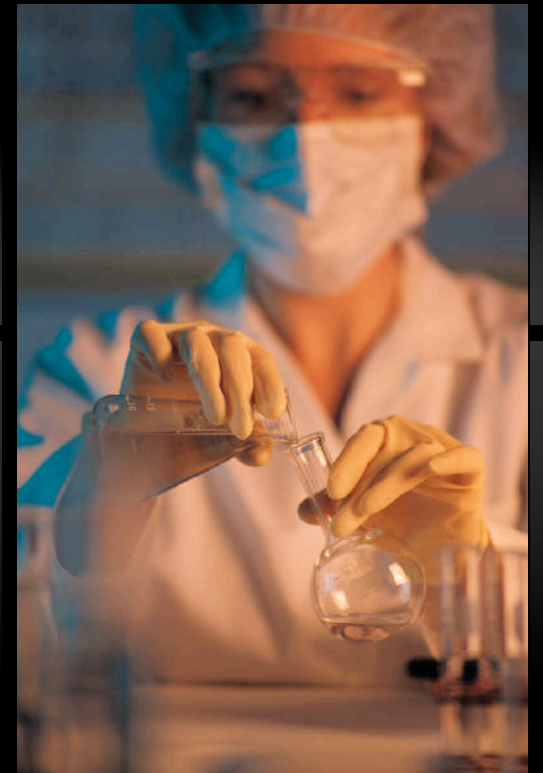


Health: Ideas Presentation



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 then 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
 - ✓ Lasic 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