Table 1. Red activities were eliminated when shifting from in-person to online. **Bold** activities were unique to the online version. Numbering and coloring of lab activities has been done to make it easier to see when they occurred in both versions of the course. Activities that are missing from the online version but are not red in the in-person column (e.g. lab activity #3) are not listed because students read about the procedure and purpose, but there were no related results for them to analyze in lab. *results/data from prior quarters were available to provide to students for interpretation and analysis during the online version.

In-Person Version				Online Version		Comment on changes
Week	*Lab Session*		*Lab Activities*		*Lab Activities*	
1	1	1	Lab safety orientation		**No lab (review course syllabus and start watching video lectures)**	
		2	Practice pipetting & refresh on dilutions (planning and setting up dilutions, comparing results to peers)			We wanted to give students time to orient to the online version and spend our first session together forming online community. Students read about setting up cultures, but no results to analyze from such a procedure.
	2	3	Set-up liquid cultures of E. coli carrying plasmids needed for CRISPR experiment		**Meet-and-greet: Connect to your lab session, meet your IA/Instructor and peers**	
		4	Molecular biology two-stage review		**Ice breaker activity to get to know one another** **Share a brief (1 minute) summary of CRISPR-related news (or any biology research)**	
2	3	5	Extract plasmid	2	Refresh on dilutions: develop dilutions plan, analyze dilutions data*	We decided to keep a dilutions exercise in the course because students were often going to be writing up how they would have set-up various reactions, which often involves making dilutions of stock samples.
	4	6	Check plasmids with Agarose Gel Electrophoresis (AGE)	4	Molecular Biology Two-Stage Review	
3	5	7	Bioinformatics exercise: Explore the ADE2 gene, design gRNA and HDR template		**Journal Article Discussion (part of DiCarlo et al. 2013 paper: https://pubmed.ncbi.nlm.nih.gov/23460208/)** **Analyze data from paper to draw conclusions and examine what claims can be supported**	This article provided an opportunity to get more familiar with CRISPP-Cas9 editing in yeast and experimental design, as well as focus on drawing conclusions from results. Designing the experiment themselves allowed more focused time on thinking about controls, experimental flow, methods they might use, and predicting results.
	6	8	Digest pML104 plasmid		**Designing a CRISPR-Cas9 experiment**	
		9	Check digested plasmid using AGE			
		10	Column-clean double-digested pML104 to use for ligation			
4	7	11	Hybridize gRNA oligos for ligation	7	Bioinformatics exercise: Exploring the ADE2 gene to identify important features and where to mutate	In the in-person version we found students really struggled with this bioinformatics lab and making sense of the information gathered, so we decided to split it into two labs during the online version to allow for more time to process and learn.
		12	Plan ligations (volumes to achieve desired molar ratios)			
		13	Ligate digested pML104 + gRNA oligos			
		14	Transform *E. coli* with ligations			

Table 1 continued

Week	Lab Session	In-Person Version: Lab Activities	Online Version: Lab Activities	Comment on changes
4	8	15 Examine transformations	7 Bioinformatics - Design gRNA & HDR template	
		16 Colony PCR to verify carrying desired pML104-gRNA recombinant plasmid		
5	9	17 Check colony PCRs using AGE	5 6 Analyzing results of extracting plasmid and checking with agarose gel electrophoresis*	The time required for many of the wet-lab procedures meant we had to start procedures very early in the course (e.g. extracting plasmid). But, online, we could change the order of procedures. So, for example, we had students explore the gene and design mutations prior to examining the plasmid being used for the gRNA cloning.
		18 Set-up a liquid culture of PCR-successful colonies		
		19 Make PCR copies of HDR template		
	10	20 Extract pML104-gRNA plasmid, send some for sequencing to verify	8 9 Plan digestions and analyze results of plasmid digestions*	
		21 Check HDR PCRs using AGE Column-clean HDR to use for yeast transformation		
6	11	22 Check sequencing of plamsids to verify they contain gRNA	12 Planning ligation of pML104-gRNA and transforming *E. coli*	
		23 Plan yeast transformations (volumes of plasmid + HDR to achieve desired nanograms, and various experimental conditions)		Colony PCR and checking plasmids for sequencing was covered in lecture. Also, PCR of HDR template and analyzing results was covered in lecture.
	12	24 Transform yeast	15 Analysis of ligation-transformation results*	
7	13	25 Analyze yeast transformations (count # of white and red colonies) & enter results in shared class spreadsheet	23 Planning yeast transformations and making predictions	
		26 Choose several colonies to grow up for genomic DNA extraction		
	14	27 Extract genomic DNA from yeast cultures	25 Analyze yeast transformation data*	
		28 PCR region of *ADE2* gene		
8	15	29 Check PCRs using AGE, column-clean, send for sequencing	28 29 30 31 Analyze results of PCR and sequencing of ADE2 to identify mutations*	
	16	30 Analyze ADE2 sequences to identify mutations	32 Analyze yeast transformation & sequencing data set*; CRISPR write-up - get feedback on your ideas	
		31 Enter sequencing results into shared class spreadsheet		
		Start experiment #2 (RNAi)		

Table 1 continued

In-Person Version			Online Version	Comment on changes
Week	***Lab Session***	***Lab Activities***	***Lab Activities***	
	17	32 Analyzing whole class CRISPR transformation & sequencing results - work on writing up results	**Guest lecture/lab activity (RNA-binding protein/eCLIP data)**	We had the opportunity to collaborate with someone outside of the course to add some new content, and an example of the use of CRISPR for
9		*Continue experiment #2*		
	18	*Finish analyzing data from experiment #2*	**Technique presentations: in breakout groups, decide on technique, begin research & summary.**	We added the "Technique Presentation" component to the course to give students a chance to choose another common recombinant DNA/molecular biology lab technique they wanted to learn more about. They learned about the technique, found an example of it used in research, and presented a 10 minute presentation to their lab section.
		Start Experiment #3 (SNP genotyping)		
	19	*Finish experiment #3*	**Technique Presentations Part 1**	
10				
	20	Final exam	**Technique Presentations Part 2**	Exams were done as take-home