



# The Physical Preparation Of The Dutch Track Cycling Sprint Team

Leuven 2021, Christian Bosse



# Beijing 2008

# London 2012

# Rio 2016

Track cycling [ edit ]

Men [ edit ]

Event	Gold	Silver	Bronze
Keirin <i>details</i>	Chris Hoy Great Britain	Ross Edgar Great Britain	Kiyofumi Nagai Japan
Madison <i>details</i>	Juan Esteban Curuchet Walter Fernando Perez	Joan Llaneras Antonio Tauler	Mikhail Ignatiev Alexei Markov
points race <i>details</i>	Joan Llaneras Spain	Roger Kluge Germany	Chris Newton Great Britain
individual pursuit <i>details</i>	Bradley Wiggins Great Britain	Hayden Roultson New Zealand	Steven Burke Great Britain
team pursuit <i>details</i>	Great Britain (GBR)	Denmark (DEN) New Zealand (NZL)	Great Britain
individual sprint <i>details</i>	Chris Hoy Great Britain	Michael Færk Christensen*	Mickaël Bourgain France
team sprint <i>details</i>	Great Britain (GBR) Jamie Staff Jason Kenny Chris Hoy	France (FRA) Grégory Baugé	Germany (GER) René Enders Maximilian Levy Stefan Nimke

Track cycling [ edit ]

Men [ edit ]

Event	Gold	Silver	Bronze
Keirin <i>details</i>	Chris Hoy Great Britain	Maximilian Levy Germany	Simon van Velthoven New Zealand
Omnium <i>details</i>	Lasse Norman Hansen Denmark	Bryan Coquard France	Ed Clancy Great Britain
team pursuit <i>details</i>	Great Britain (GBR) Ed Clancy Gerald Thomas Steven Burke Peter Kennaugh	Australia (AUS) Jack Bobridge Glenn O'Shea Rohan Dennis Michael Hepburn	New Zealand (NZL) Sam Bewley Aaron Gate Marc Ryan Jesse Sergent Westley Gough
sprint <i>details</i>	Jason Kenny Great Britain	Grégory Baugé France	Shane Perkins Australia
team sprint <i>details</i>	Great Britain (GBR) Philip Hindes Chris Hoy Jason Kenny	France (FRA) Grégory Baugé Michaël D'Almeida Kévin Sireau	Germany (GER) René Enders Maximilian Levy Robert Förstemann

Track cycling [ edit ]

Men's [ edit ]

Event	Gold	Silver	Bronze
Keirin <i>details</i>	Jason Kenny Great Britain	Matthijs Buchli Netherlands	Azizulhasni Awang Malaysia
Omnium <i>details</i>	Elio Viviani Italy	Mark Cavendish Great Britain	Lasse Norman Hansen Denmark
team pursuit <i>details</i>	Great Britain (GBR) <b>WR</b> Ed Clancy Steven Burke Owain Doull Bradley Wiggins	Australia (AUS) Alexander Edmondson Jack Bobridge Michael Hepburn Sam Welsford Callum Scotson	Denmark (DEN) Lasse Norman Hansen Frederik Madsen Casper von Folsach Rasmus Quaade
sprint <i>details</i>	Jason Kenny Great Britain	Callum Skinner Great Britain	Denis Dmitriev Russia
team sprint <i>details</i>	Great Britain (GBR) <b>OR</b> Philip Hindes Jason Kenny Callum Skinner	New Zealand (NZL) Eddie Dawkins Ethan Mitchell Sam Webster	France (FRA) Grégory Baugé Michaël D'Almeida François Pervis

# Agenda



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1. INTRODUCTION

2. THE PHYSICAL DEVELOPMENT BLUEPRINT

3. LTAD (LONG TERM ATHLETE DEVELOPMENT)

{ 1

INTRODUCTION

}



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# Hello!

**Christian Bosse**

Strength & Conditioning Coach

BMX Supercross &

Track Cycling Sprint



37 Olympians

17 Olympic Medalists

23 World Champions

2 Kids

1 Wife



2000



2001



1998



2008



2010



2007



2006



2006



2010



2013



2004



2015



2009



2012



# Organization Of Olympic Sport In The Netherlands



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## **CTO Heerenveen**

Speed Skating  
Gymnastics

## **CTO Amsterdam**

Rowing  
Swimming  
Baseball

## **CTO Papendal**

Track & Field  
Judo  
BMX  
Track Cycling  
Volleyball

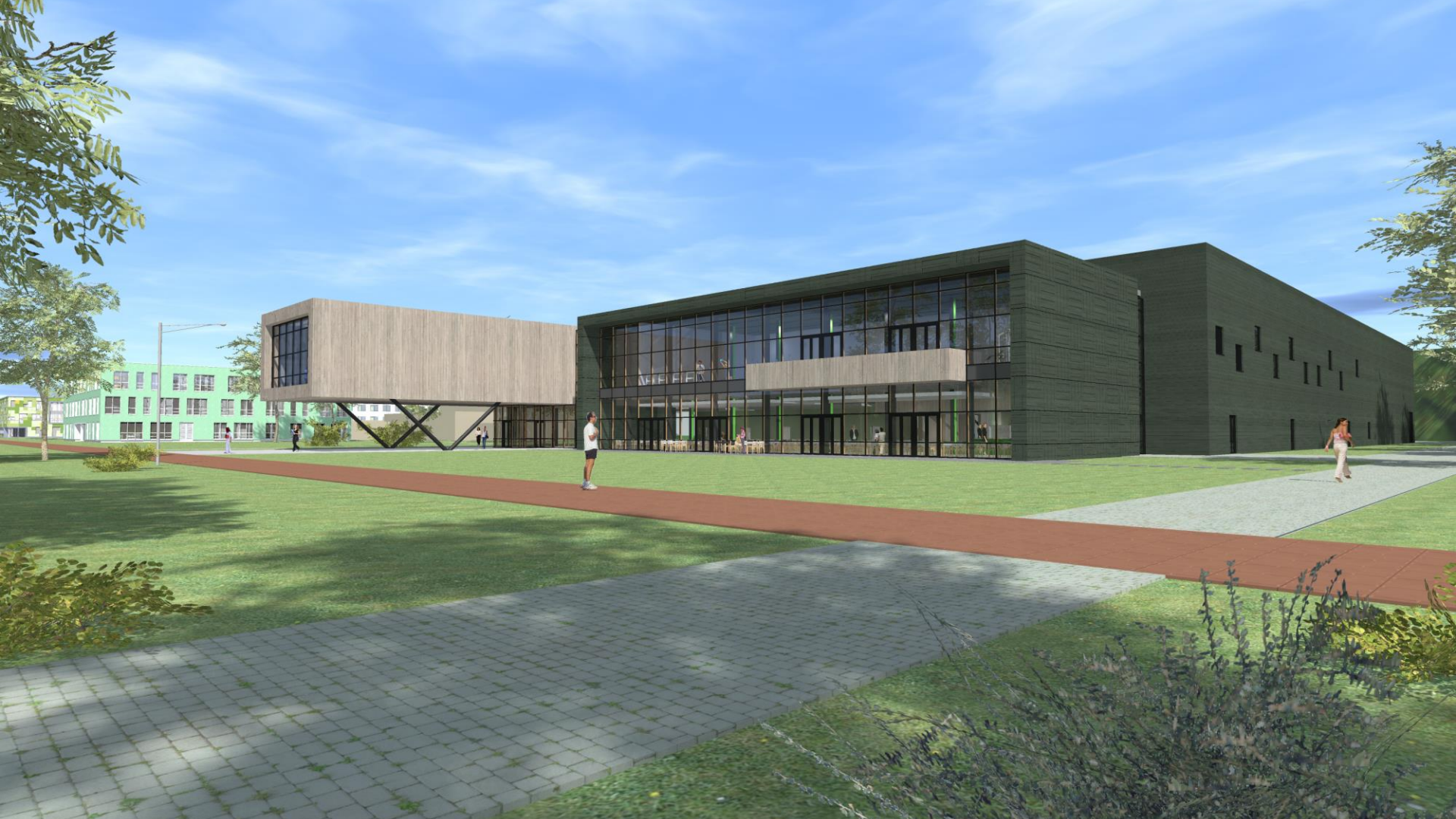
## **CTO Metropol**

Beach Volleyball  
Sailing

## **CTO Eindhoven**

Swimming  
Diving  
Water Polo









1980

1980

1984

1984

1988

1988

1992

1992

1994

1996

1996

2000

2002

2004

2006

2008

2010

2012

2014

2016

2018

2020

2022

2024

2026

2028

2030













PROFESSIONAL  
**PAFFEN  
SPORT**  
TRAINING EQUIPMENT

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**Ideal training environment,  
so now we need to do the  
work.**



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{ 2

**THE PHYSICAL DEVELOPMENT  
BLUEPRINT**

}

# What Is Strength & Conditioning?



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# Goals of Strength & Conditioning

- **Improve Performance**
- **Prevent Injuries**

# What is an IST

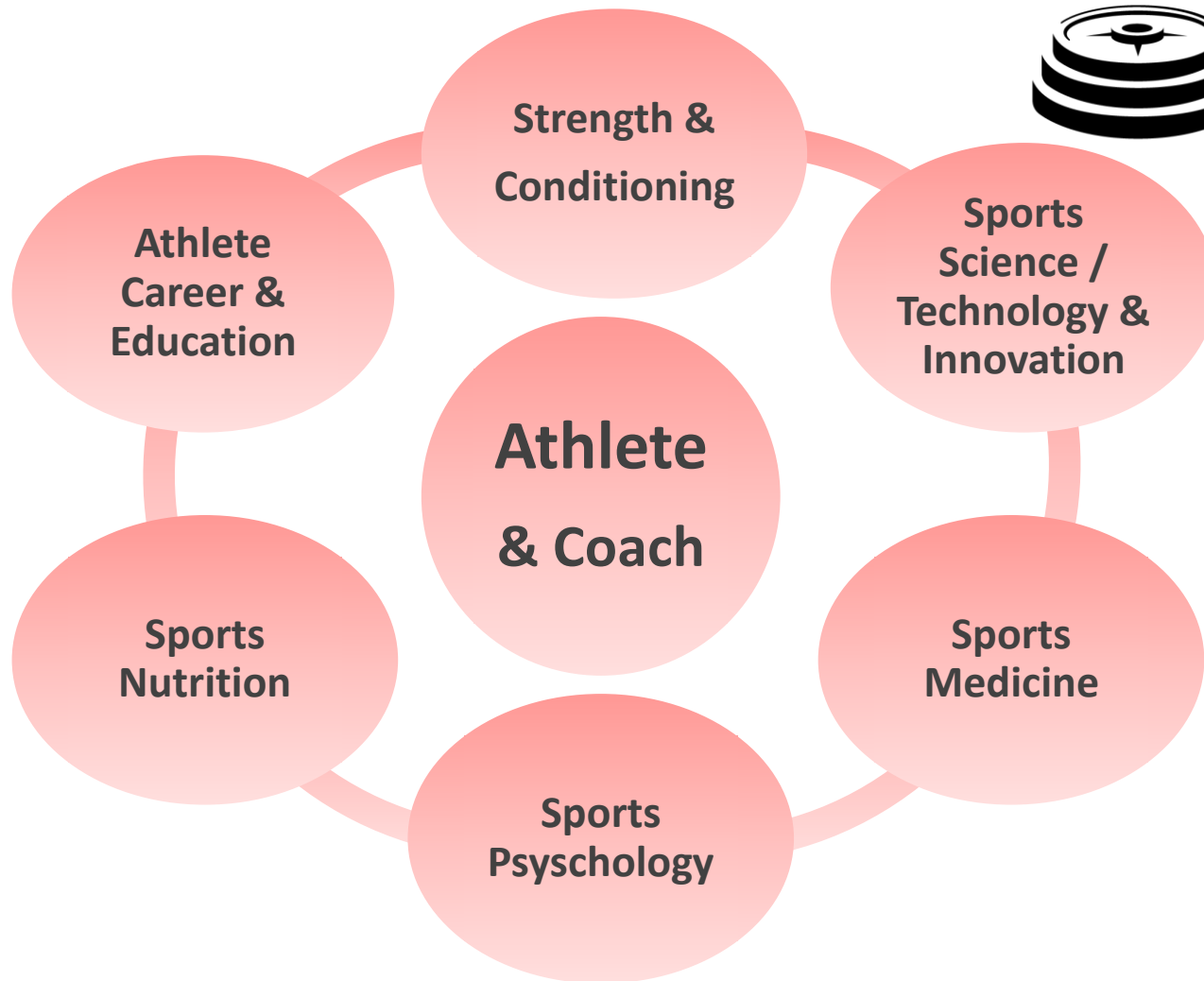
## (Integrated Support Team)?



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# How Does A Strength & Conditioning Coach Work?



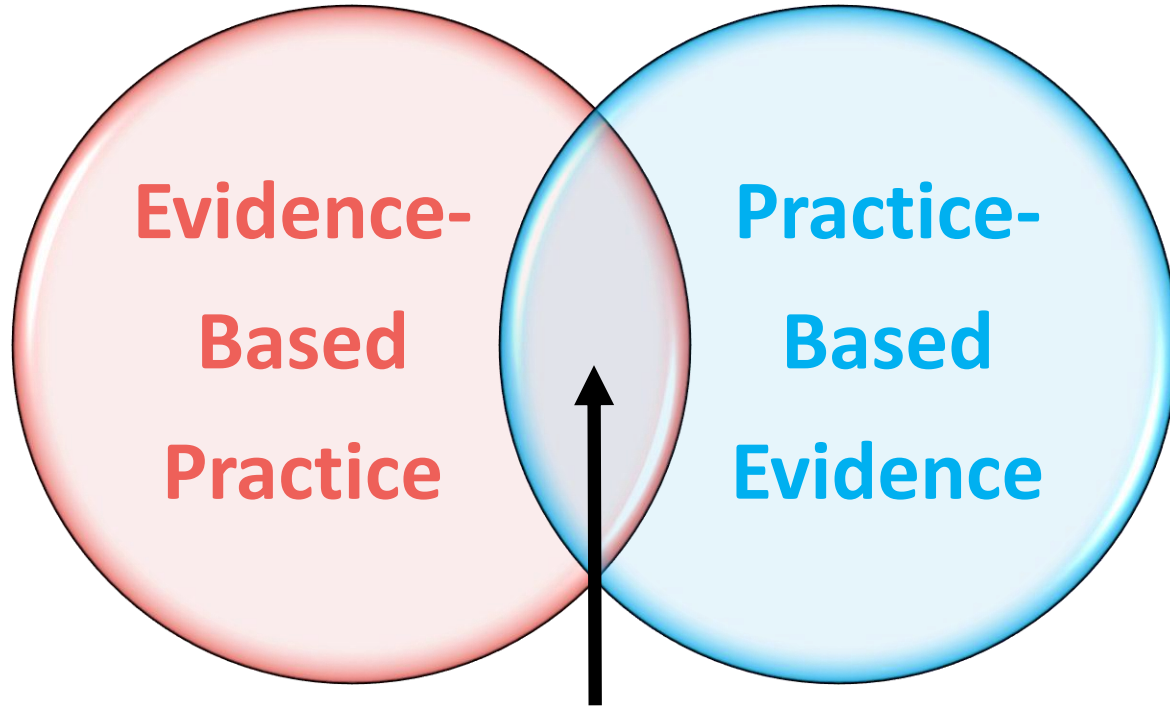
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# Science

# Art

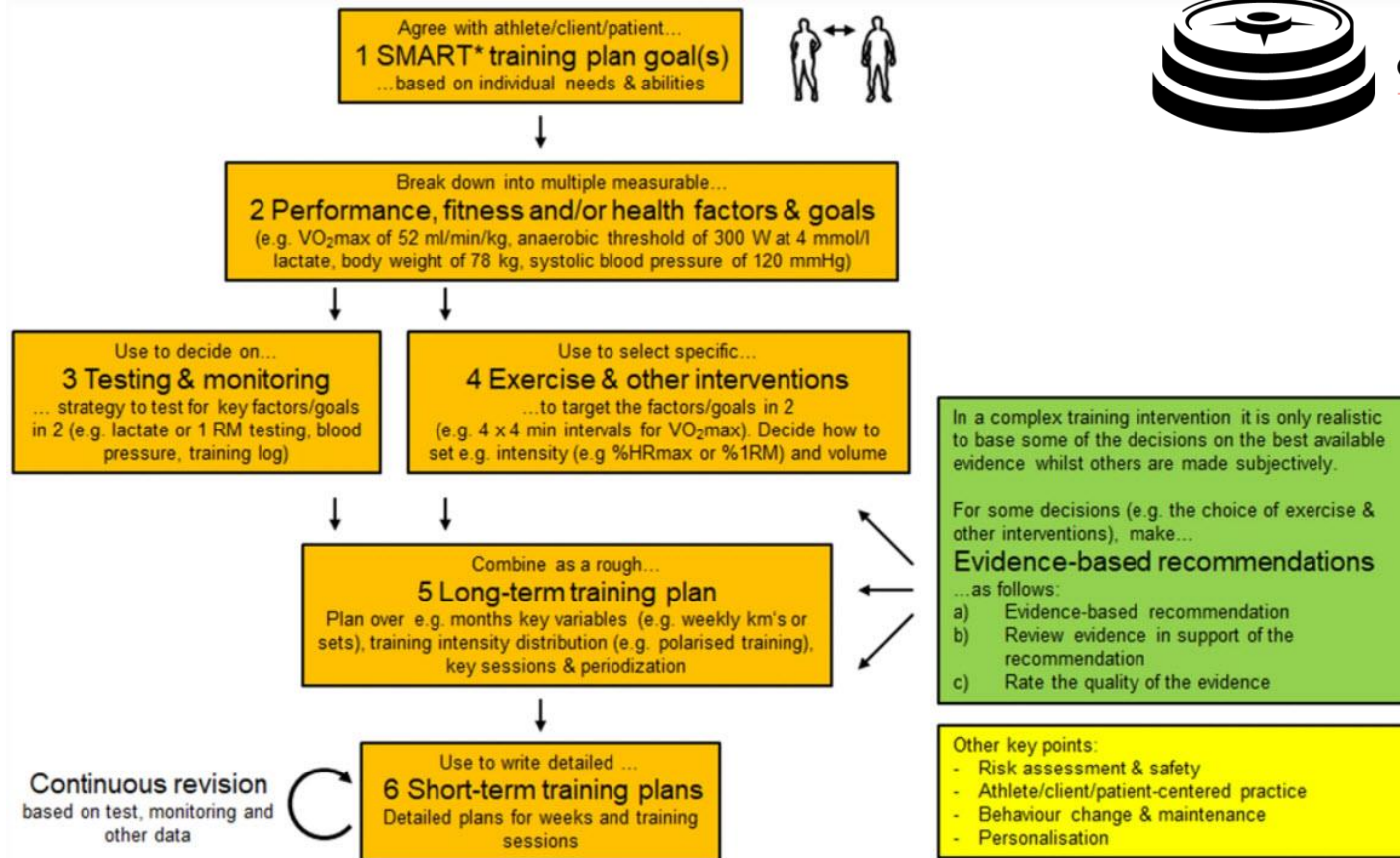


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# Performance Enhancement

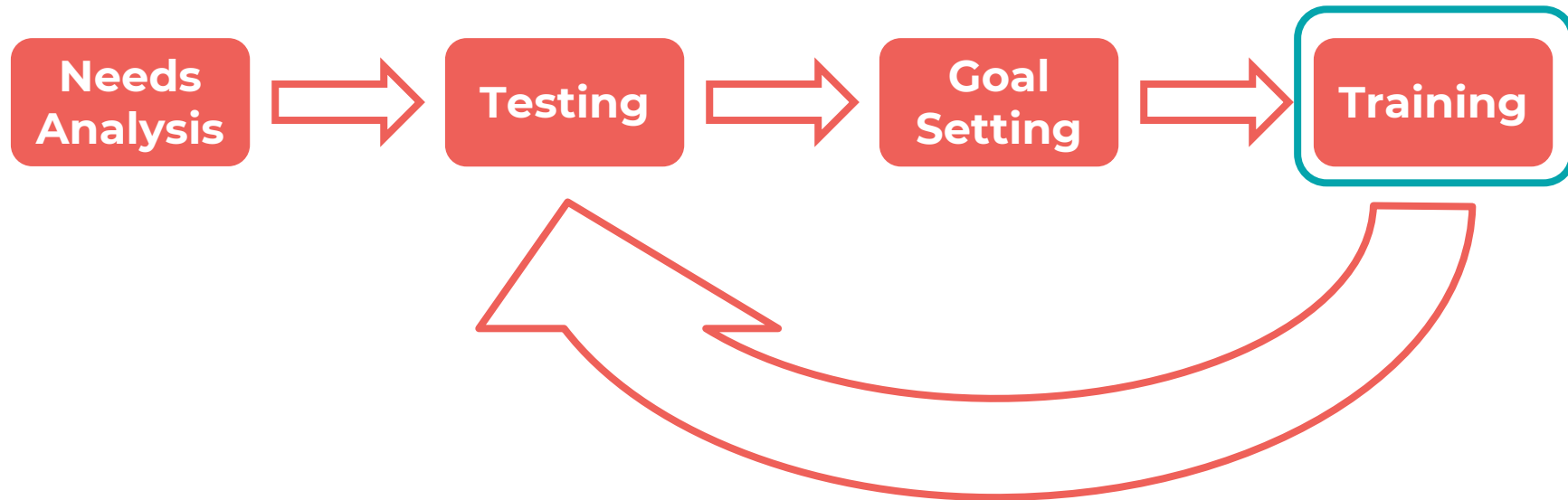




Source: Personalized, Evidence-Informed Training Plans and Exercise Prescriptions for Performance, Fitness and Health, H. Wackerhage & B. J. Schoenfeld; Sports Medicine volume 51 (2021)



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# Step 1

## Needs Analysis



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35th Conference of the International Society of Biomechanics in Sports, Cologne, Germany, June 14-18, 2017

Vercoe, J.

## PEDAL FORCES DURING THE BI

35th Conference of the International Society of Biomechanics in Sports, Cologne, Germany, June 14-18, 2017

## CYCLING START

### REVIEW ARTICLE

Sports Med 2001; 31 (7): 457-468  
0112-1642/01/0007-0457/\$22.00/0

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## PEDAL FORCES DURING THE BI

Ina Janssen a

Sports Science and Innovation

During the start of a BMX and sprint  
required to accelerate the bike. The  
force ( $F_e$ ), resultant force ( $F_r$ ) gener  
cyclists when performing a standir  
generated forces from each leg ser  
9,911 some ca

# Characteristics of Track Cycling

Neil P. Craig<sup>1</sup> and Kevin I. Norton<sup>2</sup>

- 1 Australian Institute of Sport, Track Cycling Unit Adelaide, South Australia, Australia
- 2 School of Physical Education, Exercise and Sport Studies, University of South Australia, Adelaide, South Australia, Australia

### Contents

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## **Start:**

- Peak power: 1180 – 1510 W
- Peak force: 1060 – 1450 N
  - 0.79 – 0.89 sec for 1<sup>st</sup> revolution
  - 0.43 – 0.47 for 2<sup>nd</sup> revolution

## **200 m sprint:**

- Peak power: 1720 – 2230 W
- Cadence: 120 – 140 rpm
- Maximum velocity: 63.5 km/h (avg value)

## **1000 m**

- Peak power 1750 – 1890 W (avg power 390 – 760 W)



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# Step 2

# Interpretation & Application



## Start:

- Peak **power**: 1180 – 1510 W
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  - 0.79 – 0.89 sec for 1<sup>st</sup> revolution
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## 1000 m

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# What is Force, Power & Velocity



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**Force (N):  $F = m * a$**

**Velocity (m/s):  $d / t$**

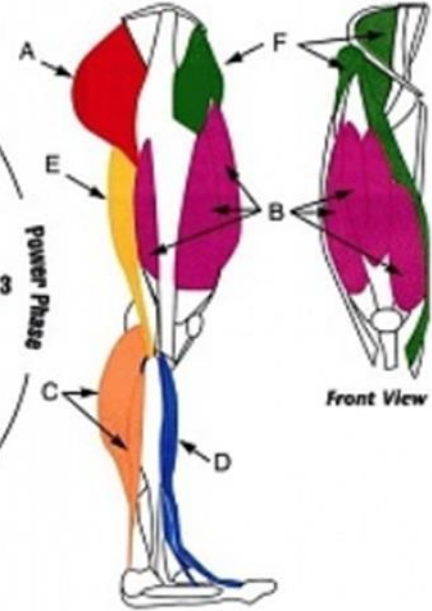
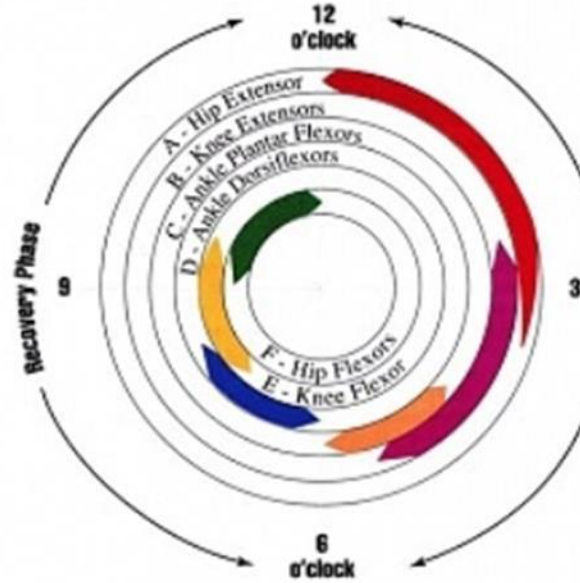
**Power (W):  $W / t$  or  $F * v$**



# How do we generate Force, Power & Velocity



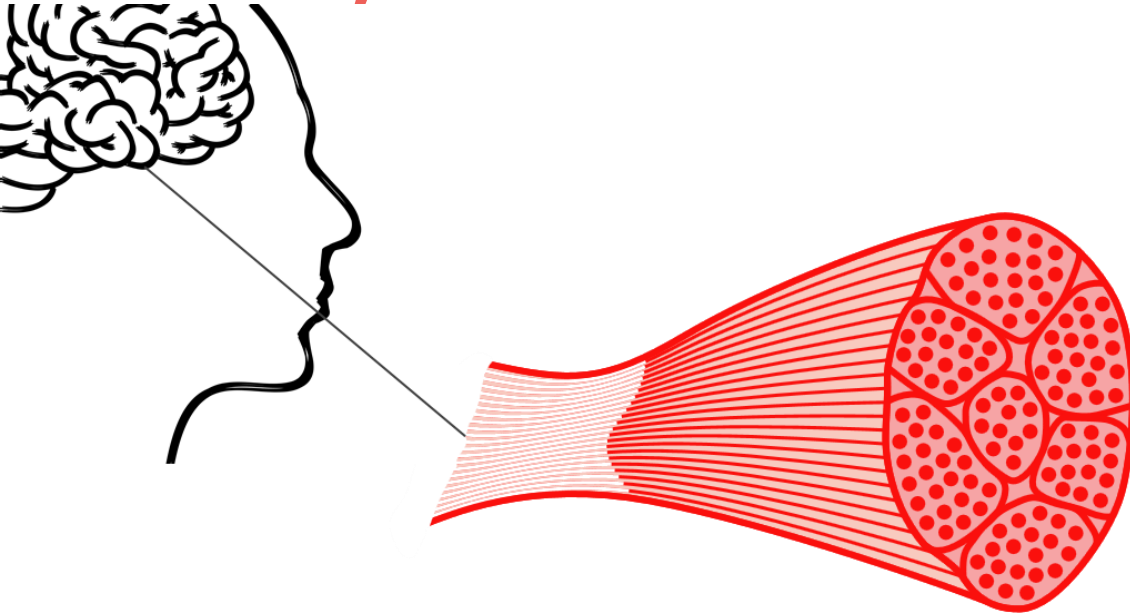
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# How do we generate Force, Power & Velocity



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**Motor Unit = connection brain & muscles**

(Motor Unit = Motor Neuron + innervated Muscle Fibers)

# How do we generate Force, Power & Velocity



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## Motor Unit Activation

### Intra-muscular

- Recruitment (how many MU can be activated)
- Firing Frequency (how fast MU's can be activated)

### Inter-muscular

- Synchronization (reciprocal inhibition)



## Start:

- Peak **power**: 1180 – 1510 W
- Peak **force**: 1060 – 1450 N
  - 0.79 – 0.89 sec for 1<sup>st</sup> revolution
  - 0.43 – 0.47 for 2<sup>nd</sup> revolution

## 200 m sprint:

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## 1000 m

- Peak **power** 1750 – 1890 W (avg power 390 – 760 W)

**Recruitment**



## Start:

- Peak **power**: 1180 – 1510 W
- Peak **force**: 1060 – 1450 N
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## Firing Frequency

## 200 m sprint:

- Peak **power**: 1720 – 2230 W
- Cadence: 120 – 140 rpm
- Maximum **velocity**: 63.5 km/h (avg value)

## 1000 m

- Peak **power** 1750 – 1890 W (avg power 390 – 760 W)



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## Start:

- Peak **power**: 1180 – 1510 W
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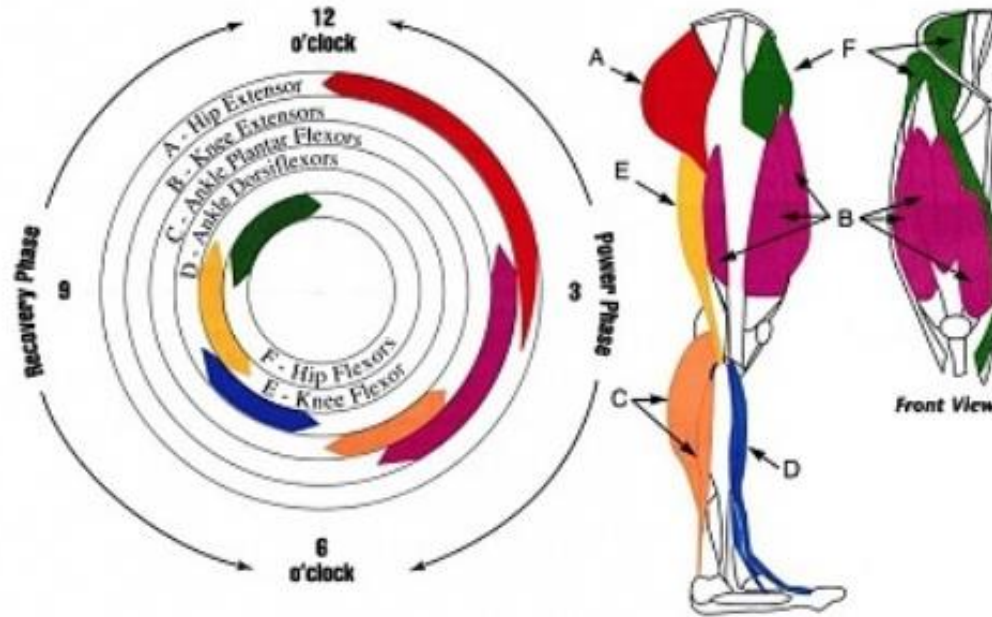
## 1000 m

- Peak **power** 1750 – 1890 W (avg power 390 – 760 W)

**Synchronization**  
?



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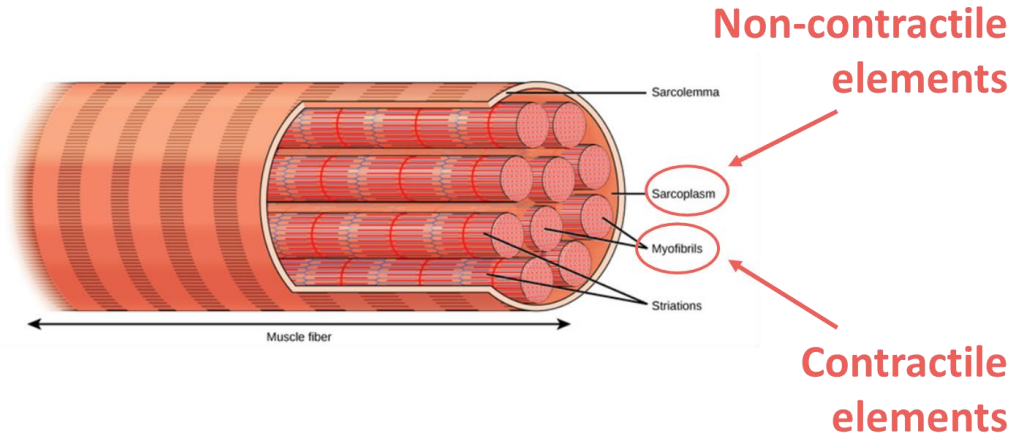


**Synchronization**  
?

# Let's talk muscles



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**Sarcoplasmic hypertrophy /  
non-functional hypertrophy**

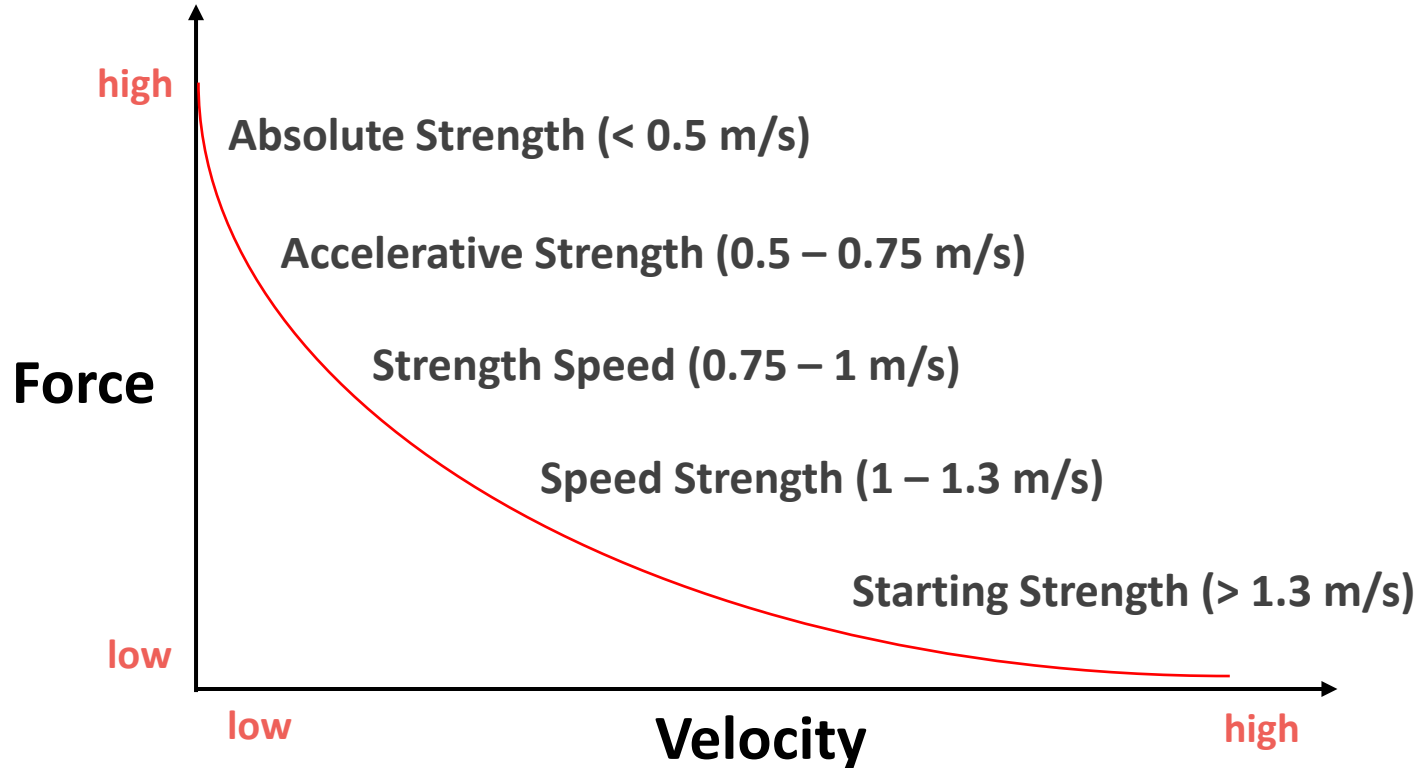
**Myofibrillar hypertrophy /  
functional hypertrophy**



# How do we train Force, Power & Velocity



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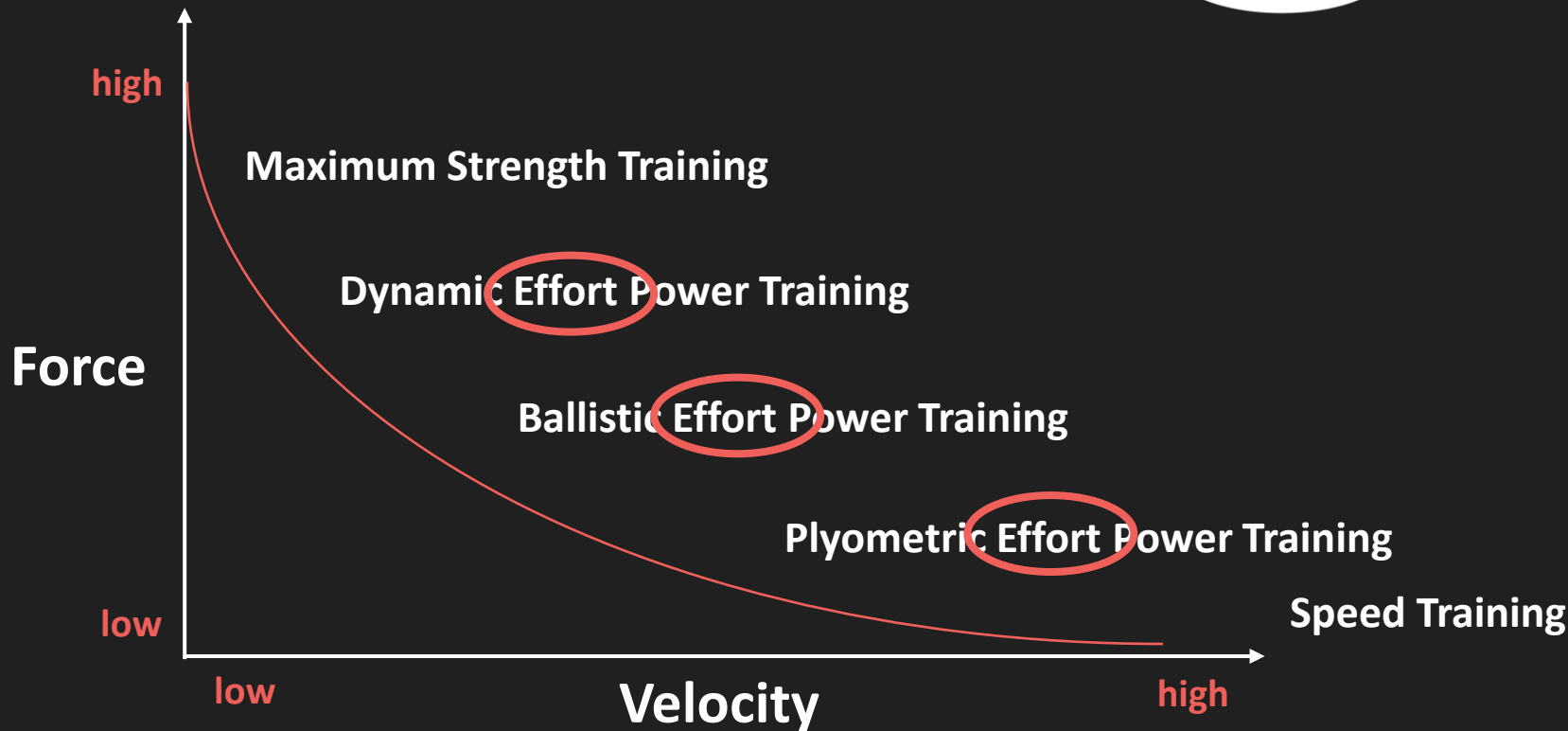
	<b>%1RM</b>	<b>Back Squat</b>	<b>Front Squat</b>	<b>Bench Press</b>	<b>Bench Row</b>
	<b>100</b>	0.15	0.27	0.24	0.40
	<b>95</b>	0.20	0.34	0.30	0.45
	<b>90</b>	0.26	0.40	0.36	0.50
	<b>85</b>	0.31	0.46	0.42	0.55
	<b>80</b>	0.37	0.52	0.48	0.59
	<b>75</b>	0.42	0.59	0.54	0.64
	<b>70</b>	0.48	0.65	0.60	0.69
	<b>65</b>	0.53	0.71	0.66	0.73
	<b>60</b>	0.59	0.78	0.72	0.78



BACK SQUAT	%1RM				
	100	0.15	0.22	0.40	0.36
	95	0.20	0.30	0.45	0.41
	90	0.26	0.39	0.50	0.46
	85	0.31	0.47	0.55	0.51
	80	0.37	0.55	0.59	0.56
	75	0.42	0.63	0.64	0.60
	70	0.48	0.72	0.69	0.65
	65	0.53	0.80	0.73	0.70
	60	0.59	0.88	0.78	0.75



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# What is Effort



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It is useful to **classify strength training** according to **methods of attaining maximal muscular tension.**

...

**There are three ways to achieve maximal muscular tension.**

*The Maximal Effort Method, the Repeated Effort Method, the Dynamic Effort Method.*



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**THE MAXIMAL**

**EFFORT METHOD**

# MAXIMAL EFFORT



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Lifting a **maximum load** or exercising  
against **maximal resistance**.

Source: 'Science & Practice of Strength Training' Zatsiorsky & Kraemer



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# MAXIMAL EFFORT





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**THE REPEATED**

**EFFORT METHOD**

# REPEATED EFFORT



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Lifting a **nonmaximal load** to failure  
(or near failure).

Source: 'Science & Practice of Strength Training' Zatsiorsky & Kraemer



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**REPEATED**  
**EFFORT**



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# THE **DYNAMIC**

# EFFORT METHOD

# DYNAMIC EFFORT



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Lifting (throwing) a **nonmaximal load**  
with the **highest attainable speed.**

Source: 'Science & Practice of Strength Training' Zatsiorsky & Kraemer



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# DYNAMIC EFFORT



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# THE BALLISTIC EFFORT (METHOD)

# RECAP



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## DYNAMIC EFFORT



CHRISTIAN BOSSE  
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Lifting (throwing) a  
nonmaximal load with the  
highest attainable speed.

Source: 'Science & Practice of Strength Training' [Zatsiorsky](#) & Kraemer



# BALLISTIC EFFORT



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Lifting or exercising against a **nonmaximal load**  
with the **highest attainable speed**  
where the x-object goes **into a free flight.**



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# BALLISTIC EFFORT



**CHRISTIAN BOSSE**  
Train Like an Olympian

# BALLISTIC EFFORT



**CHRISTIAN BOSSE**  
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# THE **PLYOMETRIC** EFFORT (METHOD)

# PLYOMETRIC EFFORT



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Lifting or exercising against a **nonmaximal load**  
with the **highest attainable speed**  
and **involvement of a short (or long) SSC**  
[stretch-shortening cycle].



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# PLYOMETRIC EFFORT



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# PLYOMETRIC EFFORT



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# PLYOMETRIC EFFORT





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# Step 3

**Choose the right Training**

**Method & Training Variables**

# MAXIMAL EFFORT



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## Maximum Strength Training

### Objectives

Increased MU recruitment  
Improved Synchronization of MU

### Intensity

85 – 100% 1 RM

### Repetitions

1 – 3

### Sets

3 – 5

### Exertion

Medium-hard to near-maximum (RPE 7-9 / RIR 1-3)

RM (Repetition Maximum)	RIR																
	100.00%	97.50%	95.00%	92.50%	90.00%	87.50%	85.00%	82.50%	80.00%	77.50%	75.00%	72.50%	70.00%	67.50%	65.00%	62.50%	60.00%
1	0	0	1	1	3	4	5	5	6	7	8	9	10	11	12	13	14
2			0	0	2	3	4	4	5	6	7	8	9	10	11	12	13
3				0	1	2	3	3	4	5	6	7	8	9	10	11	12
4					0	1	2	2	3	4	5	6	7	8	9	10	11
5						0	1	1	2	3	4	5	6	7	8	9	10
6							0	0	1	2	3	4	5	6	7	8	9
7									0	1	2	3	4	5	6	7	8
8										0	1	2	3	4	5	6	7
9											0	1	2	3	4	5	6
10												0	1	2	3	4	5
11													0	1	2	3	4
12														0	1	2	3
13															0	1	2
14																0	1
15																	0

Light Exertion

Medium Exertion

Medium Hard Exertion

Hard Exertion

Near Maximum Exertion

Maximum Exertion



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*Train Like an Olympian*



RPE	RPE Scale for Strength Training
10	Could not do more reps or load
9.5	Could not do more reps, could do slightly more load
9	Could do 1 more rep
8.5	Could definitely do 1 more rep, maybe 2
8	Could do 2 more reps
7.5	Could definitely do 2 more reps, maybe 3
7	Could do 3 more reps
5 – 6	Could do 4 to 6 more reps
1 – 4	Very light effort

**Max exertion**

**Near-max exertion**

**Hard exertion**



# MAXIMAL EFFORT



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## Maximum Strength Development

### Objectives

Increased MU recruitment  
Improved Synchronization of MU

### Intensity

85 – 100% 1 RM

### Repetitions

1 – 5

### Sets

2 – 3

### Exertion

Near maximum to maximum (RPE 8.5-10 / RIR 0-1)

# DYNAMIC EFFORT



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## Dynamic Effort Power Training

### Objectives

Improved RFD  
Increased Firing Frequency

### Intensity

50 – 70% 1 RM

### Repetitions

2 – 6

### Sets

3 – 5

### Exertion

Light to medium (RPE 5-6 / RIR 4-6)

# BALLISTIC EFFORT



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## Ballistic Effort Power Training

### Objectives

Increased Firing Frequency  
Enhanced Power (work / time)

### Intensity

20 – 50% 1 RM

### Repetitions

2 – 6

### Sets

4 – 6

### Exertion

Light (RPE < 4 / RIR > 6)

# PLYOMETRIC EFFORT



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## Plyometric Effort Power Training

### Objectives

Enhanced Elastic Energy & Use Of The SSC  
Increased Firing Frequency

### Intensity

0 – 20% 1 RM

### Repetitions

2 – 10

### Sets

3 – 6

### Exertion

Light (RPE < 4 / RIR > 6)





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# Step 4

# Annual Plan



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	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Avg Int	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	80.0%	82.5%	85.0%	87.5%	80.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	82.5%	87.5%	92.5%	80.0%	85.0%	90.0%	85.0%	80.0%	85.0%	80.0%	85.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	80.0%	85.0%	85.0%	90.0%	85.0%	87.5%	80.0%	85.0%	87.5%	80.0%	85.0%	87.5%	80.0%		
Total Reps	256	272	288	304	320	294	90	252	210	168	90	96	108	69	30	24	18	120	96	72	60	42	36	24	30	36	30	42	36	36	36	36	16	12	60	42	36	36	30	36	36	30	36	36	30	36	36	30	
VL	141	163	187	213	240	235	72	208	179	147	72	86.4	99.9	65.6	27	23.4	18	99	84	66.6	48	35.7	32.4	20.4	24	30.6	24	35.7	32.4	33.3	34.2	32.4	15.6	12	48	35.7	32.4	30.6	24	30.6	31.5	24	30.6	31.5	24	30.6	31.5	24	

Functional Hypertrophy

Maximum Strength Development

Maximum Strength Training (MST)

World Cup

World Cup

Maximum Strength Training (MST)

World Champs

World Cup

World Cup

World Cup

Maintenance Maximum Strength Training



	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Avg Int	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	80.0%	82.5%	85.0%	87.5%	80.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	82.5%	87.5%	92.5%	80.0%	85.0%	90.0%	85.0%	80.0%	85.0%	80.0%	85.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	80.0%	85.0%	90.0%	85.0%	80.0%	85.0%	87.5%	80.0%	85.0%	87.5%	80.0%	85.0%	87.5%	80.0%	
Total Reps	256	272	288	304	320	294	90	252	210	168	90	96	108	69	30	24	18	120	96	72	60	42	36	24	30	36	30	42	36	36	36	36	16	12	60	42	36	36	30	36	36	30	36	36	30	36	36	30	
VL	141	163	187	213	240	235	72	208	179	147	72	86.4	99.9	65.6	27	23.4	18	99	84	66.6	48	35.7	32.4	20.4	24	30.6	24	35.7	32.4	33.3	34.2	32.4	15.6	12	48	35.7	32.4	30.6	24	30.6	31.5	24	30.6	31.5	24	30.6	31.5	24	

Functional Hypertrophy

Maximum Strength Development

Maximum Strength Training (MST)

World Cup

World Cup

Maximum Strength Training (MST)

World Champs

World Cup

World Cup

World Cup

MST + Power ('mixed method')

MST + Power ('mixed method')

MST + Power (Power Plyometric)

MST + Power (Power Plyometric)

MST

Maintenance Maximum Strength Training



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Train Like an Olympian

**MAXIMUM**

**EFFORT**

**&**

**PLYOMETRIC**

**EFFORT**



**CHRISTIAN BOSSE**  
Train Like an Olympian

**MAXIMUM**

**EFFORT**

**&**

**PLYOMETRIC**

**EFFORT**



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**DYNAMIC**

**EFFORT**

**&**

**PLYOMETRIC**

**EFFORT**



	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Avg Int	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	80.0%	82.5%	85.0%	87.5%	80.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	82.5%	87.5%	92.5%	80.0%	85.0%	90.0%	85.0%	80.0%	85.0%	80.0%	85.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	80.0%	85.0%	90.0%	85.0%	80.0%	85.0%	87.5%	80.0%	85.0%	87.5%	80.0%	85.0%			
Total Reps	256	272	288	304	320	294	90	252	210	168	90	96	108	69	30	24	18	120	96	72	60	42	36	24	30	36	30	42	36	36	36	36	16	12	60	42	36	36	30	36	36	30	36	36	30	36	30		
VL	141	163	187	213	240	235	72	208	179	147	72	86.4	99.9	65.6	27	23.4	18	99	84	66.6	48	35.7	32.4	20.4	24	30.6	24	35.7	32.4	33.3	34.2	32.4	15.6	12	48	35.7	32.4	30.6	24	30.6	31.5	24	30.6	31.5	24	30.6	31.5	24	

Functional Hypertrophy

Maximum Strength Development

Maximum Strength Training (MST)

World Cup

World Cup

Maximum Strength Training (MST)

World Champs

World Cup

World Cup

World Cup

MST + Power ('mixed method')

Maintenance Maximum Strength Training

MST + Power (Power Plyometric)

MST + Power ('mixed method')

MST

MST + Power (Power Plyometric)

MST



**CHRISTIAN BOSSE**  
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	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Avg Int	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	80.0%	82.5%	85.0%	87.5%	80.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	82.5%	87.5%	92.5%	80.0%	85.0%	90.0%	85.0%	80.0%	85.0%	80.0%	85.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	80.0%	85.0%	85.0%	90.0%	85.0%	87.5%	80.0%	87.5%	85.0%	87.5%	80.0%				
Total Reps	256	272	288	304	320	294	90	252	210	168	90	96	108	69	30	24	18	120	96	72	60	42	36	24	30	36	30	42	36	36	36	36	16	12	60	42	36	36	30	36	36	30	36	36	30	36	30		
VL	141	163	187	213	240	235	72	208	179	147	72	86.4	99.9	65.6	27	23.4	18	99	84	66.6	48	35.7	32.4	20.4	24	30.6	24	35.7	32.4	33.3	34.2	32.4	15.6	12	48	35.7	32.4	30.6	24	30.6	31.5	24	30.6	31.5	24	30.6	31.5	24	

Functional Hypertrophy

Maximum Strength Development

Maximum Strength Training (MST)

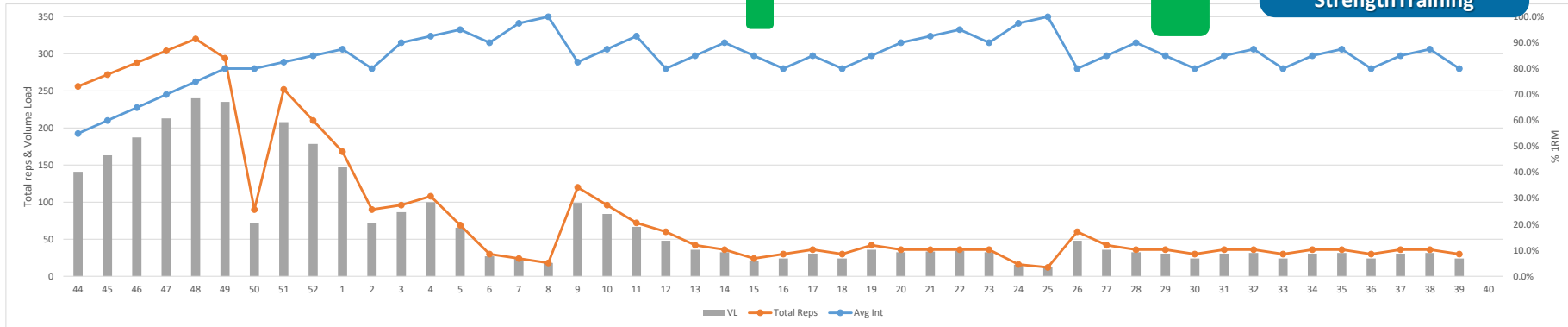
World Cup

World Cup

Maximum Strength Training (MST)

World Champs

Maintenance Maximum Strength Training







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# Step 5

## Do The Work



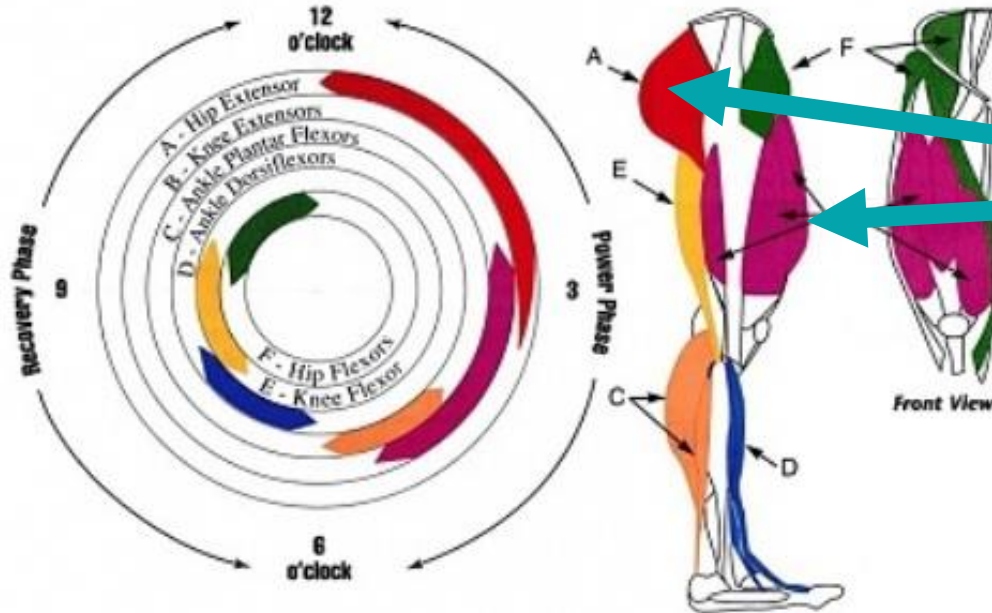
**CHRISTIAN BOSSE**  
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# How Does A Strength & Conditioning Program Look Like?

# Exercise Selection



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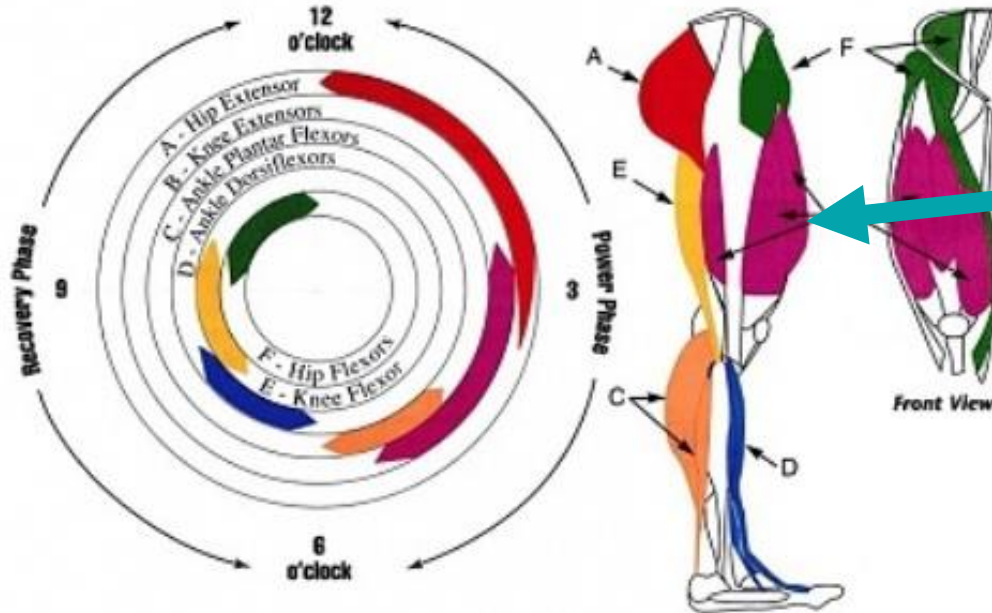


**Back Squats**

# Exercise Selection



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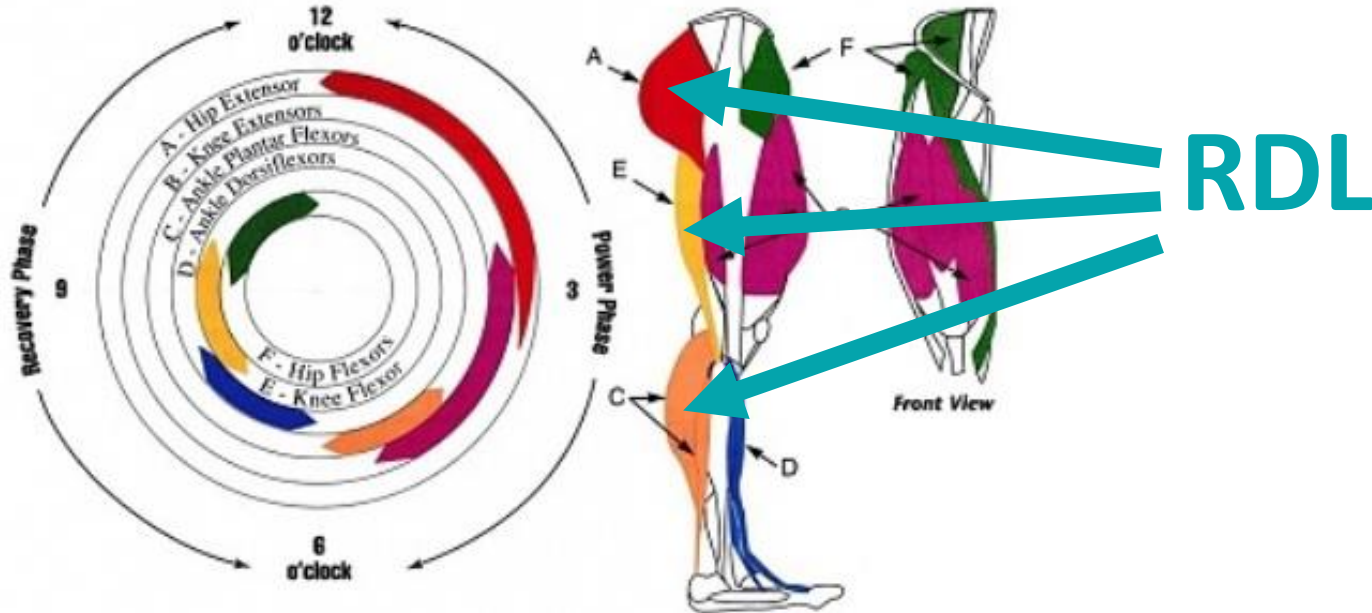


**Front Squats**

# Exercise Selection



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Session 1

Approx Time: 45 mins



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Workout type:				Set 1	Set 2	Set 3	Set 4	Set 5
#	Type	Exercises		Actual Weight				
Warm Up / Prehab		Movement Prep						
		A: Push Up to Star Hold		4				
		B: Bulgarian Split Squats (Bosu)		3				
		C: Figure Skater (Bosu)		3				
1		Power Clean	Reps	1	1	1		
			%	82.5%	85%	87.5%	%	%
			Wt.					
			Tempo: Explosive Rest 60s					
2A		Back Squat	Reps	1	1	1		
			%	82.5%	85%	87.5%	%	%
			Wt.					
			Tempo: 3d:1p:1u Rest 2min					
2B		Bench Row	Reps	1	1			
			%	82.5%	87.5%	%	%	
			Wt.					
			Tempo: 3d:1p:1u Rest 60s					
3A		Bulgarian Split Squat	Reps	1	1	1		
			%	82.5%	85%	87.5%	%	%
			Wt.					
			Tempo: 3d:1p:1u Rest 2min					
3A		Bench Press	Reps	1	1			
			%	82.5%	87.5%	%	%	
			Wt.					
			Tempo: 3d:1p:1u Rest 60s					
4A		RDL	Reps	3	3			
			%	%	%	%	%	
			Wt.					
			Tempo: 3d:1p:1u Rest 2min					
4B		BB Roull-outs	Reps	4	4			
			%	%	%	%	%	
			Wt.					
			Tempo: 3d:1p:1u Rest 60s					
5		A: BB Oh Press w/ elastic bands & KB	Reps					
			%	%	%	%	%	
			Wt.					
			Tempo: Rest					
ABS / Core		B: Weighted Back Extensions	Reps	6	6			
			%	%	%	%	%	
			Wt.					
			Tempo: Rest					
			RPE		Training Time (mins)		mins	

Warm-up

Movement Prep

Injury Prevention

Olympic Lift

Squat

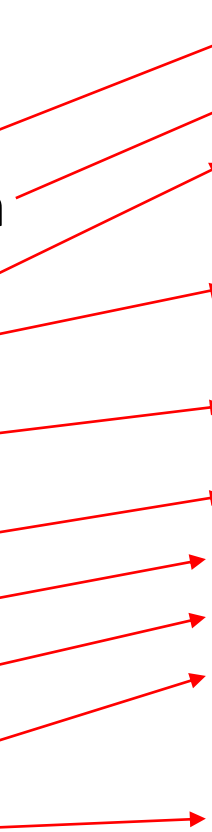
Pull

SL Squat

Push

RDL

Trunk





**CHRISTIAN BOSSE**  
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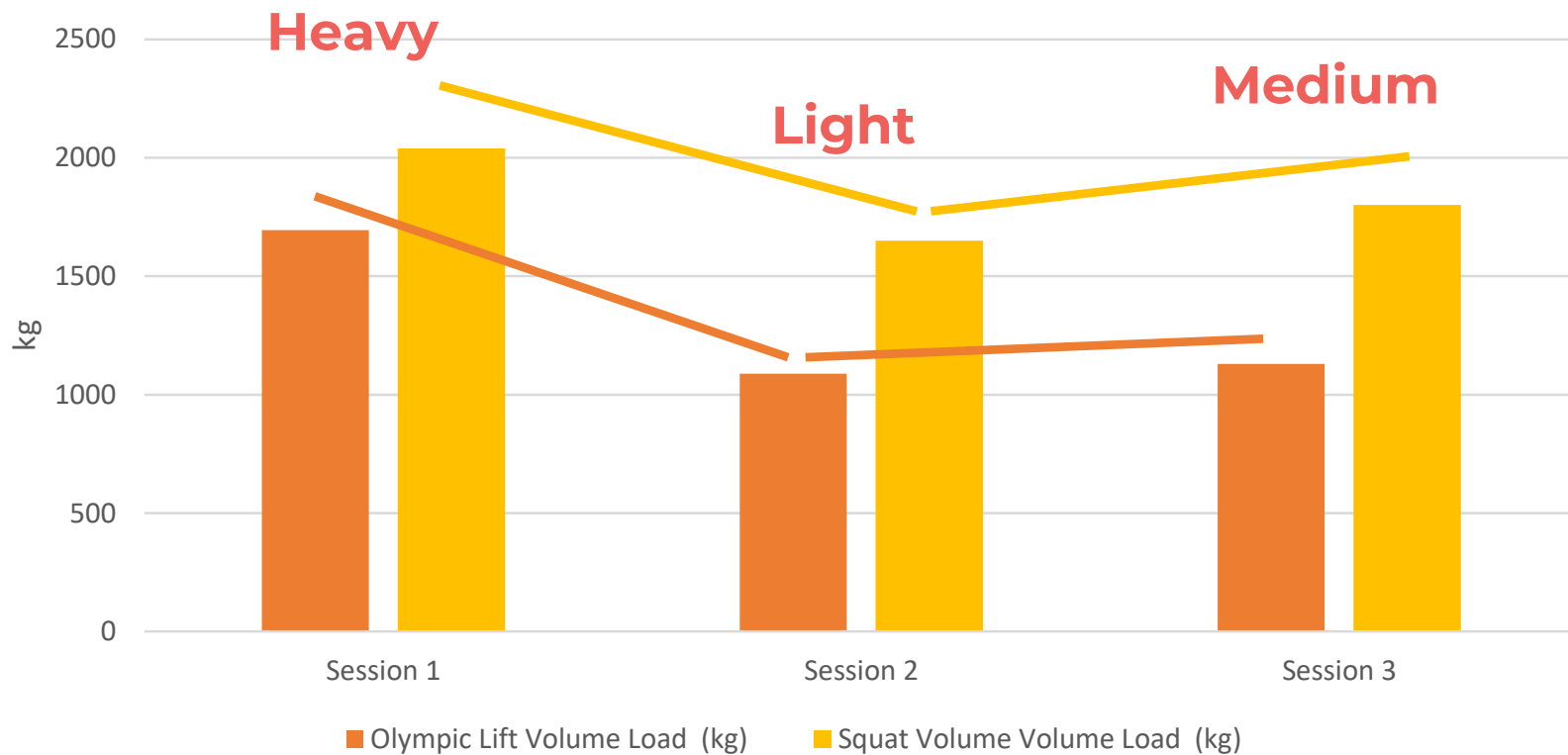
Session 1		Approx Time: 45 mins					
Workout type:		Set 1	Set 2	Set 3	Set 4	Set 5	
#	Type	Actual Weight					
	Exercises						
	Movement Prep	4					
	Bosu Bulgarian Split Squat	3					
	Push up to star hold	3					
	Clean Pull & Power Clean	2	2	2			
1A	Power Clean	Reps	3	3	3	3	3
		%	82.5%	82.5%	82.5%	82.5%	82.5%
		Wt.	113.0	113.0	113.0	113.0	113.0
	Tempo: Explosive Rest 60s						
1B	Altitude Landings	Reps	2	2	2		
		%	%	%	%	%	
		Wt.					
	Tempo: Explosive Rest 2min						
2A	Back Squat	Reps	3	3	3	3	3
		%	82.5%	82.5%	82.5%	82.5%	82.5%
		Wt.	136.0	136.0	136.0	136.0	136.0
	Tempo: 3d:1p:1u Rest 60s						
2B	Bench Row	Reps	5	5	5		
		%	82.5%	82.5%	82.5%	%	%
		Wt.	92.5	92.5	92.5		
	Tempo: 3d:0p:1u Rest 2min						
3	Back Extensions	Reps	6	6	6		
		%	%	%	%	%	
		Wt.					
	Tempo: 3d:1p:1u Rest 2min						

Session 2		Approx Time: 45 mins					
Workout type:		Set 1	Set 2	Set 3	Set 4	Set 5	
#	Type	Actual Weight					
	Exercises						
	Movement Prep	4					
	SL RDL to SL Oh Squat	3					
	Snatch Pull & Power Snatch	2	2	2			
1A	Power Snatch	Reps	3	3	3	3	3
		%	82.5%	82.5%	82.5%	82.5%	82.5%
		Wt.	72.5	72.5	72.5	72.5	72.5
	Tempo: Explosive Rest 2min						
1B	Altitude Landings	Reps	2	2	2		
		%	%	%	%	%	
		Wt.					
	Tempo: Explosive Rest 2min						
2A	Front Squat	Reps	3	3	3	3	3
		%	82.5%	82.5%	82.5%	82.5%	82.5%
		Wt.	110.0	110.0	110.0	110.0	110.0
	Tempo: 3d:0p:1u Rest 60s						
2B	Pull Ups	Reps	5	5	5		
		%	%	%	%	%	
		Wt.					
	Tempo: 3d:1p:1u Rest 2min						
2C	Shldr Press	Reps	5	5	5		
		%	82.5%	82.5%	82.5%	%	%
		Wt.	57.5	57.5	57.5		
	Tempo: 3d:1p:1u Rest 2min						
3	Reverse Back Extensions	Reps	8	8	8		
		%	%	%	%	%	
		Wt.					
	Tempo: 3d:1p:1u Rest 2min						

Session 3		Approx Time: 45 mins					
Workout type:		Set 1	Set 2	Set 3	Set 4	Set 5	
#	Type	Actual Weight					
	Exercises						
	Movement Prep	4					
	SB Bulgarian Split Squat	3					
	Yoga Push Up	3					
	Clean Pull & Power Clean	2	2	2			
1A	Power Clean	Reps	2	2	2	2	2
		%	82.5%	82.5%	82.5%	82.5%	82.5%
		Wt.	113.0	113.0	113.0	113.0	113.0
	Tempo: Explosive Rest 2min						
1B	Altitude Landings	Reps	2	2	2		
		%	%	%	%	%	
		Wt.					
	Tempo: Explosive Rest 2min						
2A	Bulgarian Split Squat	Reps	3	3	3	3	3
		%	82.5%	82.5%	82.5%	82.5%	83%
		Wt.	120.0	120.0	120.0	120.0	120.0
	Tempo: 3d:0p:1u Rest 60s						
2B	Bench Press	Reps	5	5	5		
		%	82.5%	82.5%	82.5%	%	%
		Wt.	80.0	80.0	80.0		
	Tempo: 3d:1p:1u Rest 60s						
2C	RDL	Reps	5	5	5		
		%	82.5%	82.5%	82.5%	%	%
		Wt.	135.0	135.0	135.0		
	Tempo: 3d:1p:1u Rest 2min						
3	Back Extensions	Reps	8	8	8		
		%	%	%	%	%	
		Wt.					
	Tempo: 3d:1p:1u Rest 2min						



## Volume Load (load-based)





# What about Individualization?



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A	B	C	D	E	F	G	H	I	J	K	L	M
		Technical										
Power Clean / Clean	Point(s) to improve	Full extension	Turnover	Contact mid-thigh	Turnover (bar crashing)		Catch position (hip) start position (set up) &	Catch position (ju	Turnover (bar cra	Contact mid-thigh Turnover (bar crashing)	Feet Turnover (bar crashing) & posture	Full extension Turnover (bar crashing)
	Corrective Exercises	Clean Pull Clean Pull & Power Clean	Static Pull-under Pull-under from sternum Pull-under from hip	Hit contact point 'Hit' & Clean Pull 'Hit' & Clean Pull & Power Clean 'Hit' & Power Clean	Static Pull-under Pull-under from sternum Pull-under from hip Clean Pull (keep bar close) Power Clean - catch & front squat		<u>Catch position:</u> Hang Power Clean & stick catch position Hang Power Clean & stick catch position & Front Squat <u>Start position:</u> set-up and pull to below knee	Pull-under from sternum Pull-under from hip 'no feet' Power Clean	Static Pull-under Pull-under from sternum (focus on connecting the bar) Pull-under from hip	Static Pull-under Pull-under from sternum (focus on connecting the bar) Pull-under from hip	Pull-under from sternum (focus on connecting the bar & feet) Pull-under from hip (focus on connecting the bar & feet) 'no feet' Power Clean	Clean Pull Clean Pull & Power Clean
Back Squat	Point(s) to improve	Full depth ('sit in hole')		Knee valgus Back position (bottom)	Back position (bottom)		Full depth (mover	Full depth (mover	Forward lean grip	Knee valgus	Forward lean	Back position (bott
	Corrective Exercises	Loosing' bar in bottom position										
		1.5 rep Back Squat Paused Back Squat		<u>Knee valgus:</u> Back Squat w bands <u>Back position:</u> ankle mobility Squat between heels (back against block ?)	Squat between heels		1.5 rep Back Squat Paused Back Squat	1.5 rep Back Squat Paused Back Squat	Front Squat - Back	Back Squat w bar	Front Squat - Back	Ankle mobility Squat between heels (back against block ?)
Front Squat	Point(s) to improve	as Back Squat Grip (Fingers on bar)	Grip (Fingers on bar)	Depth	Grip (Fingers on bar)		same as Back Squat	same as Back Squat	Upper back posture		Upper back posture	same as Back Squat
	Corrective Exercises	Wrist mobility (partner exercise) Front Squat with straps (straps & hands around	Wrist mobility (partner exercise) Front Squat with straps (straps & hands around	Wrist mobility (partner exercise) 1.5 rep Front Squat with straps (straps &	Wrist mobility (partner exercise) Front Squat with straps (straps & hands around		Wrist mobility (partner exercise) 1.5 rep Front Squat with straps (straps &	Wrist mobility (partner exercise) 1.5 rep Front Squat with straps (straps &	Wrist mobility (partner exercise) 1.5 rep Handsfree Front Squat - Front	Wrist mobility (partner exercise) Handsfree Front Squat - Front Squat complex	Wrist mobility (partner exercise) Handsfree Front Squat - Front Squat complex	Wrist mobility (partner exercise) Handsfree Front Squat - Front Squat complex

# PLANNING PRINCIPLES



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- **Phase Potentiation**
- **Compatible Training Factors**

# How Do We Test?



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# Testing (S & C)



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## Start:

- Peak **power**: 1180 – 1510 W
- Peak **force**: 1060 – 1450 N
  - 0.79 – 0.89 sec for 1<sup>st</sup> revolution
  - 0.43 – 0.47 for 2<sup>nd</sup> revolution

## 200 m sprint:

- Peak **power**: 1720 – 2230 W
- Cadence: 120 – 140 rpm
- Maximum **velocity**: 63.5 km/h (avg value)

## 1000 m

- Peak **power** 1750 – 1890 W (avg power 390 – 760 W)

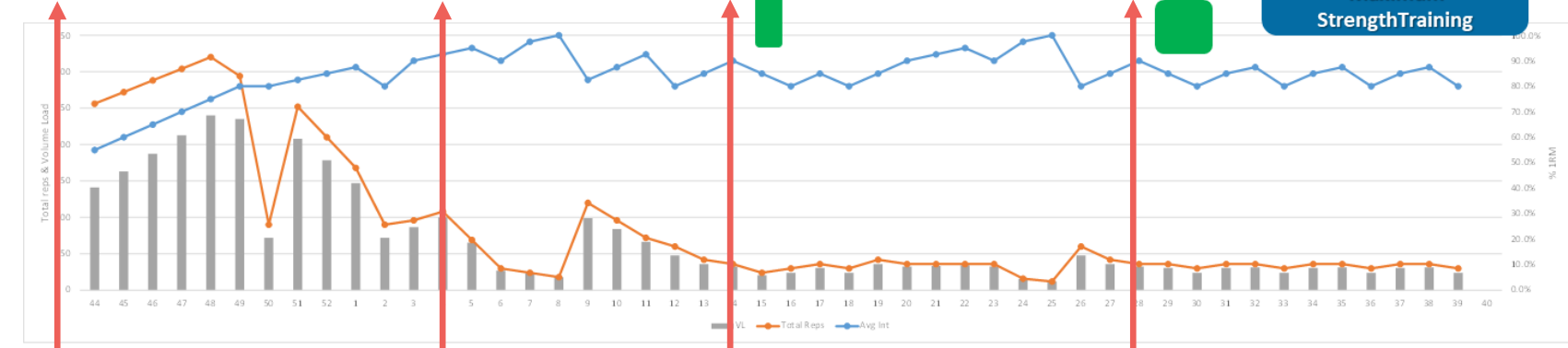
# Testing (S & C)



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Force	Power	Velocity
<p><u>Strength testing</u></p> <ul style="list-style-type: none"><li>• 1 RM<ul style="list-style-type: none"><li>• Actual -&gt; 1-2* year</li><li>• Predicted (VBT) -&gt; ongoing</li></ul></li><li>• IMTP -&gt; 4* year</li></ul>	<p><u>Loaded Jump Squats</u></p> <ul style="list-style-type: none"><li>• EUR (loaded CMJ vs loaded SJ) -&gt; 2* year</li><li>• DSI (loaded CMJ vs IMTP) -&gt; 2* year</li></ul>	<p><u>Jump testing</u></p> <ul style="list-style-type: none"><li>• CMJ &amp; SJ -&gt; 4* year</li><li>• EUR (CMJ vs SJ)</li><li>• (Drop jumps (CT, FT, RSI))</li><li>• Ongoing velocity monitoring → VBT</li></ul>

	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Avg Int	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	80.0%	82.5%	85.0%	87.5%	80.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	82.5%	87.5%	92.5%	80.0%	85.0%	85.0%	80.0%	85.0%	80.0%	85.0%	85.0%	90.0%	92.5%	95.0%	90.0%	97.5%	100%	80.0%	85.0%	90.0%	85.0%	80.0%	85.0%	87.5%	80.0%	85.0%	87.5%	80.0%	85.0%	80.0%			
Total Reps	256	272	288	304	320	294	90	252	210	168	90	96	108	69	30	24	18	120	96	72	60	42	36	24	30	36	30	42	36	36	36	36	16	12	60	42	36	36	30	36	36	30	36	36	30	36	36	30	36	30
VL	141	163	187	213	240	235	72	208	179	147	72	86.4	99.9	65.6	27	23.4	18	99	84	66.6	48	35.7	32.4	20.4	24	30.6	24	35.7	32.4	33.3	34.2	32.4	15.6	12	48	35.7	32.4	30.6	24	30.6	31.5	24	30.6	31.5	24	30.6	31.5	24		



Test 1

Test 2

Test 3

Test 4

1 RM

X

X

IMTP

X

X

X

X

DSI

X

X

EUR

X

X

X

X

RSI

X

X

X

X



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# Applied Research Projects



**CHRISTIAN BOSSE**  
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## Goals:

- Understand your athletes
- Optimize training & competition

### Start:

- Peak **power**: 1180 – 1510 W
- Peak **force**: 1060 – 1450 N
  - 0.79 – 0.89 sec for 1<sup>st</sup> revolution
  - 0.43 – 0.47 for 2<sup>nd</sup> revolution

### 200 m sprint:

- Peak **power**: 1720 – 2230 W
- Cadence: 120 – 140 rpm
- Maximum **velocity**: 63.5 km/h (avg value)

### 1000 m

- Peak **power** 1750 – 1890 W (avg power 390 – 760 W)



# Applied Research Projects



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- The importance of a good start in BMX Supercross (University of Nijmegen)
- Influence of real time velocity feedback on exercise execution (University Groningen)
- Individual load-velocity profiling (in-house / Master student University Sevilla)
- Relationship between velocity and fatigue / readiness throughout 2 meso-cycles (University Maastricht)



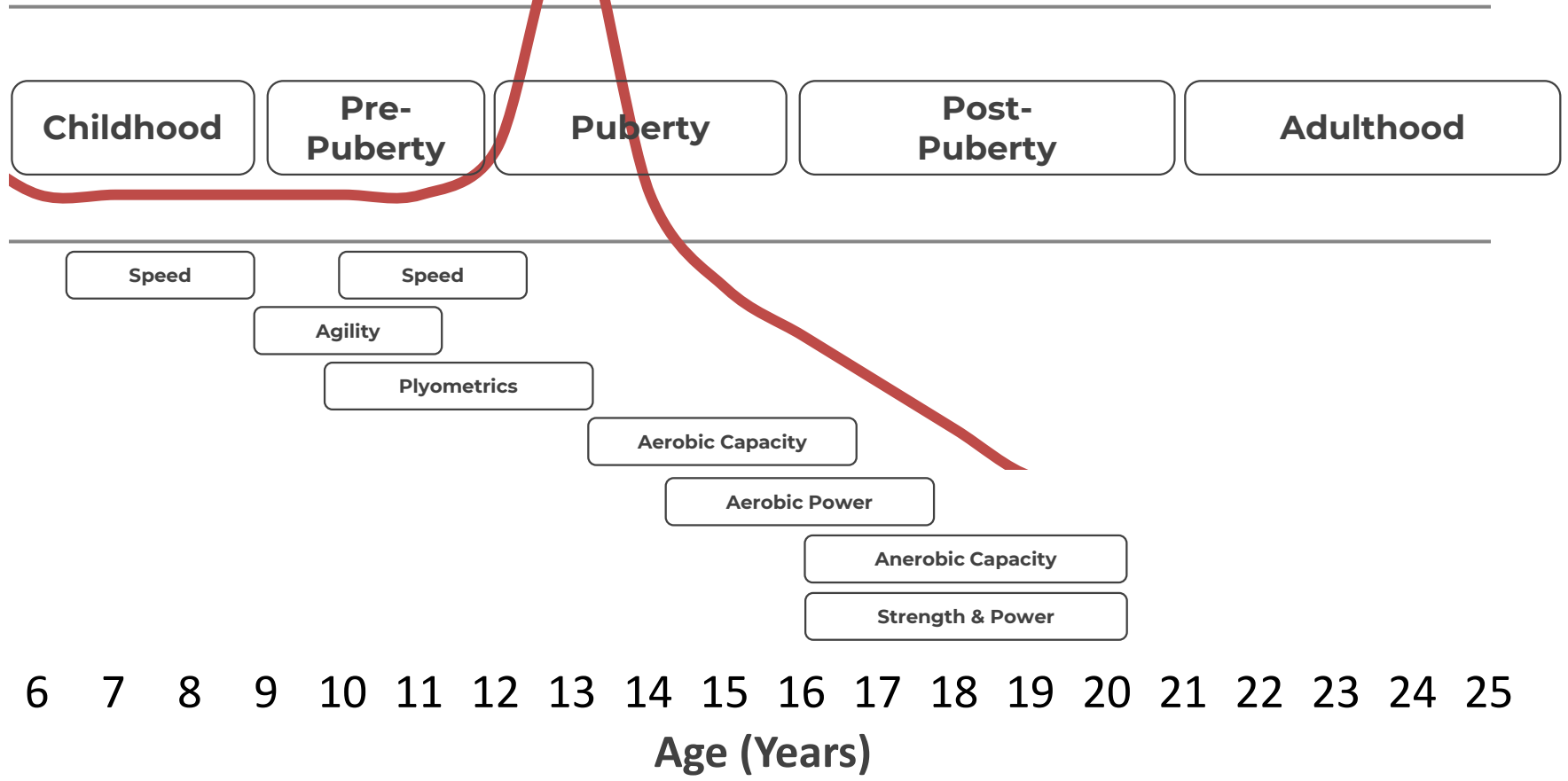
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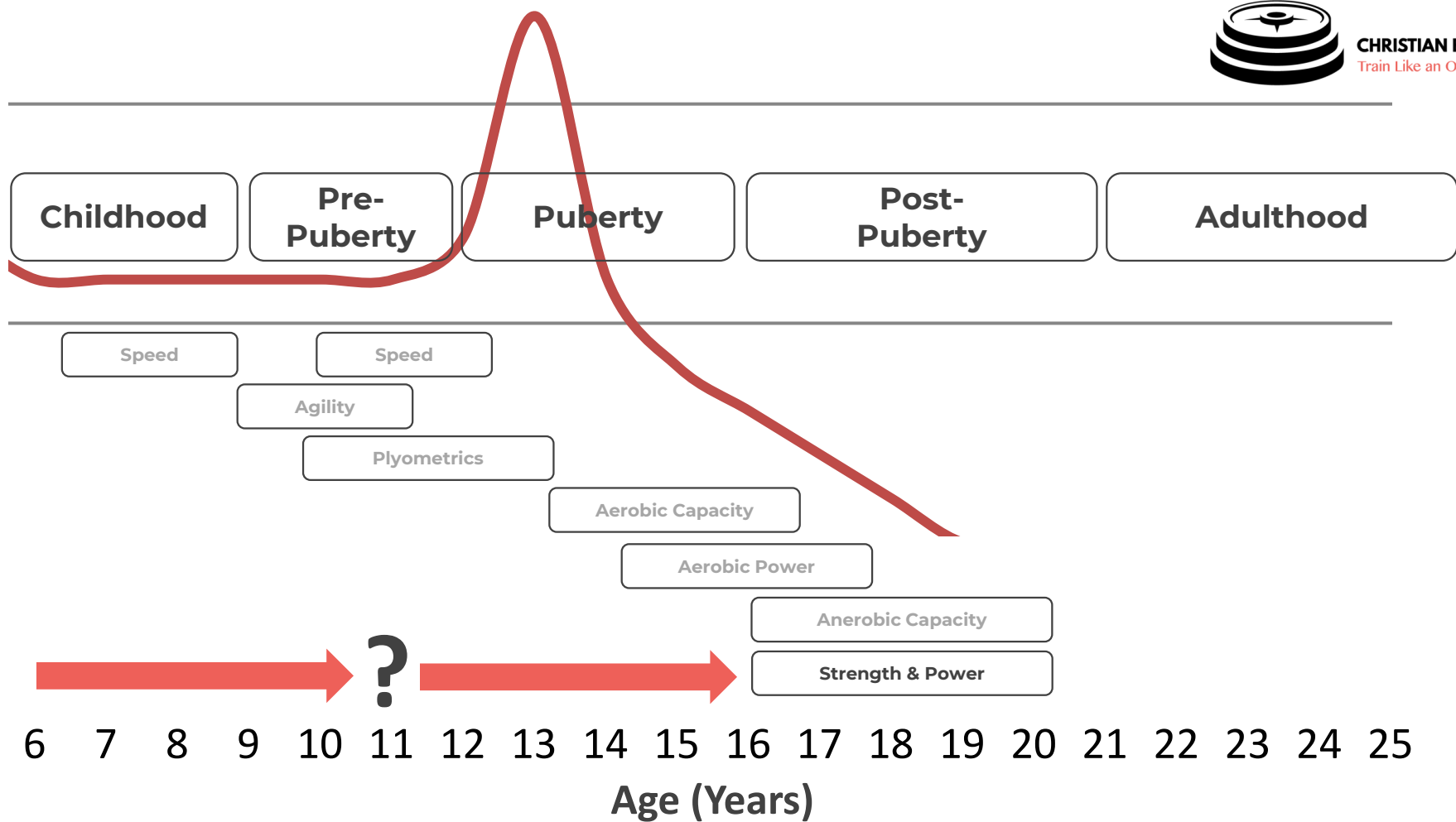
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LTAD

Long Term Athlete Development

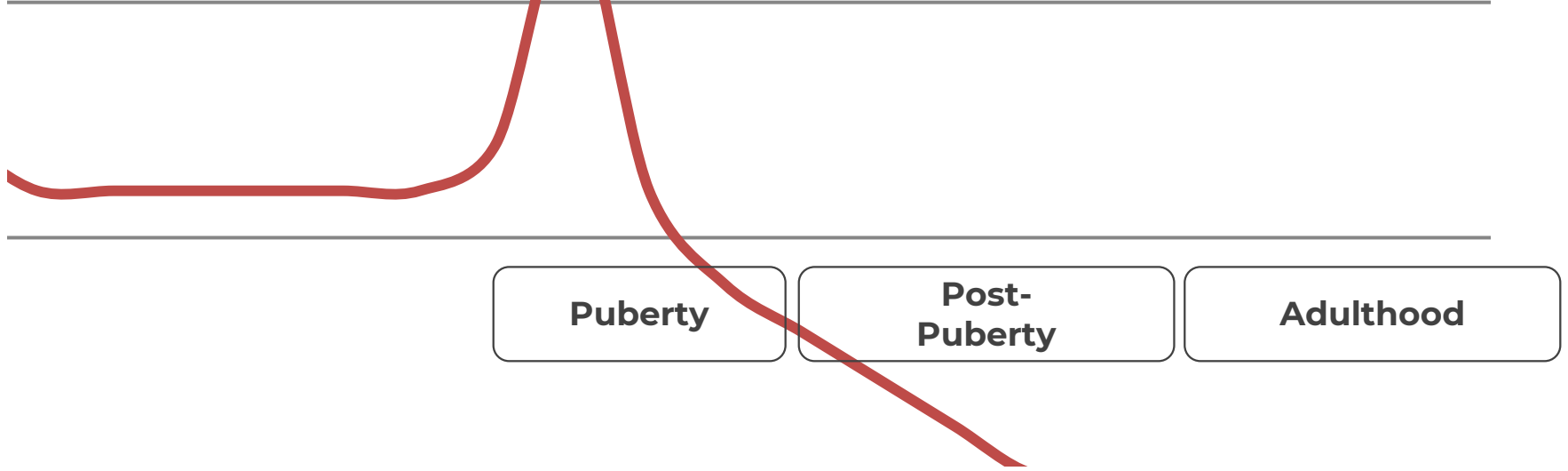
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**CHRISTIAN BOSSE**  
Train Like an Olympian



**Puberty**

**Post-Puberty**

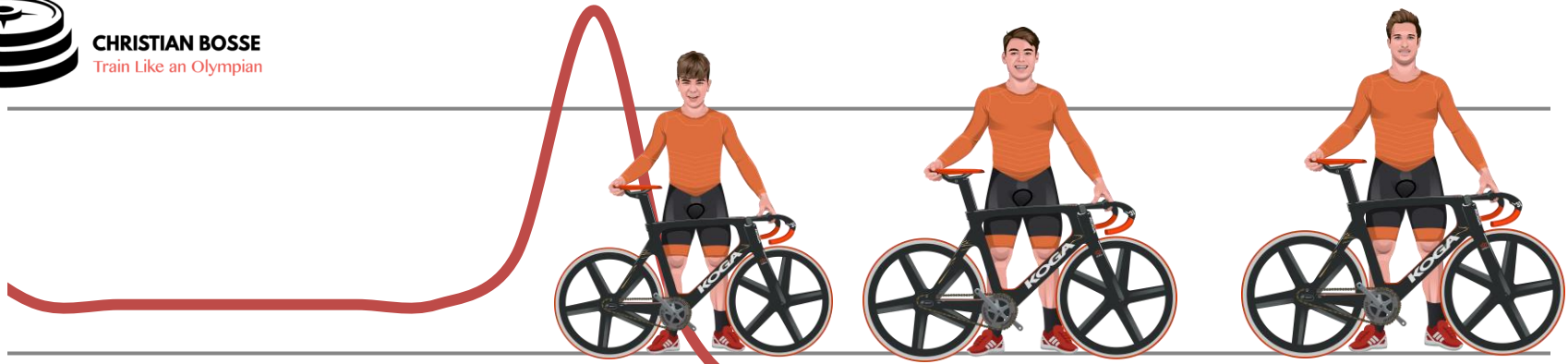
**Adulthood**

6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

**Age (Years)**



**CHRISTIAN BOSSE**  
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**Puberty**

**Post-  
Puberty**

**Adulthood**

**Guiding Principle & Focus**

**'Deliberate Practice'  
& Technical Mastery**

**Maximizing  
Physical Development**

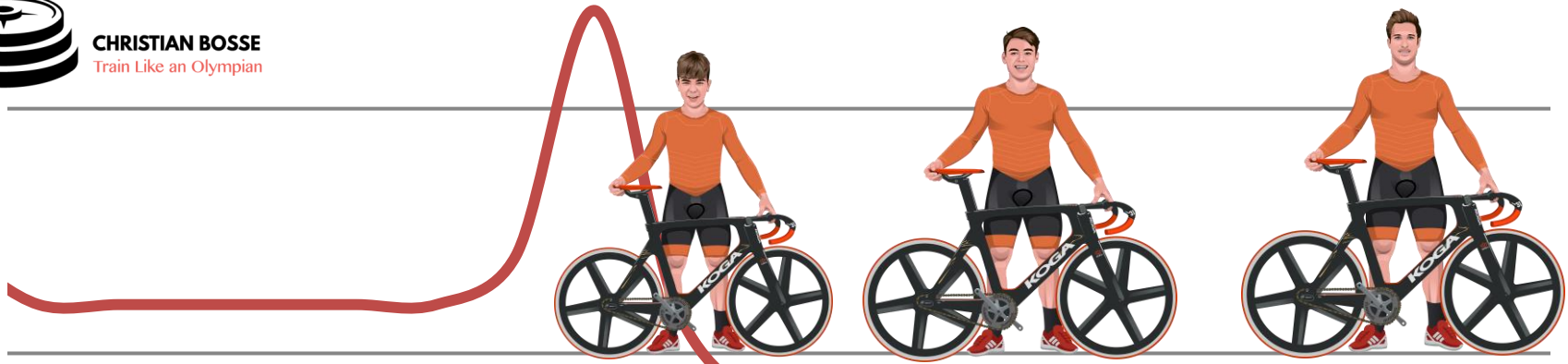
**Maximizing Competition  
Results**

6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

**Age (Years)**



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**Puberty**

**Post-Puberty**

**Adulthood**

## Guiding Principle & Focus

'Deliberate Practice'  
& Technical Mastery

Maximizing  
Physical Development

Maximizing Competition  
Results

Technique

Training

Competition



6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

**Age (Years)**



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**hugohaak** • Following

Izu Velodrome



**hugohaak** 10 years ago we started with a dream, today we have realized the dream! #unreal #soproud #olympics #gold #teamnl #teamsprint #happiestmenonearth #workhard #memories #tokyo NL

6w



**harrielvreyse** 🇳🇱 🇳🇱 🇳🇱



6w 1 like Reply



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AUGUST 3



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**@harrielaavreysen**

**@jeffreyhoogland**

**@roy259berg**

**@matthijs.buchli**

**Contact**

**Website: <https://christianbosse.com/>**

**@c.bosse**



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