Sustainable alternative proteins-healthy human

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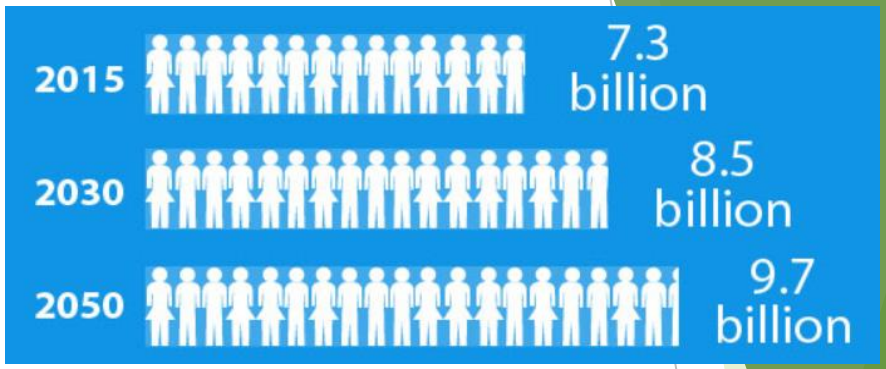

Population growth
Expanding middle class

EU Consumer move away from meat & milk‘dietary shift’

demand **PROTEIN** rich food

increase by **78%**

EU alternative protein sources

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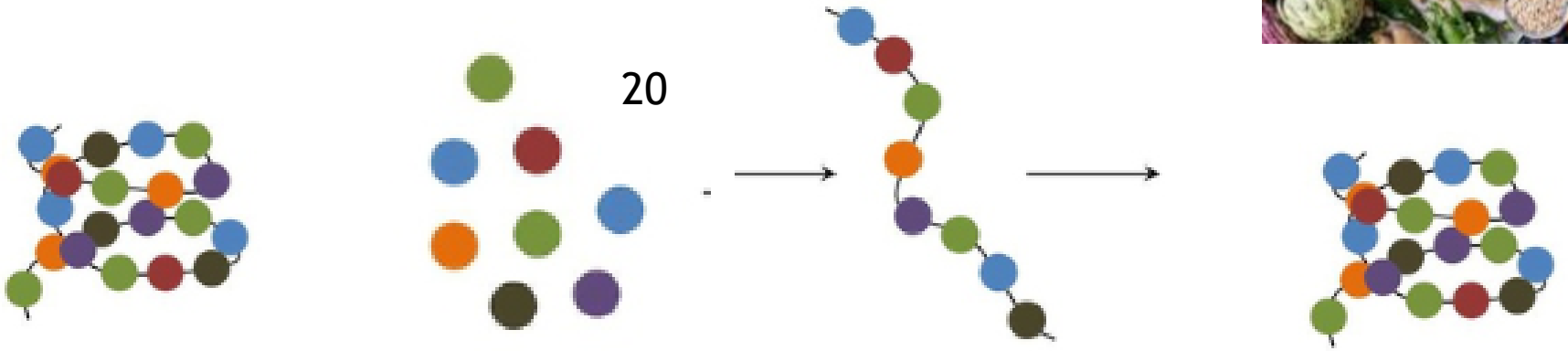
Proteins

Amino acids

peptides

20



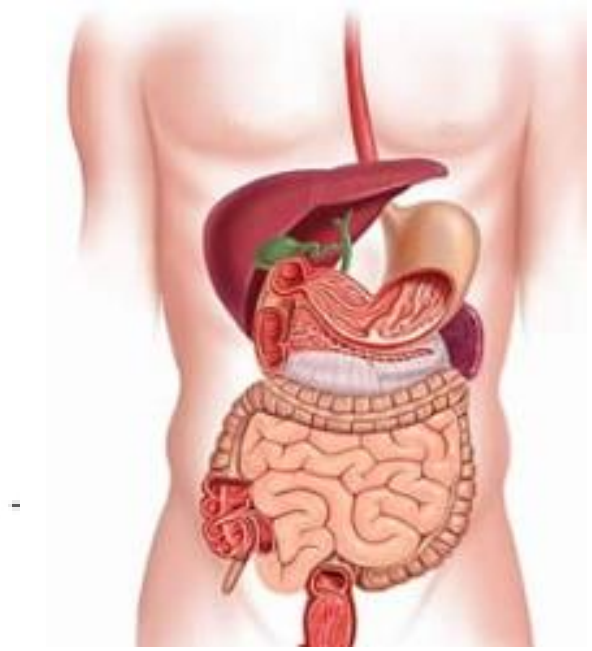
Proteins

9 are essential (must be in our diet), 11 others can be made

histidine, isoleucine, leucine, lysine (1st limiting AA), methionine, phenylalanine, threonine, tryptophan, valine

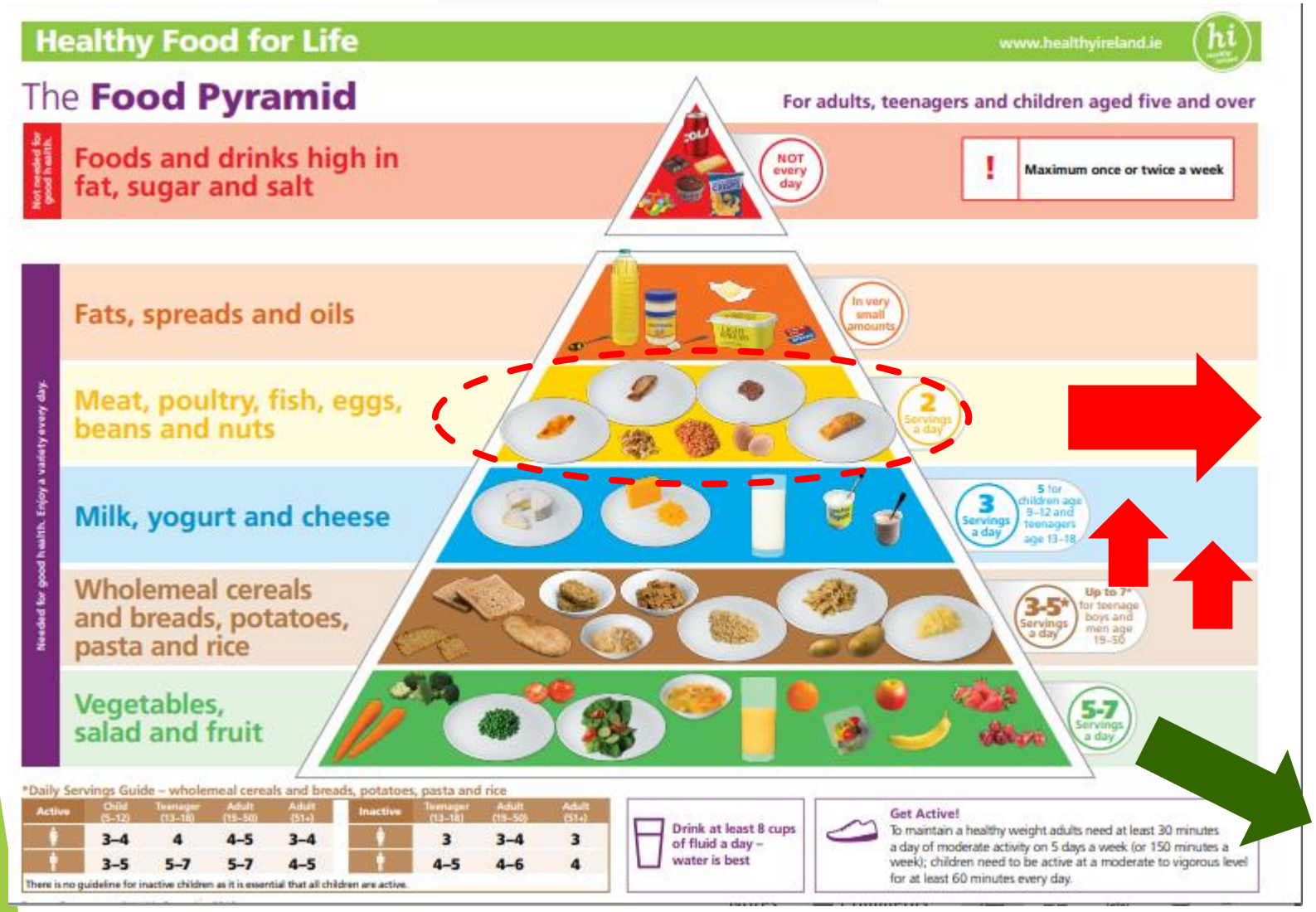
Proteins

upper gut digest proteins into peptides and free amino acids



Free amino acids cross gut barrier into bloodstream before/or in ileum

Amino acids



RDA protein 0.8g/kg body weight

Man 80kg = 64g/day
Woman 60kg = 48g/day

Fibre, Vitamins, minerals, antioxidants

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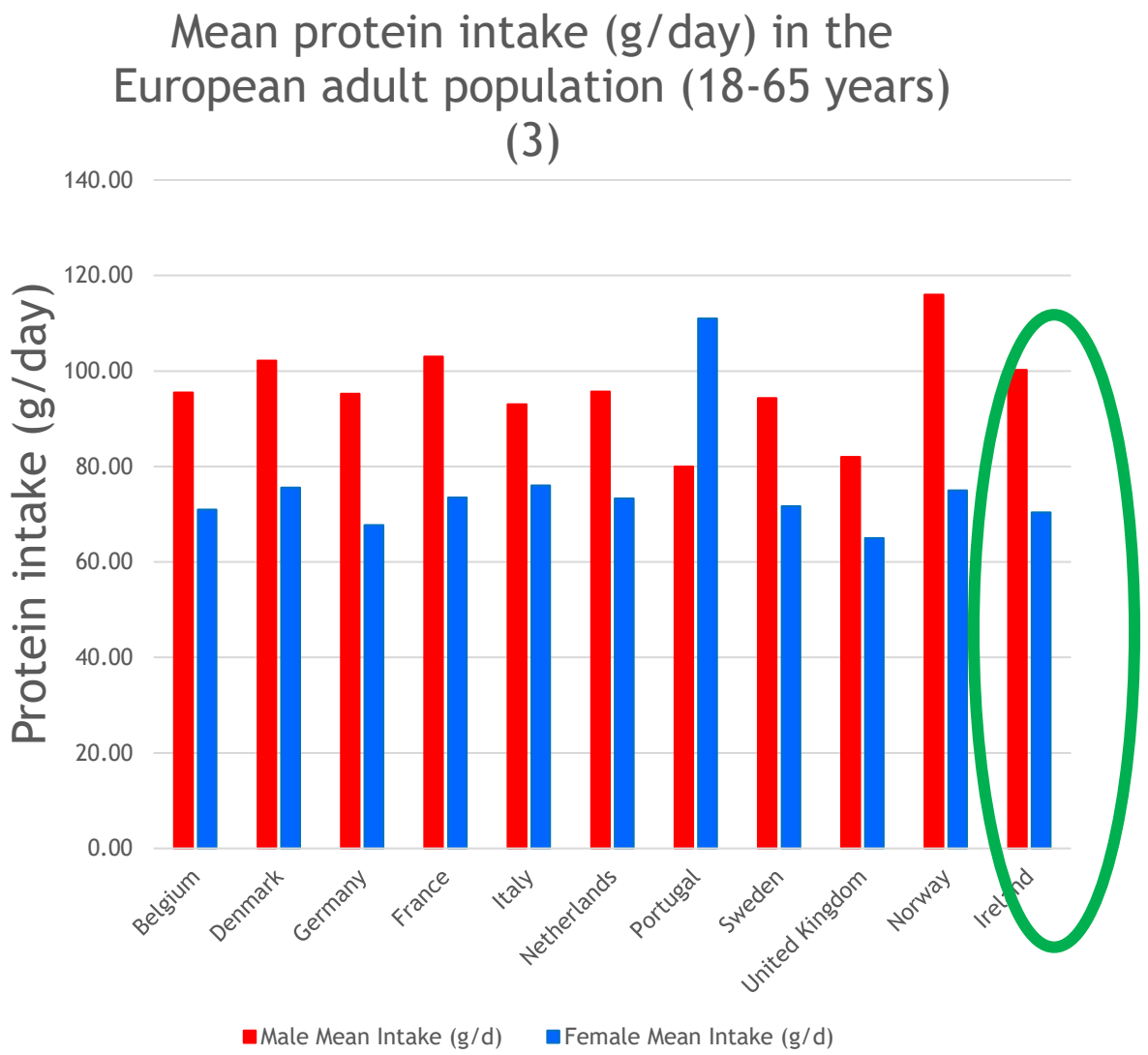
IUNA. National Adult Nutrition Survey. Summary Report. 2011



Mean protein intake in Ireland
Men: 85.2 g/day
average weight 80kg
RDA: 64g/80kg

Women: 84.2 g/day,
average weight 60kg
RDA: 48g/60kg

Opportunity: Reduce our protein intake

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% Contribution of food group to protein intake in the adult Irish population (18-64 years). (1)

Opportunity: To shift our reliance on meat as our protein source

Dietary Shift

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To shift from animal based protein to plant/alternative proteins:

Environmentally sustainable protein

Healthy for human

Environmentally sustainable food systems may not necessarily deliver healthy foods

To the human body, not all dietary protein is the same

Quality of dietary protein is determined by.....

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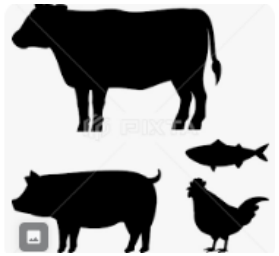
Kumar et. al. 2022



raw

Microalgae (Chlorella)	SCP (Solein)	Crickets
		

Novel Proteins

Protein quality	HIGH	LOW
Essential Amino Acid composition	complete	incomplete soy, buckwheat, quinoa
Digestibility DIAAS 0-100%	HIGH 100%	LOW 50-80% ?
Anti-nutritional factors	LOW	HIGH ?
Net protein Utilization NPU, BV	HIGH	LOW ?
Allergy	Milk, eggs, shell fish	Nuts, soy, lupins, gluten, celery ?
Bioactive peptides	HIGH	HIGH

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Microalgae (Chlorella)	SCP (Solein)	Crickets
		

Solutions to improve AA composition & digestibility of plant/alternative protein foods

combine incomplete proteins together to ‘complete’ protein intake

Use Processing can improve digestibility, remove anti-nutritional factors

1st Task fill knowledge gaps in protein quality for plant/alternative

Essential Amino Acid composition

Digestibility DIAAS 0-100

Anti-nutritional factors

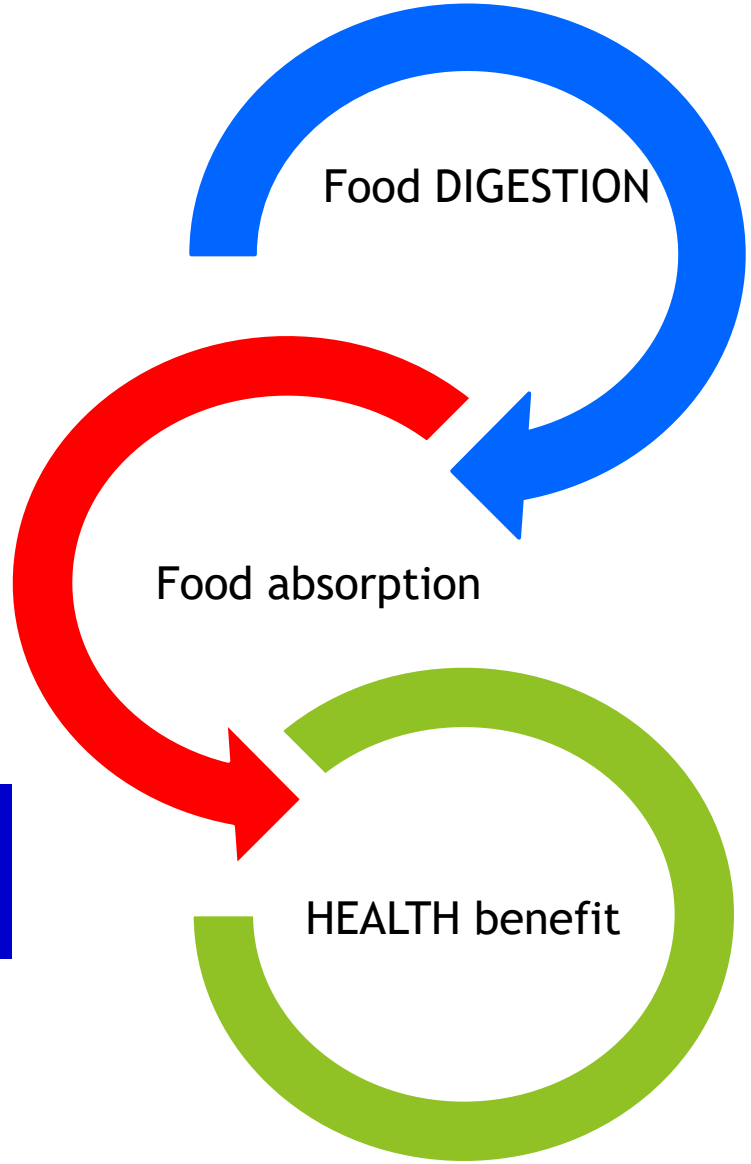
Allergy

Gut health

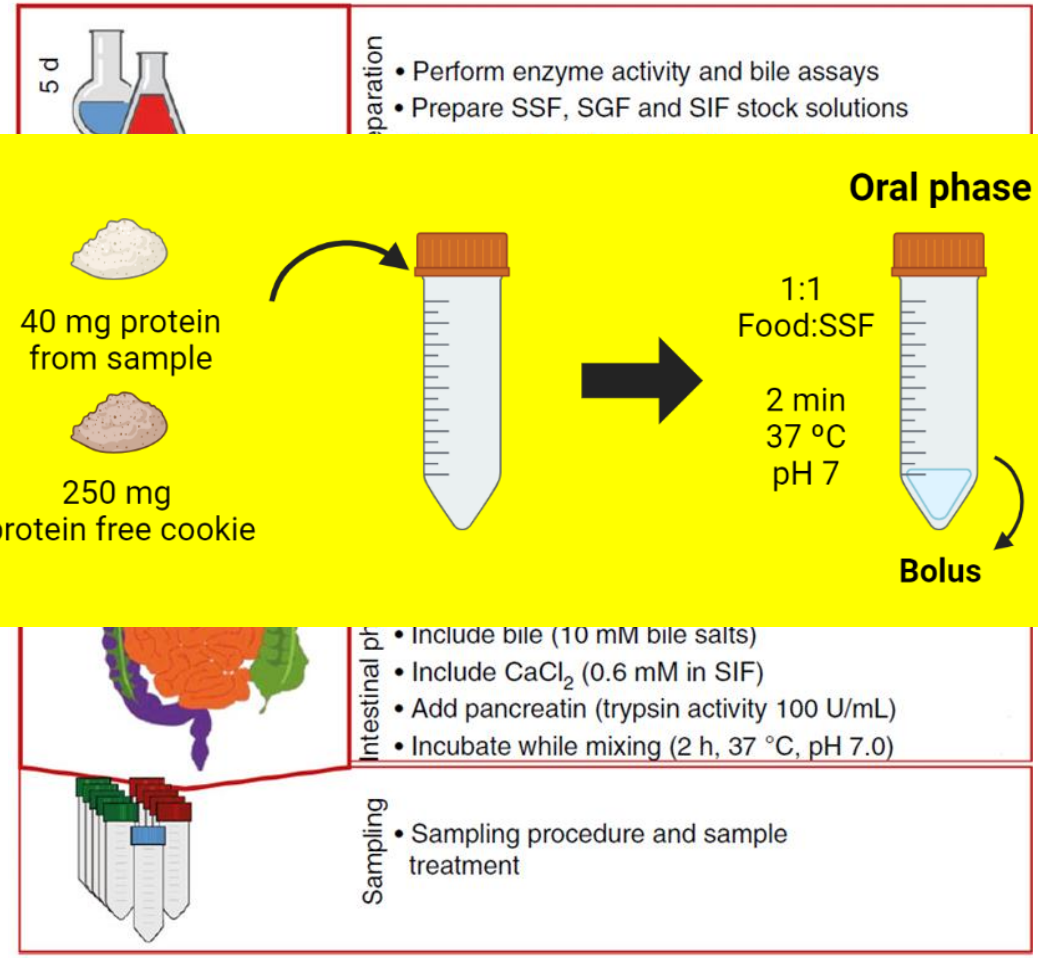
Net protein Utilization NPU, BV

Bioactive peptides

Filling knowledge gaps

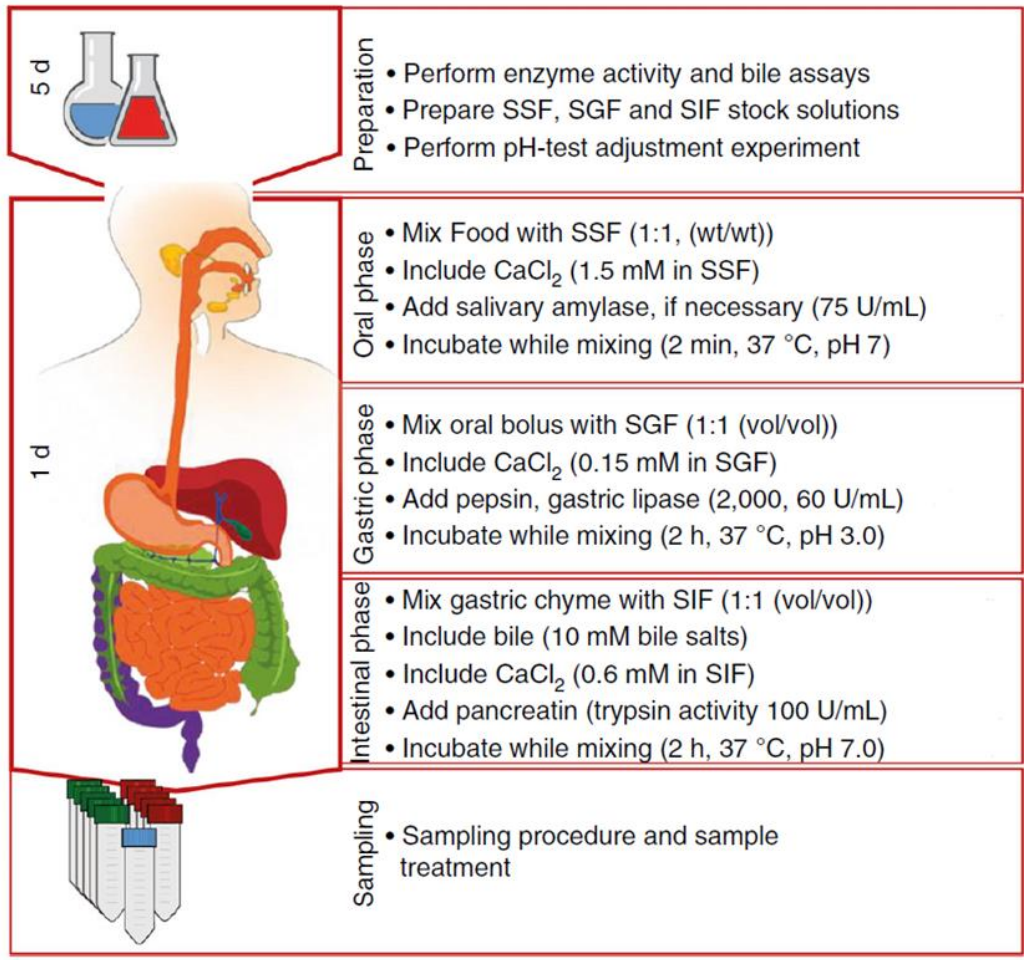


Food digestion (in vitro)



Brodkorb et al. Nat Protocols 2019, ISO standard

In vitro digestion



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Generate Digestion Data

In vitro Digestible Indispensable Amino Acid Score

Anti nutritional factors
Inhibit enzymes, eg anti-trypsin
block enzymes
accessibility (eg polyphenols)

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Digestibility DIAAS 0-100

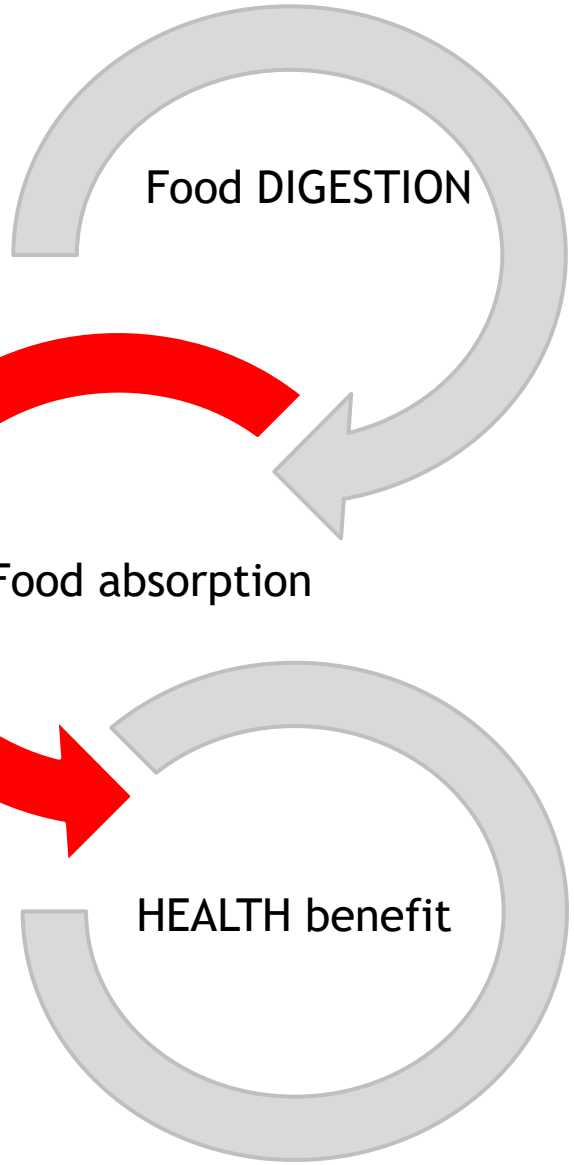
Anti-nutritional factors

Bioavailability

Gut health, allergy

Net protein Utilization NPU, BV

Bioactive peptides



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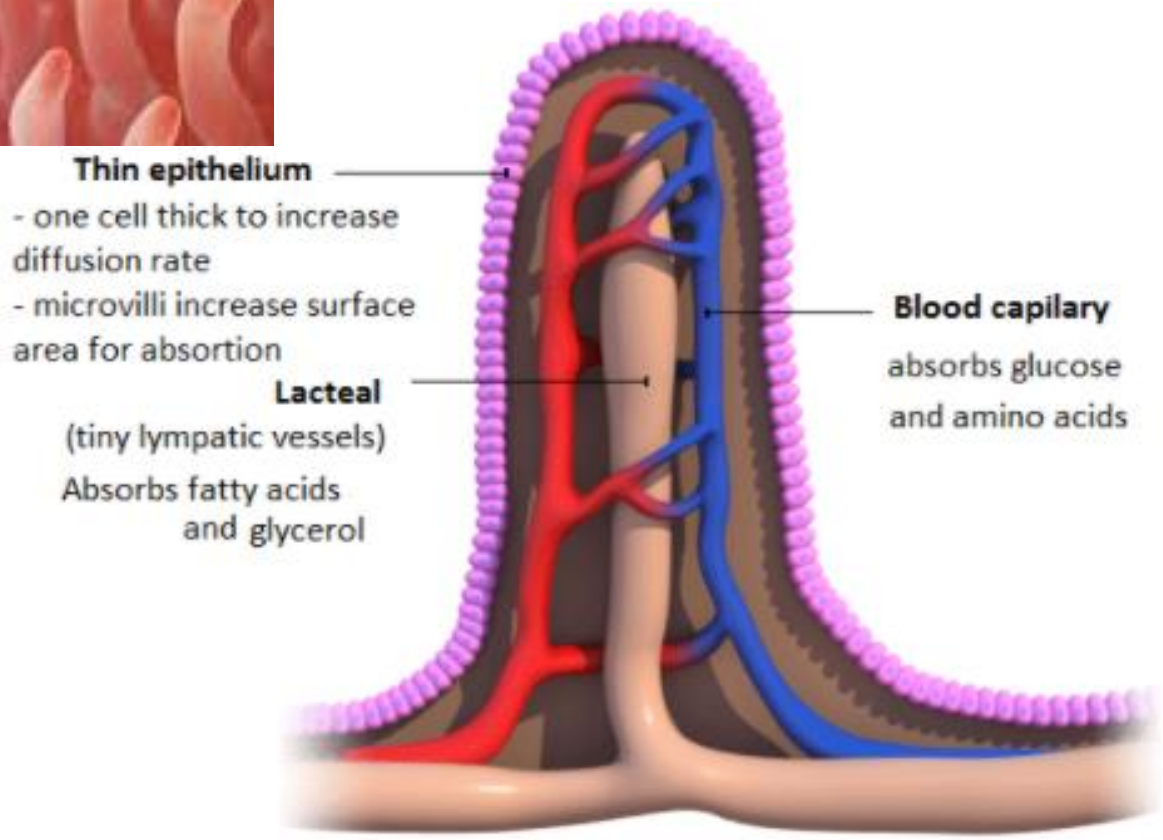
Food absorption



Gut barrier villi

Single layer of cells 5 types

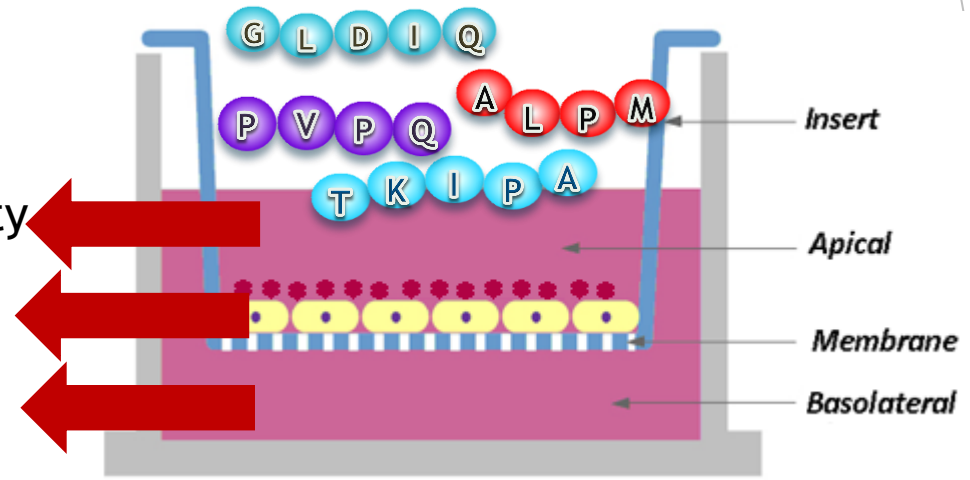
tight junctions with each other

Food absorption – In Vitro

Caco2
Human colorectal carcinoma
72 yr caucasian male enterocytes

HT29-MTX
Human colon adenocarcinoma 44yr female
Goblet cells

21 days
Mature polarised barrier



Bioaccessibility
Allergy
Gut health

Absorption
Bioactive peptides

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Digestibility DIAAS 0-100

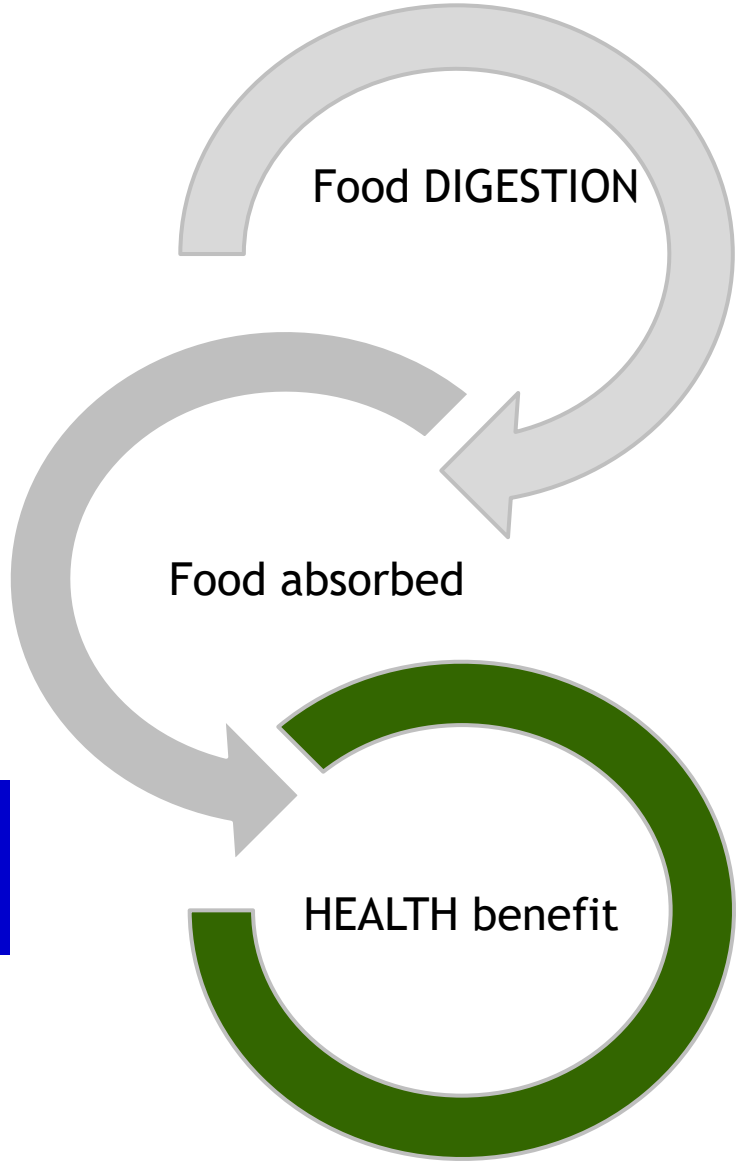
Anti-nutritional factors

Allergy

Gut health

Net protein Utilization NPU, BV

Bioactive peptides



Basolateral Samples

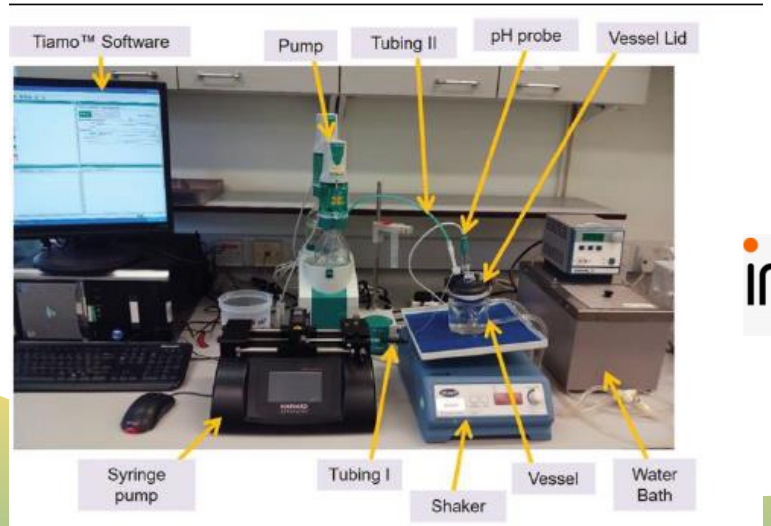
Muscle, fat, liver, immune

workflow

Step 1

Step 2

In vitro digestion



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Step 3

In vitro absorption

Protein rich Food digesta

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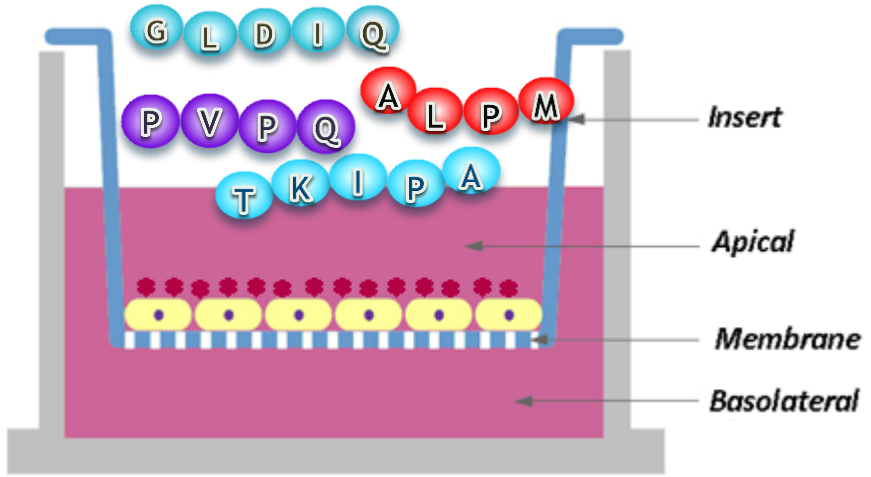

Microalgae (Chlorella)	SCP (Solein)	Crickets
		

Essential Amino Acid composition

Digestibility DIAAS

Fill knowledge gaps

Net protein Utilization NPU, BV

Anti-nutritional factors

Evaluate how Processing to improve

Bioactive peptides

Gut Health, Allergy

Digestion data can also play a role in selecting environmental sustainable food systems?

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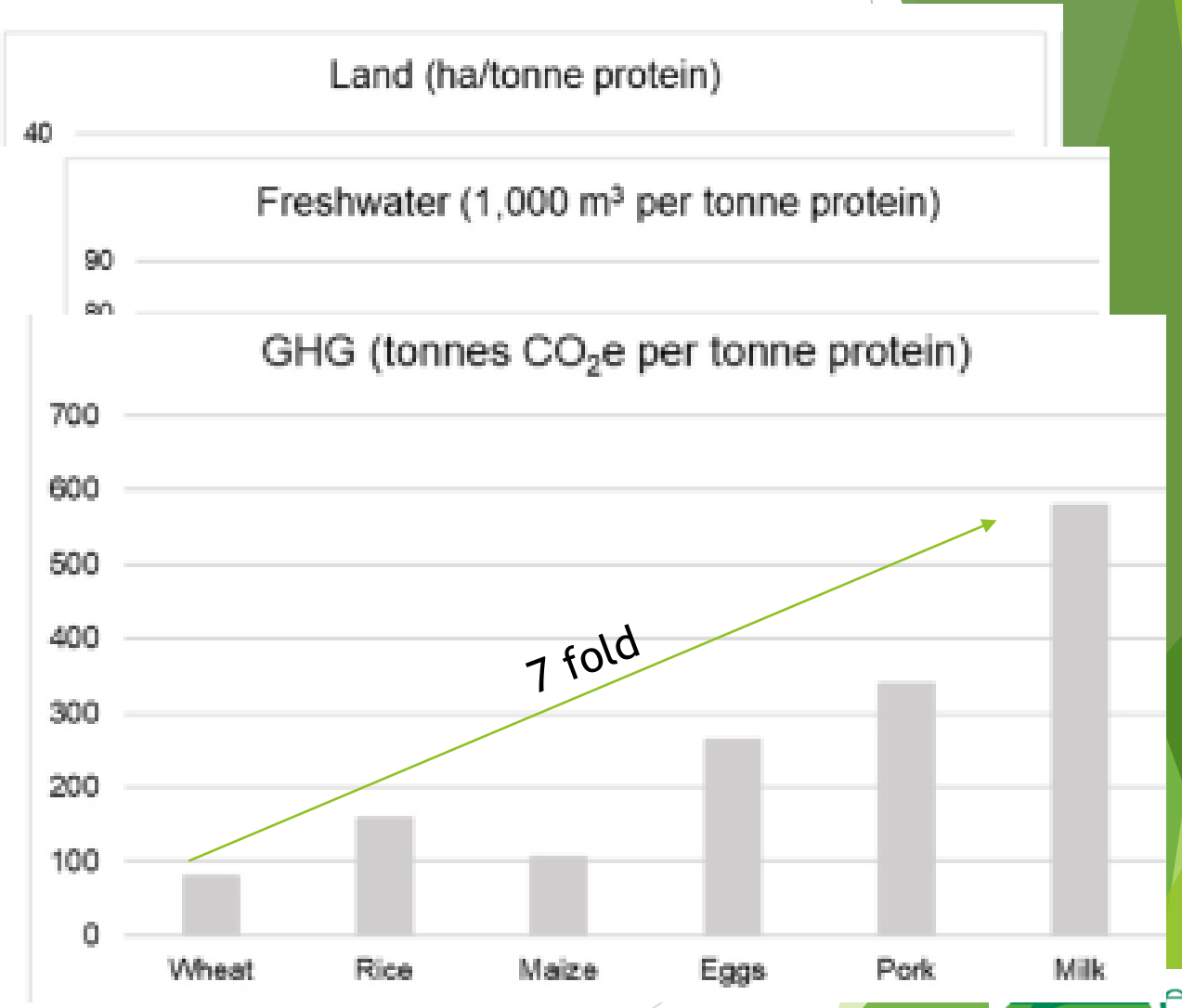
Which protein rich food should our land produce?

Environmental Impact Assessment

PROTEIN PRODUCTION?

+

PROTEIN PROCESSING?



Moughan, food security.
doi.101016/j.gfs.2021.100548

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Which protein rich food should our land produce?

Environmental Impa

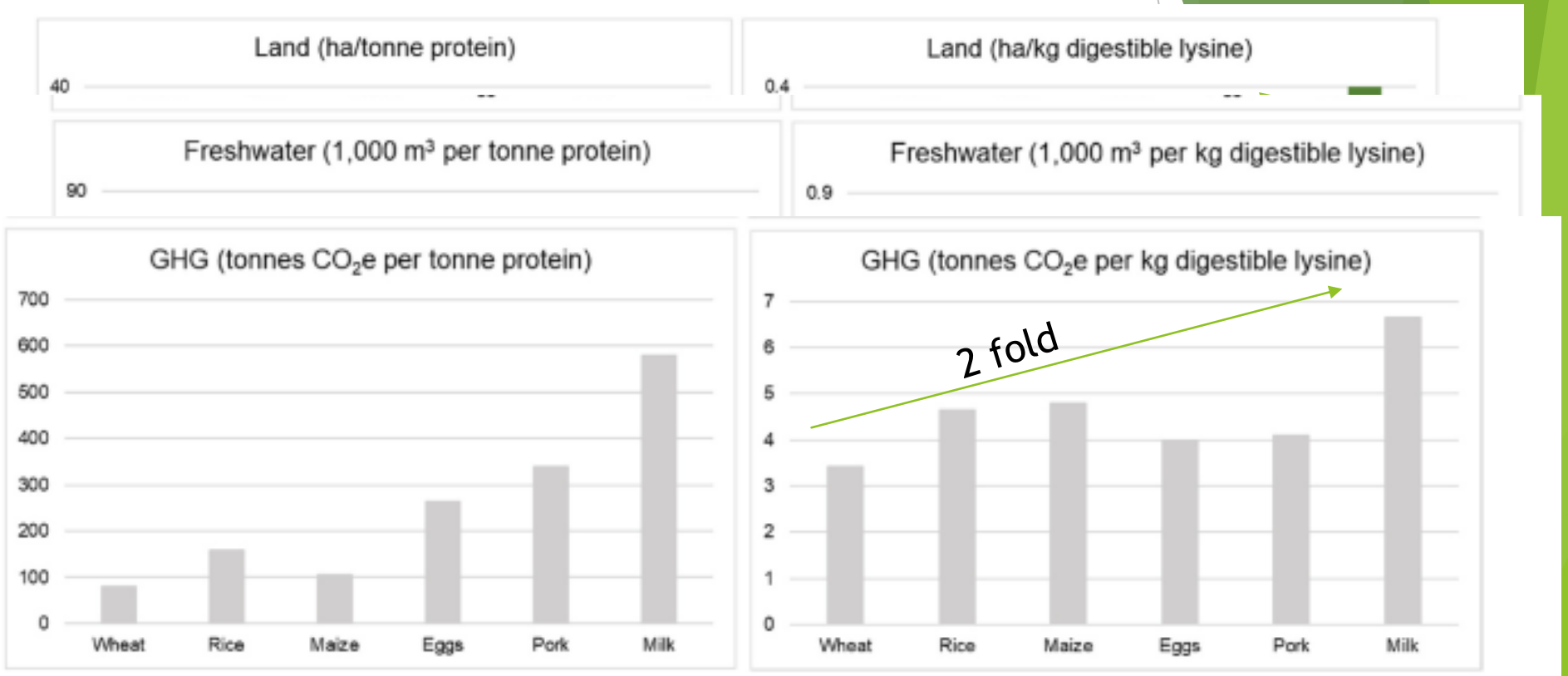
PROTEIN PRODUC

+

PROTEIN PROCES

+

DIGESTION (lysine)



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U-PROTEIN

VistaMilk

INFOTECH

INFBAR

GIANT LEAPS

BIOPROTEIN

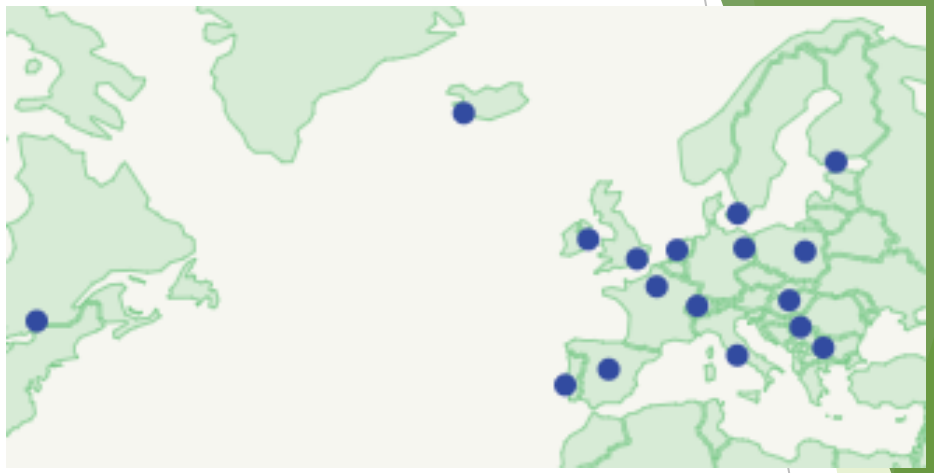
EAT4AGE

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

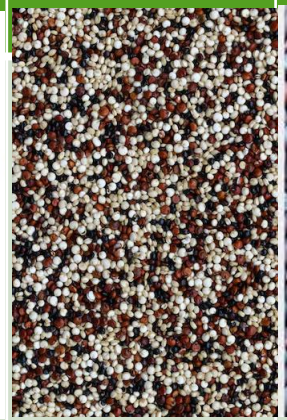
Department of Agriculture, Food and the Marine

sfi Science Foundation Ireland

GIANT LEAPS

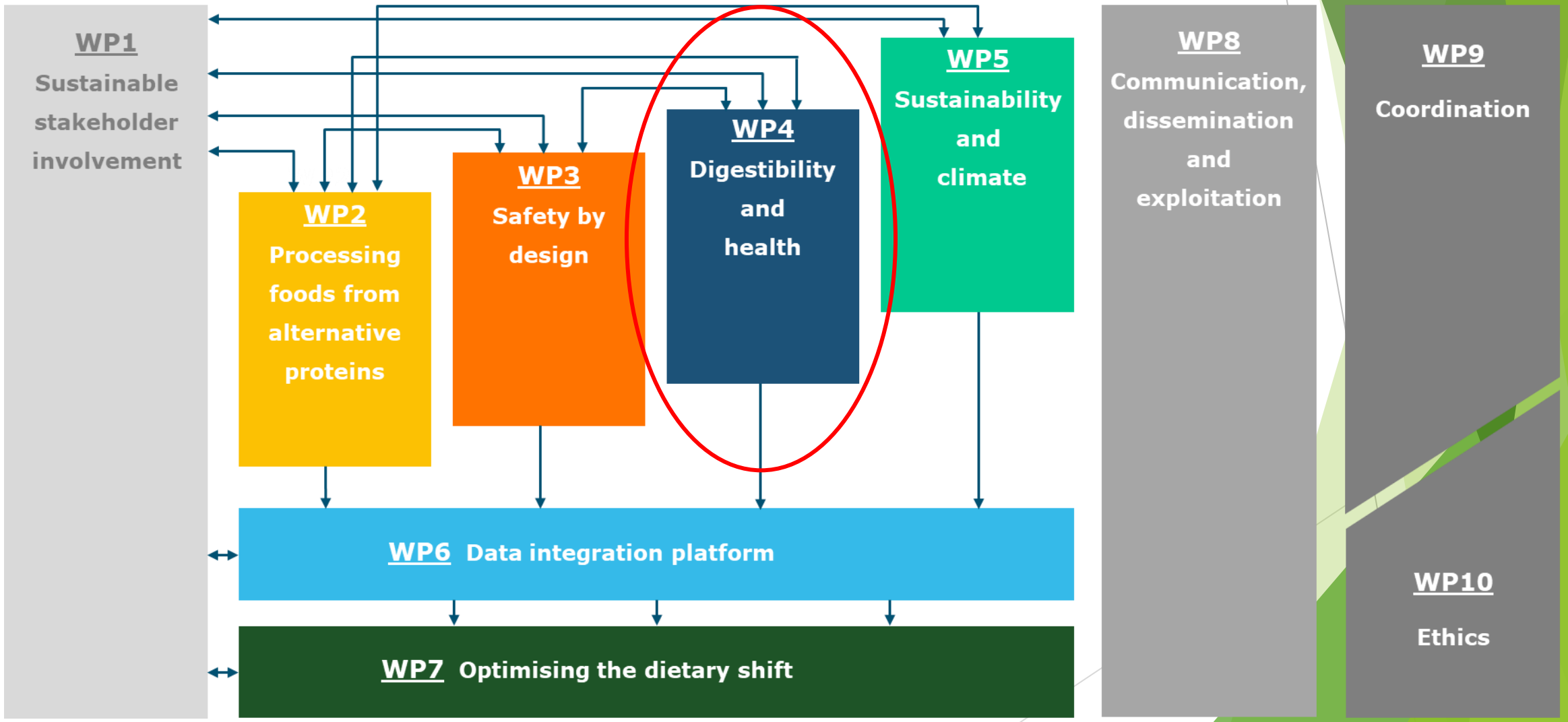


- Protein utilization and the dietary Shift
- Project duration: 1 September 2022 – 31 August 2026
- HORIZON Europe Research and Innovation Action
- Final EU/total budget: € 10.3 / 11.9 million
- 34 partners:

Faba bean	Lentil	Oat	Quinoa	Rapeseed	Microalgae	Single-cell	Crickets	Cultured beef
								

Focus on filling knowledge gaps

Work package structure and interactions



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Thank you!

HEALTHY human®

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