

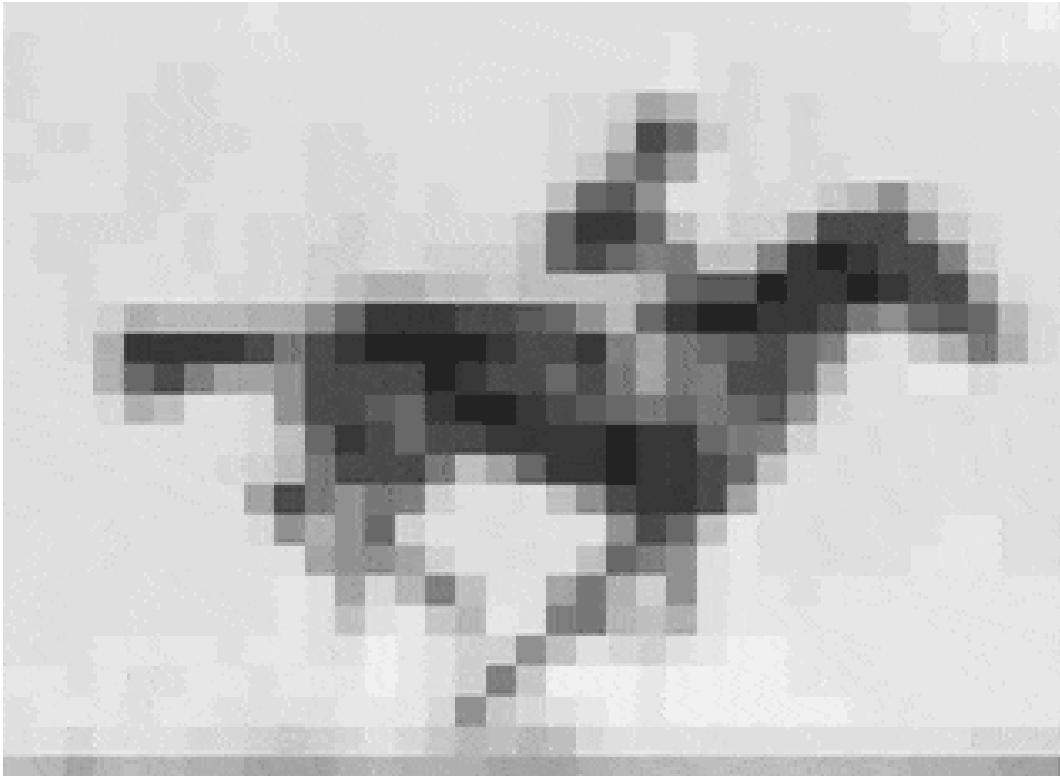


What could replace a micro-chip in sensing and storing information?



DNA

Storage Of A Movie In *E. Coli*



Original Image

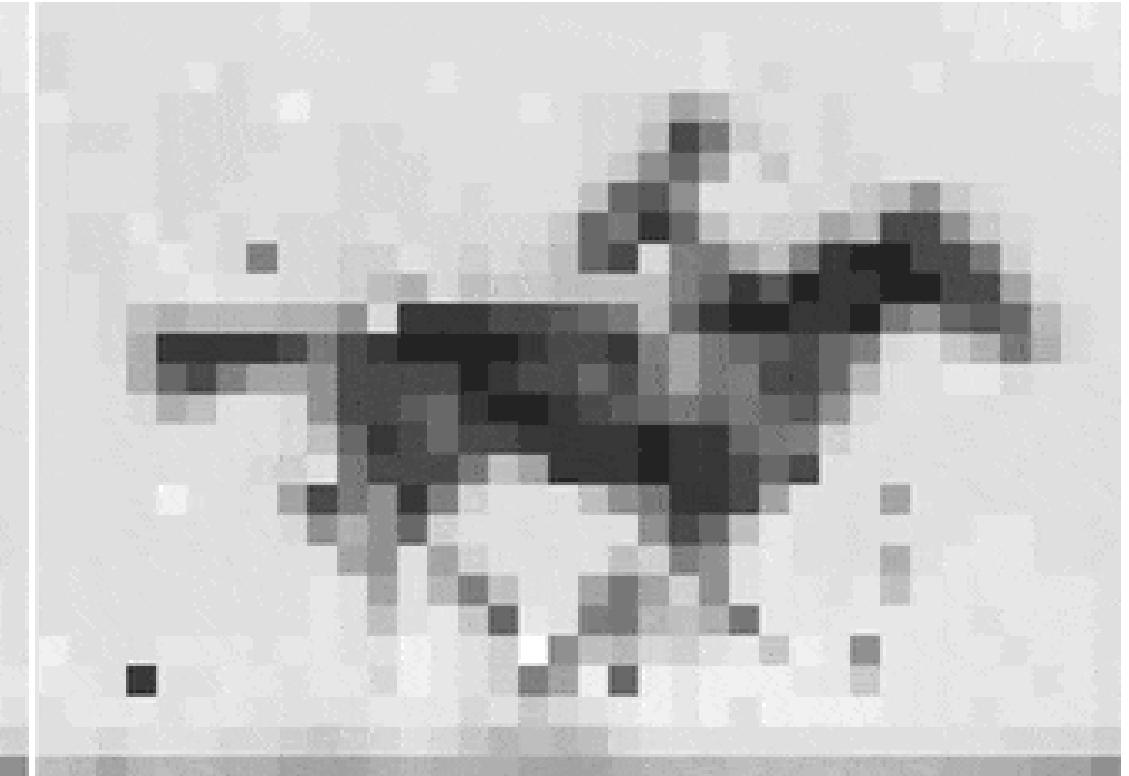


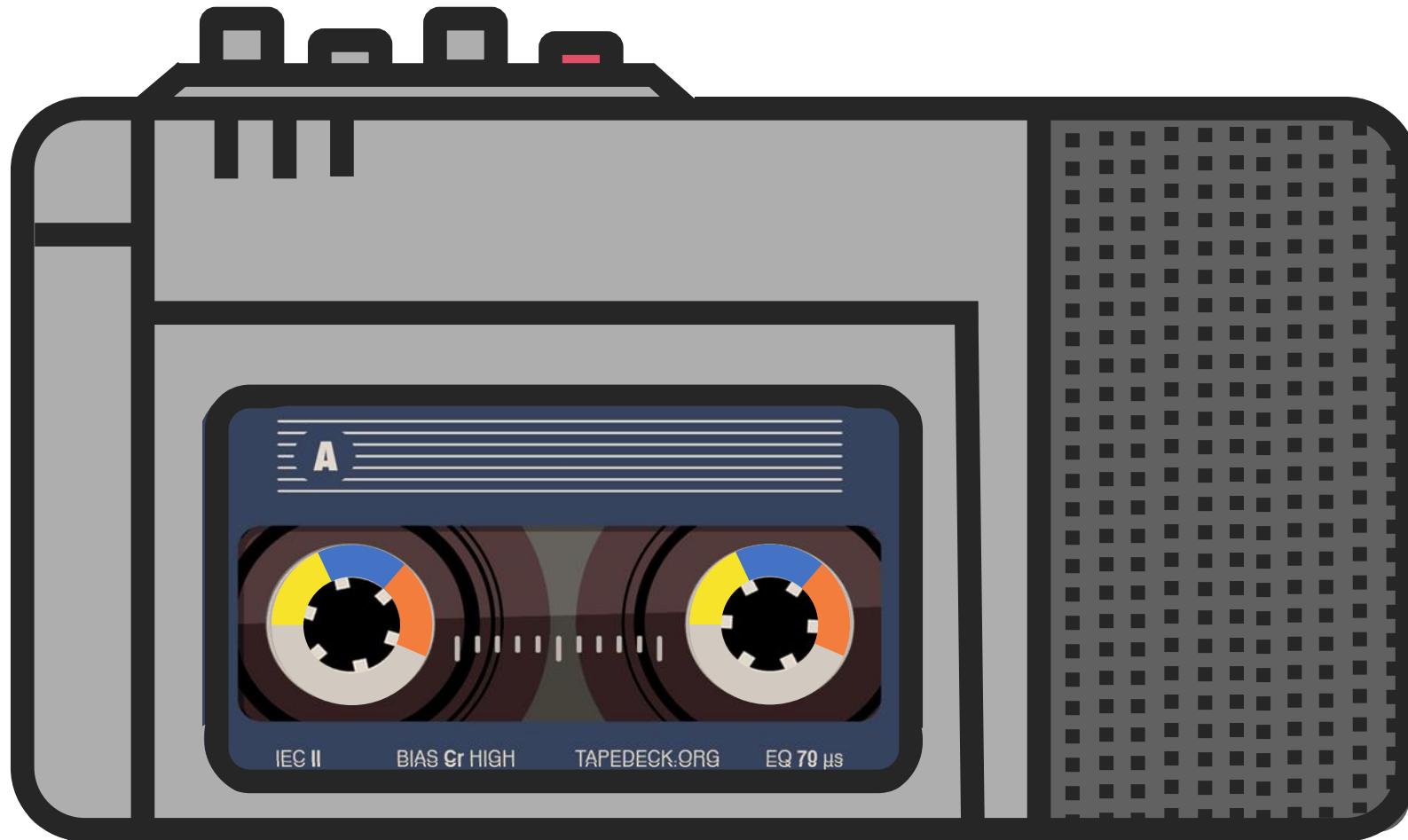
Image Reconstructed From Bacteria

Shipman, S. (2017). CRISPR–Cas encoding of a digital movie into the genomes of a population of living bacteria



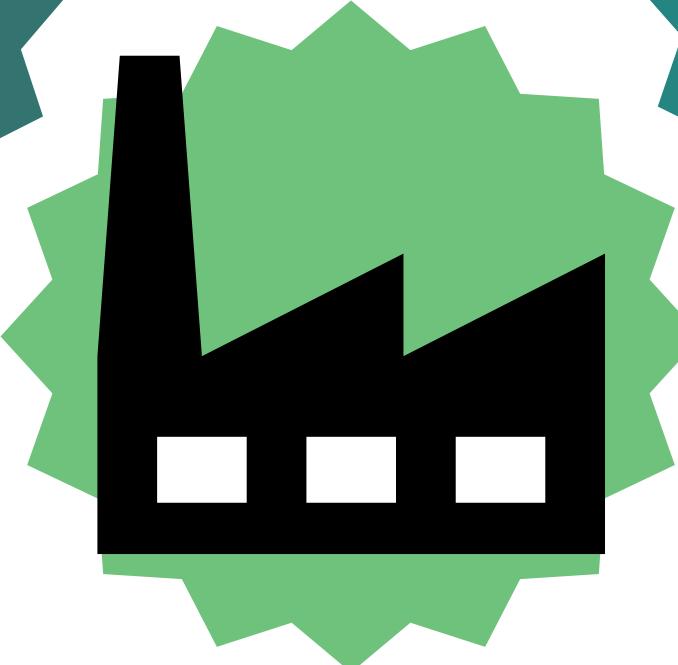
TAPE RECORDER







Lab
Experiments



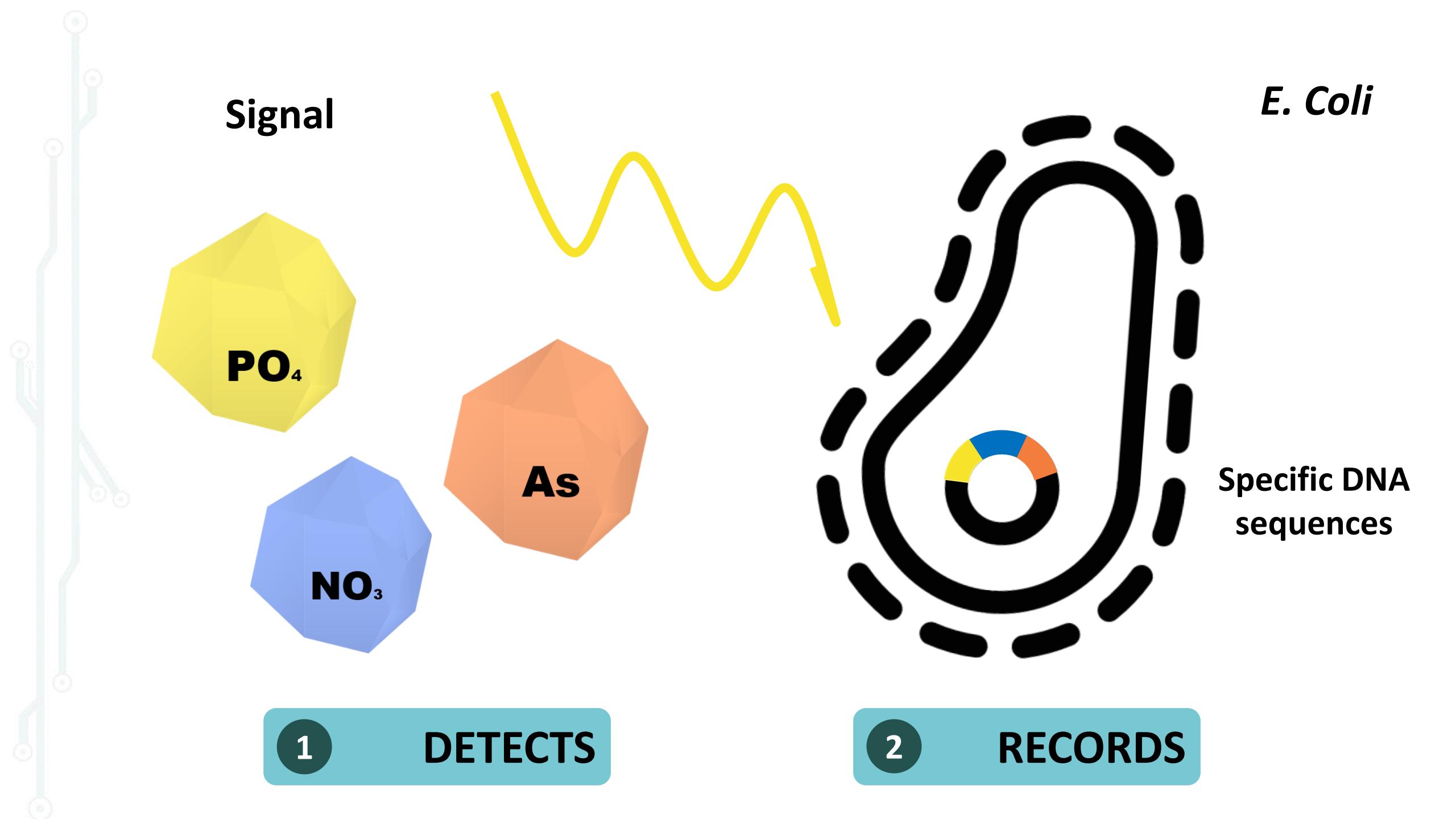
Industrial
Processes

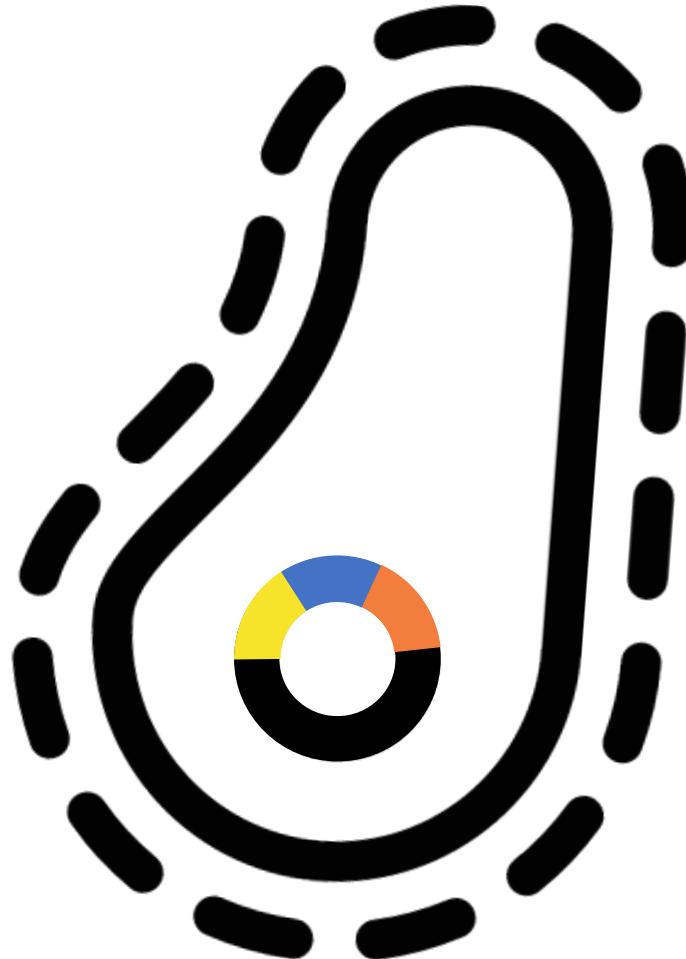


Human
Body



Soil
Water

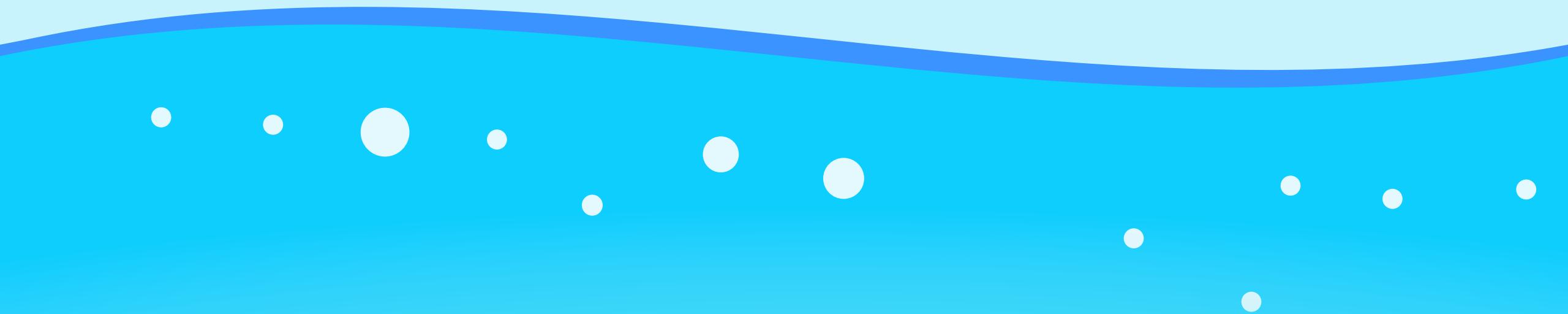




3

REPRODUCES

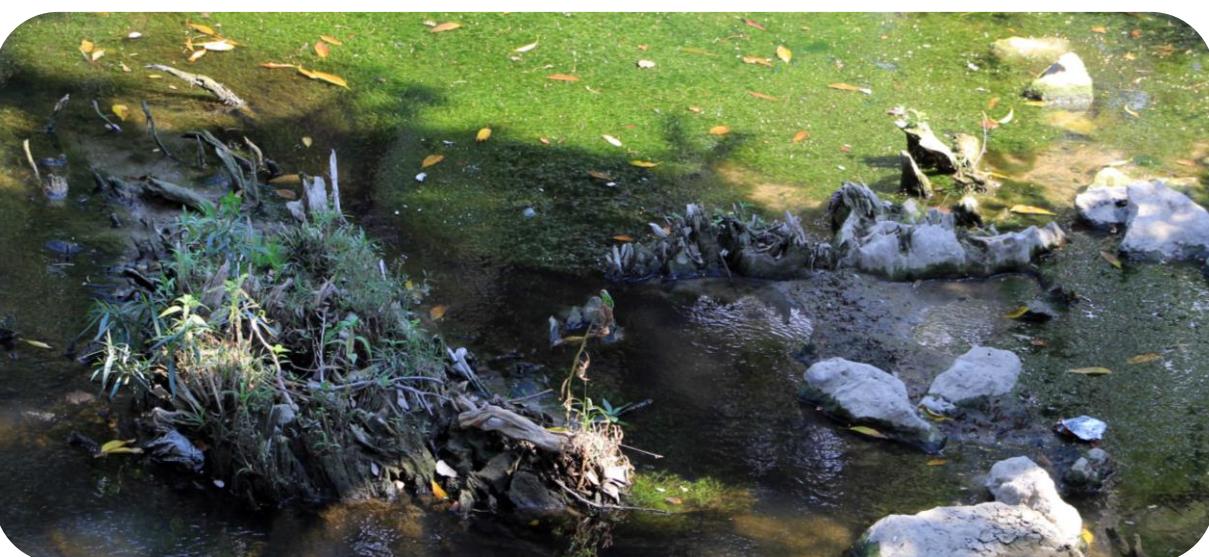
HUMAN PRACTICES







Tabasco
Chiapas

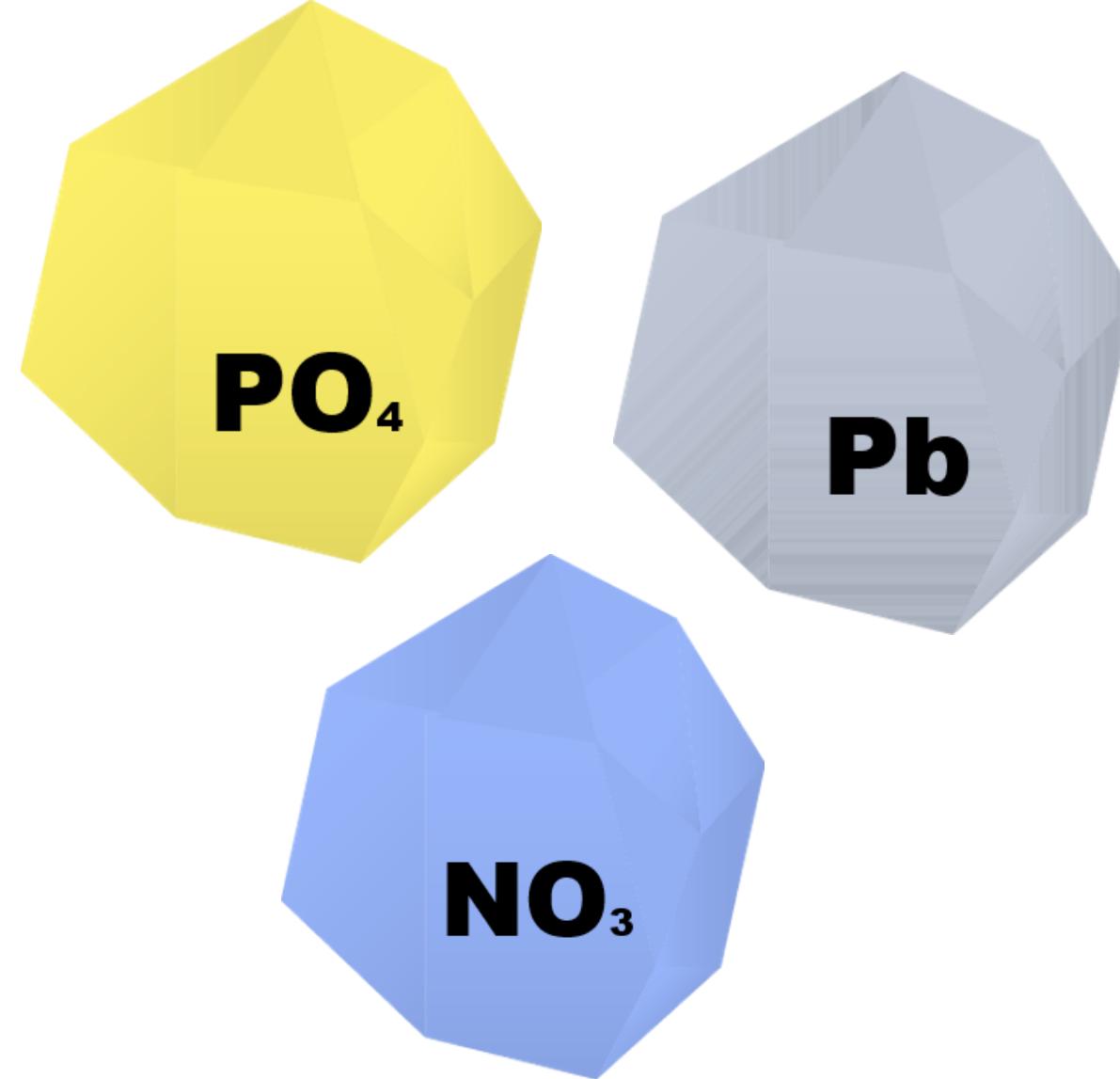


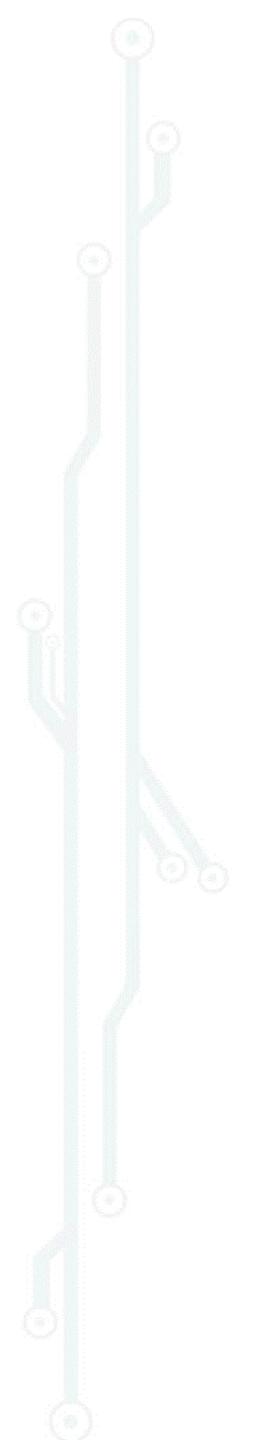


CONANP
COMISIÓN NACIONAL
DE ÁREAS NATURALES
PROTEGIDAS



- Pb
- NO₃
- PO₄





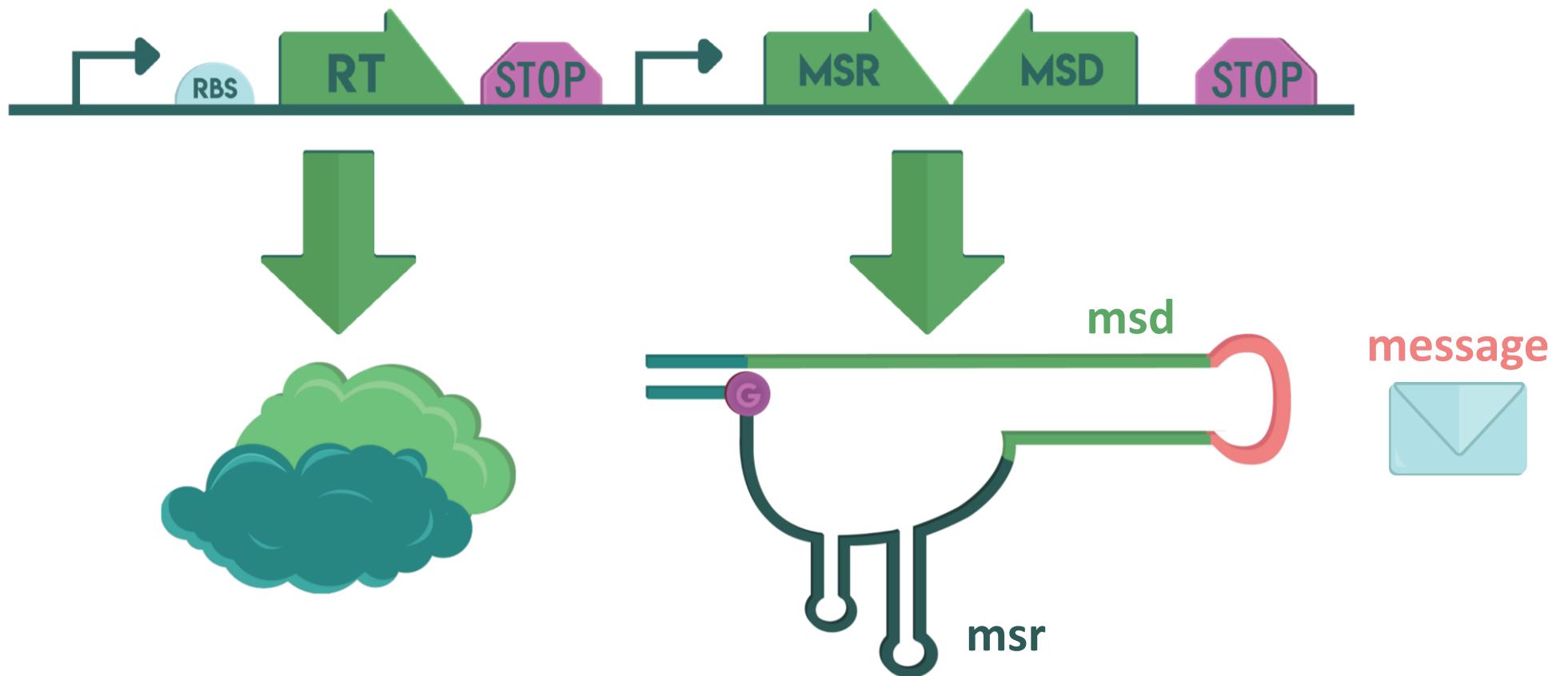
How does the system work?

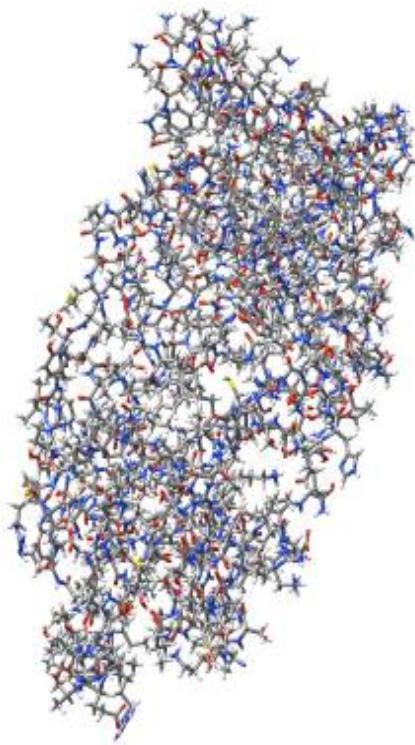
SCRIBE System

CRISPR Cas1-2

SCRIBE System

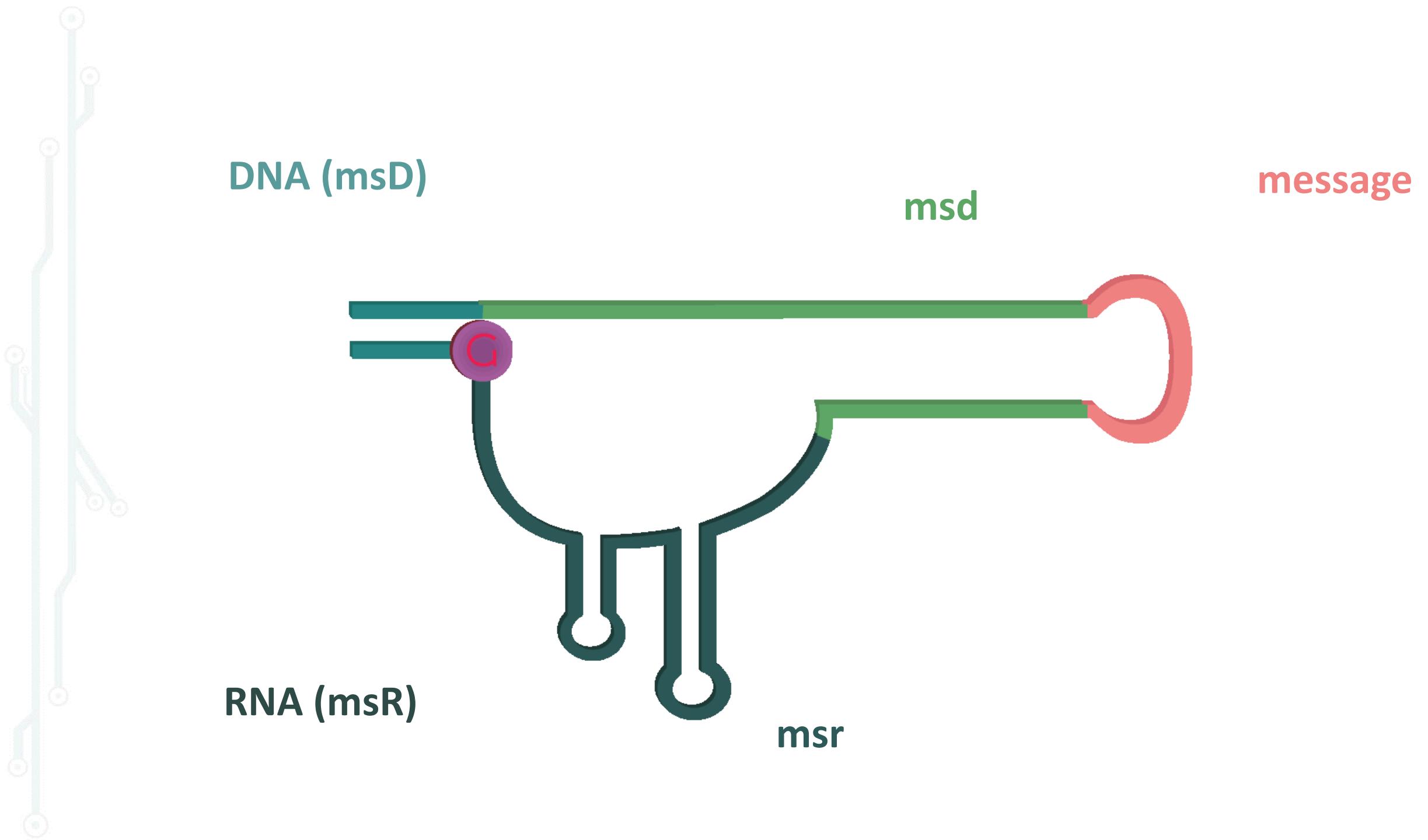
Synthetic Cellular Recorders Integrating Biological Events

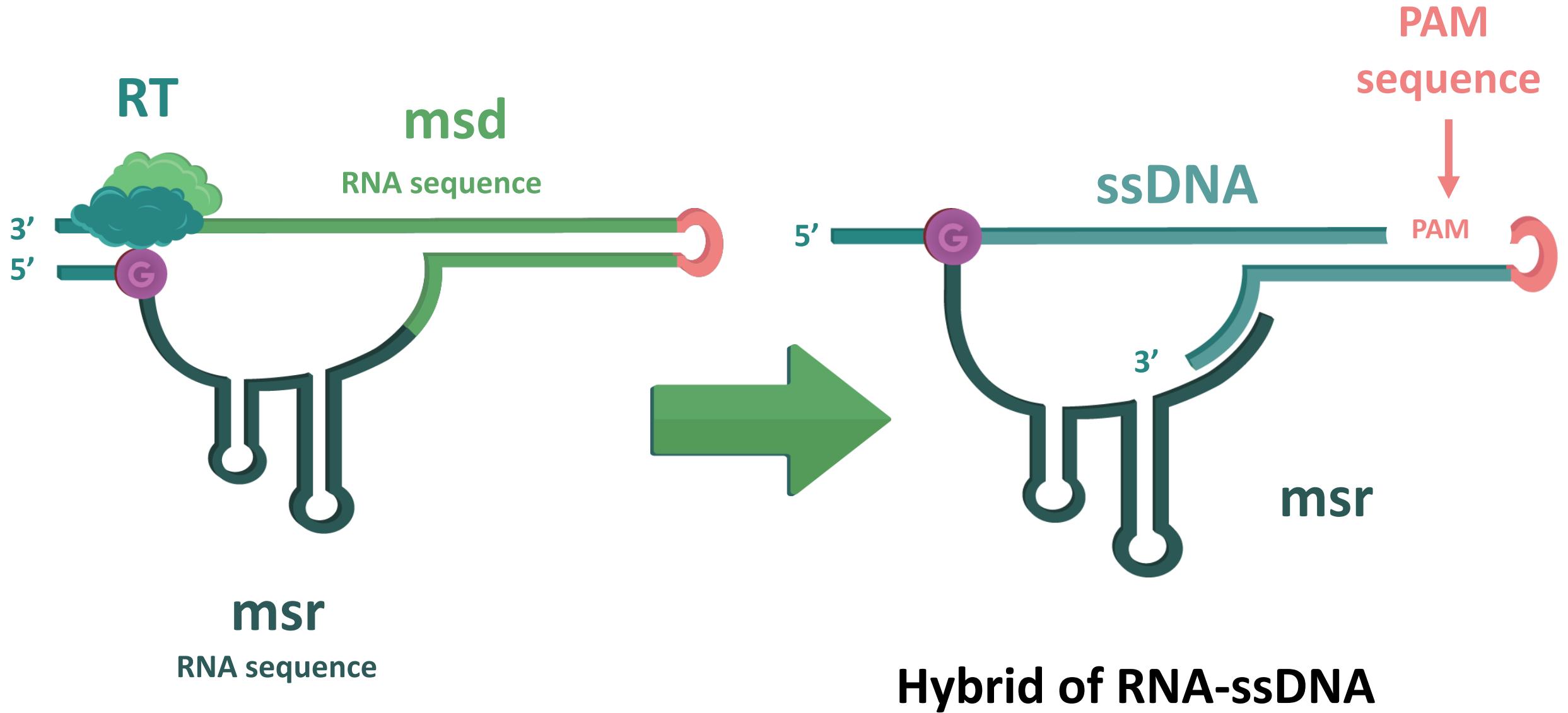




Protein crystallography of the retrotranscriptase





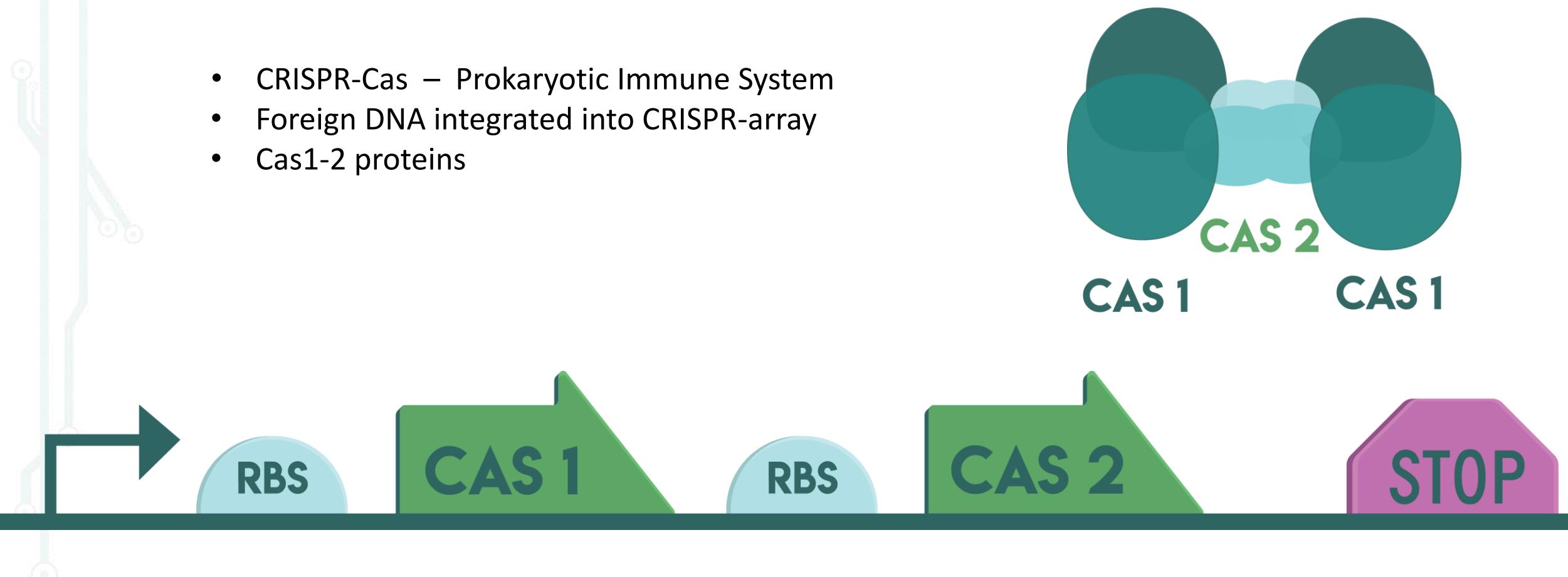


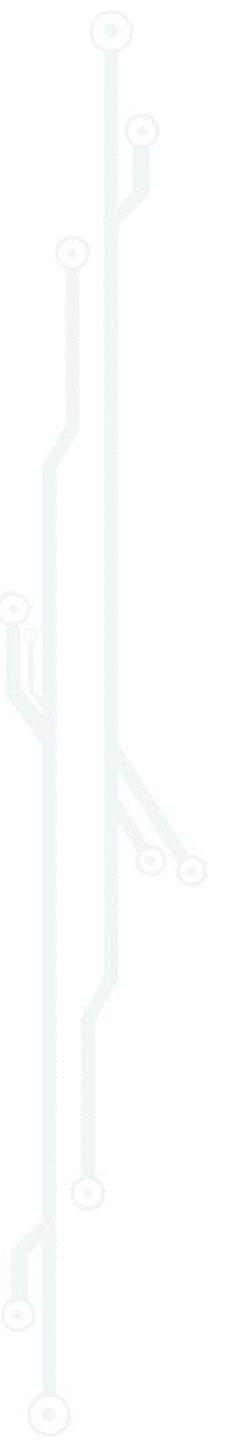
CRISPR

CRISPR

Clustered Regularly Interspaced Short Palindromic Repeats

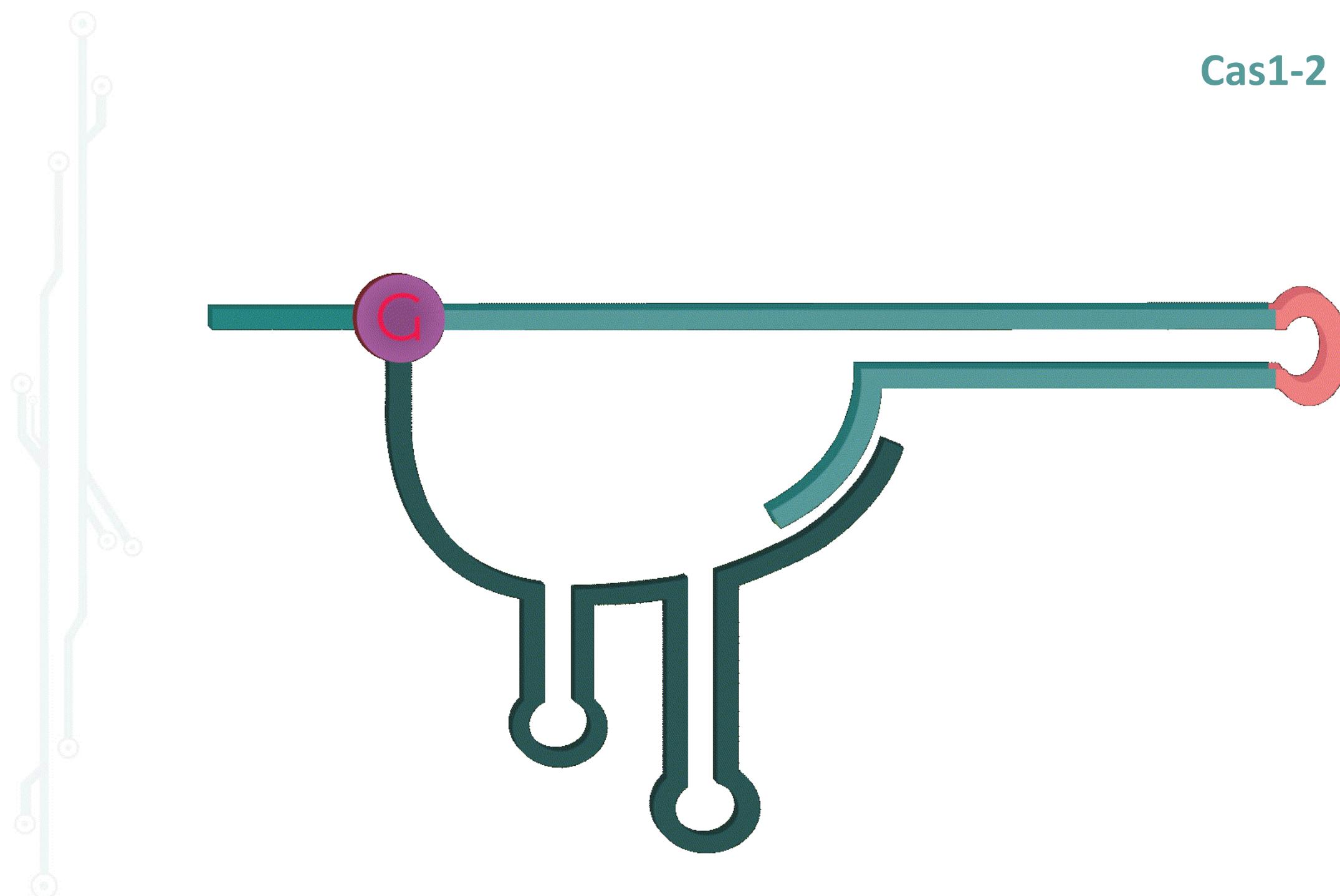
- CRISPR-Cas – Prokaryotic Immune System
 - Foreign DNA integrated into CRISPR-array
 - Cas1-2 proteins



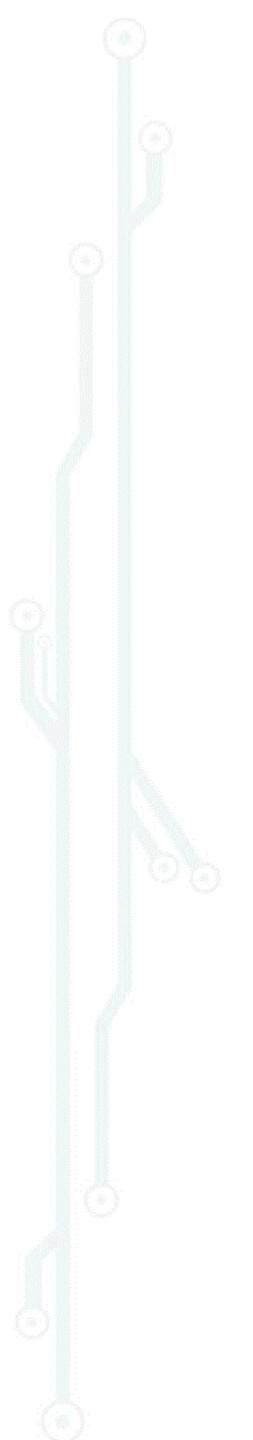
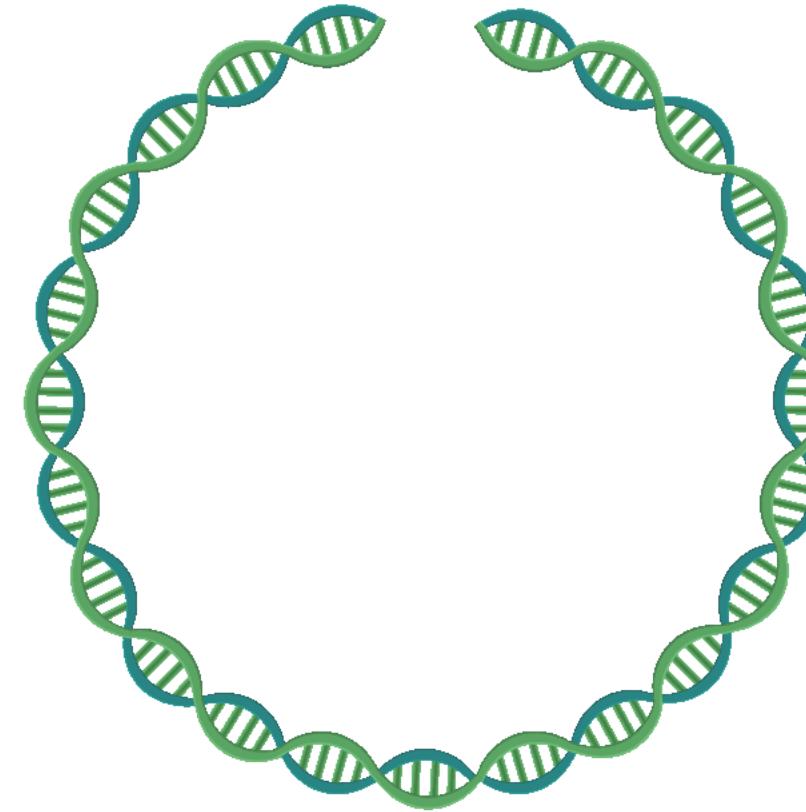


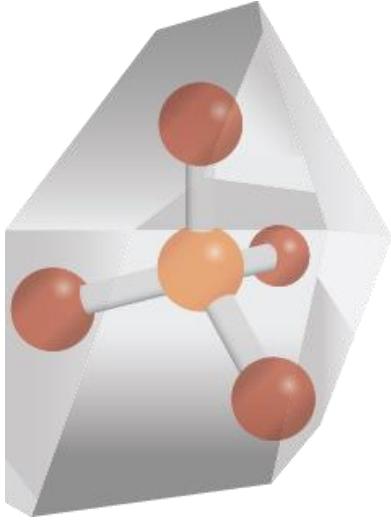
CRISPR

Cas1-2 complex

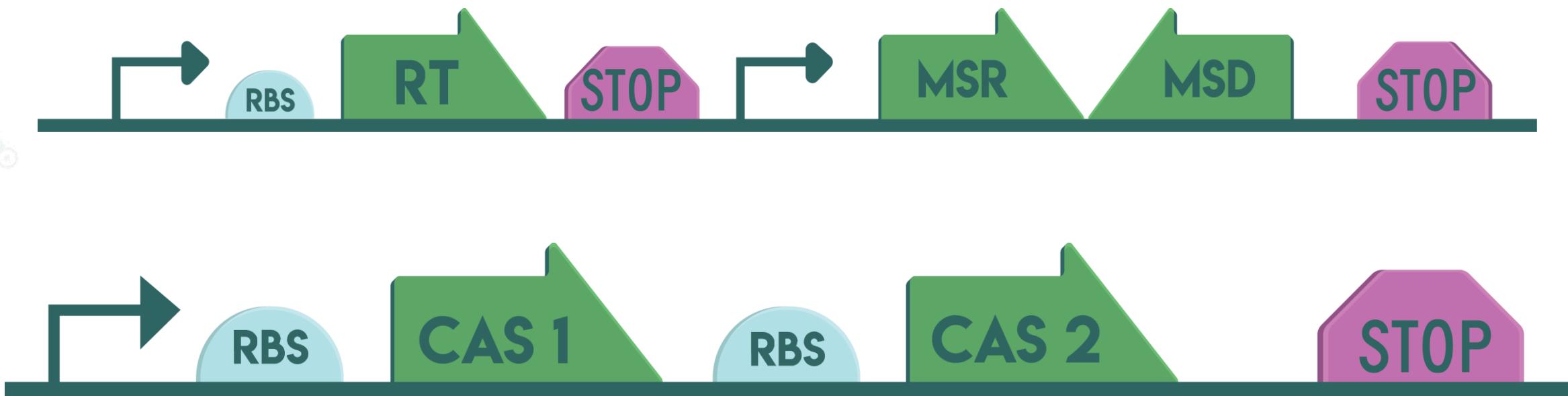
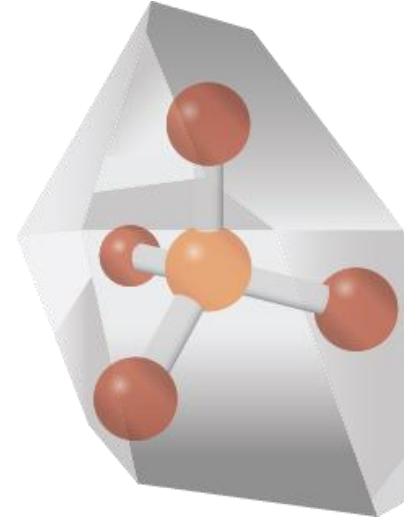


Message insertion





E. CODING



RESULTS

Interlab

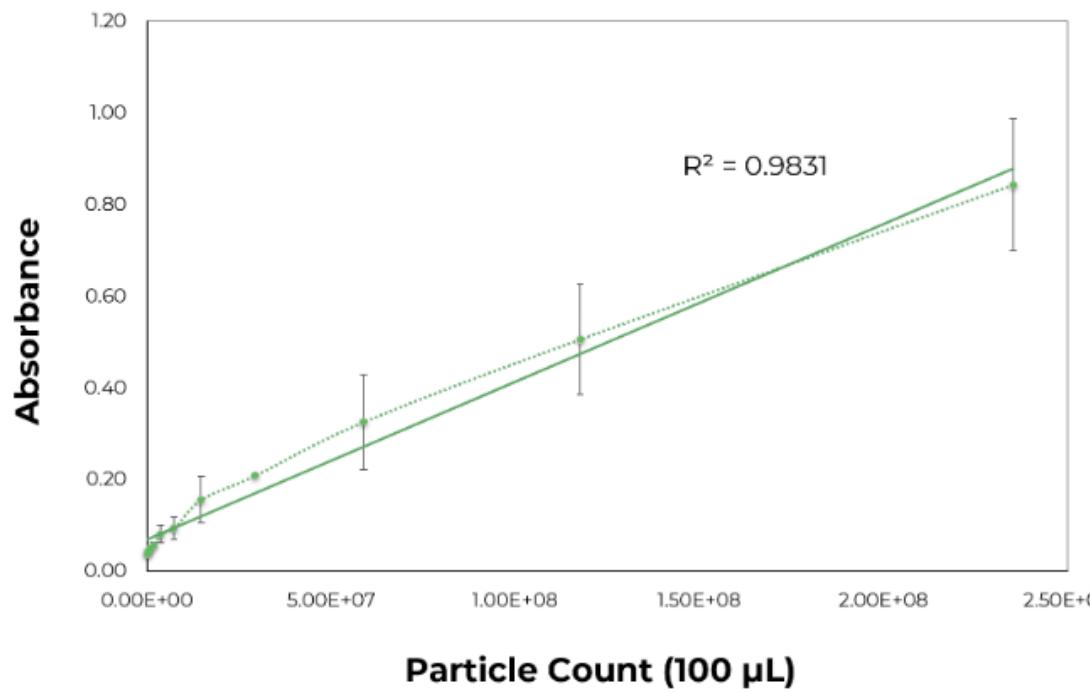


Figure 1: Calibration curve of particle count from Absorbance at 600

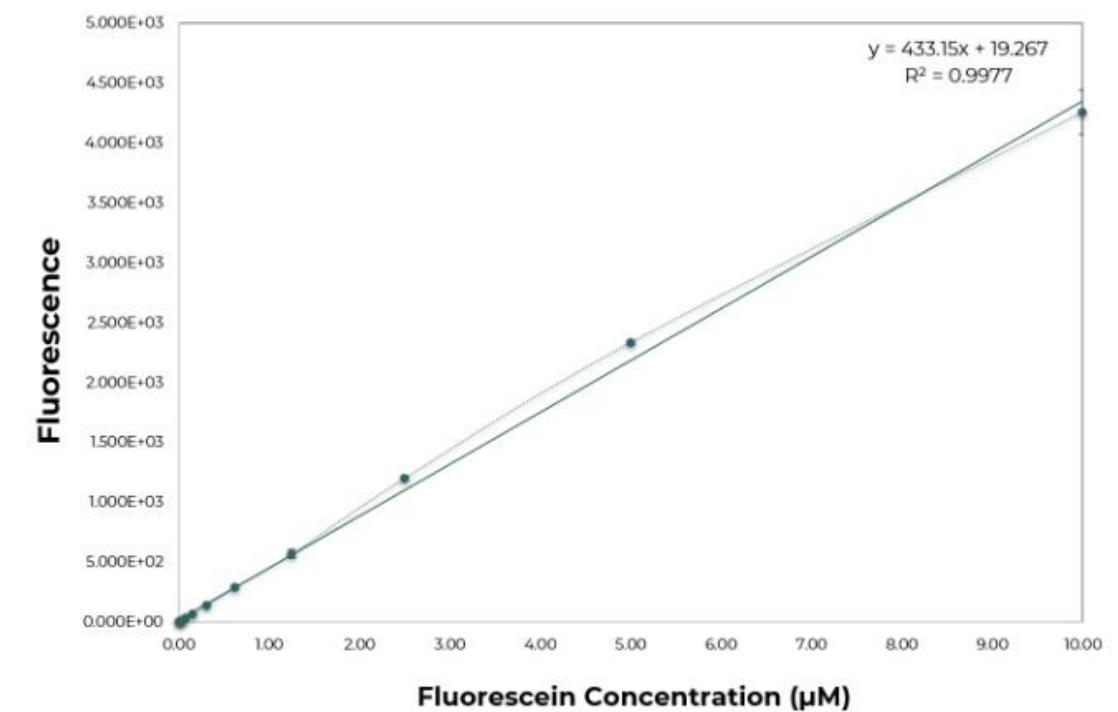


Figure 2: Calibration curve of Fluorescein

Interlab

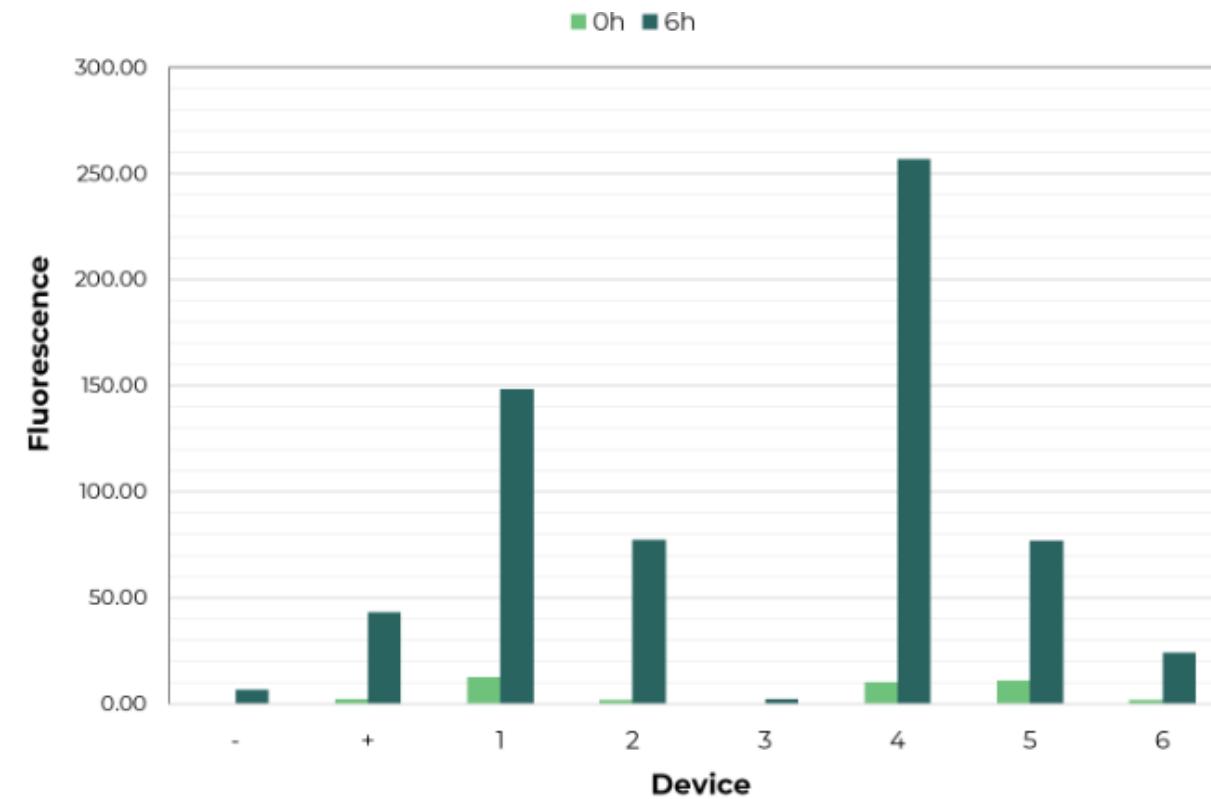


Figure 5: Fluorescence of transformed bacteria with devices from iGEM kit.

Cas1-2 Production

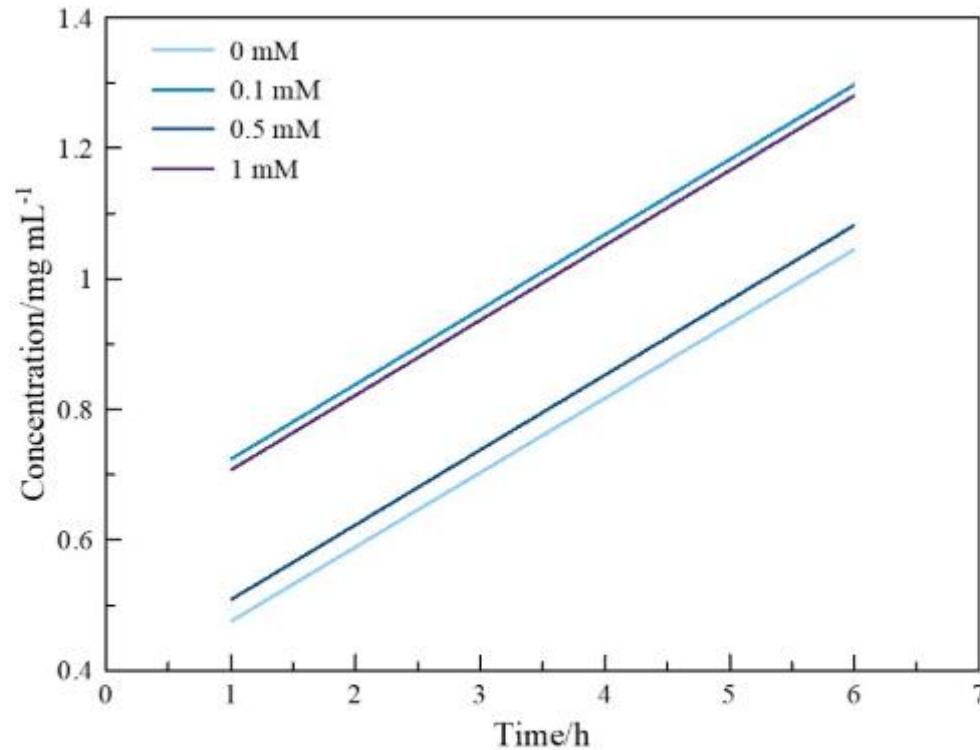
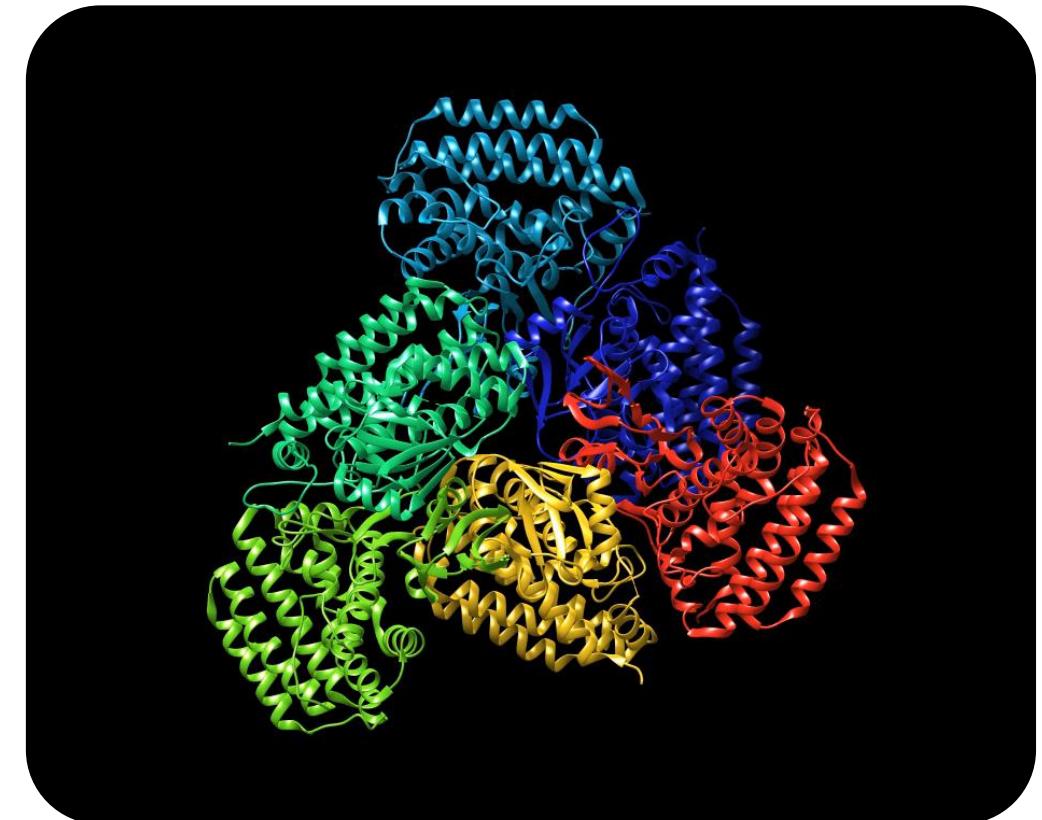


Figure 1: Production of Cas proteins under different concentration and time



Protein crystallography of
the Cas1-2 Complex

System Functionality

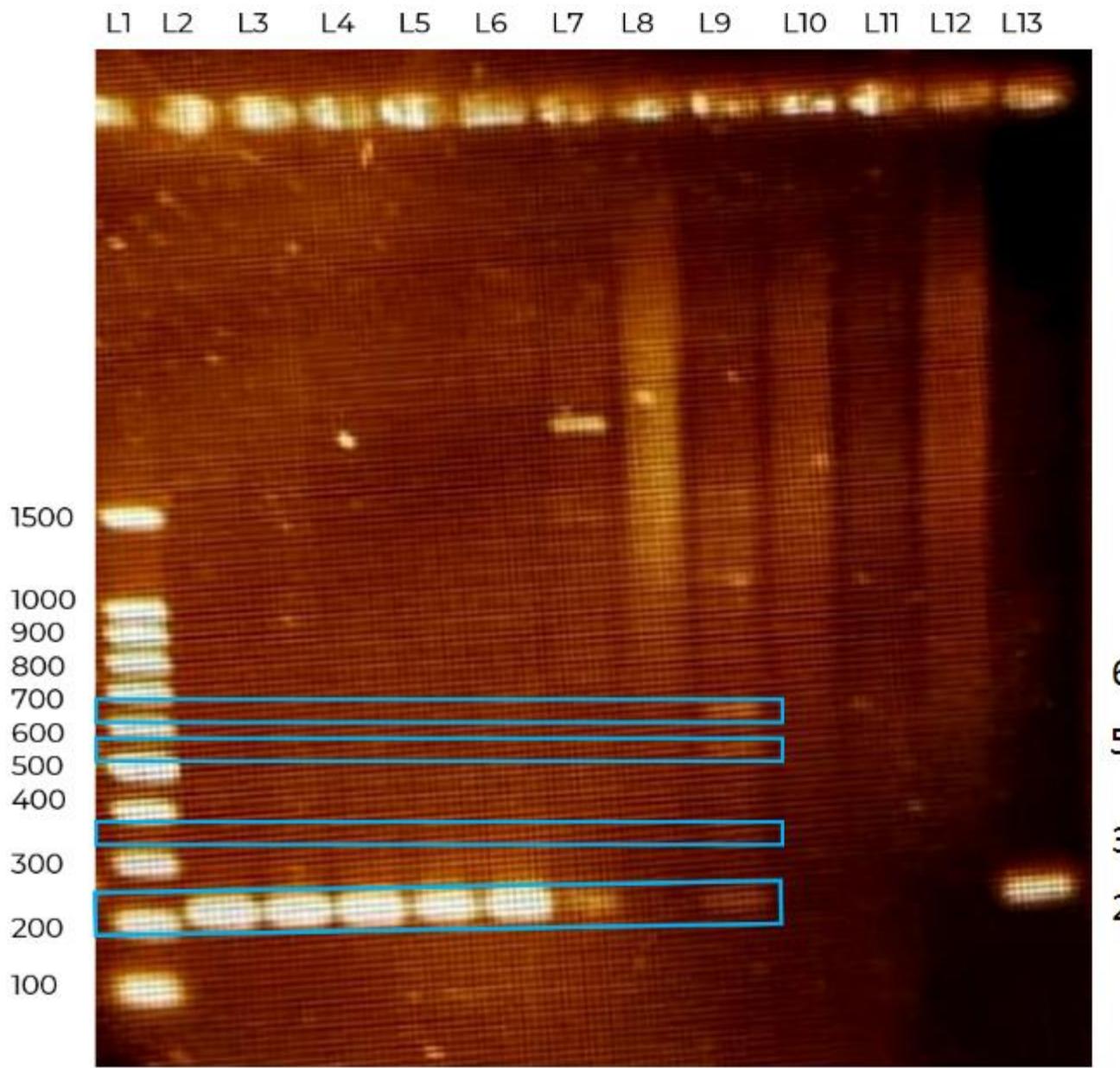
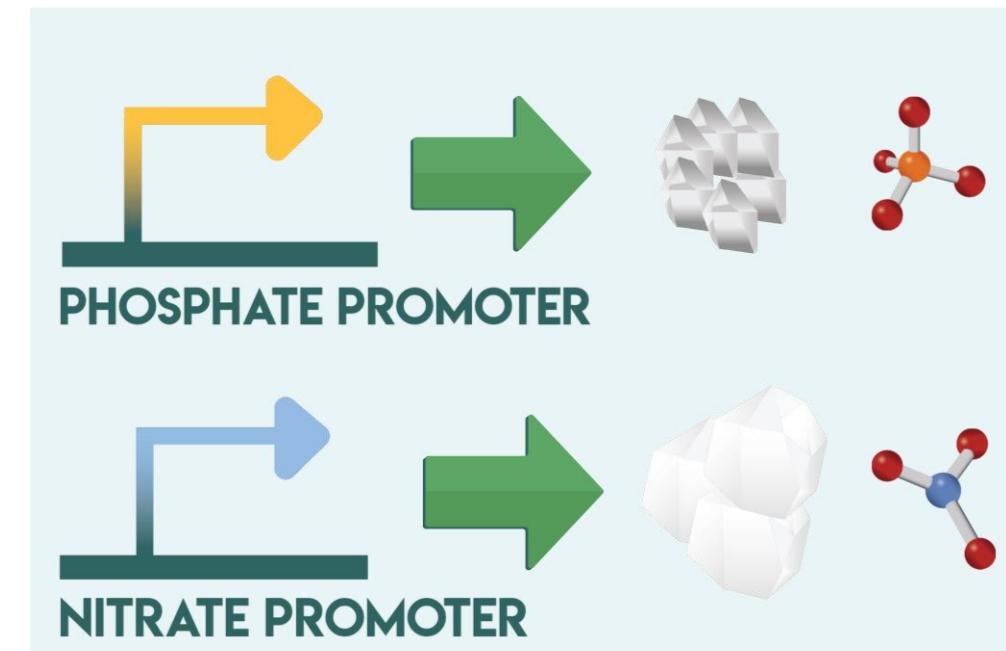
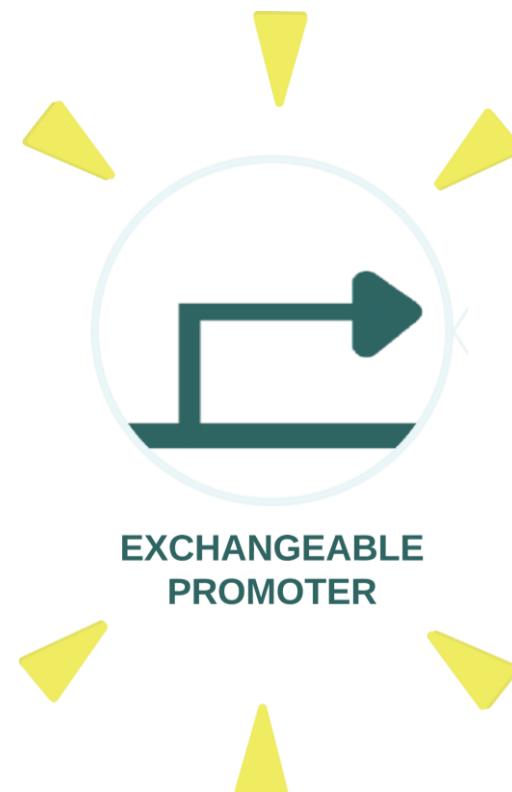


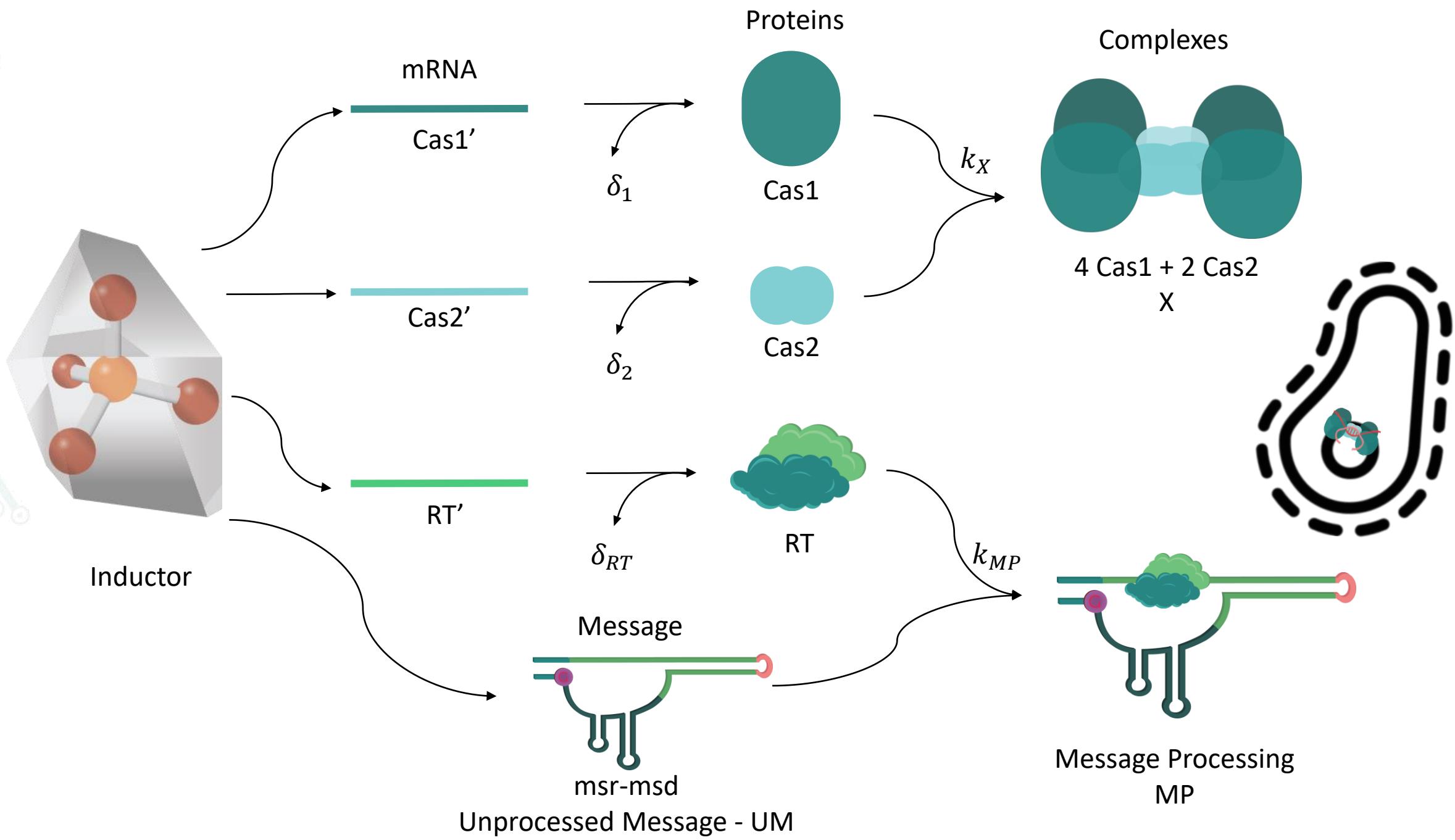
Figure 3: Cotransformation Gel. Integration of desired Sequence.

FUTURE WORK

- Sequence expanded arrays.
- Experiment with more concentrations of IPTG.
- Measure Cas1-Cas2 production with promoters, and test it with the whole system.
- Add more than one promoter to the system



MATHEMATICAL
MODEL

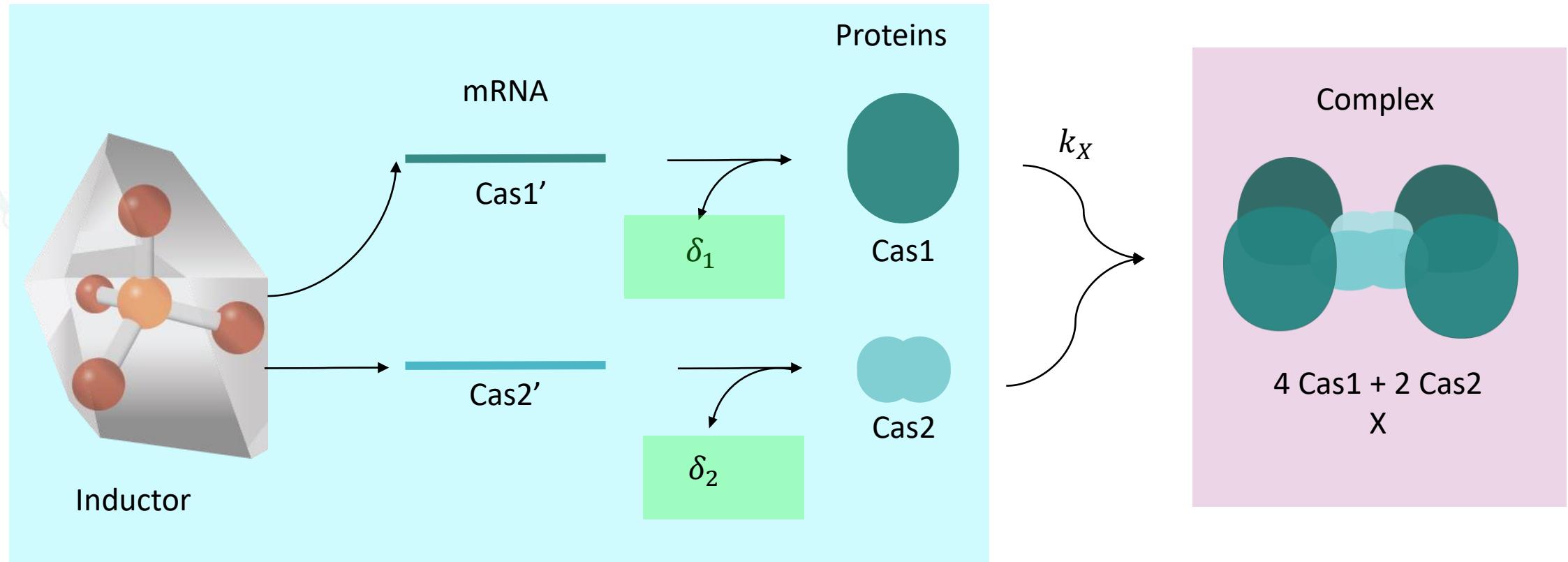


$$\frac{d[Cas1]}{dt} = \frac{r_1[I]}{C_1 + [I]} + b_1 - \delta_1[Cas1] - 4k_X[Cas1]^4[Cas2]^2 + 4k_{-X}[X]$$

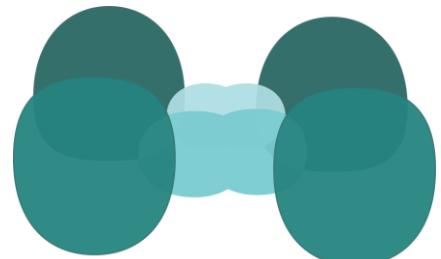
Hill Equation

Protein
Degradation

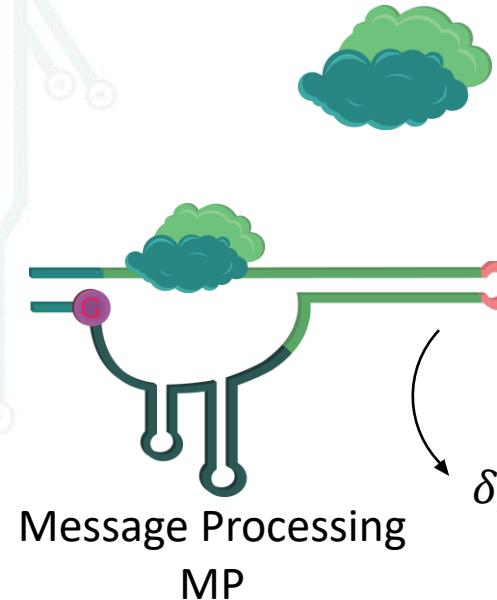
Complex Formation



Complexes



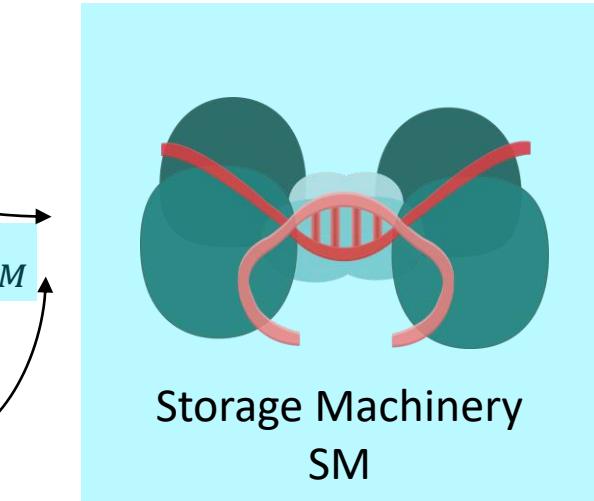
4 Cas1 + 2 Cas2
X



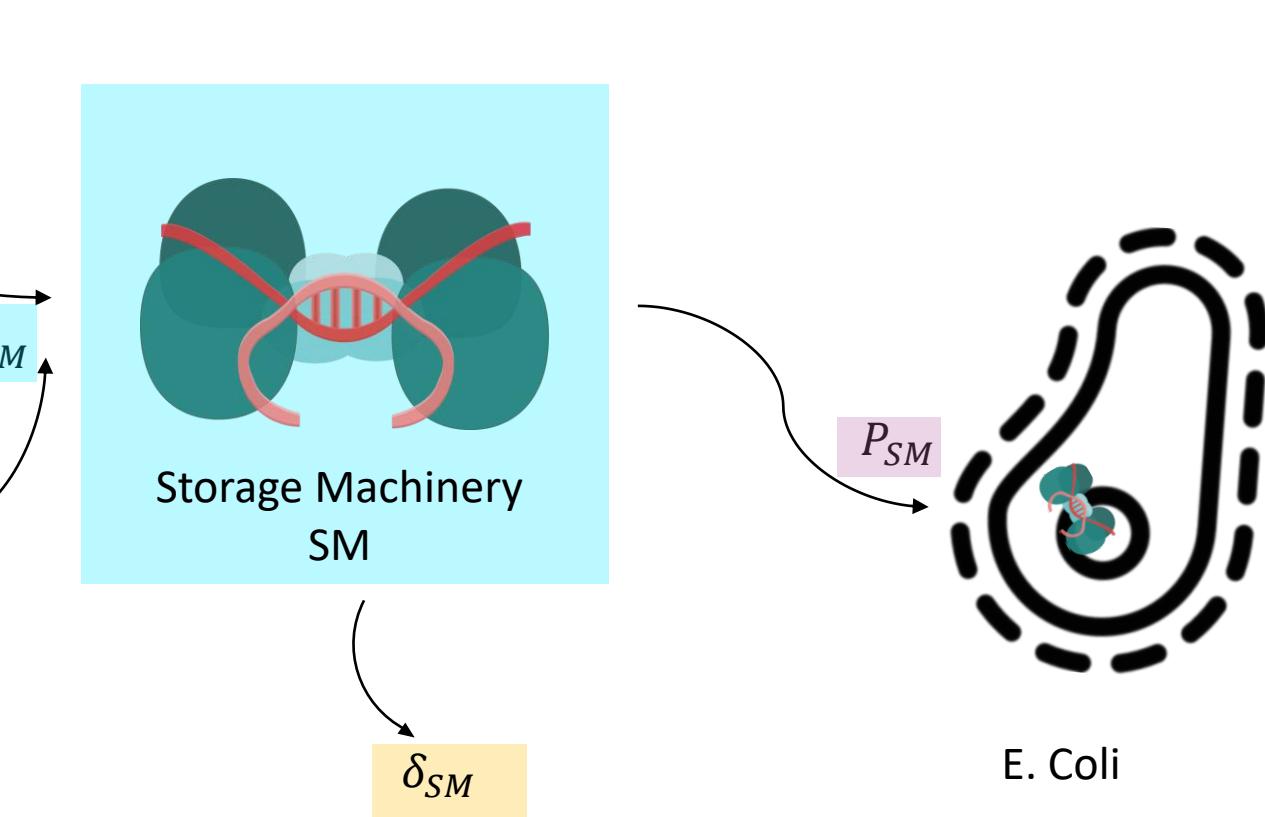
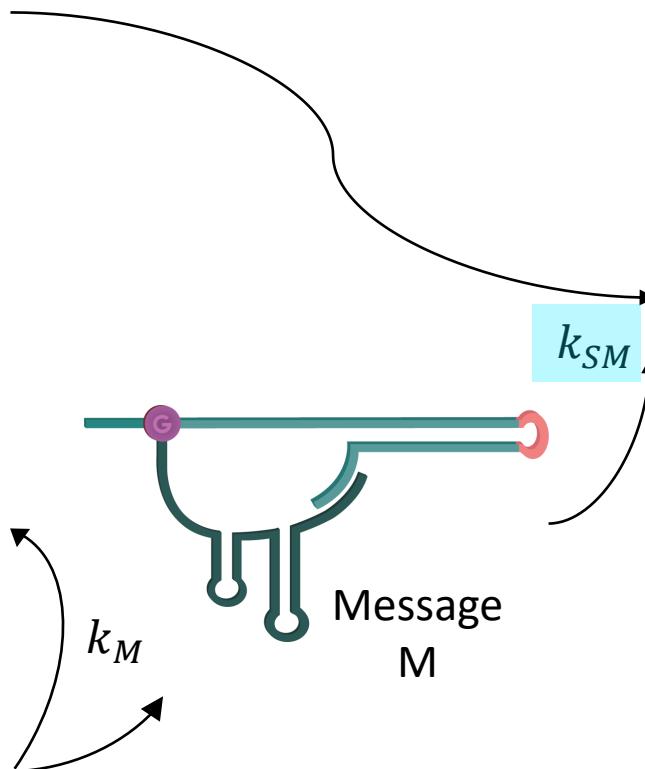
Message Processing
MP

$$\frac{d[SM]}{dt} = k_{SM}[M][X] - \delta_{SM}[SM] - P_{SM}[SM]$$

Formation Degradation Insertion



δ_{SM}

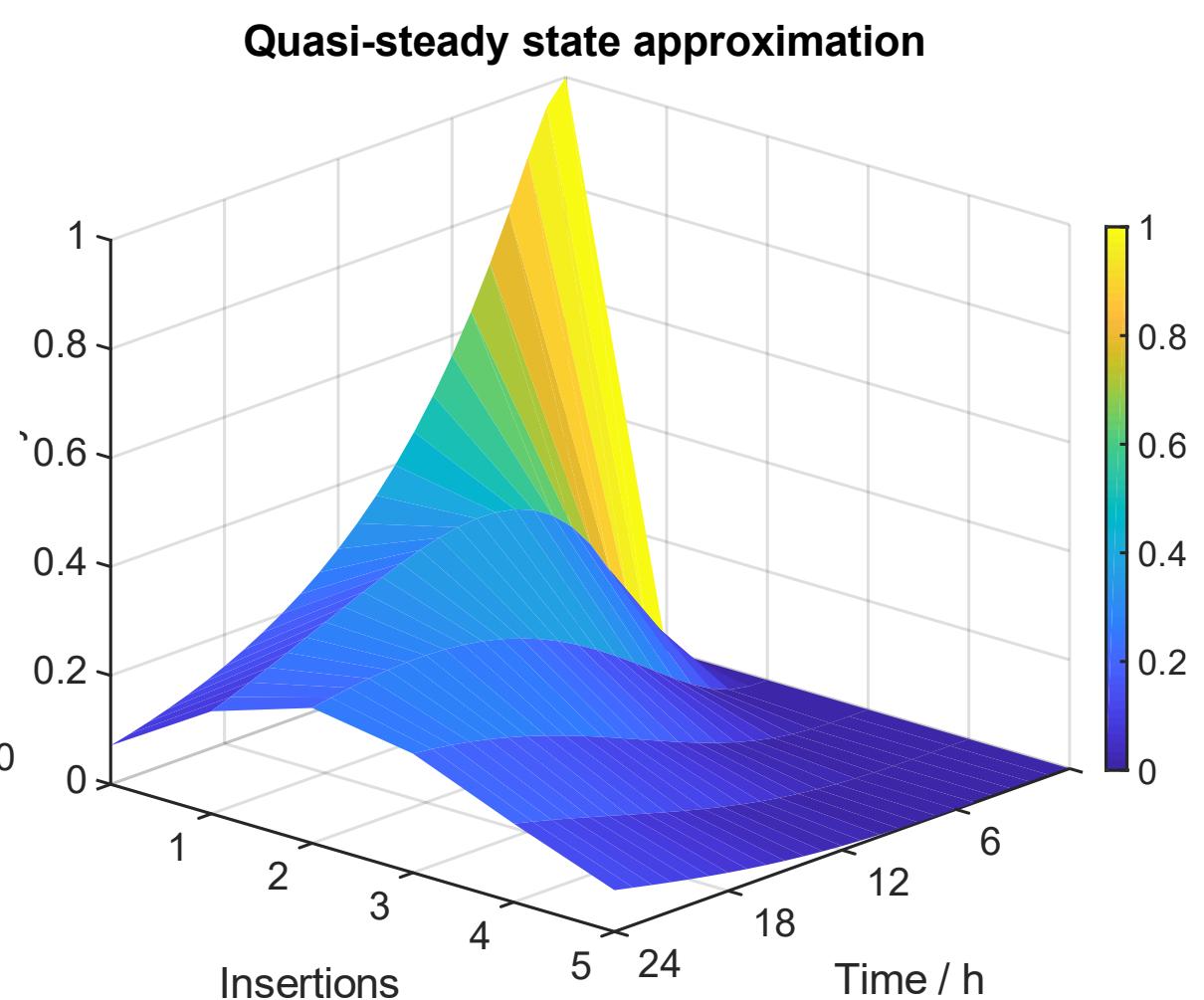
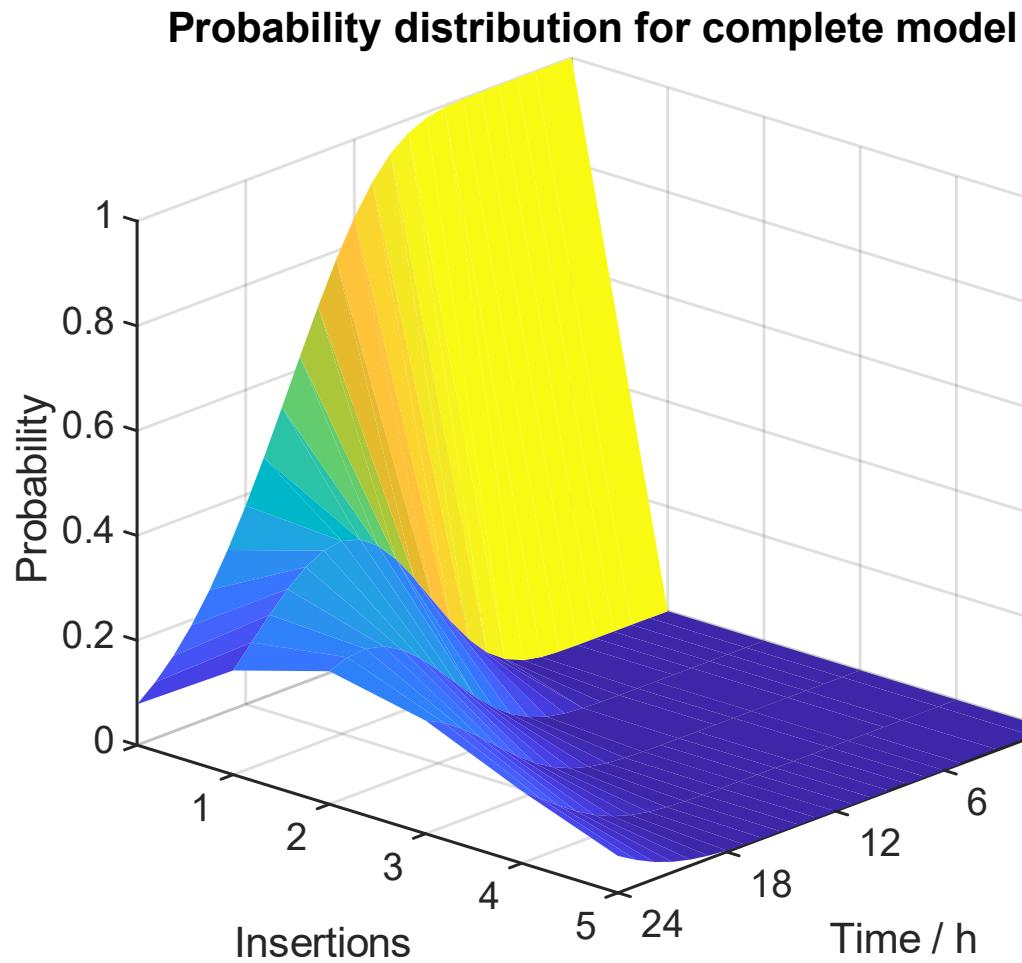


E. coli

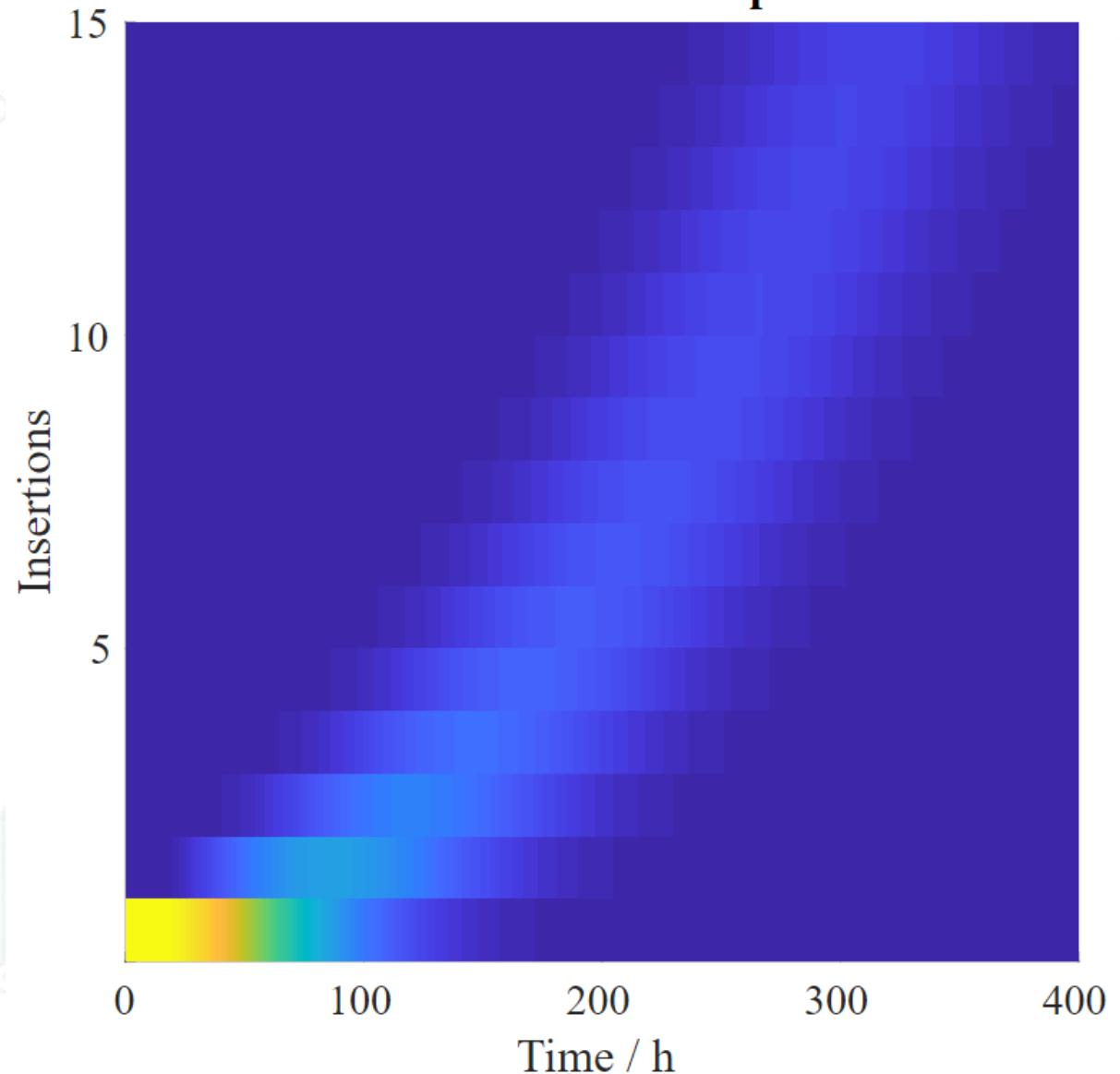
Quasi-steady state approximation

$$\frac{d[MP]}{dt} = \frac{r_{RT}[I]}{C_{RT} + [I]} + b_{RT} - k_M[MP]$$

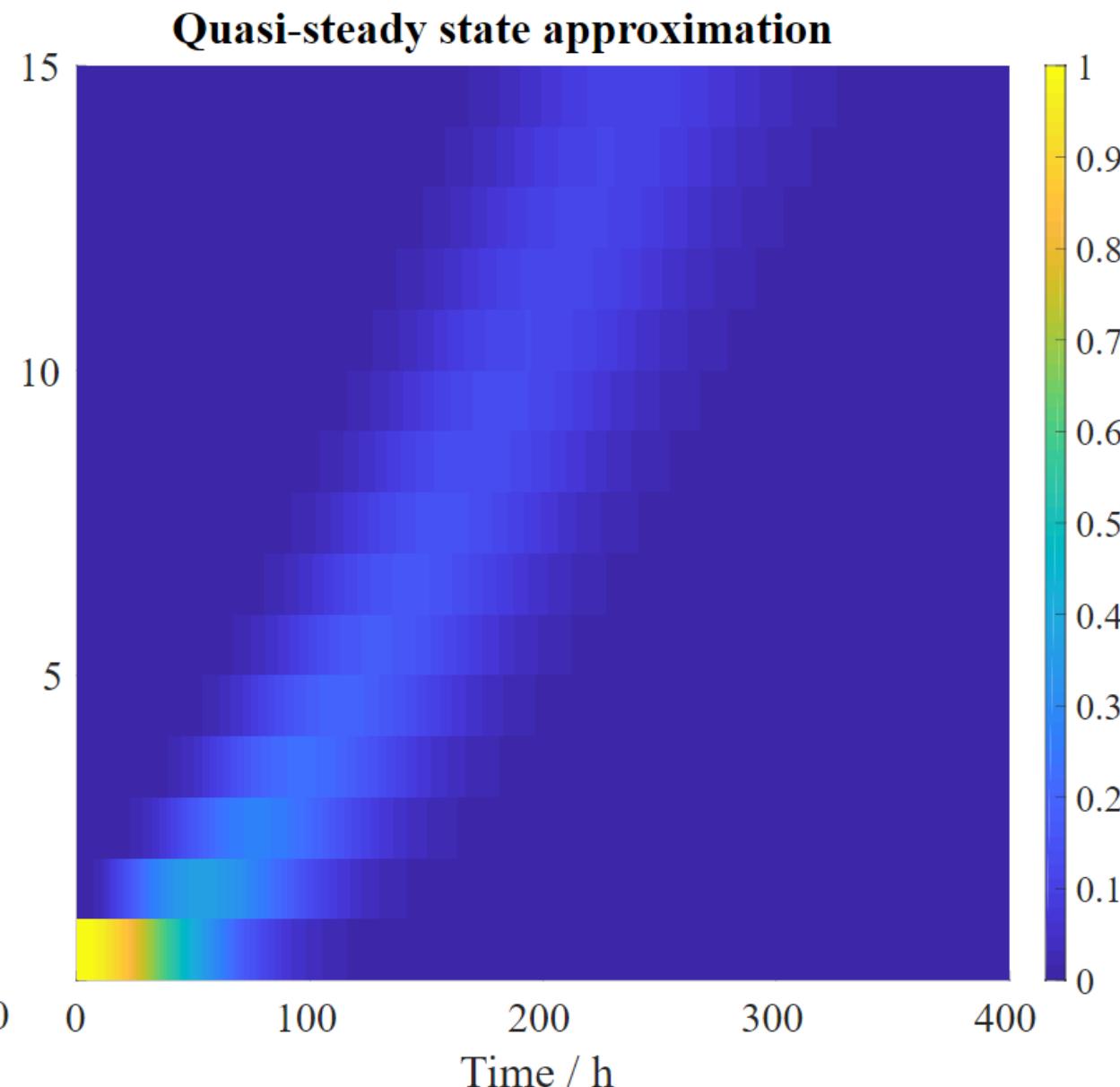
$$\frac{d[Ins]}{dt} = k_M[MP]$$



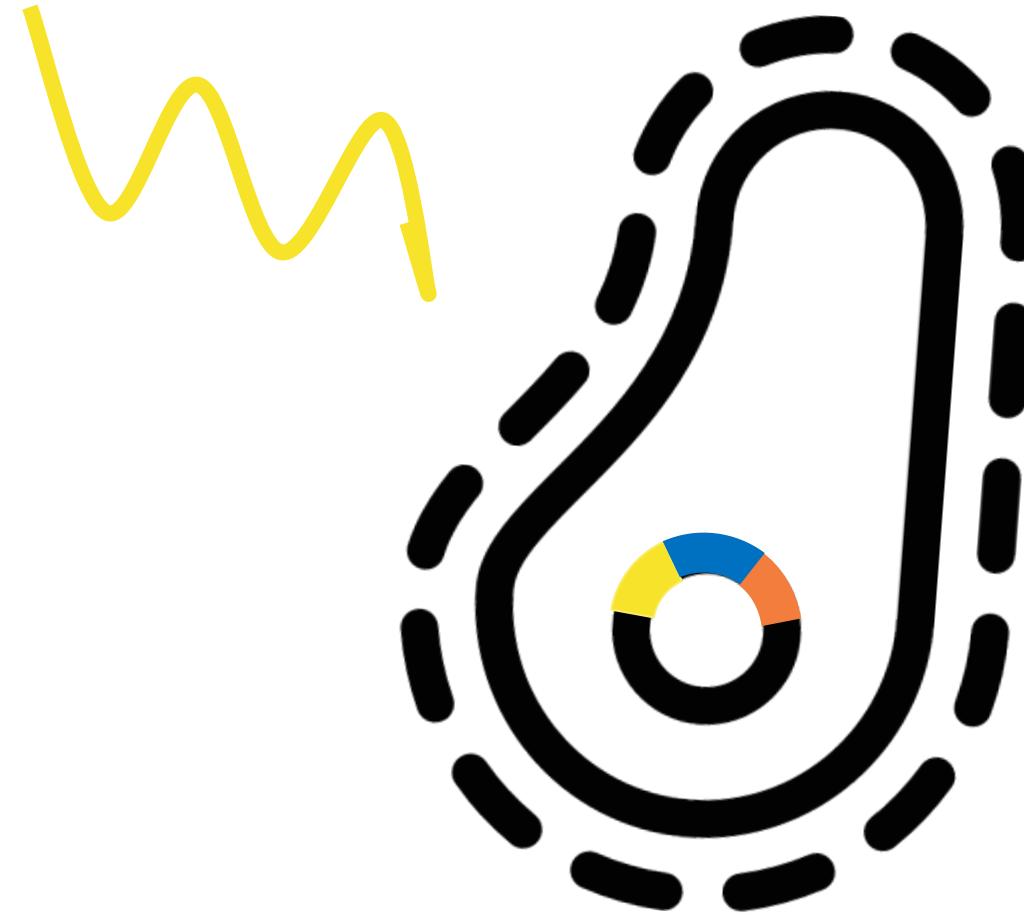
Insertions distribution for complete model



Quasi-steady state approximation



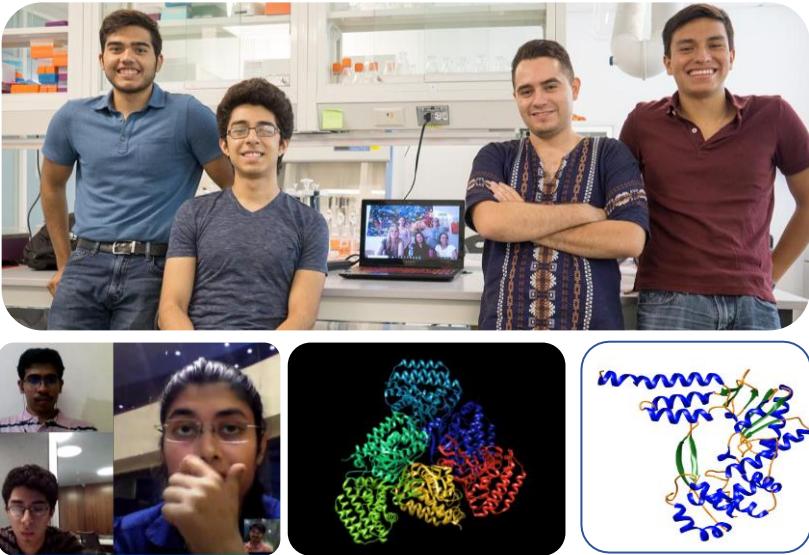
CONCLUSION



COLLABORATIONS

+20

iGEM teams from **14** different countries from all around the world



4

International water samples

Estonia, France, Israel,
Munich

more collaborations

Tec-Chihuahua. ICT
Mumbai, Düsseldorf
OLM Madrid



ENGAGEMENT

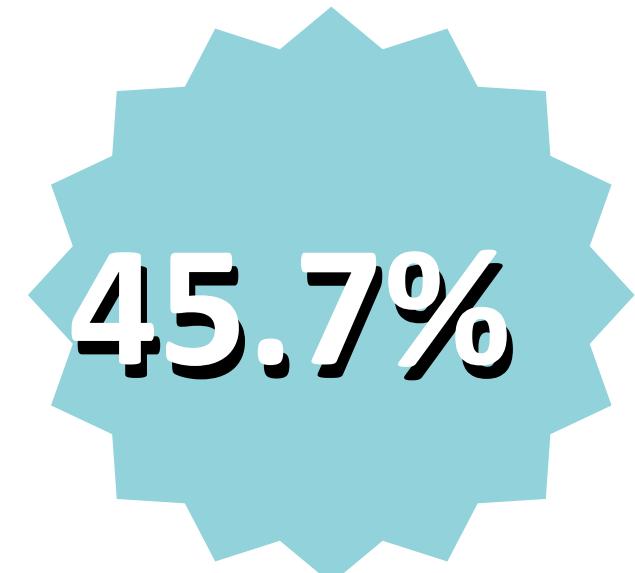
PUBLIC AND EDUCATIONAL ENGAGEMENT



Have a good understanding regarding scientific studies



Believe antibiotics are used in the treatment of viral and bacterial diseases



Believe that scientists, due to their knowledge, are dangerous

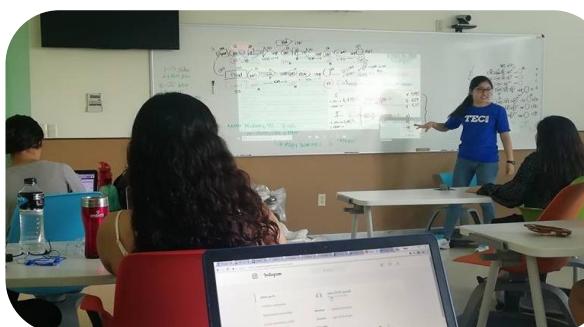
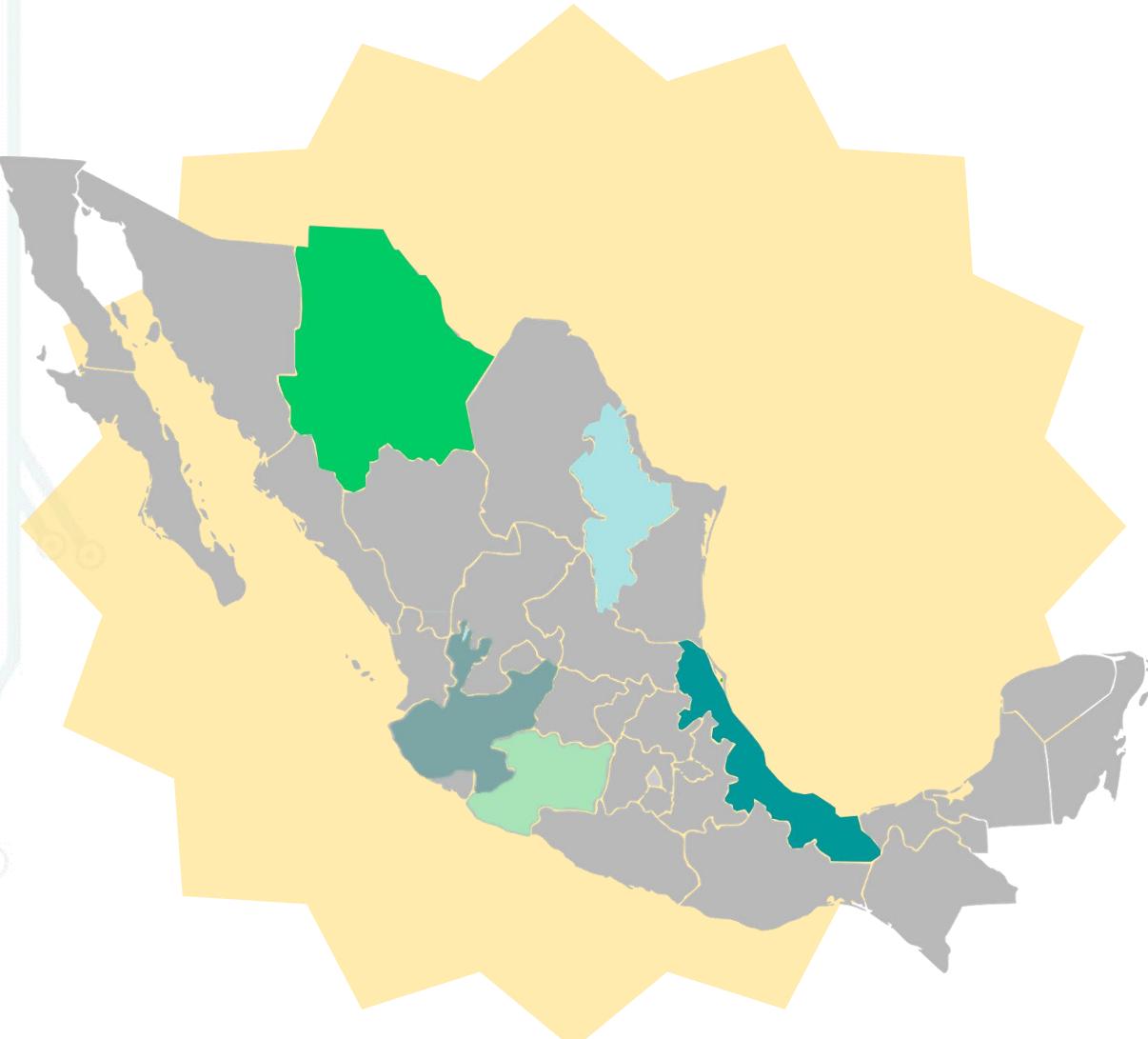
National Congress of Science



After iGEM Networking Event



National Education Tour



Science Seminar

Free tuition college class of **150** students



Curiosamente

A video collaboration with
Curiosamente

- Educational youtube channel
- **+1 million** subscribers

+160k
views



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160,544 views

12K

93

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...



CuriosaMente
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4

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magazines of
national reach

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TU DIARIO VIVIR

Contaminación en Chiapas exhibida a nivel
mundial

Tec Review



Tecnológico
de Monterrey

Estudiantes buscan mitigar contaminación en agua con
memoria biológica

Alumnos del Tec concursarán en competencia internacional de biología sintética con su proyecto "E-coding".

Por Dulce Pontaza - agosto 1, 2018



CONECTA

Presentations

- International presentation at **Gulf Coast Undergraduate Research Symposium** at RICE University



- National presentations in science congresses.



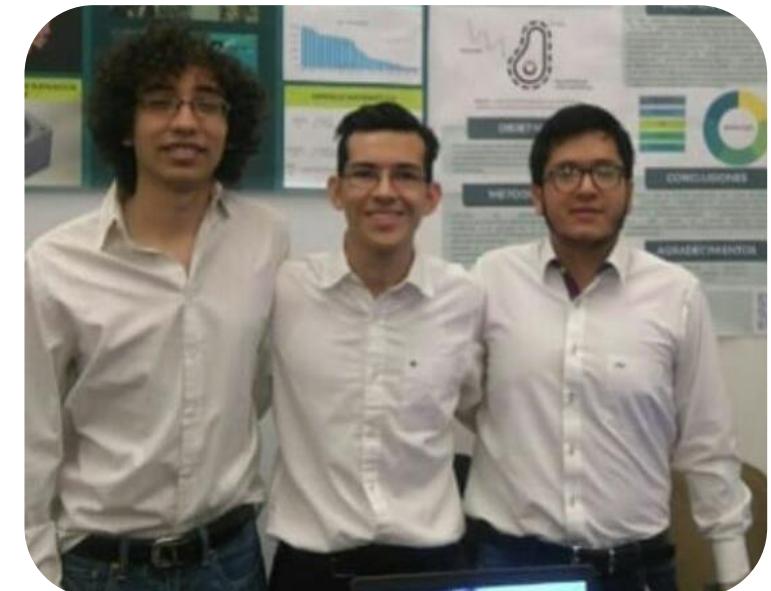
GENOBIO TEC 18

National congress about
Biotechnology and Genomics.



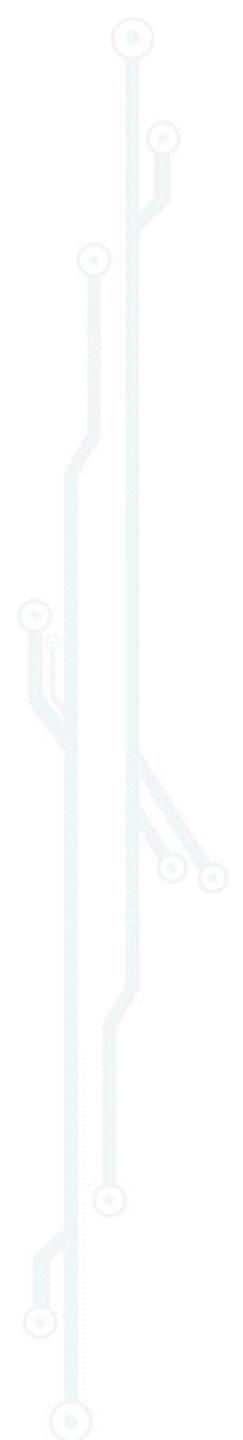
CONEXIÓNTEC

Institutional event from Tec de
Monterrey



EXPOCIENCIAS

Program from the National network of
youth activities in Science and
Technology



MEDALS

Bronze

- ✓ Registration and Giant Jamboree Attendance
- ✓ Wiki, poster, presentation, safety and judging forms,
- ✓ We sent the DNA samples of our new parts to the registry.
- ✓ Attributions
- ✓ Interlab Measurement study

Silver

- ✓ Validated Parts
 - Cas1-Cas2 proteins:
 - [BBa_K2761007](#)
 - [BBa_K2761009](#)
 - RT & msd-msr:
 - [BBa_K2761010](#)
- ✓ Collaborations
 - More than # collabs
- ✓ Human Practices
 - [BBa_K2761010](#)

Gold

- ✓ Integrated Human Practices
- ✓ Improve a Previous Part or Project
 - [BBa_K2761010](#)
- ✓ Mathematical model
- ✓ Demonstrate your work.

ATTRIBUTIONS

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Ex-iGEMER



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- Kharen con H

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- Martha Karina Godina García
- Sergio Alexis Espinoza Benavides



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Miguel Domínguez

Wiki

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References

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