

Soybean as food material

Nutritional effect for human health and
physicochemical properties in various foods.

Tuesday 4th August 2009

Motohiko Hirotsuka

Presentation Contents

1. Profile ; FUJI OIL CO., LTD
2. Soy Food & Soy processing in Japan
3. Components in Soy bean
4. Physiological elements in Soybean &
Trends of Soy Foods
5. Summary

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FUJI OIL CO., LTD



1) Oils & Fats
Chocolate
Whipping cream products
Margarines · Shortening
Cheese material

2) Soy protein products

2-1) Soy protein
Soy protein Isolate
Textured soy protein
Soy peptide

2-2) Soy protein food
TOFU
Tofu burgers
GANMO



Hannan Business Operations Complex
(Izumisano city, Osaka, Japan)



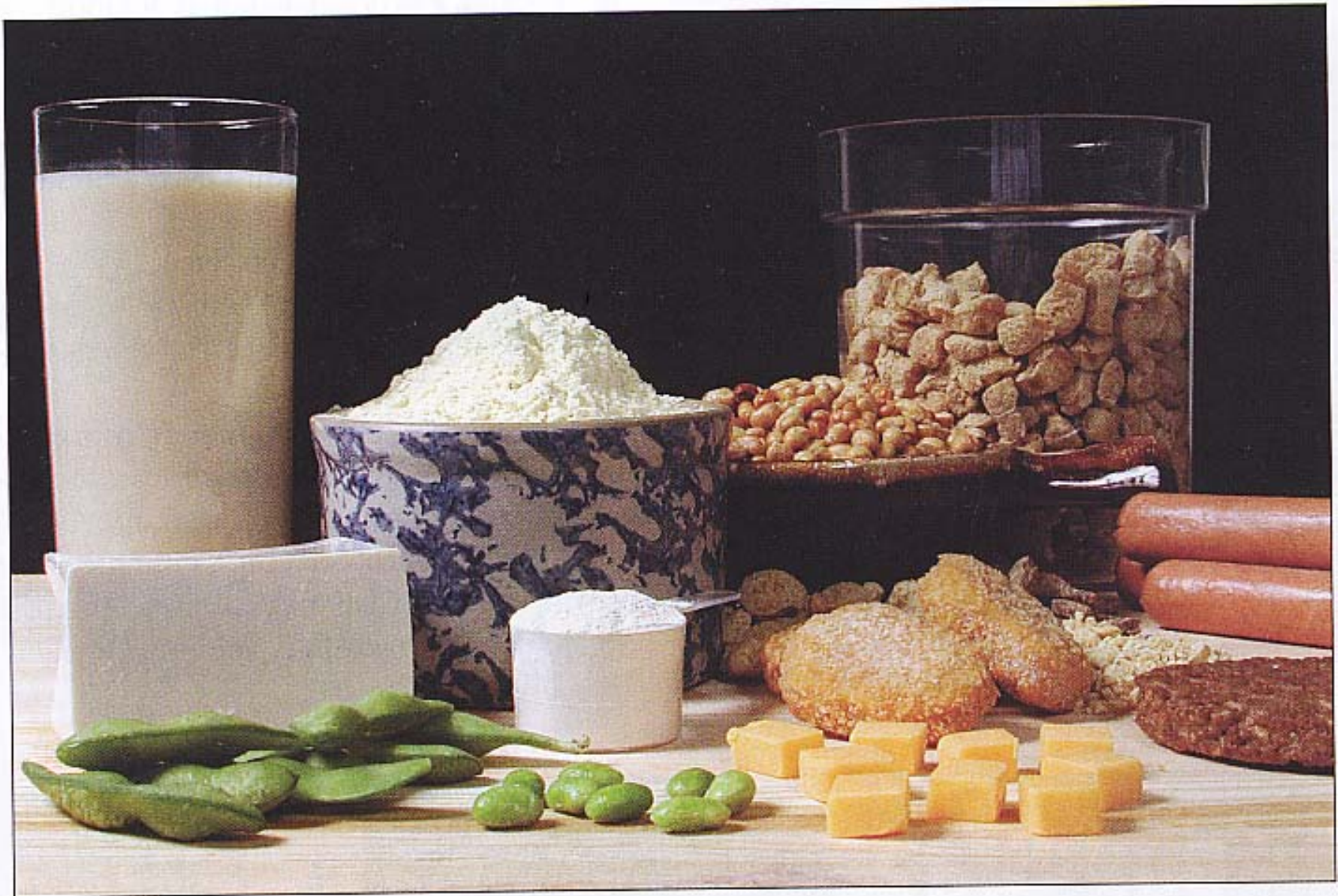
Tsukuba Research and Development Center

Food Science Research Institute

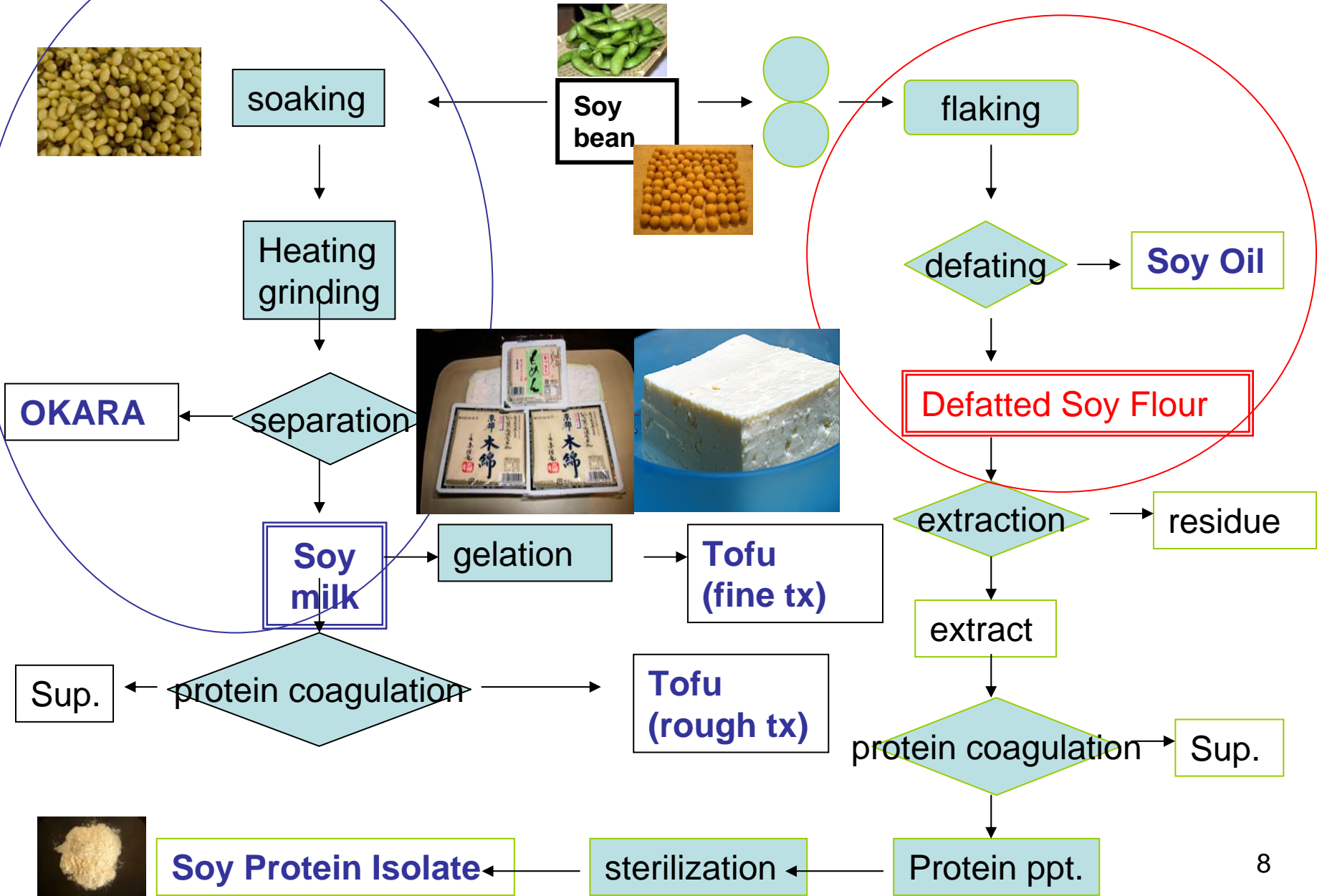
- Group 1 ; Protein**
- Group 2 ; Oil & Fat**
- Group 3 ; Saccharide**
- Group 4 ; Fermentation**
- Group 5 ; Nutrition & Human health**

Presentation Contents

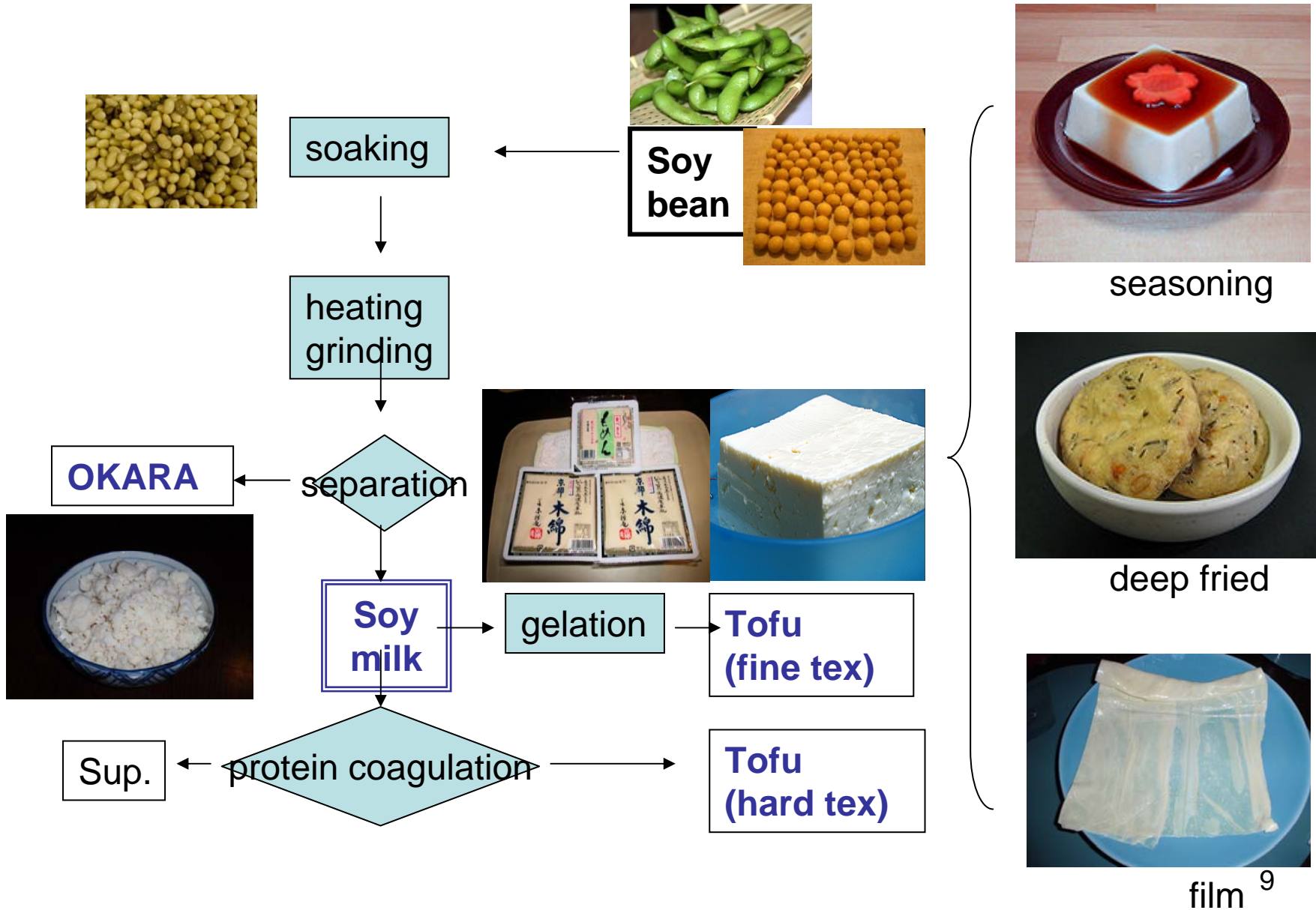
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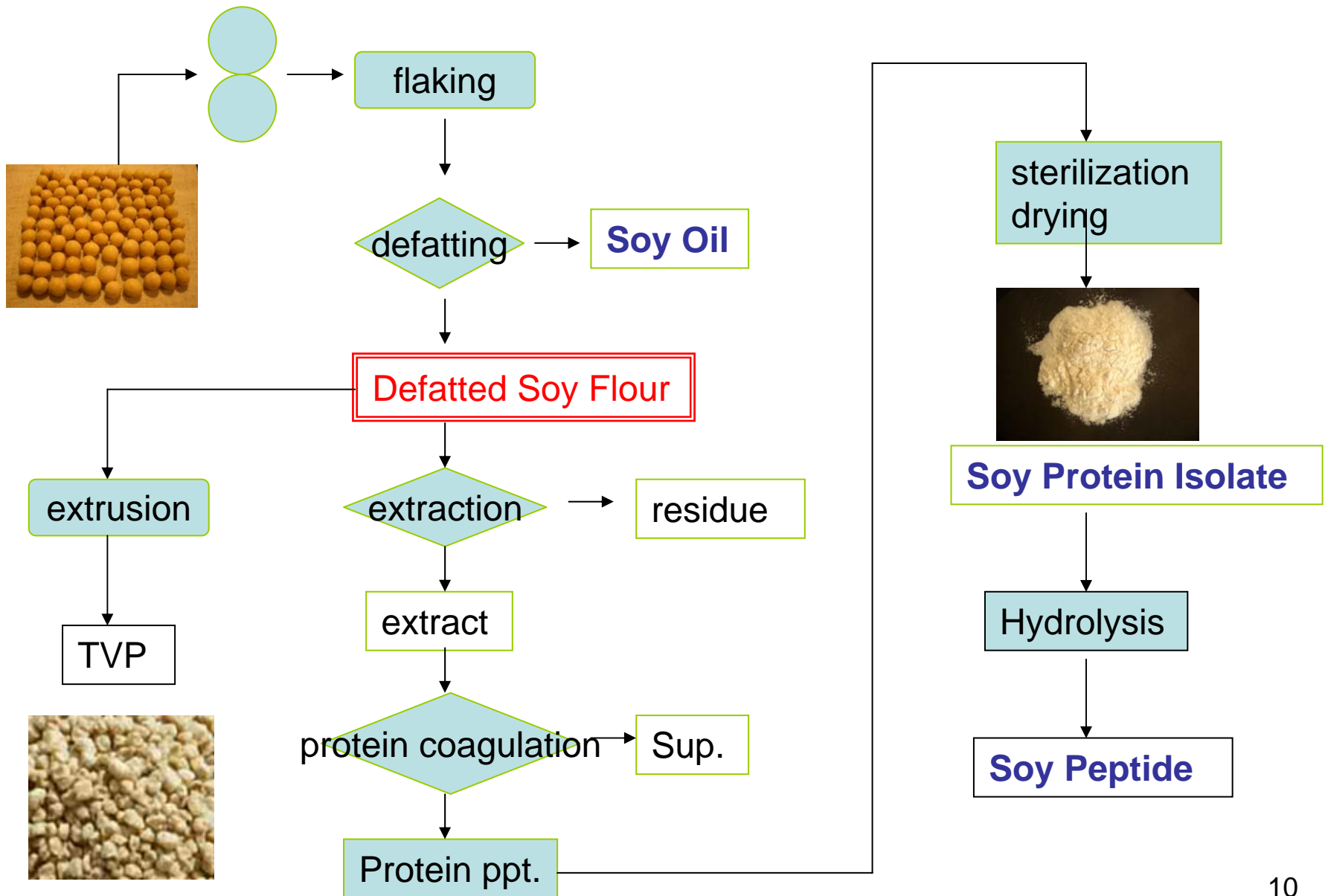
Typical processing process



Production of tofu derivative foods



Processing for Defatted soy flour



Soy Protein Ingredients & their applications



powder



grain



paste

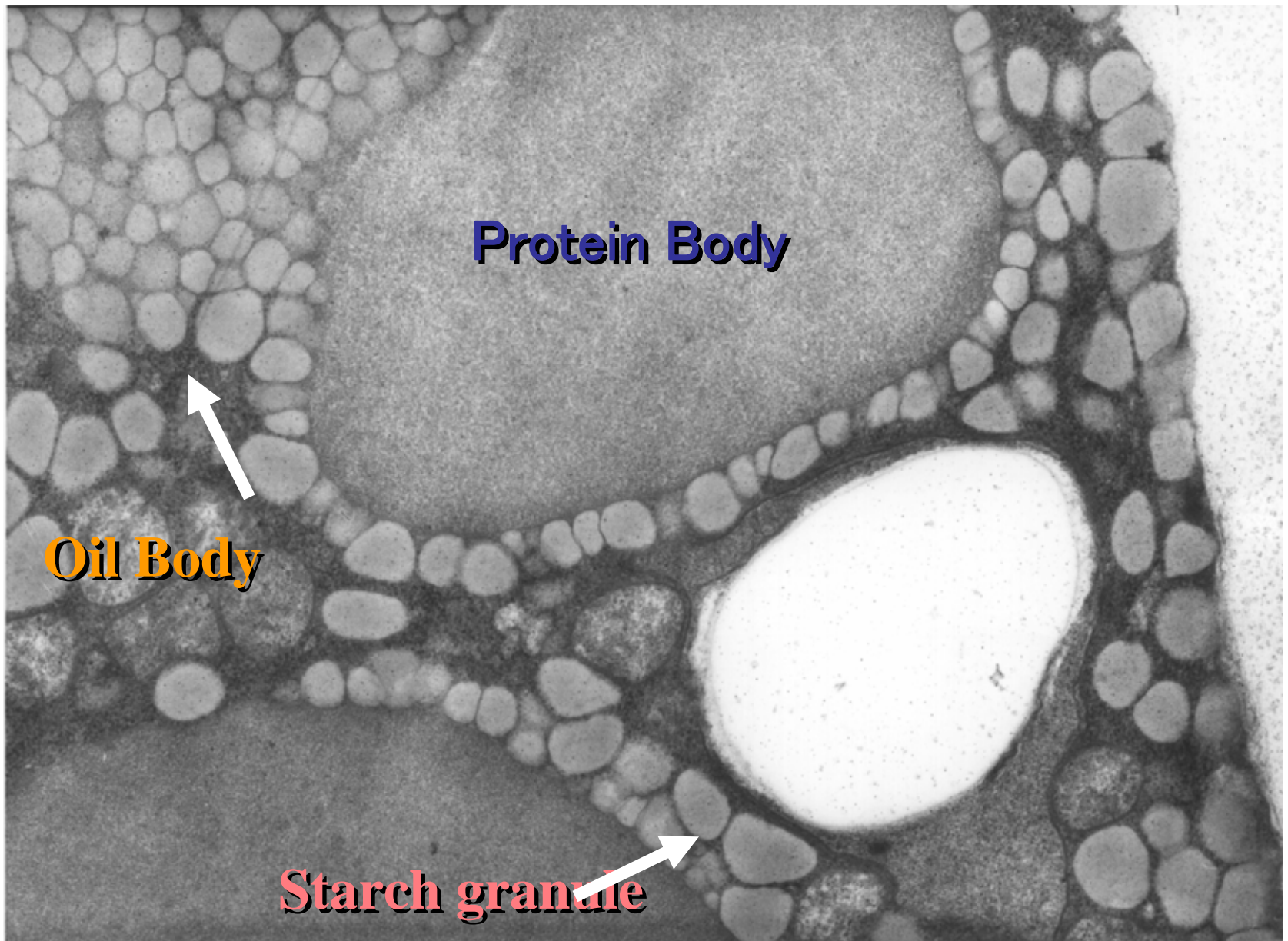


fiber



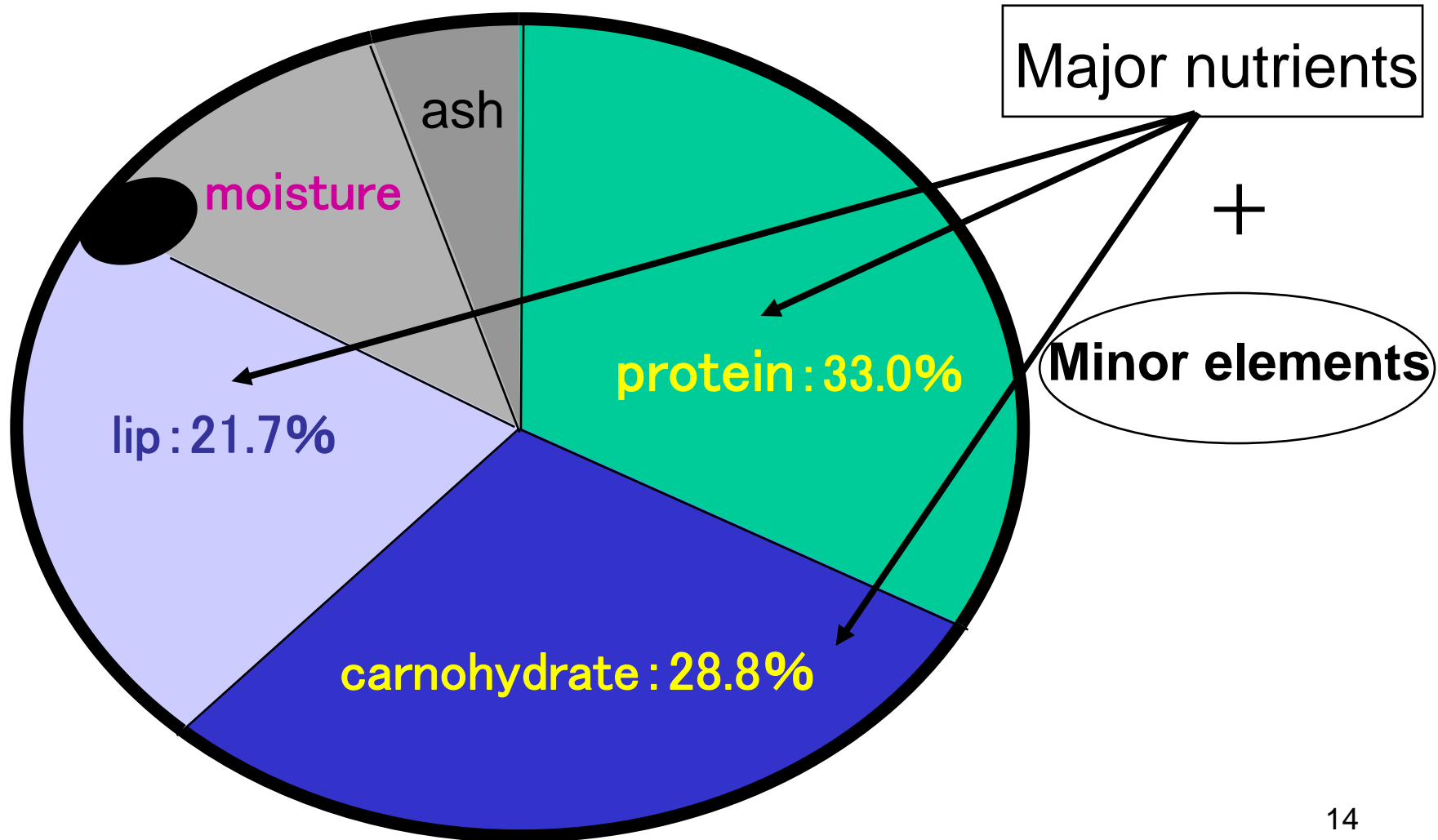
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Micro-Structure of Soybean by SEM 13

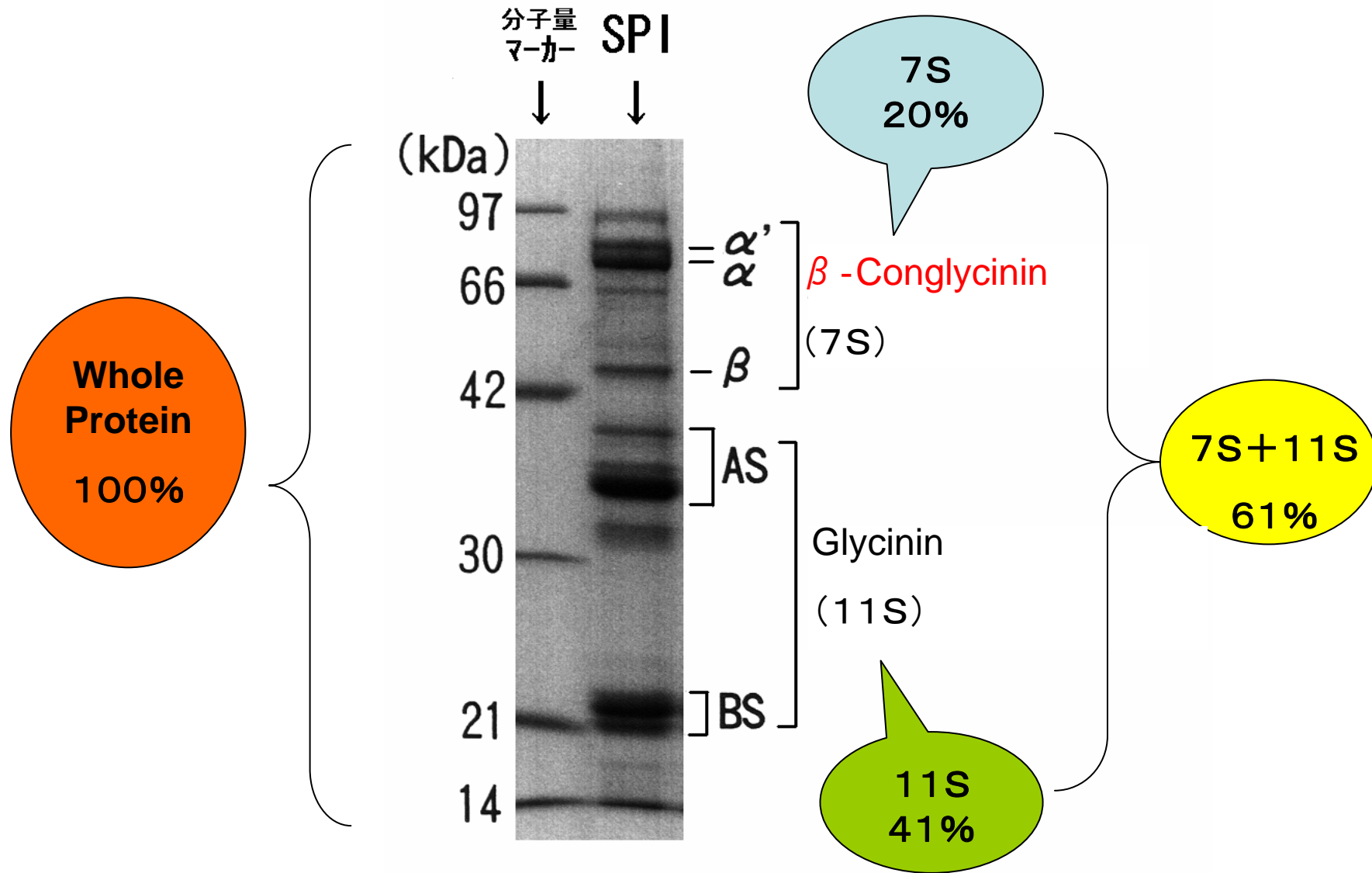
Constituents of soy bean



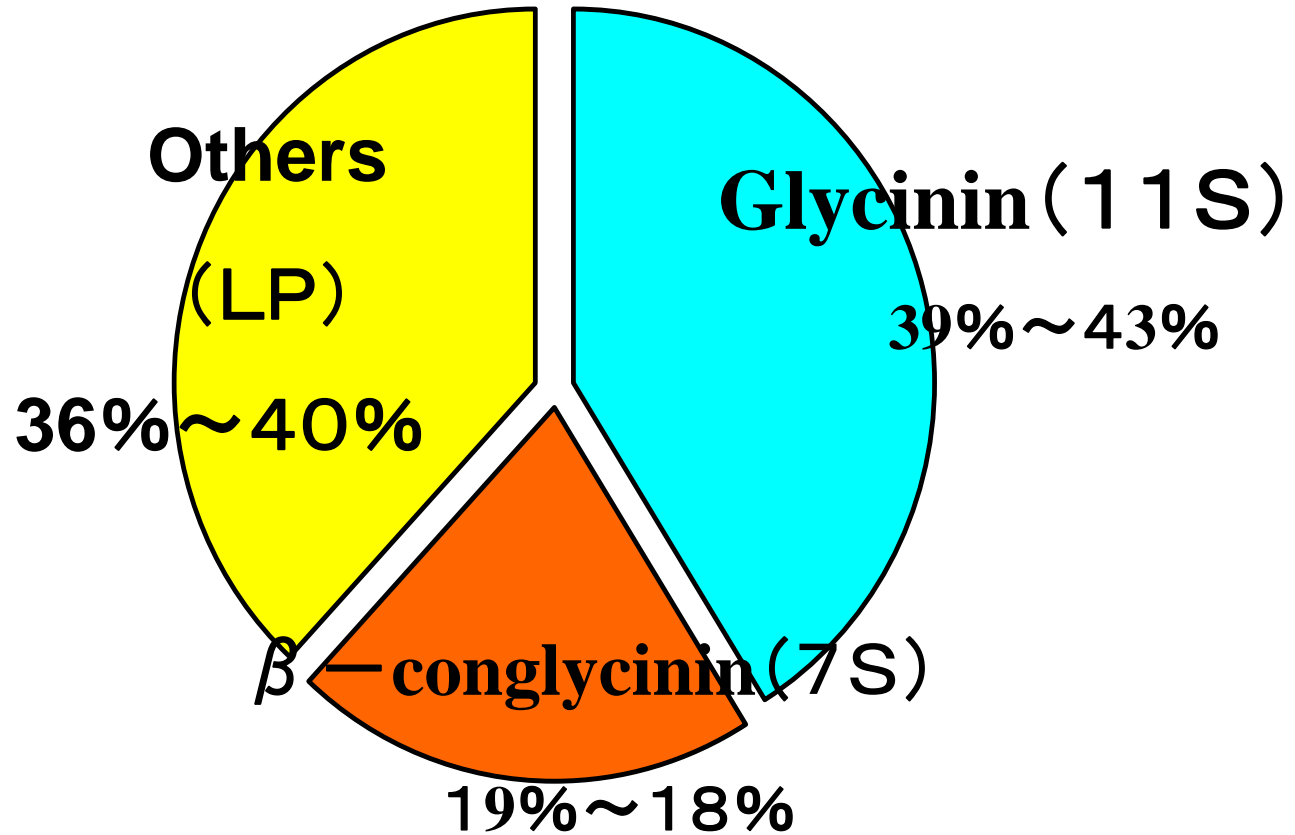
Physiological elements in Soy

Class	Element
Protein	Soy globulin Enzyme
Carbohydrate	Fiber Oligo saccharide
Polyphenol	Isoflavone Phytate Saponin
Lipid	Phospho lipid Tochopherol

Recovery with the SDS-PAGE Analysis for SPI



SPI: Soy Protein Isolate



The protein composition of soy protein

SPI



11S



7S



LP



Tofu-gels with each soy protein fraction

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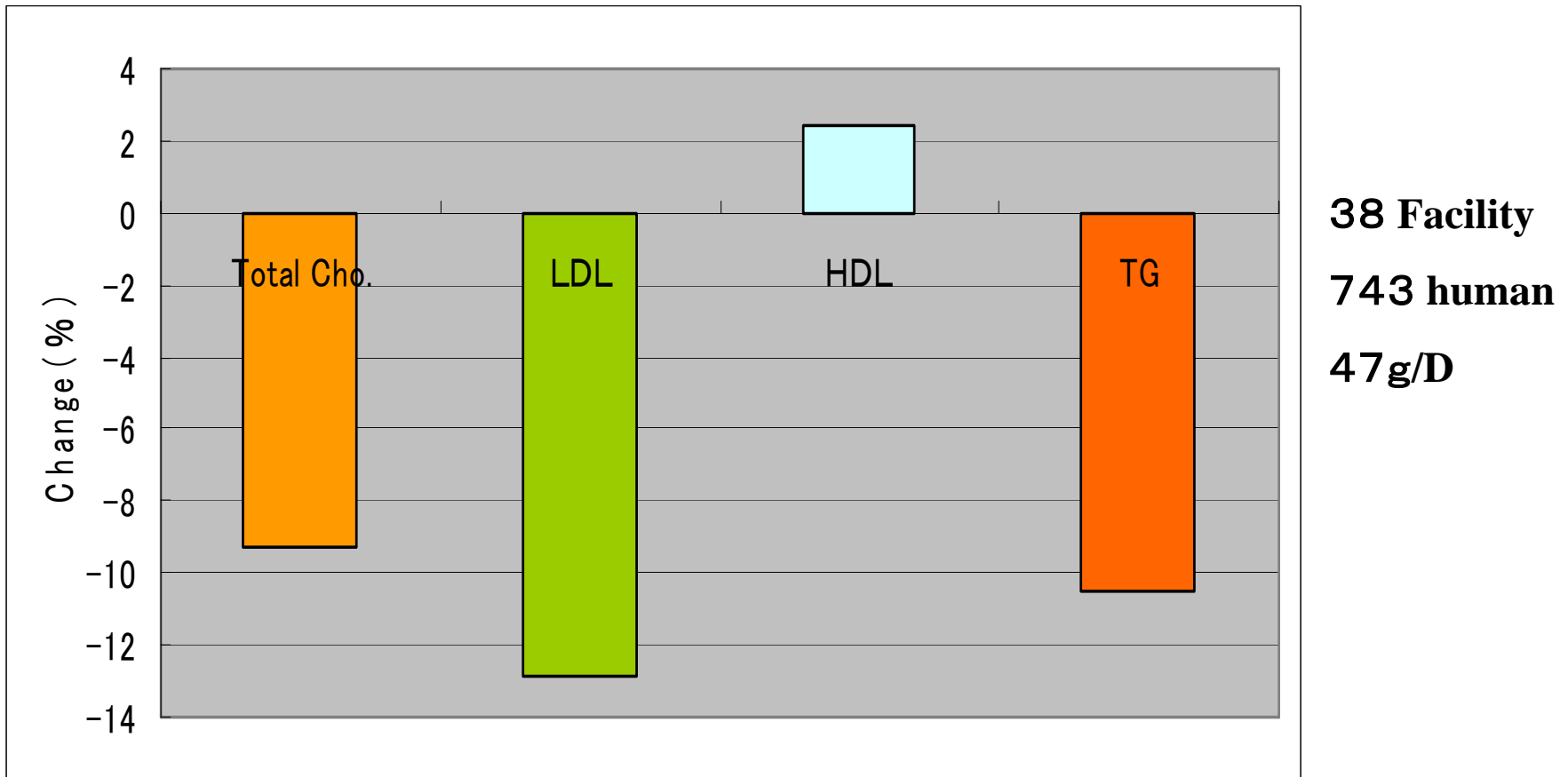
Key Words(1)

β — conglycinin

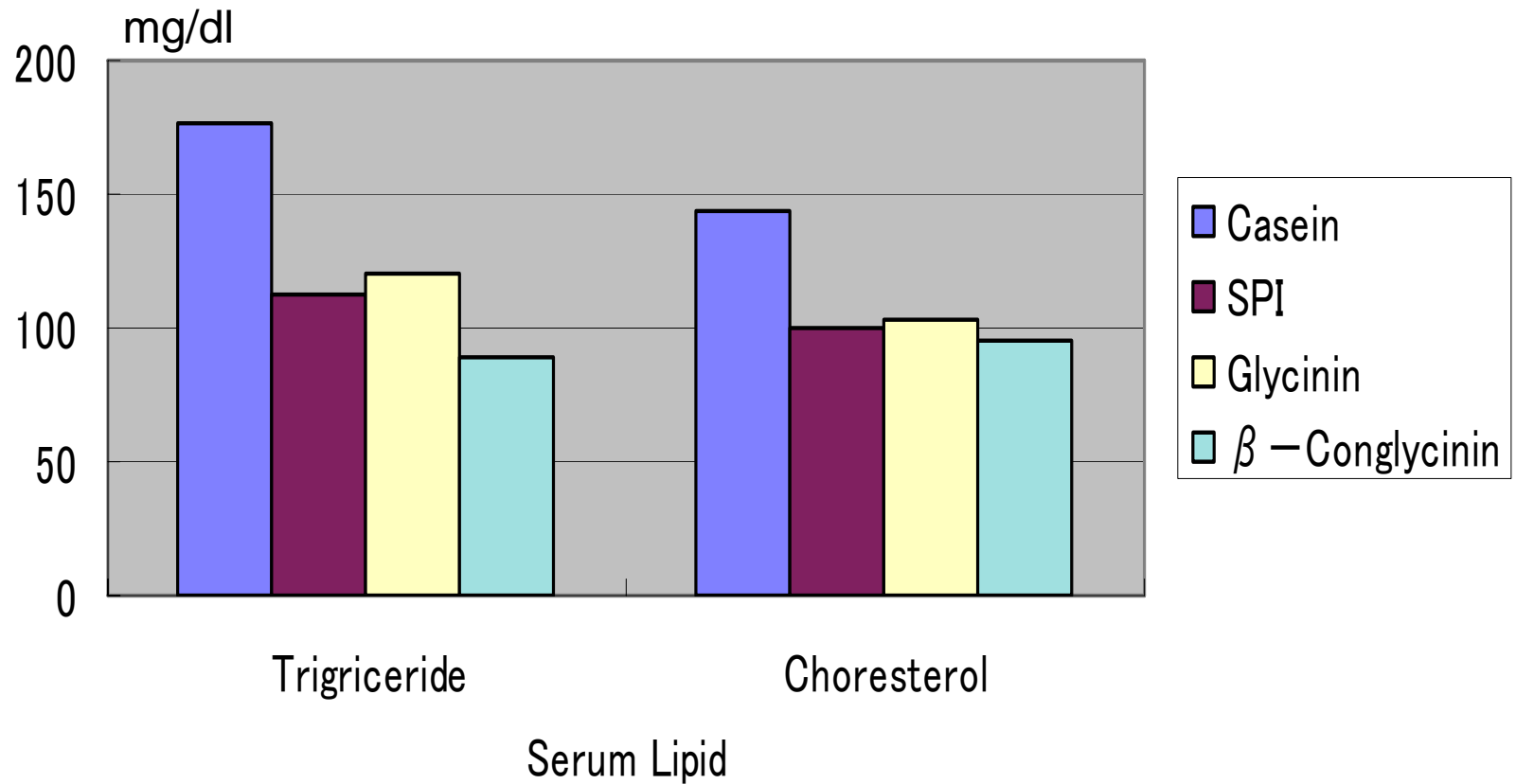
TG

Visceral Fat

Obesity



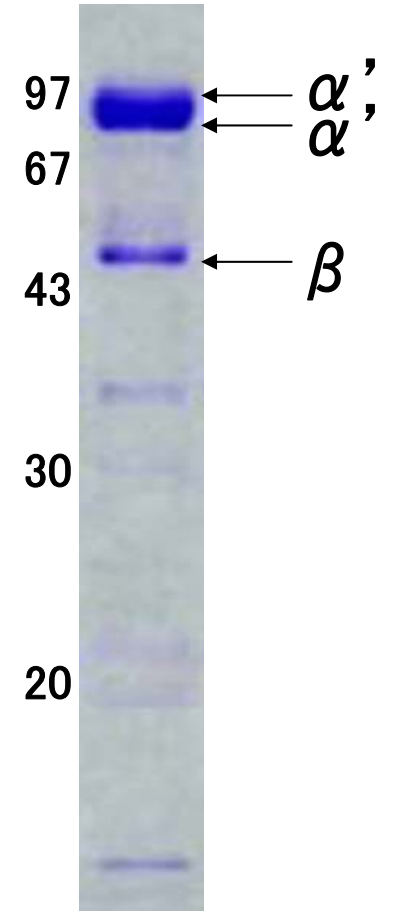
Meta-analysis of the effects of soy protein intake on serum lipids.



Effect of Protein Species on serum lipid level
(6week Rat)

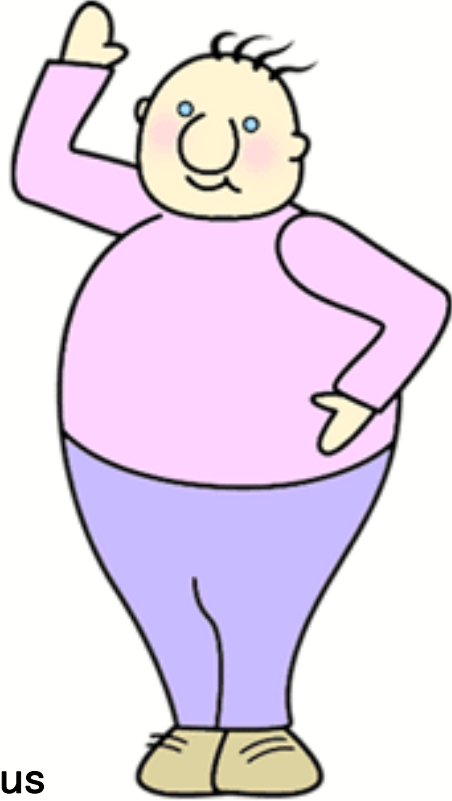


kDa



Powdered Soy β — Conglycinin

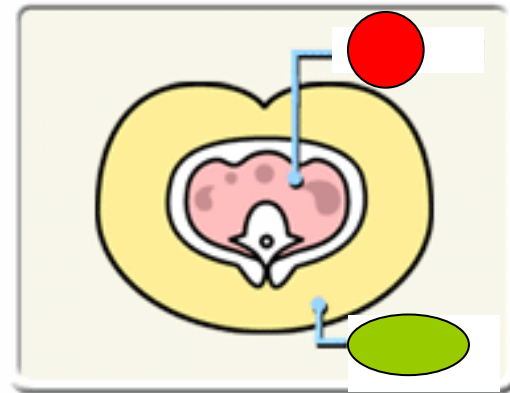
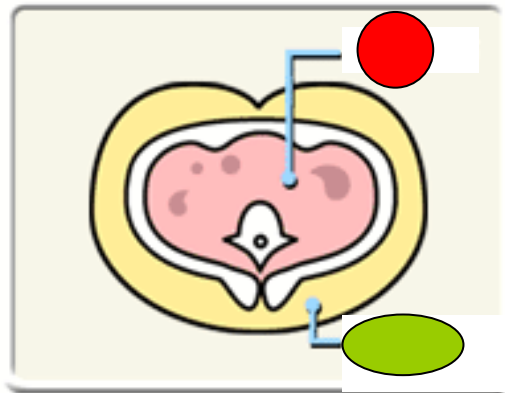
(Sterilized • Dried)



Visceral



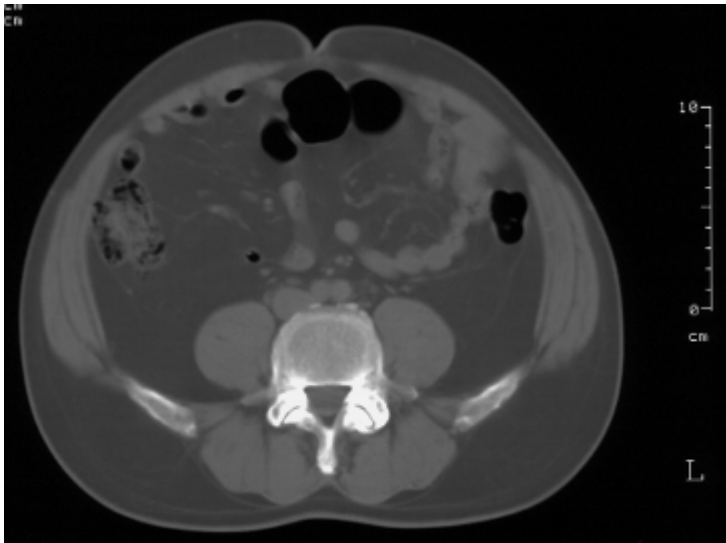
Subcutaneous



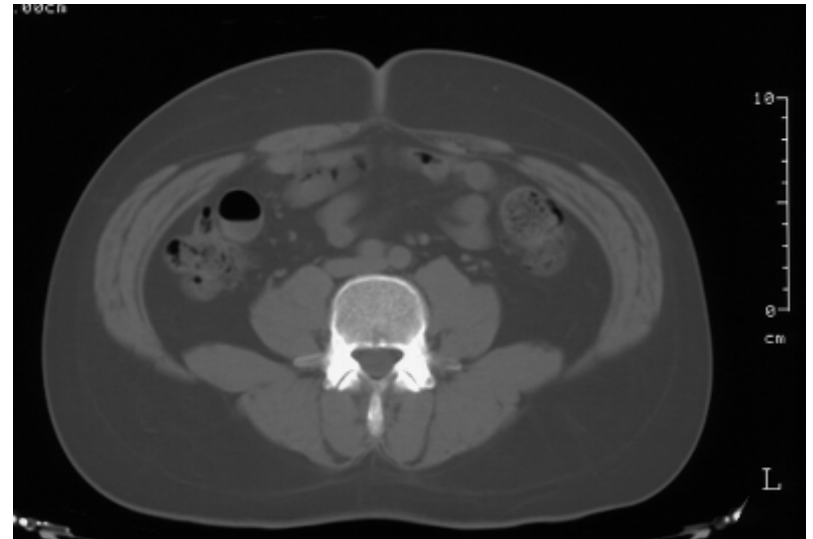
Obesity Type;

Apple type / Pear Type

Obesity with visceral Fat

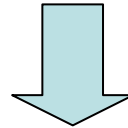


Obesity with subcutaneous fat



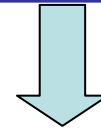
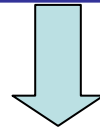
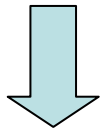
CT-scan image of abdominal cross-section

Obesity with visceral Fat



Disturbance of adipocytokine secretion

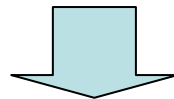
(adiponectin ↓ , PAI-I · TNF- α ↑)



diabetes

hyperlipidemia

hypertension



Metabolic Syndrome

Test Food

Powdered Soy β — Conglycinin **50%**
(Casein) **Tablet**
Dextrin **50%**

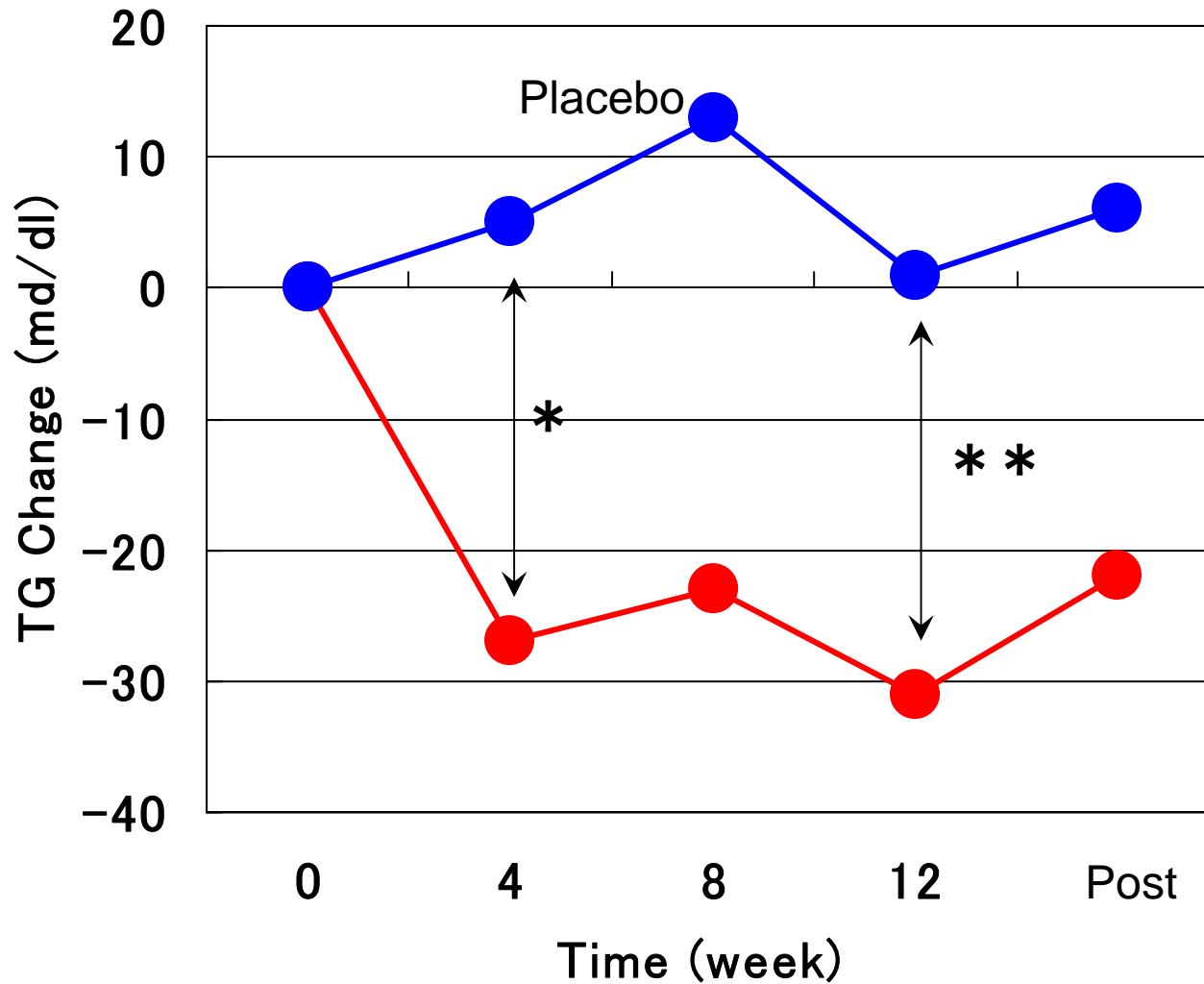
Test Design

**Continuous intake of 6g
tablets with 6g sample per
Day.**

**The test carried for 6
month.**

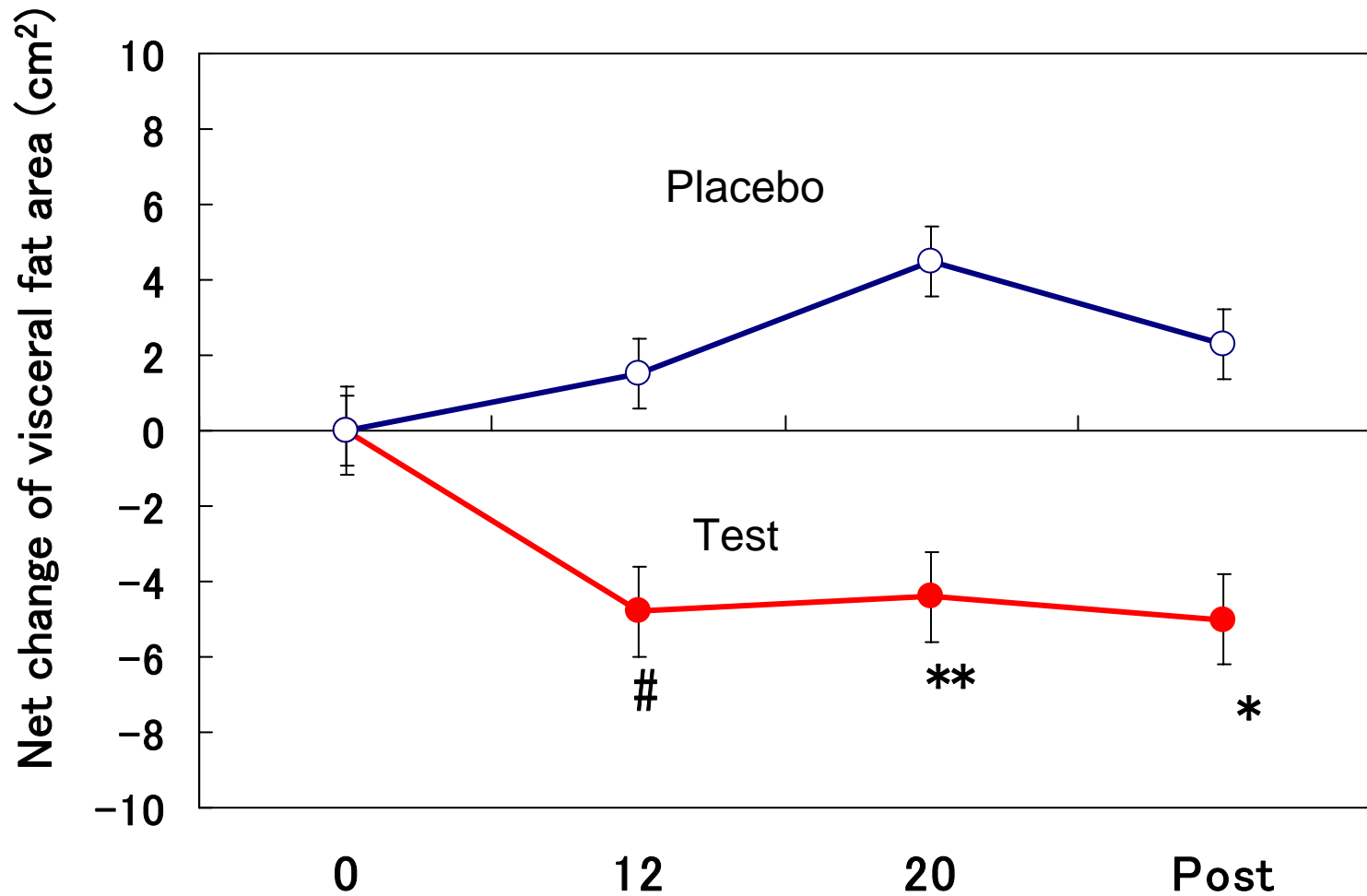


Change in Serum TG



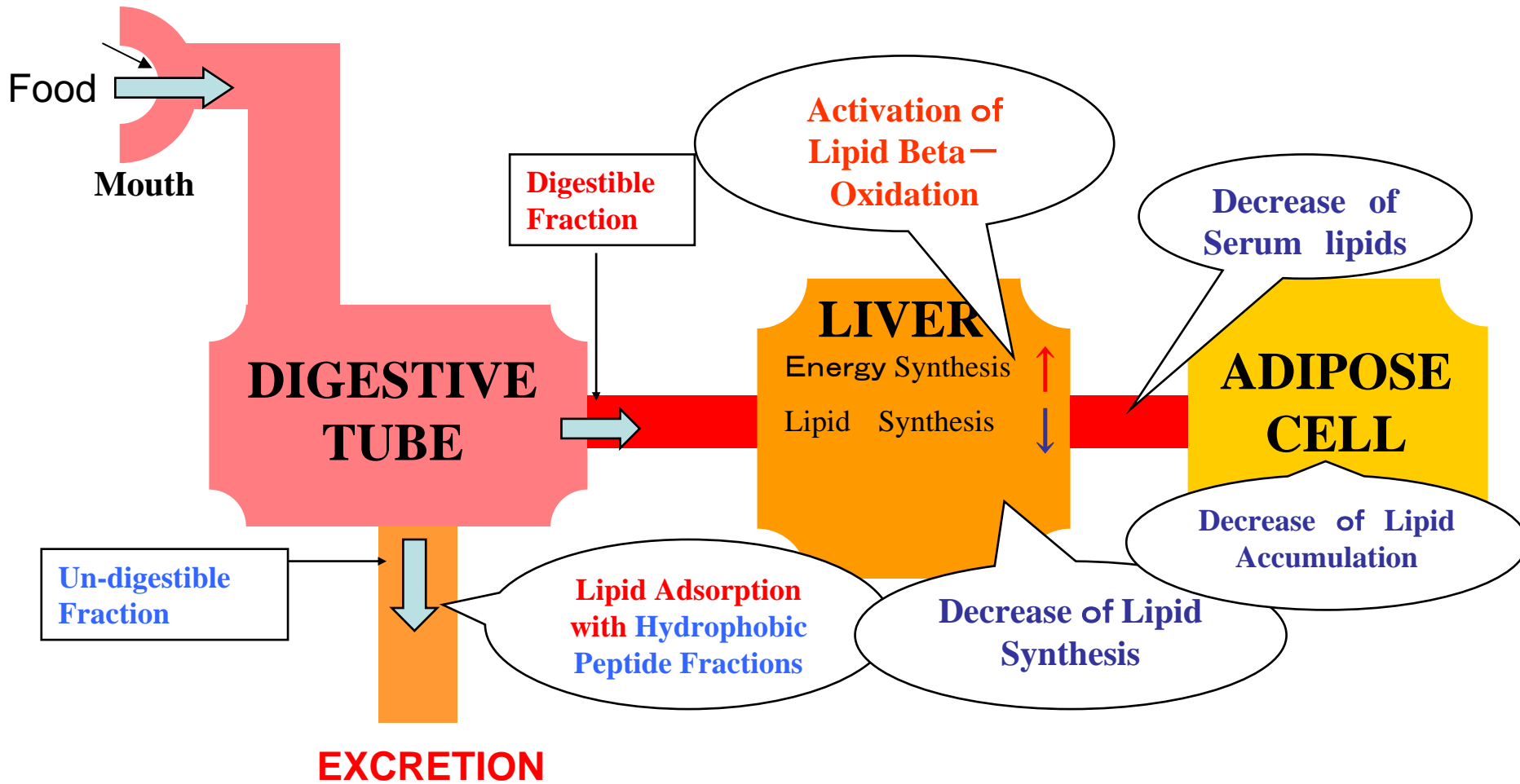
*, $p < 0.05$; **, $p < 0.01$

Change of Visceral fat area



Placebo

β —Conglycinin



Effect of β —Conglycinin on Lipid Metabolism

“ Adipocytokine ”

Soy protein



Adiponectin

Leptin



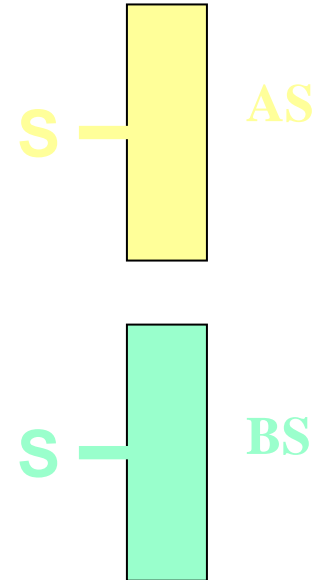
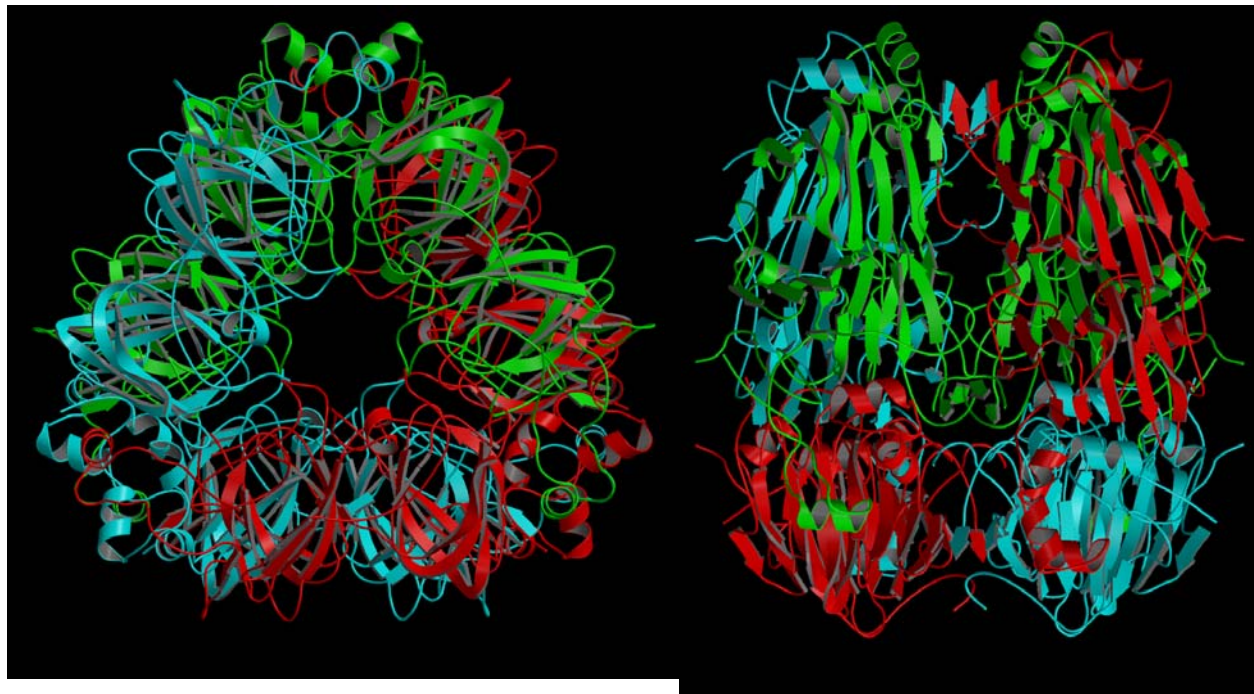
PAI-1
TNF- α

Insulin Resistance
Diabetes
Hyperlipidemia
Fatty Liver
Atherosclerosis

Key Words(2)

Soy Peptide
Stress

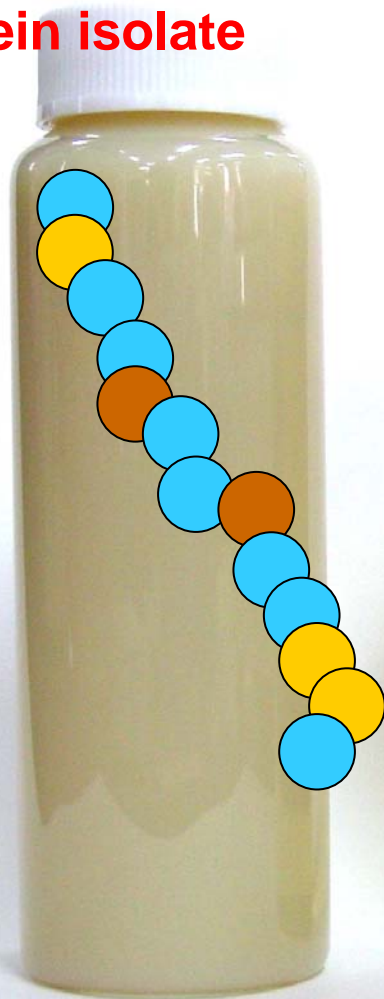
Conformation of Glycinin



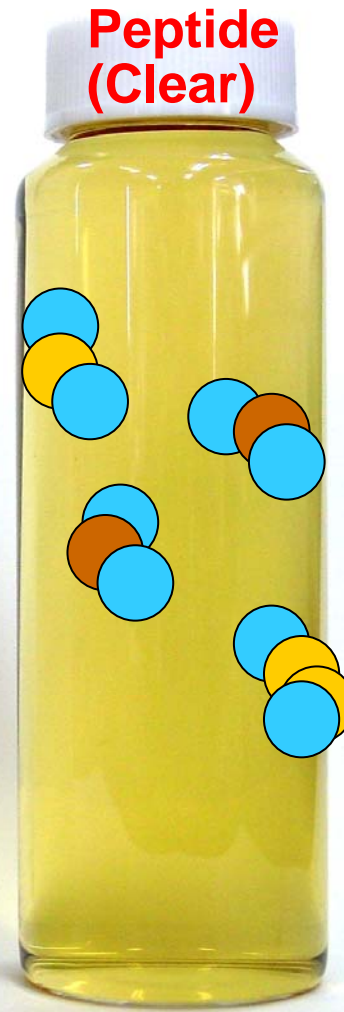
**Utumi et.al ::Proceedings of the National Academy of Sciences
USA 100, 7395-7400 (2003)**

Soy protein and peptide solution (8%)

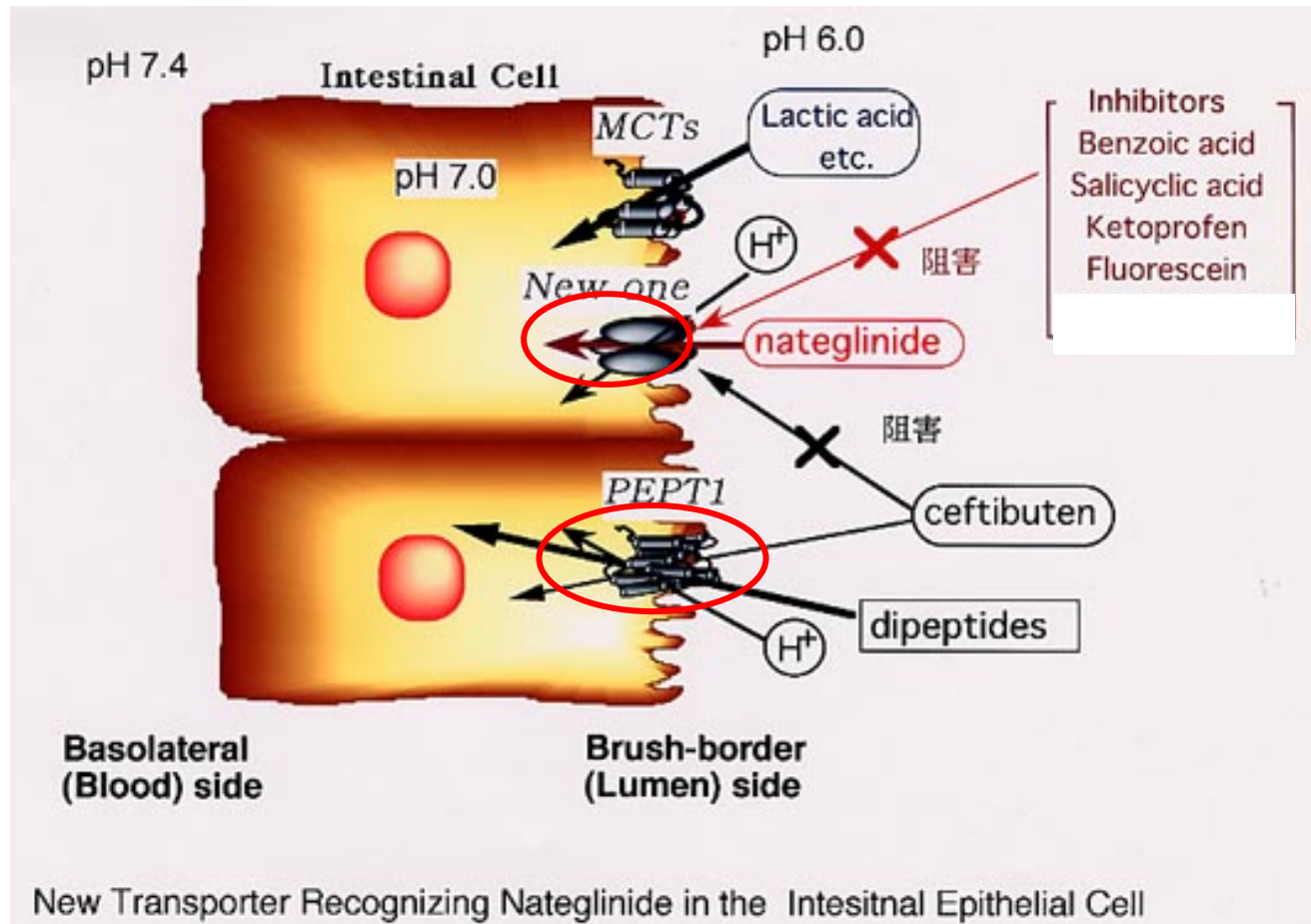
**Soy protein isolate
(Cloudy)**



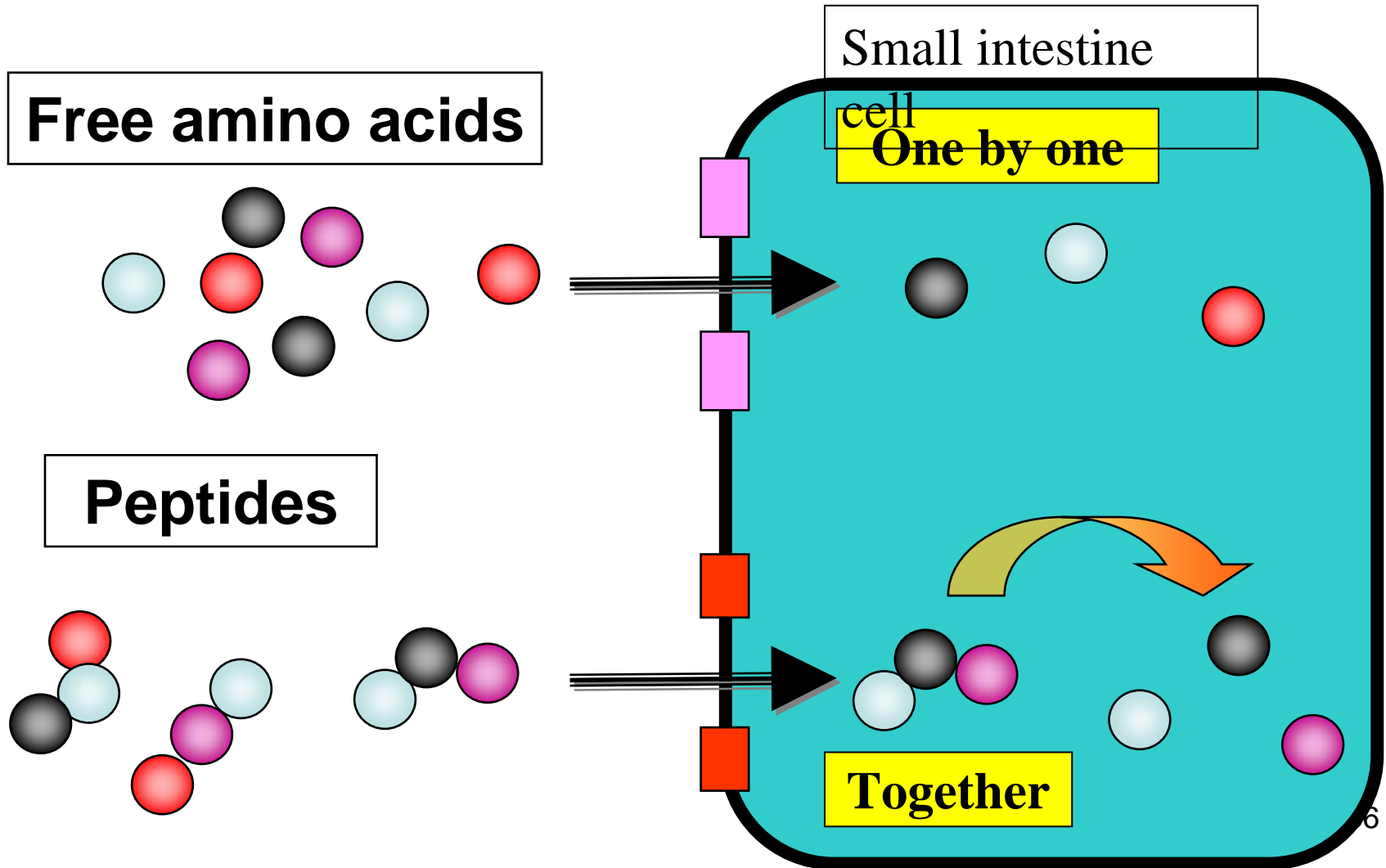
**Peptide
(Clear)**



Peptide Transporter



Gut absorption of Amino acid and Peptide



Experimental design for absorption rate of amino acid, peptide and protein with same amino acid composition.

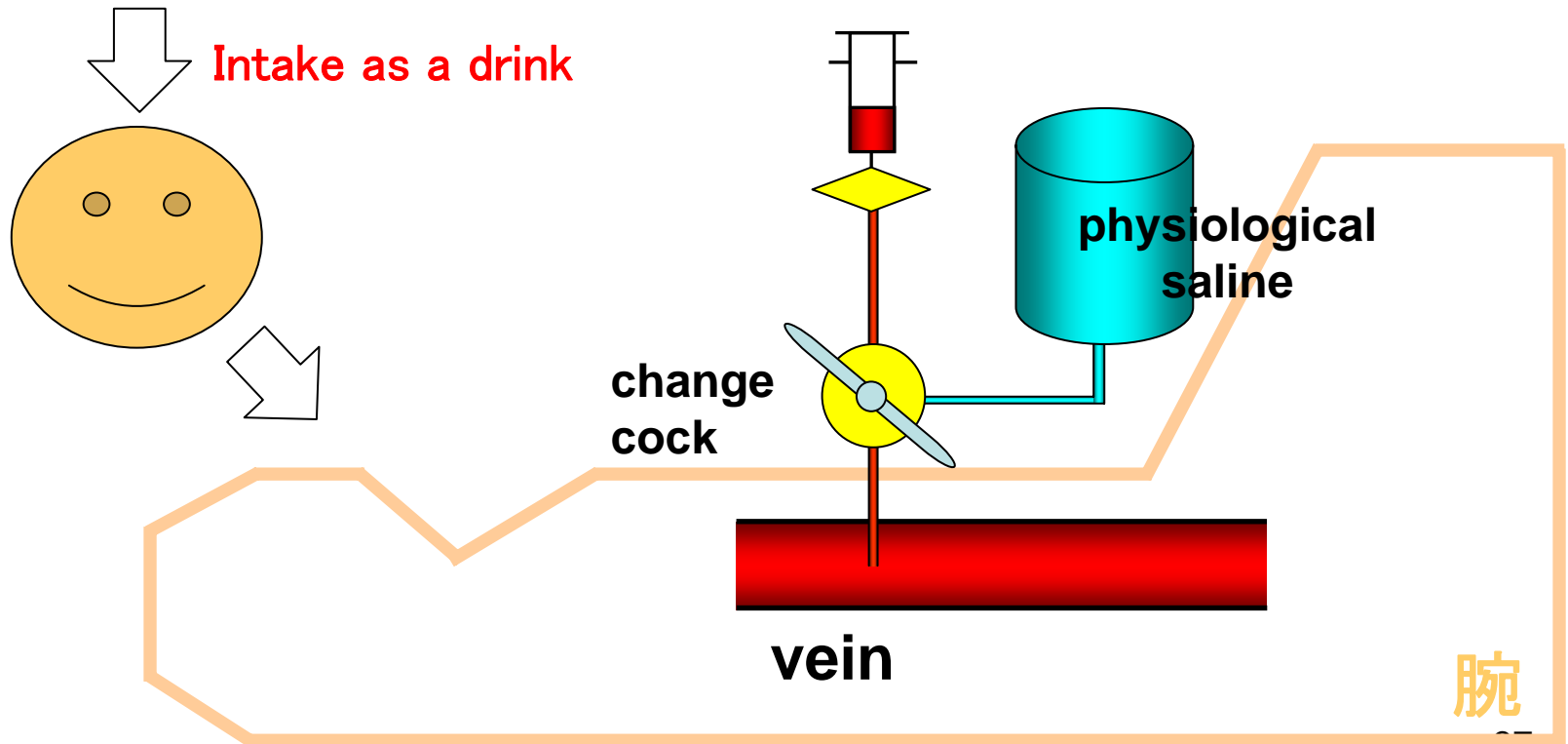
Protein
Peptide
Amino acid mixture

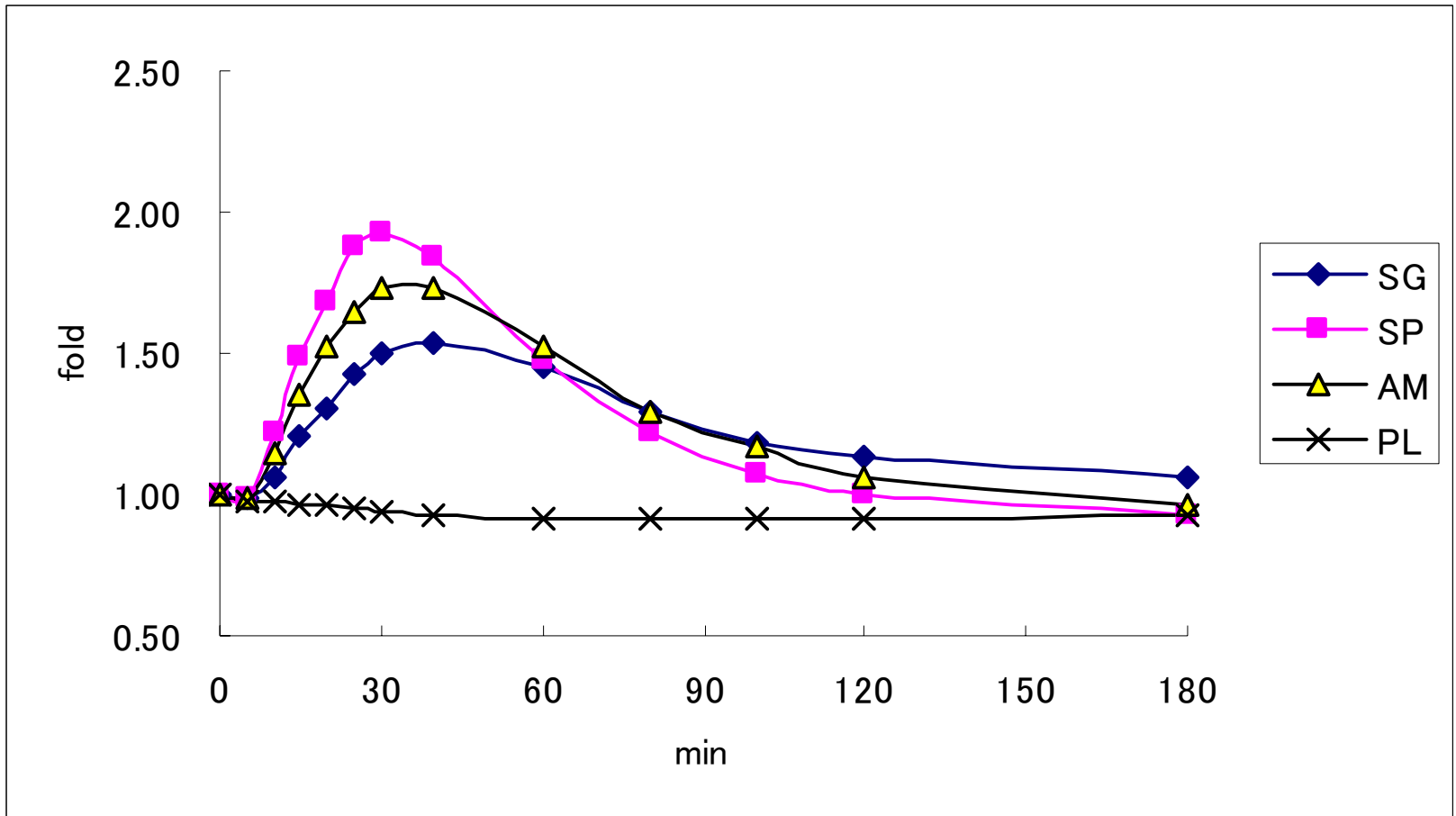
Analysis of Free Amino Acid



blood drawing

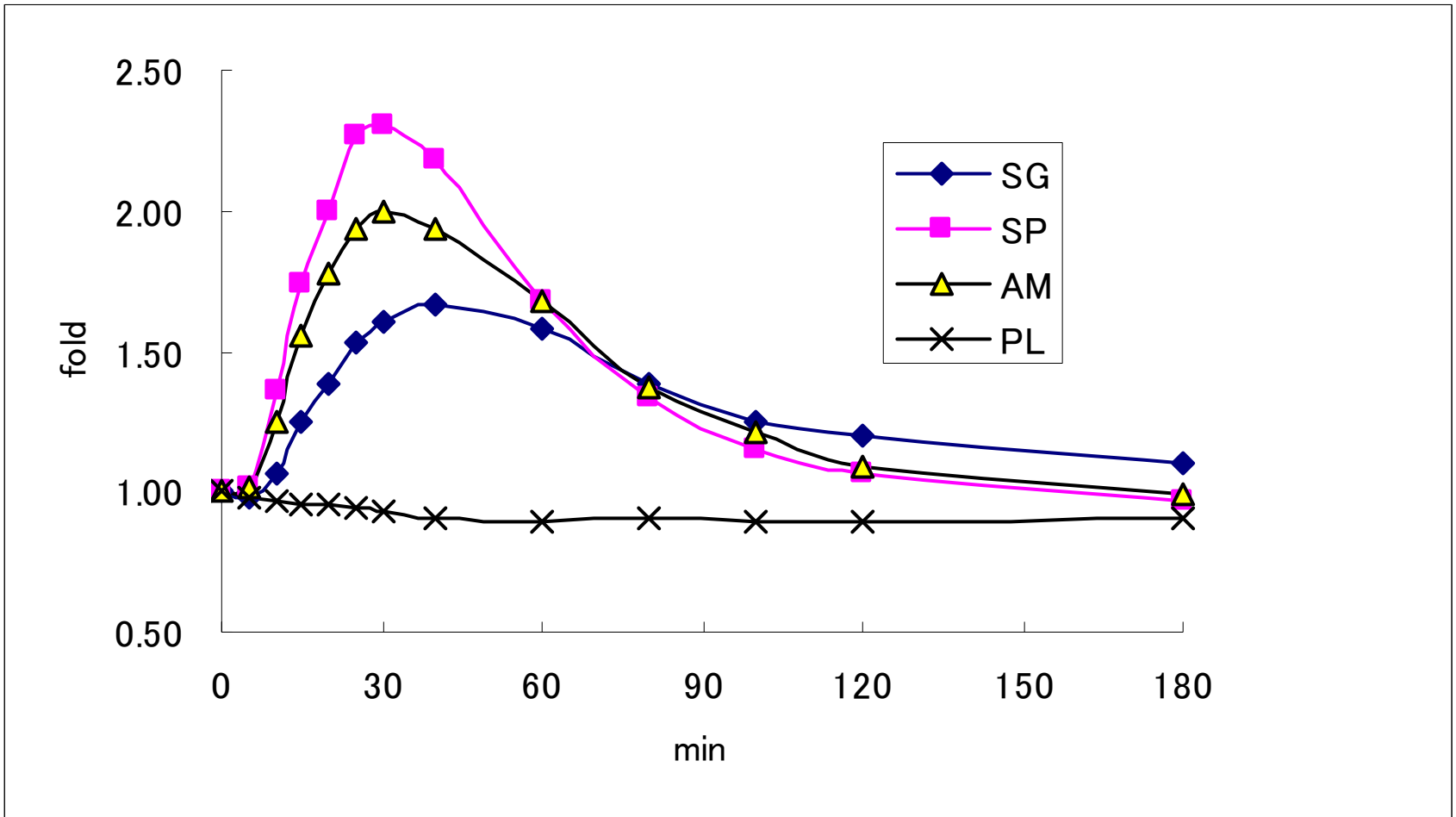
(0,5,10,15,20,25,30,40,60,80,100,120,180 min)





Increment of essential amino acid

KFLIMVTW



Increment of branched-chain amino acid

VLI



Blood drawing for measurement of initial CPK value.



Squat

25 times



Rest for 1min



4 cycle



Intake the peptide drink



Blood drawing for measurement of CPK value after 30min.and 18hr.

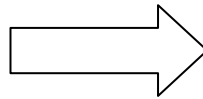
Experimental design for suppression of CPK increment in serum with soy peptide

Indicator of Muscular Inflammation

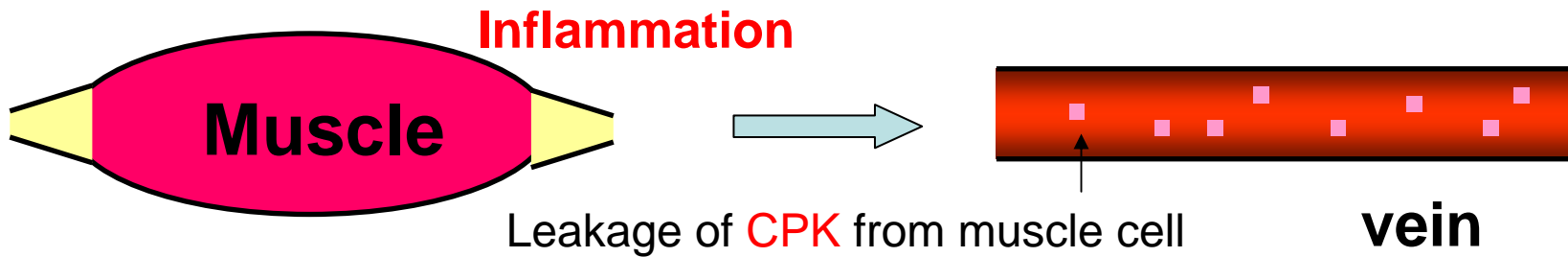
Muscular exercise



After
1~2 days



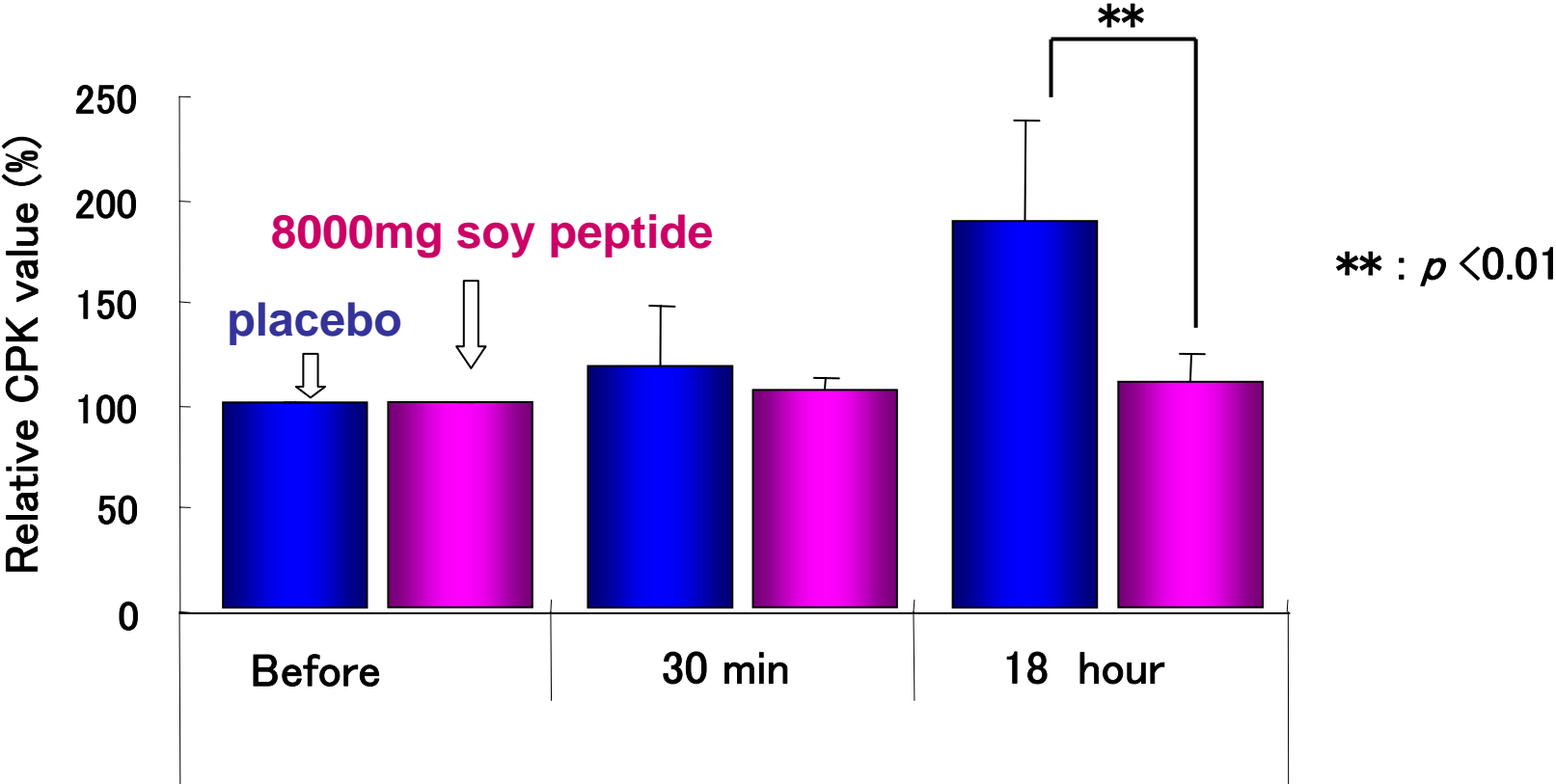
Muscular
Inflammation



CPK is considered as a indicator of **Muscular Inflammation**

CPK: Creatine PhosphoKinase

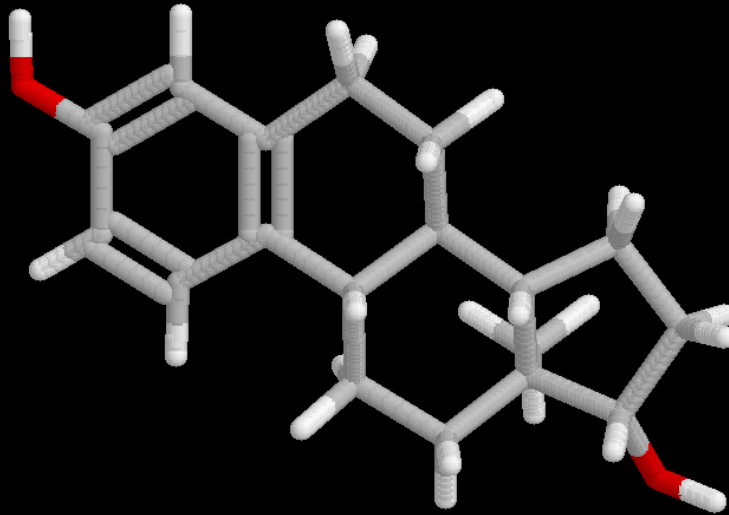
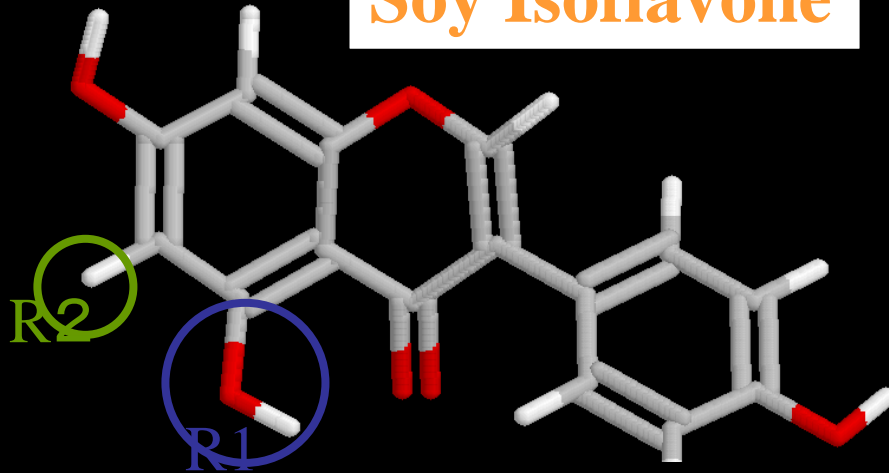
Change of CPK value in serum after muscle exercise



Key Words(3)

Isoflavon
Female hormone

Soy Isoflavone



daidzin

H

H

genistin

OH

H

glycitin

H

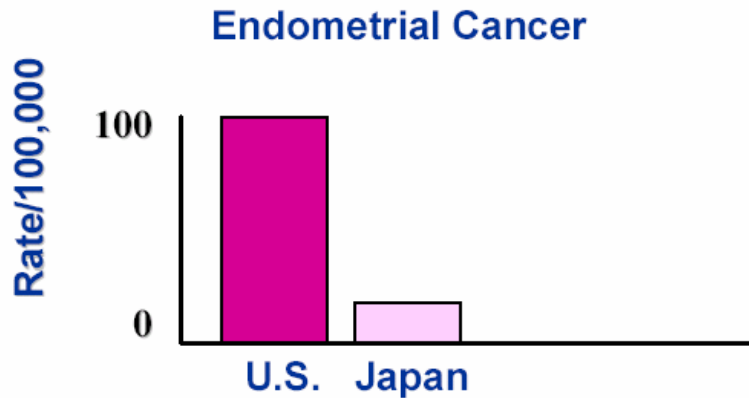
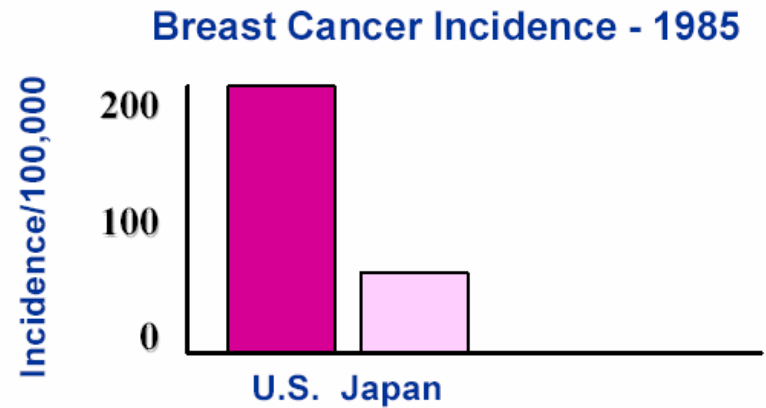
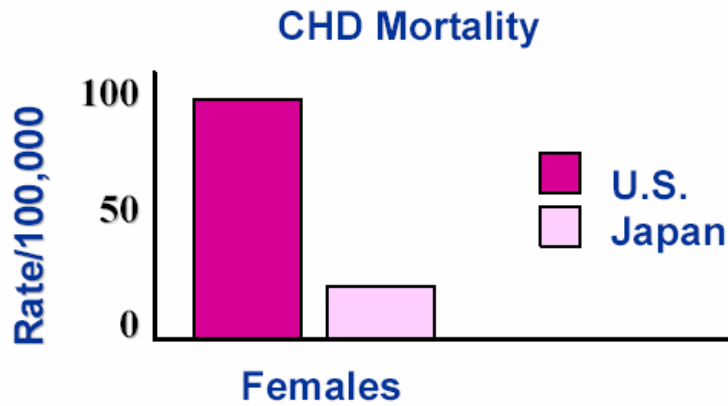
OCH₃

Female hormone; Estrogen

(例; β -estradiol)

Soy Isoflavone & Female hormone

Rationale for Choice of Soybean Estrogen



Urinary Excretion of Soybean Phytoestrogens (Genistein/Daidzein in nmol/24 hours)

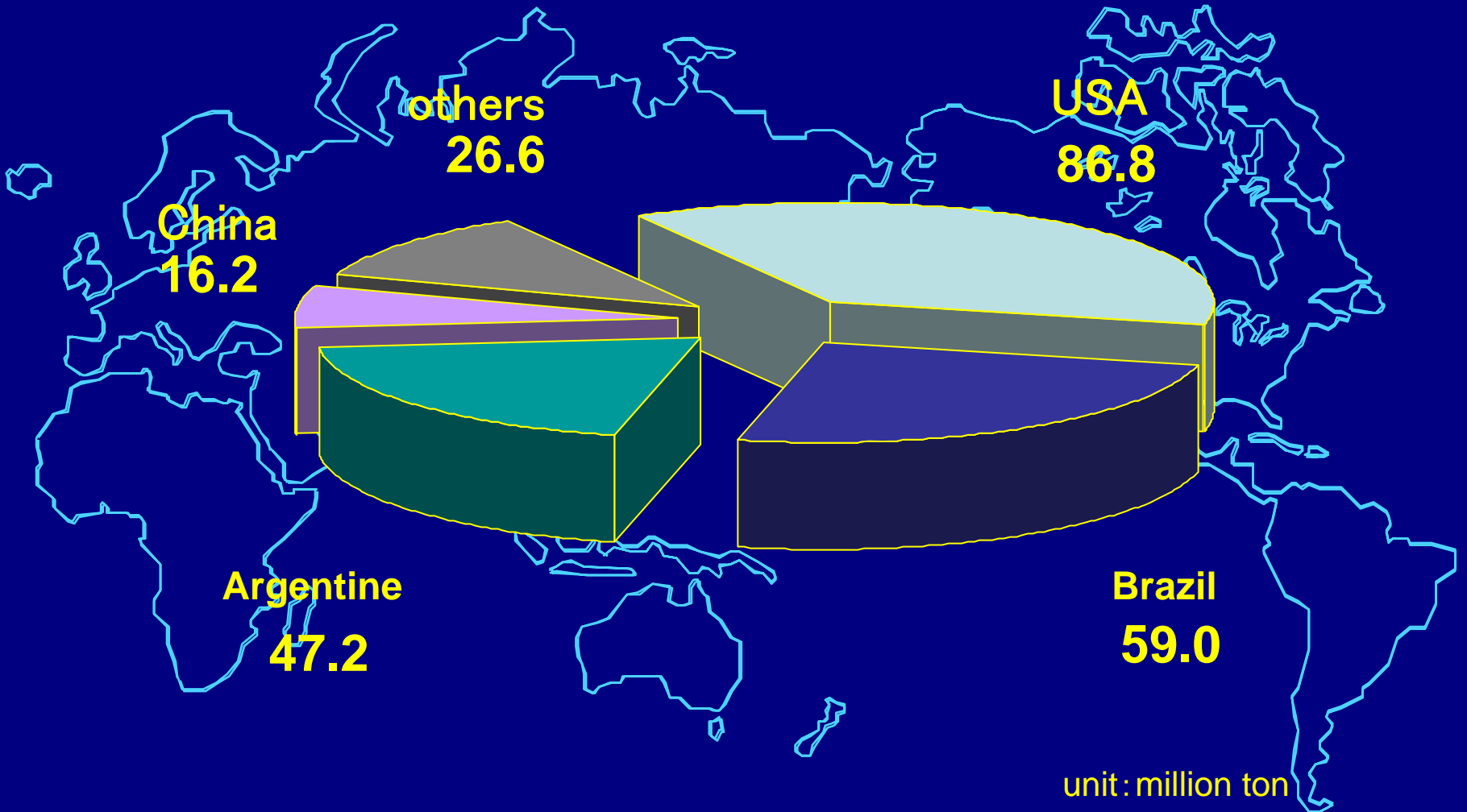
Japanese Women	3,000
U.S. Women	35

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Production of soy bean

(2006-2007 USDA)



(Total 235,77 million tons)

Food Shortage & Environmental Problems

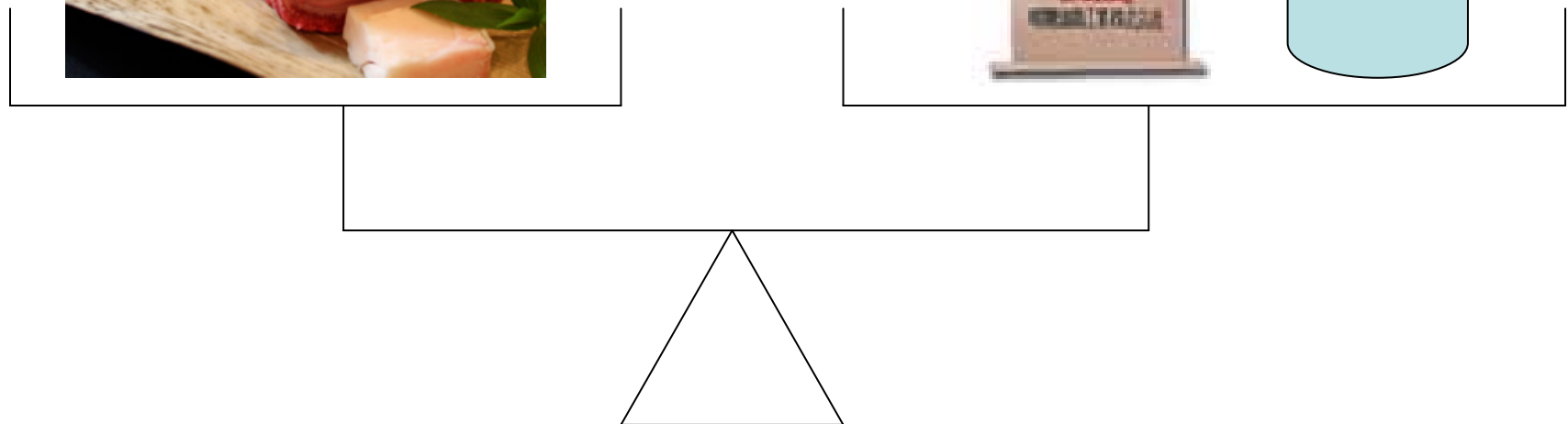
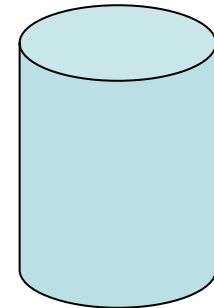
Beef; **1kg**

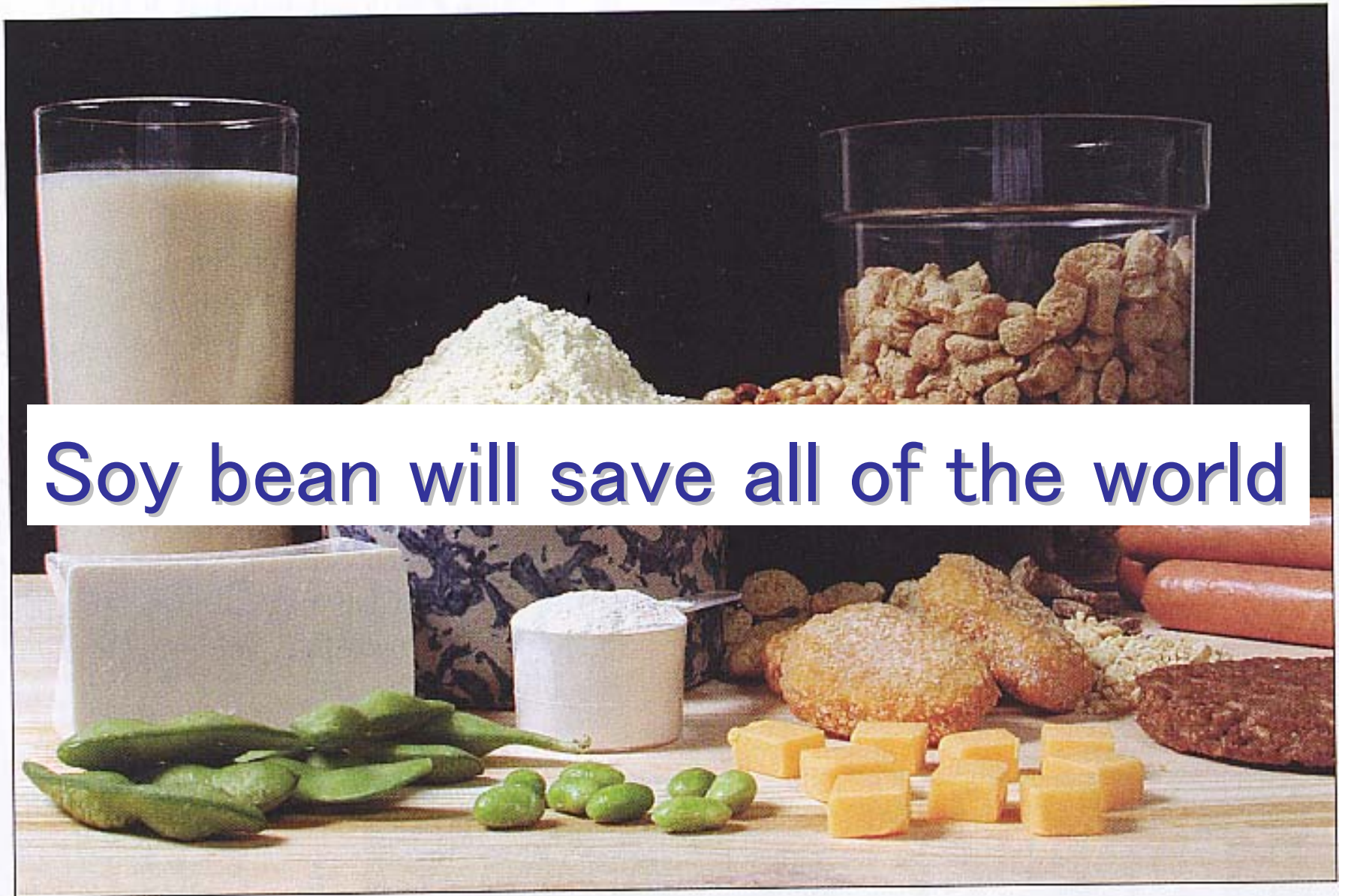


Soy flour; **30kg**



water; **20,000kg**





Soy bean will save all of the world

Thank you very much !



β —conglycinin
(tablet)

Soy Peptide
(powder)