Health:
Ideas Presentation
Fixing Plants to Fix Nitrogen

✓ Farming depletes soil nutrients
  ✓ Especially in the third world: limited knowledge of efficient farming practices
✓ Legumes lead to proliferation of nitrogen-fixing bacteria
✓ Proposal: add bacteria to crops like corn and cotton
  ✓ Consideration: cost, impact on ecosystems, bacterial life cycles/habitat, effects of excess nitrogen-fixing on the soil
Healing a Hole in the Heart

- Problem: faulty heart valves cannot be replaced with human tissue
  - Catheter: two metal discs placed within the heart to close a hole
  - Biodegradable bone scaffolds used to regrow bone tissue; the scaffold than degrades
- What if we create a biodegradable catheter that degrades away when heart tissue grows over it
  - Could we use similar technology to biodegradable stitches?
  - Apply this to replace valves or arteries
Seeing Into the Future

- Many people need vision correction due to eye strain and genetic predisposition
- Lasik surgery and contact lenses are expensive and nonpermanent
- Cannot be used in children or in extreme cases
- **What if we can prevent or reverse ocular degeneration more effectively?**
  - Examples of great vision from the animal kingdom
  - Strengthening eye muscles
  - Dealing with extreme cases
  - Finding ways to prevent the eye from changing shape (cause of near and farsightedness)
Bubble Screens for Genes

✔ Take current cell sorting methods to the next level
  ✔ Currently, immuno-staining is used: hard to see which combinations of genes are expressed
  ✔ Used for types of cells with more than one marker
    ✔ Leukemia

✔ We can engineer cells in a test tube with bacteria-created buoyancy bubbles
  ✔ Fluorescence rainbow based on buoyancy shows which genes are expressed
  ✔ Target the procedure to identify specific gene markers
The Viral Kill Switch

✓ E.coli cells or bacteria can be bonded to human cells and engineered to perform specific functions

✓ What if a virus can be used instead?
  ✓ Engineer viral cells already bonded to human cells
  ✓ Create a signal basis to track the proliferation of human cells
  ✓ If cells multiply too quickly (a danger signal for cancer), the viral markers can trigger the lysosomes to initiate autophagy
  ✓ Ethanol overproduction as a marker of very rapid cell division
  ✓ Modify a human gene to produce low levels of a specific virus to bind to the cells
  ✓ Issue: some cell types need to proliferate rapidly (skin); the viral markers must avoid targeting these cells
  ✓ Safety considerations: could the virus be dangerous in some way?
Markers for Malaria

- Malaria kills millions of people every year
  - No major advance in treatment due to selection pressure
    - Drug resistant parasites
    - Vaccines are difficult to create
  - Drug cocktails: also prone to resistance
- Mosquito nets: prevention
  - Can we create a synthetic material that regenerates itself?
  - A net that repairs its own holes
- Treatment: markers used to anticipate resistance
  - Tagging the plasmodium with a bacteria/viral kill switch that causes the plasmodium to self-destruct upon binding to a human cell
Build a Better Bug Spray

- Mosquitoes are responsible for transmitting many bloodborne diseases
  - Yellow fever, etc.
  - Global warming may create more hospitable conditions for mosquitoes

- What if we eradicate mosquitoes?
  - Pesticide programs
  - Need to consider the ecological consequences
  - Add chemicals to standing water to hinder mosquito breeding

- We can create a contagious disease that can be transmitted between mosquitoes

- Biological bug spray
  - Engineering mosquitoes that are not harmful to humans…but it has to dominate over the wild type
  - Exploit people’s natural resistance to mosquitoes
  - Why are some animals immune to mosquito bites
The “Stems” of Cancer

- Applying to stem cell research to cancers like melanoma and blood disorders
- Cancers can be caused by stem cells proliferating rapidly.
- A certain protein can cause blockage of things entering the cell. This makes medicine and chemotherapy not accessible.
- Cancer patients sometimes develop resistance to treatment. Stem cells can create a sort of generic bone marrow treatment that doesn’t trigger an immune response.
- Uses of stem cells: 1. Stopping cancerous stem cells 2. Using stem cells to create safe treatments (bone marrow, organ transplants)
An E.coli a Day Keeps the Doctor Away

- People are born with vitamin deficiencies or develop them as they age
- What if we implant E.coli into the digestive tract
- The E. coli are engineered to produce essential vitamins
- A feedback mechanism would control the bacteria populations to prevent toxicity