Every 4 minutes a new person is diagnosed

Every 10 minutes somebody dies

10% of all leukemia patients are under 20
Leukemia

Components of the bone marrow:

- Myelocyte
- Erythrocyte
- Eosinophil
- Normoblast
- Fat
Current Leukemia Diagnosis

State of the art

CD33+ cell

Anti-CD33

FACS
Desired Features of SensorBricks

- Sensitivity
- Simplicity
- Modularity
SensorBricks - ToolBox

Protein A from *Staphylococcus aureus*

**CD33+ cell**

**Domain B of Protein A**
SensorBricks - ToolBox

Quorum Sensing System from Vibrio fischeri
SensorBricks in Real Life

patients blood cells

Mix anti-CD33 + Fusionprotein
SensorBricks in Real Life

- patients blood cells
- Mix anti-CD33 + Fusionprotein
- Antibody-Fusionprotein + blood sample
SensorBricks in Real Life

1. Patients blood cells
2. Mix anti-CD33 + Fusionprotein
3. Antibody-Fusionprotein + blood sample
4. Take SN containing AHL

Take SN containing AHL
SensorBricks in Real Life

- **Add SensorBricks**
- **Detect fluorescent signal**
- **Mix patient's blood cells**
- **Mix anti-CD33 + Fusionprotein**
- **Antibody-Fusionprotein + blood sample**
- **Take SN containing AHL**
Experimental Pipeline

1. Build Detection System
2. Test SensorBricks receiver
3. Simulate AHL sender
4. Test SensorBricks sender
5. Establish Leukemia Test
Results

- Build Detection System
- Test SensorBricks receiver
- Simulate AHL sender
- Test SensorBricks sender
- Establish Leukemia Test
Building a Detection System
Building a Detection System

Building a Detection system

RFC 78
SensorBricks in Real Life
SensorBricks in Real Life
Results

1. Build Detection System
2. Test SensorBricks receiver
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Results

- Build Detection System
- Test SensorBricks receiver
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The fluorescence signal is proportional to the AHL input.
Direct correlation of fluorescence to [AHL] after 2 hours

Fluorescence (YFP/RFP) vs. AHL concentration in nM
Results

- Build Detection System
- Test SensorBricks receiver
- Simulate AHL sender
- Test SensorBricks sender
- Establish Leukemia Test
Results

- Build Detection System
- Test SensorBricks receiver
- Simulate AHL sender
- Test SensorBricks sender
- Establish Leukemia Test
Simulate AHL Sender

Proof of Principle: Cocultivation Assay

**Sender** expressing LuxI

Sender:  
- pTet
- LuxI

**Receiver** detecting AHL

Receiver:  
- pTet  RFP  pTet  LuxR  pLuxR  YFP
Simulate AHL Sender

Low amounts of LuxI lead to a detectable induction
Results

- Build Detection System
- Test SensorBricks receiver
- Simulate AHL sender
- Test SensorBricks sender
- Establish Leukemia Test
Future Outlook

Build Detection System

Test SensorBricks receiver

Simulate AHL sender

Test SensorBricks sender

Establish Leukemia Test
Future Outlook

1. Build Detection System
2. Test SensorBricks receiver
3. Simulate AHL sender
4. Test SensorBricks sender
5. Establish Leukemia Test
Potential of SensorBricks

Amplification

pTet  RFP  pTet  LuxR  pLuxR  LuxI  YFP
Potential of SensorBricks

Amplification

Pigments

http://2009.igem.org/Team:Cambridge
Potential of SensorBricks

Amplification

Pigments

Modularity

Multiple Detection

- pTet
- RFP
- pTet
- LuxR
- pLuxR
- LuxI
- YFP

Pigments
Thanks to:

Andy Oates, Annelie Oswald, Marko Storch, Petra Schwille, Johnson Madrid, Kaj Bernhardt, Michael Bachmann
BIOTEC Dresden, MPI-CBG Dresden, TU Dresden
<table>
<thead>
<tr>
<th>Feature</th>
<th>FACS</th>
<th>SensorBricks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection Limit</td>
<td>1 cell in 10 000 cells</td>
<td>1 sender cell in 10 000 receiver cells</td>
</tr>
<tr>
<td>Price (Hardware) in US$</td>
<td>~ 200 000</td>
<td>~ 50 000</td>
</tr>
<tr>
<td>Total test time</td>
<td>3 h</td>
<td>4-5 h</td>
</tr>
</tbody>
</table>