JUSTIFICATION [2]

- Synthetic fuel
- Gene therapy
- Curing disease
- Creating tougher foods
OUTLINE

• History of genetic engineering
• Past projects
• Craig Venter and synthetic life
• Ethical considerations
• Road Ahead
• Conclusions
1944: DNA identified as the carrier of genetic information (Mcleod and McCarty)

1953: Structure of DNA Discovered (Watson and Crick)
RECOMBINANT DNA TECHNIQUES [5]

Diagram showing the process of transforming animal cells into bacterial cells to express DNA.
INITIAL SUCCESS [6]

- 1977: E.Coli bacteria made to produce insulin
- FDA approved and sold commercially
- 1st genetically engineered organism
- Traits found in nature could be imparted on other organisms
HUMAN GENOME PROJECT [7,8]

- Hoped to map 20,000-25,000 human genes
- Completed in 2003
  - Working model of human genome announced
  - Mapped 92%
INTERESTING PROJECTS [9,10]

Dolly the Sheep
Born on July 5, 1996 at Scotland’s Roslin Institute
First mammal cloned from an adult cell
Euthanized in 2003 because of lung cancer

Maroon Carrots
• “BetaSweet” carrots
• Developed 10 years ago by Professor Emeritus Leonard M. Pike for fun
• Coloring comes from the antioxidant anthocyanin.
• Based off wild carrots collected in Brazil
The Glowing Bunny
Named Alba
Created in 2000 by Eduardo Kac
Embryo injected with a green phosphorescent protein found in jellyfish

Photosensitive Flies
Gero Miesenboeck & his team at Yale
Engineering fruit flies to be light-sensitive in the neural area responsible for escape
Beheaded flies so they could not move, unless the modified cells were flashed with light
SYNTHETIC LIFE [13]

• “We’re here today to announce the first synthetic cell.”
• “This is the first self-replicating species that we’ve had on the planet whose parent is a computer. It also is the first species to have its own website encoded in its genetic code.”
**SYNTHETIC LIFE**

- **Simplest life goal**
  - Synthesis necessary

- **Two sides of synthesis**
  - Biology – incorporation
  - Chemistry – accuracy, watermarking
When asked how significant synthetic life is:

“Perhaps it is a giant philosophical change in how we view life. We actually view it as a baby step in terms of it has taken us fifteen years to do an experiment that we wanted to do fifteen years ago.”

Privately owned spin-off company

Employs more than 400 scientists

In July 2009, ExxonMobil invested $600 million in Synthetic Genomics

New life form to create oil from CO$_2$, water and light
ETHICAL CONSIDERATIONS [15]

- Environmental
  - New species affecting natural environment
  - Human health concerns

- Religious/Moral
  - Should we play God?
  - Does this go against nature?

- National Security
  - Terrorism
  - Biological Warfare
**Road Ahead [16,17]**

- **Projections for the near future**
  - 2011-2014 - Customized cells
  - 2011-2016 - 20%+ efficient genetically engineered algae ponds to generate hydrogen
  - 2015-2025 - Almost all fish (for food) comes from massive isolated land-based fish farms, some with volumes approaching a cubic mile.
  - 2011-2020 - Future Crime: Genetic modification of baby DNA to pass false paternity lawsuit
  - ?- Customizable offspring

- **Regulations on allowable genetic alterations**
CONCLUSIONS

• Humans are experimenting with their surroundings in ways never seen before
• New synthetic biology has the potential to provide many new tools for mankind
• Synthetic biology also creates many ethical dilemmas that will be faced in years to come

“What I cannot build I cannot understand.”

— Richard Feynman
REFERENCES


[17] [http://brandguide.tamu.edu](http://brandguide.tamu.edu).
Questions?