IPRO 318: Food Safety, Genetically-Modified Crops and Protein Engineering

Objectives

Making the peanut less allergenic

- To conduct collective research
- To create collective list of engineered crops
- To review available technologies used to genetically modify plants
- To gain knowledge about peanut allergen
- To organize this information into a user friendly webpage

Strategy to complete objectives

- Organize into sub teams
- Research
- Meet with National Center for Food Safety and Technology
- Create a website

Team Organization

Advisor : Zhang

Team Leader :
Jennifer Miller

Website and Background
Sub-Team Leader:
Nivedita Chandrasekharan

Database and Technology
Sub-Team Leader:
Jennifer Peavler

Kurt Ziegel

Pavan Patel

Ali Khiabani

Andres De La Hoz

Elizabeth Kuebrich

Lauren McClelland

Hee Seo

Team Organization

Advisor : Zhang

Team Leader :
Jennifer Miller

Legal Background
Sub-Team Leader:
Nivedita Chandrasekharan

Technology and Peanut Allergens
Sub-Team Leader:
Elizabeth Kuebrich

Kurt Ziegel

Pavan Patel

Ali Khiabani

Andres De La Hoz

Jennifer Peavler

Lauren McClelland

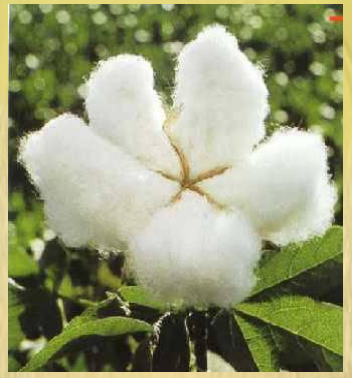
Hee Seo

Database Subgroup

- This group was responsible for:
  - **Creating a collective list of GM Crops**
  - **Researching the top 6 GM crops in the US**
  - **Creating a collective list of countries which produce GM crops**
  - **Creating a list of the top 10 companies that deal with GM crops**

Database Subgroup

- The 6 major crops are:
  1. Corn
  2. Cotton
  3. Rice
  4. Soybean
  5. Tomato
  6. Wheat



Corn/Maize

Purpose of modification:

- Pest resistance
- Reducing pest infecting the corn plants also reduces the diseases carried by these pests
- Herbicide resistance
- Disease resistance
- Drought resistance

Technology used

•Bacteria Vector

Cotton

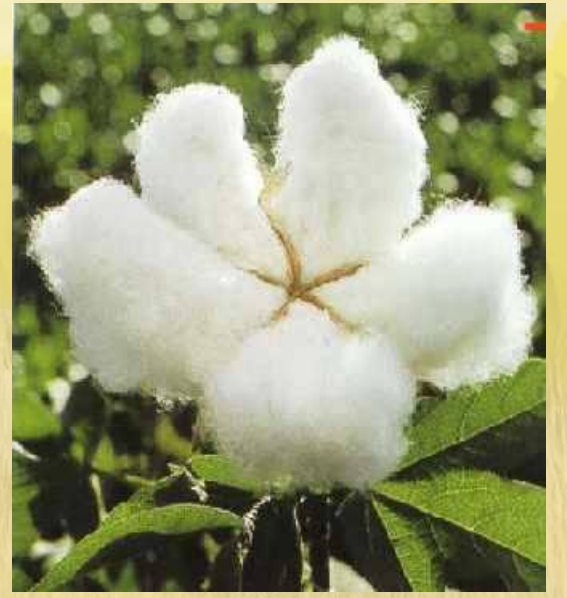
Background:

It is used as a fiber, in food products as an oil, and as an animal feed.

GM cotton has now taken over 43% of all cotton growth worldwide.

GM cotton is one of the most widely used genetically modified crops available.

It was the first GM crop available in southern Africa.



Purpose of modification:

Insect resistance

Herbicide tolerant

Rice

Background:
World's second most important cereal crop

Technology:
Electroporation

Staple diet for 2 of the 6 billion people on the planet.

Purpose of modification:

Increased Yields

Less Harm to the Environment

Increased Nutrition

Soybean

Background:

One of the most widely planted GM plants in the world today

Monsanto was the first company to genetically modify the soybean.

Purpose of modification:

- **Pest resistance**
- **Plant transformation efficiency**
- **Hypoallergenicity**
- **Superior feed for livestock**
- **Flavor**

Tomato

Background:

- **The first GM tomato in the U.S. was the Flavr-Savr tomato.**

- **A company called Calgene introduced the Flav-Savr.**

- **The Flavr-Savr tomatoes were engineered to have a longer shelf life.**

Purpose of modification:

- **Extending shelf life**
- **Insect resistance**
- **Pesticide resistance**
- **Higher plant yield**
- **Better flavor and color**
- **Vaccination carrier applications**

Wheat

Background:

- GM Wheat is not currently being grown
- Still exploring ways of improving wheat
- Well adapted to harsh environments

Technology:

- Chemical-induced mutagenesis
- Bacteria Vector
- Biolistic

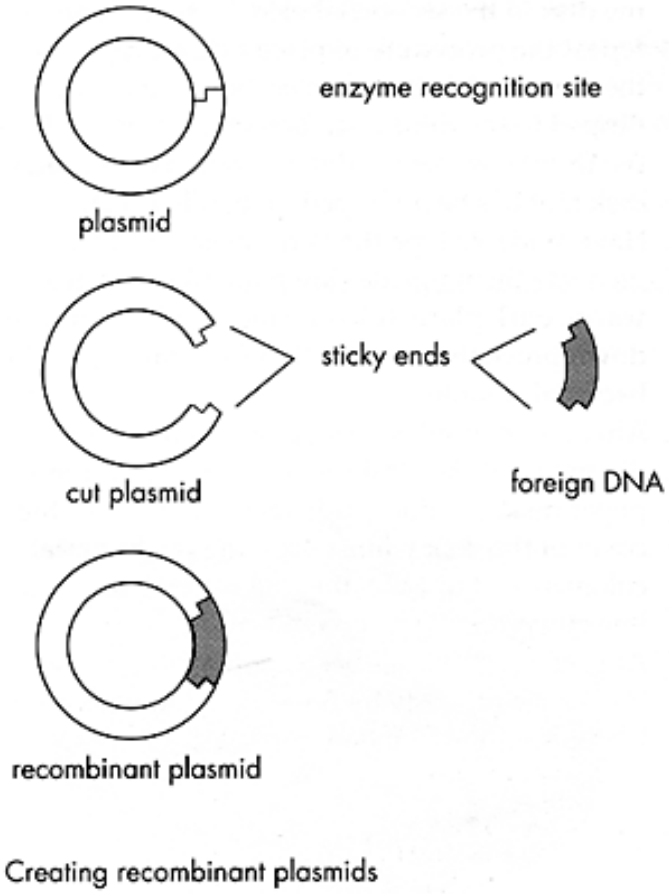
Purpose of modification:

- Herbicide resistance
- Fungal resistance
- Virus resistance
- Pest resistance
- Feed
- Food

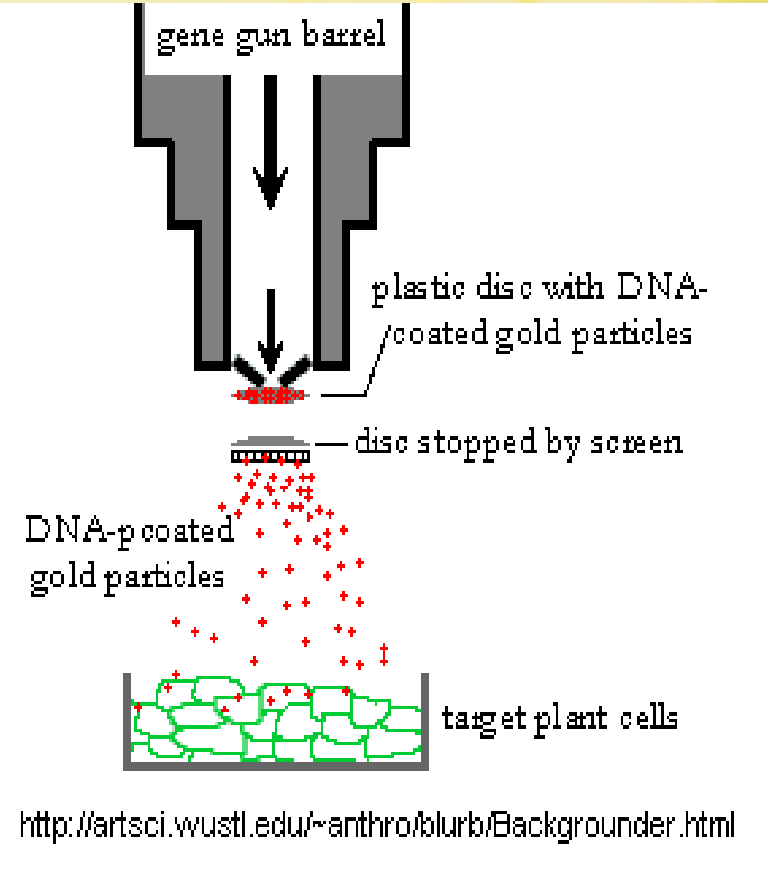
Technology / Peanut Allergen Sub Group

- This sub group was responsible for :
  - **Research of Technology**
  - **Research allergens in Peanuts**

Gene Splicing and Gene Gun

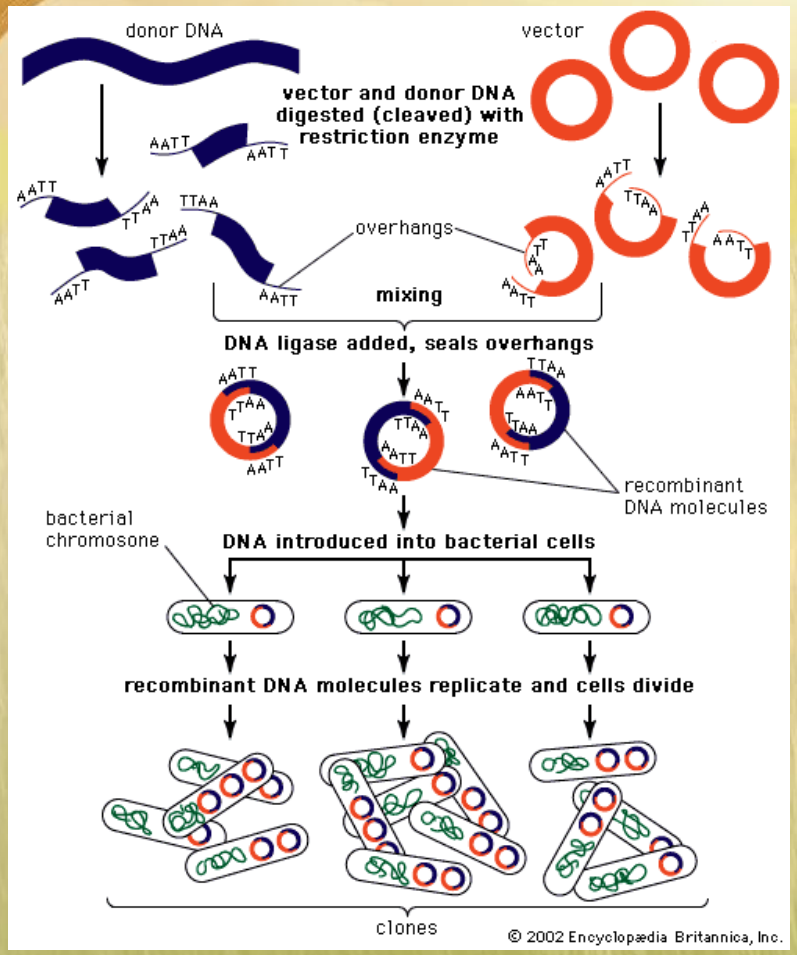


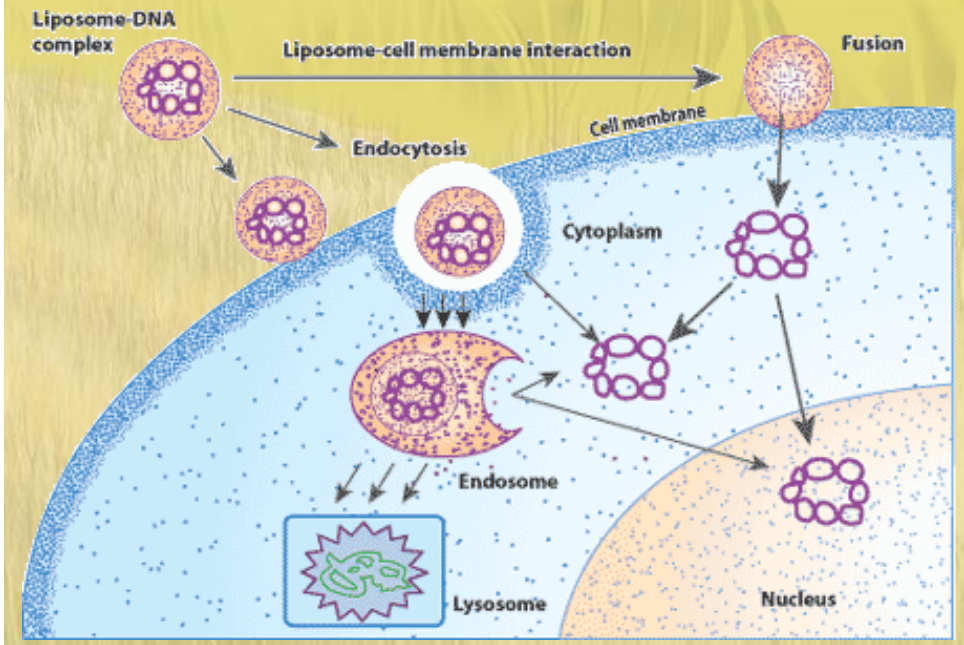
Creating recombinant plasmids



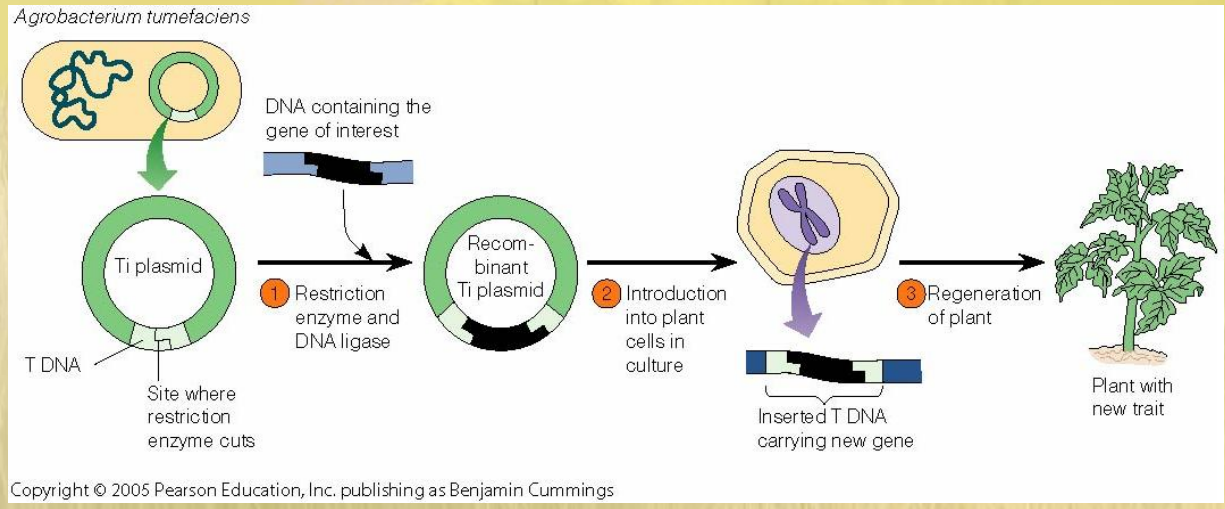
http://artsci.wustl.edu/~anthro/blurb/Backgrounder.html

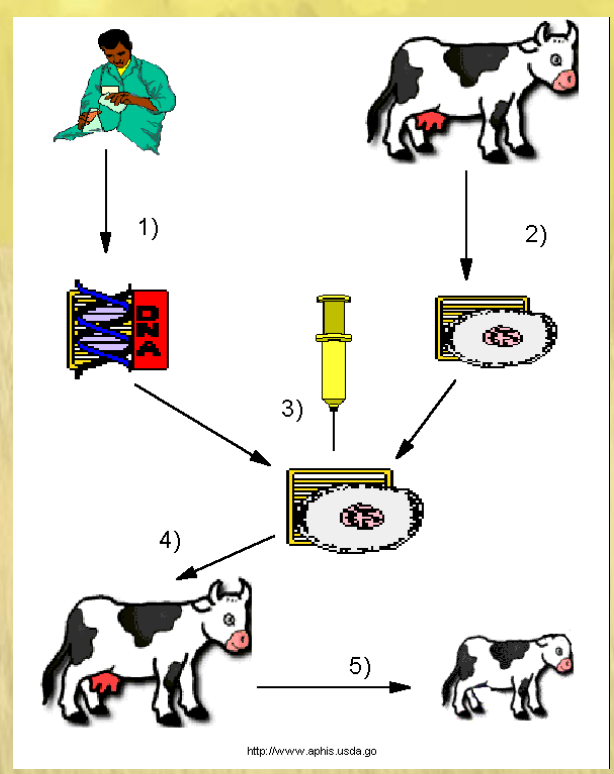
Viral Vector and Lipofection





Protoplast transformation and Injection

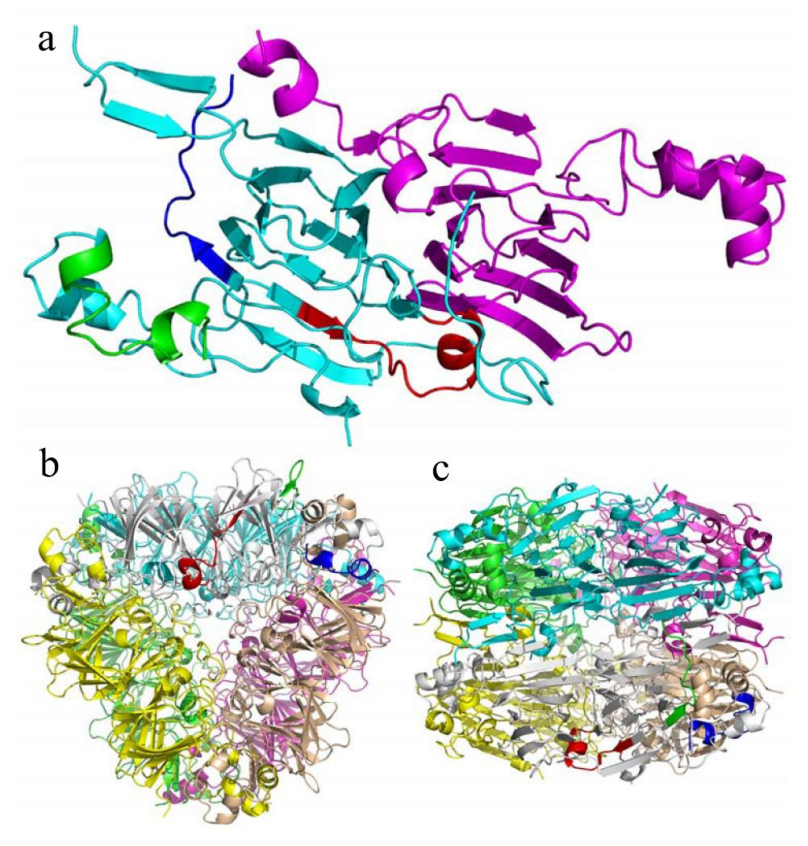




Peanut Allergen Research

- 8 known peanut allergens
- 3 of the 8 are major allergens

Ara h 3 Peanut Allergen



- **Structure of ara h 3 determined at IIT.**

- Future IPRO will target the inter-molecular interfaces to reduce the allergens stability.

Background Subgroup

- This sub group was responsible for:
  - **Researching the background of GM Crops**
  - **Researching the Risks of GM crops**
  - **Researching the Benefits of GM crops**

Risks

- Creates farmer dependency on GM food companies and patent prevents the use of these benefits without considerable payment.

- Can have unforeseen health side effects as a result of genetic variation.

- Reduces biodiversity, making crops more susceptible to epidemic.

Benefits

- Allow for the development of crops that require less pesticide use, which helps the environment.
- Strong, resistant crops are less prone to damage.
- Shelf life of food can be greatly increased.
- Food with higher quality nutrients can be used to treat nutrition issues.

Legal Background Subgroup

- This sub group was responsible for:
  - **Researching the Rules, Regulations, and Laws that pertain to GM crops**

Legal Background Subgroup

- The European Union's legal standards for GM food are much higher and are more thorough than America's

Webpage Subgroup

- This subgroup was responsible for:
  - **Creating a user friendly web page.**
  - **The site will serve to showcase information about genetically modified crops including background, benefits and risks, technology, and detailed information on 6 major GM crops**

Webpage Subgroup

ILLINOIS INSTITUTE OF TECHNOLOGY

Home | About Us | Background | Technology | Database

IPRO 318 **Genetically Modified Crops**

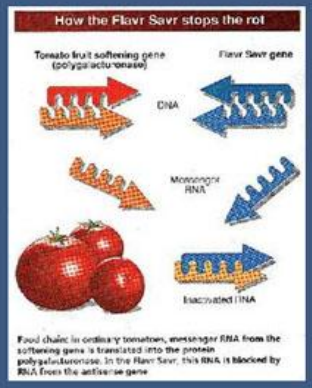
Crops:
- Corn
- Cotton
- Rice
- Soybean
- Tomato
- Wheat

Crop Name:

Tomato

Background:

The first genetically engineered tomato in the U.S. was the Flavr-Savr tomato. A company called Calgene introduced the Flav-Savr. The Flavr-Savr tomatoes, engineered to spoil less quickly after harvesting, could be left to ripen on the vines longer, developing more flavor and allowing later shipment to stores (ripe tomatoes can't be shipped very far because they spoil too quickly and are normally shipped green and chemically-ripened later).



In late 1991, Calgene had a variety of Flavr-Savr tomatoes ready for marketing. Before they marketed the Flavr-Savr tomatoes, Calgene decided to seek FDA approval. The company wanted to reassure consumers that the genetically modified tomato was safe. The FDA declared that the tomato was safe for consumers, and Calgene announced that the Flavr-Savr would be available in test markets after the 1993 growing season.

In early 1993, public concerns about food safety prompted Calgene to request a ruling from the FDA regarding the safety of antibiotic resistance genes in GE foods (Flavr-Savr carries resistance to the antibiotic *kanamycin*). At the same time, Campbell Soup Co, which had collaborated with Calgene to develop the

Accomplishments

- Obtained information about background, risks, benefits, and technology of GM crops.
- Created a Database of Top 6 GM crops
- Identified eight peanut allergens
- Created a website

Ethics

Law

- **Canon:** To be knowledgeable of and comply with all state and federal laws regarding Intellectual Property.
- **Pressure:** The desire to be recognized with in the field.
- **Pressure**: To complete research within eminent deadline.
- **Risk:** Taking credit for someone else's work resulting in an infringement on copyright laws could lead to fines or imprisonment.
- **Measure:** A lack of lawsuits or complaints within the field will serve as a measure for this canon.

MAJOR OBSTACLES

- Too much information to digest
- Biased information, not many neutral sites
- No CS majors for creation of web page

Recommendations For Future IPROs

- Research Protein Engineering
- Research Current Peanut Modifications
- Maintain Relationship with National Center for Food Safety and Technology

Future of IPRO 318

Information assembled during this semester will aid future IPROs in making the peanut less allergenic