OBJECTIVES

- What is sports nutrition
- Good nutrition & physical activity
- Different type of athletes
- Understand the 2 main muscle fibres
- Energy metabolism:
  - ATP-CrP system
  - Anaerobic/ glycolytic system
  - Aerobic/ oxidative

ATHLETIC

PERFORMANCE

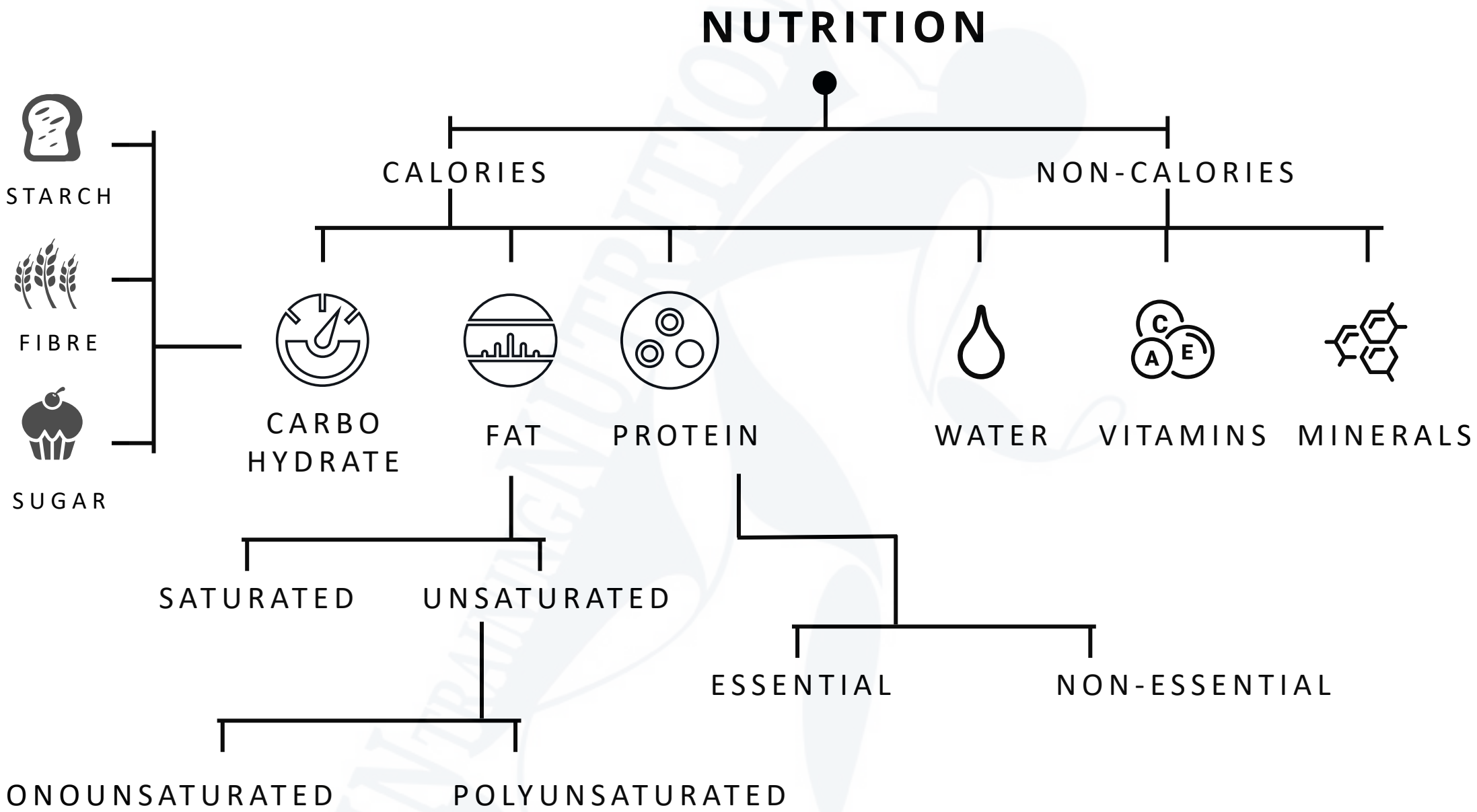
- Genetics
- Desire
- Proper training
- Rest/ recovery

(Mahan & Raymond, 2017)

ATHLETIC
PERFORMANCE

- Genetics
- Desire
- Proper training
- Rest/ recovery
- Optimised nutrition
- Hydration

(Mahan & Raymond, 2017)



SPORTS

NUTRITION consists of:

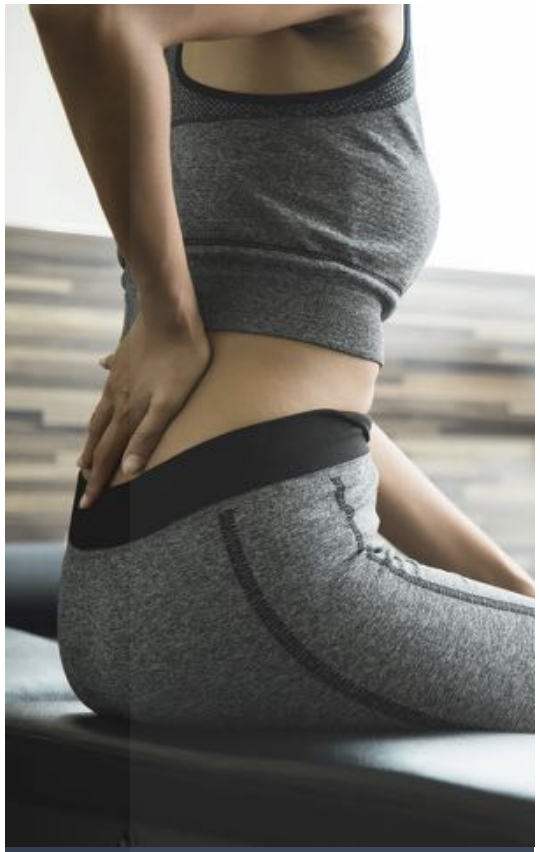
1. Healthy eating habits

2. Supplements

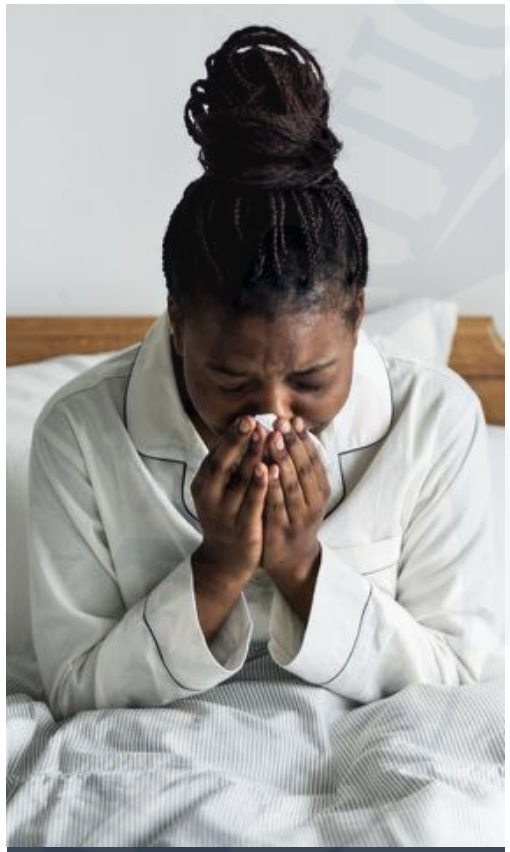
3. Sports foods

(IOC, 2011)

SPOTTING POOR NUTRITION

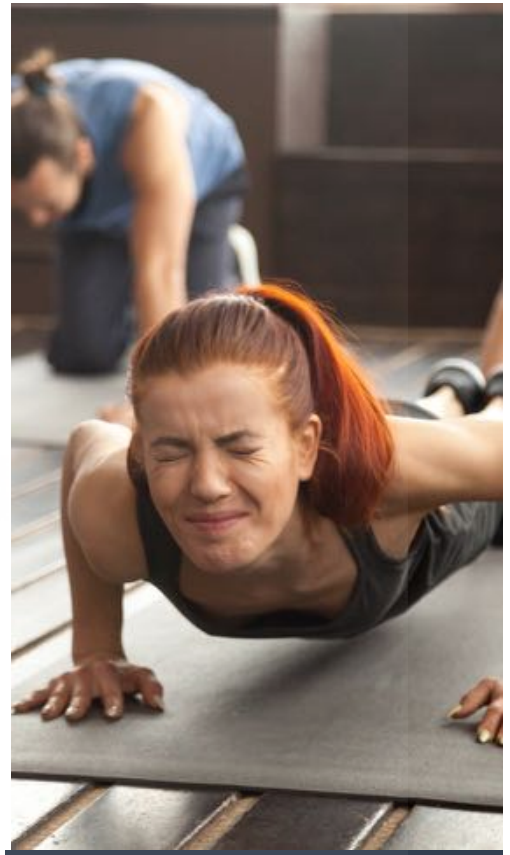


INJURY



ILLNESS

OVERTRAINING



DECREASED PERFORMANCE

(Burke & Deakin, 2010)

ATHLETE vs EXERCISER

Athlete:

- Training in sports aiming to improve his/ her performance/ results
- Actively participating in sports competitions
- Formally registered in a local, regional or national sports federation
- Have sports training and competition as his/ her major activity (way of living) or focus of personal interest, devoting several hours in all or most days for these activities, exceeding the time allocated to other types of professional or leisure activities

Represent < 1% of the population

(acc.org, 2016)

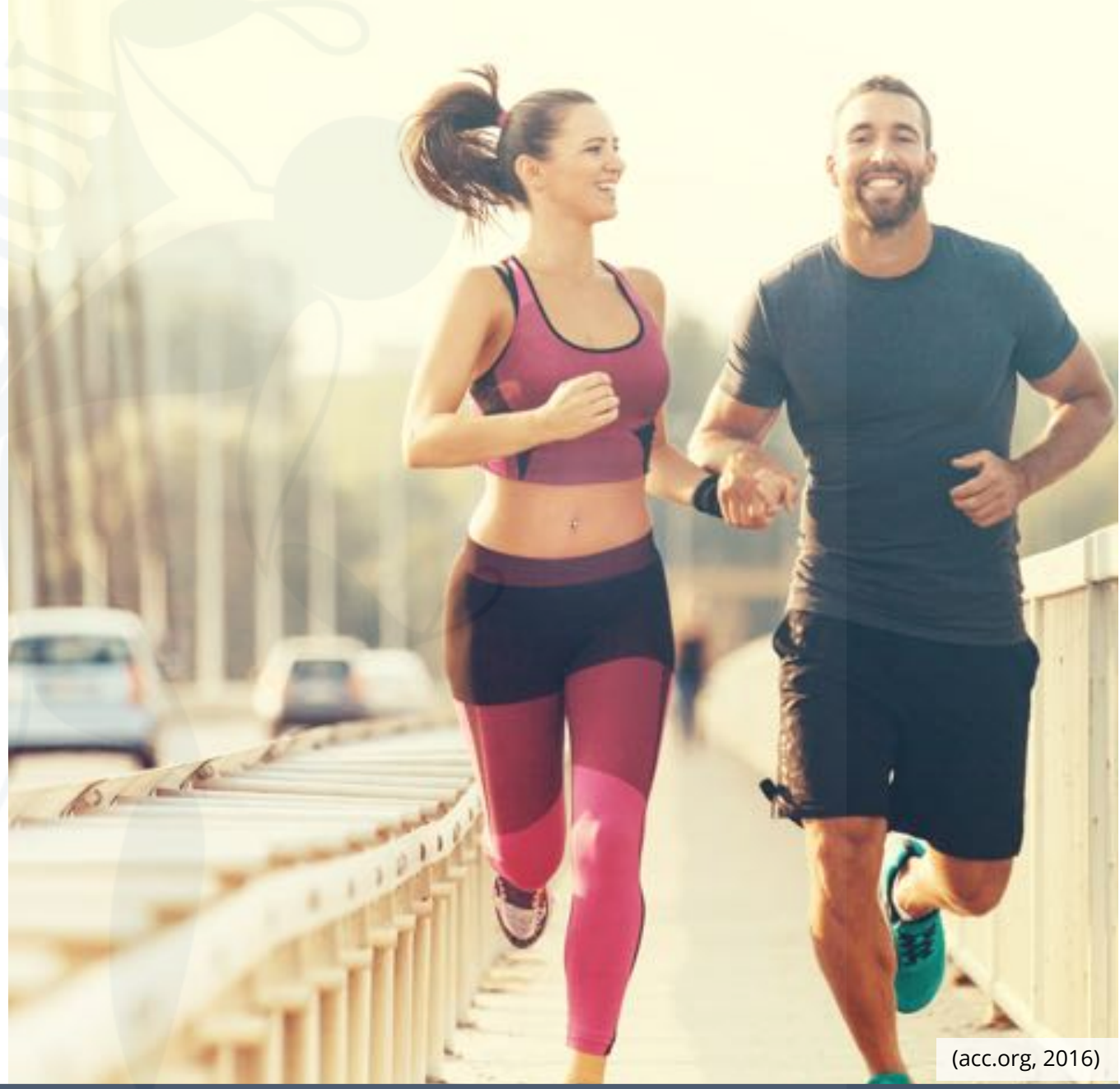
ATHLETE vs EXERCISER

Exerciser:

- Does not meet these criteria
- May or may not compete
- Replaces the terms amateur/ recreational athlete

Health promotion & body aesthetics:

- Usually primary goal
- Not necessarily performance
- Great population to benefit from medical advice



(acc.org, 2016)

TYPES OF EXERCISE

ENDURANCE:

Prolonged activity at a lower intensity

Metabolic adaptations: Increase oxygen supply

RESISTANCE:

Short, intense bursts of power output

Increase in strength, power & muscle mass

SPORTS:

Combination of endurance & strength

(Mahan & Raymond, 2017)

WHAT IMPACTS

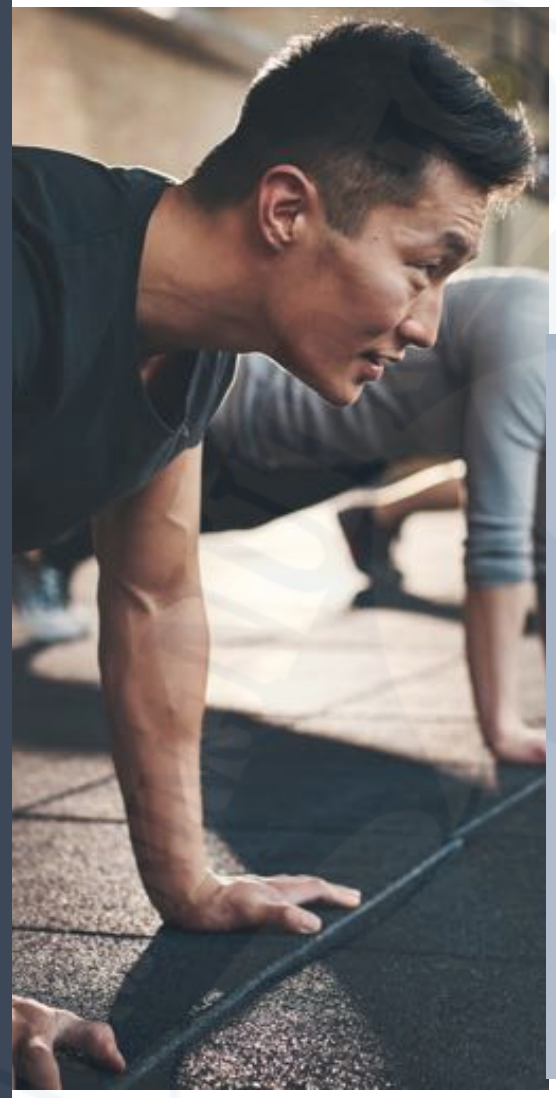
EXERCISE CAPACITY?

- The muscles total cross sectional area
- **Muscle fibre type**
- Number of active motor units
- Motor neuron firing frequency
- Muscle length
- Velocity of contractions

(Burke & Deakin, 2010)

MUSCLE FIBRES

Why do we need to know about them?



- Help you understand which energy systems & nutrients best fuel your muscles
- Muscle biopsy needed for definitive answer
- Type of activity you excel at can give you an estimation

SLOW TWITCH

Type 1 MUSCLE FIBRE

- Fatigue resistant
- Aerobic/ oxidative energy system
- Well supplied by capillaries:
  - AKA blood vessels
  - More oxygen supply
- Pronged low intensity activity
  - i.e. marathon

(Burke & Deakin, 2010)

FAST TWITCH

Type 2 MUSCLE FIBRE

- Two types of fast twitch:
  - Fast Twitch a (FTa)
  - Fast Twitch b (FTb)
- More fatigable
- Greater anaerobic/ glycolytic activity
- Lower aerobic/ oxidative capacity
- Better suited to high intensity exercise
  - i.e. weight lifting

(Burke & Deakin, 2010)

MUSCLE FIBRE

Composition & performance

- The type is determined by:
  - Genetics
  - Training induced alterations
- Elite endurance athletes:
  - 70 – 90% slow twitch muscle fibres
- Sprint & explosive sports athletes:
  - More fast twitch fibres

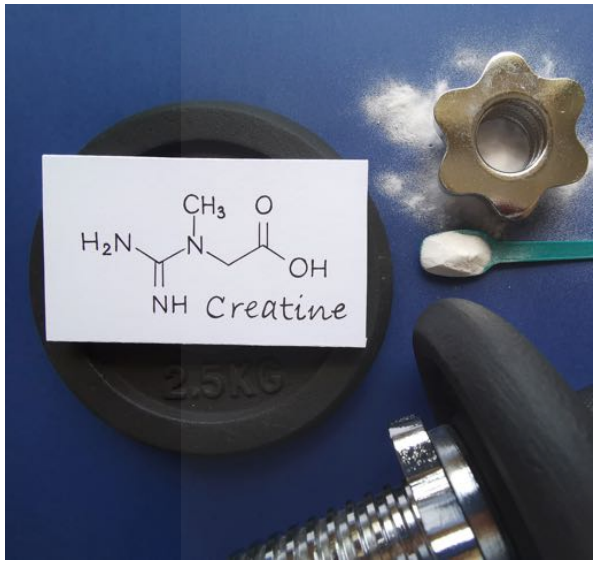
(Burke & Deakin, 2010)

ENERGY METABOLISM

Why do we need
to know
about them?

- Understand why we fatigue
- What training & nutrition measures can be helpful to prevent it

ENERGY METABOLISM



ATP-CrP:

Adenosine triphosphate (ATP)

Creatine Phosphate (CrP)

Independent of oxygen

ANAEROBIC:

Glycolytic system

Independent of oxygen

AEROBIC:

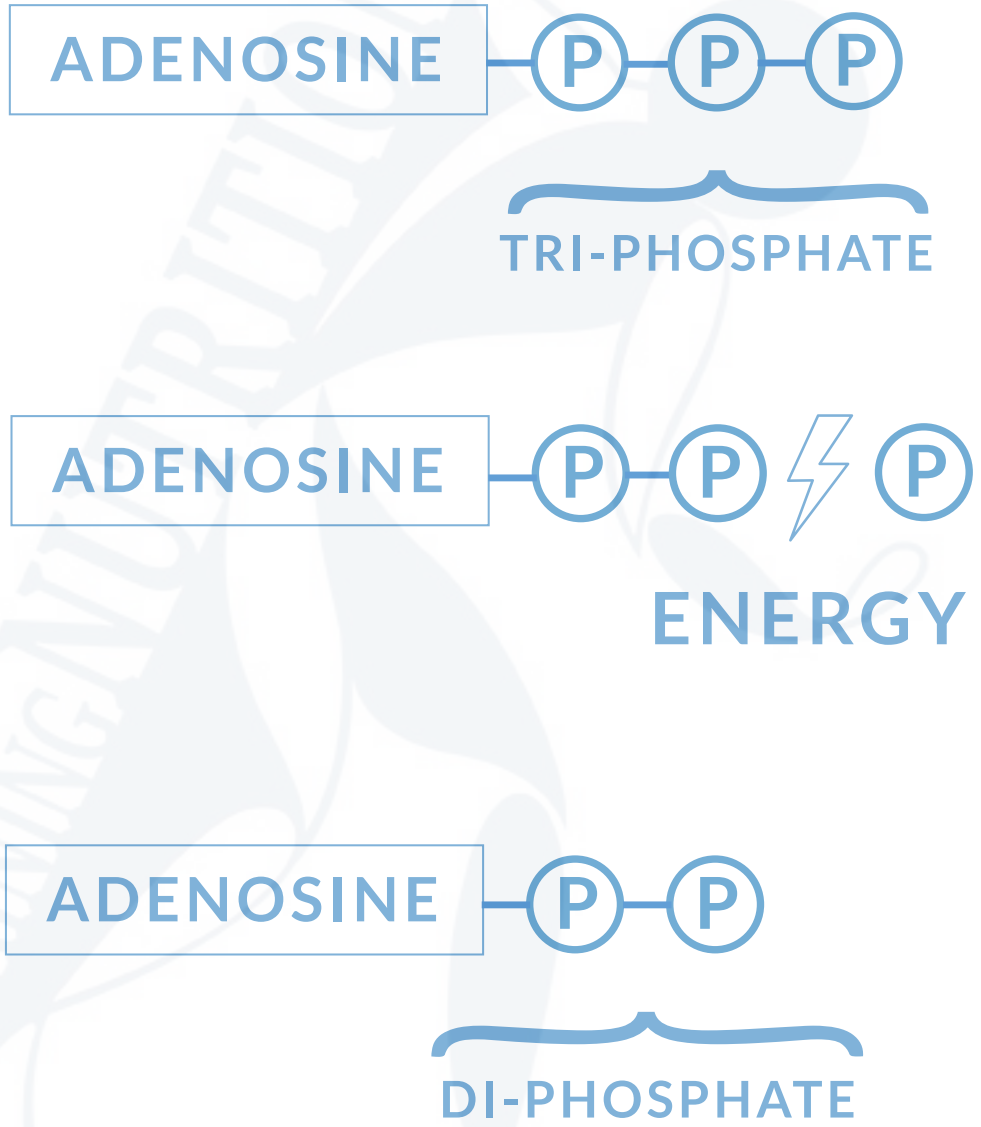
Oxidative system

Dependent of oxygen

(Mahan & Raymond, 2017)

ATP-ADP

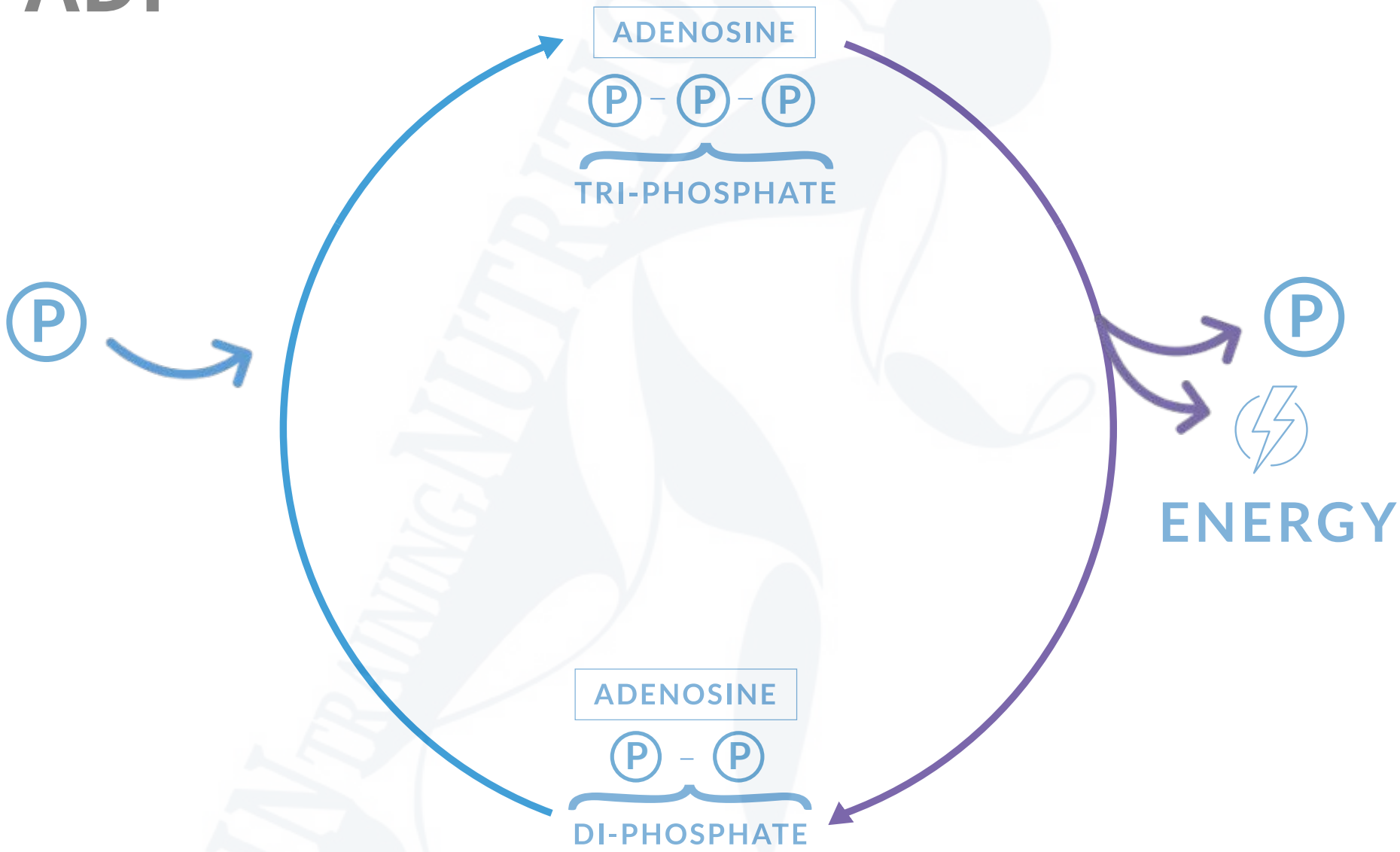
CYCLE



(McArdle et al, 2013)

ATP-ADP

CYCLE

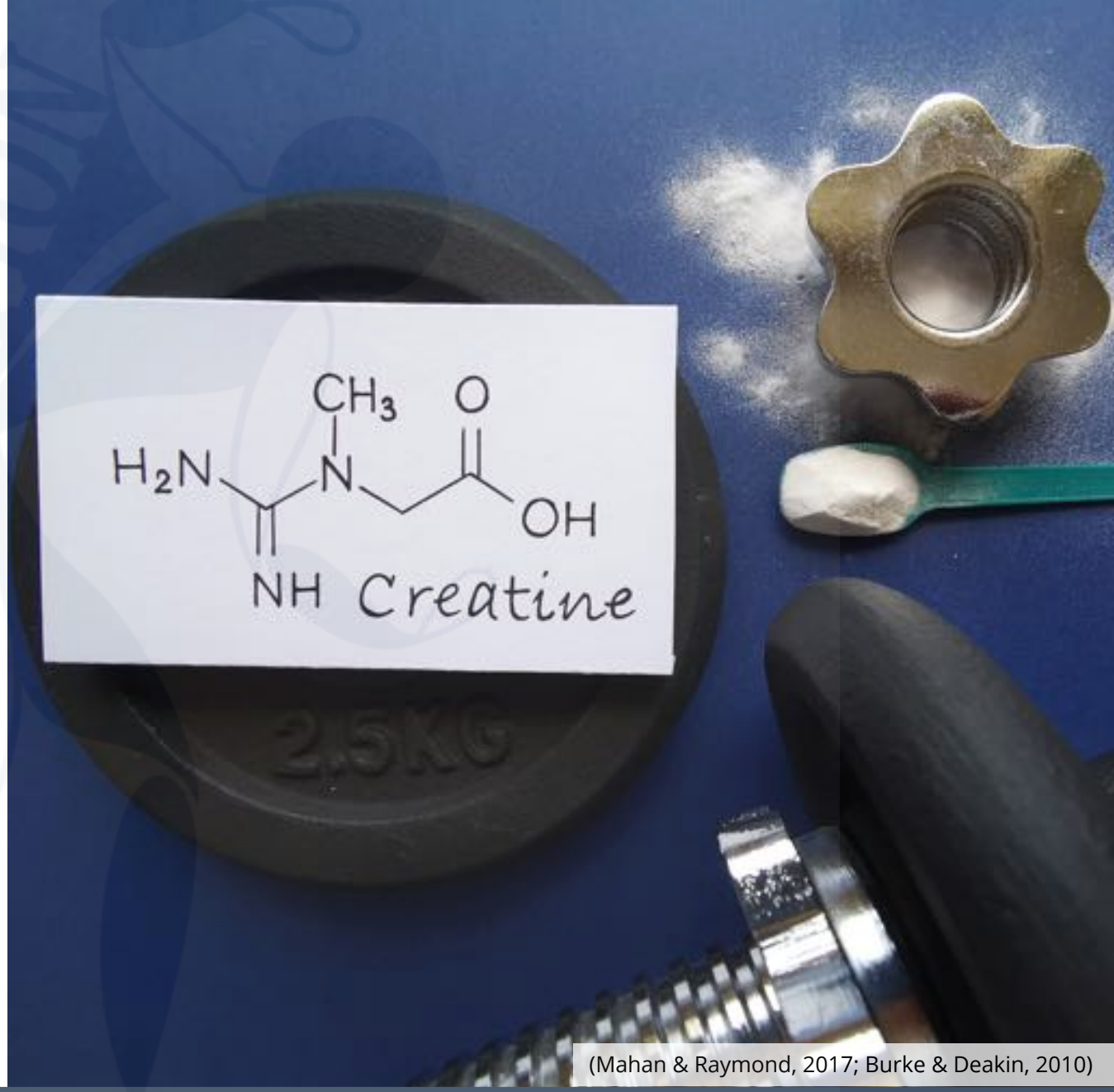


(McArdle et al, 2013)

ATP-CrP

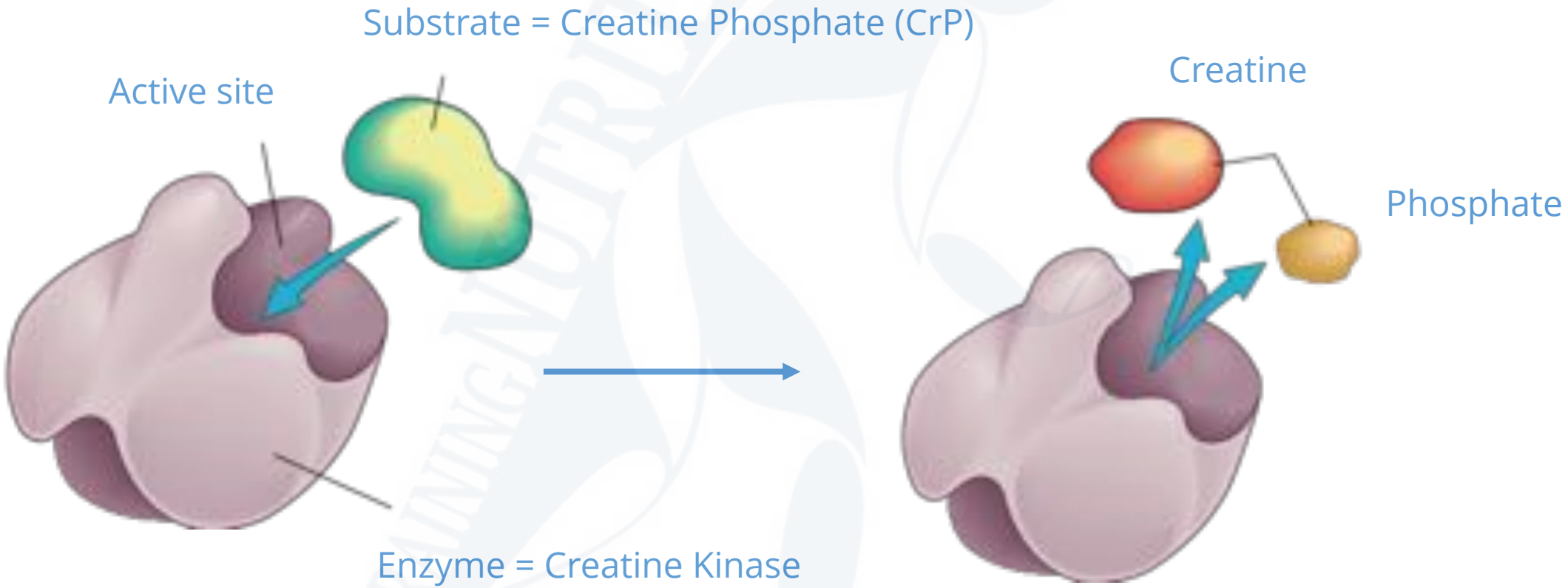
SYSTEM

- CrP is a high energy compound
- Available in limited amounts
- Fasted way to replenish ATP
- No oxygen needed
- Found in protein foods & supplements



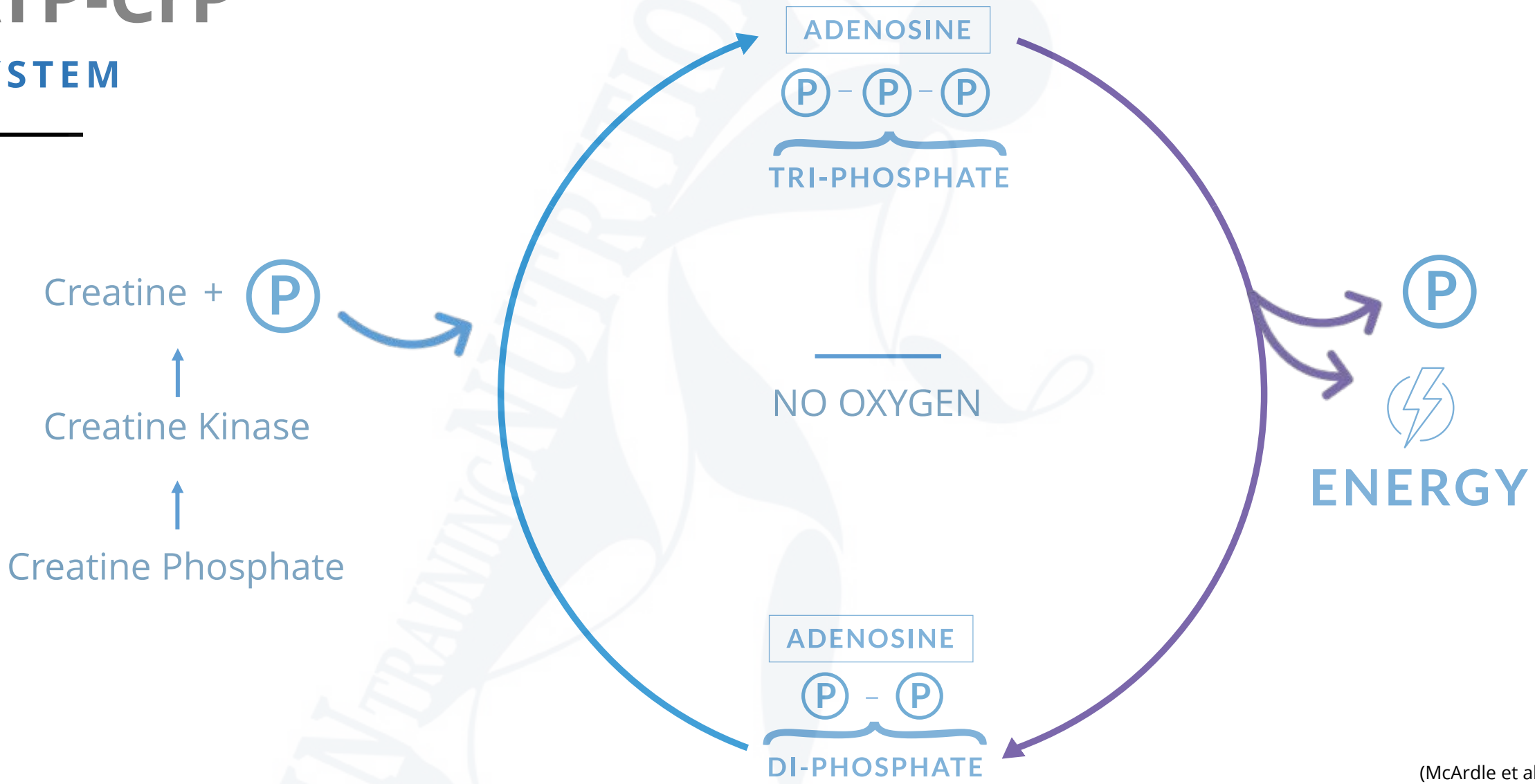
(Mahan & Raymond, 2017; Burke & Deakin, 2010)

ENZYME BREAKDOWN OF CREATINE PHOSPHATE



ATP-CrP

SYSTEM



(McArdle et al, 2013)

ANAEROBIC

SYSTEM

- No oxygen needed
- Glyco = glucose Lysis = breaking down
- Glycolysis = breakdown of glucose
    - Glycogen from muscles stores is first broken into glucose
    - Glucose from dietary intake of carbohydrates
- 60 – 120 seconds to deplete this system
- Lactic acid/ lactate = end product

(Mahan & Raymond, 2017)

LACTATE

Not just a waste product

Cori cycle

- Moved from the muscle to the liver
- Converted into glucose
- Can then be used again in glycolysis
- Energy insufficient, cannot be sustained

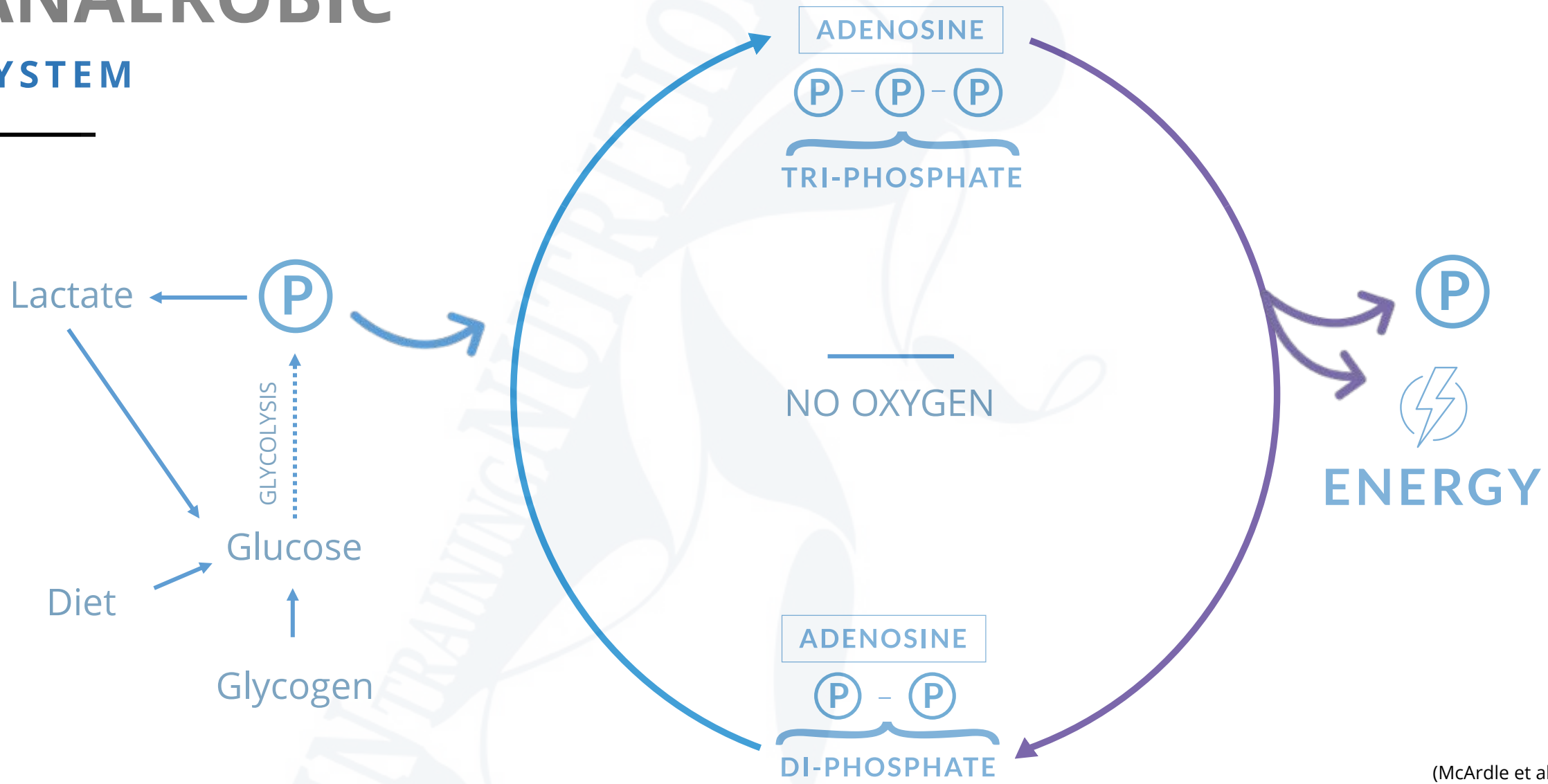
Build up: high intensity exercise, little oxygen

- Cause the muscle to fatigue

(Burke & Deakin, 2010)

ANAEROBIC

SYSTEM



(McArdle et al, 2013)

AEROBIC

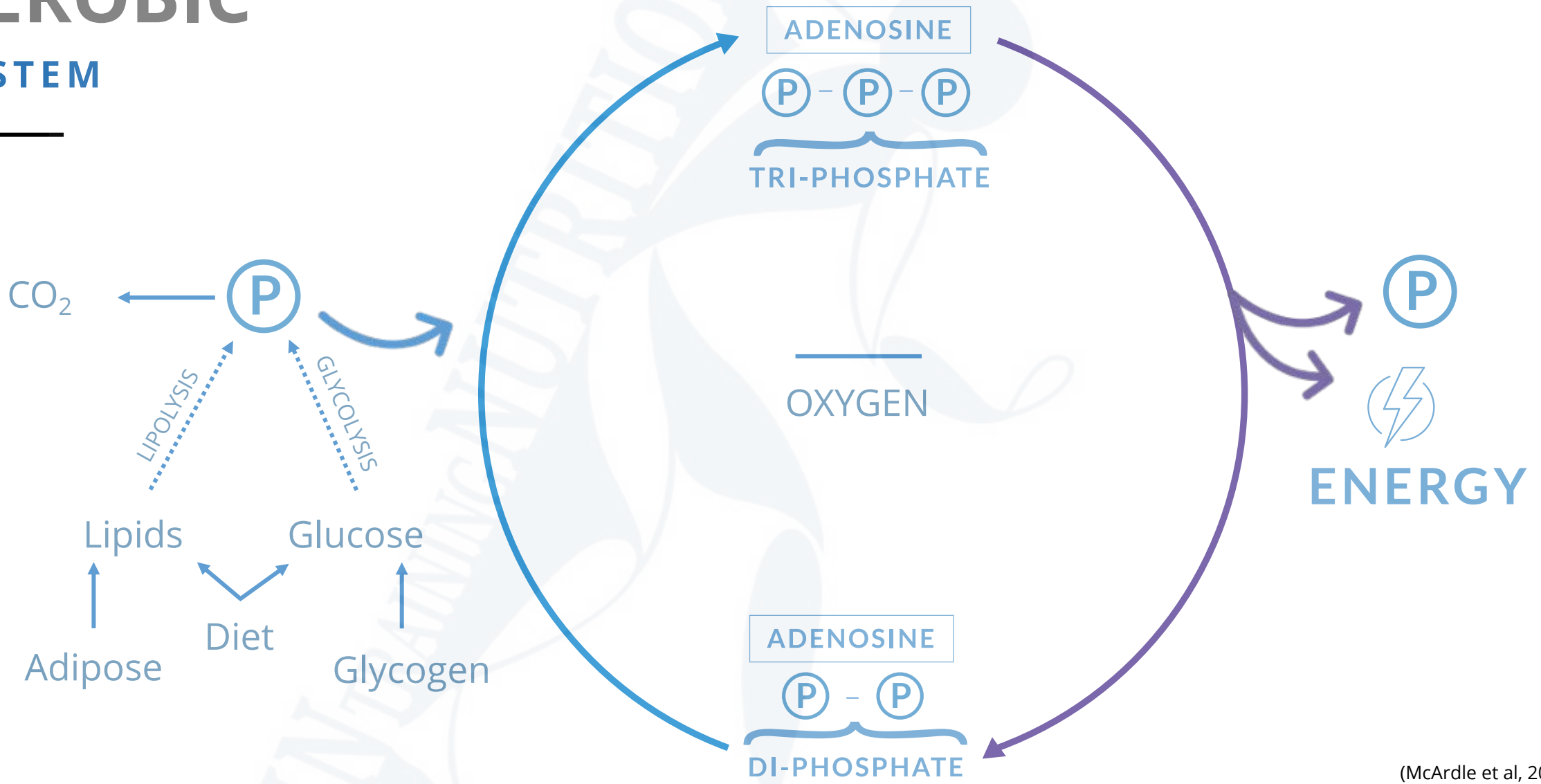
SYSTEM

- Prolonged exercise at low intensity
- Requires oxygen
- Substrate used is CHO & lipids
  - Amino acids also used to a limited extent
- How much CHO vs lipid depends on:
  - Exercise intensity & duration
  - Preceding diet
  - Substrate availability
  - Training status & environmental factors

(Burke & Deakin, 2010)

AEROBIC

SYSTEM



(McArdle et al, 2013)

EXAMPLE OF ENERGY REQUIREMENTS & MACRONUTRIENTS

- During a 1 hour **low/ moderate** run:
  - Aerobic/ oxidative system
  - Mainly CHO & some fats

Energy	kCal/ hour	% Fat	% Protein	% CHO
Males	816	24	5	71
Females	603	38	2	60

(Burke & Deakin, 2010)

INTENSITY

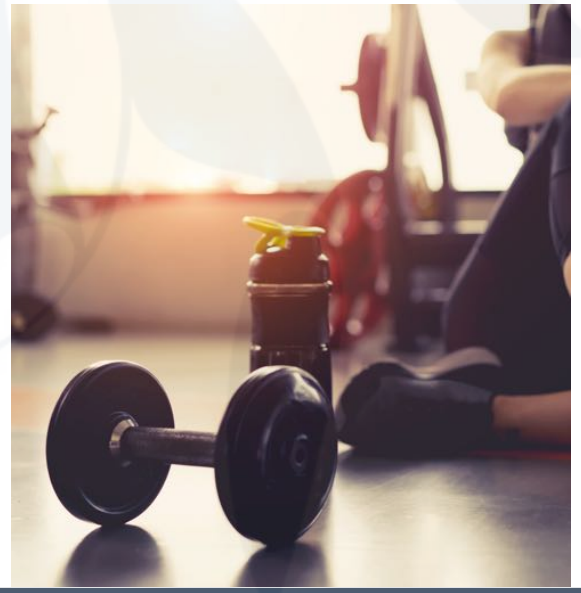
& ENERGY SYSTEM

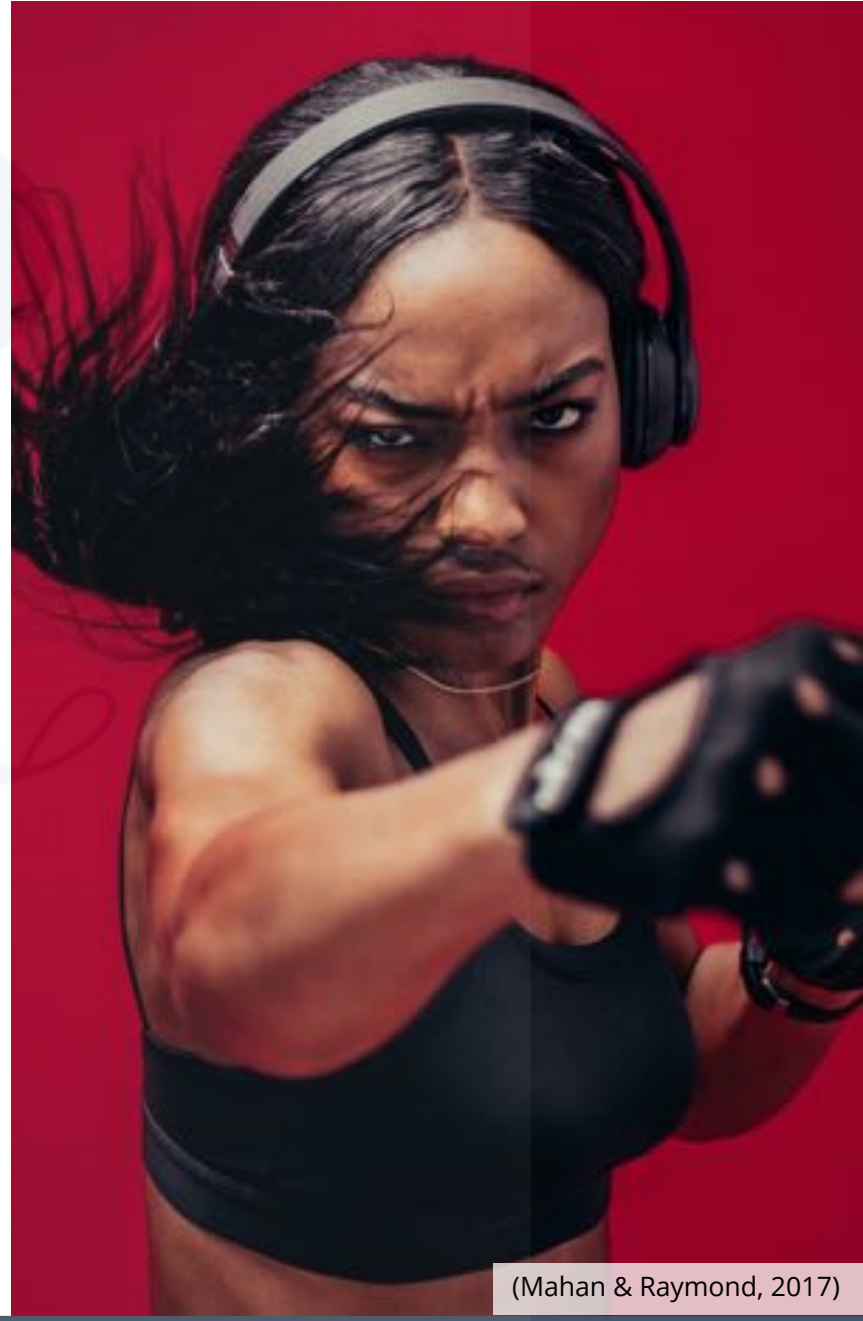
High intensity & short duration

- Anaerobic
- Weight lifting

Stop-start sports

- Anaerobic & aerobic
- Basketball, football, soccer, tennis & swimming





(Mahan & Raymond, 2017)

INTENSITY

& ENERGY SYSTEM

Moderate intensity

- Aerobic & blood glucose & fatty acids
- Jogging, hiking, aerobic dance, gymnastic, cycling

Moderate to low intensity

- Aerobic (glycolysis then lipolysis)
- Walking

(Mahan & Raymond, 2017)

TRAINING

& ENERGY SYSTEMS

Well trained individuals have:

- Improved oxygen delivery
    - Better cardiovascular health
- More mitochondria
    - More ATP generation

(Mahan & Raymond, 2017)

ENERGY

REQUIREMENTS

Adequate calorie intake:

- Support energy expenditure
- Maintain strength, endurance, muscle mass & overall health

Vary with:

- Age, gender, size, training/ sports type
- Frequency, intensity & duration of exercise
- Endocrine & environmental conditions

(Mahan & Raymond, 2017)

HOW DO WE USE ENERGY

RESTING

ACTIVE

EATING

(health.cleveland.org, n.d.)

HOW MUCH ENERGY

DO YOU NEED?

Active individuals (30 – 40min, 3 x/ week)

- 25 - 35kCal/kg/d

Moderate/ high level of intense training

- 50 – 80 kCal/kg/d

Elite athletes

- 150 - 200kCal/kg/d

Large athletes

- 60 – 80 kCal/kg/d

(Mahan & Raymond, 2017; Potgieter, 2013)

EXAMPLE

METHOD

- Calculate average current daily intake
  - Using a 3 day food record
  - Total energy/ weight = kCal/kg/d
  - e.g. 65kg consuming 1950kCal/d
  - = 30kCal/kg/d average

EXAMPLE

METHOD

- Choose an appropriate energy value
- In relation to current intake and goals (i.e. weight loss/ maintenance/ gain)

For example:

- 25kCal/kg/d for weight loss
- 30kCal/kg/d for weight maintenance
- 35kCal/kg/d for weight gain

EXAMPLE

EXERCISER

- **Total energy:** 25 – 35kCal/kg/d
- **Weight:** 65kg (BMI: 21.7kg.m2)
- **Energy:** 25 - 35 x 65 = 1625 - 2275kCal/d

EXAMPLE

ATHLETE (moderate)

- **Total energy:** 50 – 80kCal/kg/d
- **Weight:** 65kg (BMI: 21.7kg.m2)
- **Energy:** 50 - 80 x 65 = 3250 - 5200kCal/d

SUMMARY

- Science of fuelling your body:
  - Energy
  - Macro & micronutrients & adequate hydration
- If not optimised will lead to:
  - Injury, illness, overtraining & decreased performance
- There are different types of exercise:
  - Each has unique nutrition needs
- Type of muscle fibre:

SUMMARY

- Body needs consistent energy from ATP
- There are 3 main energy systems:
  - ATP-CrP
  - Anaerobic/ glycolytic
  - Aerobic/ oxidative
- Each system uses different substrates to provide energy
- All systems work together to create ATP
  - Depending on duration & intensity of exercise

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