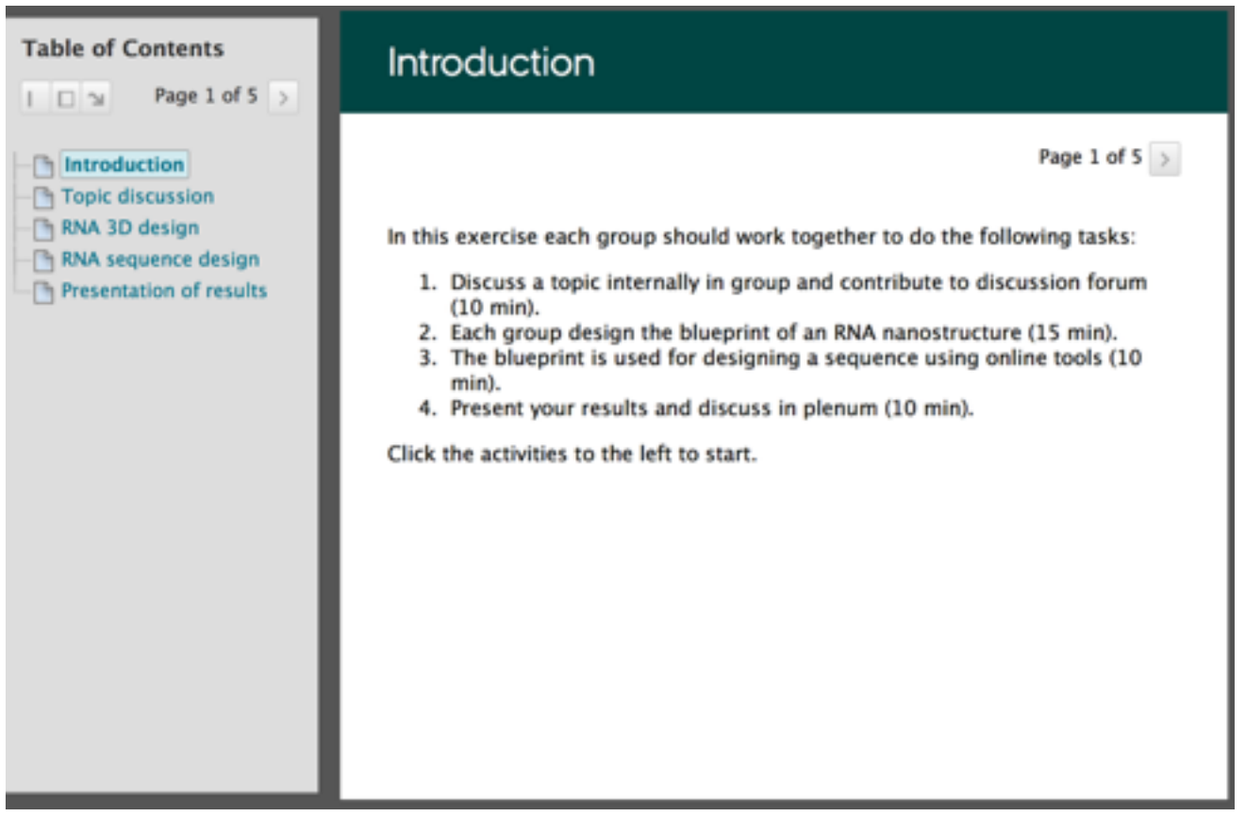
My use of learning modules



What is a learning module?

A Learning Module is a collection of Content Items focused on a specific subject that students can navigate at their own pace. Instructors can create a structured path for progressing through the items.

- **Learning path is displayed in the Table of Contents, which can be used to navigate through the Learning Module.**
- **Can force students to progress through the content in the order that is set.**
- **Learning Modules can be set to open in a new browser window.**
- **Tracking Statistics for the Learning Module**
- **Instructors can customise the hierarchical view of the Learning Module.**



Example

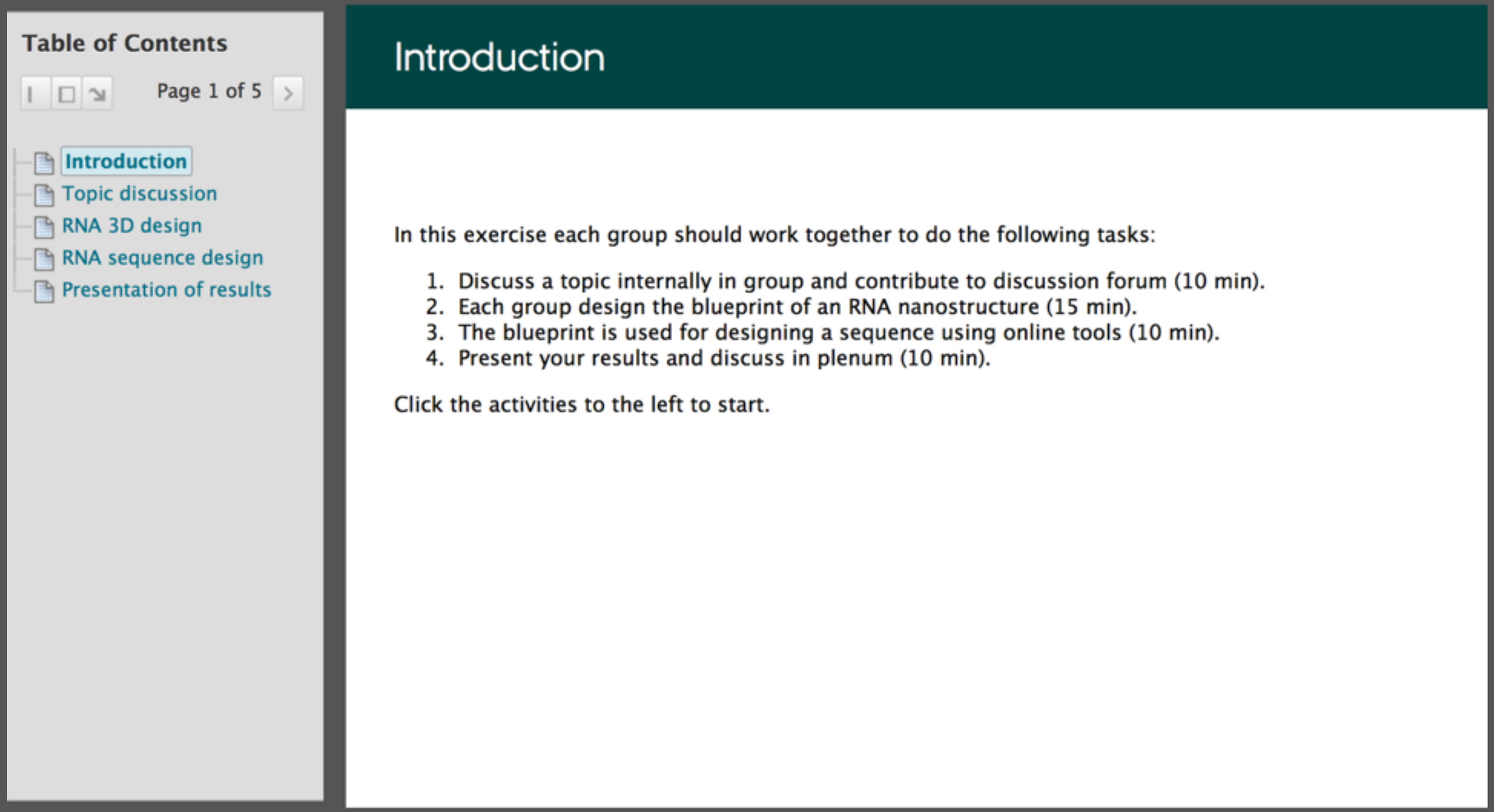


Table of Contents
Page 1 of 5
Introduction
Topic discussion
RNA 3D design
RNA sequence design
Presentation of results
Introduction
In this exercise each group should work together to do the following tasks:
1. Discuss a topic internally in group and contribute to discussion forum (10 min).
2. Each group design the blueprint of an RNA nanostructure (15 min).
3. The blueprint is used for designing a sequence using online tools (10 min).
4. Present your results and discuss in plenum (10 min).
Click the activities to the left to start.

Example

Table of Contents

Page 2 of 5

- Introduction
- **Topic discussion**
- RNA 3D design
- RNA sequence design
- Presentation of results

Topic discussion

Time for this activity: 10 min

First use 5 min in the group to discuss a topic from the lecture in more detail.

The topics are distributed among the work groups as follows:

- Group 1: What are the structural benefits of using RNA for constructing nanostructures?
- Group 2: What are the functional benefits of using RNA for constructing nanostructures?
- Group 3: What structural modules are used in RNA architectonics and how do they differ fr
- Group 4: Describe the design principle of tensegrity. What physical properties are used and
- Group 5: How does the RNA tectonics method work? What method is used for sequence des
- Group 6: What are the pros and cons of the different self-assembly strategies?
- Group 7: How can RNA nanostructures be functionalized?

After your group discussion you should contribute your answer to the discussion forum. Write the
How can RNA nanostructures be functionalized?". Now write your answer to the question that you
other groups to give them feedback on the quality of their answer (be kind :-).

Click to launch Discussion Forum

Example

Table of Contents

Page 3 of 5

- Introduction
- Topic discussion
- RNA 3D design
- RNA sequence design
- Presentation of results

RNA 3D design

Time for this activity: 15 min

In this activity you should consider the 3D design of your RNA nanostructure (see graphics below, a print-out will be handed o

- Group 1-4 should design a 2H-AE tile.
- Group 5-7 should design a 2H-AO tile.

Work in the groups to discuss the following features of your design:

- What is the base-pair distance between crossovers on each of the two helices?
- Where would you place the 5' and 3' ends?
- Choose internal KL sequences (blue box)
- Choose external KL sequences to form hexagonal lattice (red boxes)
- Choose immobile RNA junctions (see helper graphics below)
- Insert GU wobbles to avoid >8 bp stems (for efficient synthesis)
- Add GGAA to 5' end to make a good start site for T7 RNA polymerase
- Now write out the sequence and dot bracket notation (use the templates below) (Hint: Use a text editor with monospace

Information:

2H-AO

```
((((((((((((..[[[[[[.)))))((((((((((.......))))))))))((((((.......)))))))))))))(((((((((((((..]]]]]].))))))((((((((((.......))))))))))((((((.......)))))
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
```

2H-AE

```
((((((((((((((((((((.......))))))))))((((((.......)))))(((((((..[[[[[[.))))))))))))))))))))((((((((((((((((..]]]]]].))))))((((((((((.......))))))))))
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
```

2H-AE

Example

Table of Contents

Page 4 of 5

- Introduction
- Topic discussion
- RNA 3D design
- **RNA sequence design**
- Presentation of results

RNA sequence design

Time for this activity: 10 min

Now that you have designed your RNA nanostructure you need to design a sequence.

First you will need to construct an input file for the online sequence design software NUPACK.

You will need the structure and sequence that you designed in former activity.

Use NUPACK to design your sequence by inputing your structure and sequence constraints. The input sh

- material = RNA
- temperature[C] = 37.0
- trials = 4
- sodium[M] = 1.0
- dangles = some
- allowmismatch = true
- structure RNA_seq = [INPUT YOUR STRUCTURE HERE, REMEMBER TO REMOVE SQUARE BRACKETS]
- domain a = [INPUT YOUR SEQUENCE CONSTRAINTS HERE]
- RNA_seq.seq = a
- prevent = AAAA, CCCC, GGGG, UUUU, KKKKKK, MMMMMM, RRRRRR, SSSSSS, WWWWWW, YYYYYY

If your input was returned with an error then submit this input instead:

- material = RNA
- temperature[C] = 37.0
- trials = 4
- sodium[M] = 1.0
- dangles = some
- allowmismatch = true

Example

Table of Contents

Page 5 of 5

- Introduction
- Topic discussion
- RNA 3D design
- RNA sequence design
- **Presentation of results**

Presentation of results

Time for this activity: 10 min

The last activity is to present your result.

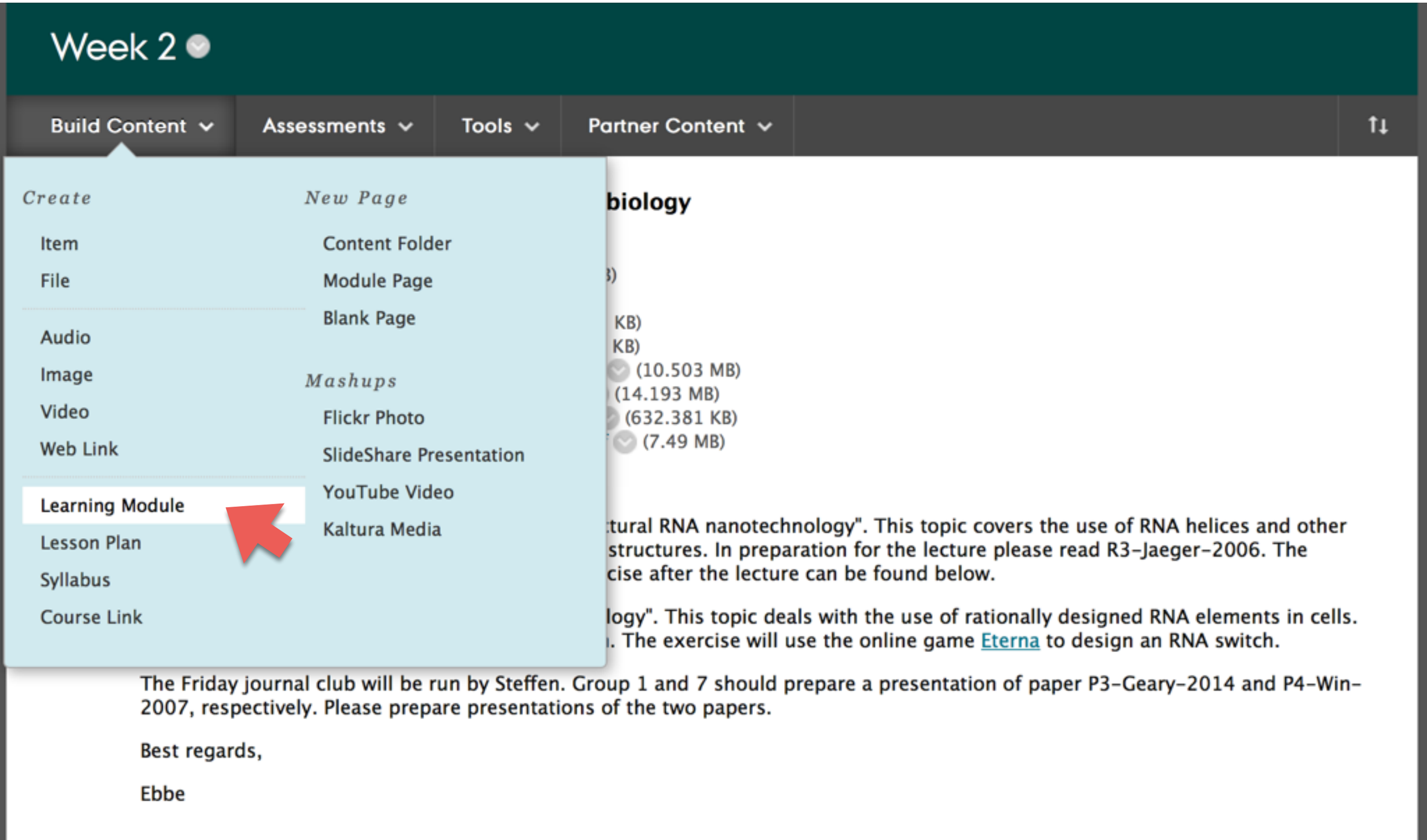
Report your sequence design result on the wiki pages. Include the "enssemble defect"

Also describe shortly your design choices. Why you design is better? How it feels to cr

Launch wiki pages

Finally present your final design for the class.

How to construct a learning module



Create a module

Create Learning Module

A Learning Module is a collection of Content Items focused on a specific subject that students can navigate at their own pace. For example, a Learning Module about the solar system can include lecture notes, links to websites with pictures of all the planets and assignments. Instructors can create a structured path for progressing through the items. The path can be set so that students must view content sequentially or set to permit users to view the content in any order. ***More Help***

* *Indicates a required field.*

Cancel | Submit

1. Learning Module Information

* Name

Colour of Name — Black

Text

Arial | 3 (12pt)

Path: p

Words:0

Create a module

Create Learning Module

A Learning Module is a collection of Content Items focused on a specific subject that students can navigate at their own pace. For example, a Learning Module about the solar system can include lecture notes, links to websites with pictures of all the planets and assignments. Instructors can create a structured path for progressing through the items. The path can be set so that students must view content sequentially or set to permit users to view the content in any order. ***More Help***

2. Learning Module Options

Select ***Yes*** *to force users to progress through the content in the order that is set by the number next to each Content Item. Users are unable to advance to a page within the Learning Module without viewing the previous page.*

Enforce Sequential Viewing of the Learning Module?	○ Yes ◉ No
Open in New Window	○ Yes ◉ No

3. Standard Options

Permit Users to View this Content	◉ Yes ○ No
Track Number of Views	○ Yes ◉ No
Select Date and Time Restrictions	☐ Display After  *Enter dates as dd/mm/yyyy. Time may be entered in any increment.* ☐ Display Until  *Enter dates as dd/mm/yyyy. Time may be entered in any increment.*

Create a module

Create Learning Module

A Learning Module is a collection of Content Items focused on a specific subject that students can navigate at their own pace. For example, a Learning Module about the solar system can include lecture notes, links to websites with pictures of all the planets and assignments. Instructors can create a structured path for progressing through the items. The path can be set so that students must view content sequentially or set to permit users to view the content in any order. ***More Help***

4. Table of Contents

*Select **Yes** to show a structured view of the Learning Module. Users can choose to display the Table of Contents on the bottom or on the side of the Learning Module.*

Show Table of Contents to Users — (•) Yes ( ) No

Hierarchy Display — None

5. Submit

*Click **Submit** to proceed. Click **Cancel** to go back.*

Cancel | Submit

Create a module