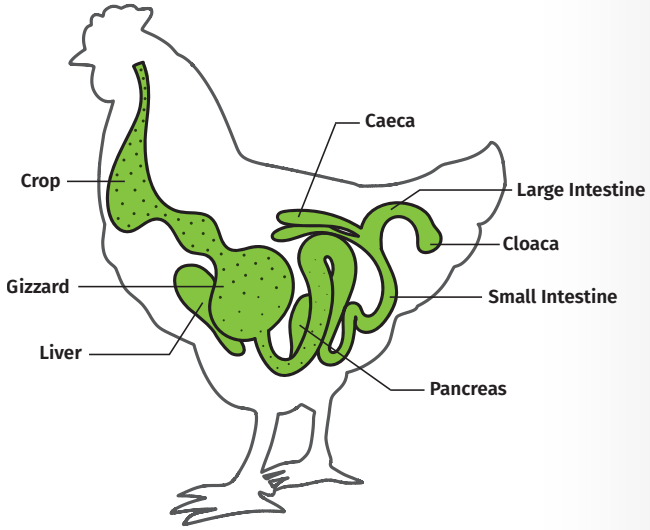
DSM ACADEMY
Advancing Animal Science

Overview of Feed Enzymes

What are digestive enzymes?

- Digestive enzymes break down feedstuffs to their basic components
- Secreted in the stomach and by the pancreas
- Intestinal enzymes include:
  - Proteases (protein)
  - Lipases (fats)
  - Amylases (starch)
  - Carbohydrases (sucrase, etc.)



What are substrates?

- Substrates are found in feed ingredients and acted upon by the enzyme
- Substrates are broken into smaller pieces, more easily absorbed or utilized

Substrate	What do you get from that substrate?
Protein	Amino acids, peptides
Fats	Fatty acids
Starch	Glucose (energy)
Carbohydrates	Smaller components -> Energy and prebiotics
Phytic acid	Phosphorus

Feed enzymes accomplish several objectives

- Increase and expand upon enzymes already present (phytase, amylase, protease)
- Supplement enzymes not already present (non-starch polysaccharide (NSP) enzymes)
- Improve ingredient digestibility
- Improve animal performance (growth and feed conversion rate)
- Improve environmental factors (litter quality, air quality)
- Reduce anti-nutritional factors
- Lower feed costs
  - Feed contributes 65%-70% or more of production costs

Many Examples of Feed Enzymes Currently on the Market

Enzyme	Primary Target/Substrate and Source	Primary Product Produced
Phytases	Phytic acid from all plant ingredients	P, inositol
Proteases	Protein from plant and animal ingredients	Amino acids, peptides
Amylases	Starch from cereals	Glucose (energy)
Xylanases	Arabinoxylan from cereals (corn, wheat, etc.)	Xylo-oligomers
Glucanases	Glucans mainly from cereals	B-linked ologosaccharides
Pectinases	Pectins from leguminous ingredients (SBM, canola, beans, etc.)	Galacturonic acids and others
Galactosidases	Oligosaccharides in leguminous ingredients	Galactose, sucrose, others
Cellulases	Cellulose in all plant ingredients	Oligomers and glucose
Debranching enzymes	Ancillary components attached to NSPs in plants	Improved NSP enzyme efficacy

Feed Enzymes Can Have Primary and Secondary Nutritional Uplifts

Enzyme	P	Ca	Trace Minerals	Energy	Amino Acids
Phytases	1	2	2	2	2
NSP Enzymes				1	2
Proteases				2	1
Amylases				1	

1 = Primary Effect
2 = Secondary Effect