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FROM SCIENCE TO PERFORMANCE

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#FuelYourPassion

Dr Mike Posthumus

Head of Sports Performance at the

Sports Science Institute of South Africa.

Honorary Researcher at UCT

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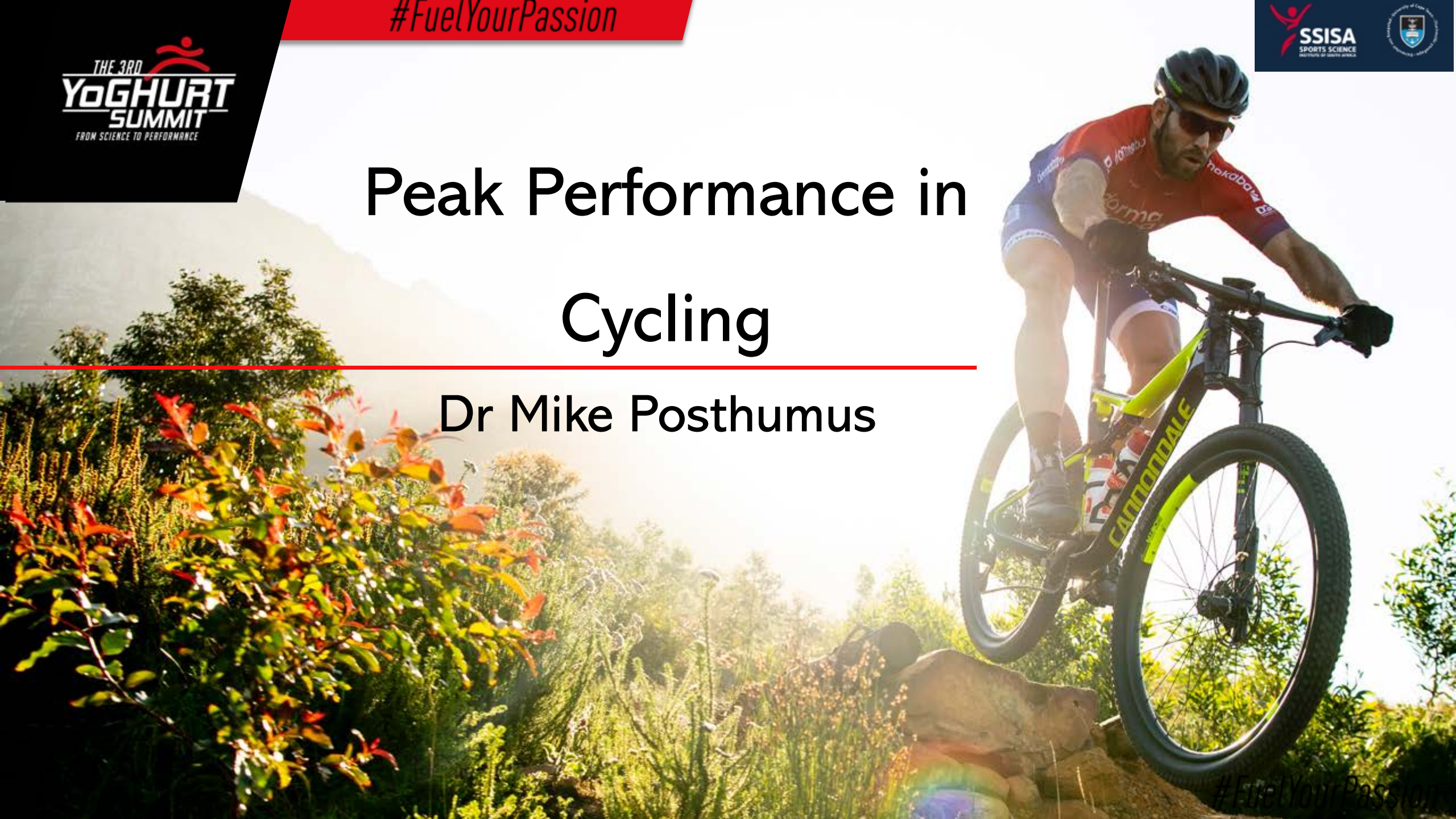
SSISA SPORTS SCIENCE

Peak Performance in Cycling

Dr Mike Posthumus



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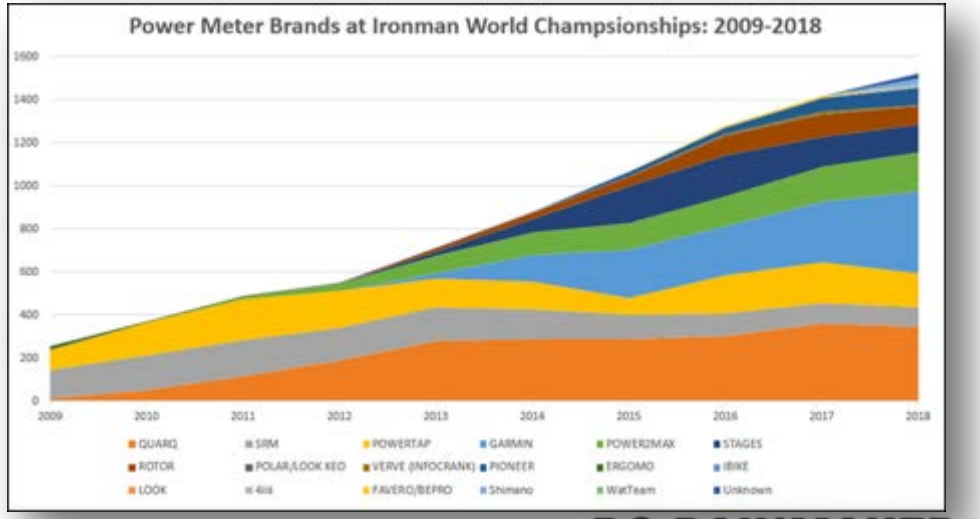
Technology

- Technology can help athletes/team gain an advantage if correctly used
- Cycling has been fortunate to have access to advanced load measurements since 1984
- Recent advances in technology have made power meters more affordable
- 65% of the 2018 field at Kona Ironman WC
- 48% of the 2018 Cape Epic Field
- *"95% of competitive cyclists train with power"*

IRONMAN WORLD CHAMPIONSHIP

ABSA CAPE EPIC



DC RAINMAKER

Training aids

TREAD MOUNTAIN BIKING WITH SOUL

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
HRM	85%	85%	84%	86%	82%	83%	84%	84%	86%	86%	84%	90%
Power Meter	16%	18%	19%	19%	18%	20%	22%	30%	35%	43%	42%	48%
GPS	N/A	23%	26%	29%	43%	54%	67%	77%	86%	91%	88%	91%

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What Are The Demands

- Hard training sessions of races may burn up to 6,000 kCal
- Training may account between 8 and 30 hrs / week – depending on experience and phase of training.
- Generally polarised
- Between 5,000 and 20,000 additional kCal expended each week.
- Equivalent?

☑ 100 kCal ☑ 150 kCal

☑ 200 kCal

TREAD
MOUNTAIN BIKING WITH SOUL

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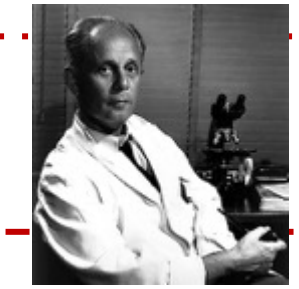
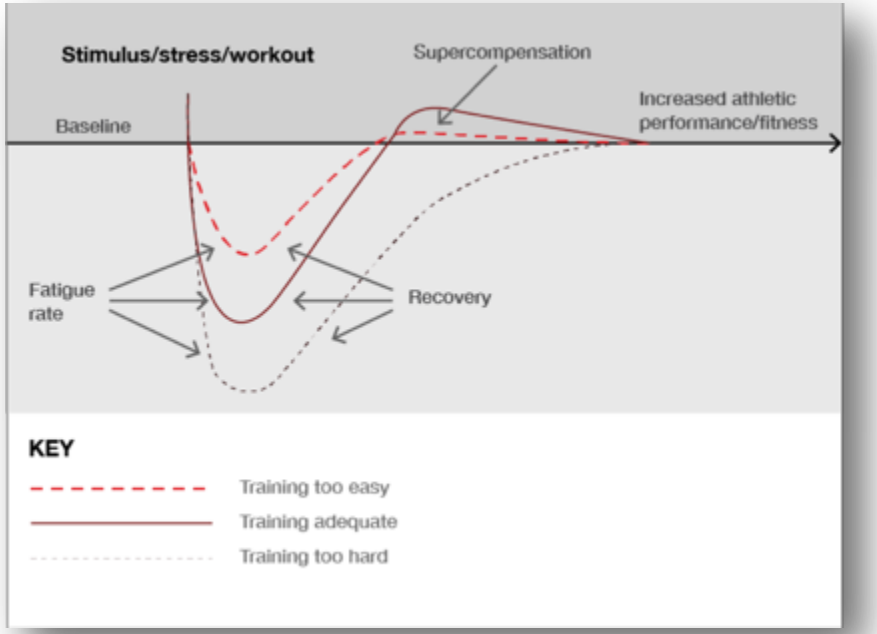
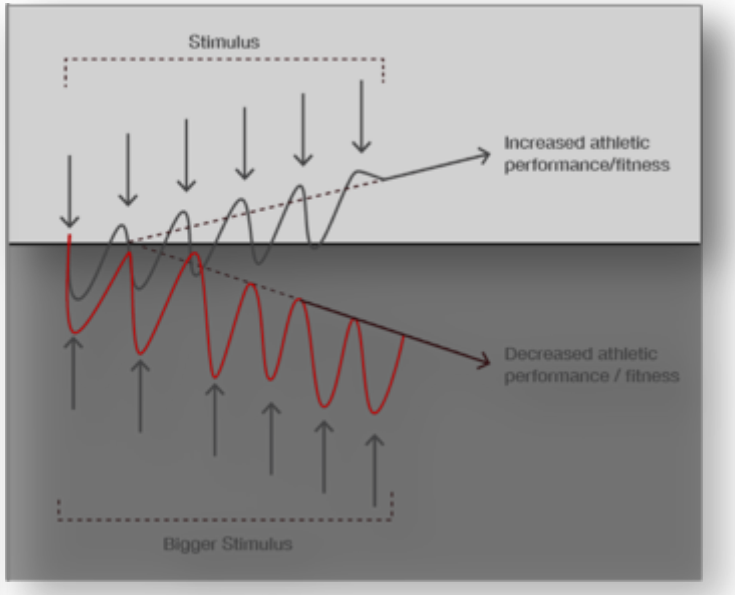
Back To Basics

WHAT IS TRAINING? The act of performing a given athletic task with the goal of creating a stress to your body's homeostasis with the intention to trigger signals to cause positive physiological adaptations







WHAT IS RECOVERY? The return to a normal state after an exercise stress has been applied.

How Do We Optimise Recovery

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Nutrition

Sleep

What Is The Optimal Training Intensity

Wolpern et al. BMC Sports Science, Medicine, and Rehabilitation (2015) 7:16
DOI 10.1186/s13102-015-0011-z

BMC Sports Science, Medicine & Rehabilitation

RESEARCH ARTICLE Open Access

Is a threshold-based model a superior method to the relative percent concept for establishing individual exercise intensity? a randomized controlled trial

Ali E. Wolpern[1], Dara J. Burgos[1], Jeffrey M. Janot[2] and Lance C. Dalleck[1*]

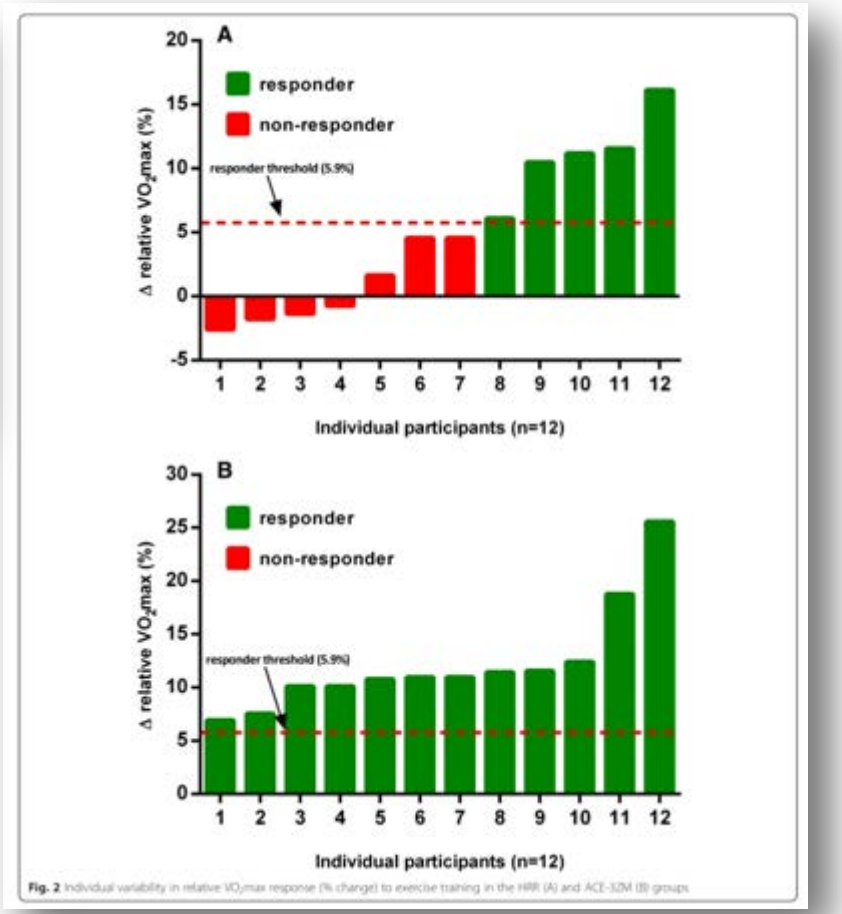

Fig. 2 Individual variability in relative VO_2max response (% change) to exercise training in the HIIR (A) and ACE-3ZM (B) groups

Individualised training zones result in greater training adaptation

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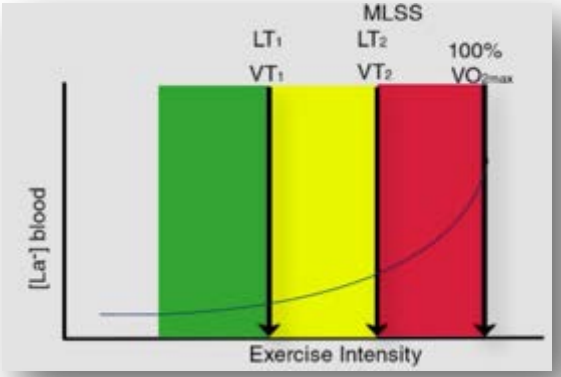
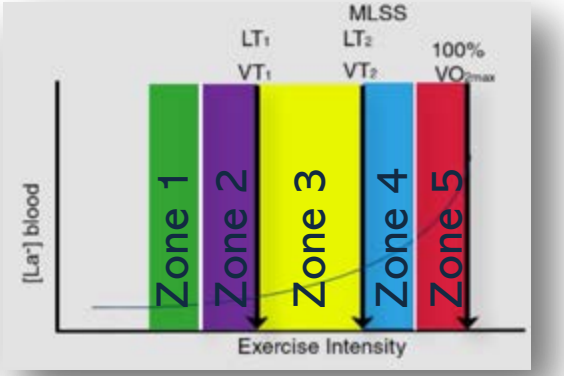
What Is The Optimal Training Intensity





Training zone	Rating		Percieved exertion	Description
ZONE 1	6	0	NO EXERTION AT ALL	Easy to breathe and hold a conversation. Feels like it can be held for hours.
	7		EXTREMEMELY LIGHT	
ZONE 2	8	1		
	9		VERY LIGHT	
	10	2		
	11		LIGHT	
	12	3		
ZONE 3	13		SOMEWHAT HARD	Breathing has become more notice-able, can only speak in short sentences, can hold intensity for a few hours
	14	4		
ZONE 4	15	5	HARD	Short of breath and difficult to speak, can hold for between 10 seconds and 40 minutes
	16	6		
ZONE 5	17	7	VERY HARD	
	18	8		
	19	9	EXTREMELY HARD	
	20	10	MAXIMAL EXERTION	

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- Training is prescribed within training zones
- May be defined as HR, Power, or as RPE.

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What Is The Optimal Training Intensity

J Appl Physiol 114: 461–471, 2013.
First published December 20, 2012; doi:10.1152/japplphysiol.00652.2012.

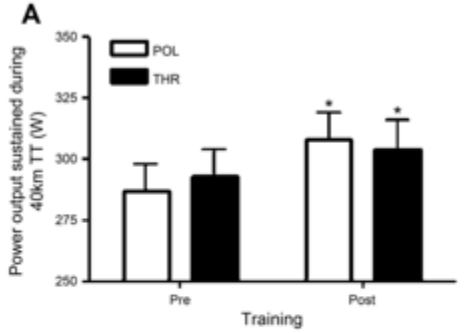
Six weeks of a polarized training-intensity distribution leads to greater physiological and performance adaptations than a threshold model in trained cyclists

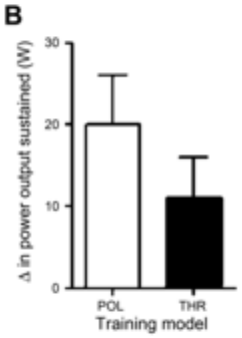
Craig M. Neal,[1] Angus M. Hunter,[1] Lorraine Brennan,[2] Aifric O'Sullivan,[2] D. Lee Hamilton,[1] Giuseppe DeVito,[3] and Stuart D. R. Galloway[1]

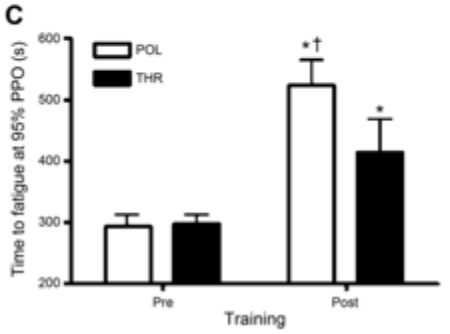
[1]*Health and Exercise Sciences Research Group, School of Sport, University of Stirling, Stirling, Scotland, United Kingdom;* [2]*School of Agriculture and Food Science, University College Dublin, Dublin, Ireland; and* [3]*Institute for Sport and Health, University College Dublin, Dublin, Ireland*

Submitted 29 May 2012; accepted in final form 17 December 2012

Training zone	Rating		Percieved exertion	Description	
ZONE 1	6	0	NO EXERTION AT ALL	Easy to breathe and hold a conversation. Feels like it can be held for hours.	80%
	7		EXTREMEMELY LIGHT		
ZONE 2	8	1			
	9		VERY LIGHT		
	10	2			
	11		LIGHT		
	12	3			
ZONE 3	13		SOMEWHAT HARD	Breathing has become more notice-able, can only speak in short sentences, can hold intensity for a few hours	
	14	4			
ZONE 4	15	5	HARD	Short of breath and difficult to speak, can hold for between 10 seconds and 40 minutes	20%
	16	6			
ZONE 5	17	7	VERY HARD		
	18	8			
	19	9	EXTREMELY HARD		
	20	10	MAXIMAL EXERTION		







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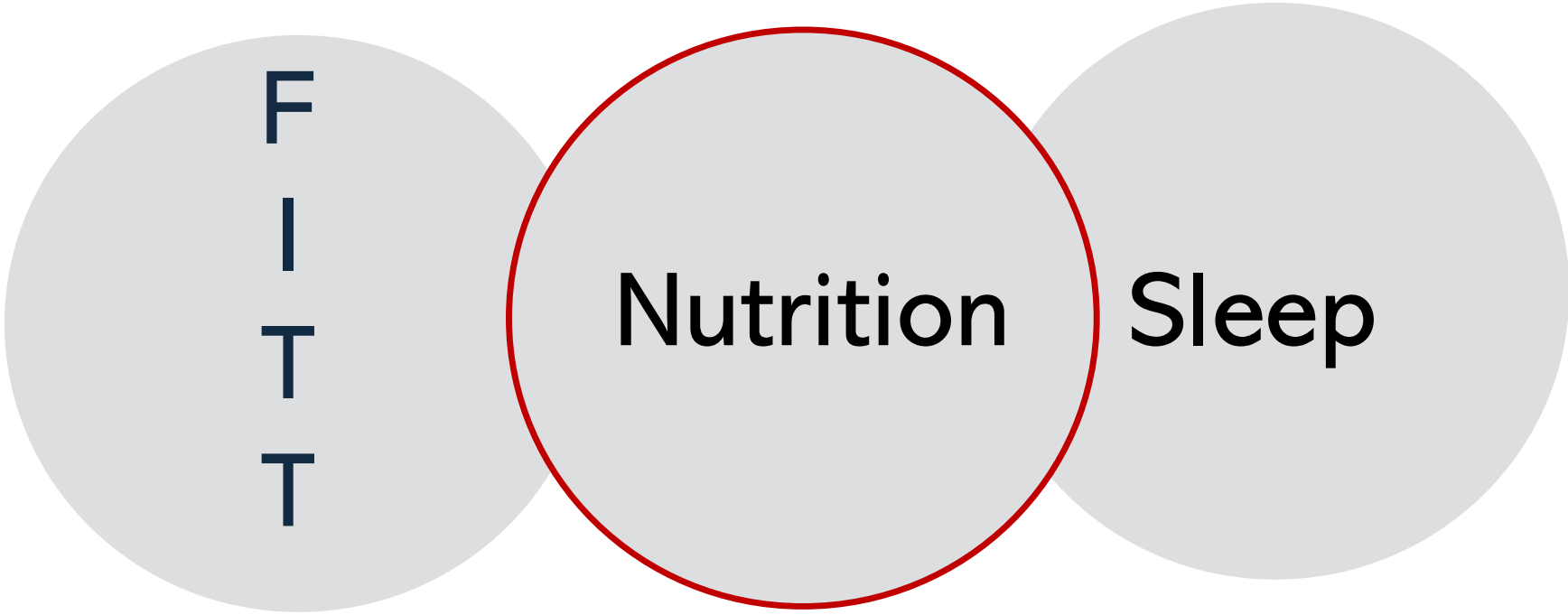
Polarised training results in greater training adaptations

How Do We Optimise Recovery



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Performance Nutrition

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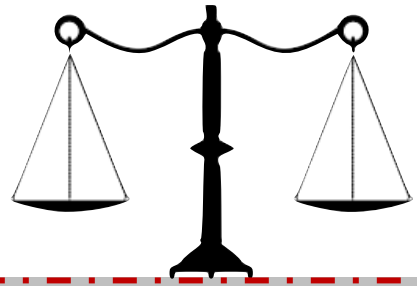
- 5593 kJ produced
- Cyclist have a Gross Efficiency of approximately 20%.
- 4.2 kJ = 1 kCal
- Expended 6658 kCal.

Nutrition

- Optimal performance **60-90g** carbohydrate per hour
- Over 5.5 hours 90g carbohydrates = **1980 kCal**

Jeukendrup, A. Sports Med 44 Suppl 1: 25-33, 2014.

- Still a 4678 kCal Deficit
- 1169g of Carbohydrate!
- 514g of Fat



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Stage (Watts)	Heart Rate (bpm)	RER	Vo2 (ml/min/kg)	% Max VO2 *	Energy Expenditure (Kcal/hour)	Gross Economy	CHO (g/hour)	Fat (g/hour)
95	97	0.85	22	34	562	15	67	25
130	104	0.81	26	40	666	17	54	41
165	110	0.84	33	51	840	17	91	42
200	121	0.85	35	54	899	19	108	40
235	132	0.89	41	63	1062	20	156	34
270	139	0.91	45	69	1173	20	194	28
305	151	0.93	51	78	1334	20	242	24
340	157	0.95	55	85	1446	20	289	14
375	163	1.04	57	88	1497	21	331	0
410	166	1.10	61	94	1602	22	355	0

All values are reported as the average of the last minute of each stage.
Based on a predicted VO_2max of 65 ml/min/kg.

Nutrition

At race intensities, the carbohydrate is the predominant fuel source

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Performance Nutrition

☑ Start ☑ 1 hour ☑ 2 hour ☑ 3 hour ☑ 4 hour ☑ 5 hour

- 1 Bottle (600ml)= 48g CHO
- 1 Gel = 22g CHO
- 1 Bar = 24g CHO
- 8g Protein/ hour?

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Recovery Nutrition

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Protein

- ~0.25-0.3 g/kg protein immediately after
  - Therefore 20g perfect for most.
- Aim for rapid digestible, complete, rich in Leucine
- Goal of 1.2-1.4 g/kg/day

Nutrition

Moore et al. AJCN. 89:161-168, 2009;

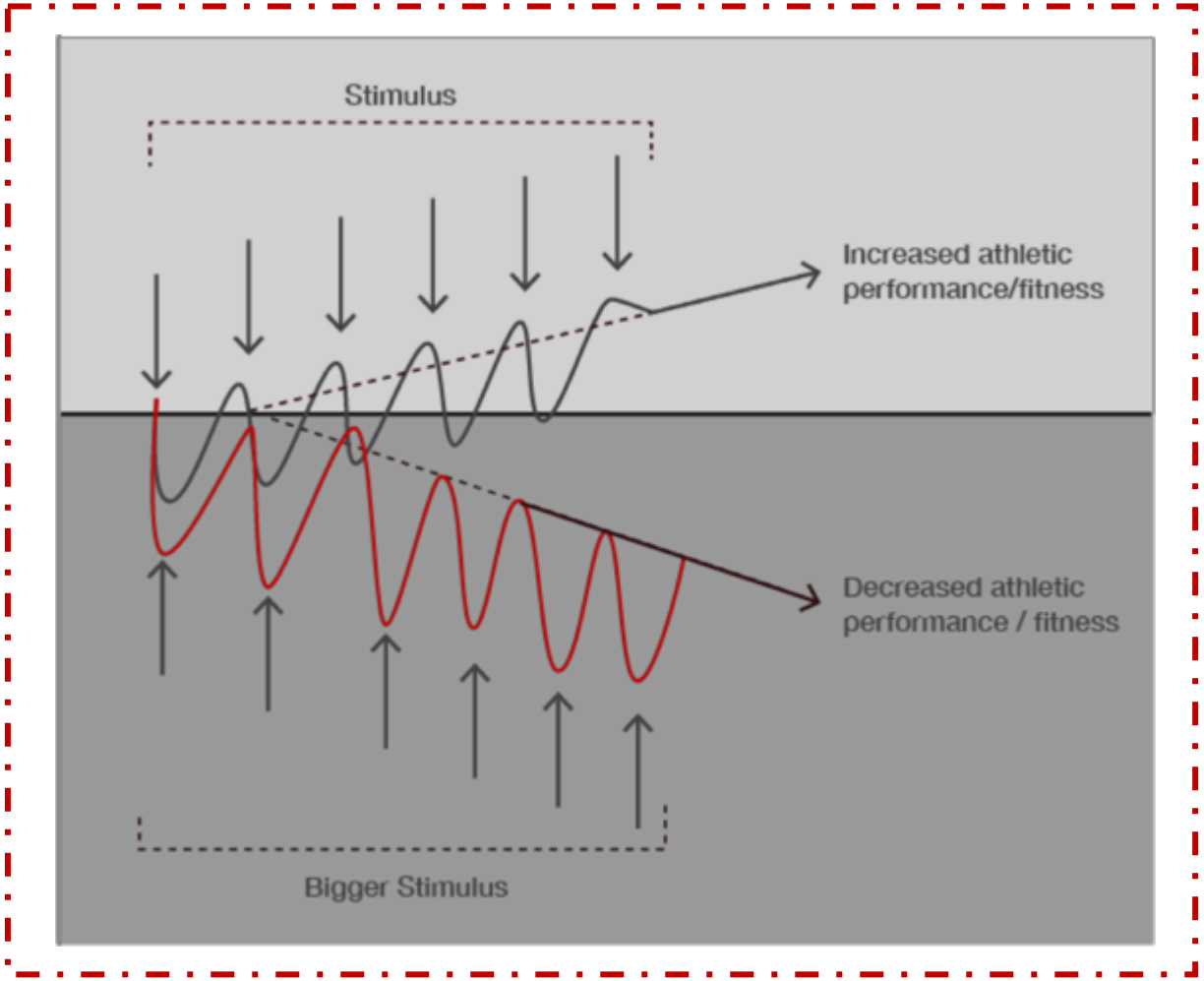
Witard et al. AJCN. 99:86-95, 2014.

Joint Position Statement: Nutrition and Athletic Performance.

Med Sci Sports Exerc. 48:543-68, 2016

Philips & van Loon. J Sports Sci. 29:S29-S38, 2011.

How To Monitor Performance



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How To Monitor Performance

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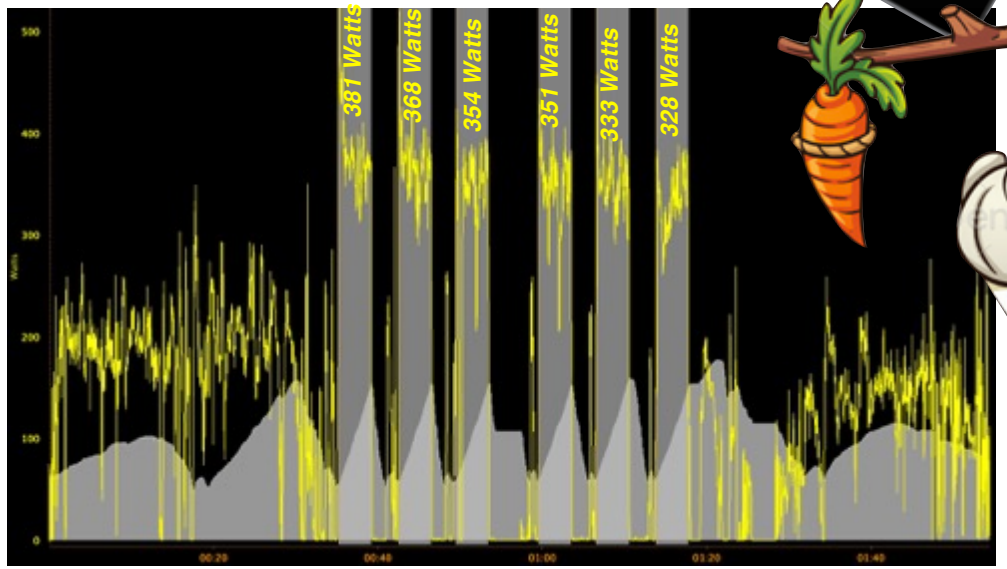
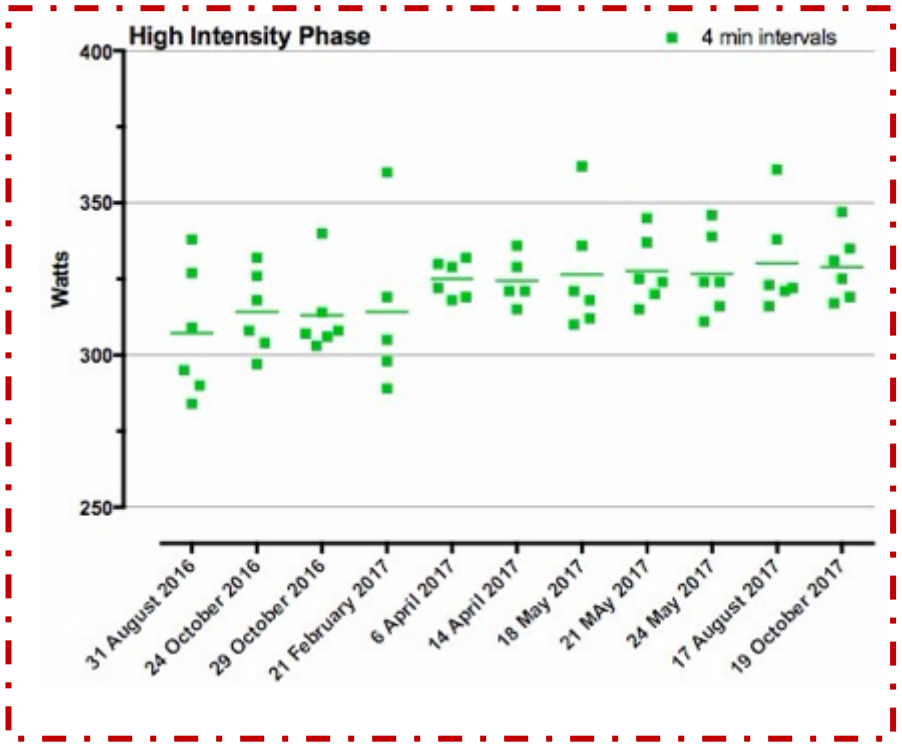
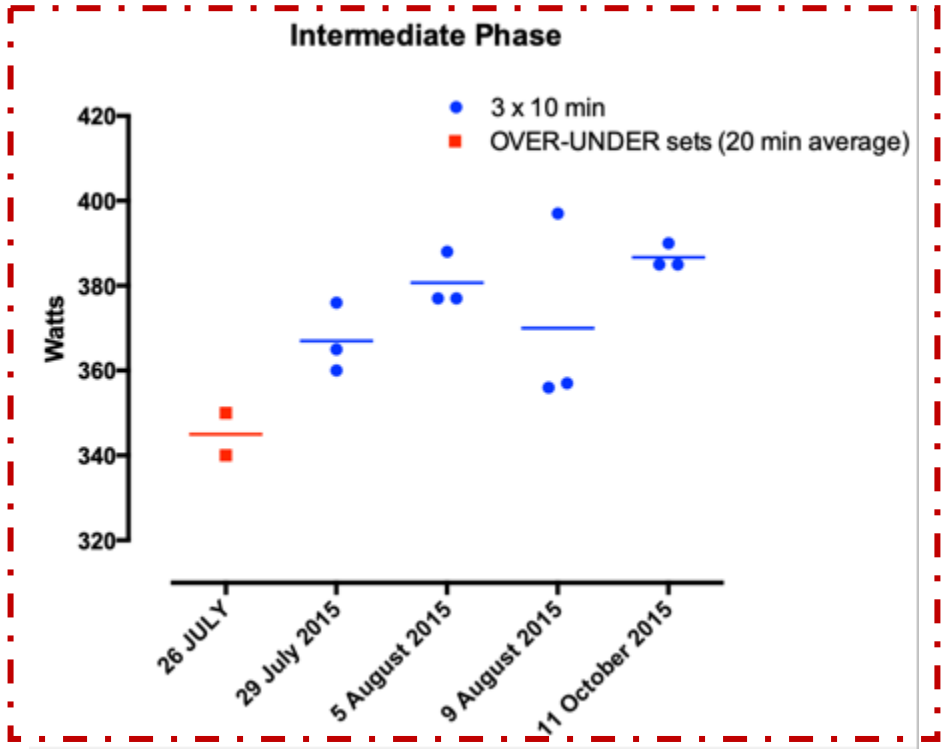


How To Monitor Performance

- Calculate and plot each interval (index sessions)
- Compare to same workout durations
- Is there progression?





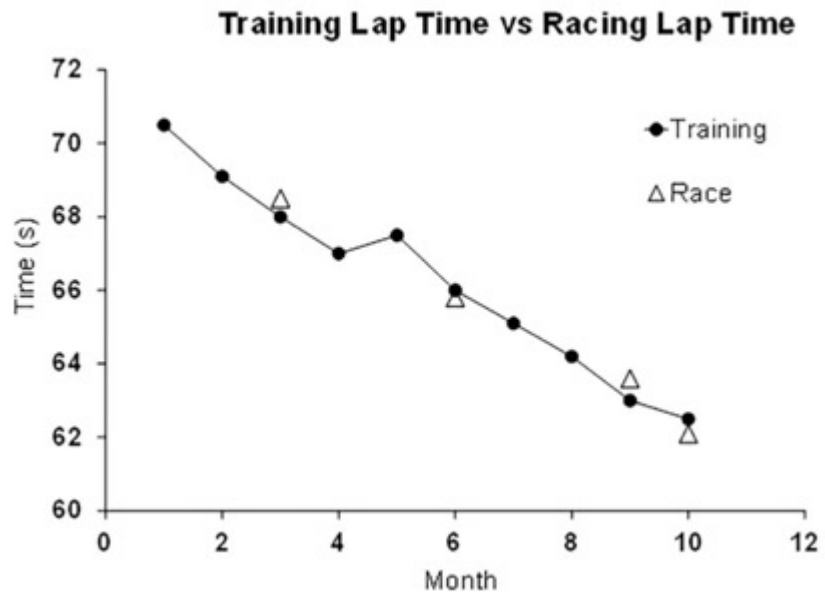
How To Monitor Performance

International Journal of Sports Physiology and Performance, 2017, 12, S2-2-S2-8
http://dx.doi.org/10.1123/IJSPP.2016-0388

Human Kinetics
BRIEF REVIEW

Monitoring Training Loads: The Past, the Present, and the Future

Carl Foster, Jose A. Rodriguez-Marroyo, and Jos J. de Koning



"Perhaps we need to consider the idea of going "back to the future" in terms of index-training sessions, monitored warm-up procedures, which may allow us to follow the widely used adage in almost any endeavour, ***"KISS"*** (keep it simple, stupid), which may be the most important element of training monitoring."

How To Monitor Performance

- If training adaptations are not optimal, the recovery between training sessions may not be sufficient.
- The amount of recovery required depends of the frequency, intensity, mode and duration of the training session.
- Nutrition is a major components of a good recovery regimen.
- To optimise nutrition it is important to ensure that the training demands are quantified.
- To ensure that recovery is sufficient, an athlete should also be regularly monitored.

END THANK YOU