PROTEIN

Recovery, repair & muscle growth

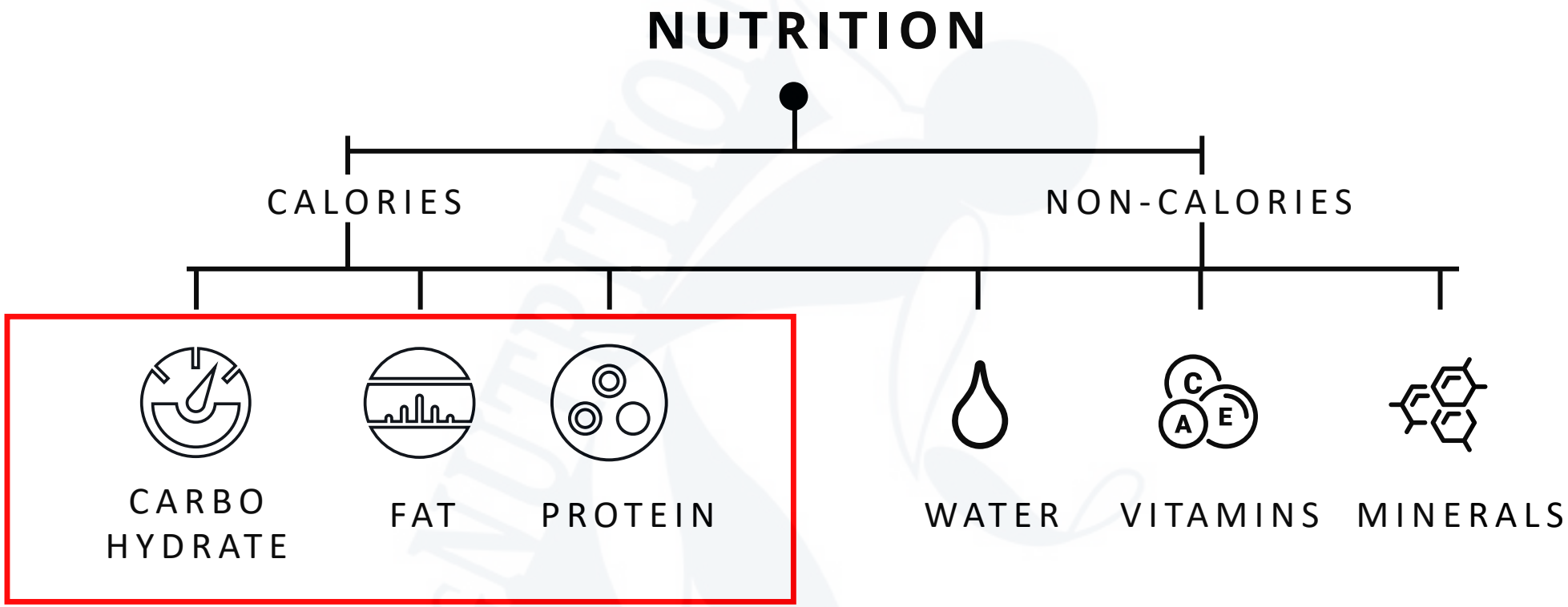
DID YOU KNOW

When it comes to protein and exercise, **more is not always better.**

There is a **false perception** that if you want to build muscle, you must simply eat more protein. Too much protein will just be used for fuel or stored as fat.

Muscle growth depends on **genetics, training and nutrition...**

(Mahan & Raymond, 2017)


NUTRITION
CALORIES
NON-CALORIES
CARBO HYDRATE
FAT
PROTEIN
WATER
C
A
E
VITAMINS
MINERALS

ENERGY

MEASUREMENTS

kCal = Calorie

kJ = Kilojoule

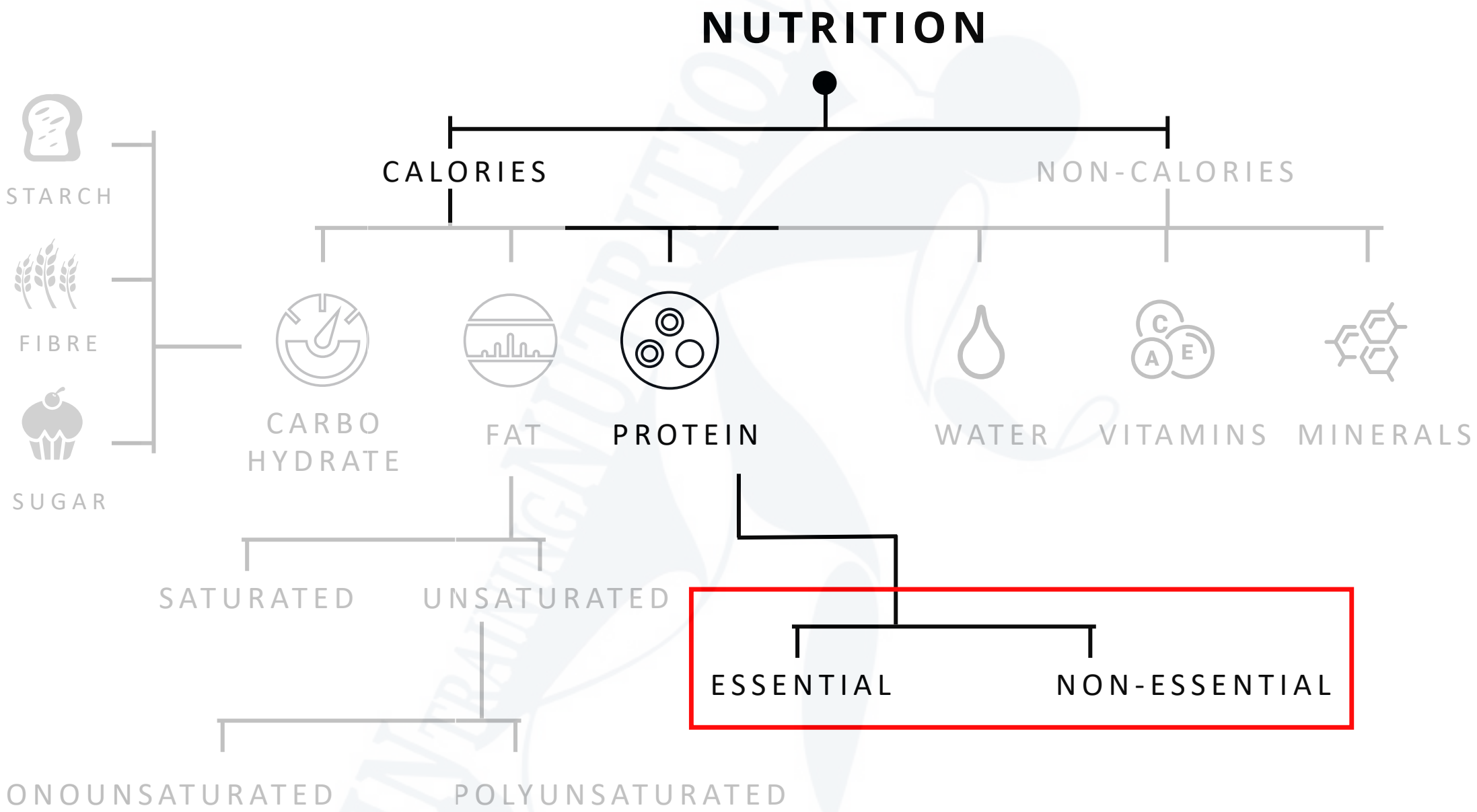
Same as kilometres & miles **or** kilograms and pounds

1 kCal = 4.18kJ

kCal to kJ (x 4.18)

kJ to kCal (/ 4.18)

(Mahan and Raymond, 2017)


NUTRITION
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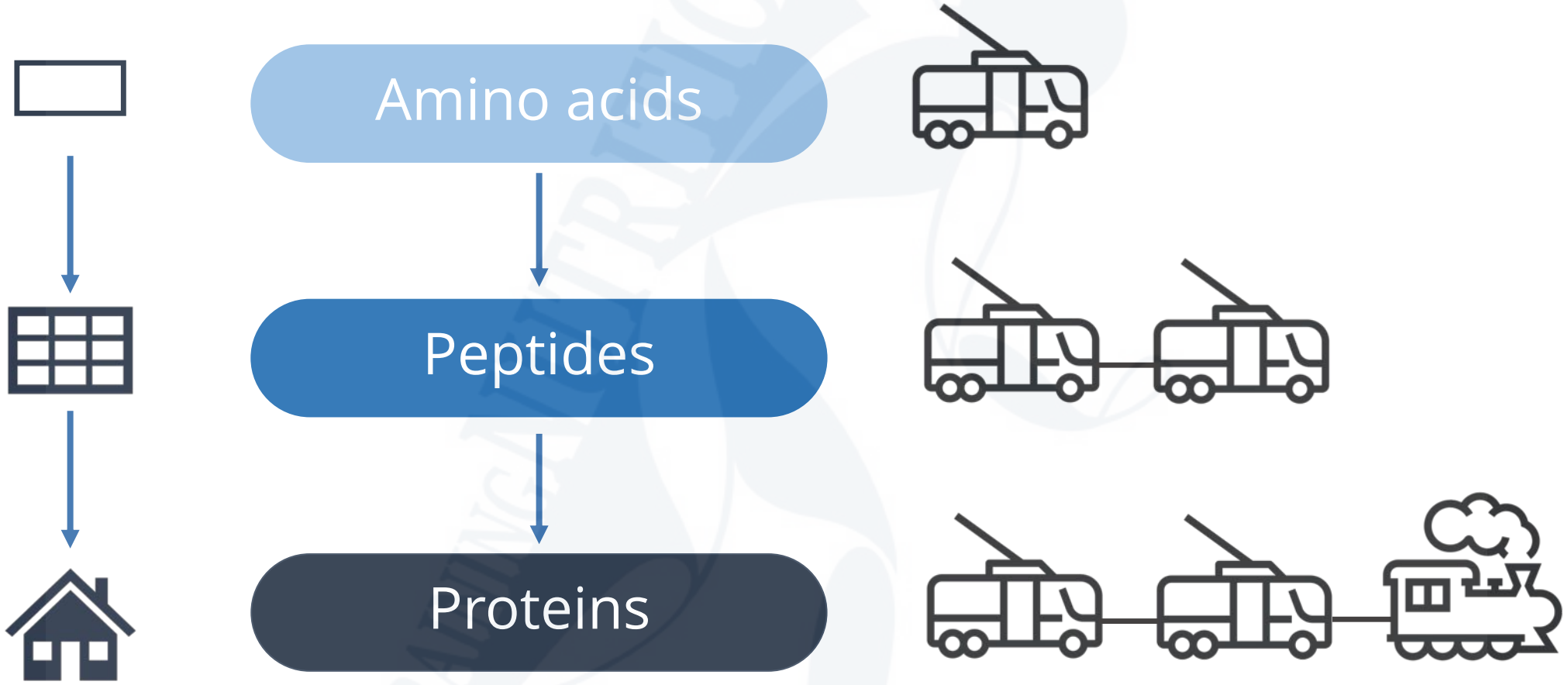


(Mahan and Raymond, 2017)

1.  2.  3.  4.  5.  6.  7.  8.  9. 

Essential	Conditionally essential	Non-essential
1. Histidine	Arginine	Alanine
2. **Isoleucine**	Cysteine	Aspartic acid
3. **Leucine**	Glutamine	Asparagine
4. Lysine	Glycine	Glutamic acid
5. Methionine	Proline	Serine
6. Phenylalanine	Tyrosine	Selenocysteine
7. Threonine		Pyrrolysine
8. Tryptophan		
9. **Valine**		

(Mahan and Raymond, 2017)

TYPES OF PROTEIN FOODS

ANIMAL

PLANT

SUPPLEMENTS

- HBV = High biological value
- Consists of all 9 amino acids

(Mahan & Raymond, 2017)

ANIMAL

PROTEINS

- Meat, poultry & fish:
  - High biological value protein
- Eggs:
  - Previously demonised
- Dairy:
  - High in leucine

Fish

- **White**
  - e.g. hake, kingklip, haddock, cod, basa etc
- **Oily**
  - e.g. salmon, mackerel, trout, pilchards, sardine's etc

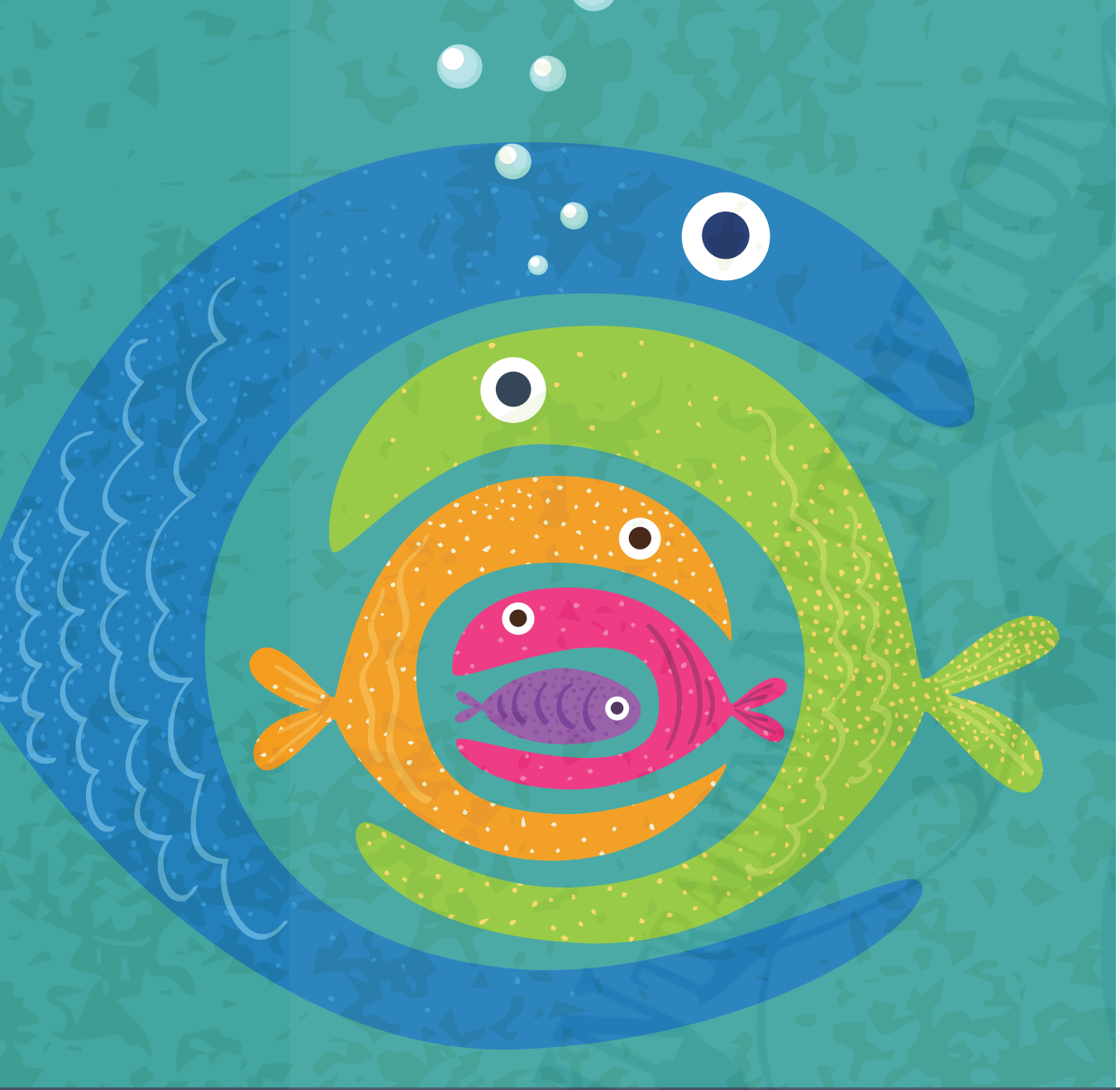
BOTH good source of HBV*

Low in saturated fat

Good source of omega 3

*HBV = High biological value

(Pennutrition, 2019; Mahan and Raymond, 2017)



FISH

& MERCURY

- Methylmercury toxicity
- Avoid:
  - Shark, swordfish, king mackerel, marlin, escolar, orange roughy or tilefish
  - Albacore tuna
  - Dried fish from Asia
- Choose a variety of low mercury fish

(Pennutrition, 2019, Mahan and Raymond, 2017)

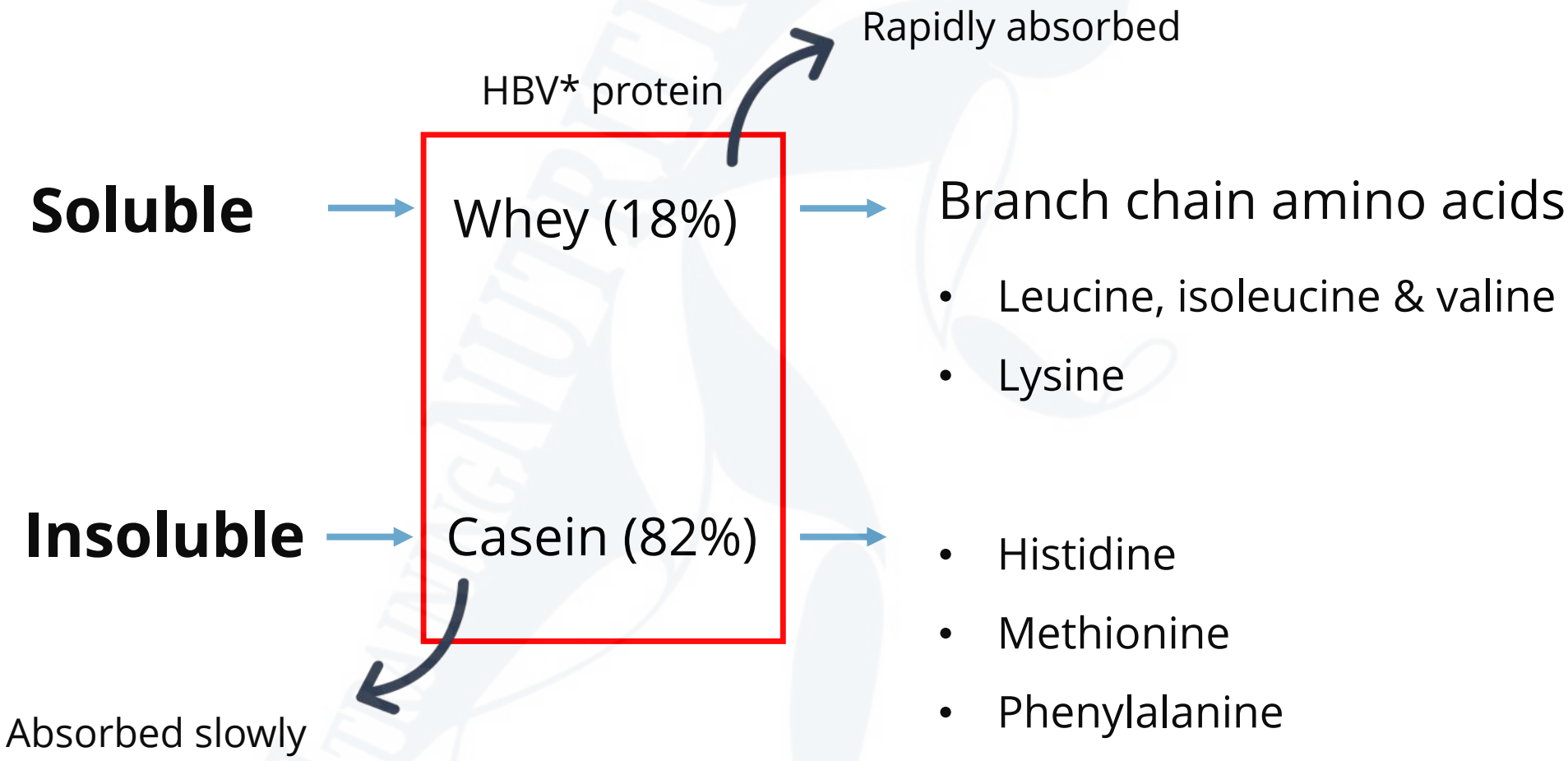
EGGS

& CHOLESTEROL

- Avoidance = outdated recommendation
  - Limit to < 3 x per week & avoid the yolk
- Current recommendations:
  - 1 x per day (or 7 per week)
  - Consume the entire egg
  - Low in saturated fats

(Pennutrition, 2019, Mahan and Raymond, 2017)

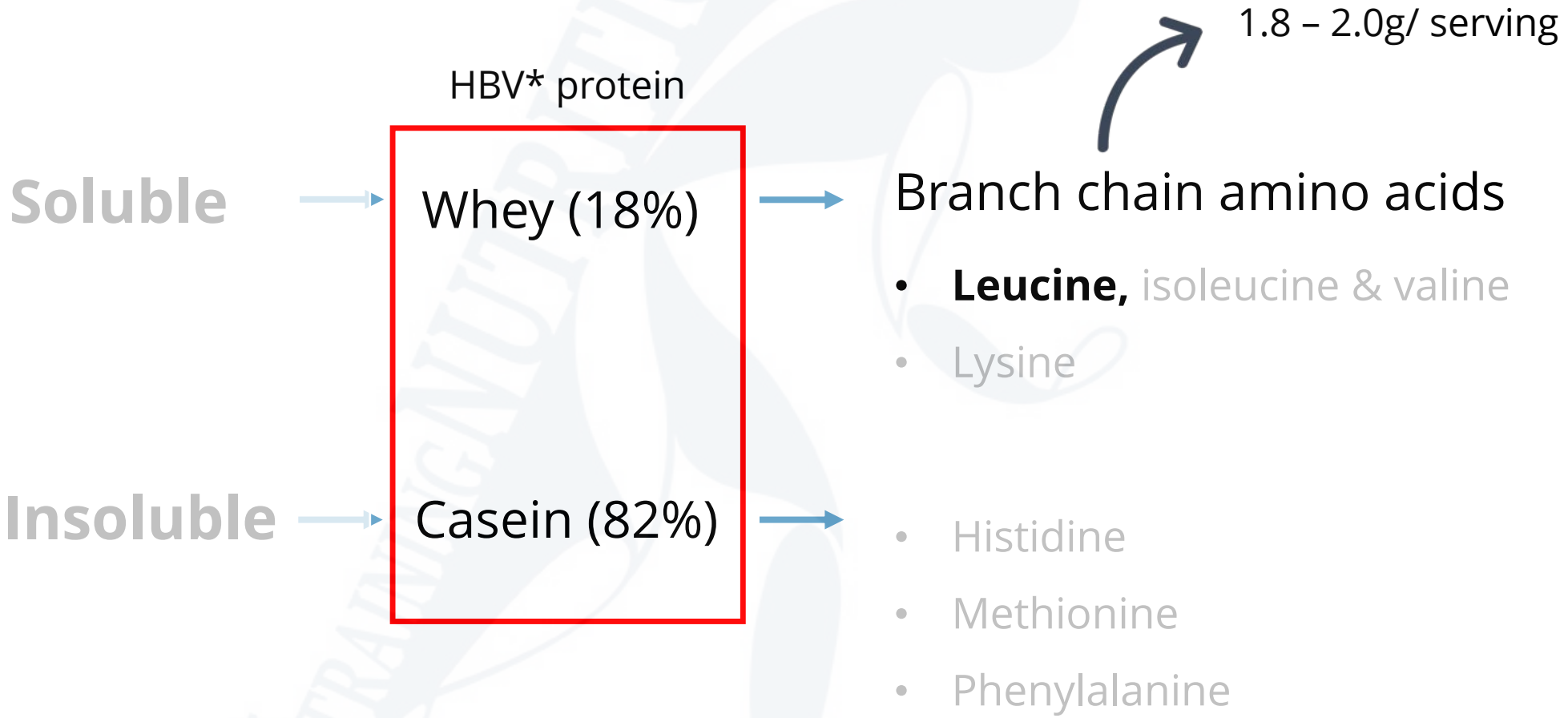
MILK PROTEIN COMPOSITION



*High biological value

(Rediscoverdairy.co.za, 2019; Pereira 2013; Severin & Wenshiu, 2005)

MILK PROTEIN COMPOSITION



*High biological value

(Rediscoverdairy.co.za, 2019; Pereira 2013; Severin & Wenshiu, 2005)

PLANT

PROTEINS

- Legumes:
  - Beans, lentils, chickpeas
- Soya beans:
  - Soya milk, tofu, tempeh
- Other:
  - Quinoa, seitan, mycoprotein

(Mahan & Raymond, 2017)

IS SOY

SAFE

- Unfermented
  - Soya milk alternative, tofu & soya ‘meat’ replacements
- Fermented
  - Tempeh & miso
- Contains various quality nutrients
  - Protein, fibre, EFA, vitamins & minerals

(Bda.uk.com, 2019)

IS SOY

SAFE

- Antinutrients
  - Impair absorption of certain minerals (iron, zinc & calcium)
  - Well absorbed in a mixed diet
- Does not raise cancer risk
- Does not disrupt hormone levels

(Bda.uk.com, 2019)

PROTEIN

SUPPLEMENTS

- Different proteins have different amino acid complements, digestion and absorption rates
- Milk based:
  - Whey & casein
  - Higher leucine content
  - Good digestibility & absorption
- Plant based:
  - Hemp, pea, soya

(Pennutrition, 2017)

PROTEIN

SUPPLEMENTS

- Milk vs soy
  - Better for muscle gains
- Plant proteins (pea/ rice)
  - Higher intake may negate lower protein effects (approx. 30g protein)
  - Higher intake helps reach adequate leucine levels

(Burke & Deakin, 2011; Pennutrition, 2017)

PROTEIN

SUPPLEMENTS

- Concentrate vs isolate
  - Concentrate = with some fat and CHO
  - Isolate = only protein
- Hydrolysed
  - Partially broken down- little benefit

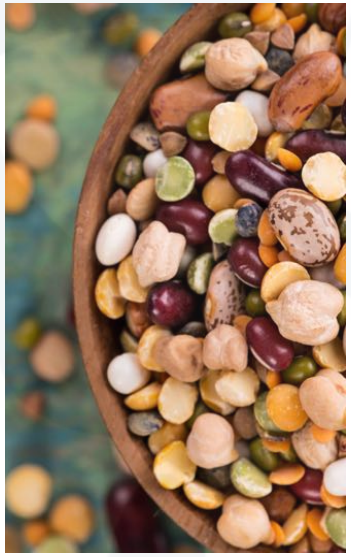
(Pennutrition, 2017)

ENERGY IN PROTEIN FOODS

4kCal/g

ANIMAL

4kCal/g



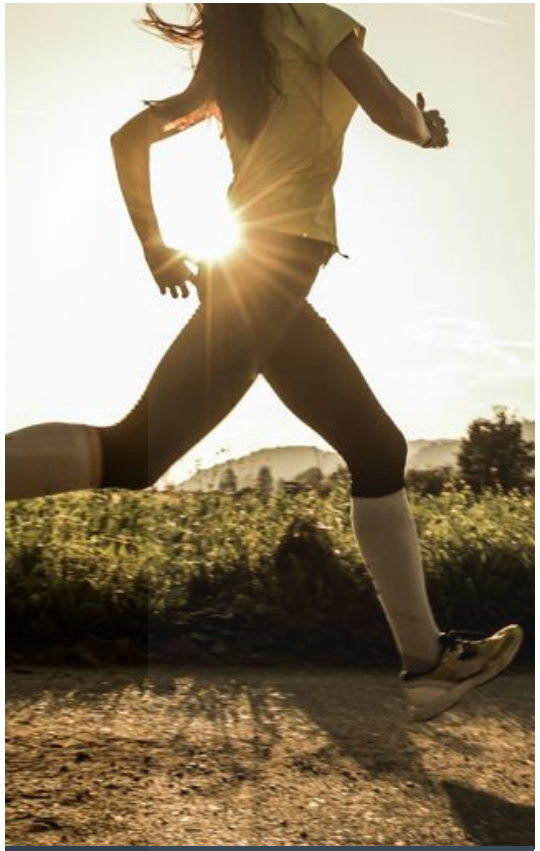
PLANT

4kCal/g

SUPPLEMENTS

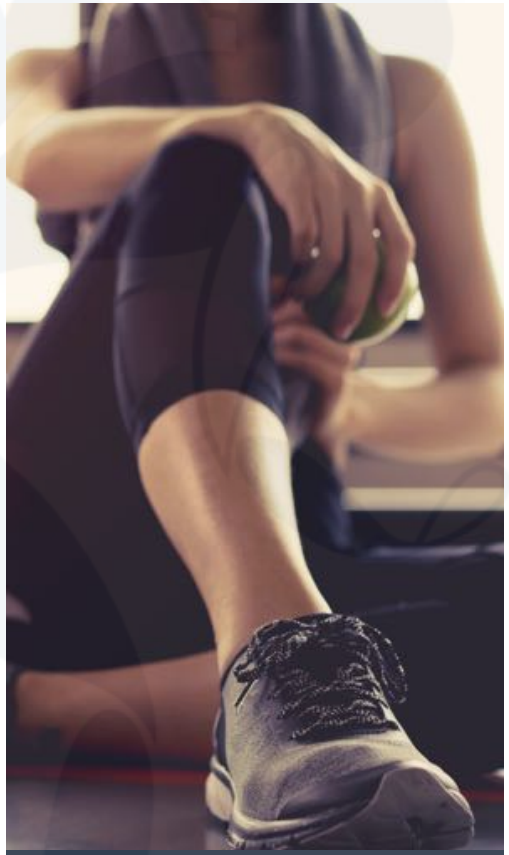
(Mahan & Raymond, 2017)

WHY IS PROTEIN IMPORTANT?

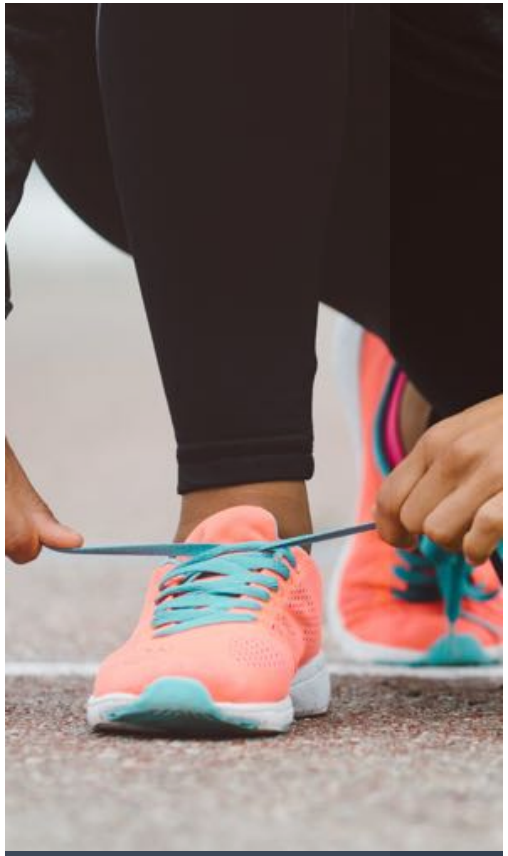


BUILD & REPAIR TISSUE

HORMONES & ENZYMES



MESSENGER & IMMUNE CELLS



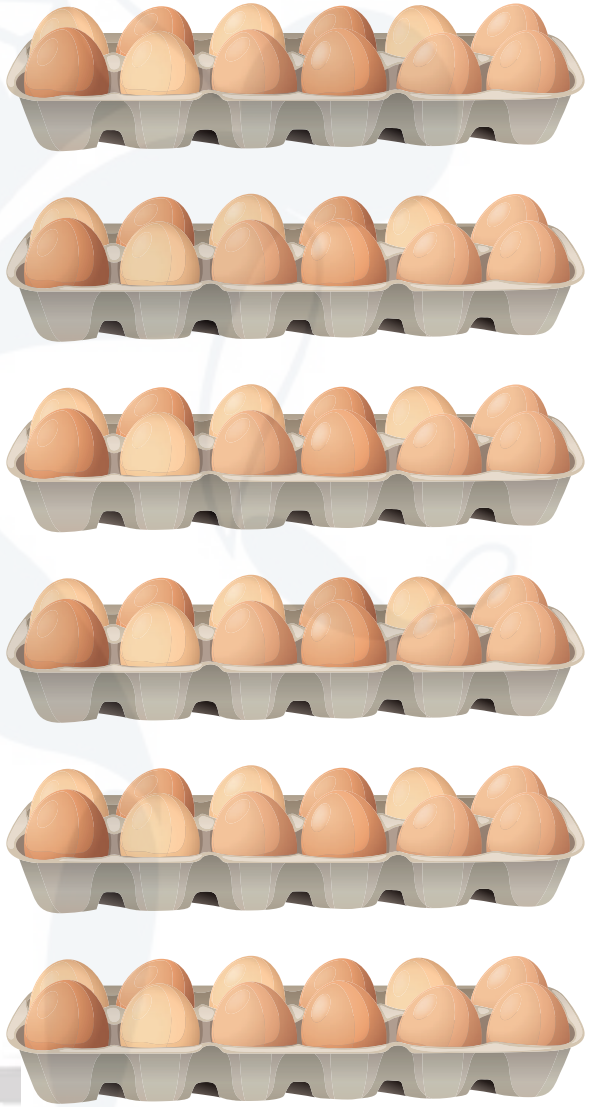
TRANSPORT CELLS

(Burke & Deakin, 2010)

DIET

& PROTEIN TURNOVER

- Diet obviously has an effect on protein metabolism
  - Starvation = clear net negative protein balance
  - Optimal levels
  - High intake = plateau



(Burke & Deakin, 2011)

TOO MUCH

PROTEIN

- Few side effects <2g/kg/d
- Unnecessary
- High cost (monetary)
- May compromise CHO intake
  - May affect ability to train & compete
- Used for energy

(Mahan & Raymond, 2017; Slater et al, 2011, Burke & Deakin, 2011)

TOO MUCH

PROTEIN

- Result in:
- Dehydration, hypercalciuria, weight gain & stress on the kidneys and liver
- Single amino acid supplements:
  - May interfere with the absorption of other essential amino acids
- Amino acid supplements instead of food
  - May lead to deficiencies

(Mahan & Raymond, 2017)

OTHER

FACTORS

- Ensure sufficient energy & CHO intake
- Inclusion of CHO with protein:
  - Protein sparing (CHO used for energy)
  - May have an impact on reducing breakdown
  - Increase post exercise glycogen synthesis

(Mahan & Raymond, 2017; Burke & Deakin, 2011)

PROTEIN requirements

For EXERCISERS

- Timed according to training
  - Encourage post-workout recovery
- BOTTOM LINE:
  - **10 – 35% of total energy**
  - **0.8 – 1g/kg/d**

(Mahan & Raymond, 2017, Potgieter, 2013)

EXAMPLE

EXERCISER

- **Weight:** 65kg (BMI: 21.7kg.m2)

- **Total energy:** 25 – 35kCal/kg
- **Protein: 0.8 – 1g/kg/d**

- **Energy:** 25 - 35 x 65 = 1625 - 2275kCal/ d
- **Protein:** 0.8 - 1 x 65 = 52 – 65g/d

PROTEIN requirements

For ATHLETES

International Olympics Committee (IOC)

Endurance athletes

- **1.3 – 1.8g/kg/d**
  - Slightly higher requirements
  - Endurance = increases leucine use

10-20% lower in women than in men

Resistance/ strength athletes

- **1.6 – 1.7g/kg/d**
  - Higher range in competition season
  - Supports muscle protein synthesis
  - Reduced muscle breakdown
  - Repairs muscle damage

(Phillips, 2012; Potgieter, 2013)

ENDURANCE

EXERCISE

- Protein will be used as energy
  - If CHO and energy is insufficient
  - During high intensity workouts
- Experimental data suggests:
  - Protein intake post-workout
    - Augment gains in fitness
    - Untrained & new training schedule
- Branch chain amino acids (BCAA)
  - Leucine, isoleucine & valine (~Lysine)
  - Preferentially oxidised

(Pennutrition, 2017; Burke & Deakin, 2011)

RESISTANCE

EXERCISE

- Diet
  - Whole food vs supplements
- Sufficient resistance training: 6-8 weeks
  - Increases anabolism by 40 – 100%
- High vs low responders
  - Despite additional nutritional support

(Mahan & Raymond, 2017; Tipton & Phillips, 2013; Pennutrition, 2017)

TESTOSTERONE

& muscle gains

- Increases lean muscle tissue
  - Even in absence of resistance exercise
- Increases protein synthesis & amino acid re-utilization (but not breakdown)
- Effects magnified with resistance exercise
- Testosterone levels:
  - Increased with acute exercise
  - Decreased with high protein diet

(Burke & Deakins 2011)

INSULIN

& muscle gains

- Net stimulatory effect on muscle protein synthesis
  - Reduces breakdown of muscle proteins
  - Provides a theoretical basis for including CHO and protein post-workout

(Burke & Deakins 2011)

INCREASING

STRENGTH

- More muscle does not = more strength
- Contractile protein = more strength
  - Age
  - Genes
  - Epigenetic influences
  - Neural adaptations
  - Cognitive
  - Psychological factors

(Pennutrition, 2017)

INCREASING

STRENGTH

- More muscle does not = more strength
- Contractile protein = more strength
  - Age
  - Genes
  - **Epigenetic influences**
  - Neural adaptations
  - Cognitive
  - Psychological factors

(Pennutrition, 2017)

EXAMPLE

ATHLETE (strength)

- **Weight:** 65kg (BMI: 21.7kg.m2)

- **Total energy:** 50 – 80kCal/kg
- **Protein: 1.6 – 1.7g/kg/d**

- **Energy:** 50 - 80 x 65 = 3250 - 5200kCal/d
- **Protein:** 1.6 – 1.7 x 65 = 104– 110.5g/d

*At the end of L5 will calculate this in food terms

PROTEIN

BEFORE EXERCISE

- Different according to various sports nutrition bodies
  - ACSM- Moderate amount added to pre-workout meal
  - ISSN- 0.15 – 0.25g/kg added to pre-workout meal
  - IOC- Protein should be eaten after exercise (not before)

(Kerksick et al, 2008, Rodriquez et al, 2009; Slater et al, 2011)

PROTEIN

DURING A WORKOUT

- May improve endurance performance
  - CHO: Protein (3-4 : 1)
  - Increasing muscle glycogen
  - Reducing muscle damage
  - Promoting better training adaptations
- Perhaps due to added energy?
  - Insufficient evidence to make a consensus
  - More research is needed

(Rodriquez et al, 2009; Slater et al, 2011, Van Essen, 2006; Cermak, 2009)

PROTEIN

AFTER EXERCISE

Consensus between ACSM, ISSN and IOC

- ~20g HBV protein with CHO
  - EAA (6-20g) + 30-40g CHO
  - CHO replaces muscle glycogen
- Within 30 minutes post workout
- Using dietary sources
- Can use a liquid meal replacement/ whole food
  - i.e. flavoured low fat milk

(Potgieter, 2013)

LOSING FAT

GAINING MUSCLE

IOC recommends:

- Decreasing daily CHO intake
  - 3 – 4g/kg/d
- Increasing protein
  - 1.8 – 2.7g/kg/d
- While following a low energy diet &
- Specified training program

(Mahan & Raymond, 2017; Phillips, 2011)

NEXT

SUPPLEMENTS & SPORTS FOOD

Pros & cons of sports food & supplements

Scientific vs anecdotal evidence

AIS supplement program

- Group A:
  - Sports foods, medical supplements & performance supplements
- Group B:
  - Food polyphenols, sick pack, amino acids & antioxidants

SUMMARY

- Animal proteins consist of HBV protein
  - All 9 EAA
- Plant proteins provide us with variety
  - Soy is a safe, high protein alternative
- There are a variety of protein supplements
  - Milk based vs plant based
    - May be linked to leucine content
- Protein is the building blocks for all cells
- Too much dietary protein intake
  - More harm than good

SUMMARY

- Rather aim to optimize protein utilization
- Protein requirements are slightly different between exercisers, endurance and strength athletes
  - Timing of protein intake after a workout may maximise protein muscle stimulation
- Various factors affect muscle gains
  - Gender, testosterone & insulin levels