



Deconstructing Synthetic Biology – Biotechnology Case Studies Across Scales

Course Content Map

The table below describes the content of a 10-week course on the deconstruction approach to the scales framework. The course is offered two class periods a week for one hour and fifty minutes during each class period. For modularity, class periods are divided into two blocks, giving the students a break in between each block. The course is divided into three modules/topics based on synthetic biology application areas. Topics covered in each block are described, including when students presented newsreels (described in [Northwestern_CSB_Deconstructing_SynBio_Syllabus.pdf](#)) and when guest lectures were incorporated. The topic content follows the approach described in the manuscript, progressing with instructors describing the scales framework and deconstruction approach in the beginning, and progressing to students performing the deconstructions through in-class activities and assignments. The jigsaw activity in the human health section is described in the manuscript. The content is modular and can be adapted to any topics of interest. Assignments are mapped onto when they are released and collected within the content map.

Week	1-hr Block	Assignments		Topic	Content	Notes
		Announce	Due			
1	3	A1		Environmental Health	Introduction to Course / Syllabus	Intro to course topics, technology previews; Incorporate inclusive teaching practices.
	4				Environmental Health Big Picture Introduction	What are the problems?, What can synbio do? What is being done (research/companies)? (Heilmeier Catechism)
2	1		A1 Due		Newsreel example / N2 Fixation Case Study	Teaching assistant demonstrates newsreel example; Introduction to nitrogen fixation deep-dive case study
	2				N2 Fixation Case Study (~30 min/scale)	Cellular Scale, Molecular Scale
	3				N2 Fixation Case Study (~30 min/scale)	Circuits Scale, Communities Scale
	4				N2 Fixation Case Study	Societal Scale (~40-50 min Discussion)
3	1	A2			Newsreel / In-class literature deconstruction	Teach students how to identify scales in a relevant publication.
	2				N2 Fixation - Introduce interfaces between scales	Teach students that scales connect along interfaces, identify challenges, framing synthetic biology along scales
	3				<u>Guest Lecture Invite</u> - Environmental SynBio	
	4				Synthetic Biology Concepts Across Scales Review	Bringing all concepts together; Concept check-in
4	1			<u>Guest Lecture Invite</u> - SynBio Company		
	2			Newsreel / Refactoring in SynBio		
	3		A2 Due	Student presentations and discussion for A2	Students present their A2 assignment findings to the class	
	4	Final Project				



Northwestern CSB Deconstructing Biology – Content Map

5	1		Biochemical Production	Biochemical Production Big Picture Introduction	What are the problems?, What can synbio do? What is being done (research/companies)? (Heilmeier Catechism)	
	2			Food-Energy-Water (FEW) Nexus (Case studies)	Golden Rice and RoundUp Case Studies	
	3			Newsreel / Biofuels	Introduction: What is the problem and how are we solving it now?	
	4			Biofuels	Biofuels 1.0 and 2.0 - Corn Ethanol Facility Case Study	
6	1		Biochemical Production	<u>Guest Lecture Invite</u> - Biochemical Production		
	2			Small group analysis for course feedback	In-person evaluation of course by external evaluator	
	3			In-class group deconstruction	Students work in groups to deconstruct technologies; teach students to work together	
	4					
7	1	Final Project Topic Decided	Biochemical Production	Artemisinin Case Study	Discussion of early efforts and metabolic engineering feats	
	2			Newsreel / Artemisinin Case Study	Biochemistry to Scale-Up; challenges, solutions, and societal scale discussion	
	3			Human Health	Human Health Big Picture Introduction	What are the problems?, What can synbio do? What is being done (research/companies)? (Heilmeier Catechism)
	4				Newsreel / Built-in overflow block	In case issues emerge in course schedule timing
8	1	Final Project Checkpoint	Human Health	<u>Guest Lecture Invite</u> - Ethics/Policy/Art (Societal Scale)		
	2			Societal Scale Discussion / Overflow block		
	3			In-Class deconstruction Jigsaw (Day 1)	Gene Drives and Car-T Therapy Case Studies	
	4					
9	1		Human Health	In-Class deconstruction Jigsaw (Day 2)	Gene Drives and Car-T Therapy Case Studies	
	2					
	3	Final Project Checkpoint		Anti-Racism, Diversity, Equity, and Inclusion (ARDEI) Activity	Personal Genomics Case Study	
	4			Newsreel / ARDEI Activity (Continued)		
10	1		Human Health	<u>Guest Lecture Invite</u> - Local Faculty		
	2			Case studies redux / The Future of SynBio (CAD) / The SynBAS NRT Introduction		
	3			Final Presentations		
	4	Final Project				



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