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# Molecular pharming system development

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## Introduction

- Molecular pharming involves using plants as bio-factories for the production of biopharmaceuticals, therapeutics and industrial enzymes
- Dr. Altosaar's protein production system utilizes rice granules as a host to produce stable proteins
- Rice is the most widely consumed staple food for a large part of the world's population and is easily and cheaply grown



## Abstract

- The global enzyme market is growing steadily each year, reaching a market value of \$4.8 billion in 2013 with expected growth to \$7.1 billion by 2018.
- To meet this increase in demand the worlds largest protein companies are searching for ways to reduce costs and increase production. This research project will focus on a demonstration of the Protein Easy system (developed by Dr. Altosaar) for the worlds largest chemical company, BASF.

## Methodology

- Research and literature reviews were undertaken to determine the optimum enzyme to select for a demo of the protein easy system
- Market analysis was performed to determine which enzymes possess large segments of the market or are predicted to grow in popularity in the future
- Analysis of BASF was performed to enable the selection of an enzyme that would spark the interest of the worlds largest chemical company

Is it a feasible project for our lab?

Is it of interest to others?

Does it have commercial applications that are instantly available?

## Results

### Global enzyme market

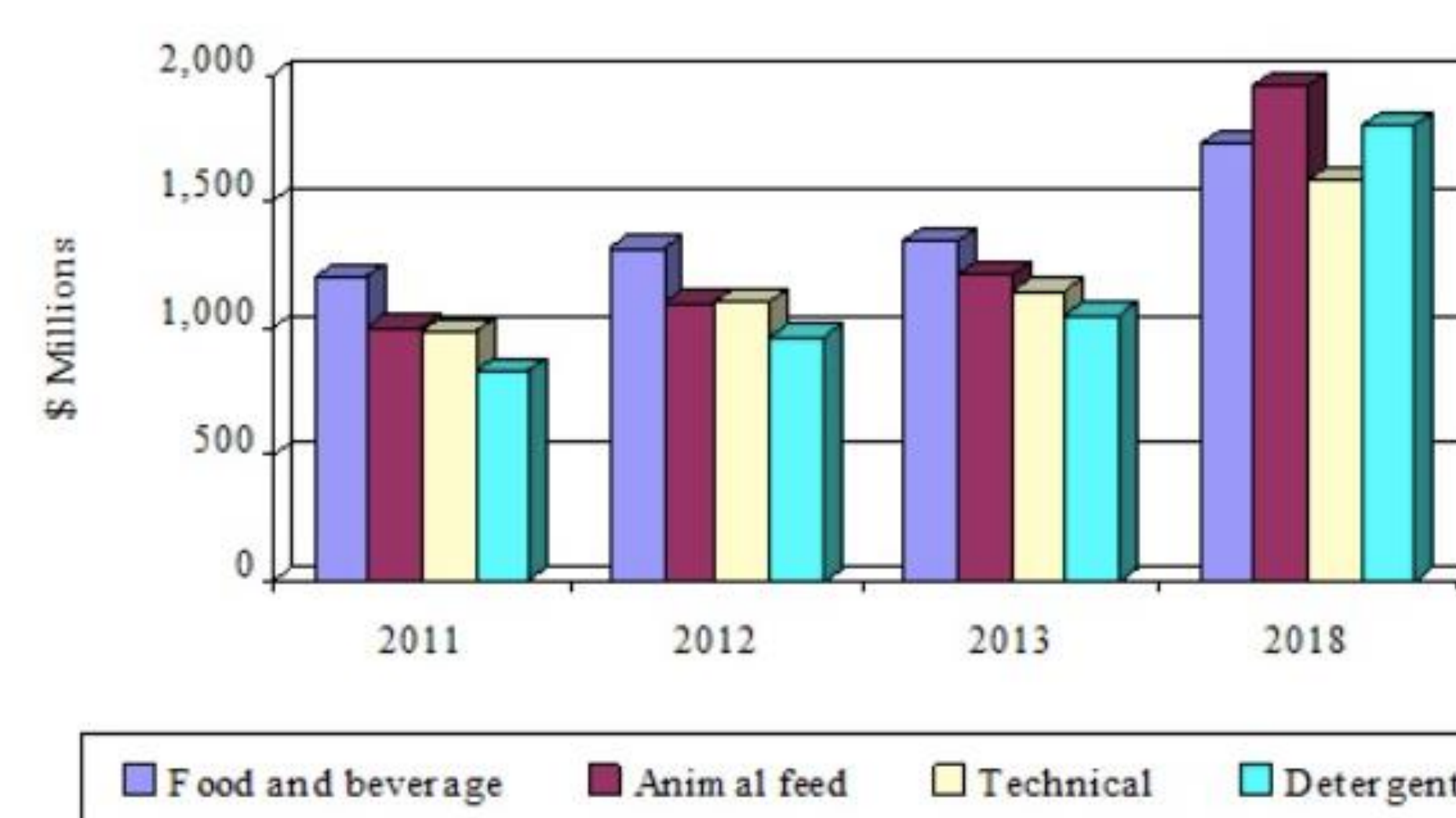
- The estimated worldwide industrial enzyme market in 2000 was \$1.5 billion



- This market **was** expected to reach \$4.4 billion by 2015
- Now, the market is expected to reach around \$7.1 billion by 2018.

### SUMMARY FIGURE

GLOBAL INDUSTRIAL ENZYME MARKET, 2011-2018 (\$ MILLIONS)



Source: BCC Research

### Market Segments

#### Technical enzymes

- Around 65% of Industry
- Enzymes in detergent, starch, textile, leather, pulp and paper, and personal care industries.

#### Food Enzymes

- Around 25%
- Enzymes employed in the dairy, brewing, fats and oils, and baking industries.

#### Feed Enzymes

- Around 10%
- Used in animal feed

- Proteases remain the dominant enzyme type, because of their extensive use in the detergent and dairy industries
- Proteases are part of the technical enzyme segment, which accounts for the largest segment of the industry
- In 2013 BASF completed the acquisition of Henkel's detergents enzyme technology

## Conclusion

- The successful production of a protease in a protein rich rice granule would show BASF that this system could be used to produce their desired protein cheaply and easily, potentially gaining their interest and investment in the system.
- If the experiment fails then the lab would gain valuable insight on how the protein and rice are interacting during growth, and could provide suggestions to improve and develop the system for the future.

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