Imagine......
Magnetosome Formation
Magnetotactic bacteria have magnets

Schüler D, Genetics and cell biology of magnetosome formation in magnetotactic bacteria, FEMS Microbiology Reviews, 2008
3 steps to form magnetosome

1. Vesicle Formation
2. Iron Uptake
3. Biomineralization

Outside of cell
3 steps to form magnetosome

1. Vesicle Formation
2. Iron Uptake
3. Biomineralization

\[ \text{Fe}_3\text{O}_4 \]
3 steps to form magnetosome

1. Vesicle Formation
2. Iron Uptake
3. Biomineralization

↓ Outside of cell
3 steps to form magnetosome

1. Vesicle Formation
2. Iron Uptake
3. Biomineralization

↓ Outside of cell
MamLQSB would be essential to form vesicle
Experiments and Results
Construction of pLQB

**Diagram:**
- **pLQB**
  - RBS
  - mamL
  - His
  - RBS
  - mamQ
  - His
  - RBS
  - mamB
  - Terminator

**Image:**
- Negative Control
- pLQ
- pLQB

**Label:**
- mamQ

**Markers:**
- 30
- 25
- 15
- 10
Observation under TEM

Slice the pellet of *E. coli*

Stain Lipid and Protein of *E. coli*

Observe under TEM
Magnetosome Formation

Observation under TEM

Slice the pellet of *E. coli*

Stain phospholipid and cytoplasm

Observe under TEM
Observation under TEM

1. Slice the pellet of *E. coli*
2. Stain phospholipid and cytoplasm
3. Observe under TEM
Observation under TEM

Slice the pellet of *E. coli*

Stain phospholipid and cytoplasm

Observe under TEM
Vesicle formation in pLQB transformants

Negative Control

pLQB
Vesicle formation in pLQB transformants

Negative Control  pLQB

mamL, Q and B would be sufficient for *E. coli* to form vesicles
Vesicle formation in pLQB transformants

Negative Control

pLQB
Magnetosome Formation

Difference between control and pLQB

Why is the percentage so low??

<table>
<thead>
<tr>
<th></th>
<th>(§) 16</th>
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<tbody>
<tr>
<td>Negative control</td>
<td>1.8%</td>
</tr>
<tr>
<td>pLQB</td>
<td>8.4%</td>
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</tbody>
</table>
Modeling

Modeled *E. coli*

- **4.0%** theoretical rate

pLQB transformants

- **10.0%** actual rate

Every *E. coli* would have at least 1 vesicle
Vesicle formation in pLQ transformants

[Diagram showing the gene expression process with RBS, mamL, mamQ, His, and Terminator]

- **pLQ**
  - Vesicles are indicated by arrows
  - Scale bar: 1 μm

- **pLQB**
  - Vesicles are indicated by arrows
  - Scale bar: 1 μm
Magnetosome Formation

Comparison of the number of vesicles

Do we need MamB protein?

The graph shows the percentage of sections containing vesicles for different treatments:

- Negative control: 1.8%
- pLQB: 8.4%
- pLQ: 14.6%
Why was the vesicle formed without mamB?

High Homology

Magnetotactic bacteria

E. coli
Conclusion

We observed vesicles in *E. coli* under TEM.

We found that mamB was not essential for *E. coli* to form vesicles.
Magnetosome Formation

Future Plan

1. Vesicle Formation
2. Iron Uptake
3. Biomineralization

Diagram showing the process of magnetosome formation with steps involving iron uptake and biomineralization.
DMS makes cloud

marine creatures
DMS Synthesis

5 genes in the DMS biosynthesis pathway

Methionine → AT → 4-Methylthio-2-oxobutyrate (MTOB) → DMS
Detecting the peak of MTOB

Sample1 – background1 → Peak of MTOB (about 35.448)

Sample1: MTOB
background1: Milli-Q

Met → MTOB
AT
DMS Synthesis

AT protein worked

Sample2 – background2

Sample2: MTOB(-) AT(+)

background2: MTQB(-) AT(-)
AT protein worked

Sample2 – background2

Sample2: MTOB(-) AT(+)  background2: MTOB(-) AT(-)

Peak of MTOB!!
5 genes in the DMS biosynthesis pathway

- **Met** (Methionine)
- **MTOB** (4-Methylthio-2-oxobutyrate)

**DMS Synthesis**
Our question

Lack in knowledge  Have proper knowledge

How can we interact with people who are not scientists?
Policy & Practice

Approach

Lecture for Zeze high school students

Booklet about iGEM & synthetic biology
Policy & Practice

Evaluation

Some students became interested and visited our lab!!

High school teacher judged
the booklet is really useful to make people interested in synthetic biology and iGEM.
<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>BBa_K1312000</td>
<td>generate some magnetosome proteins</td>
</tr>
<tr>
<td>BBa_K1312002</td>
<td>dddD gene from <em>Ruegeria pomeroyi</em>.</td>
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<tr>
<td>BBa_K1312004</td>
<td>pSB1C3 plus 6x His tag</td>
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<tr>
<td>BBa_K1312005</td>
<td>S-adenosyl methionine-dependent methyltransferase relate to Met-DMSP byosynthesis pathway(SAMmt)</td>
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<tr>
<td>BBa_K1312006</td>
<td>NADPH-dependent flavinoid reductase relate to Met-DMSP byosynthesis pathway(REDOX)</td>
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<td>BBa_K1312007</td>
<td>mamQ</td>
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</tbody>
</table>
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References

Magnetosome Formation


DMS Synthesis

Thank you for your kind attention!!