OPPORTUNITIES FOR MUSTARD

SASKMUSTARD AGM
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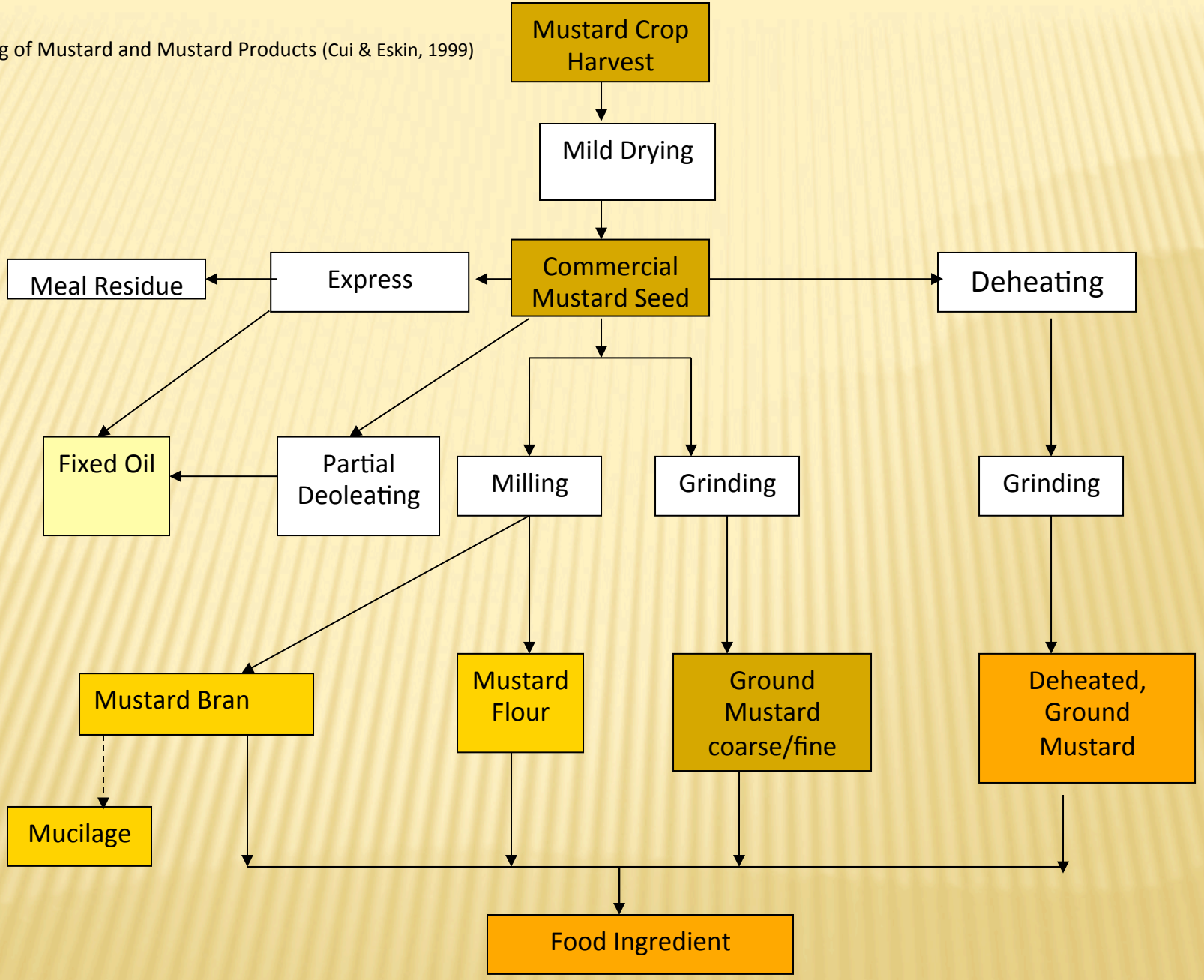
The Pathfinders Research & Management Ltd

OUTLINE

- Report commissioned by SMDC
  - Scientific literature review of current research on
    - Protein
    - Mucilage (hydrocolloid)
    - Bioactives (glucosinolates, phenolics)
    - Specific Properties: antimicrobial, antioxidant, therapeutic
  - Research & commercialization opportunities

Photos courtesy of SMDC

Processing of Mustard and Mustard Products (Cui & Eskin, 1999)











Photos: GS Dunn (www.gsdunn.com)

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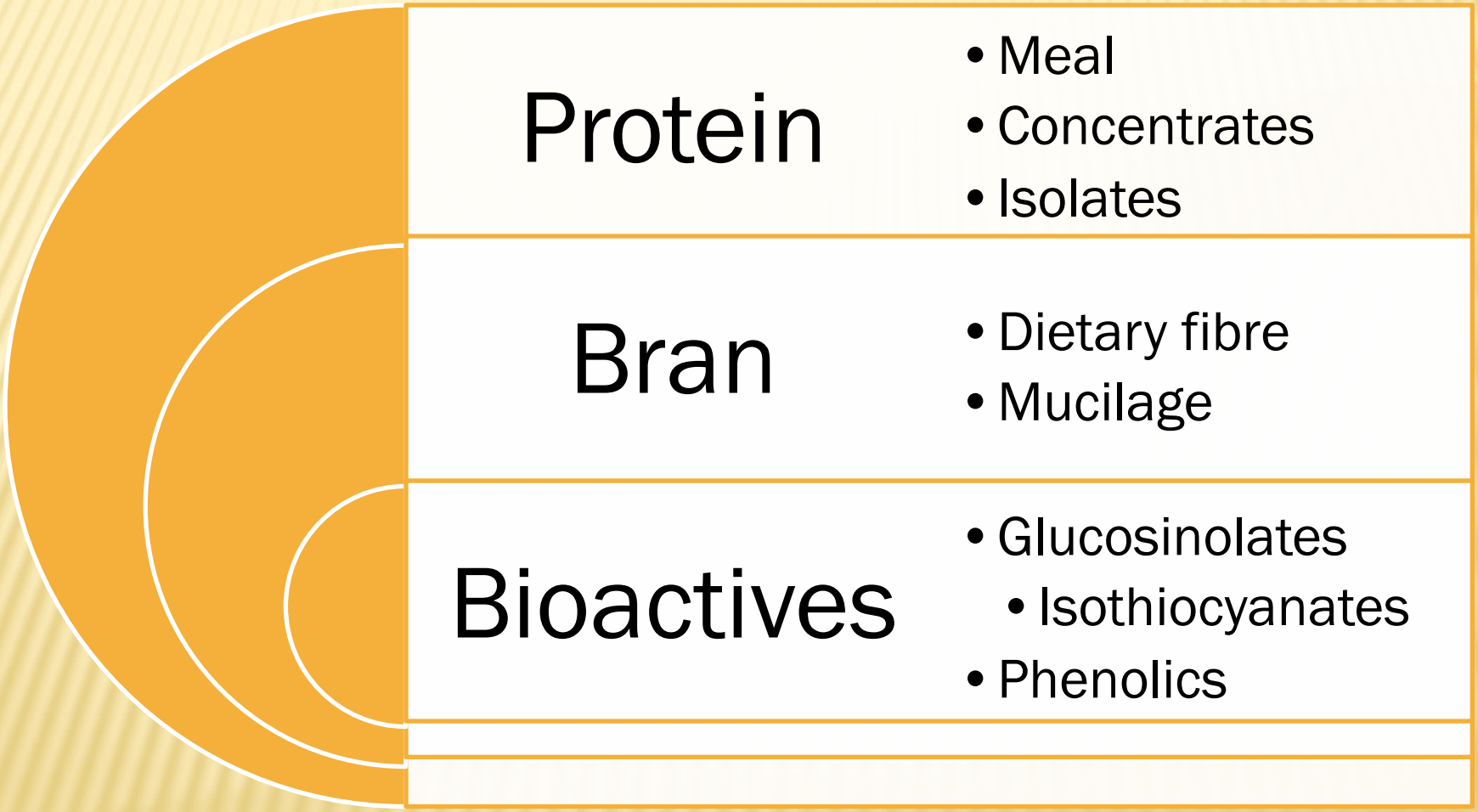
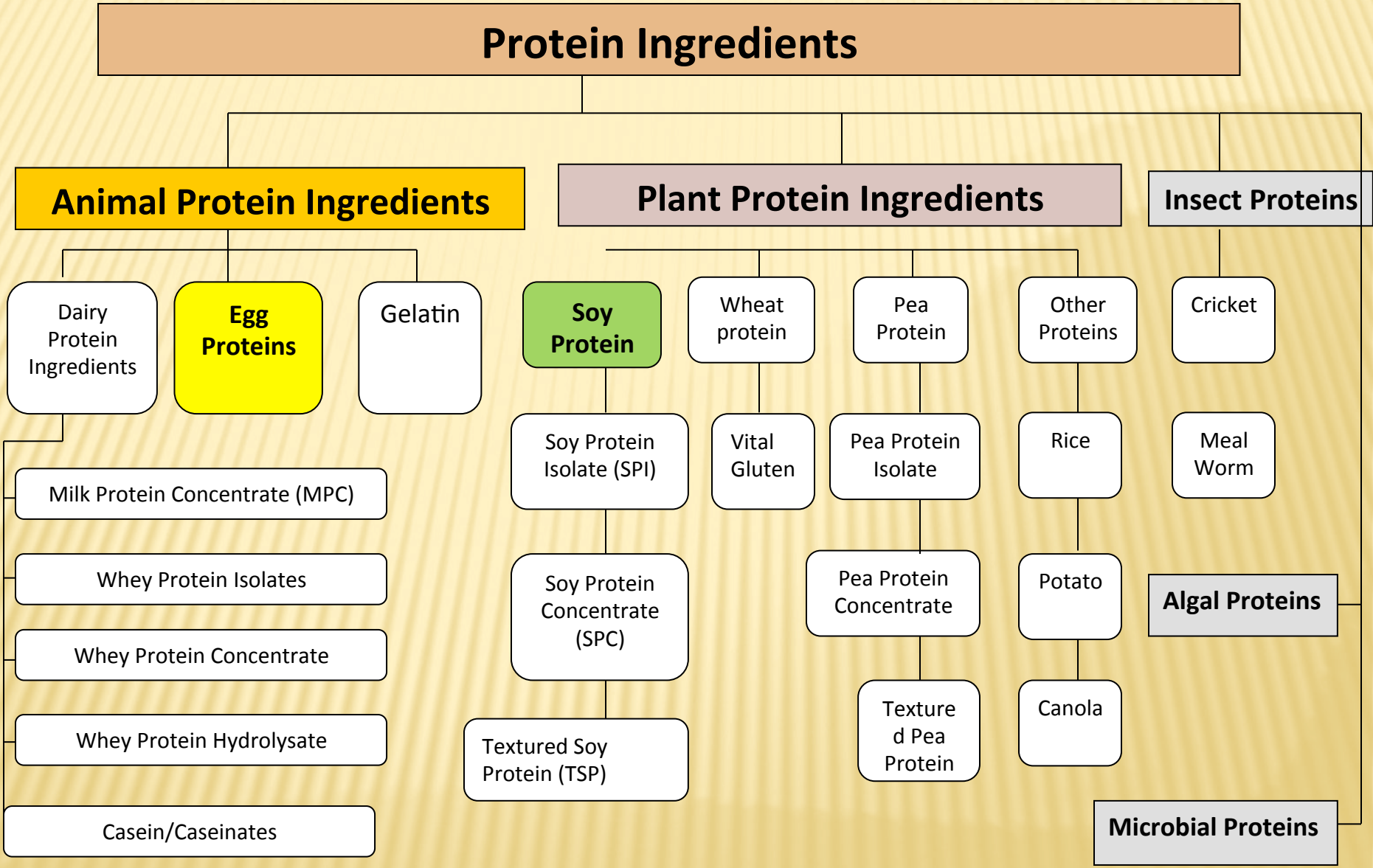
BEYOND THE FLOUR

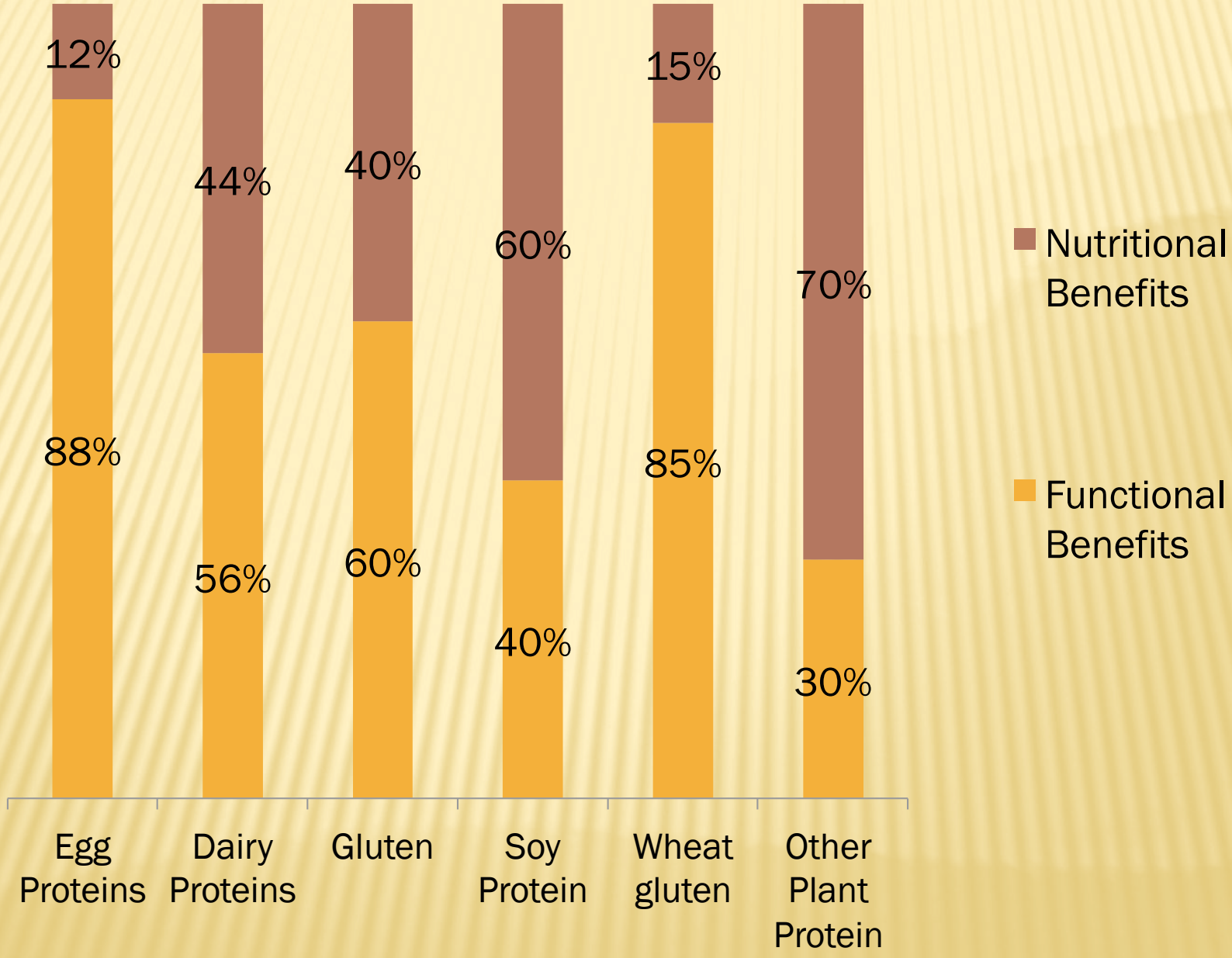


PROTEIN-WHY?

- Consumer driven
- Increasing interest in plant proteins
- Shift from sports nutrition to infant nutrition to healthy aging
- Allergenicity should not be an issue
- Understanding protein behavior is critical



Modified from Frost & Sullivan presentation: 2013 Protein Trends & Technologies Seminar
http://www.globalfoodforums.com/wp-content/uploads/2013PTT-Strategic-Insights-into-the-Global-Protein-Ingredient-Market-C.Shanahan.pdf



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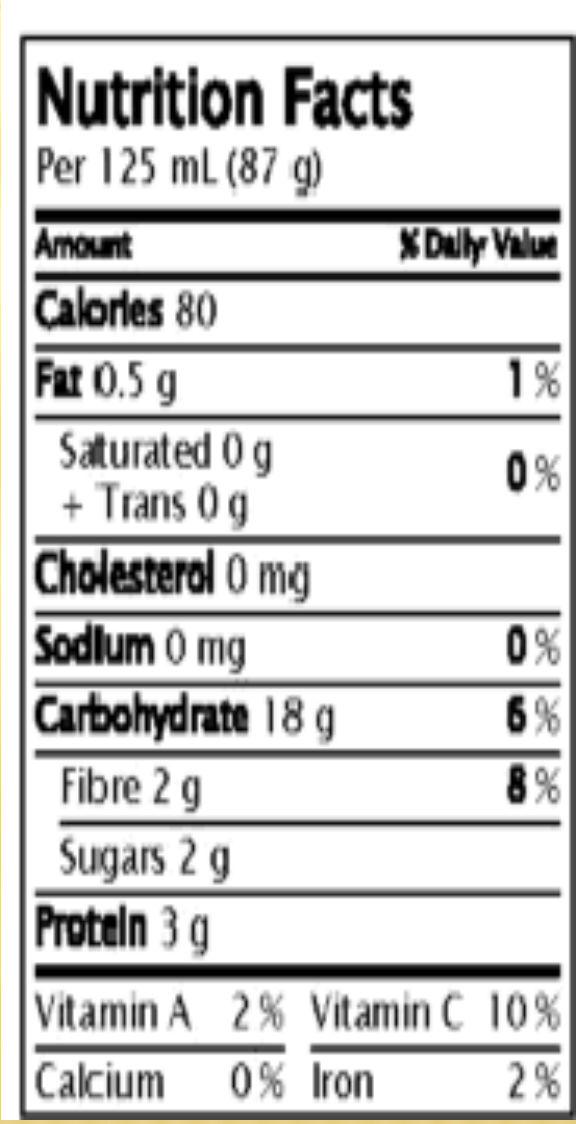
RESEARCH NEEDED-PROTEINS

Properties	
Functional	Characterization and understanding of protein properties and interactions Protein modification and behaviour Applications
Nutritional	Protein quality (bioavailability, digestibility) Protein complementation Anti-nutritional factors (ITC) Dietary exposure
Processing	Optimization & scale up of extraction, isolation and purification processes to enhance functionality
Safety	Allergenicity Microbial Organic/inorganic contaminants Toxicology
Health Benefits	Evidence to support nutritional and health benefits

MUSTARD BRAN AS A DIETARY FIBER

- Important component of diet- insufficient consumption
- Beneficial effects: less prone to obesity, stroke, hypertension
- Companies focusing on DF as way to market products and brands

- For manufacturer: DF designation could permit inclusion of mustard bran as part of the DF calculation in Nutrient Facts table



Nutrition Facts

Per 125 mL (87 g)

Amount	% Daily Value
Calories 80	
Fat 0.5 g	1 %
Saturated 0 g + Trans 0 g	0 %
Cholesterol 0 mg	
Sodium 0 mg	0 %
Carbohydrate 18 g	6 %
Fibre 2 g	8 %
Sugars 2 g	
Protein 3 g	

Vitamin A	2 %	Vitamin C	10 %
Calcium	0 %	Iron	2 %

DIETARY FIBRE DESIGNATION -REQUIREMENTS

Properties	
Usage	•Prove a history of significant safe use (in Canada)
Composition	•Origin and physical form •Method of manufacture •Potential applications and levels of intended use in products
Physico-chemical specifications	•Nutrient composition (DF-total and constituent), protein, crude fat, carbohydrate, ash, energy value, vitamins, minerals nutrients •Properties: particle size, hydratability etc •Chemical analyses: natural toxins, ANF, pesticides, solvent residues •Functional properties in foods

DIETARY FIBRE DESIGNATION -REQUIREMENTS

Properties	
Physiological efficacy	•In typical end-products, same form, levels relevant to products intended for sale •Animal experiments : *in vivo* properties •Clinical studies: to investigate one or more physiological effects
4 Possible Effects Permitted	•Improves laxation or regulatory by increasing stool bulk •Reduces blood total and/or low-density lipoprotein cholesterol levels •Reduces post-prandial blood glucose and/or insulin levels •Provides energy-yielding metabolites through colonic fermentation

YELLOW MUSTARD AS SOURCE OF MUCILAGE GUM

Potential opportunities within the hydrocolloid market

- Mucilage gives YM its thickening, water binding & emulsifying properties
- Water soluble mucilage potential competitor with xanthan gum
- Synergisms with galactomannan gums (LBH, GG)
- Unique chemical, structural, rheological and emulsification properties; potential antioxidant properties

RESEARCH NEEDED-YMM

Properties	
Functional	Mucilage molecular properties, modes of action, Effects of chemical or enzymatic modifications Interactions between YMM and other food components Specific food applications Effects on food quality, shelf life, replacement of synthetic antioxidants
Processing	Optimization & scale up of extraction, isolation and purification processes to enhance functionality
Safety	Allergenicity Microbial Organic/inorganic contaminants Toxicology
Health Benefits	Evidence to support nutritional and health benefits •Dietary fibre

BIOACTIVES

- Glucosinolates & degradation products : isothiocyanates (ITC)
  - 2° plant metabolite
  - Appears to have anticancer, antimicrobial and antioxidant activities
- Phenolics: antimicrobial & antioxidant properties

ANTIMICROBIAL ACTIVITY OF ITC

- Growing interest in use of natural plant products as antimicrobial agents
- Contribute to “clean” label with easily pronounceable names

ANTIMICROBIAL ACTIVITY OF MUSTARD

- Effective dose/exposure time
- Food: fermented sausage, dry cured ham, chicken, beef patties
- Food pathogens
- Mechanisms of delivery-microencapsulation/food films
- Endogenous formation of ITC
- Mechanism of action of ITC
- Effect of autoclaving on mustard meal and antimicrobial activity
- Sensory effects and consumer acceptance

ANTIMICROBIAL ACTIVITY-FUTURE WORK

- Better understanding of antimicrobial mechanisms
- Enhance antimicrobial efficacy: e.g. processing, encapsulation, packaging
- Interaction ITC in foods & stability
- Food formulations and consumer acceptance
- Regulatory approval (depending upon ITC form)
- Validation methods; testing on virulent food pathogens

HEALTH /THERAPEUTIC BENEFITS

Research Agency	Researcher	Research Focus
UofGuelph	Duncan/Wright	Yellow mustard mucilage as dietary fibre (human)
Oxford, UK	Lett	YMM and glycemic response/satiety (human)
Dehli, India	Yadav	Mustard bran and insulin resistance (rat model)
UofManitoba	Eskin	YMM and anticancer activities (rat model)
International	Many researchers	Glucosinolates/ITC and anticancer, anti-inflammatory, antimicrobial, antioxidant and wound healing.

NON-FOOD APPLICATION-BIOFUMIGANT

- Viable alternative to chemical pesticides
  - Cover crop & green manure in vegetable and green house production systems
  - Turf applications
  - Seed meals (liquid or granular form)-*B. juncea*
    - Pre-plant soil treatment for soil-borne nematodes and diseases
    - Organic production opportunities
    - Registered as fertilizer, turf product and pre-crop soil fumigant

RECOMMENDATIONS

- Protein
- Dietary Fibre designation
- Antimicrobial activity-stabilization of ITC and incorporation into food matrices/packaging

CRITICAL SUCCESS FACTORS

- Engaging/partnering with MNE
- Regulatory approvals (if needed)
- Sound scientific evidence of efficacy, consumer acceptance, cost and value
- Uses for all mustard co-products
- Continued support of mustard industry (producers, ingredient suppliers, food manufacturers)

THANK YOU

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