

# **Animal Science Volunteer Training:** *Learning about biotechnology in animal agriculture through Phytase*

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4-H Youth Development



# Enzymes

- **Phytase and Animal Agriculture**
  - **Nutritional biotechnology commonly added to swine and poultry feeds**
  - **Breaks down Phytate into a usable form of the mineral Phosphorus**
  - **Results in**
    - **More efficient use of Phosphorus by the animal**
    - **Less Phosphorus ends up in environment**
    - **Has potential to decrease water pollution**
- **Phytase Video**
  - [https://www.youtube.com/watch?v=cG-Jc\\_C2mYg](https://www.youtube.com/watch?v=cG-Jc_C2mYg)

# Enzymes

- **What is an enzyme?**
  - **Protein**
  - **Biological Catalyst – speeds up reactions without being used up**
    - **Reduces the activation energy of the reaction**
  - **Very specific with what substrate they will bind to**
  - **Name commonly ends in “ase”, but not always**
- **Activation Energy**
  - **Amount of energy required for a reaction**
- **Substrate**
  - **Molecule that an enzyme acts upon**

# Enzymes

- **Nutritional Examples**

- **Lactase** → **Lactose**
- **Sucrase** → **Sucrose**
- **Maltase** → **Maltose**
- **Pepsin** → **Protein**
- **Phytase** → **Phytate**



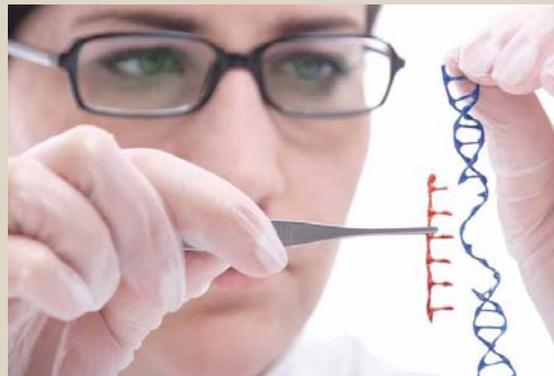
Substrates

# Enzymes

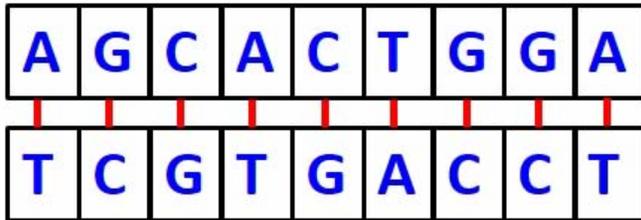
- **Activities**
  - **Match Demonstration – Catalyst**
  - **Lock/Key Demonstration – Specificity**
  - **Puzzle Pieces Demonstration – Enzyme/Substrate Reaction**
  - **Toothpickase**

# Phytase

- **How is phytase mass produced today?**
  - **Recombinant DNA technology**
- **Recombinant DNA technology or genetic engineering**
  - **Inserting DNA from a specific gene of one species into another species**
  - **Typically involves bacteria as the source of the DNA or the recipient**



Recipient Cell





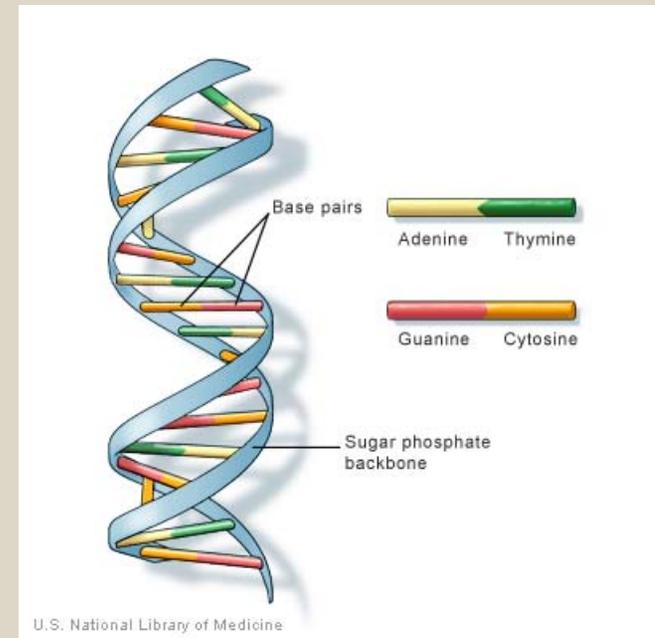
# DNA

- **Base pairing**

- **A always pairs with T**
- **G always pairs with C**

- **Activities**

- **Origami DNA**
  - <http://www.yourgenome.org/activities/origami-dna>
- **Base Pairing**



# DNA

- **Genetic Engineering or Genetic Modification**
  - **Inserting a specific strand of DNA from one species into a different species**
    - **Results in Transgenic organism**
  - **This strand is specifically selected for what it does**
- **Why would we do this?**
  - **Production of substance that benefits human or animal medicine**
    - **Phytase in livestock feeds, benefits environment**
    - **Insulin for human diabetic patients**
    - **Lactose free milk for lactose intolerant people**

# DNA

- **Genetic engineering activity**
  - **Insert DNA from Phytase gene of bacteria into a yeast cell**
    - **Leads to mass production of the hormone Phytase**

– **Your genetic tools =**



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**If you have any questions, please  
contact us anytime...**

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