Genetically Engineered Microorganisms and Animal Food






The Future of Microbial Biotechnology Workshop

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Animal Food Regulation in the USA

Drug

–Treats, cures, mitigates, or prevents diseases

–Affects the structure or function of the animal (other than providing nutritive value, taste and aroma)

–Improves animal productivity (i.e.: growth rate, milk production, carcass characteristics

Food

- "Articles used for food or drink for man or other animals."
  - Provides nutritive value, taste, or aroma.
  - Affects the characteristics of food.
  - Directly or indirectly becomes a component of food (processing and packaging).

Animal Food Regulation in the USA

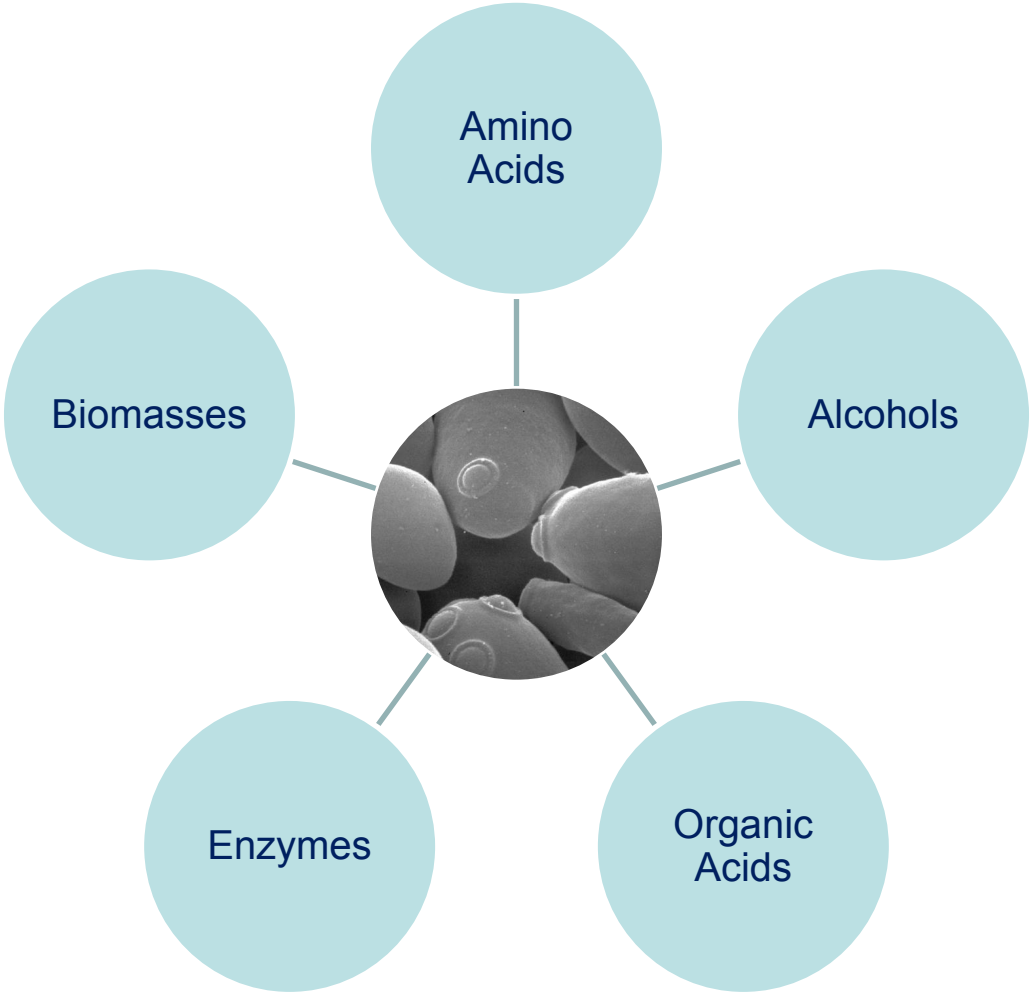
Drug

Food

"Prevents dehydration"

"Source of water, an essential nutrient"

Animal Food



Regulatory Pathways for Animal Food

- Food Additive
  - Food additive petition process.
- Generally Recognized as Safe (GRAS)
  - Firm's conclusion that the use of a substance is GRAS.
- Defined Ingredient
  - Association of American Feed Control Officials (AAFCO)

General Considerations

- Microbial Safety
  - Safety of the source organism
- Molecular Biology Description
  - Safety of the host organism
  - Safety of the genetic material used to make the modifications
  - Genetic engineering techniques used to modify the source organism
  - Characterization of the genetic modifications
  - Description and properties of the final source organism

Microbial Safety

- Source organism identity
  - Organism source
    - Purchased from organism culture banks
    - Isolated: from where?
  - Data to substantiate identity and taxonomical classification
    - 16 sRNA and phenotypic tests
    - Third party identity confirmation

Microbial Safety

- Scientific Literature
  - Safety assessment: focus on the genus-species
    - Not strain basis
    - History of use in animal food?
  - Pathogenicity and virulence
  - Animal or human diseases associated with the organism
  - Production of toxins or undesirable substances
  - Absence of safety information in the scientific literature does not mean that there are no safety concerns

Microbial Safety

- Source organism viability in the final market formulation
  - "Dead means dead"
    - Logarithmic reductions are not equivalent to absence
    - Detailed description of kill steps
  - Viable organisms in the market formulation:
    - FAP
    - Can be used by a different firm

Molecular Biology Description

- Plasmid Map
- Detailed description of:
  - Genetic material that was introduced and its source
    - Synthetic or Genomic
      - Information on the gene donor and safety considerations
  - Intentional changes to the nucleotide sequence incorporated into the genome of the source organism

Molecular Biology Description

- Source organism development
  - Description of the technology used
    - Extrachromosomal plasmid, random insertion, homologous recombination, genome editing
    - Techniques used to introduce the plasmid
    - Techniques used to select potential source organism strains

Molecular Biology Description

- Characterization of the source organism
  - Describe the analytical method use and bioinformatics approach to characterize DNA insertions, deletions, and edits
    - Whole genome sequencing, southern blot analysis, sanger sequencing of PCR, biochemical analysis
  - Sequence of nucleotides that were inserted, deleted, or edited
    - Number of copies, location, coding sequence errors or mutations, alterations, resistance genes, unintended proteins, pathway modifications.

Manufacturing Process

- Detail description of the manufacturing process
  - Time, temperature, pH, control points
  - Kill step
  - Specifications
  - Cleaning procedures between batches
- Fermentation Media
  - All substances must be acceptable for use in animal food for their intended use
  - Provide certificate of analysis and regulatory status

Questions

- Bioengineered organisms: case-by-case basis
- Questions: come talk to us!
  - Animalfood-premarket@fda.hhs.gov