

Nutrition and Functionality, an Integrated Approach in Developing Countries

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Solae

Solae[™]

Innovation through Nature



Agenda

- ***Solae***
- ***Soy and Nutrition***
- ***Protein Quality – Health Claims***
- ***Soy Protein Isolate- Functionality***
- ***Product Development Examples***

Solae at a Glance

- Annual Revenues: ~\$1.2 Billion
- 3,000 Global Employees
- >3,000 Customers in More Than 80 Countries
- Solae® Consumer Ingredient Brand
- Regional Headquarters:
 - St. Louis, MO
 - Sao Paulo, Brazil
 - Hong Kong, China
 - Geneva, Switzerland
- Technology Centers:
 - St. Louis, MO
 - Aarhus, Denmark
 - Esteio, Brazil
 - Moscow, Russia
 - Luoyang, China

Global Facilities



Core Applications

- Nutrition Bars
- RTD(Ready to Drink), Powdered Beverages
- Meat, Poultry, Seafood
- Meat Alternatives
- Baked Goods
- Extruded, Baked Snacks
- RTE & Hot Cereals
- Pasta
- Dairy Alternatives
- Infant Formula
- Clinical Nutrition



Institutionalized food solutions

- HIV/AIDS
- School feeding schemes
- High calorie food solutions

Solae - The soya proteins of science

<u>Research Topic</u>	<u>No of Studies</u>
● Heart Disease	110
● Women's Health	96
● Cancer	83
● Other	105



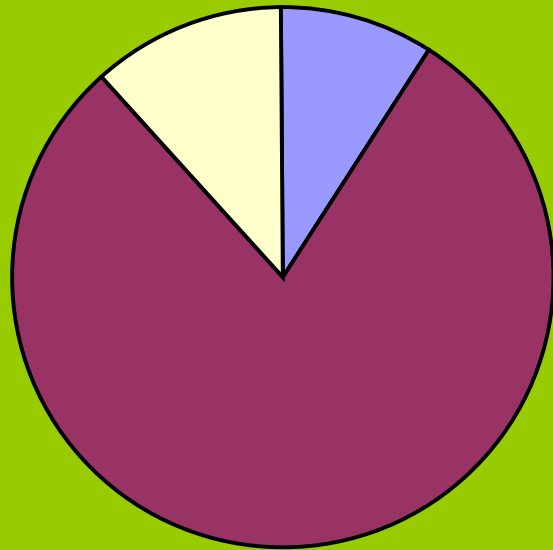
Nutrition Science Scope

- 243 Publications
- 184 Universities and Institutions

Clinical studies on soy products

- Cholesterol lowering (studies since 1997)

— Number of studies = 43



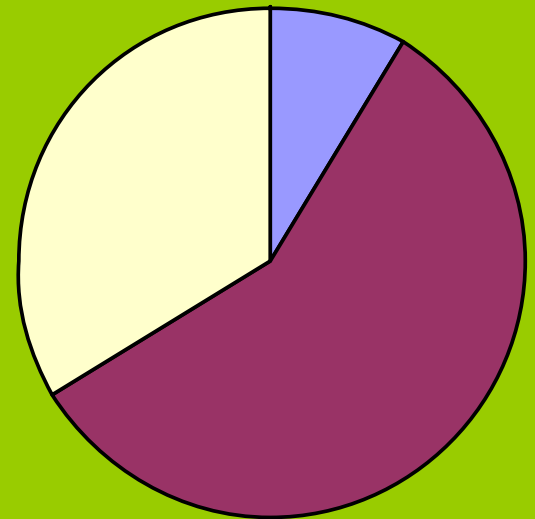
■ WBE / soyfoods

■ ISP

■ Other
(Isoflavones,
Epidemiological)

- All studies on heart, bone and women's health

— Number of studies = 112



- There are over 250 publications using Solae soy protein ingredients.
- The Solae Company encourages well controlled clinical research studies.
- This information is based on studies known and reviewed by Solae up until December 2003







NATIONAL

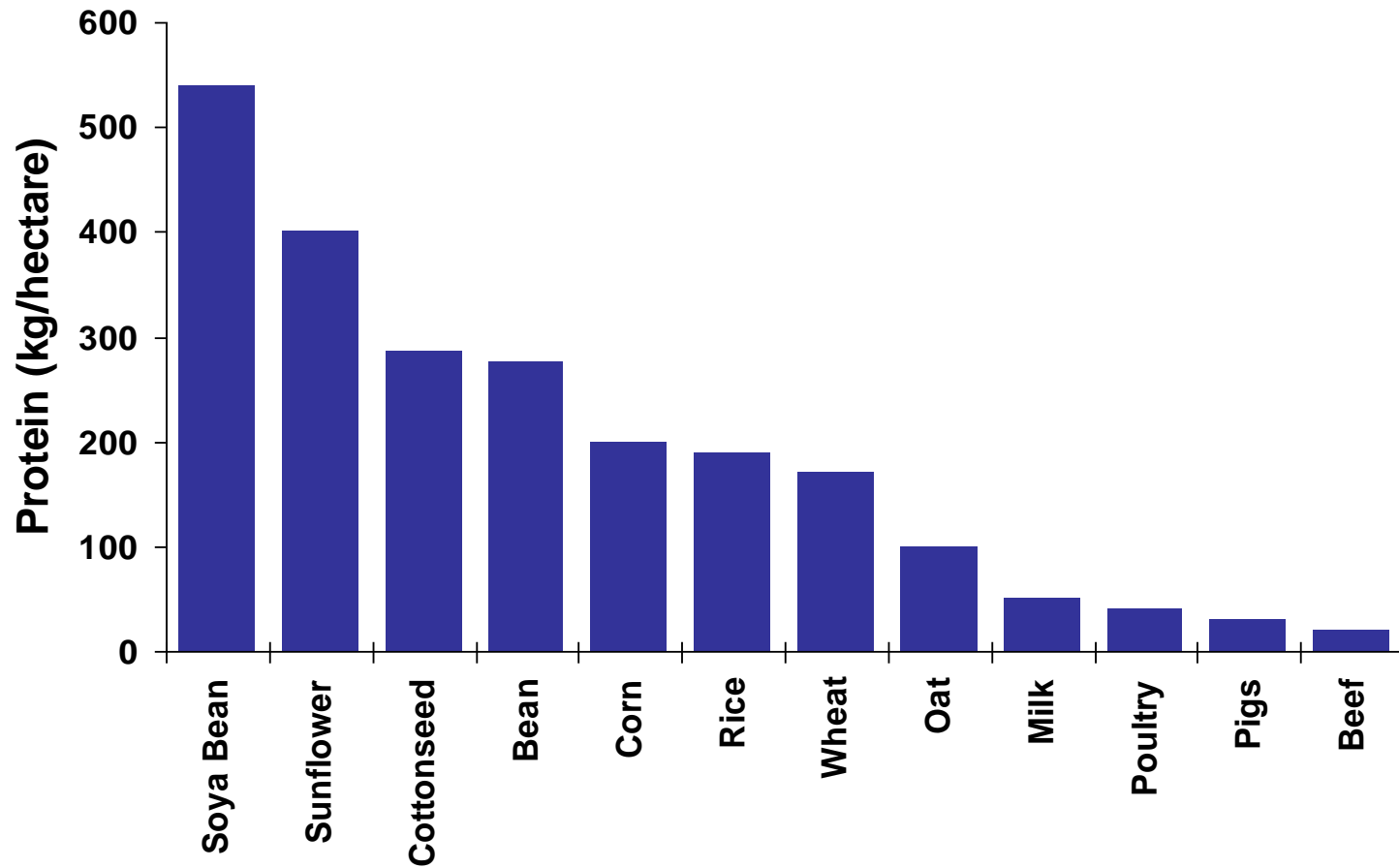
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0123

TELL A
FIND

OSTCM

The high yielding protein source



Soy Composition

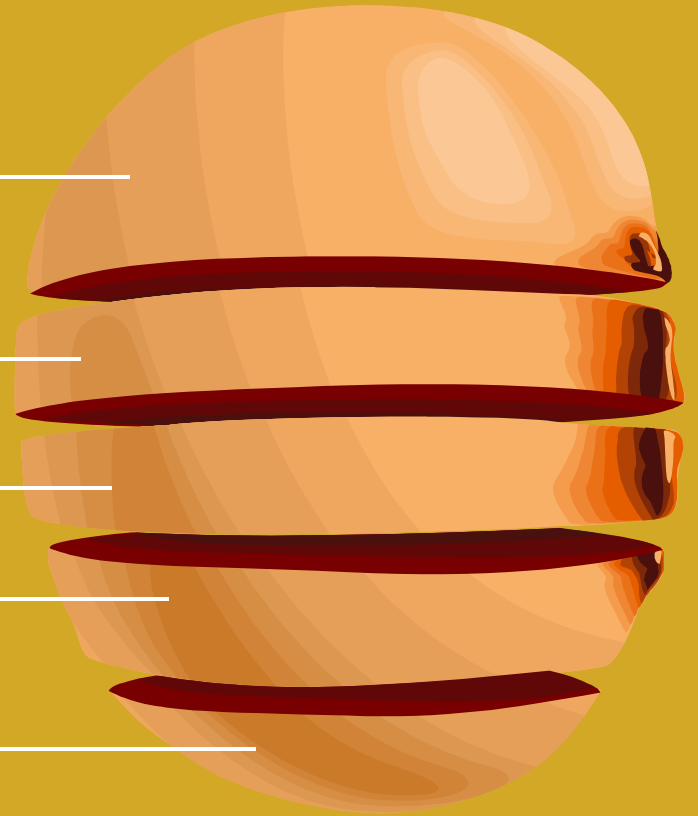
36% Protein

15% Soluble Carbohydrates
(Sucrose, stachyose, raffinose, others)

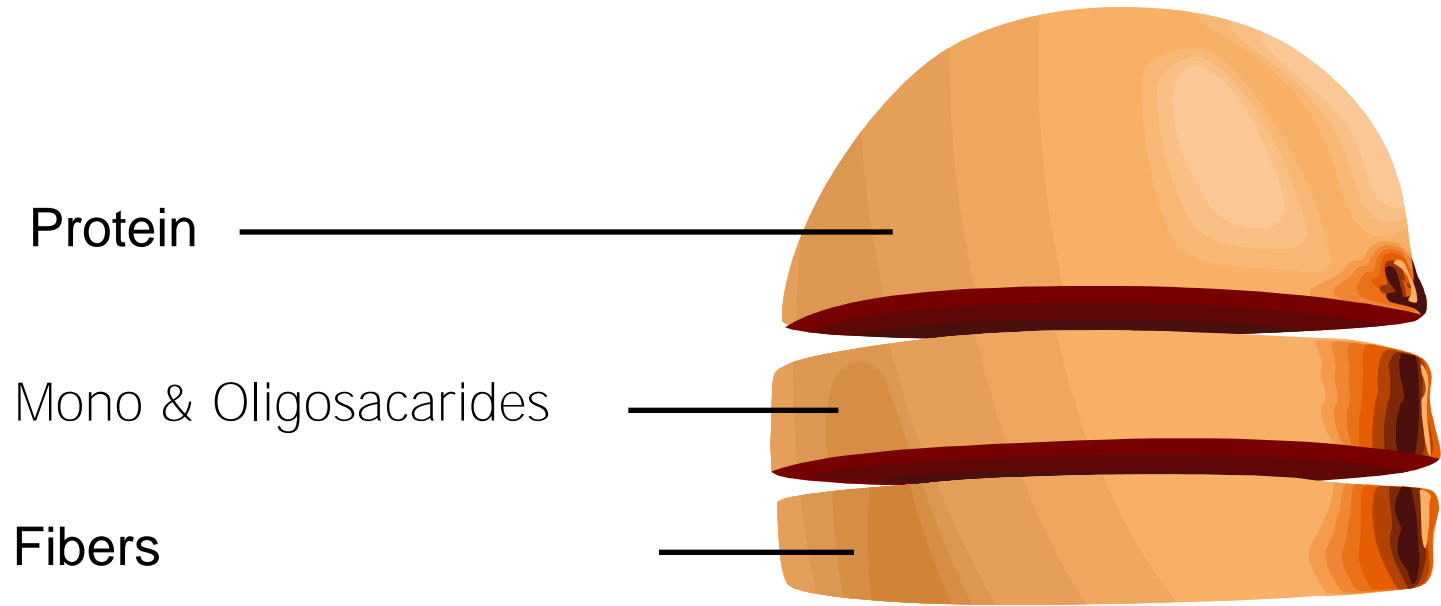
15% Insoluble Carbohydrates
(Dietary fiber)

18% Oil
(0.3% Lecithin)

16% Other



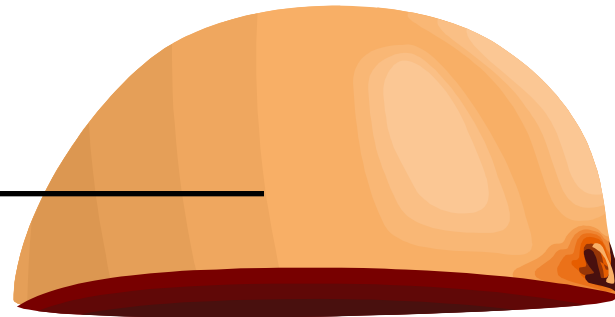
Deffated Soy Flour



>50% protein
(Dry Basis)

Soy Protein Concentrate

Protein



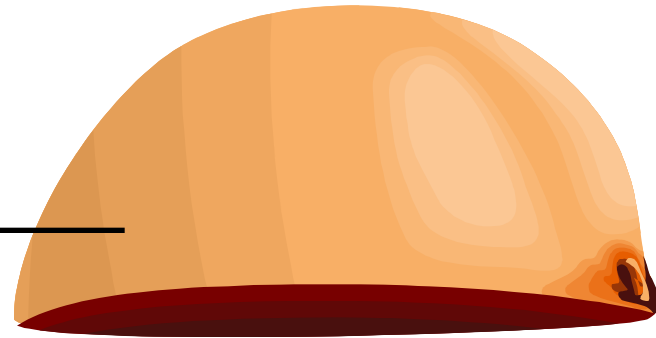
Fibers



~70% protein
(Dry basis)

Soy Protein Isolate

Protein



~90% protein
(Dry Basis)

Physical forms

- Spray dried powders



- 90% protein
- Solubility
- Water absorption
- Particle size
- Density
- Viscosity
- Dispersibility

- Textured proteins



- 50-70% protein
- Flavour
- Colour
- Texture
- Dimensions
- Composition

- Nuggets



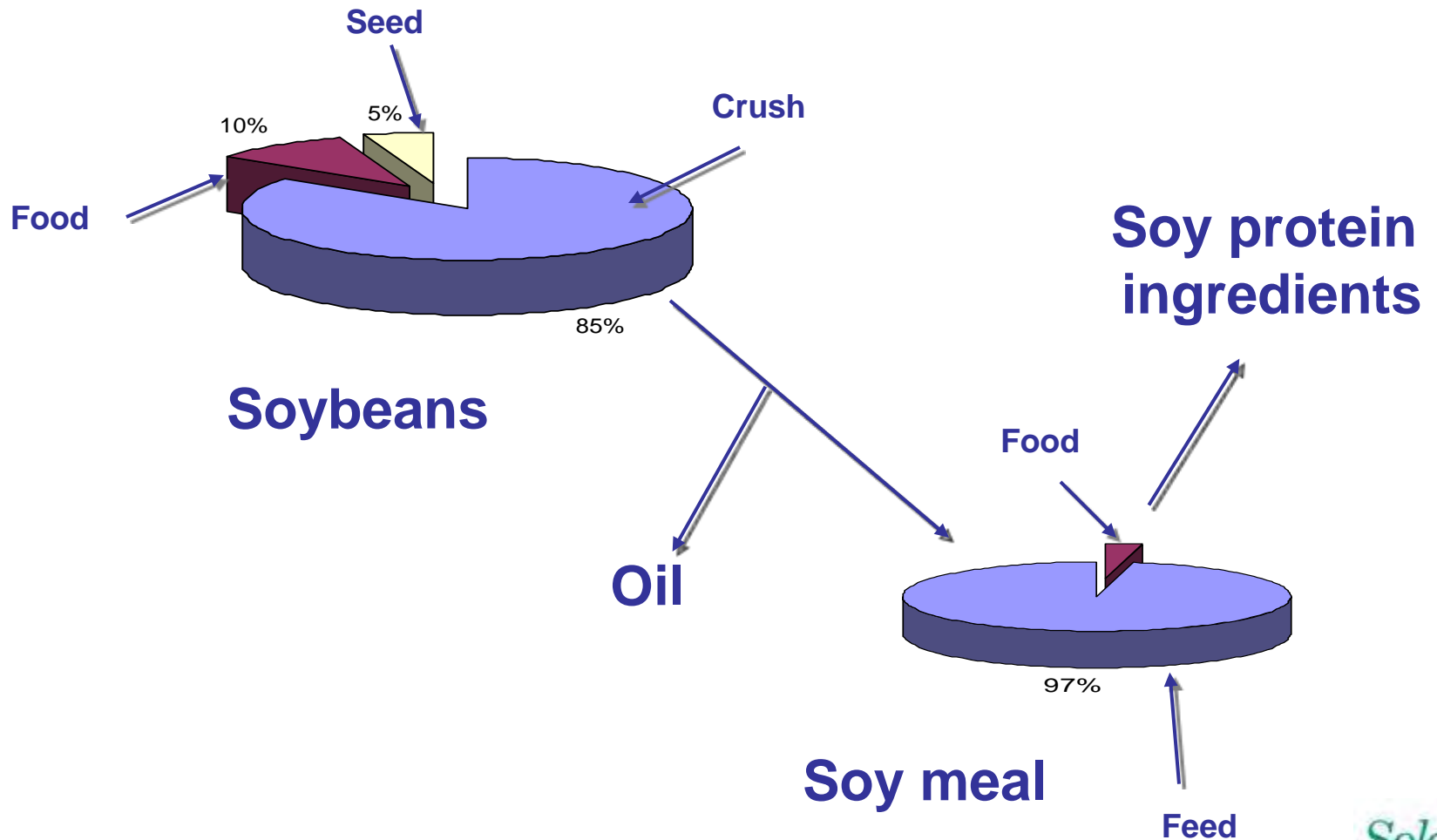
- 60-80% protein
- Dimensions
- Texture / crispiness
- Resiliancy
- Composition

General Standard for soy protein products (Codex Alimentarius STAN 175-1989)

Protein on dry matter, excluding vitamins, minerals and additives

Soya Protein Flour	min 50%	max 65%
Soya Protein Concentrate	min 65%	Max 90%
Soya Protein Isolate	min. 90%	

Soybeans in the human food chain



Health claims - US

FDA October 1999

“25 grams of soy protein a day, as part of a diet low in saturated fat and cholesterol, may **reduce the risk of heart disease**. A serving of (name of food) supplies (xx) grams of soy protein.”

Health claims - UK

JHCI July 2002

“The inclusion of at least 25g of soya protein per day, as part of a diet low in saturated fat, can help **reduce blood cholesterol levels**.”.

Nutrition

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Protein basics

- Protein consists of amino acids (“building blocks”)
- There are 20 amino acids
- Amino acids can be classified as –
 - ┆ Indispensable (essential)
 - ┆ Dispensable (non-essential)
 - ┆ Conditionally indispensable (conditionally essential)
- ┆ Also by their physical & chemical structure
 - ┆ Eg “branched chain amino acids”

Role of Protein

- Major structural component of cells
- Component of hemoglobin, enzymes and many hormones
- Component of antibodies for disease protection
- Used as an energy source in certain circumstances

Role of Soy Protein

- Nutrition

Goals

- Supports growth and development
- Maintenance of body tissue

Functions

- Formation and maintenance of muscle and nerve tissue
- Formation and maintenance of bone matrix, body fluids and secretion

- Functionality
- Economics

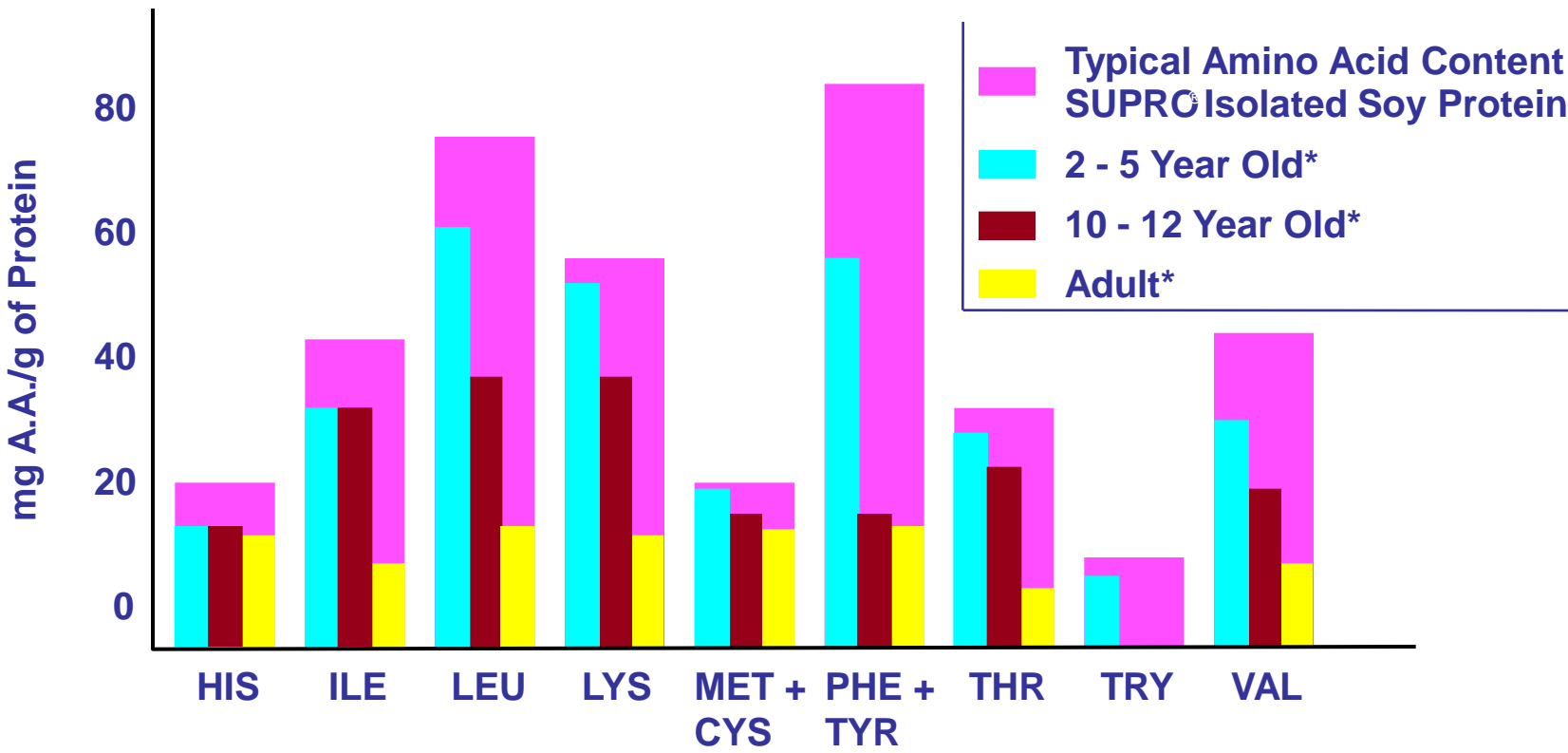
Measuring protein quality

- Protein Digestibility-Corrected Amino Acid Score (PDCAAS) is best method for determining protein quality ¹
- Recommended for regulatory purposes by recognized international organizations – Food and Agricultural Organization / World Health Organization (FAO / WHO) ²
- PDCAAS based on human amino acid requirements
- Factors used in calculating PDCAAS include –
 - Essential amino acid content
 - Digestibility
 - Uses amino acid requirements of 2- to 5-year old child
- Highest possible score is 1.0

¹ Henley EC, Kuster JM. *Food Technology* 1994; 48:74-7

² *Protein Quality Evaluation, Report of the Joint FAO/WHO Expert Consultation*
Rome: FAO Food and Nutrition Paper No. 51, 1991

Essential amino acid requirements (FAO/WHO)



* Suggested Pattern of Requirements (FAO/WHO/UNU, 1985).



PDCAAS = smallest aa score x Digestibility

$$\text{AA Score} = \frac{\text{essencial AA(mg/g)}}{\text{Reference standard AA (mg/g)*}}$$

* **Essencial aa for children from 2 to 5 anos (FAO/WHO, 1985)**

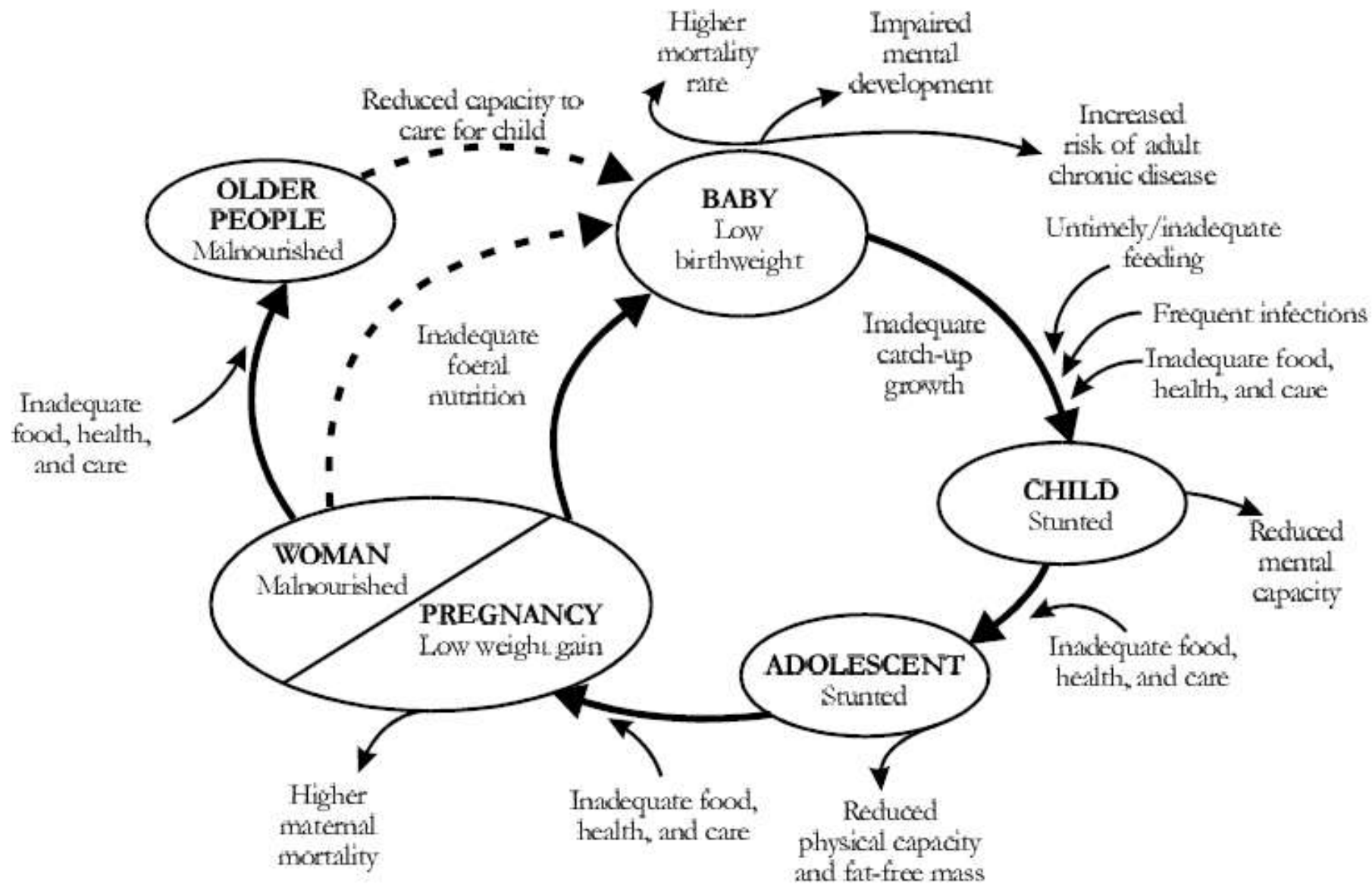
Protein Digestibility-Corrected Amino Acid Scores (PDCAAS)

Product	PDCAAS
Supro and Solae Brands isolated soya protein	1.00
Milk protein (casein)	1.00
Egg white	1.00
Skimmed milk powder	1.00
Whey protein concentrate	1.00
Beef protein	0.92
Pea flour	0.69
Wheat protein (gluten)	0.25

Protein needs of different people

	Grams protein per kg of body weight
Sedentary adult	0.8
Adult recreational exerciser	1.0 to 1.5
Competitive adult athlete	1.2 to 1.8
Growing teenage athlete	1.8 to 2.0
Adult building muscle mass	1.4 to 1.8
Athlete restricting calorie intake	1.4 to 2.0
Maximum usable amount for athletes	2.0

FIGURE 1.1 : Nutrition throughout the life cycle



Source: Prepared by Nina Seres for the ACC/SCN-appointed Commission on the Nutrition Challenges of the 21st Century.



Protein-Calorie Malnutrition

- **Kwashiorkor:** Protein deprivation
 - Mild: irritability and drowsiness
 - Moderate to severe: stunted growth, loss of lean muscle mass, lack of physical stamina, reduced immune function, increased susceptibility to infection

Milk protein allergy

- Allergy to cow's milk is reported to range between 0.3 and 7.5%.
- Clinical manifestation of hyper sensitivity to milk ranges from skin eruptions and rhinitis to anaphylaxis and death.

References

1. Bahna SL, Heiner DC (1980) Allergies to Milk. New York, NY:Grune and Stratton.
2. Goldman AS, Anderson DW, Sellers WA, Saperstein S, Kniker WT, Halpern SR. (1963) Milk allergy: oral challenge with milk and isolated milk proteins in allergic children, *Pediatrics*.32:425-443
3. Bachman KD, Dees SC (1957) Milk Allergy I: Observation on incidence and symptoms in "well" babies, *Pediatrics* 20:393-393.
4. Sampson SA, Mendelson L, Rosen JP(1992) Fatal and near fatal anaphylactic reactions to food in children and adolescents, *NEJM* 327:380-384, 421-422.

Lactose intolerance

- Lactose intolerant infants are unable to digest lactose due to an absence of lactase activity.
 - Absence of lactase can be either a permanent feature or transient due to intestinal mucosal injury.
- Lactose intolerance allows the sugar to pass into the lower intestine where bacterial fermentation can produce:
 - Diarrhea
 - Gas
 - Colic

Functionality

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Properties required from protein

- Nutritional quality
- Emulsion stability
- Suspension stability
- Viscosity
- Colour and flavour
- Solubility

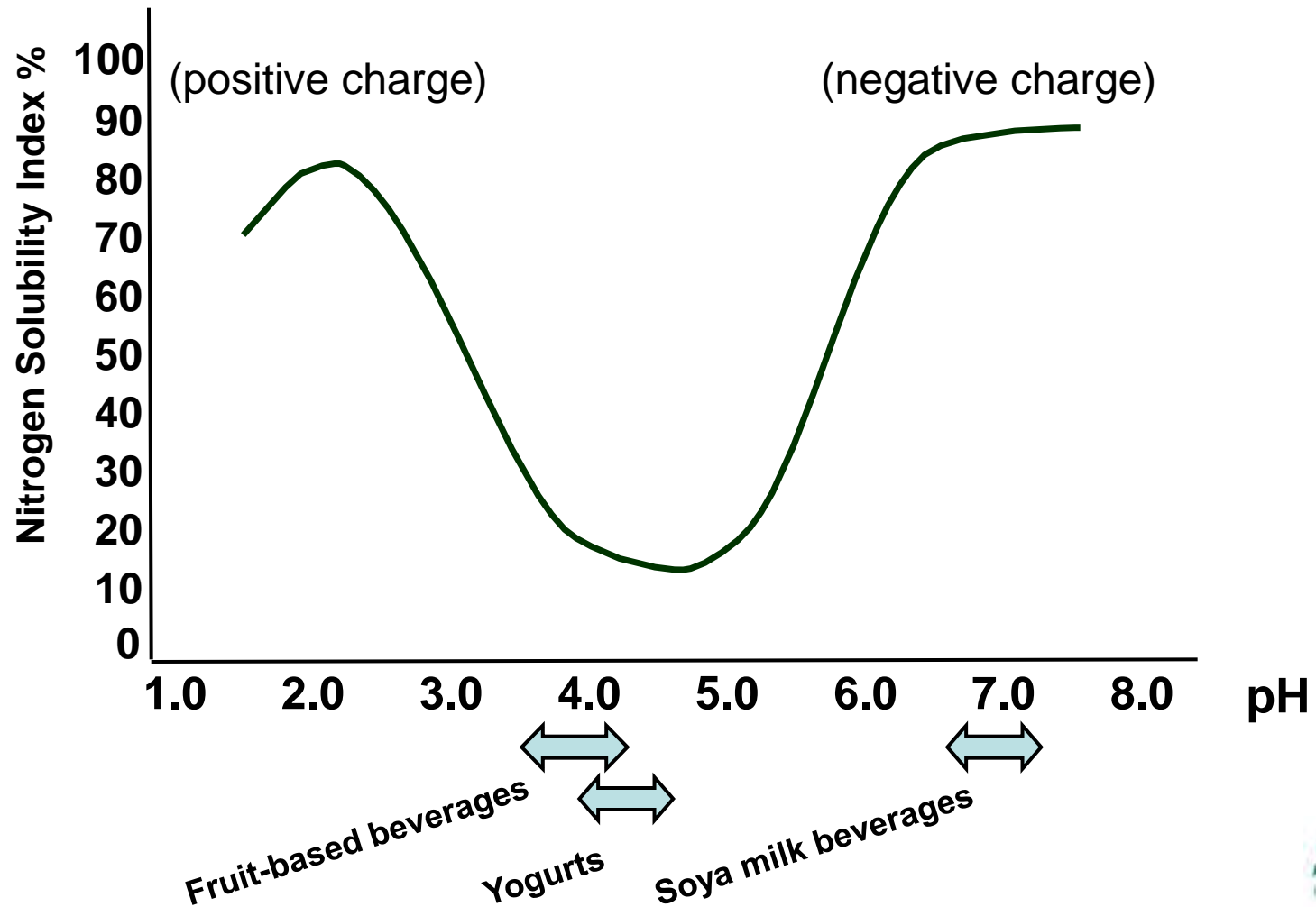
Modification of functionality through processing

- Flavour
- Texture
- Viscosity
- Solubility
- Dispersibility
- Emulsification
- Gelation
- Aeration
- Mouthfeel
- Film forming
- Stability
- Microbiological purity
- Micronutrient content

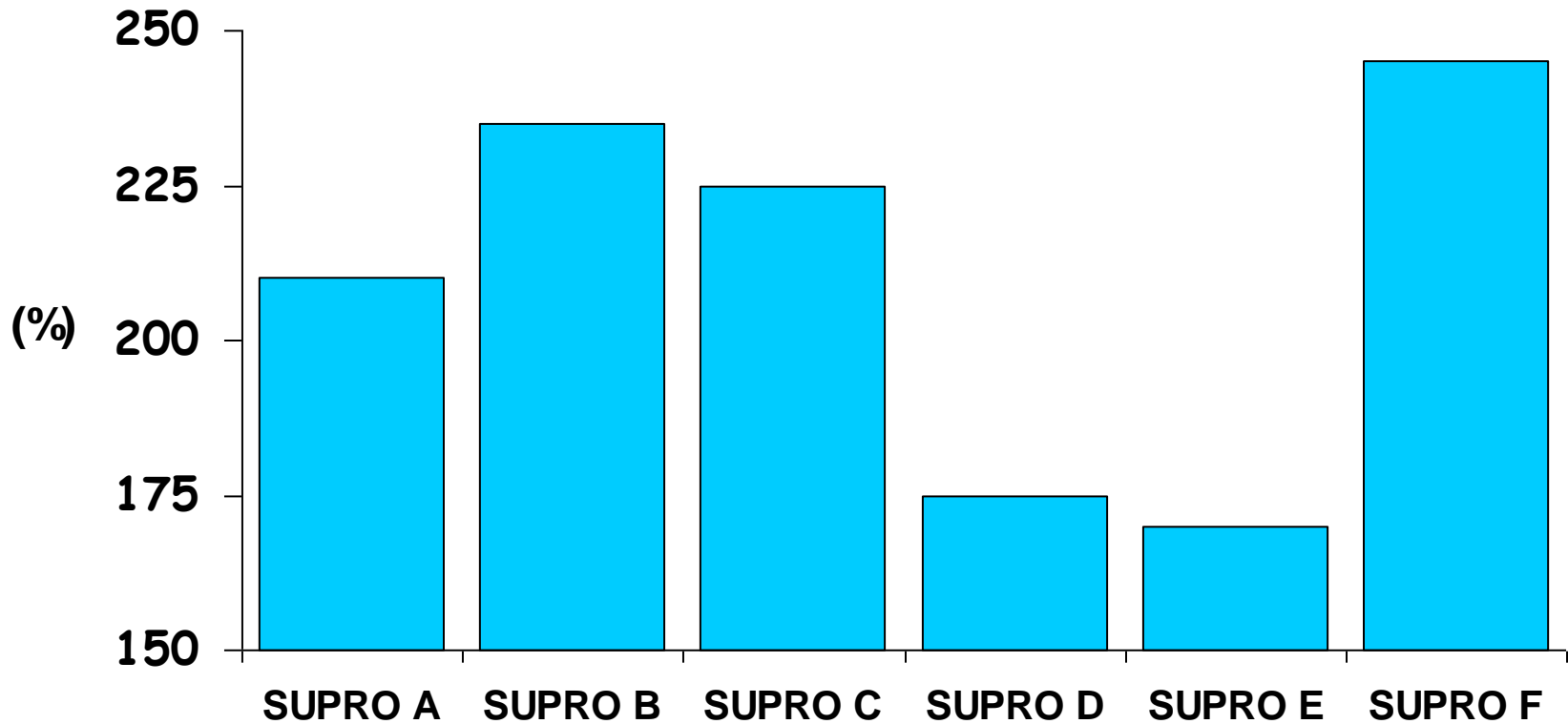


Optimised functional capabilities for different food systems

Solubility of isolated soy protein as a function of pH



Water absorption of different isolates



Examples

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LASA RTD BEVERAGES



ANDEAN



MEXICO / CAC

BRAZIL



S. CONE

