Synthetic / Post natural Ecologies.
ArtScienceBangalore
• What does synthetic biology mean for India?

• What is synthetic biology for artists and designers?

• What is synthetic biology for artists and designers in India?
Three Major Themes

• ‘Jugaad’

• Mythology

• Ecology
Jugaad

Jugaad is an Indian term which means to make-do with whatever they have around them. It is different from hack which is purely an intellectual pursuit, while jugaad is a necessity.
Things that happen in the lab

- Grow
- Protect and Sustain
- Manipulation
- Observation
- Documentation
Growth and Reproduction

Incubator
Protect and Sustain

Sterile hood
100$ Sterile hood
Original price: 8000$

20$ Microscope
Original price: 1000$

20$ centrifuge
Original price: 301.95$

10$ Water bath
Original price: 925$

10$ Incubator
Original price: 1260$
Design Workshop

with James King and Alexandra Daisy Ginsberg
PLAYING GODS
Mythology
THEN COME TO THE SACRIFICIAL ALTAR WITH US, O LORD.

I SHALL.

Daksha slowly arose as if from a deep sleep.

When he saw Shiva, he bowed before him.

I have been wicked and foolish. You have punished me. I pray now that I be permitted to complete my agnana.
Trans-kingdom conjugation between bacterial chromosome-less mini-cells and yeasts

Keiko Fukumaru and Kazuo Yoshida
Department of Biological Science, Graduate School of Science, Hiroshima University, Higashi-Hiroshima, Hiroshima 739-8526, Japan

ABSTRACT
We introduced a novel convenient method to prepare chromosome-less mini-cells from cell mixture of Escherichia coli P678-54 by using penicillin. The mini-cells prepared by this method could successfully transferred their harboring conjugative plasmids into eukaryotic yeast cells by trans-kingdom conjugation.

INTRODUCTION
In the previous papers (1-8), we have shown that conjugative plasmids in Escherichia coli and Agrobacterium tumefaciens can mobilize their conjugative plasmids into Saccharomyces cerevisiae, S. kluveri and Hansenula wingei yeast cells beyond kingdoms. In these trans-kingdom conjugations, donor bacteria have to have conjugative plasmids which have oriT, mob and tra genes originally identified as bacterial conjugation elements. In this paper, we described a novel method to prepare mini-cells which lack chromosomes but not plasmids, and the mini-cells' capability of trans-kingdom conjugation.

RESULTS AND DISCUSSION
Mini-cells have been prepared by repeating centrifugation or sucrose density gradient centrifugation (11). These are laborious and aseptically troublesome. New development of an efficient method for mini-cell preparation is indispensable to study trans-kingdom...
Flagellum Mediates Symbiosis

Takefumi Shimoyama,¹,² Souichiro Kato,¹,³ Shun’ichi Ishii,¹,⁴ Kazuya Watanabe¹,²,³*

We report here molecular mechanisms underlying a bacteria–archaeon symbiosis. We found that a fermentative bacterium used its flagellum for interaction with a specific methanogenic archaeon. The archaeon perceived a bacterial flagellum protein and activated its metabolism (methanogenesis). Transcriptome analyses showed that a substantial number of genes in the archaeon, including those involved in the methanogenesis pathway, were up-regulated after the contact with the flagellum protein. These findings suggest that the bacterium communicates with the archaeon by using its flagellum.

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² Research Center for Advanced Science and Technology, The University of Tokyo, Komaba, Meguro-ku, Tokyo 153-8904, Japan.
³ Hashimoto Light Energy Conversion Project, Exploratory Research for Advanced Technology, Japan Science and Technology Agency
The Ecosystem
Evolution of ideas
Winogradsky column
Terrarium
The Experiment

C. Elegans     E. Coli
Graphic depiction of altered E.coli
Genes of interest
H14 N18.1 / T14F9.1

T7 promoter

T7 promoter site

Ampicillin resistance

L4440
Phenotypes- H14N18.1

- Known as roller gene
- Locomotion
- Head Bent
- Head Muscle Dystrophy
Phenotypes- T14F9.1

• Known as Blister Gene

• Causes defects in:
  • Cuticulin Based Cuticle Development
  • Embryonic development ending in birth
  • Growth
  • Locomotion
  • Nematode Larval Development
H14 Gene

Brood Size : ●●●●●
Larval Stage 1 : ●●●●●
Larval Stage 2 : ●●●●●
Larval Stage 3 : ●●●●●
Larval Stage 4 : ●●●●●
Adult : ●●●●●
F2 generation : started
Movement : extremely sluggish, coiling
Sickness : yes
Death : 4-6
<table>
<thead>
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<th>Category</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brood Size</td>
<td></td>
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<tr>
<td>Larval Stage 1</td>
<td></td>
<td>●●●●●</td>
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<tr>
<td>Larval Stage 2</td>
<td></td>
<td>●●●●●</td>
</tr>
<tr>
<td>Larval Stage 3</td>
<td></td>
<td>●●●●●</td>
</tr>
<tr>
<td>Larval Stage 4</td>
<td></td>
<td>●●●●●</td>
</tr>
<tr>
<td>Adult</td>
<td></td>
<td>●●●●●</td>
</tr>
<tr>
<td>F2 generation</td>
<td></td>
<td>started</td>
</tr>
<tr>
<td>Movement</td>
<td></td>
<td>normal, active</td>
</tr>
<tr>
<td>Sickness</td>
<td></td>
<td>none</td>
</tr>
<tr>
<td>Death</td>
<td></td>
<td>0-2 nos</td>
</tr>
</tbody>
</table>
Control Vector

1.0 conc of IPTG

13.10.10

<table>
<thead>
<tr>
<th>Brood Size</th>
<th>Adult</th>
<th>Larval Stage 1</th>
<th>F2 generation</th>
<th>Larval Stage 2</th>
<th>Movement</th>
<th>Larval Stage 3</th>
<th>Sickness</th>
<th>Larval Stage 4</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>○○○○○</td>
<td>○○○○○</td>
<td>○○○○○</td>
<td>started</td>
<td>○○○○○</td>
<td>sluggish to normal</td>
<td>○○○○○</td>
<td>none</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>
Graph showing Speed (in µm/sec) of Movement in C. Elegans
Graph showing Change from F1 to F2
Graph showing sickness in C. Elegans observed over a period of 8 days.
Graph showing Life cycle and larval development of C. Elegans
At NCBS
Outreach / Human practices
“All participants are required to work hard to build positive contributions to society and have lots of fun”

IGEM 2010 Website
(http://2010.igem.org/Requirements)
DNA Cocktails
Green Fluorescent Protein (GFP) Bacteria

Take GFP protein from jellyfish DNA

Bacteria Pasmid

Let it propagate and it is ready
Green Fluorescent Protein (GFP) Bacteria

1. Take GFP protein from jellyfish DNA
2. Add the Bacteria Plasmid (DNA ring)
3. Let it propagate and it is ready
Green Fluorescent Protein (GFP) Bacteria

1. Take GFP protein from jellyfish DNA
2. Add to the Bacteria Plasmid (DNA ring)
3. Let it propagate and it is ready
Safety
Future on-going work ... 

• We wish to further observe the worms in the following two conditions:

1. Synthetically altered E.Coli.
2. Naturally occurring E.Coli.

• We want to determine whether the worms develop a resistance mechanism to the altered bacteria by genetic transfer of information from one generation to another (thus evolving).

• We wish to work on our Bio bricks in the future.

Our lab is a prototype. We wish to make it fully functional.
Thanks

• Avestha Gen
• Tata Steel
• Dr Mukund Thattai
• Piroj Shah Godrej Foundation
• Geeta Narayanan
• Alexandra Daisy Ginsberg
• James King