Operation Debug

NCTU_Formosa
Harmful Insect Elimination Force

Headquarters: National Chiao Tung University, Hsinchu, Taiwan
Insect Damage
Current Solution: Pesticide

<table>
<thead>
<tr>
<th>Harm</th>
<th>Annual US Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Health</td>
<td>$1.1 billion</td>
</tr>
<tr>
<td>Ecology and Environment</td>
<td>$5.1 billion</td>
</tr>
<tr>
<td>Groundwater Contamination</td>
<td>$2.0 billion</td>
</tr>
<tr>
<td>Other Costs</td>
<td>$1.4 billion</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$9.6 billion</td>
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</tbody>
</table>
Oriental Leafworm Moth (*Spodoptera litura*)

Agricultural damage to over 40 families of plants
Plan A: Biologically Synthesized Pheromone Traps

Mission: Aborted
Plan B: Infiltration

PBAN

(Pheromone Biosynthesis Activating Neuropeptide)
Tactical Plan

PBAN

Receptor

Gland

Pheromone

Biosynthesis Activated
Specialties

(1) Peptide
(2) Small
(3) Stable
(4) Specific
Operation Detail

Pheromone

PBAN of Moth
Biobrick
Results – Making PBAN

Oriental Leafworm Moth
(*Spodoptera litura*)

**BBa_K1415105**

**RBS**

**PBAN-SL**

**PCR**

750 bp
500 bp

SDS-PAGE
Control

25 kDa
11 kDa
3.7 kDa
BBa_K1415205

\[ \text{Control} \quad \text{PBAN-SL} \]
Fluorescence Expression of PBAN SL

Fluorescence Intensity

Time (hr)

PBAN SL
Negative Control
Mechanism

PBAN

PBAN receptor

G protein

Calmodulin

Adenylate Cyclase

Ca^{2+}
Centrifuge

Add Buffer

Pour out LB

Add Buffer

Vortex

Obtain Bio-safe PBAN solution

E. coli contain PBAN

Sonication

Autoclave

Dilute

Mash
Control
( Without PBAN )

With PBAN
Parts of Device
Entering Times of Moth in Different Conditions

- Blue light with PBAN treatment
- Only blue light treatment

<table>
<thead>
<tr>
<th>Hour</th>
<th>Entering Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>10</td>
</tr>
<tr>
<td>2nd</td>
<td>20</td>
</tr>
<tr>
<td>3rd</td>
<td>15</td>
</tr>
<tr>
<td>4th</td>
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<td>8th</td>
<td>70</td>
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<td>9th</td>
<td>15</td>
</tr>
<tr>
<td>10th</td>
<td>10</td>
</tr>
<tr>
<td>11th</td>
<td>5</td>
</tr>
</tbody>
</table>
Debugging In Style
Device for light preference
Fluorescence Expression of different PBAN

- PBAN HAH
- PBAN SL
- PBAN AS
- PBAN AI
- PBAN LD
- PBAN SI
- PBAN BM
- PBAN AA
- PBAN MB
- Negative Control

Fluorescence Intensity vs. Time (hr)
Human Practice
Industry Collaboration

iGEM Promoting

Team Exchange
Bio-camp
✅ New basic and composite BioBrick parts
   We converted 9 PBANs into standard parts and constructed 27 new BioBricks.

✅ Successfully resolving insect damage
   We developed a brand new control system and a device for its application.

✅ Real application in industry
   Organic farms are currently using our new system and loving it.

✅ Team Meetups
   We held an international conference with 22 iGEM teams from China and Taiwan.

✅ Help any registered iGEM team from another school
   We assisted TCU Taiwan iGEM Team with their modeling.
ACKNOWLEDGEMENT
Instructors:

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Prof. Wen-Liang Chen
Mission Accomplished