Fitness Matter: Fueling you gut microbes

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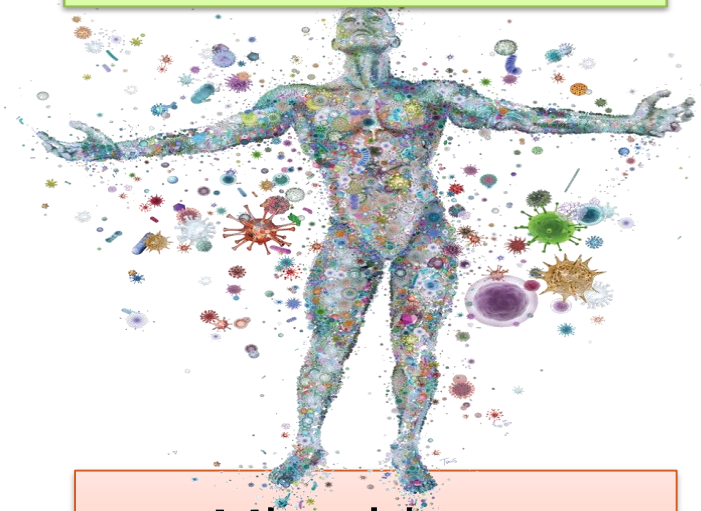
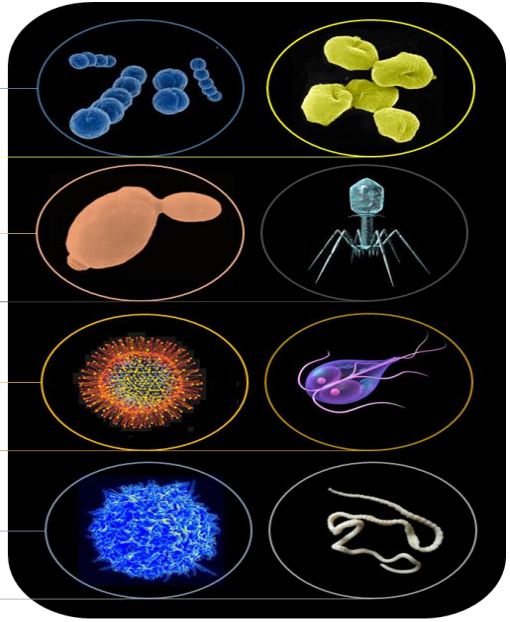
Our Microbiome

Human
~10 trillion cells
~23 thousand genes

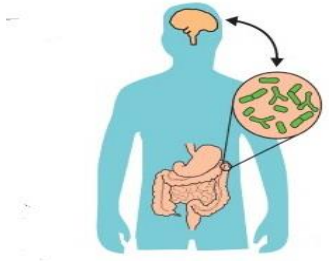


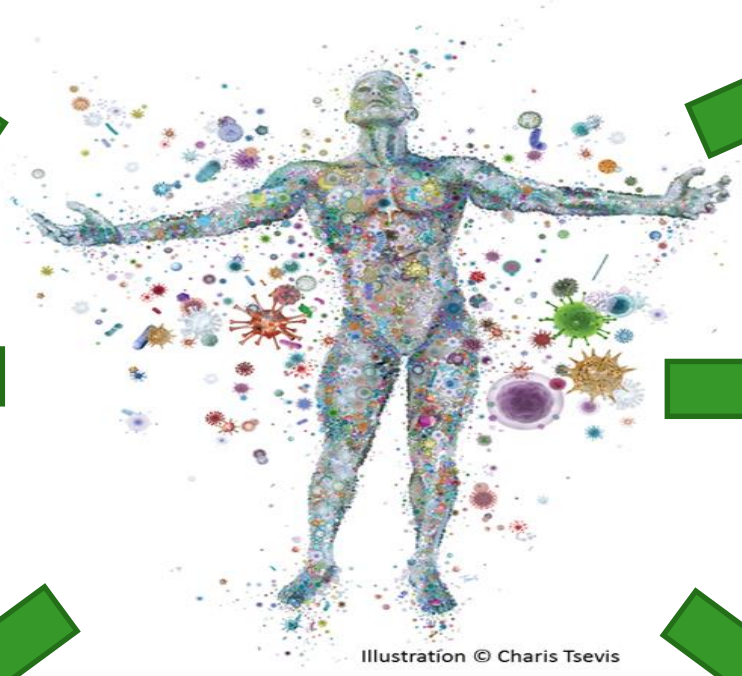
Microbiome
~100 **trillion c**ells
~3 million genes

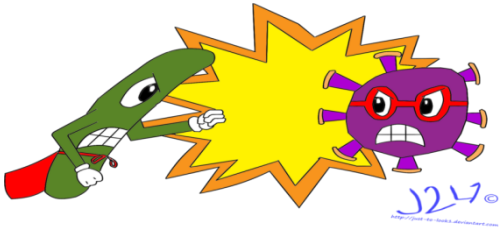
- Bacteriome
- Archaeome
- Mycobiome
- Phageome
- Euvirome
- Protozome
- Immunome
- Helminthome



Why do we study the microbiome ?







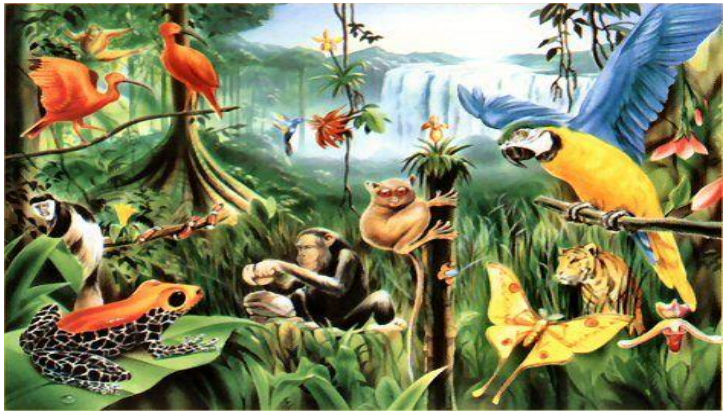
How do we study the microbiome?

- Traditional

- Modern

What makes a healthy microbiome ?

Diversity is Key

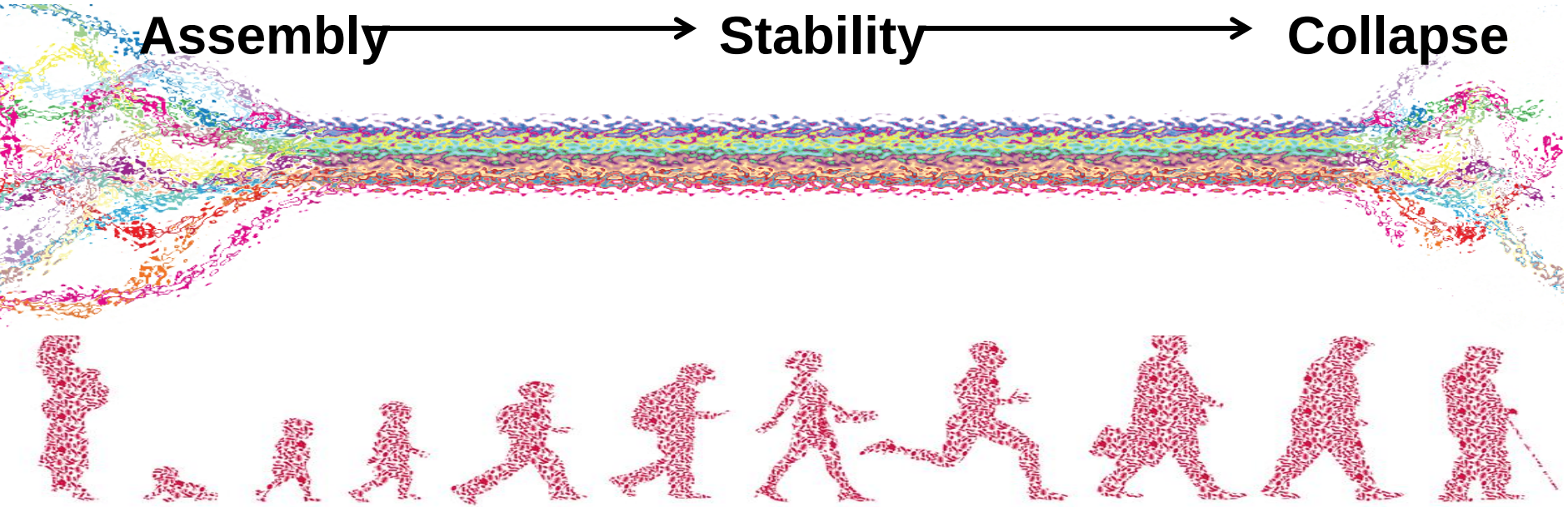


High Diversity

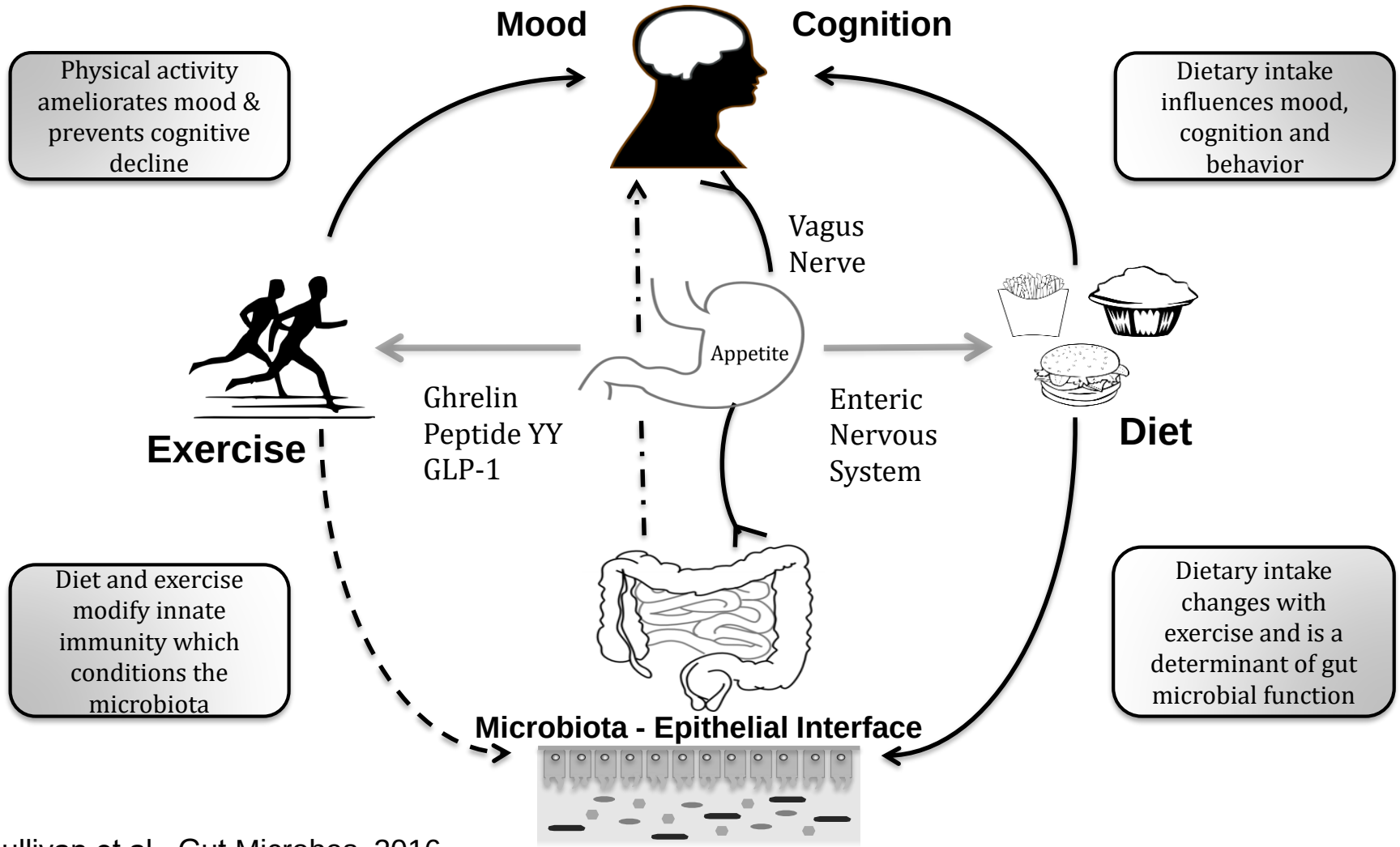
Low Diversity

Low total diversity within the gut microbiota is generally regarded as less desirable and has been observed in children that are more susceptible to allergies as well as sufferers of IBD, IBS and *C. difficile* infection (among others)

Modulating our microbes



Opportunities for interventions/diagnostics for food, biotech & pharma



O'Sullivan et al., Gut Microbes, 2016

Fitness Matters

VS.

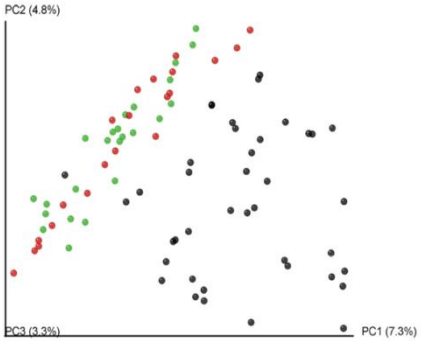
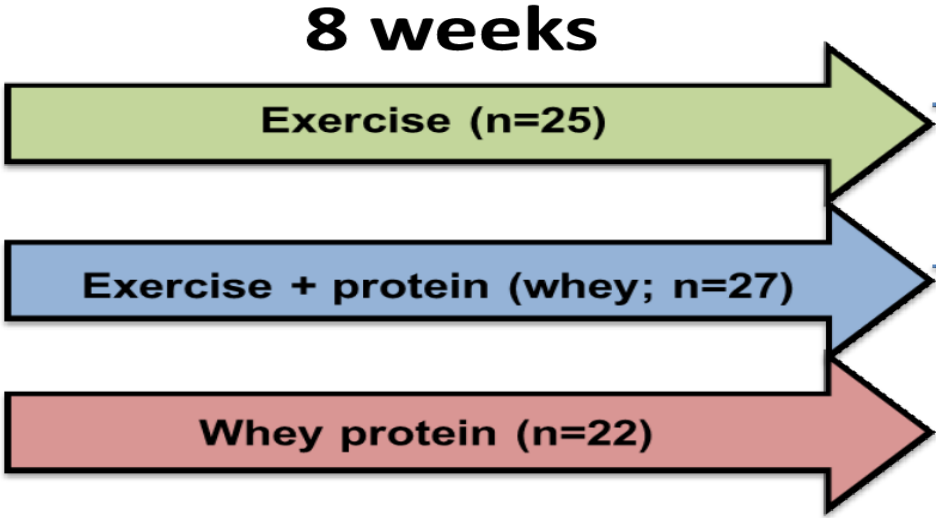


Figure 3 Unweighted UniFrac separates the athlete and control microbiota. Unweighted UniFrac principal coordinate analysis (PCoA) of

What was found?

- Athletes have more diverse gut microbes than controls at compositional, functional and metabolic levels
- This diversity was associated with protein intake and/or fitness levels
- Microbiome of athletes was primed for muscle repair, protein degradation and vitamin recovery

Can we train out gut?



What was found?

- No change in the microbiome was noted
- It was concluded that microbiome diversity can be attributed to the level of physical fitness rather than frequency of exercise undertaken

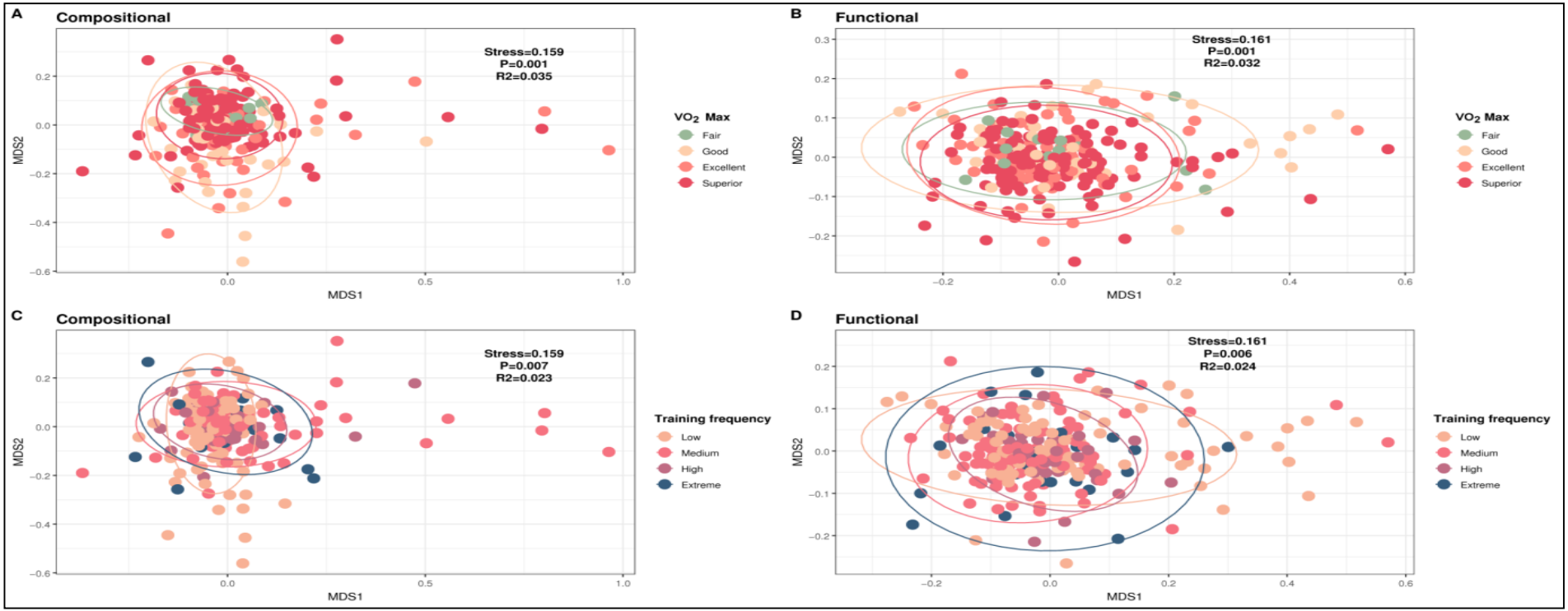
Fitness Matters– V02 Max

WHY?

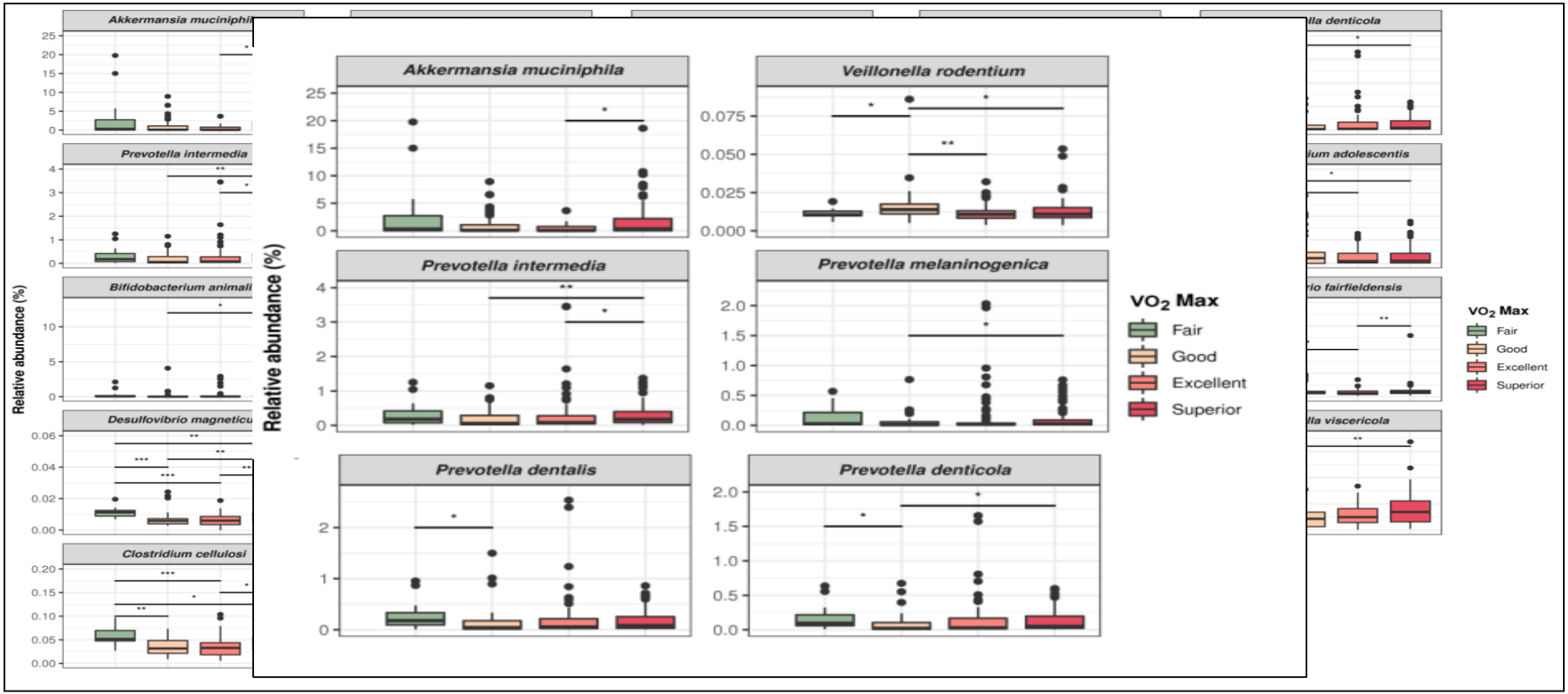
To investigate potential factors influencing gut microbiome composition and function in an active cohort.

Total participants	62
Total samples	238
Age	34 (±9) years
Sex	
Male	39
Female	23
VO2 max	46.8 (±6.6)
BMI (kg/m2)	25.6 (±3.1)
Height (cm)	174 (±9)

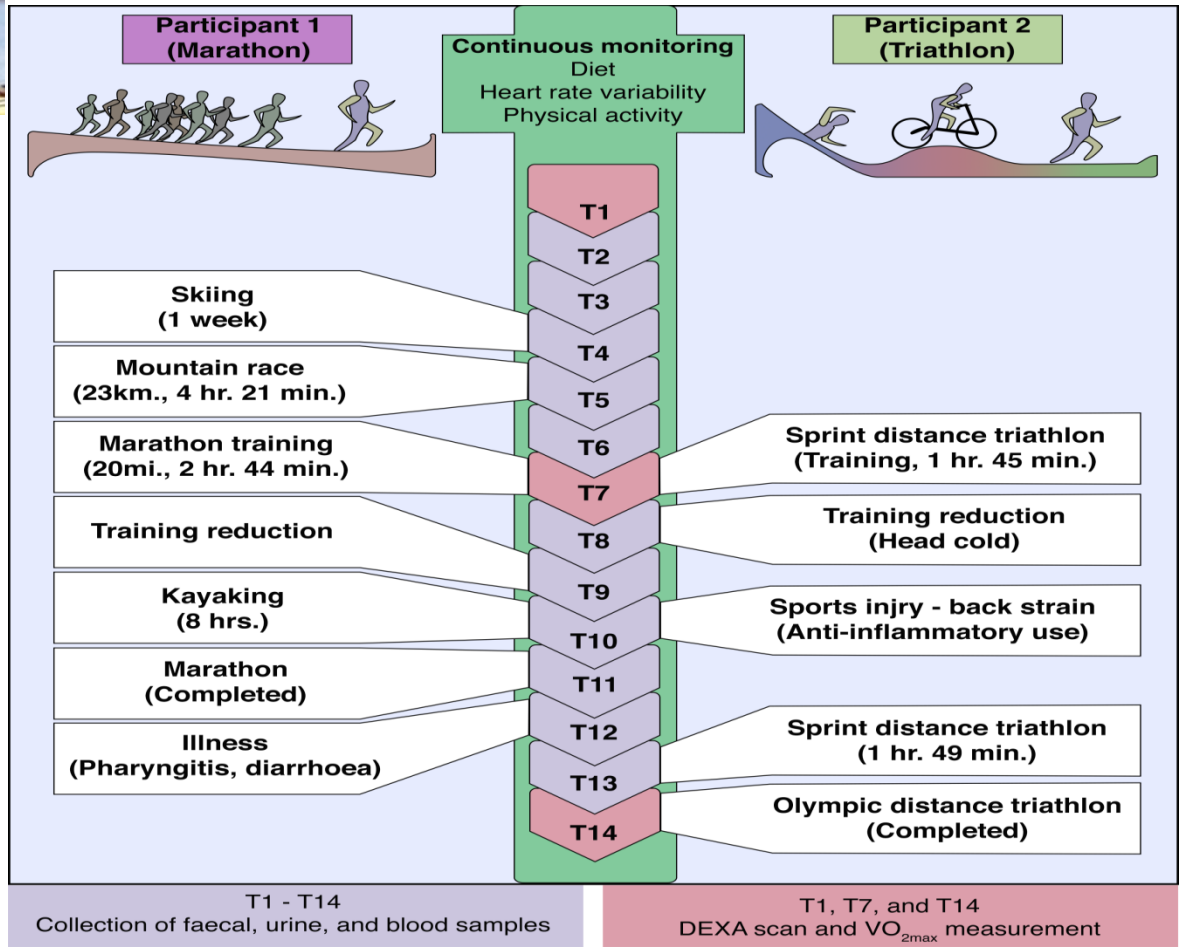
Separation Based on VO_2 Max and Training load



Significantly Different Species Based on VO_2 max



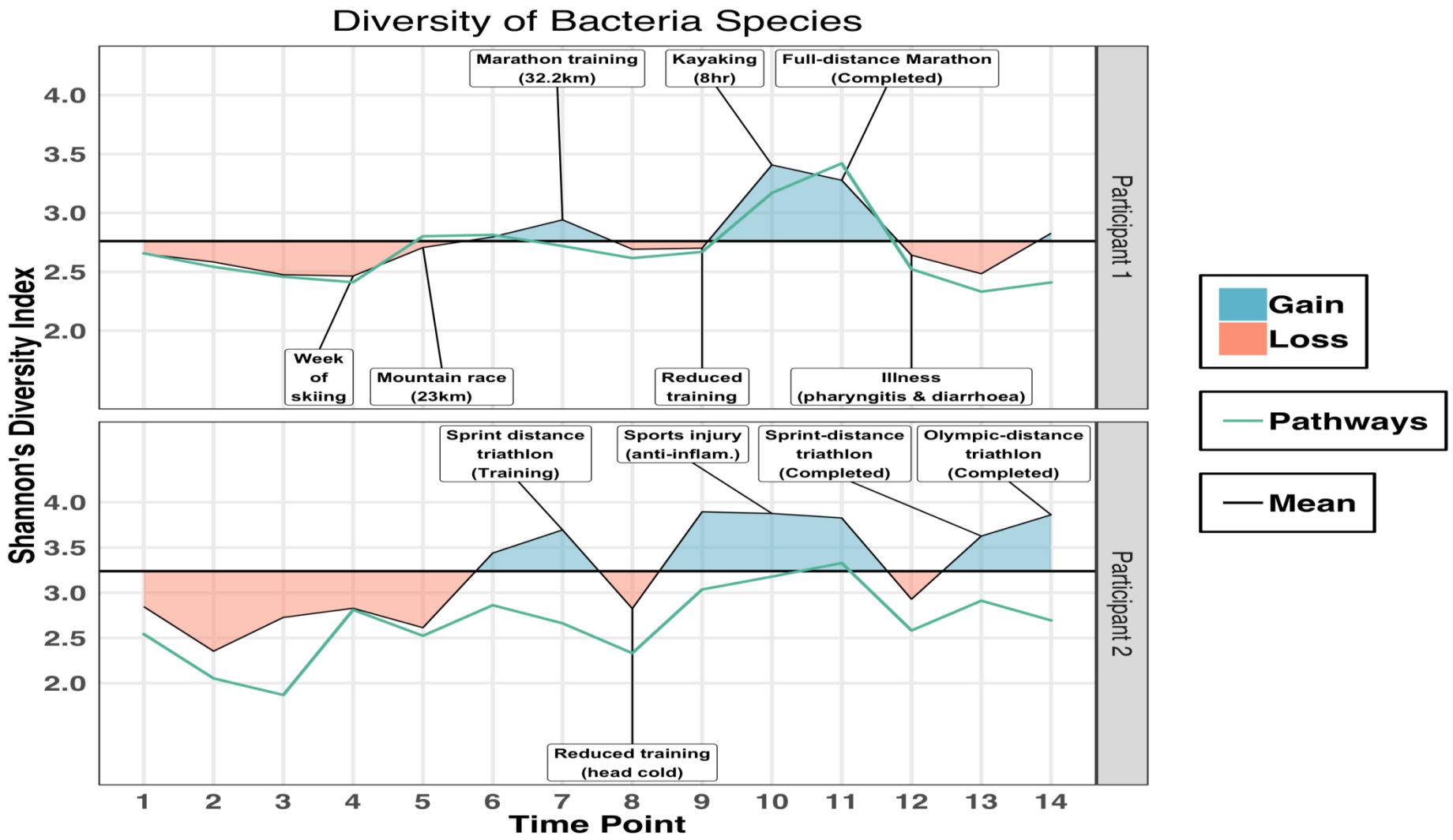
A STEP TOWARDS PERSONALIZED MEDICINE FOR ATHLETES



Improved body composition

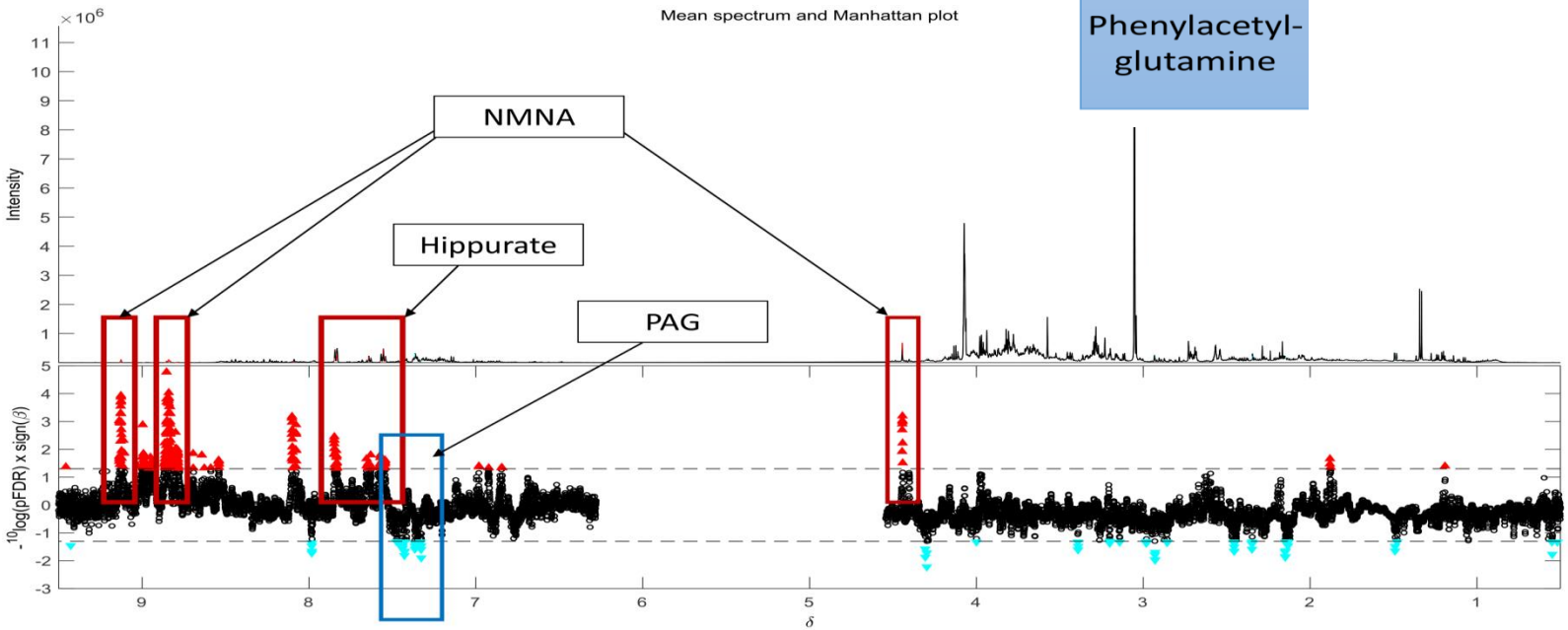
Improved cardiorespiratory fitness

Patient characteristics	Values					
	Participant 1 (Marathoner)			Participant 2 (Triathlete)		
	T_0	T_{14}	Δ	T_0	T_{14}	Δ
Age (years)	30	—	—	33	—	—
Height (cm)	181	—	—	182	—	—
Weight (kg)	93.8	89.2	**-4.6**	104.9	103.4	**-1.5**
BMI (kg/m^2)	28.6	27.2	**-1.4**	31.7	31.2	**-0.5**
Waist:Hip ratio	0.92	0.92	**0.0**	0.95	.91	**-0.04**
Body fat (%)	25.6	21.7	**-3.9**	34.7	34.5	**-0.2**
Fat mass (kg)	23.9	19.4	**-4.6**	36.3	35.7	**-0.6**
Fat mass (trunk) (kg)	14.8	11.7	**-3.1**	20.9	20.4	**-0.5**
Lean tissue mass (kg)	65.6	65.9	**0.2**	64.97	64.2	**-0.7**
Estimated VO_{2max} (mls/kg/min)	41.1	46.6	**5.5**	33.6	38	**4.4**
Max HR (bpm)	183	179	**-4**	196	179	**-17**
Resting HR (bpm)	69	50	**-19**	58	72	**-2**
Systolic BP (mmHg)	122	116	**-6**	128	127	**-1**
Diastolic BP (mmHg)	77	75	**-2**	87	72	**-15**
Weekly PA (IPAQ, METS)	891.5	—	—	646.5	—	—
Weekly PA (IPAQ, kCals)	1,393.7	—	—	1,130.3	—	—


Diversity of Bacteria Species
Shannon's Diversity Index
4.0
3.5
3.0
2.5
2.0
Marathon training (32.2km)
Kayaking (8hr)
Full-distance Marathon (Completed)
Week of skiing
Mountain race (23km)
Reduced training
Illness (pharyngitis & diarrhoea)
Participant 1
Sprint distance triathlon (Training)
Sports injury (anti-inflam.)
Sprint-distance triathlon (Completed)
Olympic-distance triathlon (Completed)
Reduced training (head cold)
Participant 2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time Point
Gain
Loss
Pathways
Mean

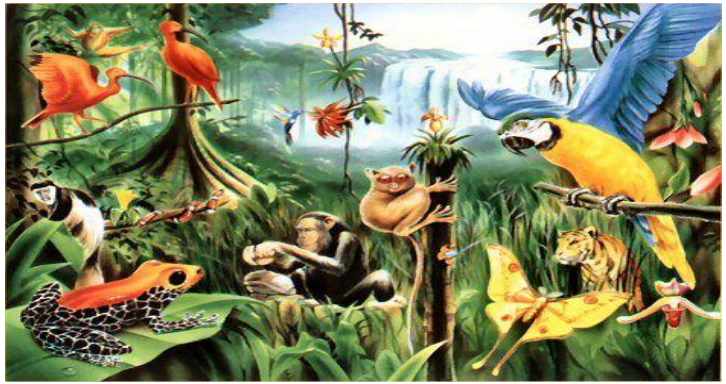
Metabolomics

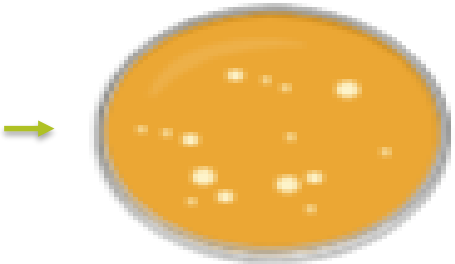
Metabolite
N-methyl nicotinate
Hippurate
Phenylacetyl-glutamine



Probiotics from the athlete gut?

Why athletes?





Why do athletes need probiotics?

How we are isolating potential novel probiotics?

- Microbiological culture methods
- Biobank of elite athlete faecal samples
- Testing potential isolates for probiotic traits

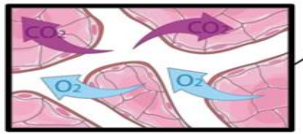
Fitness and gut health

Influencing factors

Type of sport

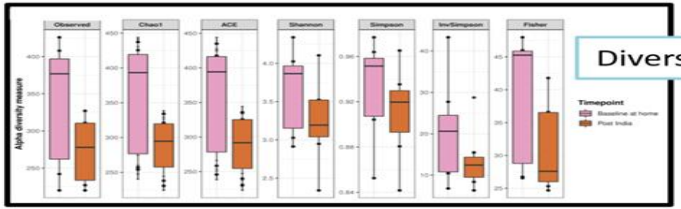
Travel

VO_2 max

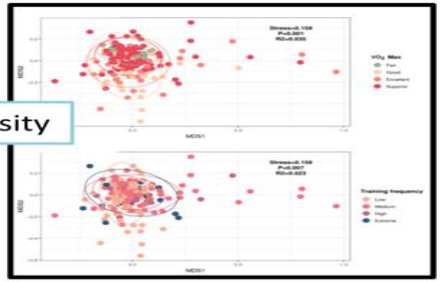


Training frequency

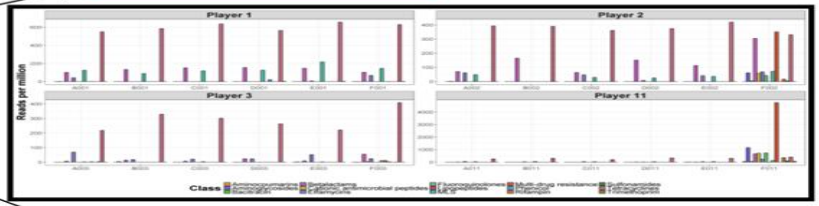
Gut microbiome aspects impacted



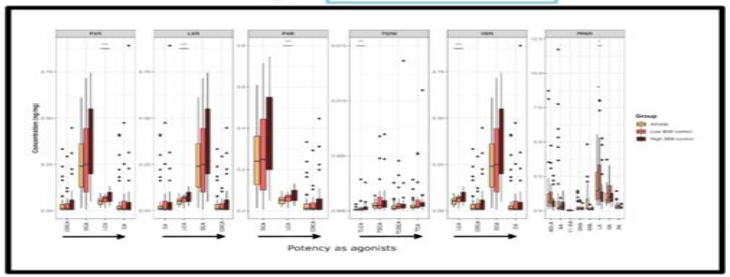
Diversity



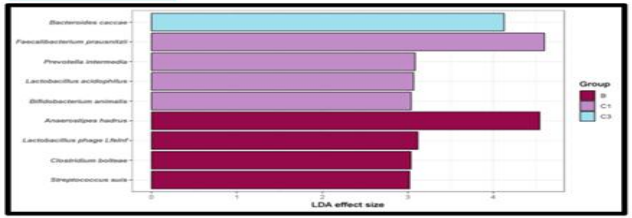
Antibiotic resistance



Metabolites



Species



Acknowledgements

apc Microbiome Ireland

Institute of Sport.ie Believe. Perform. Achieve.

IRFU

Cricket Ireland

VistaMilk









All athletes both elite and non

- Ronan Whiston
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- Eanna Falvey
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- Aine Fanning
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- Helena Nugent
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- Eileen Murphy
- Brendan Connor
- Catriona Guinane


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CIT Cork Institute of Technology Institiúid Teicneolaíochta Chorcaí

Teagasc Agriculture and Food Development Authority

Science Foundation Ireland SFI For what's next