

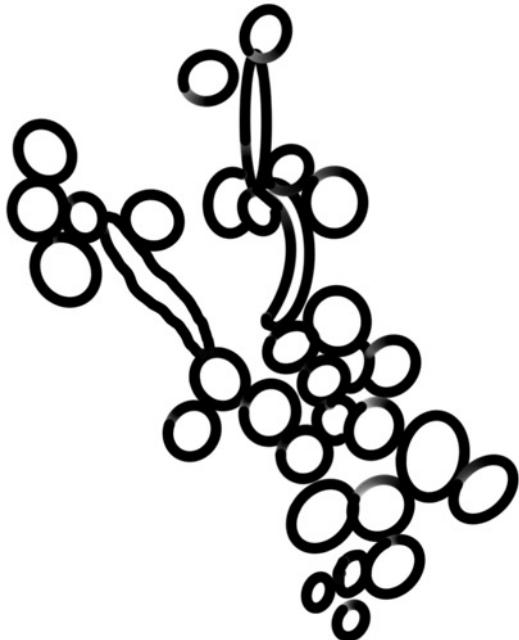
1. Initiative
2. Project Aims
3. Design → Build → Test ↪
4. For resource-limited regions

Initiative: sanitary napkin bag



Mold breeding?
Safety problems?

WE NEED A NEW WAY TO DETECT

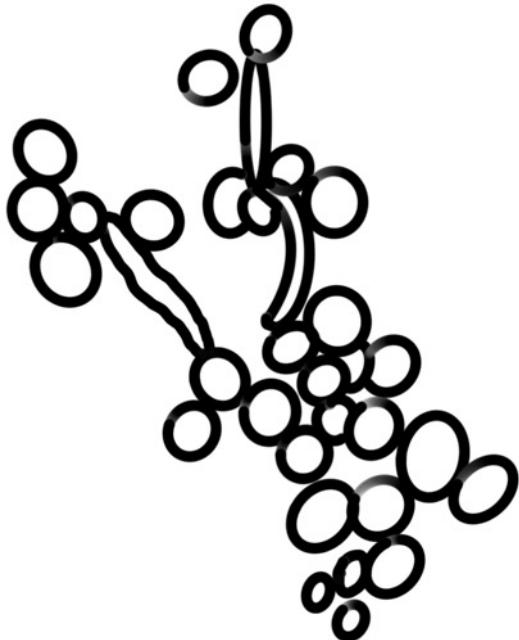


Candida albicans

Affect 75% of women

Cause vulvovagino candidiasis

WE NEED A NEW WAY TO DETECT



Candida albicans

Affect 75% of women
Cause vulvovagino candidiasis



No diagnosis for *C. albicans* that is

- Simple
- Convenient
- Cheap

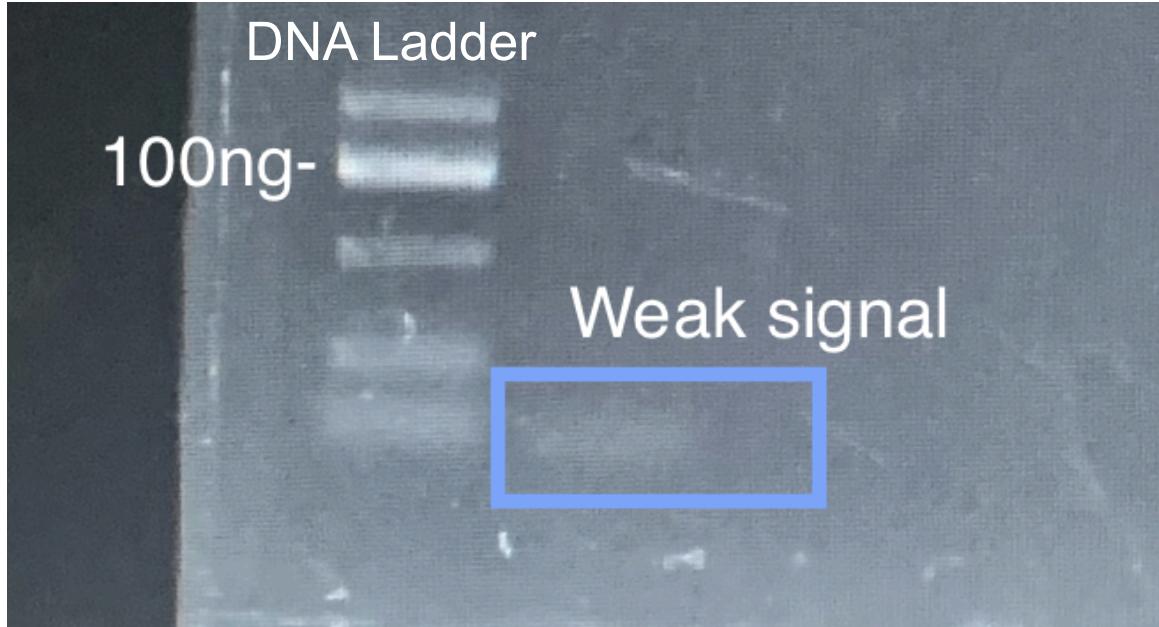
Our aims

1. Initiative
2. Project Aims
3. Design → Build → Test ↪
4. For resource-limited regions

Candidamera

To develop a cheap, convenient, fast, and accurate detection method of *C. albicans* for women which can be used ANYWHERE, under any circumstances, for any kind of user group - even in remote areas where resources are severely limited.

Design: isothermal amplification by HDA



Amplified using a commercial HDA kit
(target *Candida albicans* 5.8s rDNA)



From Helicase-Dependent isothermal Amplification (HDA) to Loop-mediated isothermal AMPlification (LAMP)

- High amplification efficiency
- Simple enzyme
- High specificity

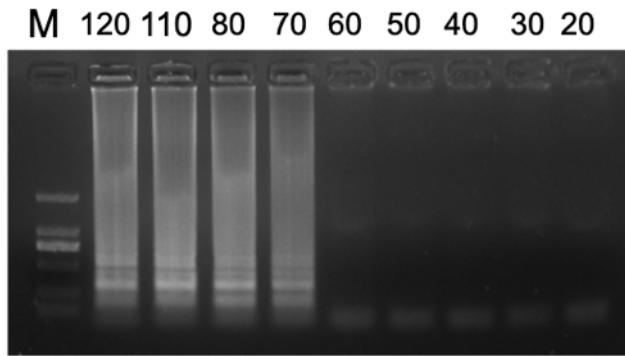


Table 1. Summary of Important Isothermal Amplification Methods

method	required enzymes	primers	temperature (°C)	reaction time (h)	target	amplicon	efficiency	refs
NASBA	2 or 3: reverse transcriptase and RNA polymerase (RNase H)	2	~ 41	1.5–2	RNA (DNA)	RNA, DNA	10 ⁶ –10 ⁹	11 , 12
E-SDA	2: DNA polymerase and NEase	2 or 4	37	2	DNA	dsDNA	10 ⁷	19 , 20 , 256
HRCA	2: ligase and DNA polymerase	2	60	1.5	DNA (RNA)	DNA	10 ⁹	24 , 49 , 227
PG-RCA	2: DNA polymerase and NEase	0	60	1–3	DNA (RNA)	DNA	~60 copies of genomic DNA	25 , 232 , 371
LAMP	1: DNA polymerase	4	60–65	< 1	DNA	DNA	10 ⁹	26 , 27
HDA	2: DNA polymerase and helicase	2	37–65	0.5–2	DNA	DNA	10 ⁷	30 , 349
RPA	2: DNA polymerase and recombinase	2	37–42	0.5–1.5	DNA	DNA	10 copies of genomic DNA	35 , 653
EXPAR	2: DNA polymerase and NEase	0	~ 60	< 0.5	short DNA (RNA)	DNA	10 ⁶ –10 ⁸	39 , 42 , 45 , 46
MDA	1: DNA polymerase	random primers	30–37	> 8	DNA	DNA	10 ⁶	47 , 666
pWGA	2: T7 gp4 primase and DNA polymerase	0	37	0.5–2	DNA	DNA	10 ³ –10 ⁸	50

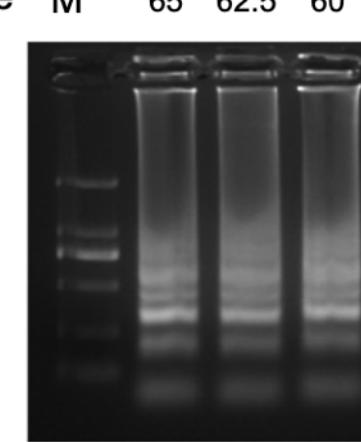
LAMP

Reaction time (min)



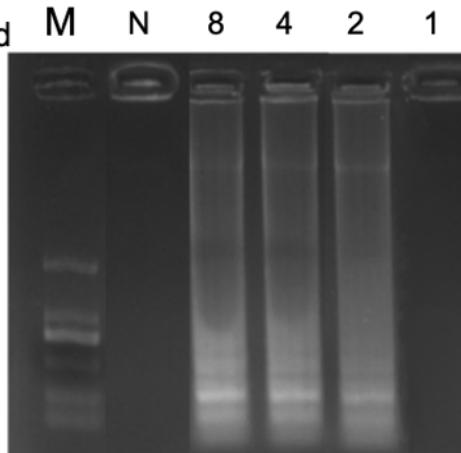
LAMP

Temperature (°C)

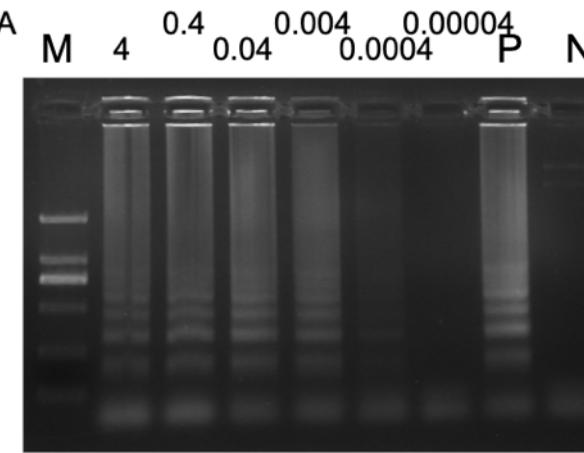


Purified Bst(U)

Amount of Enzyme added



Concentration of *C. albicans* DNA (ng/μl)



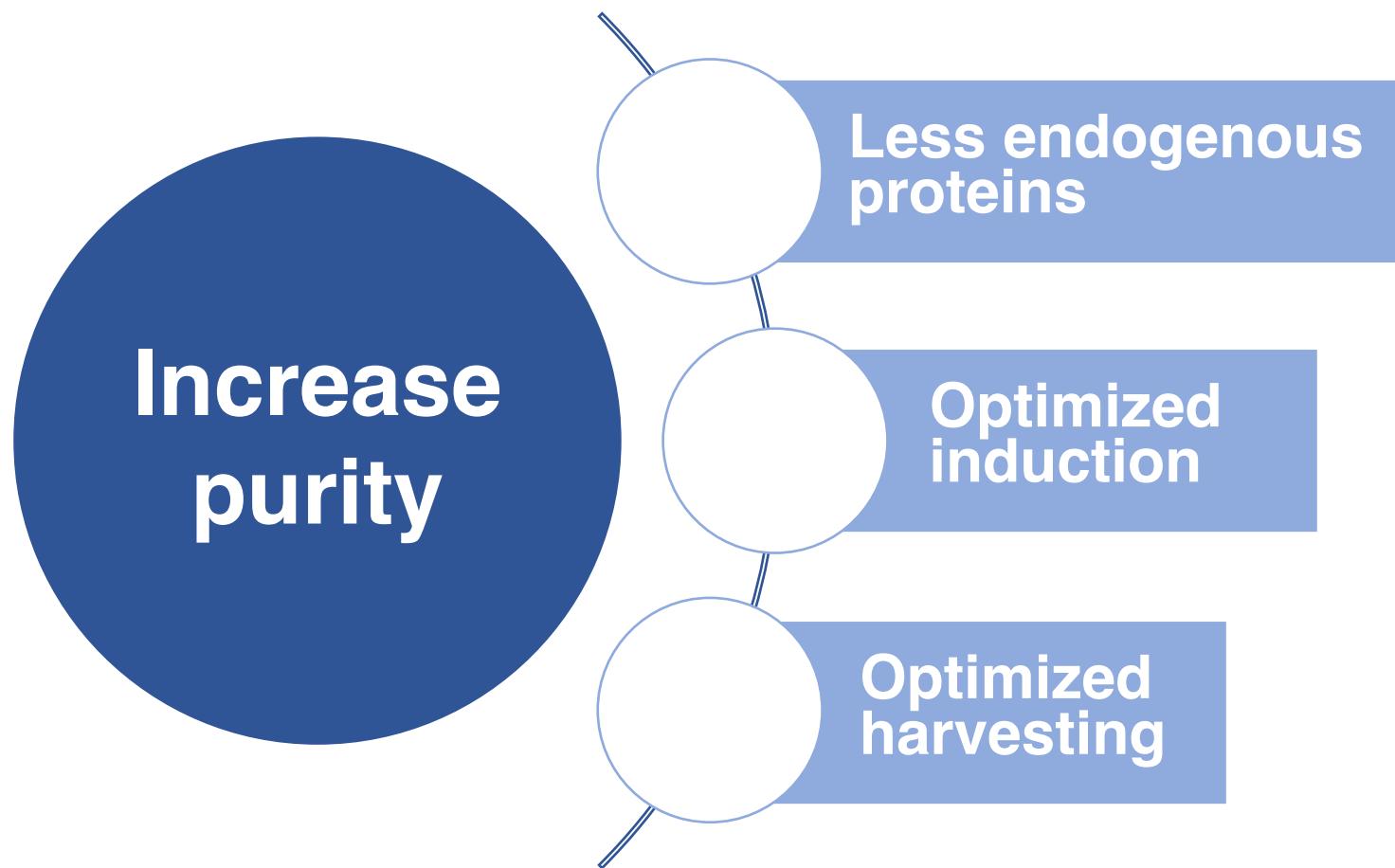
- Control line

- Test line

We hoped to use lysates of the engineered *E. coli* to catalyze LAMP directly.

Engineering: Increase the purity of Bst

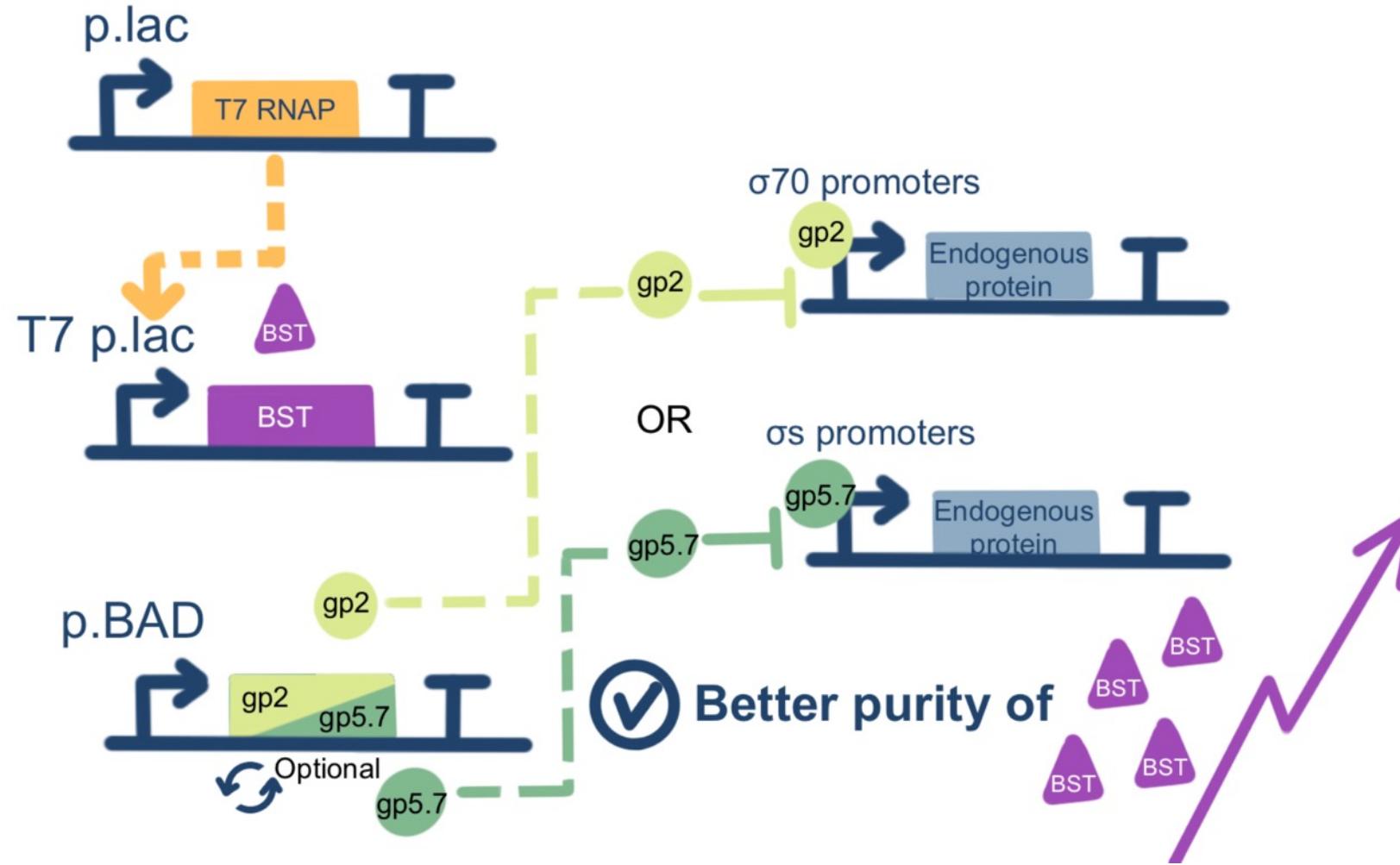
Bst DNA polymerase, the only enzyme required in LAMP reaction

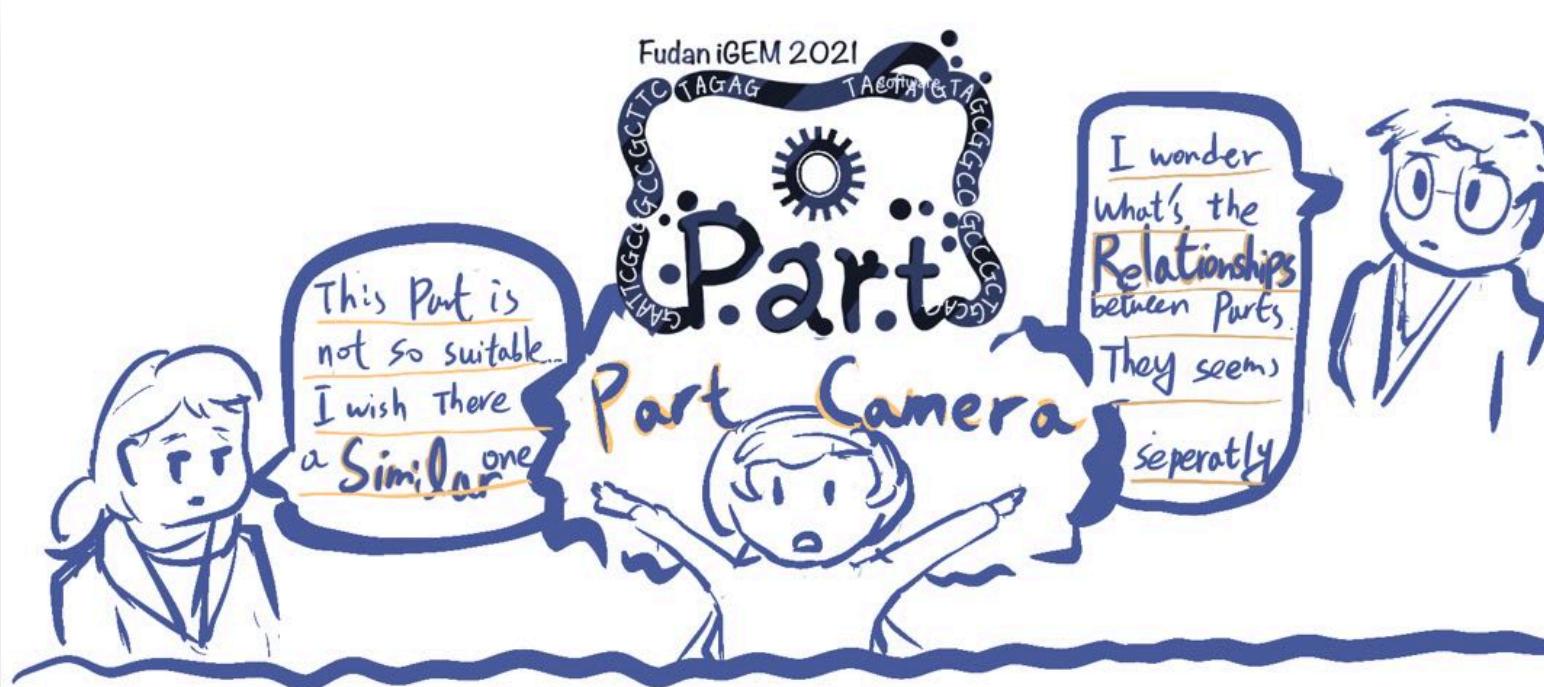


We hoped to use lysates of the engineered *E. coli* to catalyze LAMP directly.

1. Initiative
2. Project Aims
3. Design → Build → Test ↪
 - 3.1 Use existing parts
 - 3.2 Verify σS promoters
 - 3.3 Characterize T7 gp2 and gp5.7
 - 3.4 Model T7 induction
 - 3.5 Measure bacterial autolysis
 - 3.6 Induced Bst expression
 - 3.7 Isothermoal amplification
 - 3.8 Lateral flow assays
4. For resource-limited regions

Parts: Bst expressing circuits





Get Part Camera!!

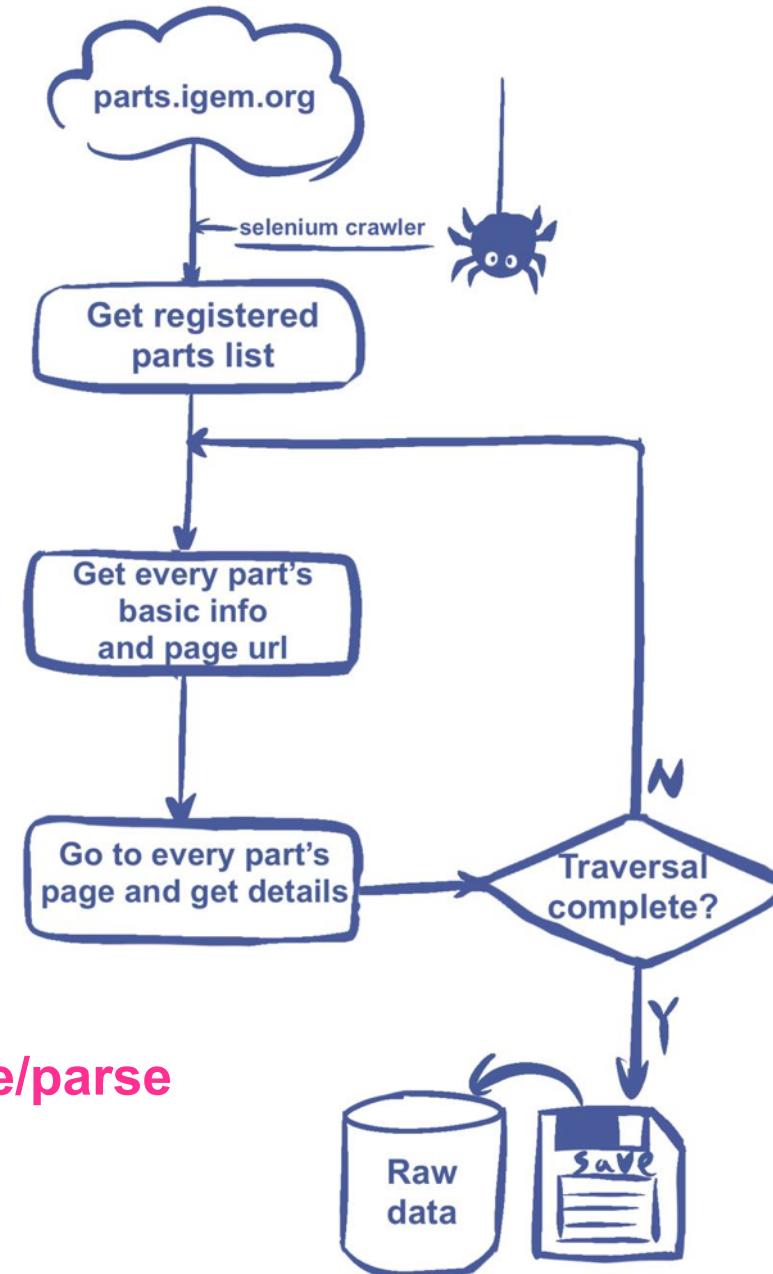


1. Go to <http://GitHub.com/FDUiGEM2021software>
2. Clone our repository into your desktop
3. Find the local project path and open it
4. Get ready to start!

For more details, please visit <https://2021.igem.org/Team:Fudan/Software>

Software: gp2 search animation

Software – parse



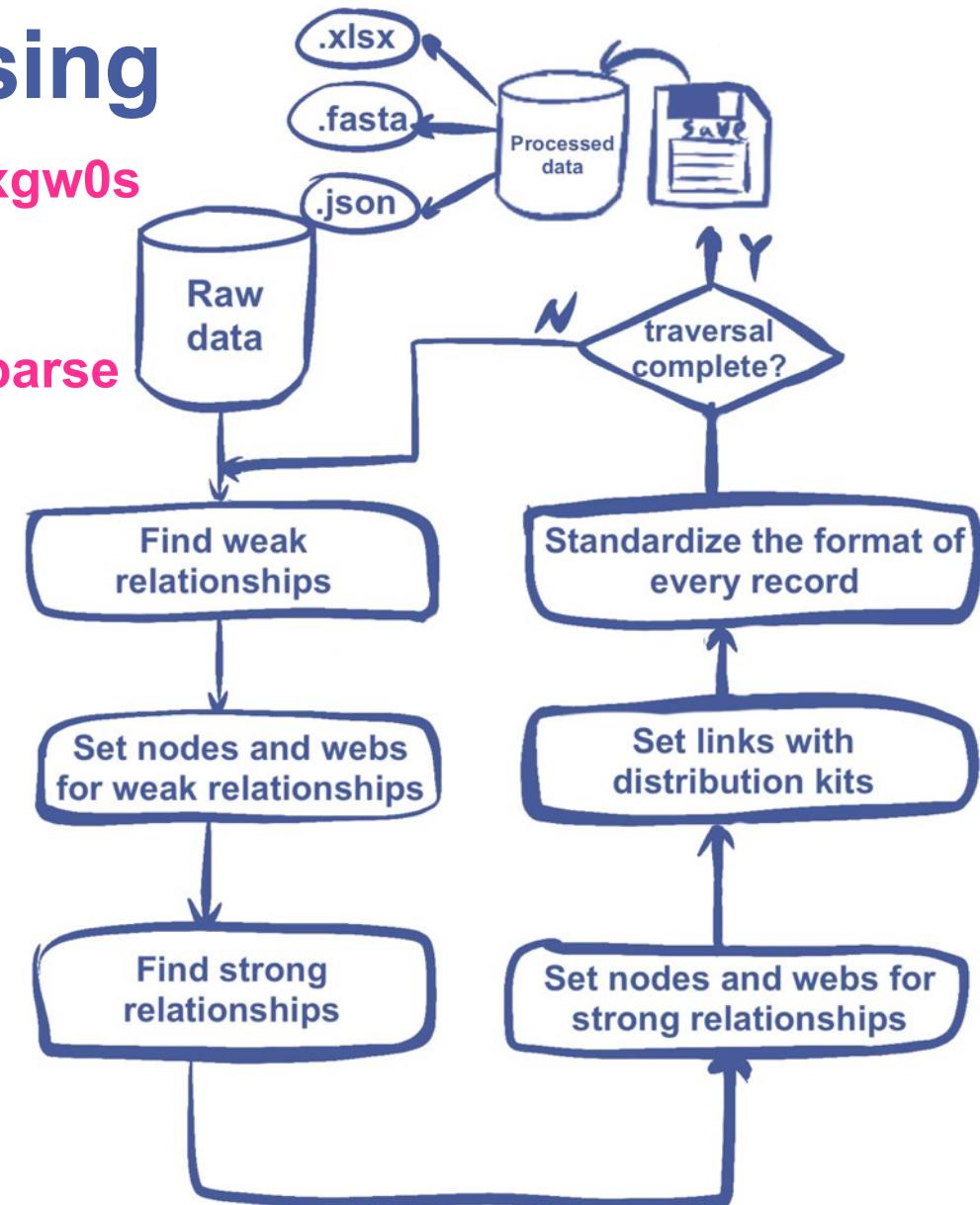
<https://github.com/FDUiGEM2021Software/parse>

Software – local processing

<https://www.dropbox.com/l/scl/AABCgPQXxgw0spyxTfBXEcfs8b5hz9y0AY>

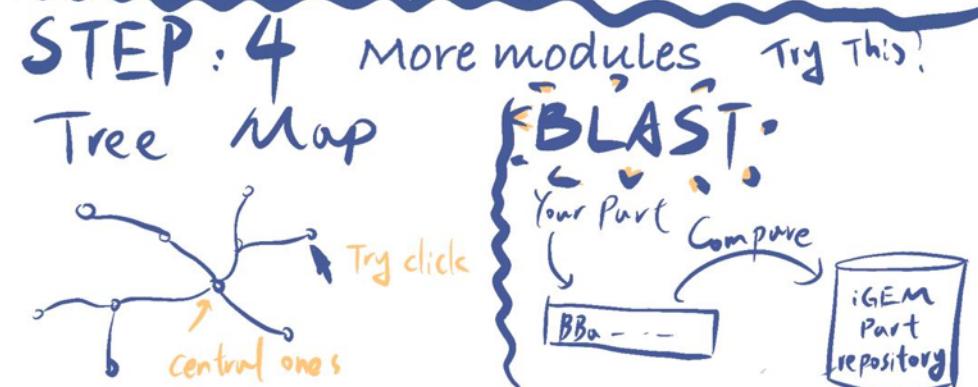
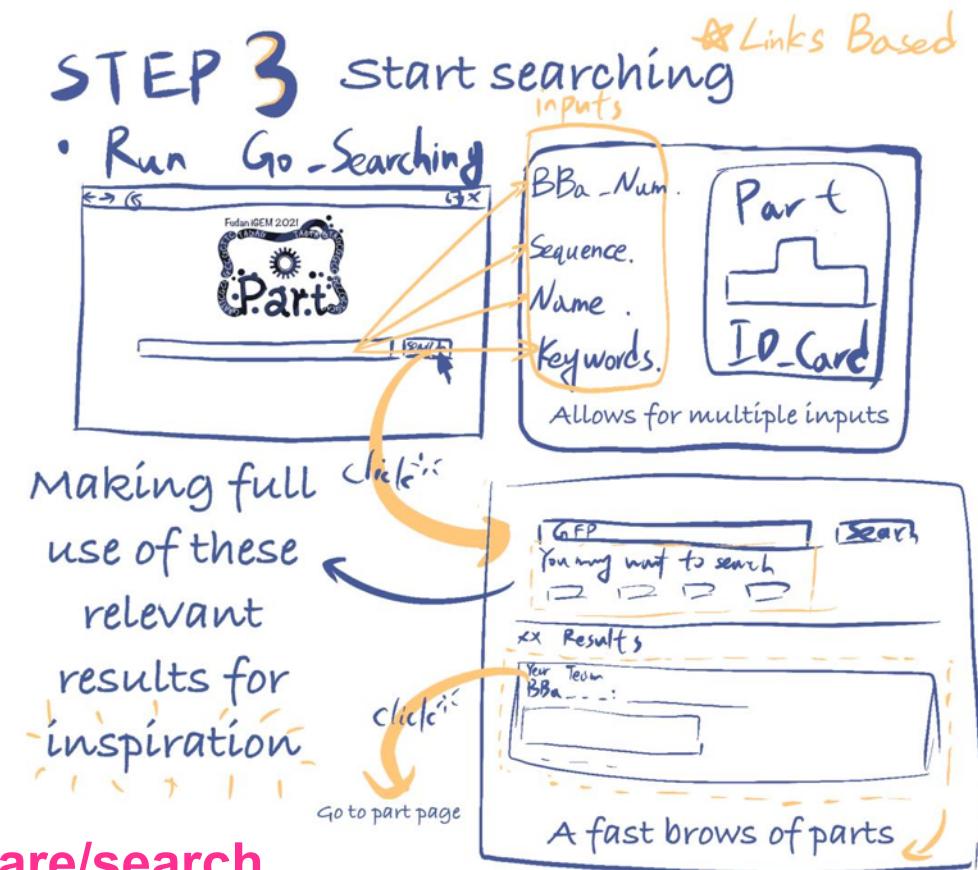
<https://github.com/FDUiGEM2021Software/parse>

这个程序在哪里

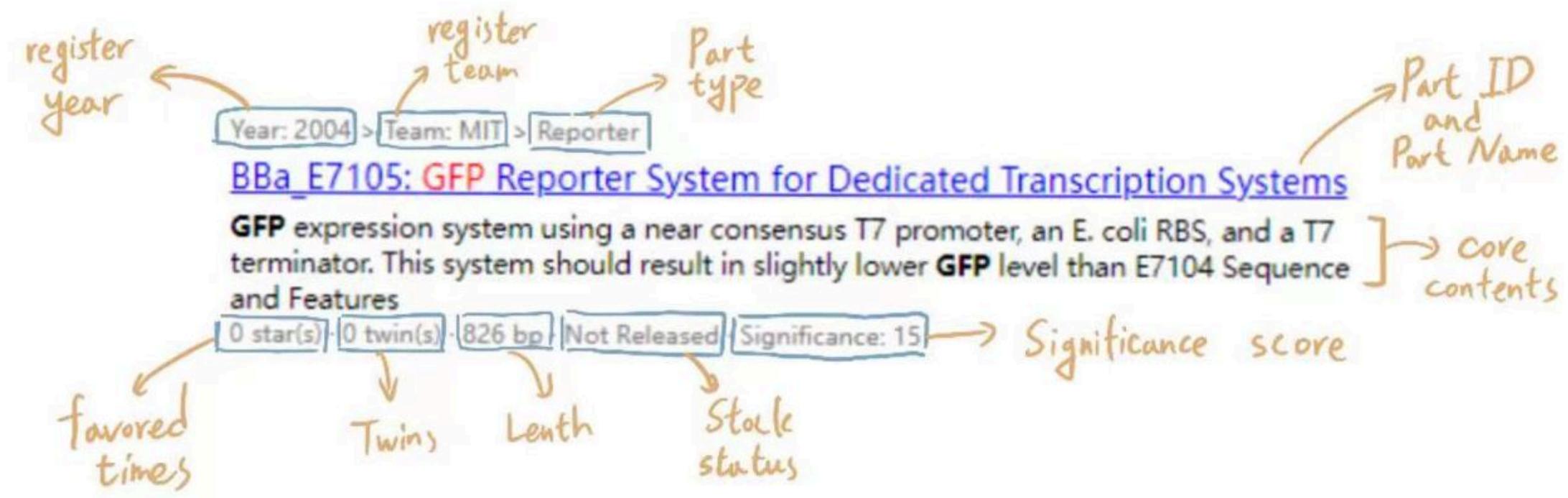


Software – search

<https://github.com/FDUiGEM2021Software/search>



Software – search result



Software – local BLAST

****Alignment****

sequence:gnl|BL_ORD_ID|144 BBa_I14053 C4, LacI Router (weak RBS) p(Rhl), Weak RBS, LacI + LVA Sequence and Features
ilength:1232
e value:0.0

TCACACAGGAAACCTACTAGATGGTGAATGTGAAACCAGTAACGTTACGATGTCGCAGAGTATGCCGGTGTCT...
|||||||...
TCACACAGGAAACCTACTAGATGGTGAATGTGAAACCAGTAACGTTACGATGTCGCAGAGTATGCCGGTGTCT...

****Alignment****

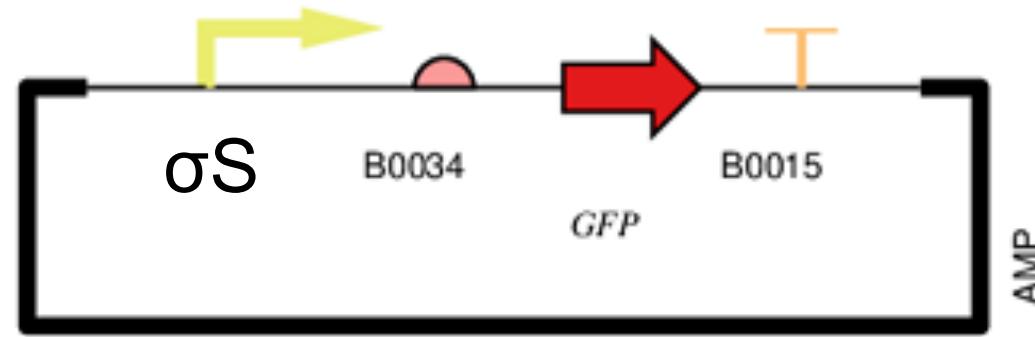
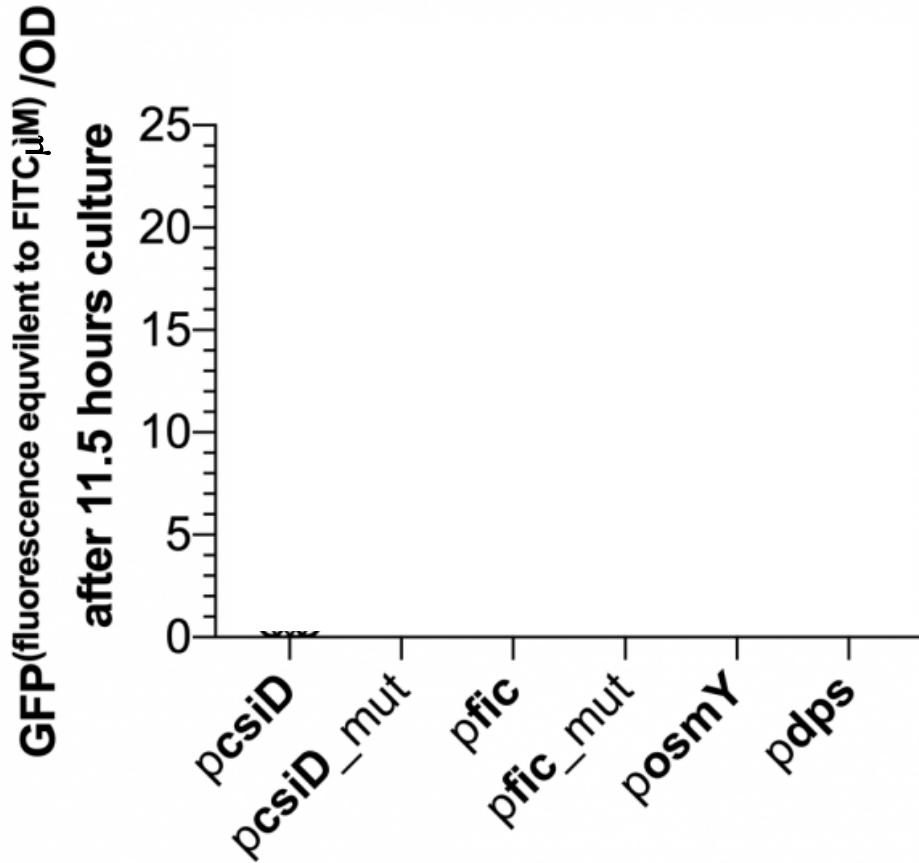
sequence:gnl|BL_ORD_ID|0 BBa_I14044 weak RBS . LacI BBa_B0031 BBa_C0012 Sequence and Features
ilength:1173
e value:0.0

TCACACAGGAAACCTACTAGATGGTGAATGTGAAACCAGTAACGTTACGATGTCGCAGAGTATGCCGGTGTCT...
|||||||...
TCACACAGGAAACCTACTAGATGGTGAATGTGAAACCAGTAACGTTACGATGTCGCAGAGTATGCCGGTGTCT...

For more details, please visit <https://2021.igem.org/Team:Fudan/Software>

TreeMap animation

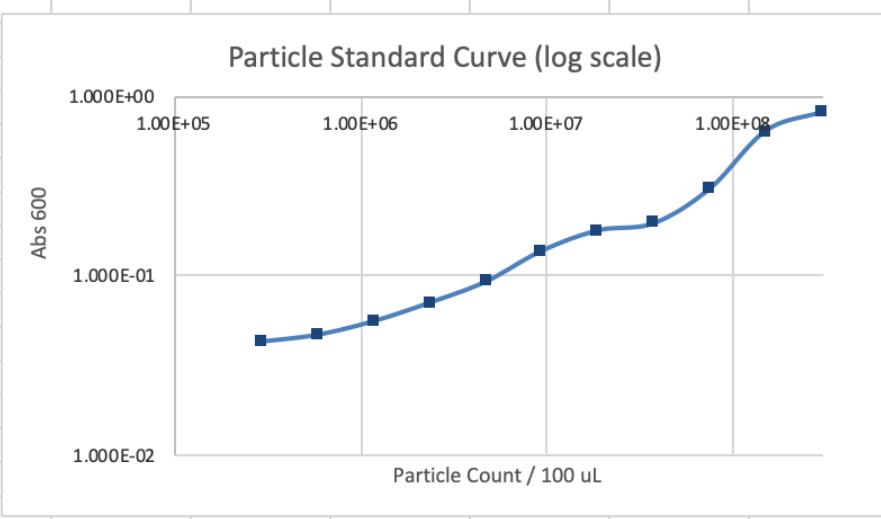
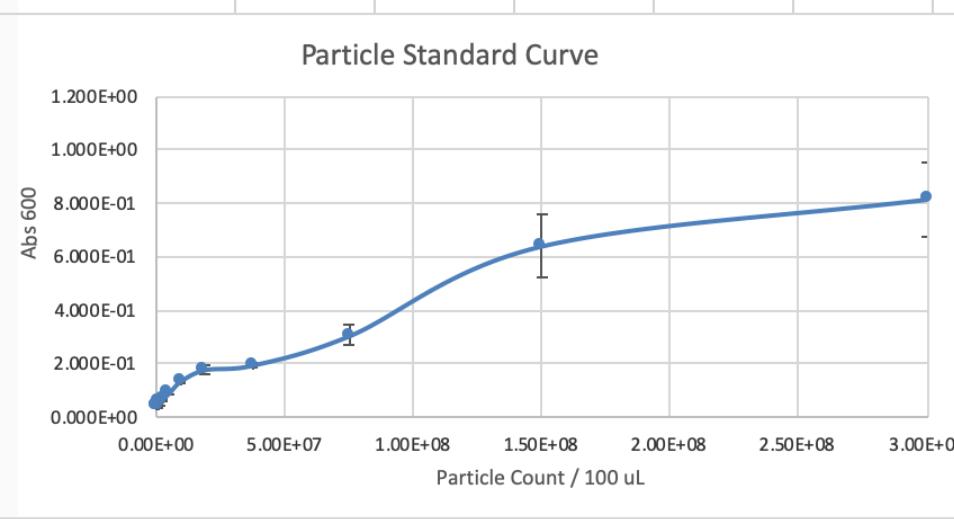
Parts: Screen σ S promoters



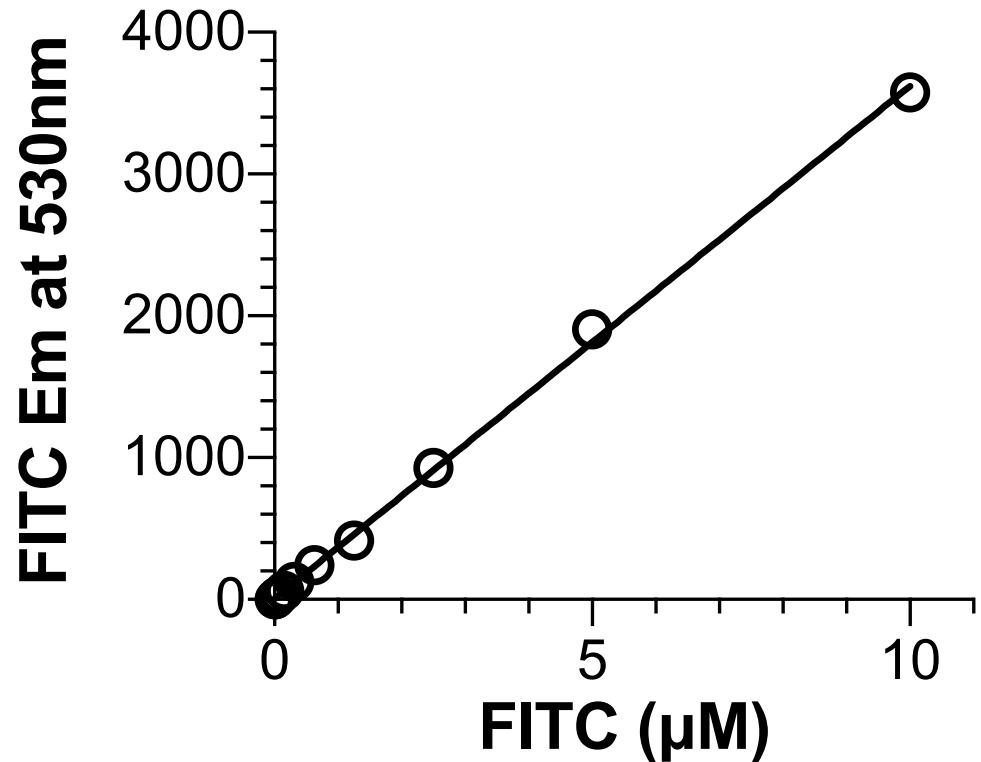
Calibrated OD600

1 OD₆₀₀ = 2 x 10⁸ particles/mL

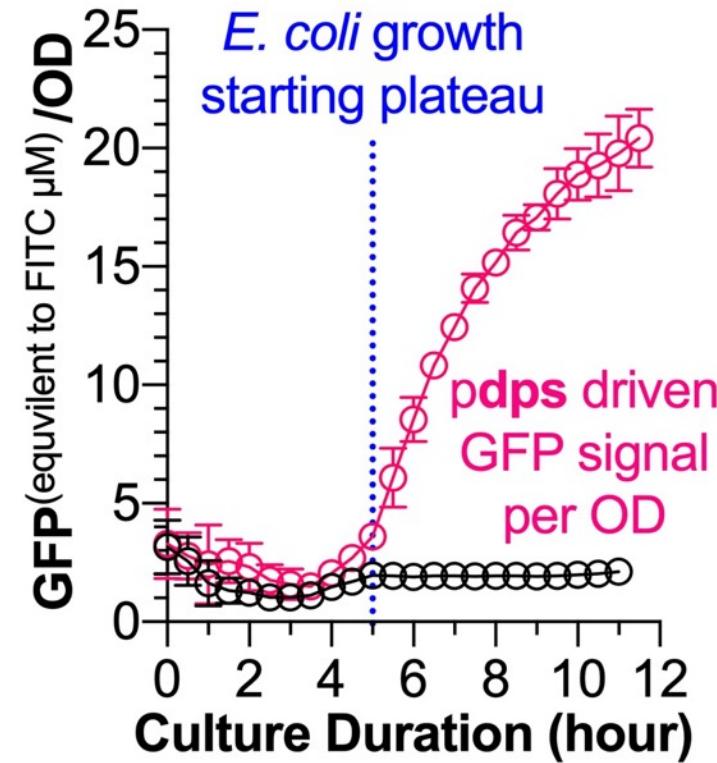
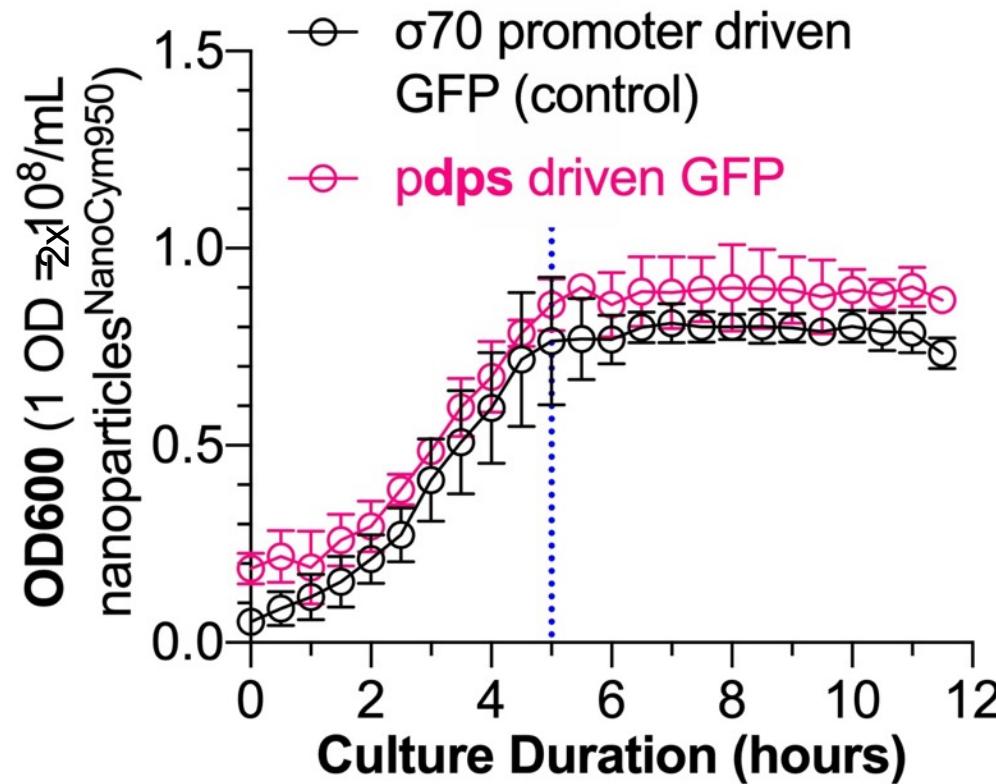
Number of Particles	3.00E+08	1.50E+08	7.50E+07	3.75E+07	1.88E+07	9.38E+06	4.69E+06	2.34E+06	1.17E+06	5.86E+05	2.93E+05	0
Replicate 1	0.715	0.555	0.332	0.202	0.168	0.138	0.088	0.072	0.049	0.045	0.043	0.046
Replicate 2	0.914	0.726	0.281	0.192	0.191	0.139	0.099	0.071	0.064	0.05	0.044	0.041
Replicate 3												
Replicate 4												
Arith. Mean	8.145E-01	6.405E-01	3.065E-01	1.970E-01	1.795E-01	1.385E-01	9.350E-02	7.150E-02	5.650E-02	4.750E-02	4.350E-02	4.350E-02
Arith. Std.Dev.	1.407E-01	1.209E-01	3.606E-02	7.071E-03	1.626E-02	7.071E-04	7.778E-03	7.071E-04	1.061E-02	3.536E-03	7.071E-04	3.536E-03
Arith. Net Mean	7.710E-01	5.970E-01	2.630E-01	1.535E-01	1.360E-01	9.500E-02	5.000E-02	2.800E-02	1.300E-02	4.000E-03	0.000E+00	

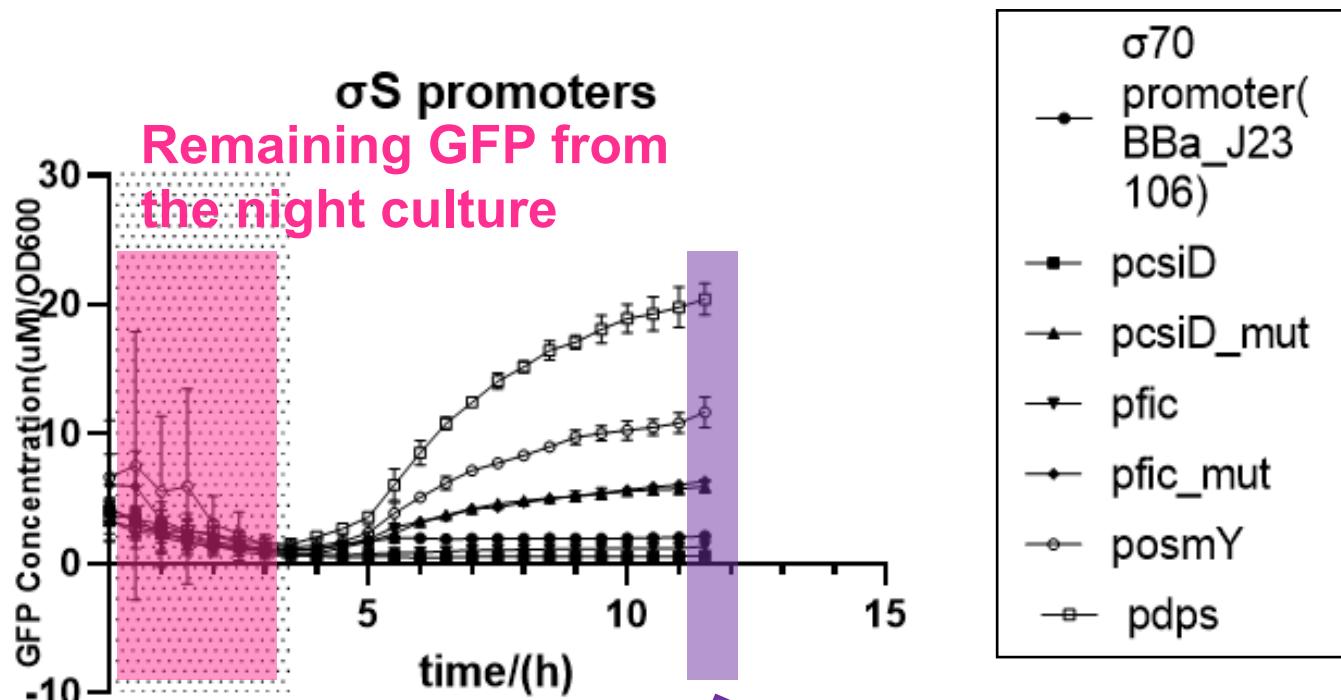


Calibrated green fluorescence using FITC

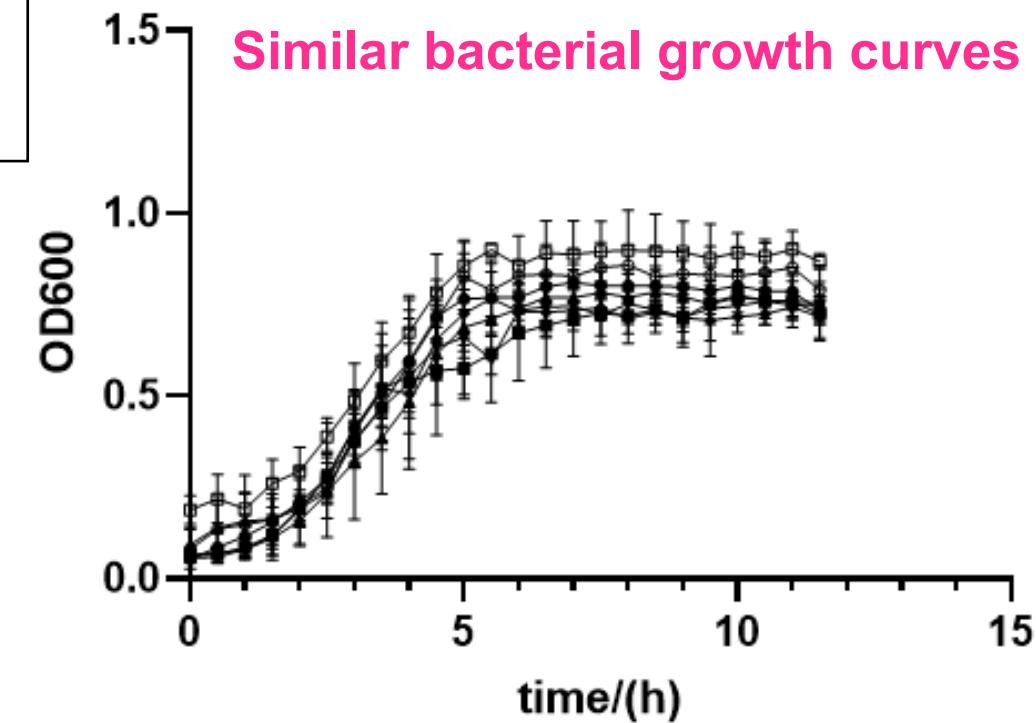


Parts: pdps is a valid σ S promoter

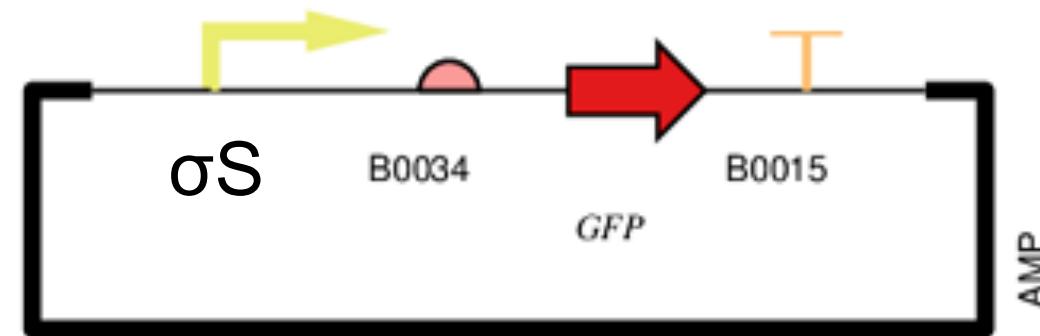
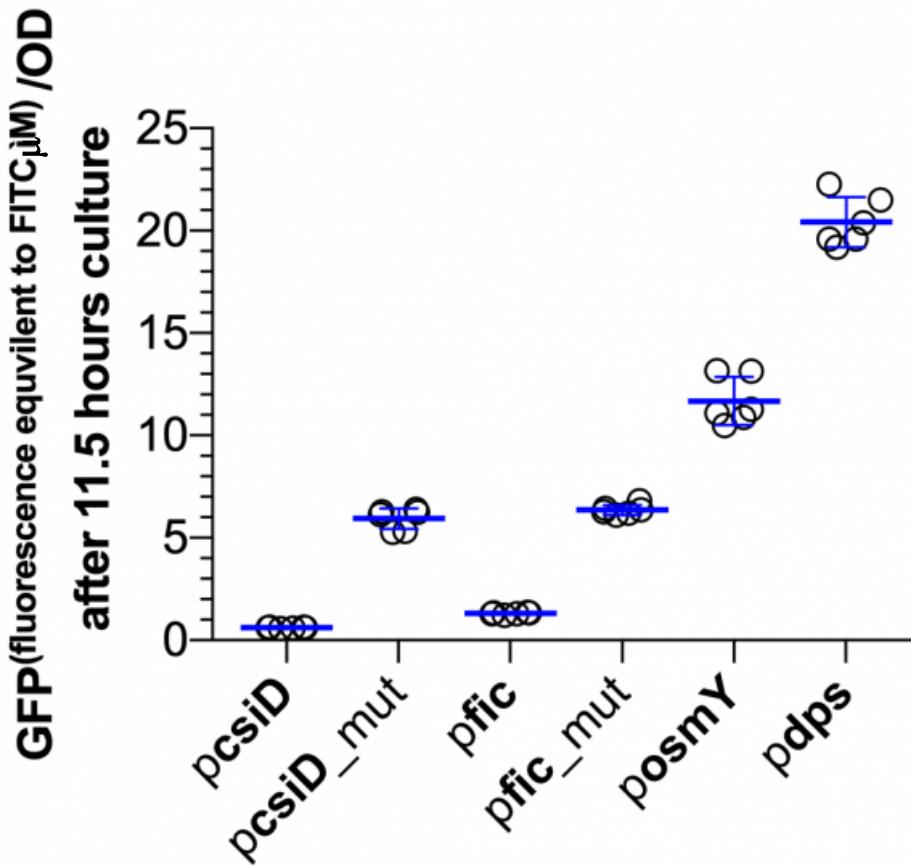




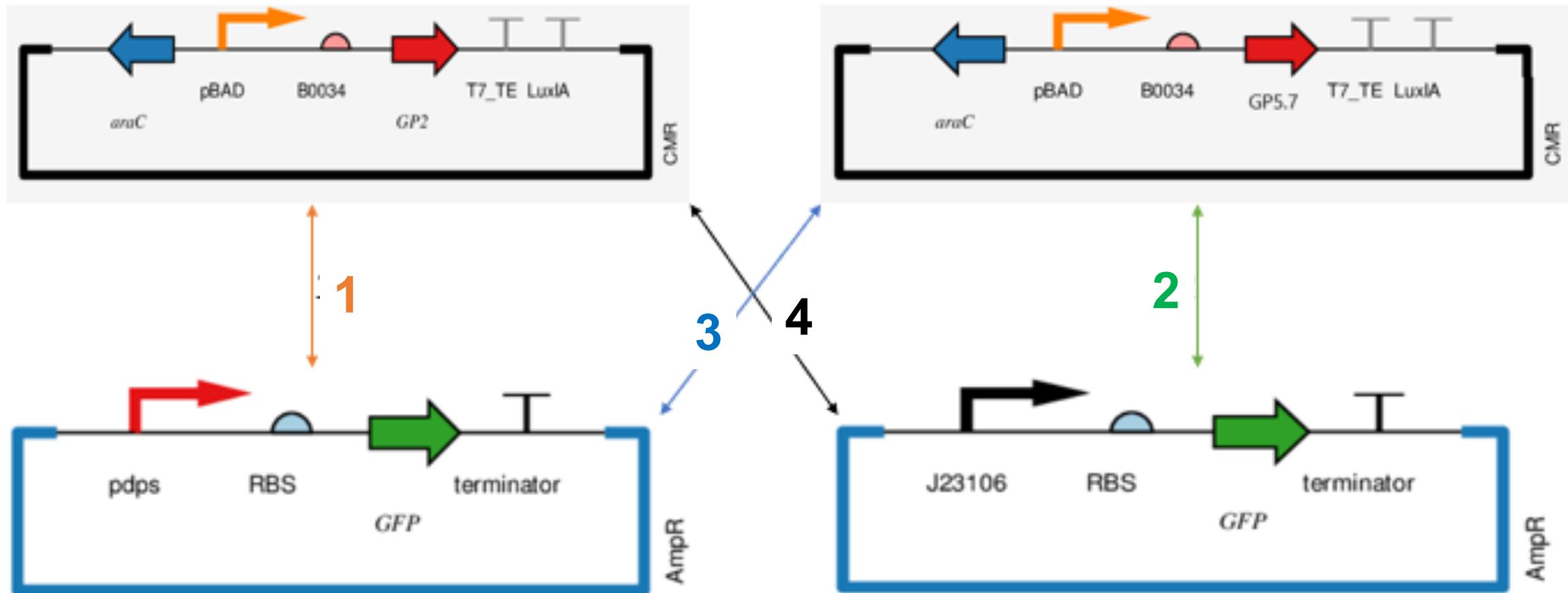
Data for the figure
in the next slide
($t=11.5$ hours)

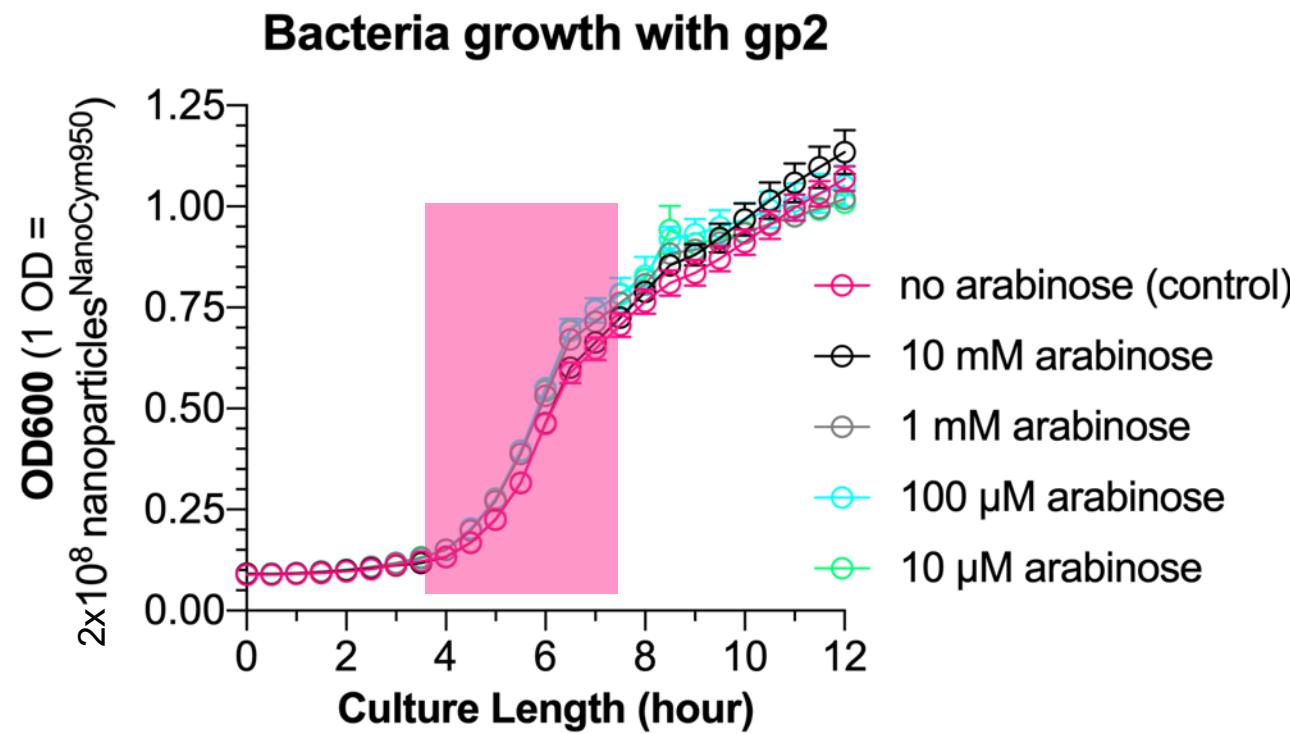


Parts: pdps is our best σ S promoter

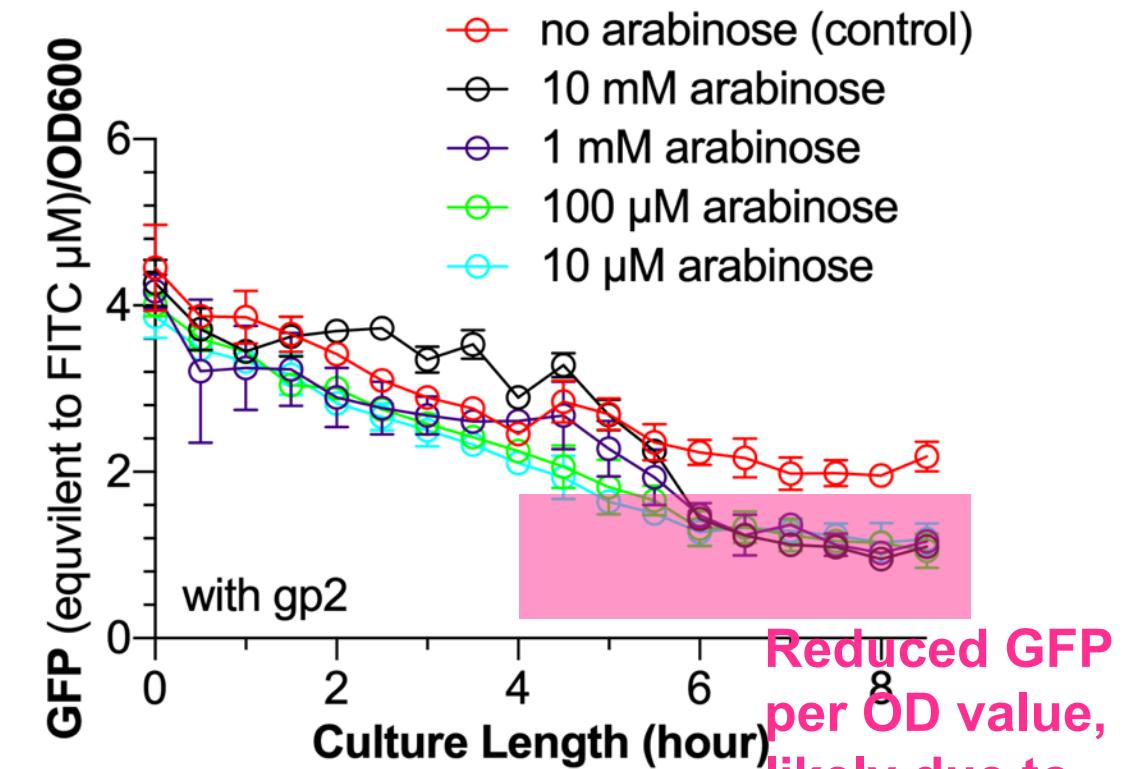


Parts: Characterize gp2 and gp5.7

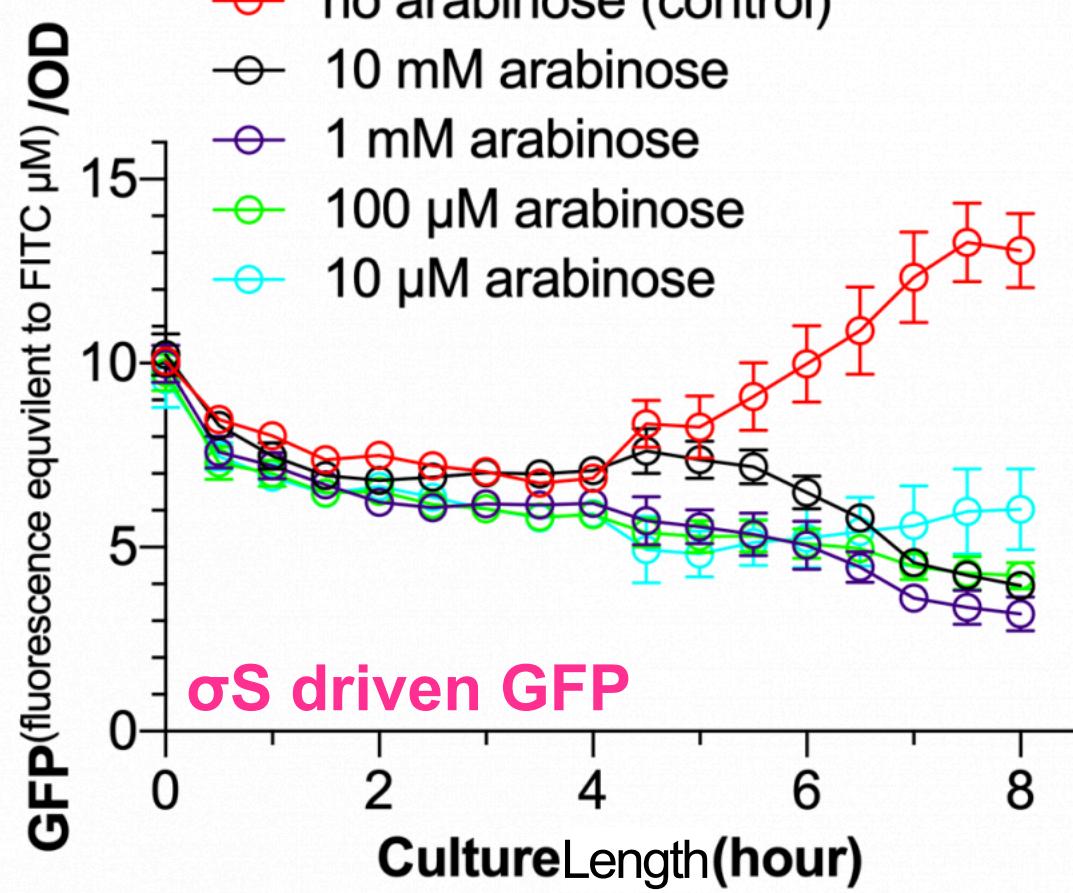
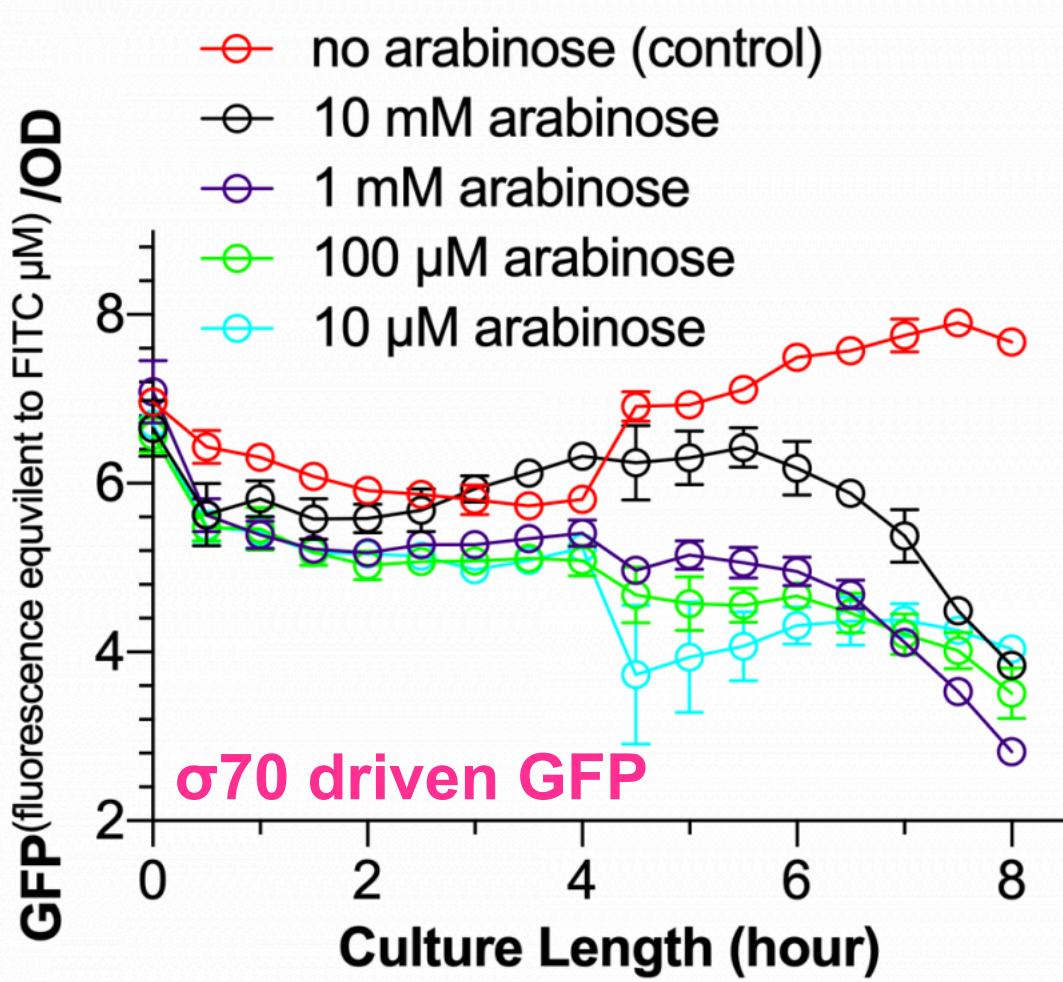




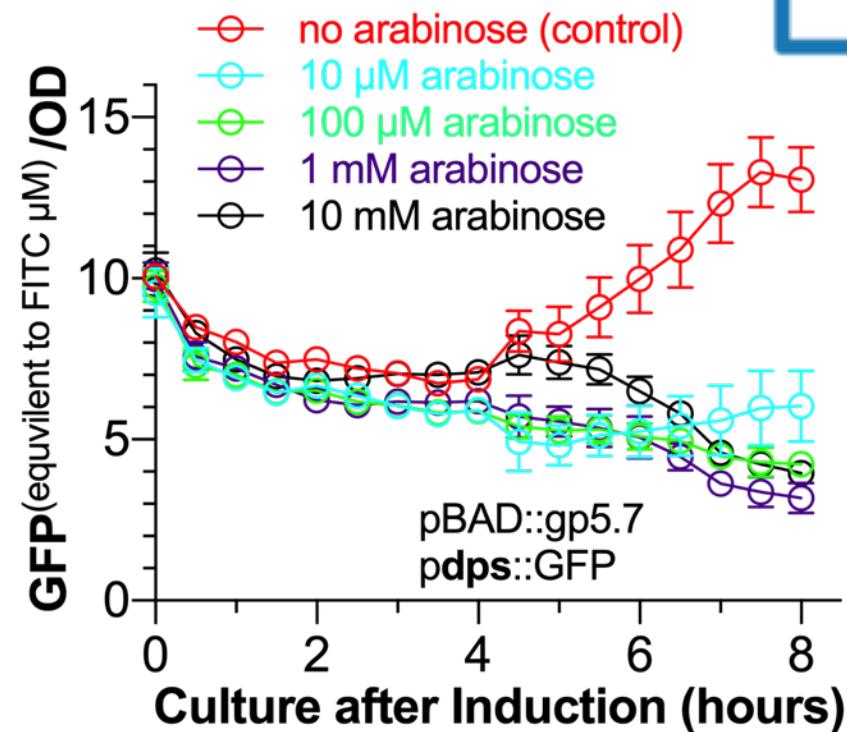
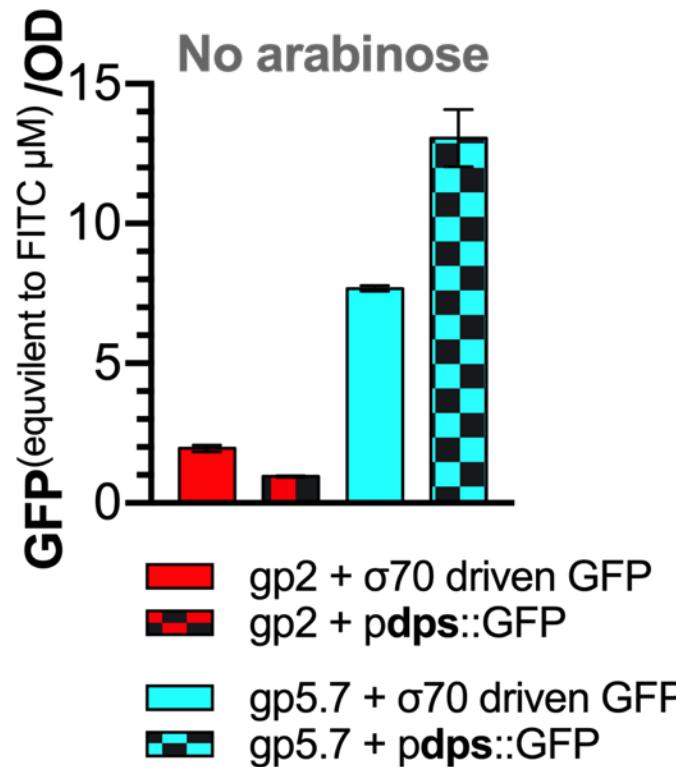
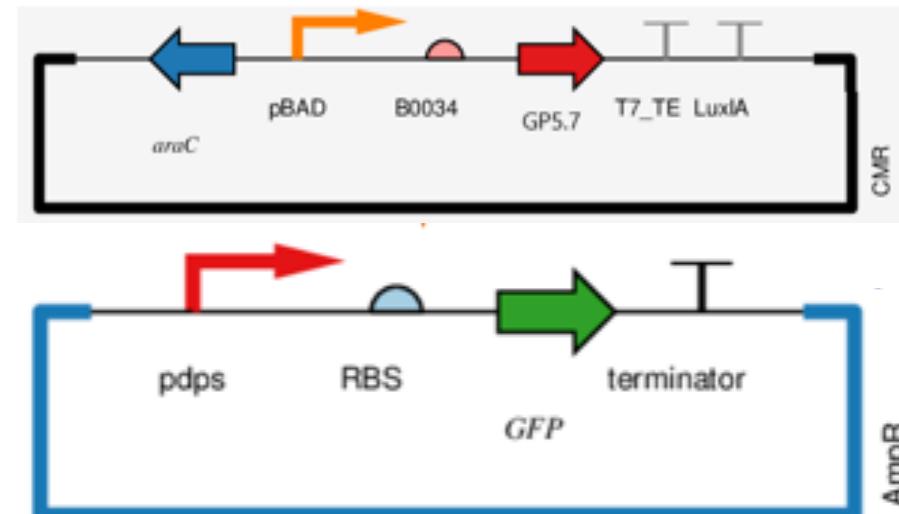
The leaky expression of gp2, slow down bacterial growth



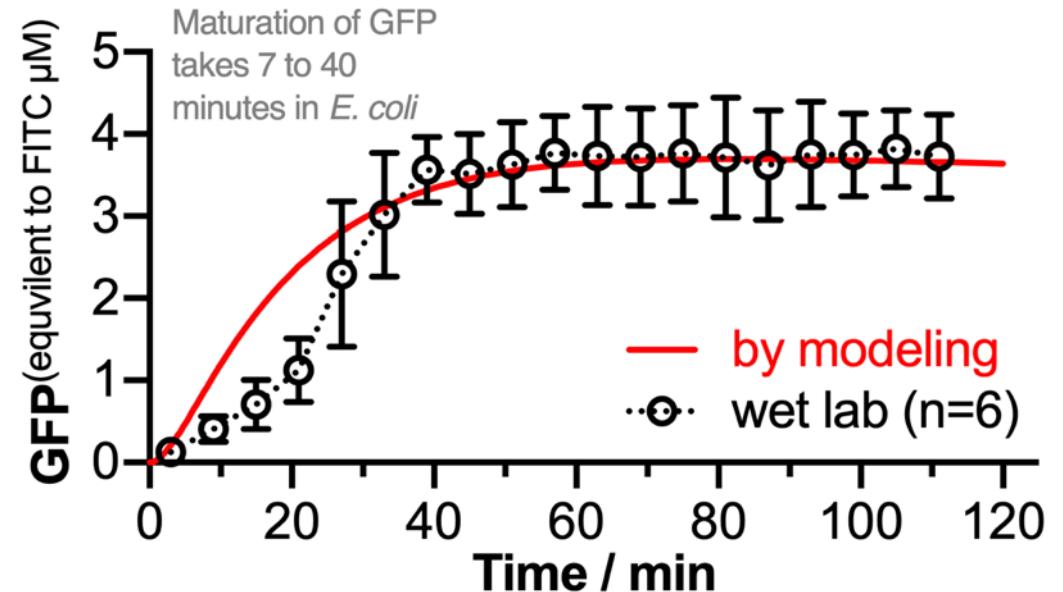
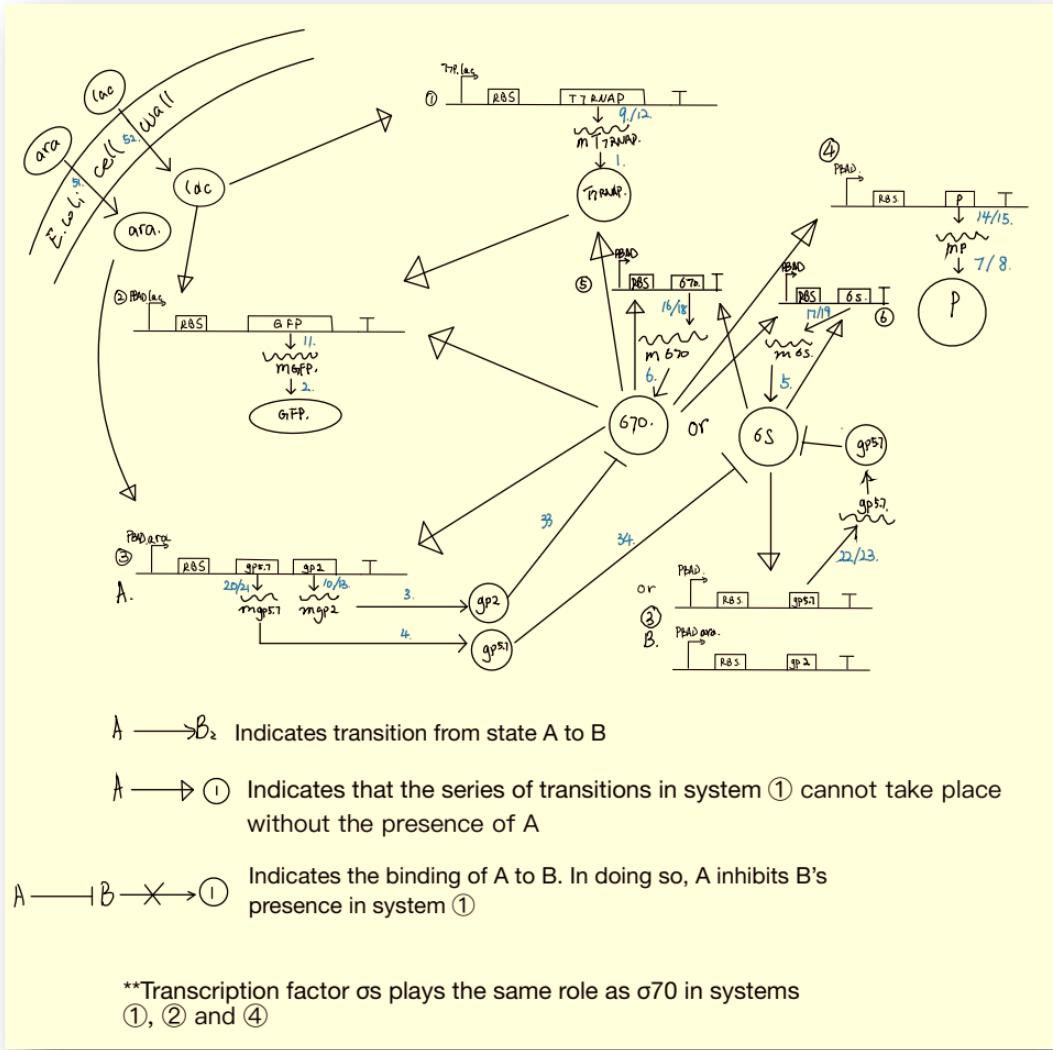
Reduced GFP per OD value, likely due to the leaky expression of gp2



Parts: Choose gp5.7

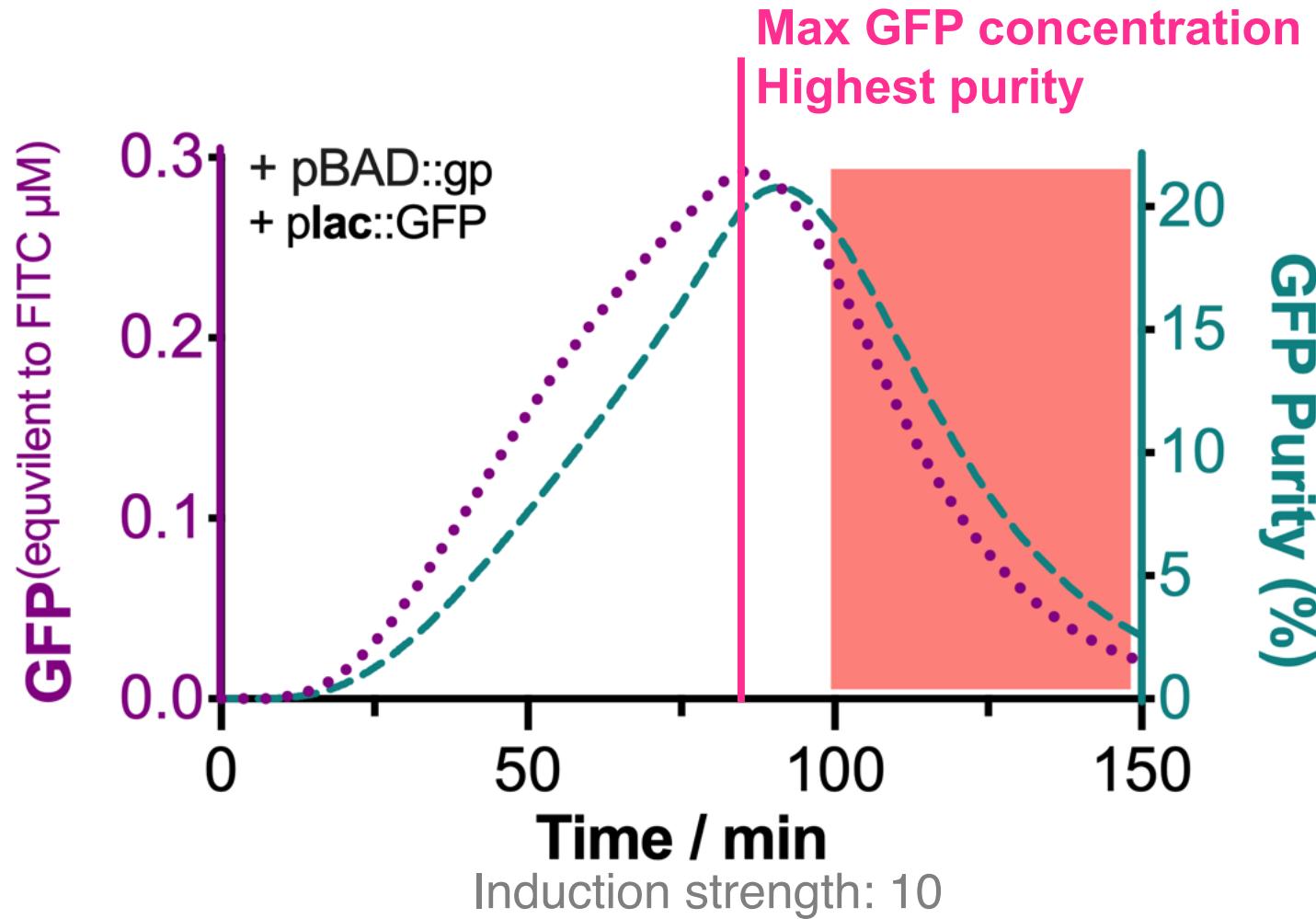


Modeling: Build a model for T7 induction

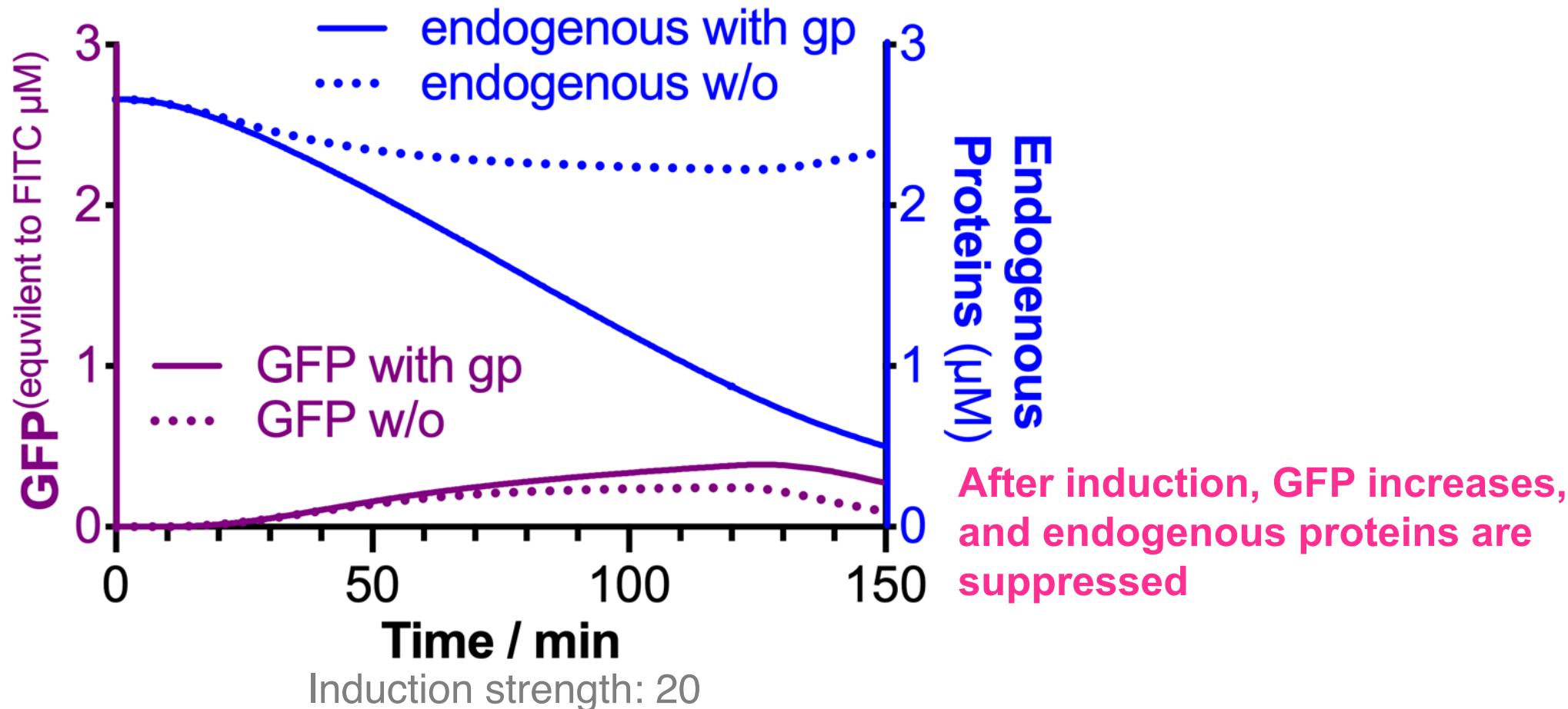


Our model complies with wet lab results.

Modeling: Find a best induction time/duration



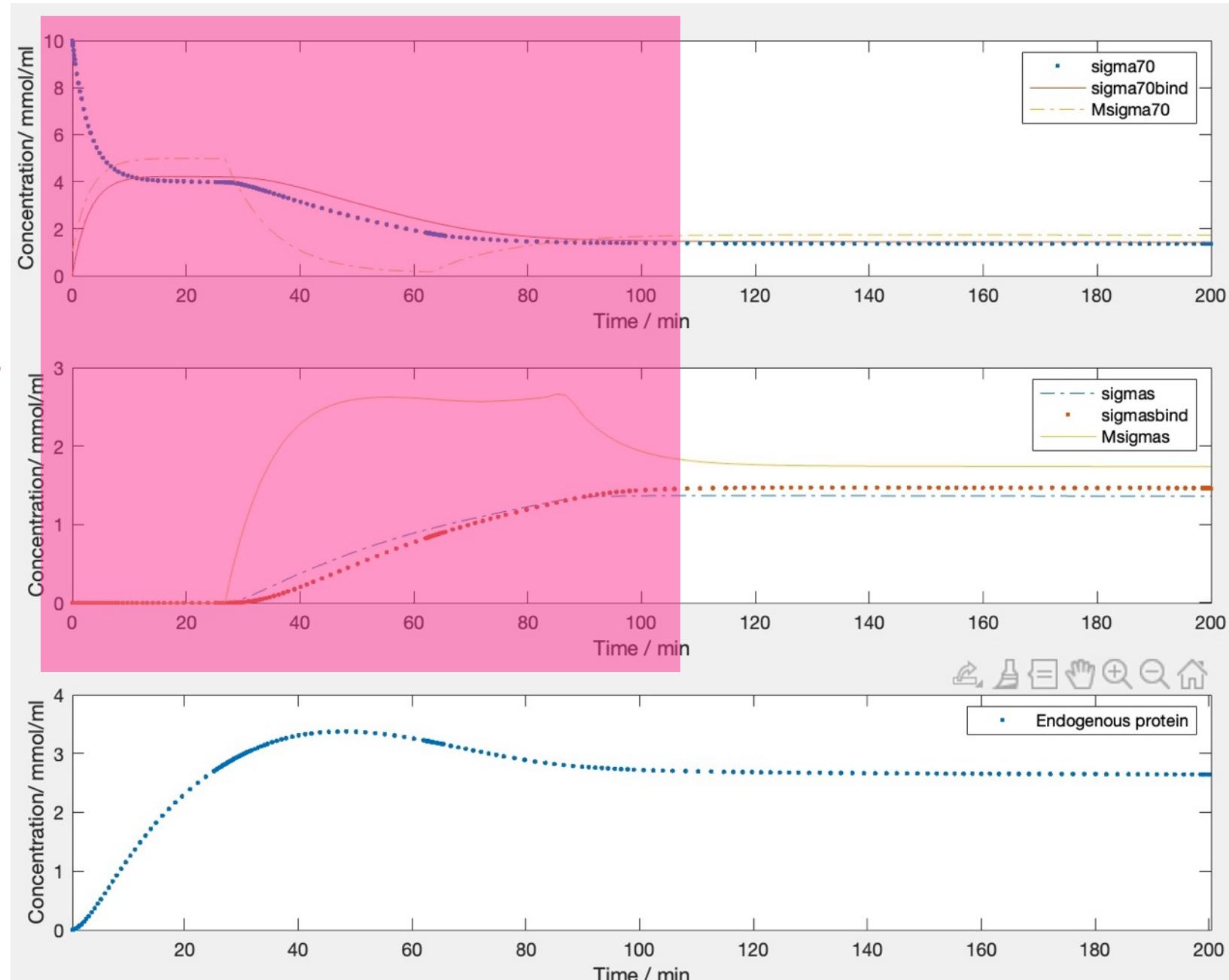
Modeling supports the usage of gp

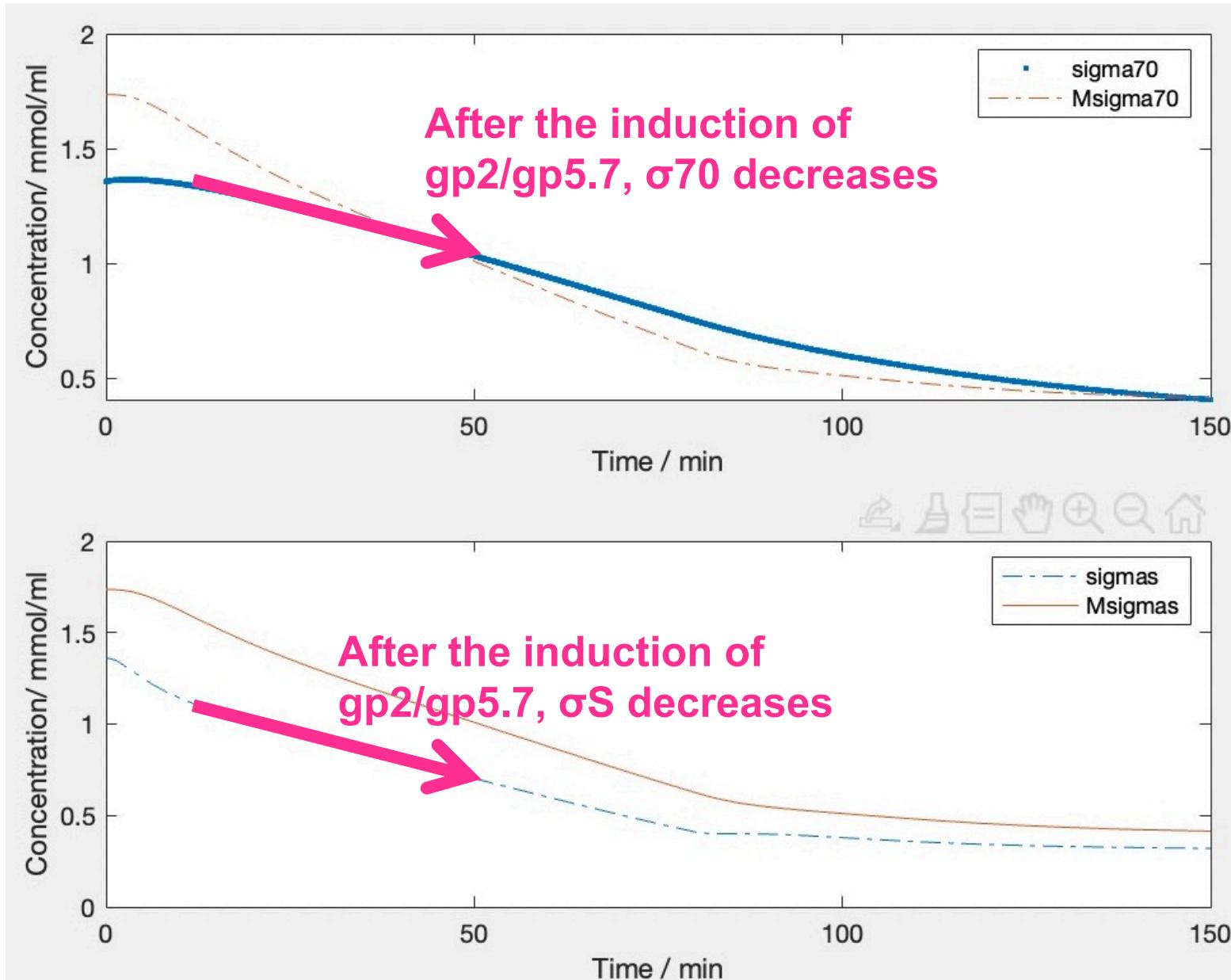


Model kinetics

	Variable	Differential equation of time	Process in every equation
Transcription factor	σ_{70}	$\frac{d\sigma_{70}}{dt} = M\sigma_{70} \times K\sigma_{70} + \sigma_{70} \cdot lac \times Krl\sigma_{70} + \sigma_{70} \cdot ara \times Kra\sigma_{70} + \sigma_{70}bind \times Kr\sigma_{70}bind + \sigma_{70}bind2 \times Kr\sigma_{70}bind2 - lac \times \sigma_{70} \times K70MT7P - ara \times \sigma_{70} \times K70Mlgp2 - \sigma_{70} \times K70MP1 - \sigma_{70} \times lgp2 \times K1 - \sigma_{70} \times \lambda\sigma_{70} - \sigma_{70} \times K70Mlgp5.7$	Positive: 6, 24, 25, 26, 32 Negative: 9, 10, 14, 17, 23, 47, 33
	σ_s	$\frac{d\sigma_s}{dt} = M\sigma_s \times K\sigma_s + \sigma_s \cdot lac \times Krl\sigma_s + \sigma_s \cdot ara \times Kra\sigma_s + \sigma_s bind \times Kr\sigma_s bind + \sigma_s bind2 \times Kr\sigma_s bind2 - lac \times \sigma_s \times KsMT7P - ara \times \sigma_s \times KsMlgp2 - \sigma_s \times KsMP2 - \sigma_s \times lgp5.7 \times K2 - \sigma_s \times \lambda\sigma_s - \sigma_s \times KsMlgp5.7$	Positive: 5, 28, 29, 30, 31 Negative: 12, 13, 15, 18, 19, 34, 48
	$T7P$	$\frac{dT7P}{dt} = MT7P \times KT7P + T7P \cdot lac \times KrlT7P - lac \times T7P \times KM GFP - T7P \times \lambda T7P$	Positive: 1, 27 Negative: 11, 43
	$P1$	$\frac{dP1}{dt} = MP1 * KP1 - P1 * \lambda P1$	Positive: 7 Negative: 49
	$P2$	$\frac{dP2}{dt} = MP2 * KP2 - P2 * \lambda P2$	Positive: 8 Negative: 50
	GFP	$\frac{dGFP}{dt} = MGFP * KGFP - GFP * \lambda GFP$	Positive: 2 Negative: 44

Regardless the initial values, both transcription factors σ 70 and σ s reach a steady stage before induction





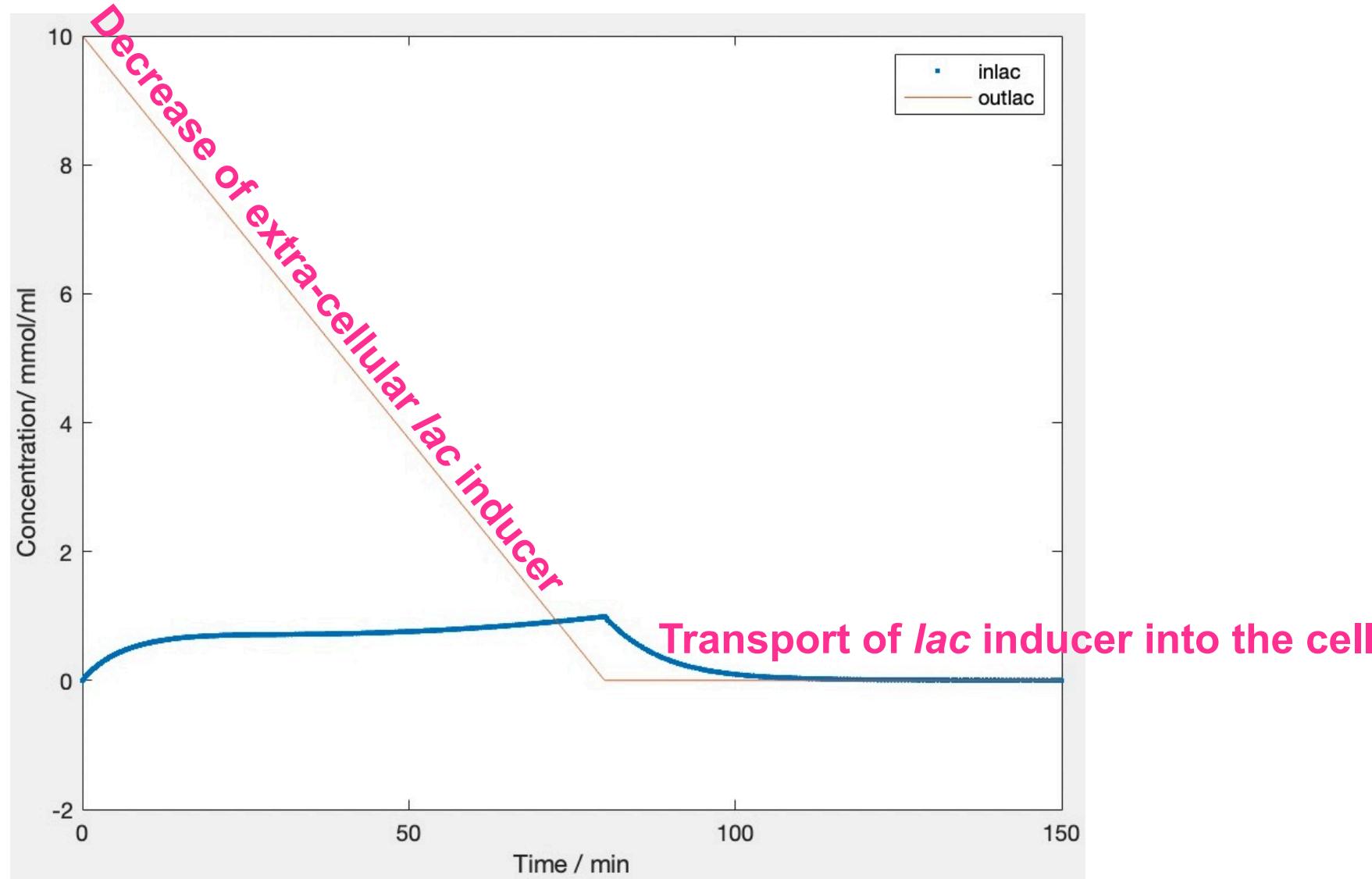


Figure 4.3 需要简化

Figure 4.4+4.5 诱导时间

Figure 4.6 需要说明

因为诱导物不够，wiki诱导强度10，
20/5/15都做了，越强越好

模型的time只能做参考，等比例

Measurement: When to harvest?

Protocol

Take 1 mL of the bacterial solution to be measured, add it to centrifuge tube ①, draw 2/3 (i.e. 666 μ L) of the bacterial solution, add it to centrifuge tube ②, and centrifuge tube ① and centrifuge tube ② simultaneously at 10,000 rpm (11,500 $\times g$) for 1 min.

1. Determination of plasmid concentration in the autolyzed portion of the bacterial solution.

1-1. Carefully transfer the supernatant of centrifuge tube ① to another centrifuge tube ③ with a pipette, add an equal volume of phenol : chloroform : isoamyl alcohol = 25:24:1 mixture, mix by reversing up and down 2-3 times, centrifuge at 12,000 rpm (13,000 $\times g$) for 2 min, carefully aspirate 500 mL of supernatant to another centrifuge tube ④ in another centrifuge tube with 125 mL of Buffer A.

1-2: Place the adsorption column in a 2 ml collection tube, add 600 μ L of Buffer PB to the column, and centrifuge at 12,000 rpm (13,000 $\times g$) for 1 min, pour off the waste solution from the collection tube and put the column back into the collection tube.

1-3: Transfer the liquid from centrifuge tube ④ to the adsorption column and centrifuge at 12,000 rpm (13,000 $\times g$) for 1 min, pour off the waste liquid from the collection tube and put the column back into the collection tube.

1-4. Add 600 μ L of Buffer PW2 (10 mM Tris-HCl, pH 7.5, 80% ethanol)(check that it has been diluted with anhydrous ethanol) to the column and centrifuge at 12,000 rpm (13,000 $\times g$) for 30 - 60 sec. Discard the waste solution and place the column back into the collection tube.

1-5. Repeat steps 1-4.

1-6. Place the column back into the collection tube. centrifuge at 12,000 rpm (13,000 $\times g$) for 1 min to dry the column.

1-7. Place the column in a new sterilized 1.5 ml centrifuge tube. Add 30 μ L of Elution Buffer (10 mM Tris, 1 mM EDTA, pH 8.0.) to the center of the membrane of the column and let stand at 55°C for 2 min, then centrifuge at 12,000 rpm (13,000 $\times g$) for 1 min to elute the DNA.

1-8, Discard the adsorption column to obtain the autolyzed portion of the plasmid.

2. Determination of plasmid concentration in the non-autolyzed portion of the bacterial solution.

2-1, Carefully aspirate the supernatant from centrifuge tube ①, add 250 μ L Buffer P1 50 mM Tris-HCl pH 8.0, 10 mM EDTA, 100 μ g/ml RNase A (From TIANGEN: RT405-12 100mg/ml) (please check if Buffer P1 has been added to RNase A first), and mix well with a pipette or vortex shaking.

2-2. Add 250 μ L Buffer P2 (200 mM NaOH, 1% SDS) to centrifuge tube ① and mix gently by inverting up and down 8-10 times to make the bacteria fully lysed.

2-3: Add 350 μ L of Buffer P3 (4.2 M guanidine hydrochloride, 0.9 M potassium acetate pH 4.8 (adjust with acetate)) to centrifuge tube ① and immediately neutralize Buffer P2 by gently turning it up and down 8-10 times. a white flocculent precipitate should appear. centrifuge at 12,000 rpm (13,000 $\times g$) for 10 min.

(Note: Buffer P3 should be inverted and mixed immediately after addition to prevent localized precipitation from affecting the neutralization effect. If there is still a small white precipitate in the supernatant, take the supernatant after centrifugation again.

2-4: Place the adsorption column in a 2 ml collection tube, add 600 μ L Buffer PB [2] to the column, centrifuge at 12,000 rpm (13,000 $\times g$) for 1 min, pour off the waste solution in the collection tube, and put the column back into the collection tube.

2-5: Carefully transfer the supernatant from centrifuge tube ① to the adsorption column by pipetting, taking care not to aspirate the precipitate, and centrifuge at 12,000 rpm (13,000 $\times g$) for 30 - 60 sec. Pour off the waste solution from the collection

2-5: Carefully transfer the supernatant from centrifuge tube ① to the adsorption column by pipetting, taking care not to aspirate the precipitate, and centrifuge at 12,000 rpm (13,000 $\times g$) for 30 - 60 sec. Pour off the waste solution from the collection tube and put the column back into the collection tube.

2-6: Add 600 μ L of Buffer PW2 (check that it has been diluted with anhydrous ethanol) to the adsorption column. centrifuge at 12,000 rpm (13,000 $\times g$) for 30 - 60 sec. discard the waste solution and return the column to the collection tube.

2-7. Repeat steps 2-6.

2-8. Place the column back into the collection tube. centrifuge at 12,000 rpm (13,000 $\times g$) for 1 min to dry the column.

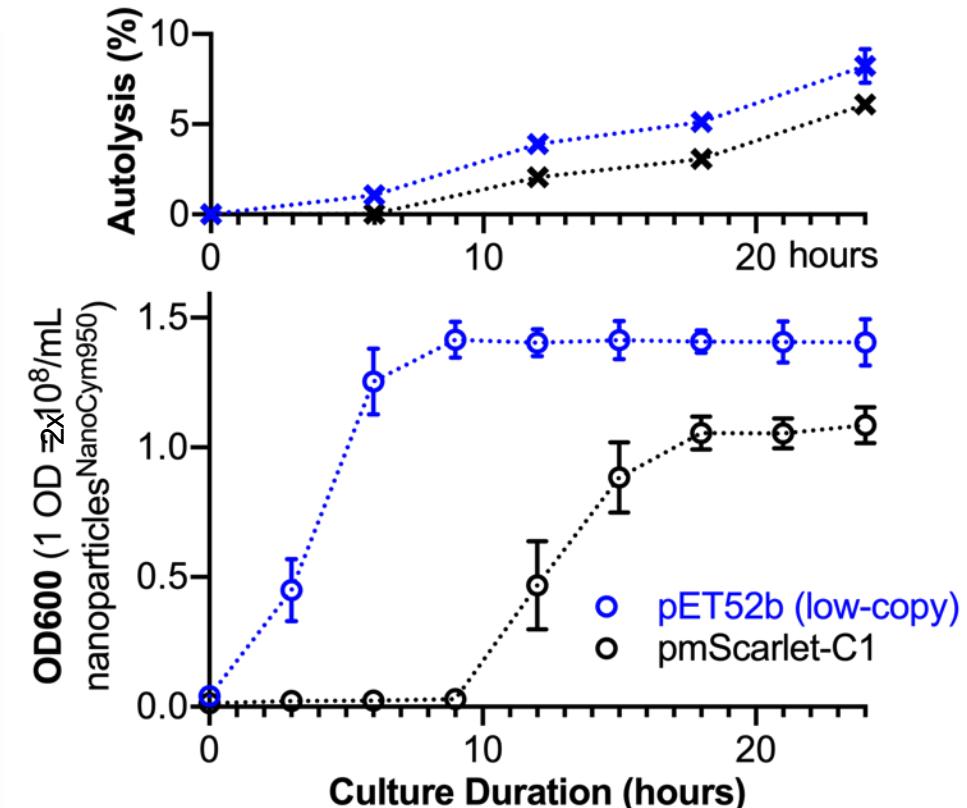
2-9: Place the column in a new sterilized 1.5 ml centrifuge tube. Add 30 μ L of Elution Buffer to the center of the membrane of the column and let it stand for 2 min at 55°C. Centrifuge at 12,000 rpm (13,000 $\times g$) for 1 min to elute the DNA.

2-10, Discard the adsorption column to obtain the non-autolyzed portion of the plasmid.

3. Calculation of autolysis rate

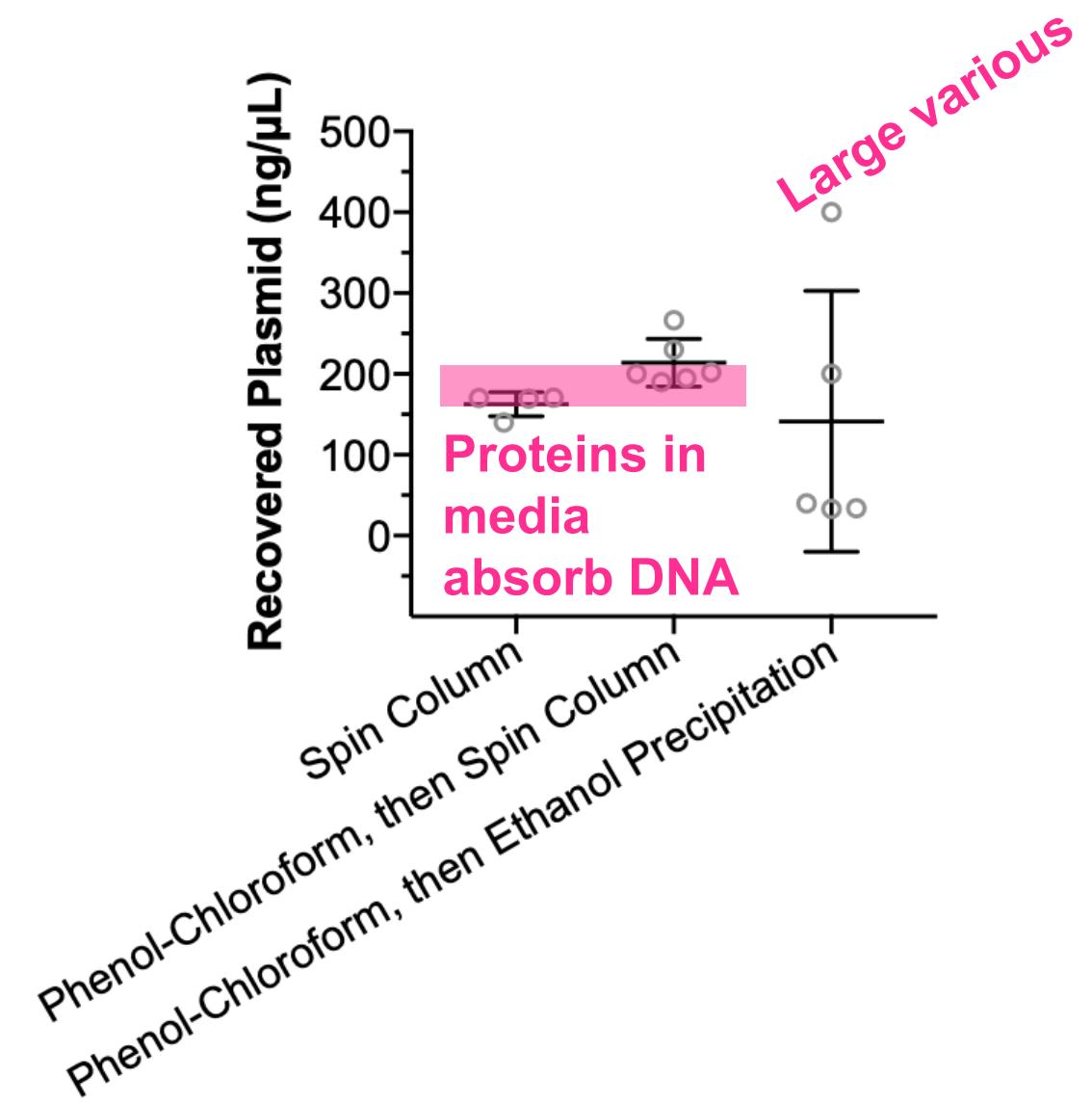
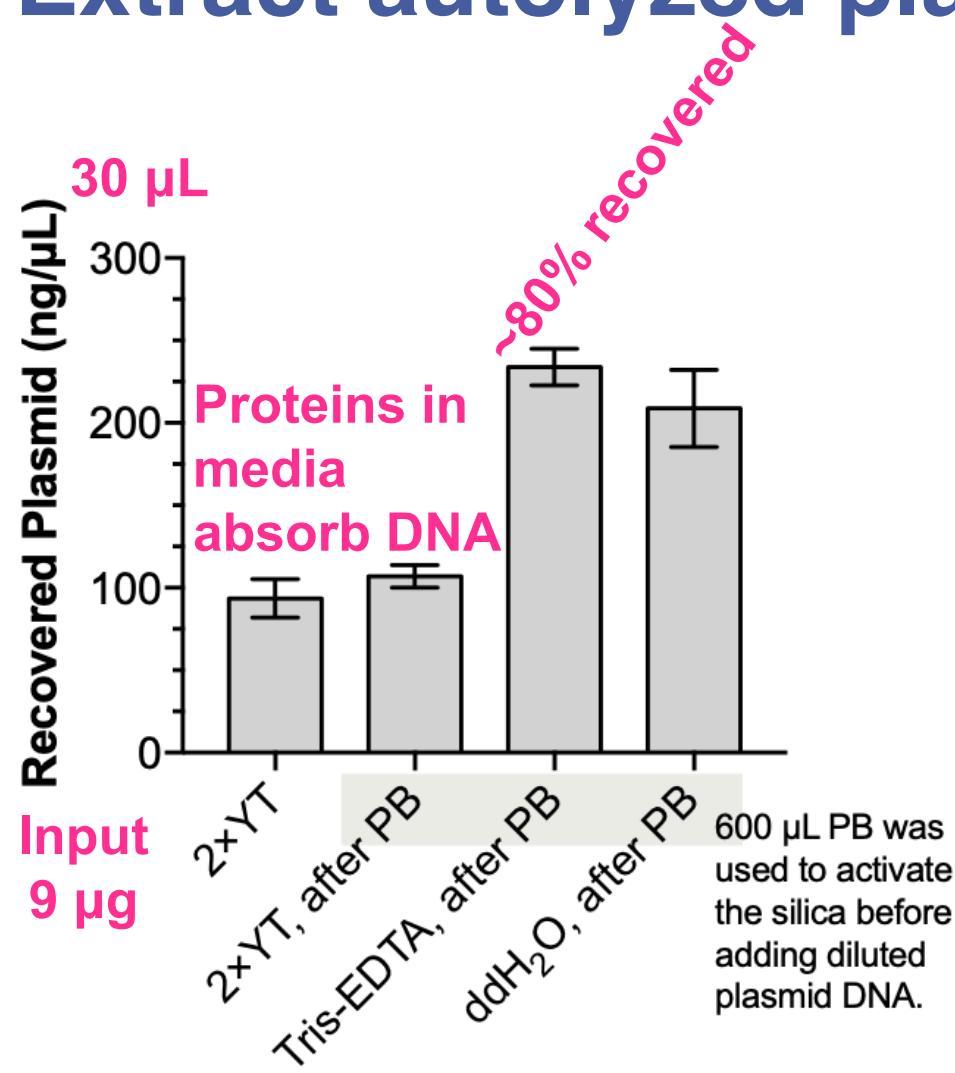
The concentration of autolyzed fraction of plasmid was measured by Nanodrop or grayscale analysis of gels as C1 (μ g/ μ L) and the concentration of non-autolyzed fraction of plasmid as C2 (μ g/ μ L), and the autolysis rate was calculated as

$$\text{Autolysis Rate} = \frac{C_1}{C_1 + 2C_2} \times 100\%$$

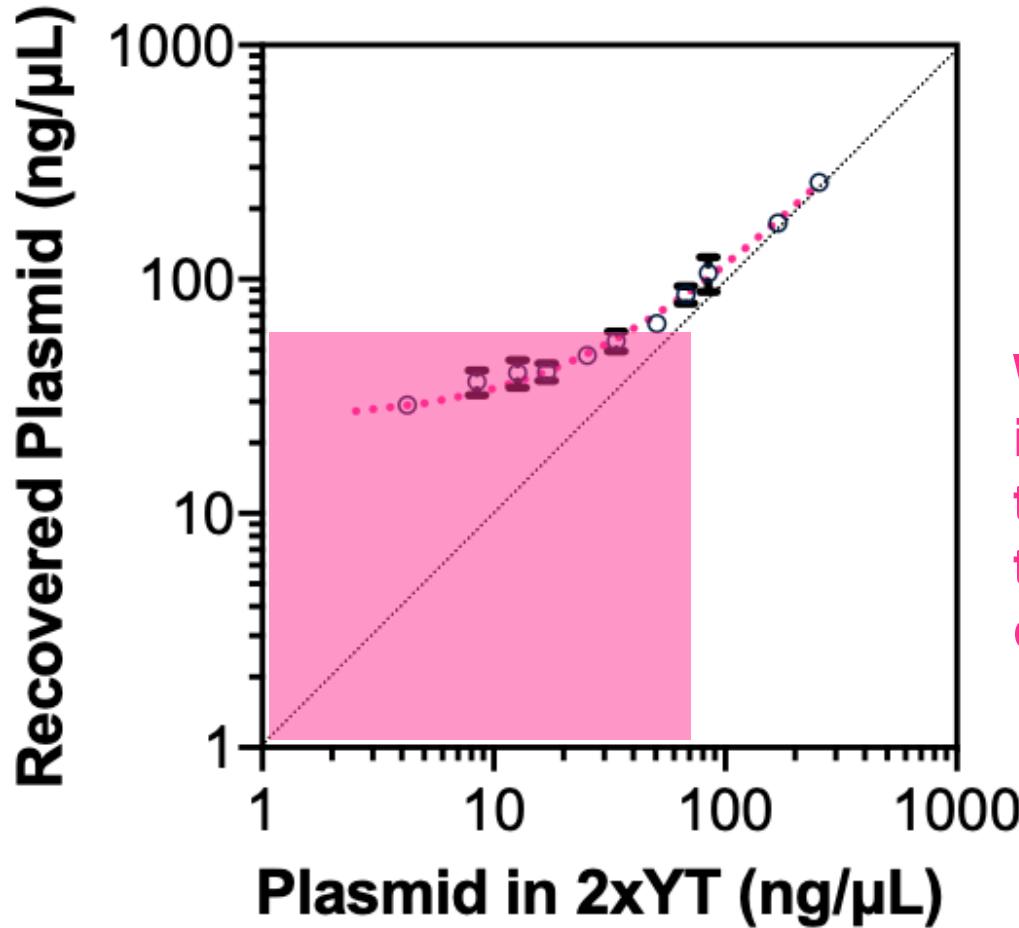


We test our protocol with different types of plasmids.

Extract autolyzed plasmids from culture media

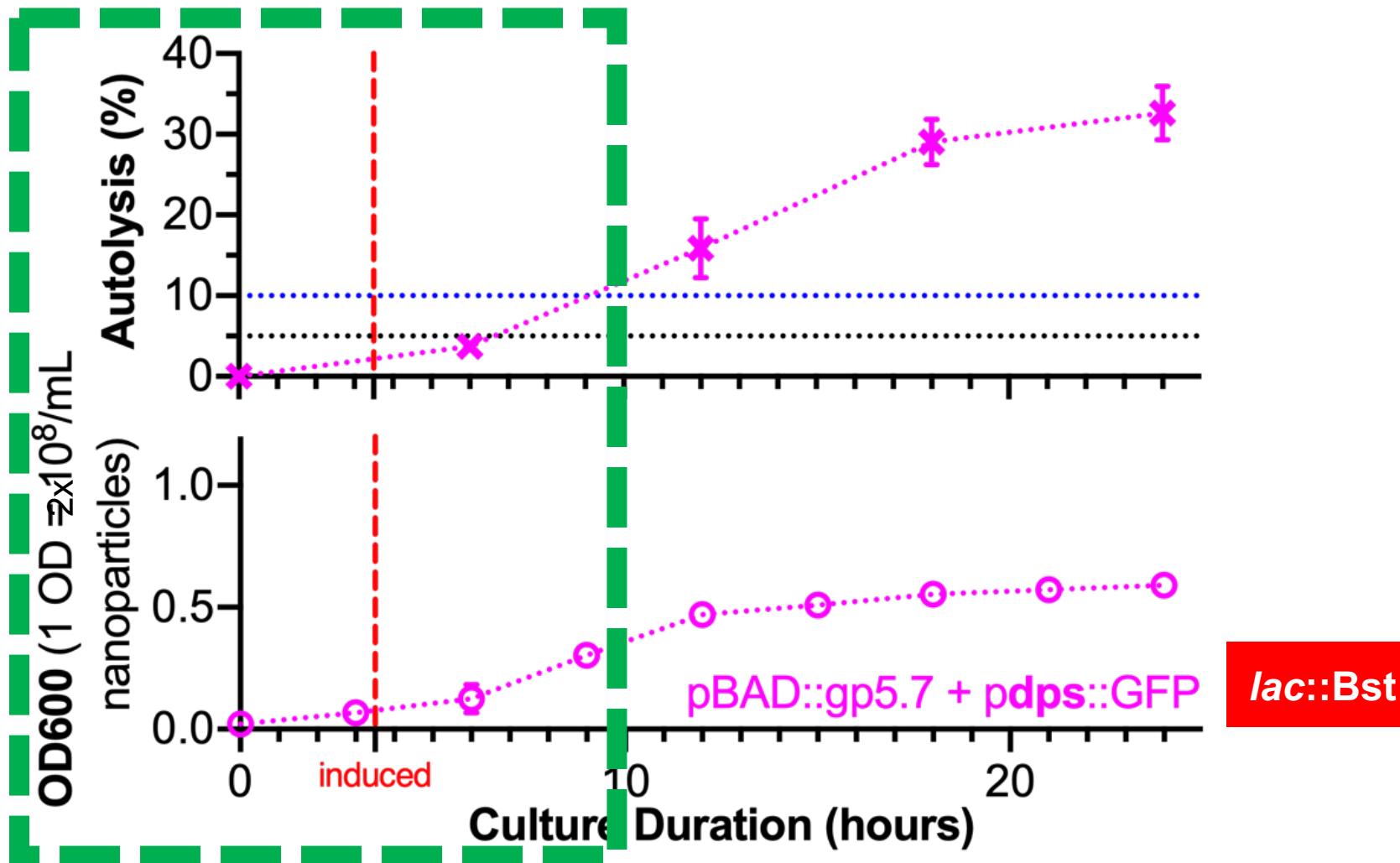


Recovery limit when using spin column



When DNA concentration is low, it is very likely to overestimate the recovered plasmids, leading to overestimated autolysis degree.

Measurement: No to extended induction



Measurement: Testing our protocol

Protocol

Take 1 mL of the bacterial solution to be measured, add it to centrifuge tube ①, draw 2/3 (i.e. 666 μ L) of the bacterial solution, add it to centrifuge tube ②, and centrifuge tube ① and centrifuge tube ② simultaneously at 10,000 rpm (11,500 \times g) for 1 min.

1. Determination of plasmid concentration in the autolyzed portion of the bacterial solution.

1-1. Carefully transfer the supernatant of centrifuge tube ① to another centrifuge tube ③ with a pipette, add an equal volume of phenol : chloroform : isoamyl alcohol = 25:24:1 mixture, mix by reversing up and down 2-3 times, centrifuge at 12,000 rpm (13,000 \times g) for 2 min, carefully aspirate 500 mL of supernatant to another centrifuge tube ④ in another centrifuge tube with 125 mL of Buffer A.

1-2: Place the adsorption column in a 2 ml collection tube, add 600 μ L of Buffer PB to the column, and centrifuge at 12,000 rpm (13,000 \times g) for 1 min, pour off the waste solution from the collection tube and put the column back into the collection tube.

1-3: Transfer the liquid from centrifuge tube ④ to the adsorption column and centrifuge at 12,000 rpm (13,000 \times g) for 1 min, pour off the waste liquid from the collection tube and put the column back into the collection tube.

1-4. Add 600 μ L of Buffer PW2 (10 mM Tris-HCl, pH 7.5, 80% ethanol)(check that it has been diluted with anhydrous ethanol) to the column and centrifuge at 12,000 rpm (13,000 \times g) for 30 - 60 sec. Discard the waste solution and place the column back into the collection tube.

1-5. Repeat steps 1-4.

1-6. Place the column back into the collection tube. centrifuge at 12,000 rpm (13,000 \times g) for 1 min to dry the column.

1-7. Place the column in a new sterilized 1.5 ml centrifuge tube. Add 30 μ L of Elution Buffer (10 mM Tris, 1 mM EDTA, pH 8.0.) to the center of the membrane of the column and let stand at 55°C for 2 min, then centrifuge at 12,000 rpm (13,000 \times g) for 1 min to elute the DNA.

1-8, Discard the adsorption column to obtain the autolyzed portion of the plasmid.

2. Determination of plasmid concentration in the non-autolyzed portion of the bacterial solution.

2-1, Carefully aspirate the supernatant from centrifuge tube ①, add 250 μ L Buffer P1 50 mM Tris-HCl pH 8.0, 10 mM EDTA, 100 μ g/ml RNase A (From TIANGEN: RT405-12 100mg/ml) (please check if Buffer P1 has been added to RNase A first), and mix well with a pipette or vortex shaking.

2-2. Add 250 μ L Buffer P2 (200 mM NaOH, 1% SDS) to centrifuge tube ① and mix gently by inverting up and down 8-10 times to make the bacteria fully lysed.

2-3: Add 350 μ L of Buffer P3 (4.2 M guanidine hydrochloride, 0.9 M potassium | acetate pH 4.8 (adjust with acetate)) to centrifuge tube ① and immediately neutralize Buffer P2 by gently turning it up and down 8-10 times. a white flocculent precipitate should appear. centrifuge at 12,000 rpm (13,000 \times g) for 10 min.

(Note: Buffer P3 should be inverted and mixed immediately after addition to prevent localized precipitation from affecting the neutralization effect. If there is still a small white precipitate in the supernatant, take the supernatant after centrifugation again.

2-4: Place the adsorption column in a 2 ml collection tube, add 600 μ L Buffer PB [2] to the column, centrifuge at 12,000 rpm (13,000 \times g) for 1 min, pour off the waste solution in the collection tube, and put the column back into the collection tube.

2-5: Carefully transfer the supernatant from centrifuge tube ① to the adsorption column by pipetting, taking care not to aspirate the precipitate, and centrifuge at 12,000 rpm (13,000 \times g) for 30 - 60 sec. Pour off the waste solution from the collection

2-5: Carefully transfer the supernatant from centrifuge tube ① to the adsorption column by pipetting, taking care not to aspirate the precipitate, and centrifuge at 12,000 rpm (13,000 \times g) for 30 - 60 sec. Pour off the waste solution from the collection tube and put the column back into the collection tube.

2-6: Add 600 μ L of Buffer PW2 (check that it has been diluted with anhydrous ethanol) to the adsorption column. centrifuge at 12,000 rpm (13,000 \times g) for 30 - 60 sec. discard the waste solution and return the column to the collection tube.

2-7. Repeat steps 2-6.

2-8, Place the column back into the collection tube. centrifuge at 12,000 rpm (13,000 \times g) for 1 min to dry the column.

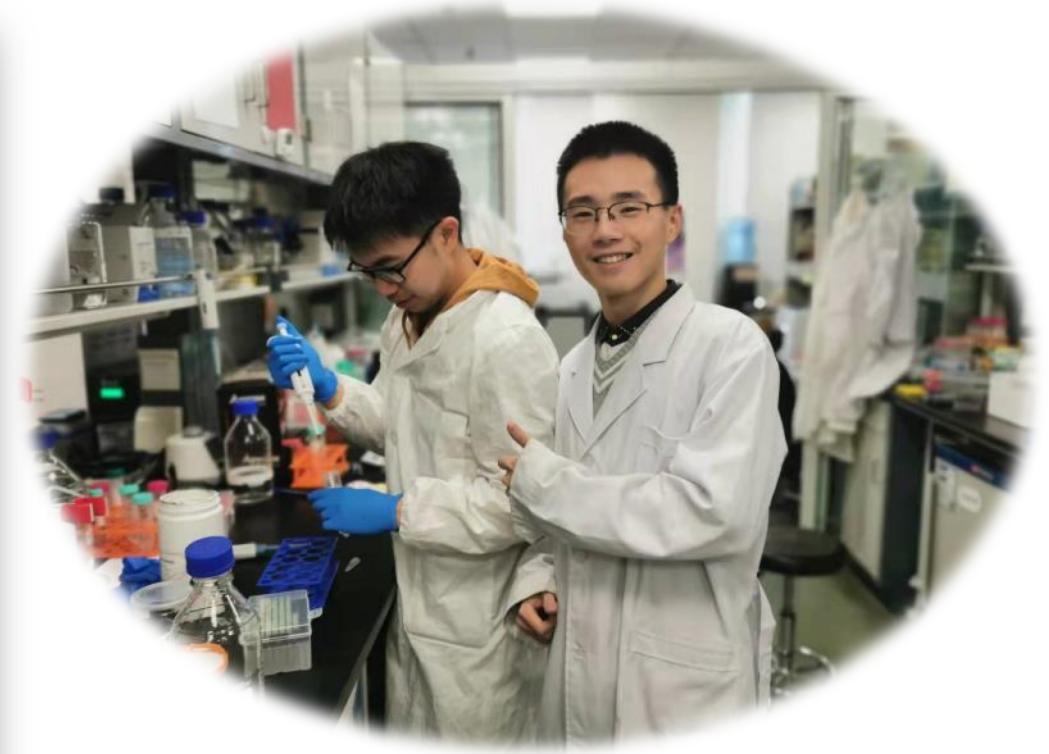
2-9: Place the column in a new sterilized 1.5 ml centrifuge tube. Add 30 μ L of Elution Buffer to the center of the membrane of the column and let it stand for 2 min at 55°C. Centrifuge at 12,000 rpm (13,000 \times g) for 1 min to elute the DNA.

2-10, Discard the adsorption column to obtain the non-autolyzed portion of the plasmid.

3. Calculation of autolysis rate

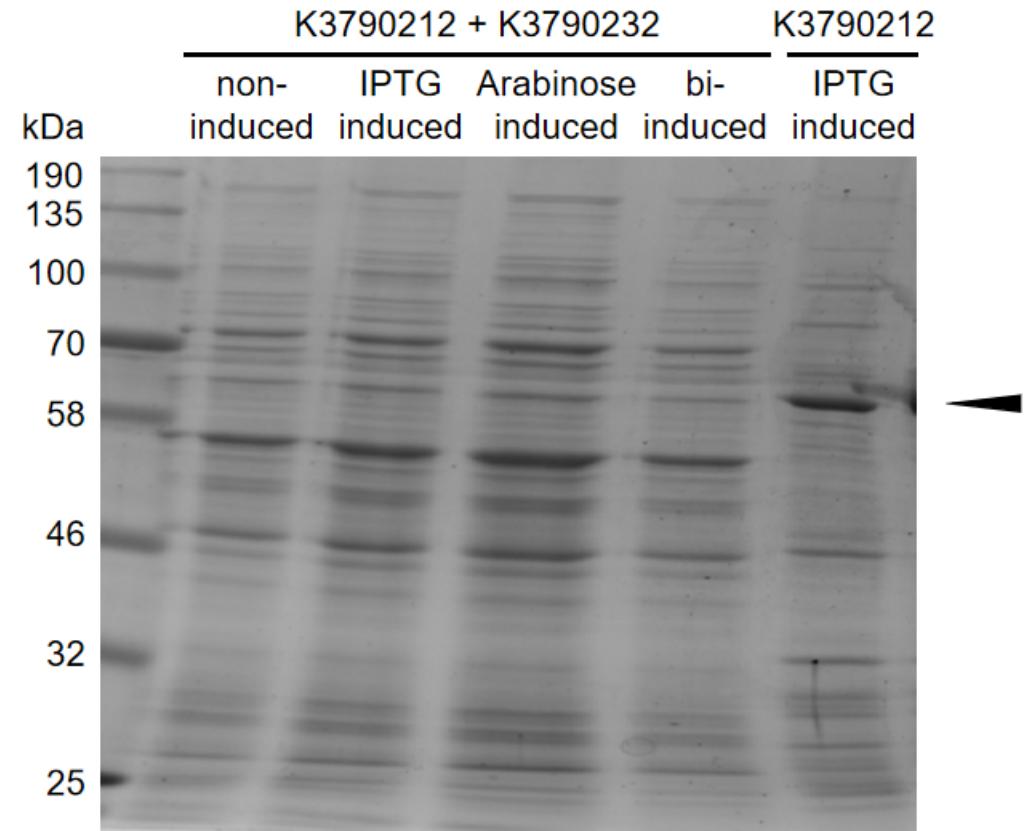
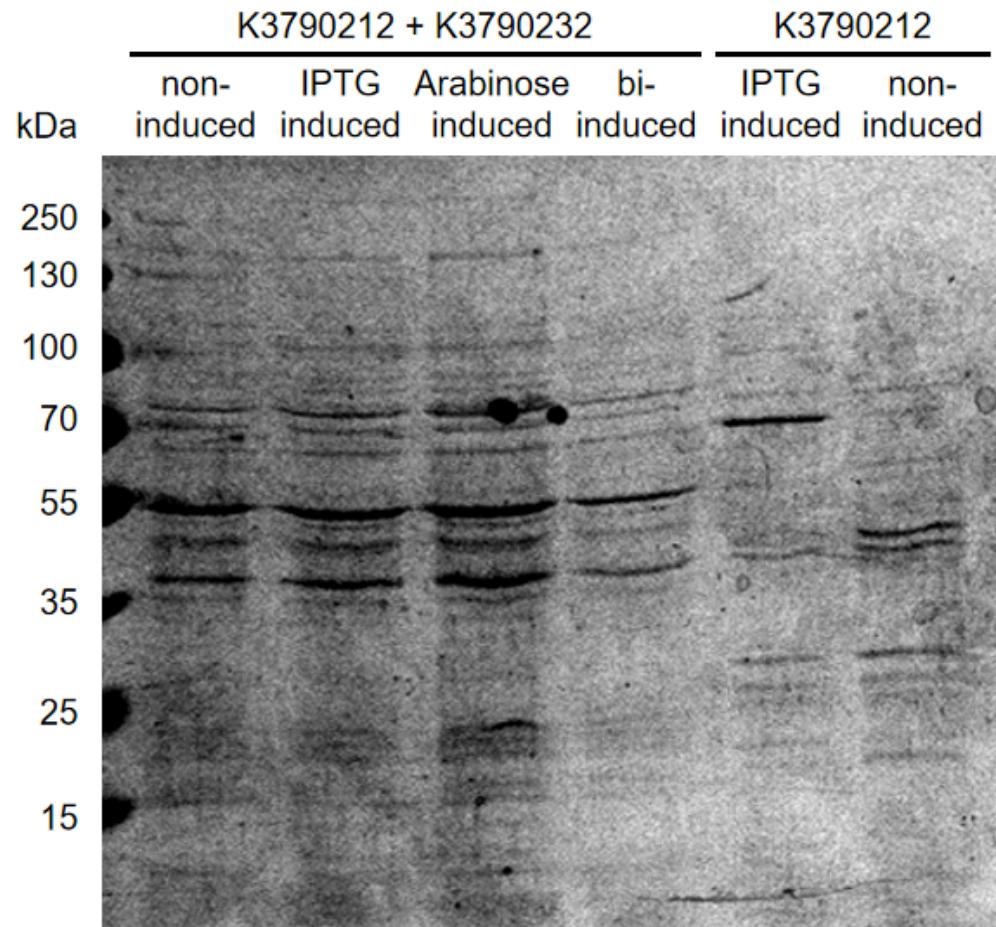
The concentration of autolyzed fraction of plasmid was measured by Nanodrop or grayscale analysis of gels as C1 (μ g/ μ L) and the concentration of non-autolyzed fraction of plasmid as C2 (μ g/ μ L), and the autolysis rate was calculated as

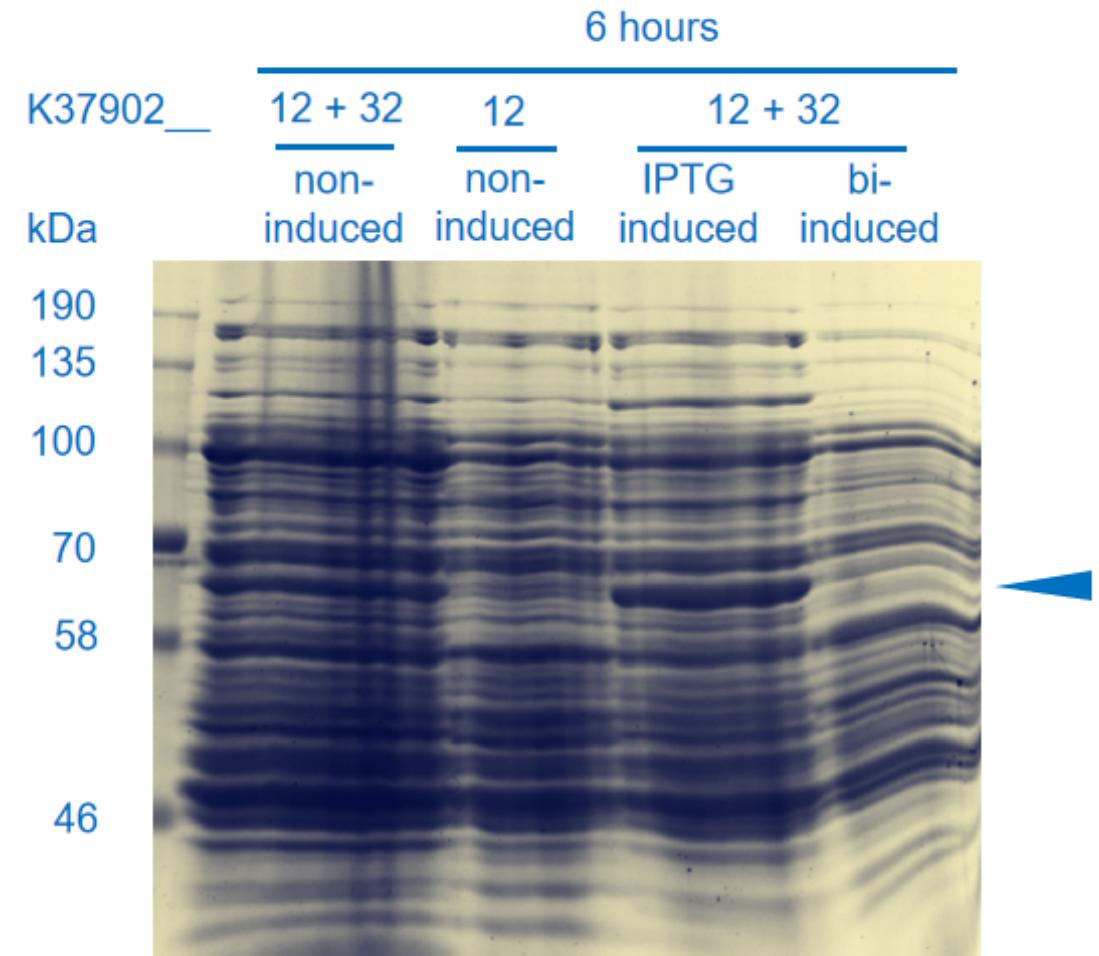
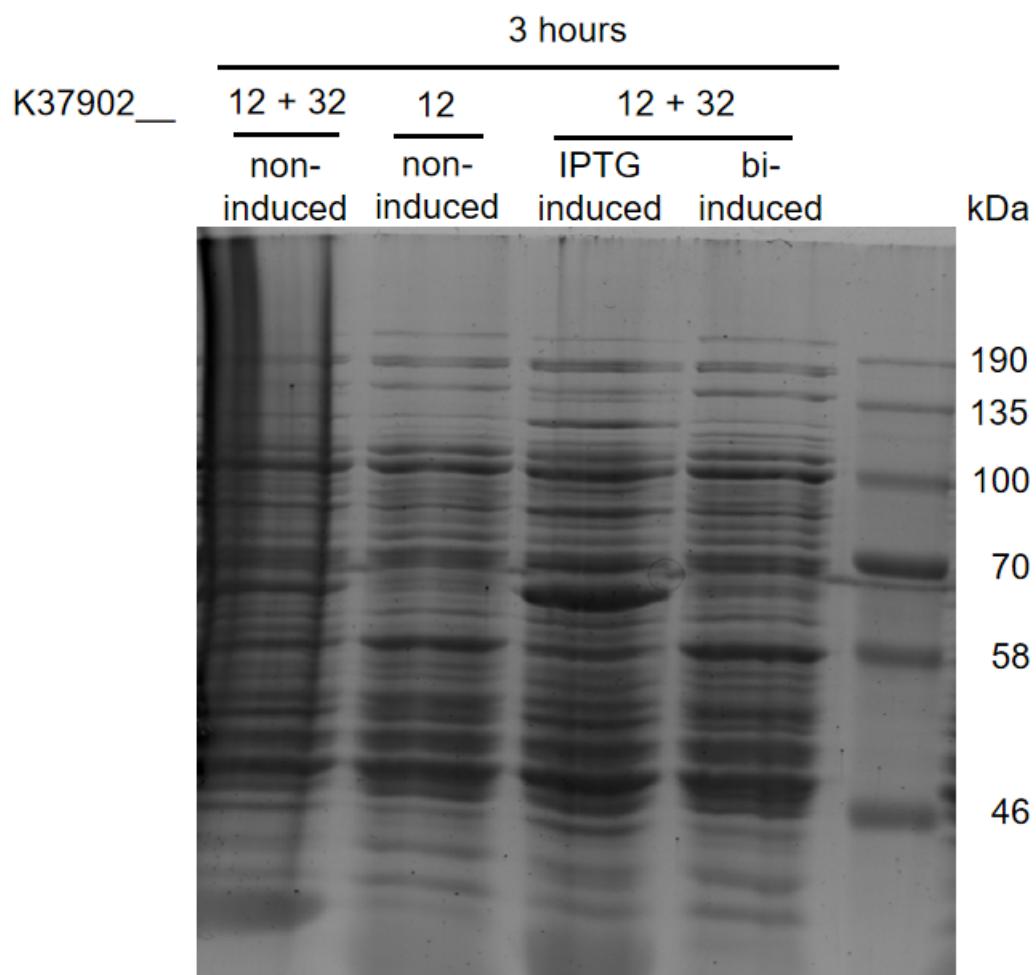
$$\text{Autolysis Rate} = \frac{C_1}{C_1 + 2C_2} \times 100\%$$



The measurement of autolysis has been used by other people.

For more details, please visit <https://2021.igem.org/Team:Fudan/Results>





Parts: Bst fusions

Bst Pol 1: Bst-(G2S)3-albA1	Bst Pol 2: albA1-(G2S)3-Bst
Bst Pol 3: Bst-(G2S)3-S.ssb	Bst Pol 4: S.ssb-(G2S)3-Bst
Bst Pol 5: Bst-(G2S)3-E.ssb	Bst Pol 6: E.ssb-(G2S)3-Bst
Bst Pol 7: Bst-(G2S)3-DbpA	Bst Pol 8: DbpA-(G2S)3-Bst
Bst Pol 9: Bst-(G2S)3-Sso10b	Bst Pol 10: Sso10b-(G2S)3-Bst
Bst Pol 11: Bst-(G2S)3- Sso7d	Bst Pol 12: Sso7d -(G2S)3-Bst



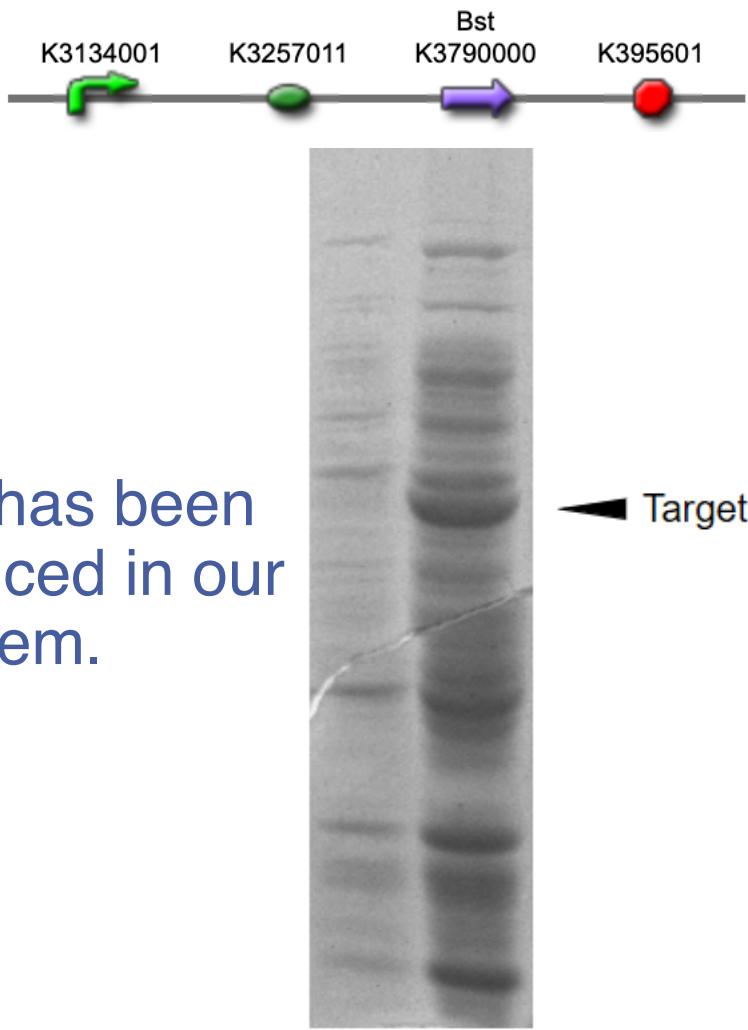
We use lysates of the engineered *E. coli* for LAMP.

Table 1. Self-made BPCB (50 mL)

20 mmol/L Tris-HCl	25 mL, to a final concentration of 10 mmol/L
KCl	0.186 g, to a final concentration of 50 mmol/L
100 mmol/L DTT	0.5 mL, to a final concentration of 1 mmol/L
0.5 mol/L EDTA	10 µL, to a final concentration of 0.1 mmol/L
~24 mL ddH ₂ O	Finalize to 50 mL
Triton X-100	v/v 0.1%
20 mmol/L Lysozyme (14 kDa)	Add 2 µL per 300 µL BPCB
PMSF	To a final concentration of 50 mmol/L

Results: Lysate of Bst and LAMP

Bst has been induced in our system.

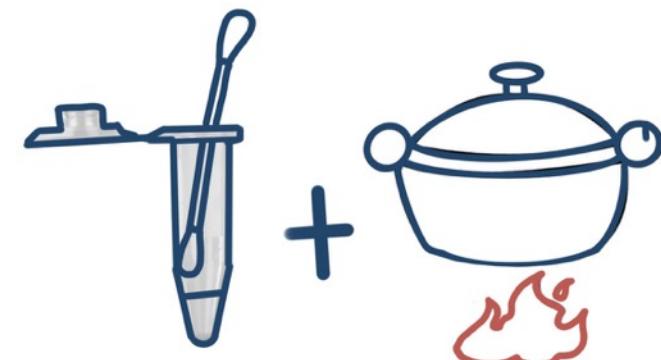


2000
1000
750
500
250
100

LAMP reactions using purified Bst (left) or self-made bacterial lysates (right).

Results: Combining LAMP and LFA

Step 1: Use the swab to collect vaginal sample.

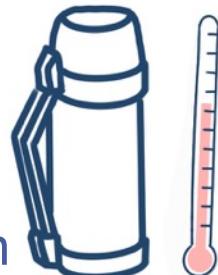


Step 3: Prepare LAMP reaction mixture using lysates of *E. coli*



Step 2: Stir the cotton swab in the tube we provide and boil it.

Step 4: Incubate the LAMP reaction tube at 65°C for 90 minutes using a thermos.



Step 5: Take out the tube and transfer the mixture into another tube containing probes and incubate at 37°C for 10 minutes.



Step 6: Insert the testing strip and check the results!

Results: Lateral Flow Assays

插入LFA实验视频

1. Initiative
2. Project Aims
3. Design → Build → Test ↪
4. For resource-limited regions
 - 4.1 Gender equality
 - 4.2 The right to get educated
 - 4.3 To cover more ages

Getting in touch with our potential users



亲爱的用户：

您好！欢迎您使用由 iGEM2021 Fudan 队伍设计的试剂盒。该试剂盒可在平时生活中利用身边的材料使用，通过本说明书，可以让实验摆脱实验室标准的束缚，仅通过试纸条的阳性结果对照，居家即可完成该试剂盒的全部步骤，成功检测白念珠菌的感染。

【试剂盒原理】

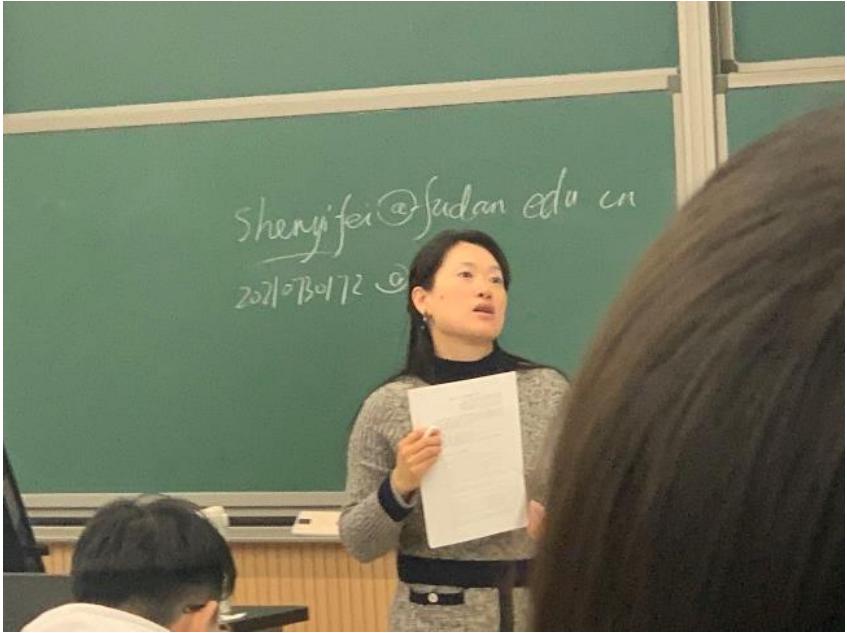
SDG 5 Gender equality & SDG10 Reducing inequality



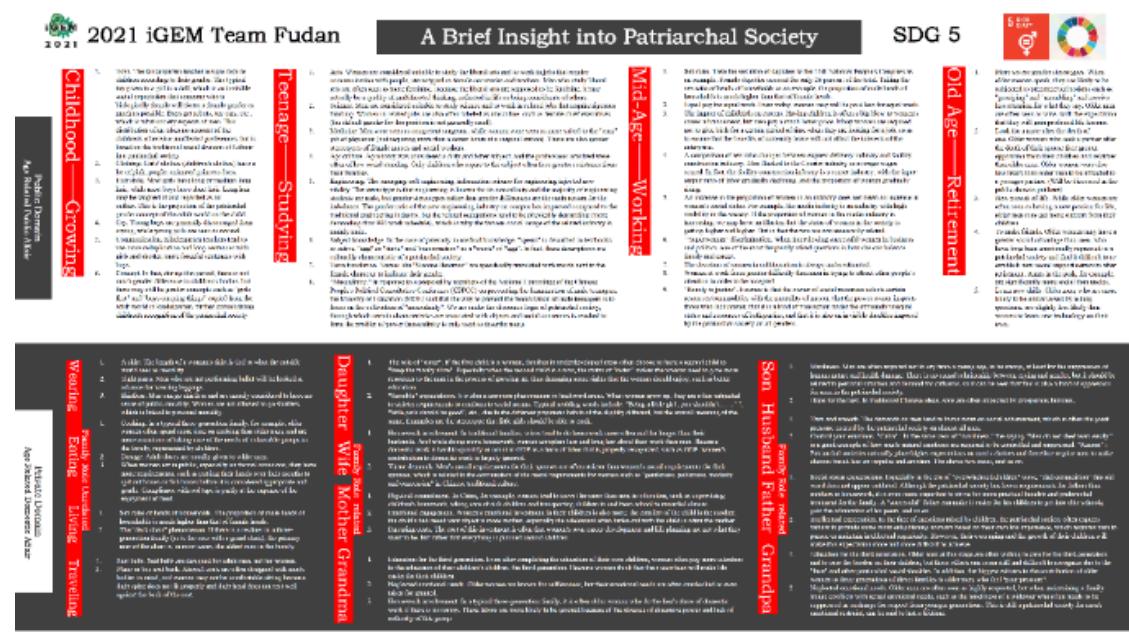
SPEC
STEA
SENS
SPECI
STRIC

Investigating No Period Shaming Program
from a student's perspective

SDG 5 Gender equality & SDG10 Reducing inequality

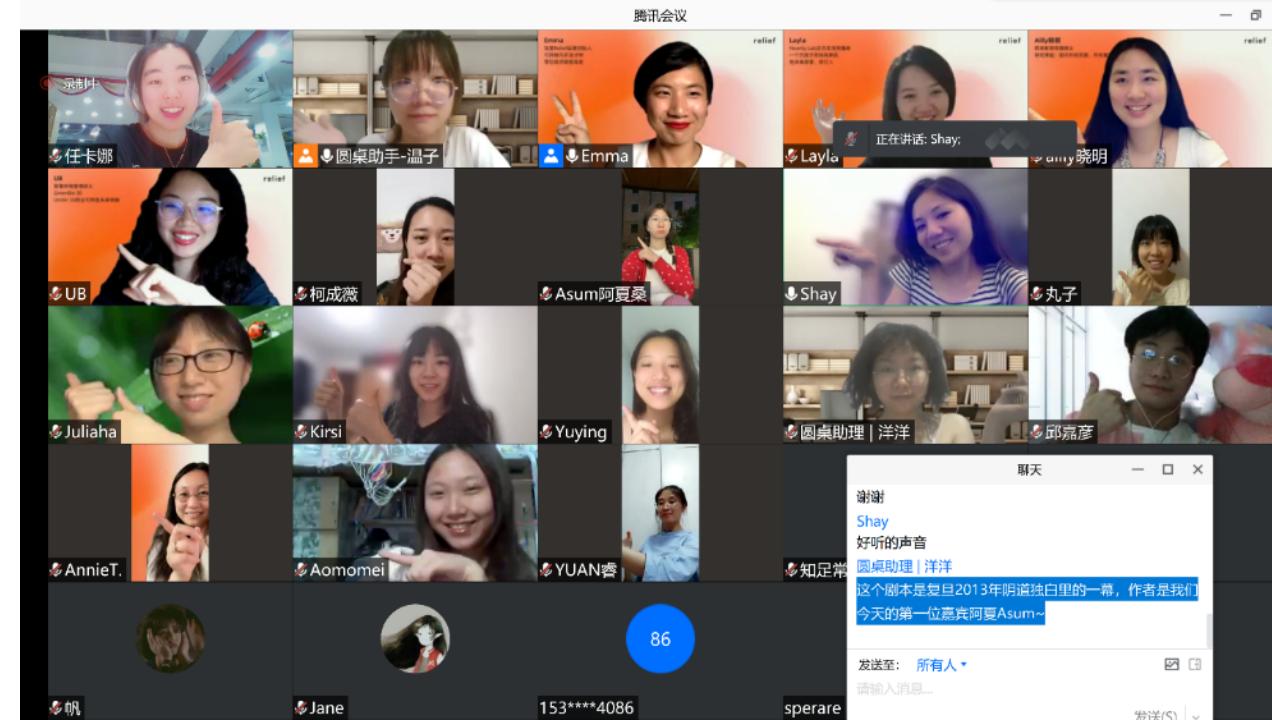


Culture of Vision and Gender Course



A Brief Insight into Patriarchal Society

SDG 5 Gender equality & SDG10 Reducing inequality



Interview: Yueruyi App for women period and health

Relief Workshop: design for women

SDG 5 Gender equality & SDG10 Reducing inequality



Should free menstrual products be legislated in China?

Inclusivity: Caring local minorities



Promoting synthetic biology to
children with intellectual disability

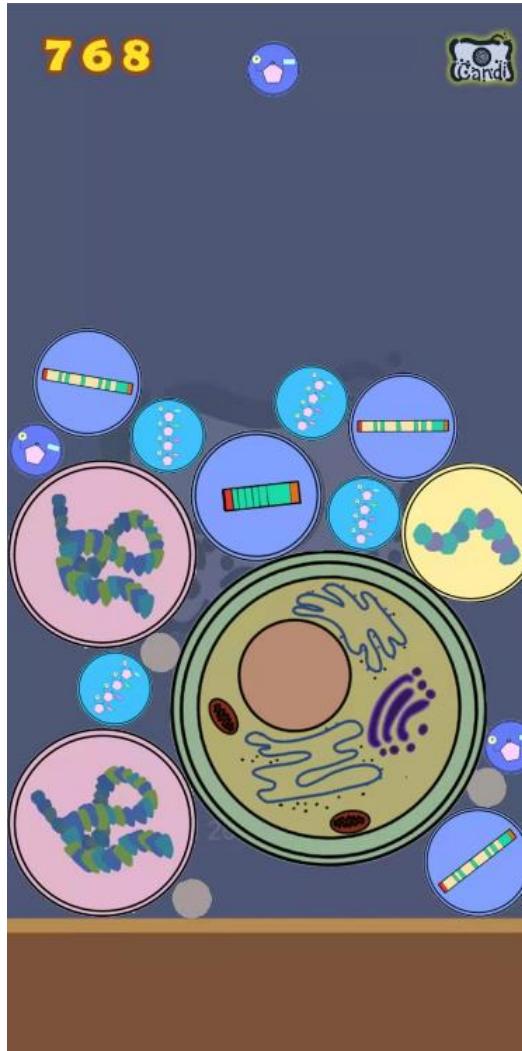


Promoting synthetic biology to
the elderly

2020															
1	Fix the Flow	APP	Aalto-Helsinki	2020	https://2020.iem.org/TeamAalto-Helsinki/Education	environment	Juvenile (12-15)	Breakthrough type, synthetic water protection tool, to protect the water source from garbage pollution	Not applicable to China, and not suitable for Android phones	The innovation of defending radish, multilingual, 14 language versions in total	Modified based on feedback				
2	Card game*	Card game	CPLU CHINA	2020	https://2020.iem.org/TeamCPLU-CHINA/Education	Therapeutics	Youth (15-25)	The card game fully demonstrates the process of protecting the protagonist's liver.	The rules are too complicated, it is not suitable for the public's ideas and can not achieve the effect of popularization	The role of God, Through the choice of various characters to protect the protagonist HP from being D	Participant				
3	video game*	APP	Edinburgh	2020	https://2020.iem.org/TeamEdinburgh/Education	Environment	Children and adolescents (12-15)	Cell phone sensor, pocket monster adaptation, collect environmental information and win prizes	Not completed, and there will be problems with the final adaptation	High public popularity and simple operation	Rich feedback				
4	MINECRAFT WORLD	Platform game	Edinburgh	2020	https://2020.iem.org/TeamEdinburgh/Education	Environment	Children and adolescents (12-15)	The adaptation of my world, the construction of treasure hunt in various related substances	The construction degree is unknown, and the specific operational difficulty is unknown	Interact and build with other teams	The game is highly creative				
5	Escape Room	Live game	Estonia	2020	https://2020.iem.org/Team:Estonia_TUT/Education	Manufacturing	Youth (15-25)	Secret room escape adaptation, familiar with car structure and escape within a limited time	Difficulty coefficient unknown	High popularity, participation and interest	High popularity, participation and interest				
6	Mu Lan Shanhan	Live game	Fudan	2020	https://2020.iem.org/TeamFudan/Education	Food & Nutrition	Old age (50-70)	Mulan family traditional fitness project	Lack of innovation and knowledge popularization	Easy to learn, the game has high popularity and strong performance	High cultural inheritance				
7	It's about'Genetics!	Trivial Pursuit Unhinged	HKUST	2020	https://2020.iem.org/TeamHKUST/Education#heading-3	Manufacturing	Youth (15-25)	Board game, component assembly, three difficulty settings, opponent attack	The rules are somewhat complex and less interesting	The design is highly innovative, the difficulty gradient demands	High difficulty				
8	BacTall web app	Q&A game	Iona Paris	2020	https://2020.iem.org/TeamsIona_Paris/Education	Therapeutics	Youth (15-25)	Q & A questions, simple difficulty mode, score ranking	It is not innovative, academic and interesting	The design is highly innovative, the difficulty gradient demands	High difficulty				
9	Room Escape PICAjCH	Live game	LINKS, China	2020	https://2020.iem.org/TeamsLINKS_China/Education	High School	Youth (15-25)	Online search for available items in the room, make new items and escape from them room	Incomplete, with unknown difficulty and education	Good education and high knowledge	Population rate				
10	Teeth Battle	Trivial Pursuit Unhinged	Mingtao	2020	https://2020.iem.org/TeamMingtao/Education	High School	Youth and adults (15-80)	A card game to protect teeth, a game between protection and attack	Educational unknown	Full of interest and suspense					
11	Taxonomy of hand	APP	MU-MABE	2020	https://2020.iem.org/TeamMU-MABE/Education	Therapeutics	Children and adolescents (10-15)	Combining biology knowledge and fun, a game to popularize science	The introduction is incomplete, and the interest is slightly poor	Good fun, happy time for the whole family					
12	Plants	Plants game	Montessori	2020	https://2020.iem.org/TeamMontessori/Education	Therapeutics	Youth (15-25)	Observe plants to infect bacteria, reproduce more plants	Poor knowledge	Comparing knowledge					
13	Blast-Go Go	Platform game	Macrow	2020	https://2020.iem.org/TeamMacrow/Edu-Edition	Diagnostics	Children and adolescents (10-15)	Put LEGO together to form a loop	Knowledge popularization may be insufficient	Full interest and high popularity	Easy to operate				
14	The Adventure of Bob Lology	APP	Nanjing NFLS	2020	https://2020.iem.org/TeamNanjing_NFLS/Education	High School	Youth (15-25)	Through the hero's dream, enter eight biotechnology world adventures	It is not completed, and the operability is difficult, and there is a problem in controlling the difficulty coefficient	High interest and popularity					
15	Board game*	Trivial Pursuit Unhinged	Nantes	2020	https://2020.iem.org/TeamNantes/FairEducation/Boardgame	Environment	Youth (15-25)	Board game, collecting components, assembling plastics, three difficulty settings	Less interesting	Good knowledge and close with synthetic biology	Difficulty level setting				
16	Virtual Escape Game	Platform game	Nantes	2020	https://2020.iem.org/TeamNantes/FairEducation/Virtualgame	Environment	Youth (15-25)	Answer questions/Interconnection between teams/All members of the team answer the questions	The popularity is insufficient, which is only limited to the role within the team	Good form and strong cooperation					
17	Minified Elite	Platform game	NEFU, China	2020	https://2020.iem.org/TeamNEFU_China/Education	New Application	Children and adolescents (10-25)	Mine sweeping game adaptation	No innovation, no popularization of synthetic biology knowledge	The project is highly relevant, and close to life					
18	Minecraft	Platform game	Nottingham	2020	https://2020.iem.org/TeamNottingham/Education	Therapeutics	Youth (15-25)	Adventure in my world game	Lack of innovation and lack of interest	The setting of adventure mechanism improves the interest					
19	Booth game	Live game	Pulching Macau	2020	https://2020.iem.org/TeamPulching_Macau/Education	High School	Youth (15-25)	Booth games to transfer/knowledge of synthetic biology	The participation of the masses is good and the popularization of science is good	High innovation and high popularity					
20	Matching Game	Card game	PYMS_GZ China	2020	https://2020.iem.org/TeamPYMS_GZ_China/Education	High School	Children and adolescents (10-25)	A card matching game that matches synthetic biological terms with definitions	The difficulty is insufficient, although the difficulty gradient is set, it is still not innovative	It has good science popularization and high compatibility with synthetic biology					
21	Early Detection Card Game	Card game	SDU-Denmark	2020	https://2020.iem.org/TeamSDU-Denmark/Human_Practices/Card_game	Diagnostics	Youth (15-25)	Card game, explore acne	Lack of education, low correlation with synthetic biology, and complex rules	Good popularity and strong interest					
22	toxinOFF Game	Platform game	Stockholm	2020	https://2020.iem.org/TeamStockholm/Human_Practices	Environment	Youth (15-25)	Platform exploration game, collection and ranking/accumulation	The difficulty setting is unknown, and the science popularization of synthetic biology is insufficient	Good interest and popularity					
23	Amphiox Games	Live game	Stockholm	2020	https://2020.iem.org/TeamStockholm/Education	Environment	Youth (15-25)	Offline live action games, using actions to convey word information	Inappropriate audience	High participation, strong popularity and high correlation with synthetic biology					
24	Quizzoff	Live game	Tel Aviv-Jaffa	2020	https://2020.iem.org/TeamTel_Aviv-Jaffa_Human_Practices	New Application	Juvenile (10-15)	Offline games to simulate virus transmission and improve epidemic prevention awareness	Non-synthetic biology science	High participation and good popularity	For epidemic prevention				
25	Escape game	Card game	Tel Aviv-Jaffa	2020	https://2020.iem.org/TeamTel_Aviv-Jaffa_EscapeGame	Environment	Children and adolescents (10-25)	The difficulty coefficient is unknown, and the game is the same as unknown	The difficulty coefficient is unknown and the audience is small	The story has strong background and high interest					
26	Educational Game*	APP	Togali Software	2020	https://2020.iem.org/TeamTogali_Software/Education	Software	Youth (15-25)	Control your world online by solving synthetic biology solutions	The difficulty coefficient is unknown, and the relationship with synthetic biology is low	The story has strong background and high interest					
27	Minigame	APP	TU Darmstadt	2020	https://2020.iem.org/TeamTU_Darmstadt/Education	Environment	Children and adolescents (10-25)	Villain breakout mode, avoid danger and pick up objects	The difficulty coefficient is unknown, the game is slightly simple, and the relationship with synthetic biology is low	The background of the story is good and interesting					
28	FunGames*	APP	ZJUT, China_B	2020	https://2020.iem.org/Team_ZJUT_China_B/EducationIEE	Diagnostics	Youth (15-25)	Detection technology of simulated virus RNA	Poor inscription	Cute, interesting and knowledgeable					
2019															
1	Celi	computer game	BIAP, Mexico	2019	https://2019.iem.org/TeamBIAP_Mexico/Public_Education	Environment	Youth (15-25)	iGEM complex element combination for Education	Lack of difficulty coefficient and interest	Good knowledge, and iGEM is accurate and relevant					
2	The BBA Game	Trivial Pursuit Unhinged	CU	2019	https://2019.iem.org/TeamCU/Public_Education	Environment	Youth (15-25)	Using synthetic biological elements to piece up combined circuits	Lack of difficulty and interest	High public participation					
3	Escape game	Live game	Evry-Pari-Saclay	2019	https://2019.iem.org/TeamEvry_Paris-Saclay_Public_EducationIP2	Manufacturing	Youth (15-25)	Set up a secret room with the knowledge of synthetic biology	The popularity is insufficient, which is only limited to the role within the team	Full of interest					
4	Card Game*	Card game	FAU Erlangen	2019	https://2019.iem.org/TeamFAU_Erlangen_Human_Practices	Foundational Advance	Youth (15-25)	Simulate tumor treatment process, through card game	It is not difficult and has no correlation with synthetic biology	It is interesting and can popularize the knowledge of tumor treatment					
5	Escape Room	Live game	FAU Erlangen	2019	https://2019.iem.org/TeamFAU_Erlangen_Human_Practices	Foundational Advance	Youth (15-25)	Solve the puzzle and escape from the secret room	The relevance of synthetic biology is not high and its popularity is low	Good interest					
6	Bio Mahjong Cards	Card game	Fudan-TSI	2019	https://2019.iem.org/TeamFudan-TSI_Public_Education	Foundational Advance	Youth (15-25)	Mahjong version of synthetic biology, with the basic element Hu Pai	The rules are complex	It is highly interesting and has great relevance with synthetic biology					
7	iGame	Poetry game	G0_Paris-Saclay	2019	https://2019.iem.org/wikis/TeamG0_Paris-Saclay/HP_iGame	Foundational Advance	Children and adolescents (10-25)	Popularize synthetic biology in the form of poetry	Synthetic biology is not highly relevant and difficult	It is beautiful and easy to understand, and improves the understanding of beauty on the basis of biology					
8	Jeopardy	Live game	HK_GTC	2019	https://2019.iem.org/TeamHK_GTC_Public_Education	High School	Youth (15-25)	Explanation of synthetic biology terms by definition	Poor interest and popularity	High correlation of synthetic biology					
9	Actionary game	Live game	HK_GTC	2019	https://2019.iem.org/TeamHK_GTC_Public_Education	High School	Youth (15-25)	Using action to guess synthetic biological nouns	The difficulty coefficient is unknown and the popularity is insufficient	It is interesting and can let students integrate into it					
10	Hangman	Live game	HK_GTC	2019	https://2019.iem.org/TeamHK_GTC_Public_Education	High School	Youth (15-25)	Using questions to guess synthetic biological terms	Lack of interest	High participation of the masses					
11	RNA-Protein translation	Live game	HK_GTC	2019	https://2019.iem.org/TeamHK_GTC_Public_Education	High School	Youth (15-25)	Encoding codes with synthetic biology	Insufficient relevance of synthetic biology	It is interesting and can let students integrate into it					
12	Street play	Live game	ISIER_Kolkata	2019	https://2019.iem.org/TeamISIER_Kolkata/Public_Education	Therapeutics	Youth and adults (15-60)	Introduce health knowledge and disease prevention knowledge to the public through games	Lack of relevance and interest in synthetic biology	High participation of the masses					
13	board game*	Card game	KCL_UK	2019	https://2019.iem.org/TeamKCL_UK/Public_Education	Foundational Advance	Youth (15-25)	The war between the immune system and the virus	Insufficient relevance of synthetic biology	High interest and competition					
14	Escape game*	Live game	Montpellier	2019	https://2019.iem.org/TeamMontpellier/Public_Education	Foundational Advance	Youth (15-25)	Escape from the secret room and leave the room with knowledge of synthetic biology	The difficulty coefficient is unknown, and the rules are complex	Strong interest and popularity					
15	Escape game*	Card game	NUSTech	2019	https://2019.iem.org/TeamNUSTech/Public_Education	New Application	Youth (15-25)	Escape from the secret room with the knowledge of synthetic biology and iGEM	The difficulty coefficient is unknown, and the interest is not explained	High participation and no rule description					
16	Card game*	Card game	NICHIU_TaiChung	2019	https://2019.iem.org/TeamNICHIU_TaiChung/Public_Education	Environment	Youth (15-25)	Learn about synthetic biology through card game	The rules are complex	High correlation of synthetic biology					
17	CMD Escape Room	Live game	NICHIU_Taiwan	2019	https://2019.iem.org/TeamNICHIU_Taiwan/Public_Education	Therapeutics	Youth (15-25)	Escape the game through the secret room to popularize the knowledge of synthetic biology, and CKD	Lack of interest	Sufficient interest and high popularity					
18	RibоФold	Platform game	OUC-China	2019	https://2019.iem.org/TeamOUC_China/Public_Education	Foundational Advance	Youth (15-25)	Popularize the knowledge of synthetic biology by constructing riboswitch	Knowledge is more specific and popular	Intellectual specificity					
19	Boolean Blackout	Live game	Pittsburgh	2019	https://2019.iem.org/TeamPittsburgh/Public_Education	Foundational Advance	Youth (15-25)	Construct gene circuit and learn pathway language (and or not)	Insufficient popularity	Intellectual specificity					
20	Escape game*	Live game	Poitiers	2019	https://2019.iem.org/TeamPoitiers/Public_Education	Manufacturing	Youth (15-25)	Escape the chamber of secrets with knowledge of synthetic biology	It is interesting and has high correlation with synthetic biology						
21	Microbe Board Game	Card game	REC-CHE/ENNAI	2019	https://2019.iem.org/TeamREC-CHE/ENNAI/Public_Education+4P	Foundational Advance	Youth and adults (15-60)	Introduce the relationship between microorganisms and human health through cards	The correlation of synthetic biology is poor	Good interest and popularity					
22	Area of Bacteria	Card game	SCU-China	2019	https://2019.iem.org/TeamSCU-China/Public_Board-Game	Manufacturing	Youth (15-25)	Introduce the impact of antibiotics on the environment through cards	The correlation of synthetic biology is poor	Good interest, online and offline combination in place					
23	PC game*	Platform game	ShanghaiTech China	2019	https://2019.iem.org/TeamShanghaiTech_China/Public_Education	Therapeutics	Youth (15-25)	Design bacteria and complete the task of customs clearance	Poor knowledge	Very interesting and popular					
24	Professor's secret	Platform game	SJTU-software	2019	https://2019.iem.org/TeamSJTU-software/Public_Education	Software	Youth (15-25)	Online secret, escape game design, using biological knowledge to escape the room	The rules are complex and the popularity is unknown	Strong interest					
25	card game*	Card game	SMMU-China	2019	https://2019.iem.org/TeamSMMU_China/Public_Education	Therapeutics	Youth (15-25)	Card game designed by synthetic biological elements	The rules are complex and less interesting	Insufficient knowledge of synthetic biology					
26	VIDEO GAME	computer game	Sorbonne_U-Paris	2019	https://2019.iem.org/TeamSorbonne_U-Paris/Public_Education	Environment	Youth (15-25)	Break through customs and collect items to treat patients	There is no synthetic biology related, and the rules are simple	Sufficient interest and high popularity					
27	Innovation Games	Live game	Sydney, Australia	2019	https://2019.iem.org/TeamSydney_Australia/Public_Education	Therapeutics	Youth and adults (15-60)	A series of games stimulate people's understanding of synthetic biology	The rules are simple and the design has no strong logic	Full interest and high popularity/Easy to operate					
28	Bacteri-on	Platform game	Tec-Monterrey	2019	https://2019.iem.org/TeamTec-Monterrey/Public_Education	Foundational Advance	Youth (15-25)	Design bacteria, difficulty stratification, complete the challenge	The rules are simple and the knowledge is poor	More interesting					
2018															
1	board game	Card game	NYMU-Taipei	2018	https://2018.iem.org/TeamNYMU-Taipei/Public_Education	New Application	Youth (15-25)	Many people work together to complete the challenge	The rules are simple and cooperative	Poor knowledge					
2	The BBA Game	Trivial Pursuit Unhinged	CU	2019	https://2019.iem.org/TeamCU/Public_Education	Environment	Youth (15-25)	Using synthetic biological elements to piece up combined circuits	Lack of difficulty and interest	High public participation					
3	Escape game	Live game	Every-Pari-Saclay	2019	https://2019.iem.org/TeamEvery_Paris-Saclay/Public_EducationIP2	Manufacturing	Youth (15-25)	Set up a secret room with the knowledge of synthetic biology	The popularity is insufficient, which is only limited to the role within the team	Full of interest					
4	Card Game*	Card game	FAU Erlangen	2019	https://2019.iem.org/TeamFAU_Erlangen_Human_Practices	Foundational Advance	Youth (15-25)	Simulate tumor treatment process, through card game	It is not difficult and has no correlation with synthetic biology	It is interesting and can popularize the knowledge of tumor treatment					
5	Escape Room	Live game	FAU Erlangen	2019	https://2019.iem.org/TeamFAU_Erlangen_Human_Practices	Foundational Advance	Youth (15-25)	Solve the puzzle and escape from the secret room	The relevance of synthetic biology is not high and its popularity is low	Good interest					
6	Bio Mahjong Cards	Card game	Fudan-TSI	2019	https://2019.iem.org/TeamFudan-TSI_Public_Education	Foundational Advance	Youth (15-25)	Mahjong version of synthetic biology, with the basic element Hu Pai	The rules are complex	It is highly interesting and has great relevance with synthetic biology					
7	iGame	Poetry game	G0_Paris-Saclay	2019	https://2019.iem.org/wikis/TeamG0_Paris-Saclay/HP_iGame	Foundational Advance	Children and adolescents (10-25)	Popularize synthetic biology in the form of poetry	Synthetic biology is not highly relevant and difficult	It is beautiful and easy to understand, and improves the understanding of beauty on the basis of biology					
8	Jeopardy	Live game	HK_GTC	2019	https://2019.iem.org/TeamHK_GTC_Public_Education	High School	Youth (15-25)	Explanation of synthetic biology terms by definition	Poor interest and popularity	High correlation of synthetic biology					
9	Actionary game	Live game	HK_GTC	2019	https://2019.iem.org/TeamHK_GTC_Public_Education	High School	Youth (15-25)	Using action to guess synthetic biological nouns	The difficulty coefficient is unknown and the popularity is insufficient	It is interesting and can let students integrate into it					
10	Hangman	Live game	HK_GTC	2019	https://2019.iem.org/TeamHK_GTC_Public_Education	High School	Youth (15-25)	Using questions to guess synthetic biological terms	Lack of interest	High participation of the masses					
11	RNA-Protein translation	Live game	HK_GTC	2019	https://2019.iem.org/TeamHK_GTC_Public_Education	High School	Youth (15-25)	Encoding codes with synthetic biology	Insufficient relevance of synthetic biology	It is interesting and can let students integrate into it					
12	Street play	Live game	ISIER_Kolkata	2019	https://2019.iem.org/TeamISIER_Kolkata/Public_Education	Therapeutics	Youth and adults (15-60)	Introduce health knowledge and disease prevention knowledge to the public through games	Lack of relevance and interest in synthetic biology	High participation of the masses					
13	board game*	Card game	KCL_UK	2019	https://2019.iem.org/TeamKCL_UK/Public_Education	Foundational Advance	Youth (15-25)	The war between the immune system and the virus	Insufficient relevance of synthetic biology	High interest and competition					
14	Escape game*	Live game	Montpellier	2019	https://2019.iem.org/TeamMontpellier/Public_Education	Foundational Advance	Youth (15-25)	Escape from the secret room and leave the room with knowledge of synthetic biology	The difficulty coefficient is unknown, and the rules are complex	Strong interest and popularity					
15	Escape game*	Card game	NUSTech	2019	https://2019.iem.org/TeamNUSTech/Public_Education	New Application	Youth (15-25)	Escape from the secret room with the knowledge of synthetic biology and iGEM	The difficulty coefficient is unknown, and the interest is not explained	High participation and no rule description					
16	Card game*	Card game	NICHIU_TaiChung	2019	<a href="https://2019										

Table. Games built during previous iGEMS

Education: Games we created during 2021



For more details, please visit <https://2021.igem.org/Team:Fudan/>

插入game1 动画

For more details, please visit <https://2021.igem.org/Team:Fudan/>

插入game2 动画

For more details, please visit <https://2021.igem.org/Team:Fudan/Education>



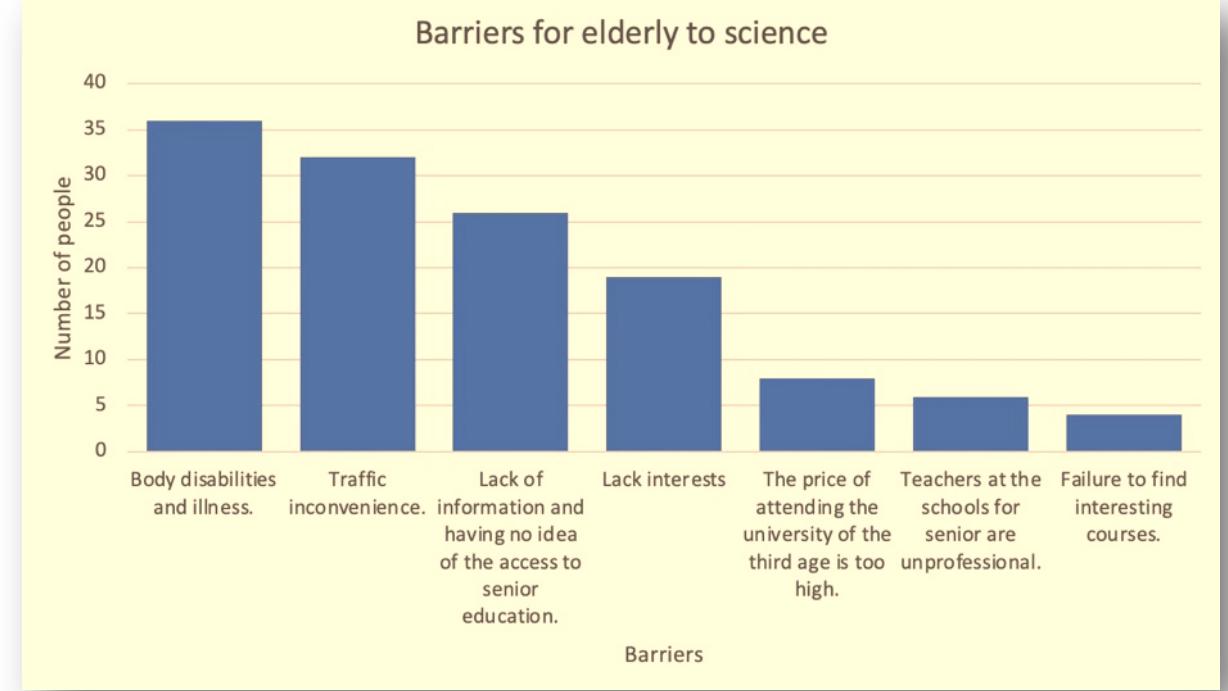
For more details, please visit <https://2021.igem.org/Team:Fudan/Education>



Investigating barriers for the elderly



**Interviewing director of Research
Department of Shanghai University
of the Third Age**



**Statistic results of the
questionnaire on barriers**

Expand access to science for the elderly



Introducing synthetic biology and our project to
the students of the university of the third age

Expand access to science for the elderly



Poster to promote our project
in the park



Screenshot of the vlog we filmmmed



Fudan iGEM 2021

Candicamera



- **Director:** Xin, Shaorong
- **Audio:** Xin
- **Animation:** Fei, Renbin, Shitao
- **Graphic:** Chongwen, Wencheng, Guonan, Renbin, Xin
- **Photograph:** Kana, Peisong, Xin, Guonan
- **Video Editing:** Shitao, Renbin
- **Sponsored by:** Yunfeng Capital, Fudan University

For more details, please visit <https://2021.igem.org/Team:Fudan>