M2D5: Confirm gRNA sequence

Date	Assignment Due
Sunday (10/27)	Data Summary Revision
Tuesday (10/29)	Journal Club 2
Friday (11/1)	Blogpost (Journal Club)
Monday (11/11)	Research Article
Tuesday (11/12)	Blogpost (Mod 2)

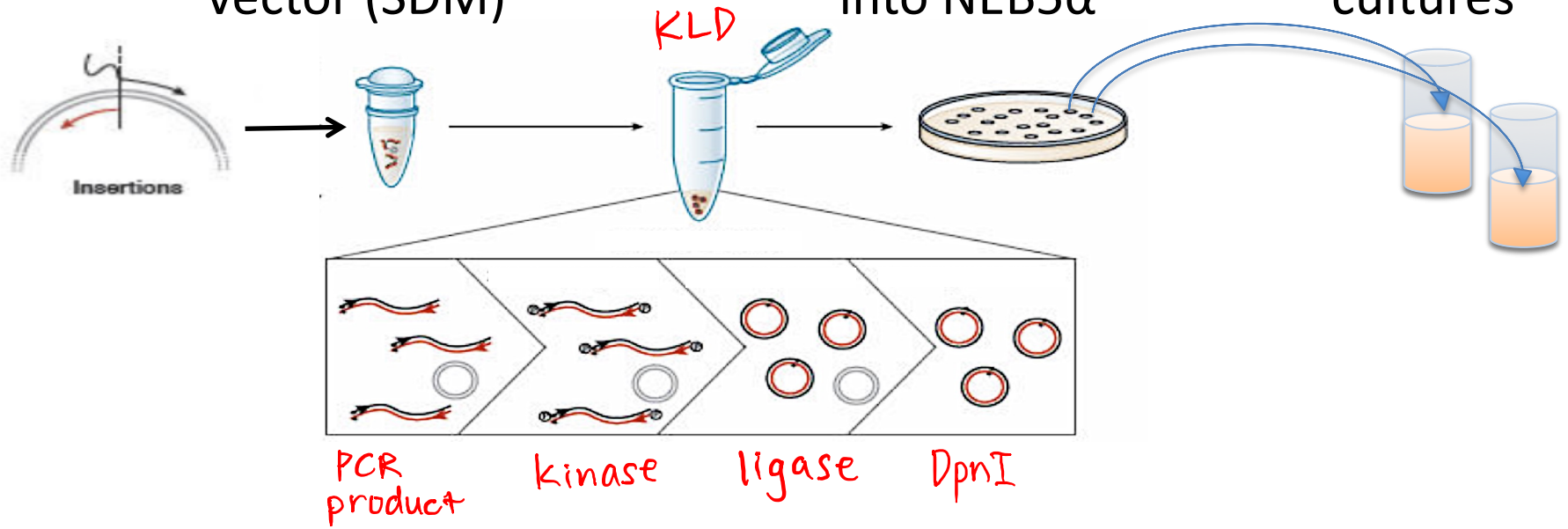
1. Quiz
2. Pre-lab discussion
3. Lab
   - Purify gRNA plasmid (mini-prep)
   - Transform CRISPRi system into MG1655
   - Send pgRNA_target plasmids to be sequenced

Last time (& while you were away):

Insert gRNA sequence into vector (SDM)

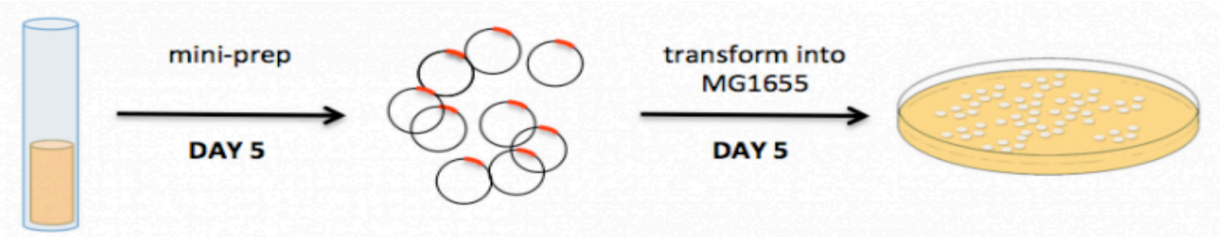
Transform into NEB5α

Inoculate liquid cultures



https://www.neb.com/products/e0554-q5-site-directed-mutagenesis-kit#Product%20Information

Today: confirm psgRNA_target

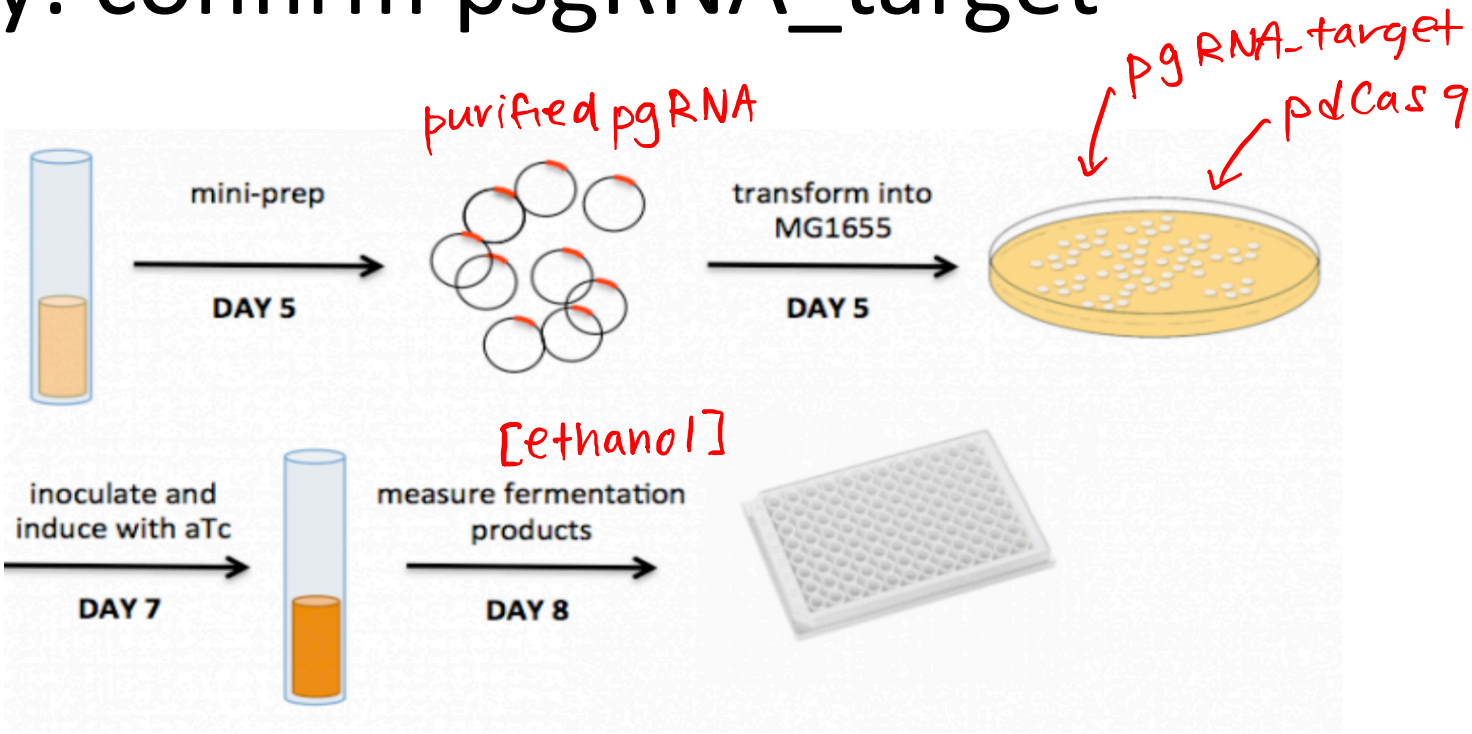


1.) Isolate pgRNA_target from *E. coli* cultures (mini-prep)

2.) Co-transform pgRNA_target (amp^R) & pdCas9 (chloramp^R) into MG1655 cells

3.) Submit pgRNA_target for sequencing to confirm product

Today: confirm psgRNA_target

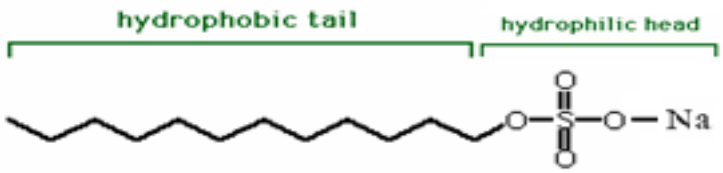


Mini-prep pgRNA_target clones

- Goal of mini-prep: purify plasmid
- Strategy:
  - _lyse_ cells to extract DNA
  - Separate DNA from proteins and lipids
  - Separate plasmid DNA from _chromosomal_ DNA
  - Purify and collect plasmid from other soluble factors

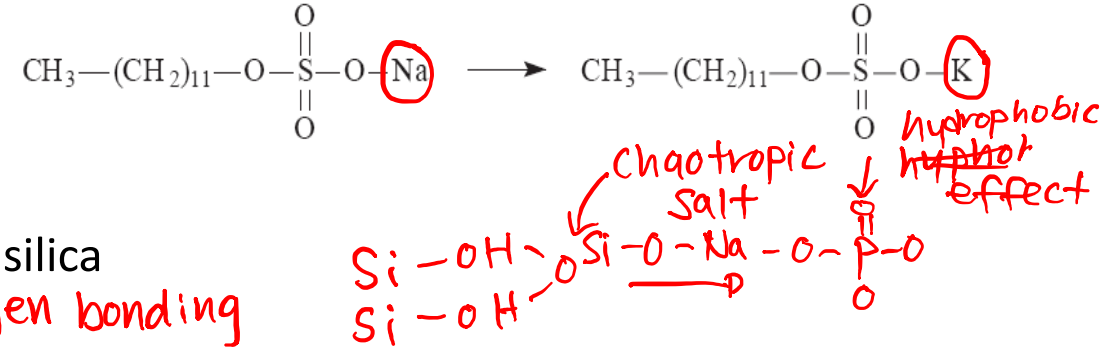
Prepare and lyse cells

- Prepare cells (P1) resuspension
  - Tris/EDTA buffer weaken the outer membrane
  - Rnase degrade RNA
- Lyse cells (P2)
  - Sodium dodecyl sulfate (SDS)
    - denatures proteins
    - ~~dissolves~~ disrupts lipid membrane
  - Sodium hydroxide (NaOH)
    - ↑pH, denaturing all DNA



Neutralization (N3)

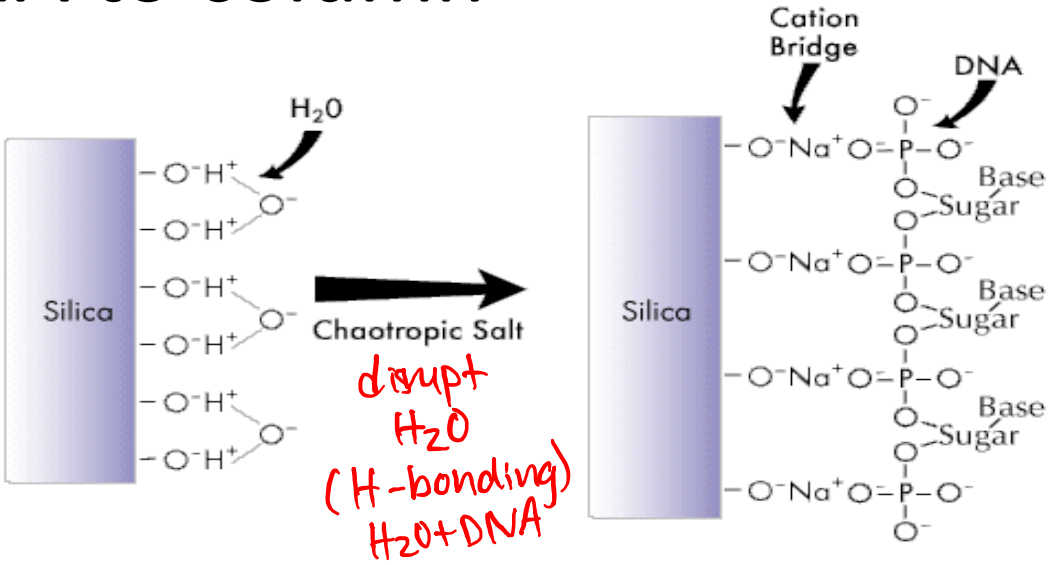
- Acetic acid / potassium acetate solution
  - Neutralizes pH → only renature plasmid DNA
  - Converts soluble SDS into insoluble PDS (white fluff)
    - → precipitate proteins, lipids, and chromosomal DNA



- Chaotropic salt
  - facilitates DNA binding to silica
    - → disrupting hydrogen bonding

➢ After centrifugation
  - supernatant: plasmid DNA (and soluble cellular constituents)
  - pellet: PDS, lipids, proteins, chromosomal DNA

Bind DNA to column

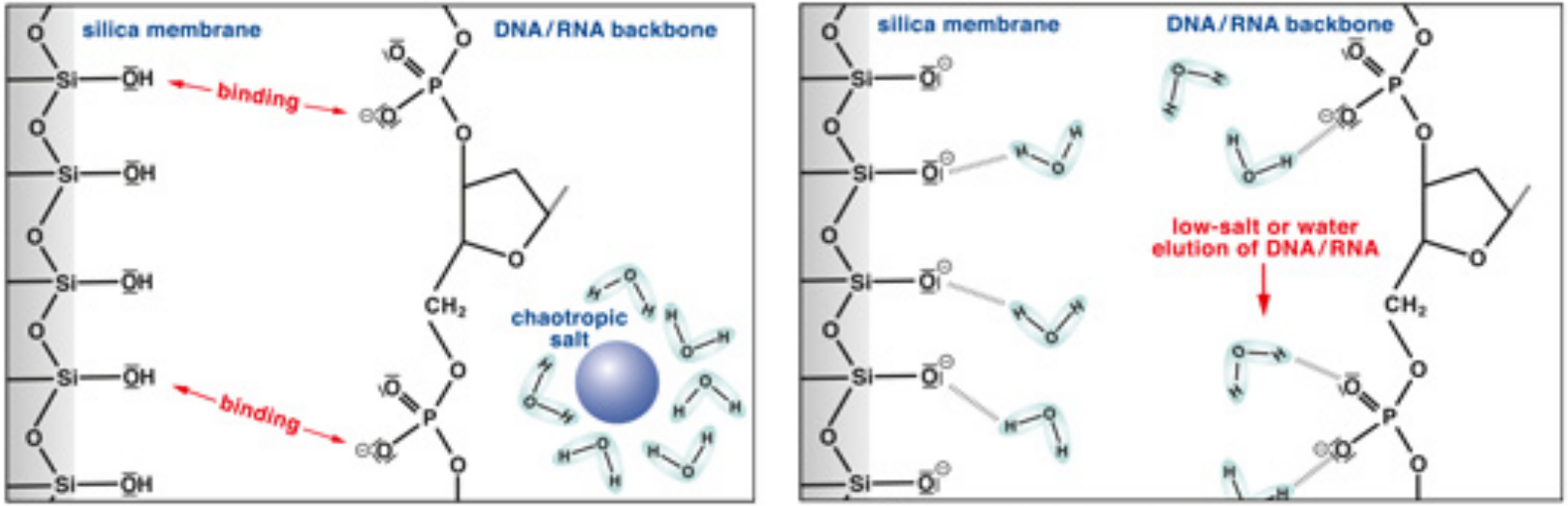


- Washes with PB (isopropanol) and PE (ethanol)
  - remove residual contaminants
  - maintain DNA onto column
- Spin off all ethanol before eluting DNA

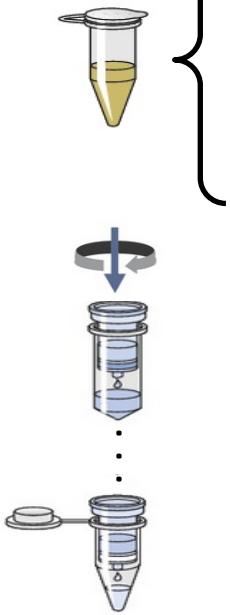
enriches for plasmid DNA

Elute DNA with water (pH 8)

- Water competes DNA off of silica column
- Collect DNA in a new tube



Summary of mini-prep to isolate DNA



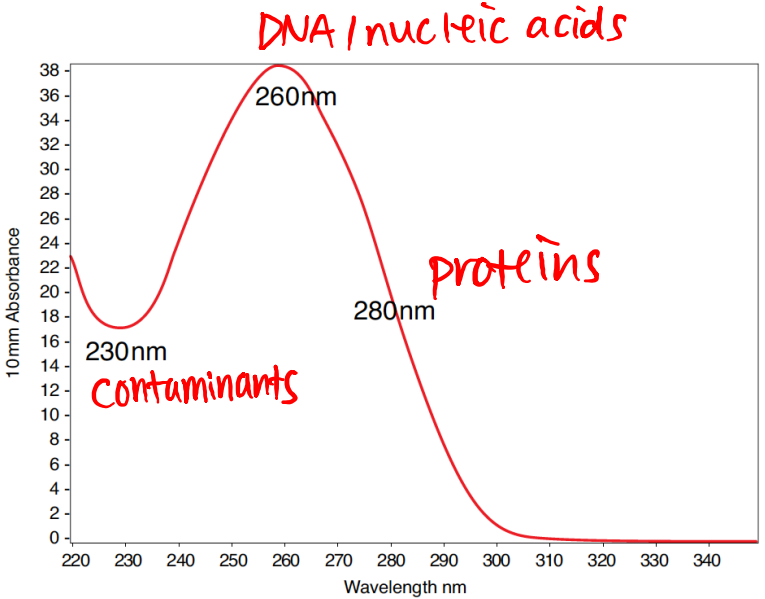
Steps	Contents	Purpose
Prepare (P1)	Tris/EDTA buffer RNase	Resuspend cells, weaken membrane, EDTA blocks DNase, RNase degrades RNA
Lyse (P2)	SDS (detergent) NaOH (alkaline lysis)	solubilize proteins, denature DNA
Neutralize (N3)	Acetic acid, chaotropic salt, potassium acetate	Renature short DNA, precipitate long DNA and protein
Spin		
Bind	Silica column	Concentrate and isolate DNA
Wash (PB, PE)	Isopropanol, ethanol	Remove contaminants
Elute	Water, pH 8.0	Elute all DNA off column

*Note: All liquid waste should be collected in conical tube, never aspirated

Measure DNA concentration with NanoDrop spectrophotometer

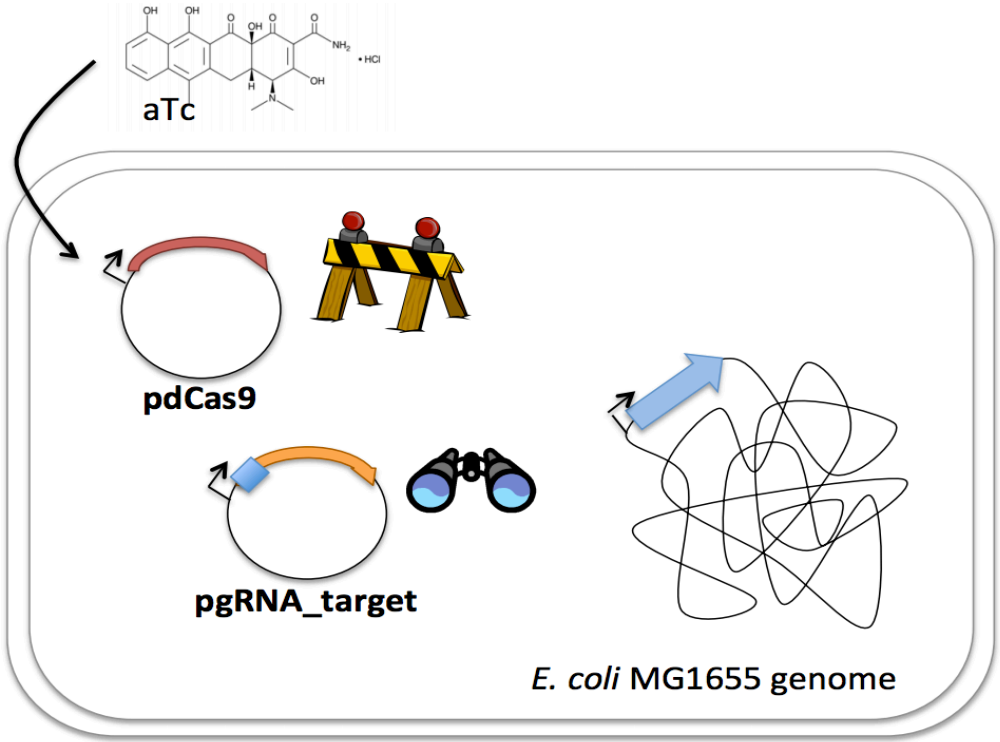
260:280 & 280:230 = purity of DNA sample

- DNA absorbs 260 nm light



https://tools.thermofisher.com/content/sfs/brochures/Thermo-Scientific-NanoDrop-Products-Nucleic-Acid-Technical-Guide-EN.pdf

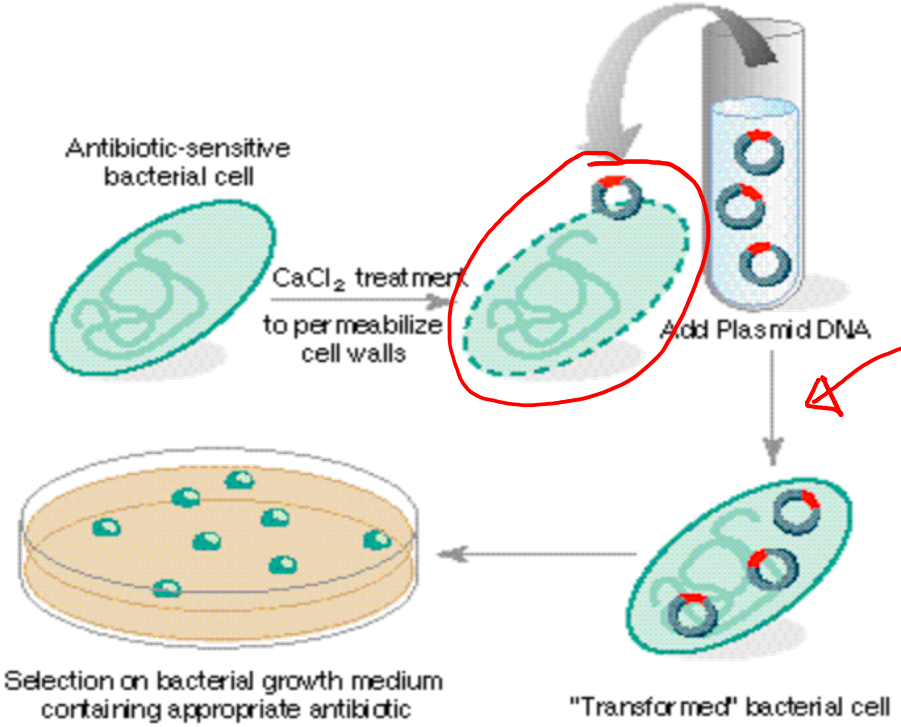
Transform CRISPRi system (two plasmids) into MG1655



- Target gene
- pgRNA_target
- pdCas9

Dr. Lyell's M2 lecture slides

Heat shock competent cells for transformation



- MG1655 made chemically **competent** by $CaCl_2$
  - In exponential growth phase
    - OD_{600} = 0.4-0.8
  - Ca^{2+} ions attract both lipopolysaccride membrane and plasmid DNA (DNA backbone)
- Heat shock competent cells with plasmids
  - 42°C for 45 sec
  - Potentially alters membrane to allow plasmid entry

- SOC medium to recover cells from heat shock!

Select for MG1655 with both plasmids using antibiotics

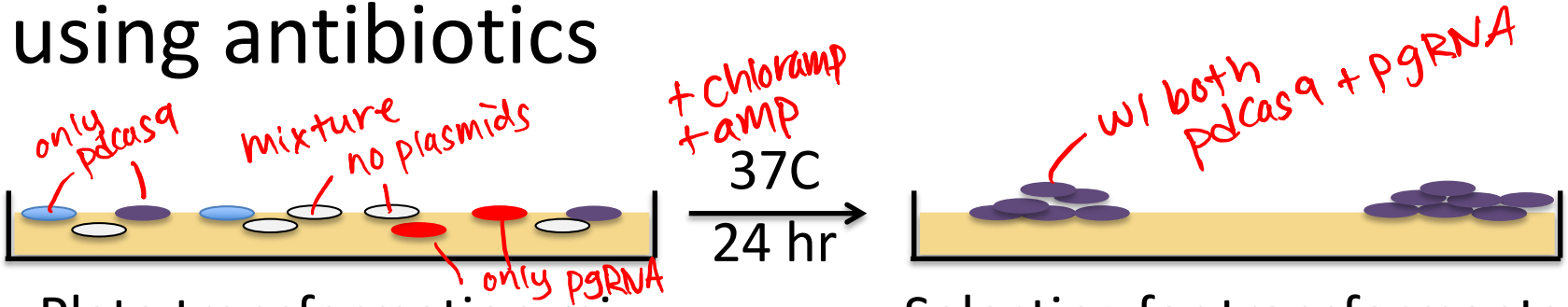


Plate transformation mix on double antibiotic plates

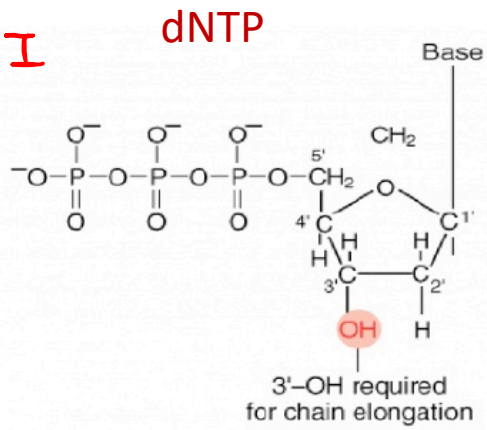
Selecting for transformants that received both plasmids

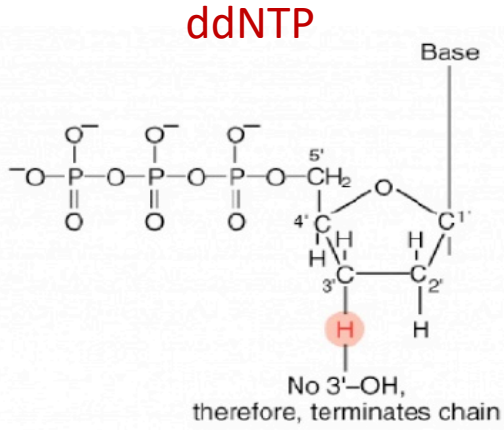
pdCas9 confers resistance to: chloramphenicol

pgRNA confers resistance to: ampicillin

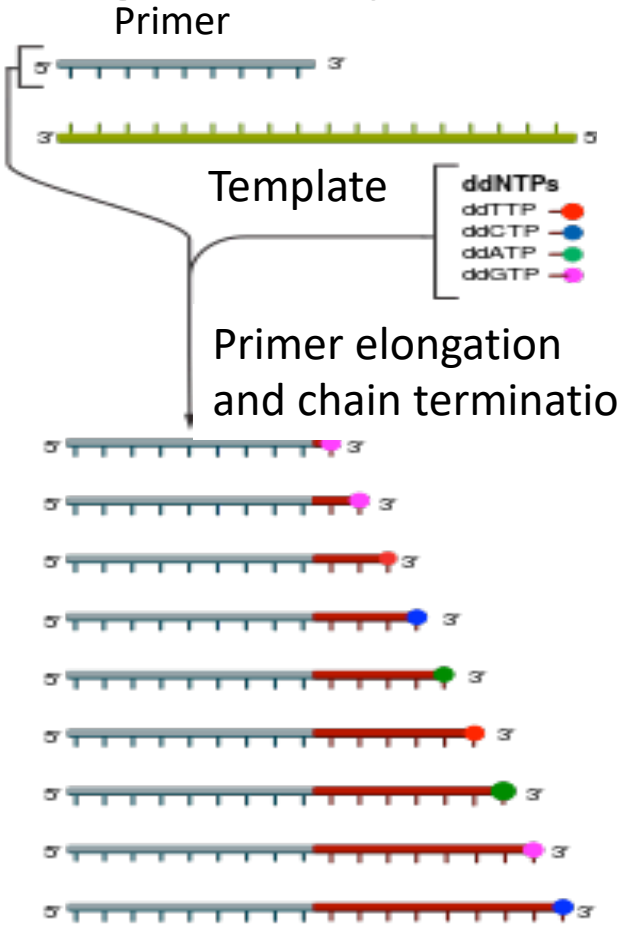
Use sequencing to determine if we have the intended pgRNA_target

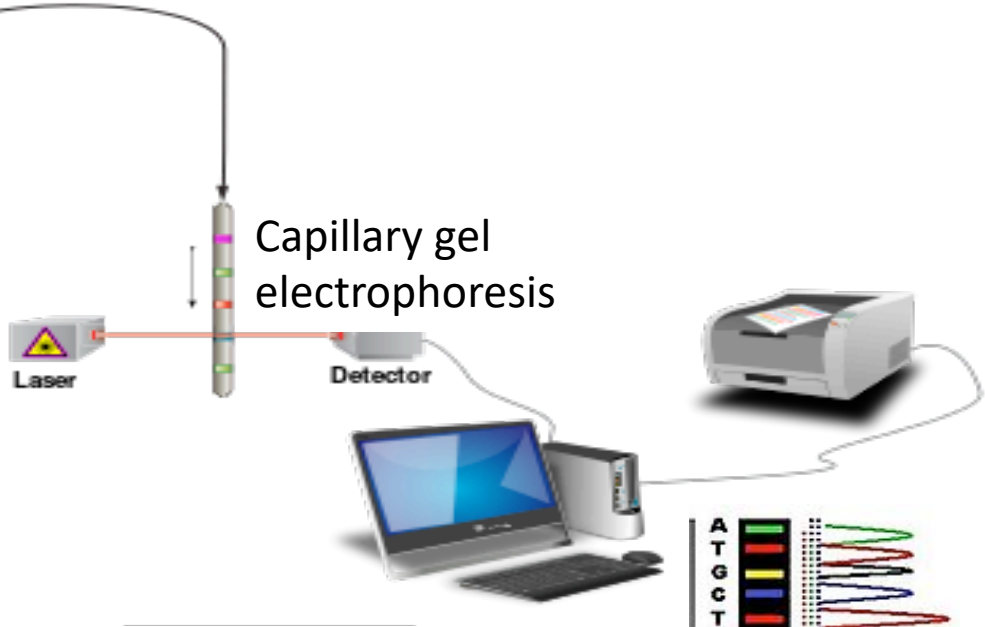
- Diagnostic digests check size
- Sanger Sequencing
  - di-deoxynucleotides terminate elongation
  - good to have both forward and reverse primers
    - ~ reads of 1000 bps
    - double check sequences of GOI





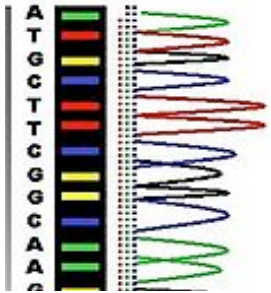
Sanger sequencing by Genewiz





Nucleotide location: fragment size

Nucleotide base: color



Chromatogram

Methods writing reminders (due M2D7)

- **Methods completed individually and included in your Mod2 Research article**
  - M2D2 through M2D5 (leave out M2D1 *in silico* cloning)
  - Using the phase "per manufacturers protocol" allowed for Qiagen miniprep kit only (not allowed for other protocols)
  - full primer sequences are reported in methods sections
- Include enough information to replicate the experiment
  - list manufacturers name
  - Be **concise and clear** in your description
- Use subsections with descriptive titles
  - Put in logical order
  - Begin with topic sentence to introduce purpose
- Use clear and concise full sentences
  - NO tables and lists
  - Passive voice expected
- Use the most flexible units
  - Write concentrations (when known) rather than volumes
- Eliminate 20.109 specific details
  - Don't reference team colors
  - Do not include details about tubes and water!
  - Assume reader has some biology experience

Example Methods

[1] ***PCR amplification of inverse pericam (IPC)***

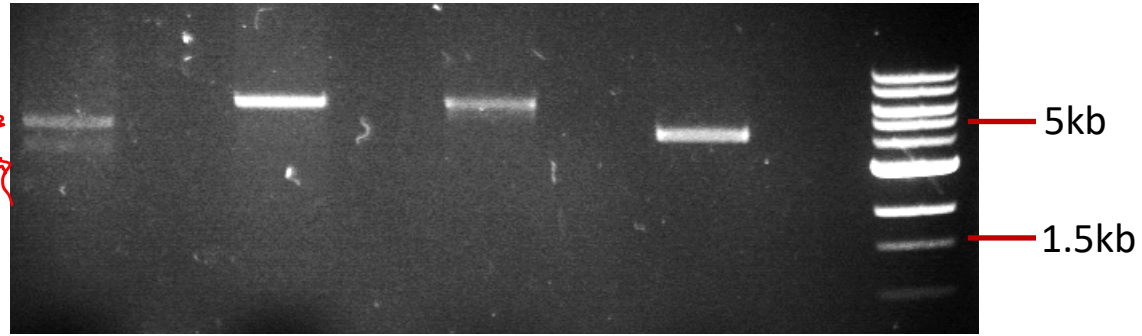
Inverse pericam (IPC) was amplified from a pcDNA3-IPC template (5 ng/uL) with 2 pmol/uL IPC-forward (5’ NNN 3’) and IPC-reverse (5’ NNN 3’) primers, using 1X MasterMix (Bio-Rad) and the following thermocycler conditions: initial denaturation at 98°C for 30 s, 25 cycles of amplification (melt at 98°C for 10 s, anneal at 55°C for 30 s, extend at 72°C for 2 min), final extension at 72°C for 2min.

[2] ***Amplification of the pRSET-IPC plasmid***

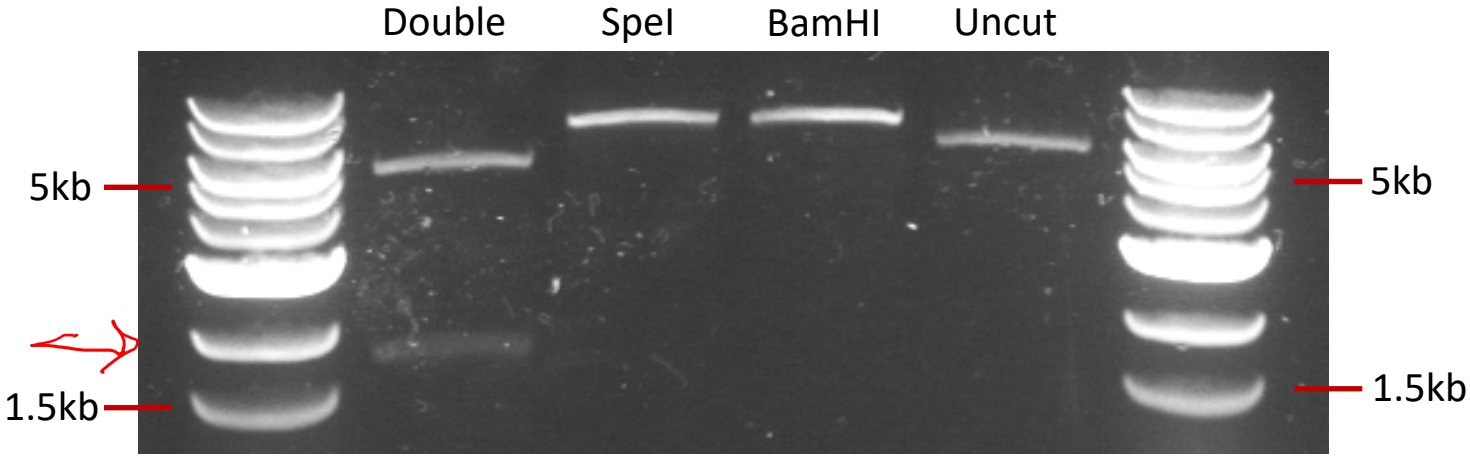
The DNA of a 1.5 mL of NEB 5alpha (genotype: *fhuA2 Δ(argF-lacZ)U169 phoA glnV44 Φ80 Δ(lacZ)M15 gyrA96 recA1 relA1 endA1 thi-1 hsdR17*) overnight culture was collected using a QIAquick mini-prep kit (Qiagen) according to the manufacturer’s protocol with a final elution in 30 µL of distilled water pH 8.0.

Diagnostic Digest

- Expected double digest band sizes
  - 5029bp
  - 1676bp



Ladder bands make for poor decoration. But they are full of useful information



New Image in Dropbox

In lab today…

1. Start your miniprep from liquid culture at front bench
2. Transform miniprep DNA and pdCas9 into MG1655
3. Prepare sequencing reactions for submission and create new sequence file in benchling for your pgRNA_target plasmid

- In downtime:
  - Incorporate Mod1 edits
  - Work on M2D7 homework
  - Work on whatever else you feel would be a good use of time