Applied Exercise Physiology

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Introduction

What Is Exercise Physiology and Why Study It?

Exercise physiology can be defined as both ***a basic*** and ***an applied science*** that describes, explains, and uses ***the body's response to exercise*** and ***adaptation to exercise training*** to ***maximize human physical potential***.

Introduction

Applying of exercise physiology;

Layperson ***Professional***

Introduction

The professional coaches have 4 practical advantages:

(1) They can ***better predict*** results
(2) They can ***better control*** the training process, thus ***protecting*** the health of athletes
(3) They gain ***better results*** per unit of time spent
(4) They may even ***satisfy*** our intellectual curiosity with respect to cause-and-effect relationships in our field

Introduction

To become respected professional in exercise physiology as a coach, need to:

1. *Understand the basic physiological functioning of the human body in various types of* ***exercise***
2. *Understand the basic physiological functioning of the human body in various* ***training programs***
3. *Provide quality training programs for* ***children and adolescents***
4. *Apply the results of scientific research to* ***maximize health, rehabilitation, and athletic performance***
5. *Respond accurately to* ***questions*** *and advertising* ***claims****, as well as recognize* ***myths*** *and* ***misconceptions*** *regarding exercise*

The Exercise Response

Exercise A single acute bout of bodily exertion or muscular activity .

Homeostasis The state of dynamic equilibrium (balance) of the internal environment of the body.

Exercise Response The pattern of homeostatic disruption or change in physiological variables during a single acute bout of physical exertion.

The Exercise Response

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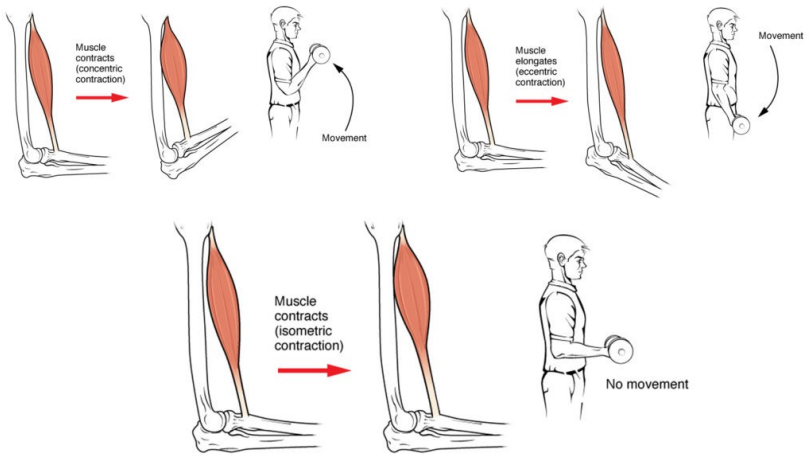
Exercise Modality or Mode The type of activity or sport; usually classified by ***energy demand*** or ***type of muscle action.***

Pathway	Maximal power ($kJ \cdot min^{-1}$)	Duration	Maximal capacity (total kJ)
Phosphagen system	400	10–15 s	≈100
Anaerobic glycogenolysis	200	45–60 s	≈200
Oxidation of glycogen and glucose	125	≈2 h	15 000
Oxidation of fats	110	8+ h	52 800+



The Exercise Response

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Exercise Modality or Mode

Sport Disciplines

Skill

Isometric	+/-
Isotonic	+/-
Cardiac remodeling	+/-

- Golf
- Archery
- Sailing
- Table Tennis
- Equestrian
- Karate
- Shooting/Rifle
- Curling
- Sled disciplines
- Ski Jumping

Power

Isometric	+++/++++
Isotonic	+/++
Cardiac remodeling	+/++

- Weightlifting
- Wrestling / Judo
- Boxing
- Short distance running
- Shot-putting
- Discus / Javelin
- Artistic gymnastics
- Bobsleigh
- Short-track skating
- Alpine skiing
- Snowboarding

Mixed

Isometric	++/+++
Isotonic	++/+++
Cardiac remodeling	++/+++

- Soccer
- Basketball
- Volleyball
- Waterpolo
- Badminton
- Tennis
- Fencing
- Handball
- Rugby
- Hockey / Ice-hockey

Endurance

Isometric	++/+++
Isotonic	+++/++++
Cardiac remodeling	++++

- Cycling
- Rowing
- Mid/long distance swimming
- Mid/long distance running
- Canoeing
- Triathlon
- Pentathlon
- X-country skiing
- Biathlon
- Long distance skating

The Exercise Response

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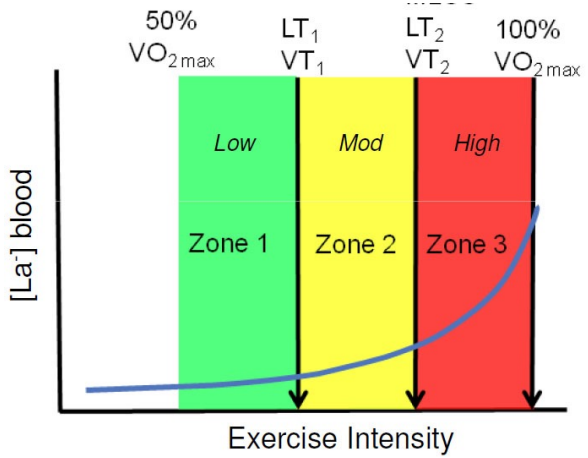
Exercise Intensity How hard the body is working during physical activity. Exercise intensity is most easily described as ***submaximal, maximal & supramaximal.***

Intensity Zone	VO_2 (%max)	Heart Rate (%max)	Lactate ($mmol \cdot L^{-1}$)	Duration	
1	45-65	55-75	0.8-1.5	1-6 h	'Zone 1'
2	66-80	75-85	1.5-2.5	1-3 h	
3	81-87	85-90	2.5-4	50-90 min	'Zone 2'
4	88-93	90-95	4-6	30-60 min	'Zone 3'
5	94-100	95-100	6-10	15-30 min	



%MHR = (0.64 × % VO2max) + 37

The Exercise Response

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Exercise Intensity

Relationship Between $\dot{V}O_2$max, HRR, and MHR

% $\dot{V}O_2$max	% HRR	% MHR
50	50	66
55	55	70
60	60	74
65	65	77
70	70	81
75	75	85
80	80	88
85	85	92
90	90	96
95	95	98
100	100	100

HRR = heart rate reserve; MHR = percentage of maximal heart rate.

The Exercise Response

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Exercise Intensity

Resistance training

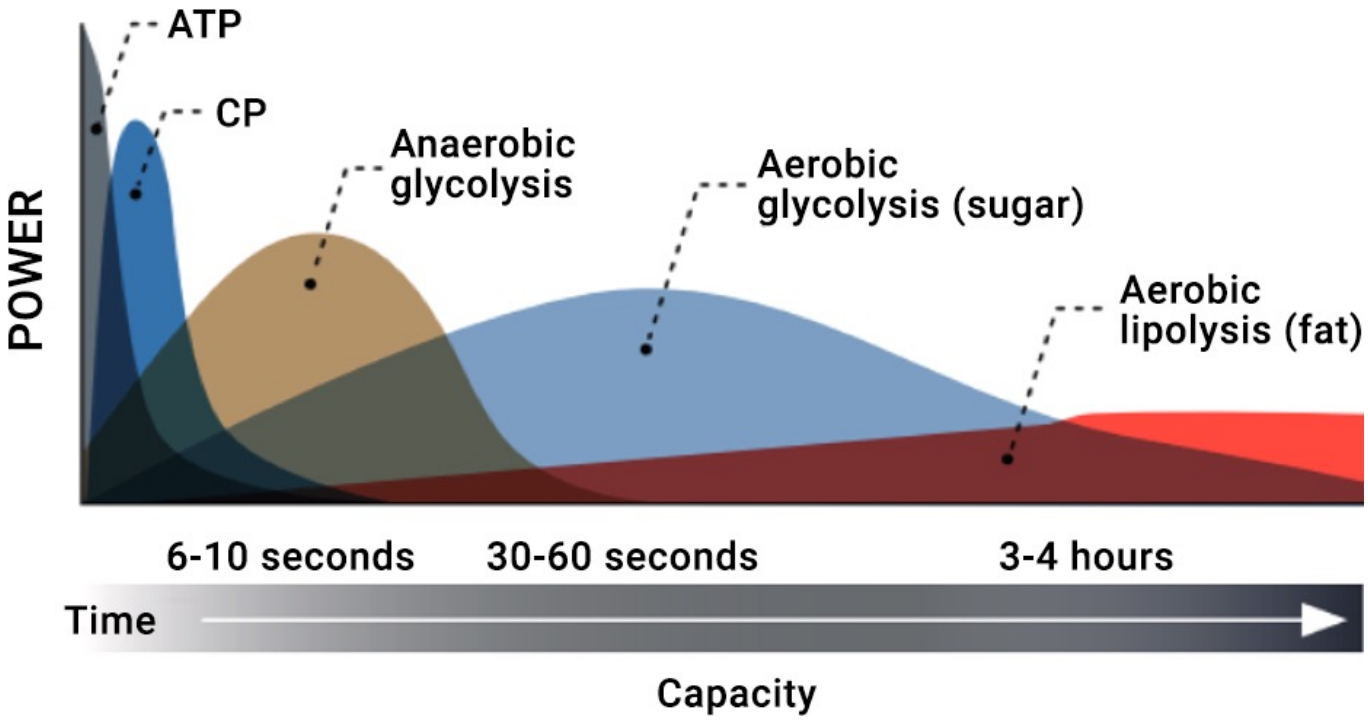
Training goal	Load (%1RM)	Goal repetitions
Strength*	≥85	≤6
Power:**		
Single-effort event	80-90	1-2
Multiple-effort event	75-85	3-5
Hypertrophy	67-85	6-12
Muscular endurance	≤67	≥12

*These RM loading assignments for muscular strength training apply only to core exercises; assistance exercises should be limited to loads not heavier than an 8RM (2).

**Based on weightlifting-derived movements (clean, snatch, and so on). The load and repetition assignments shown for power in this table are *not consistent* with the %1RM–repetition relationship. In nonexplosive movements, loads equaling about 80% of the 1RM apply to the two- to five-repetition range. Refer to the discussion of assigning percentages of the 1RM for power training for further explanation.

The Exercise Response

Exercise Duration



The Exercise Response

Exercise categories

1. ***Short-term, light to moderate submaximal aerobic exercise***
2. ***Long-term, moderate to heavy submaximal aerobic exercise***
3. ***Incremental aerobic exercise to maximum***
4. ***Static exercise***
5. ***Dynamic resistance exercise***
6. ***Very-short-term, high-intensity anaerobic exercise***

Training

Training is a consistent or chronic progression of exercise sessions designed to improve physiological function

- The enhancement of ***health*** and ***physical fitness*** for ***the general population***
- The optimization of ***performance*** of ***the athletes***

Training

The two main goals for exercise training are

(1) ***health-related physical fitness*** for *lifelong good health*

(2) ***sport-specific or skill physical fitness (sometimes called athletic fitness)*** for improving athletic and sport performance

Training

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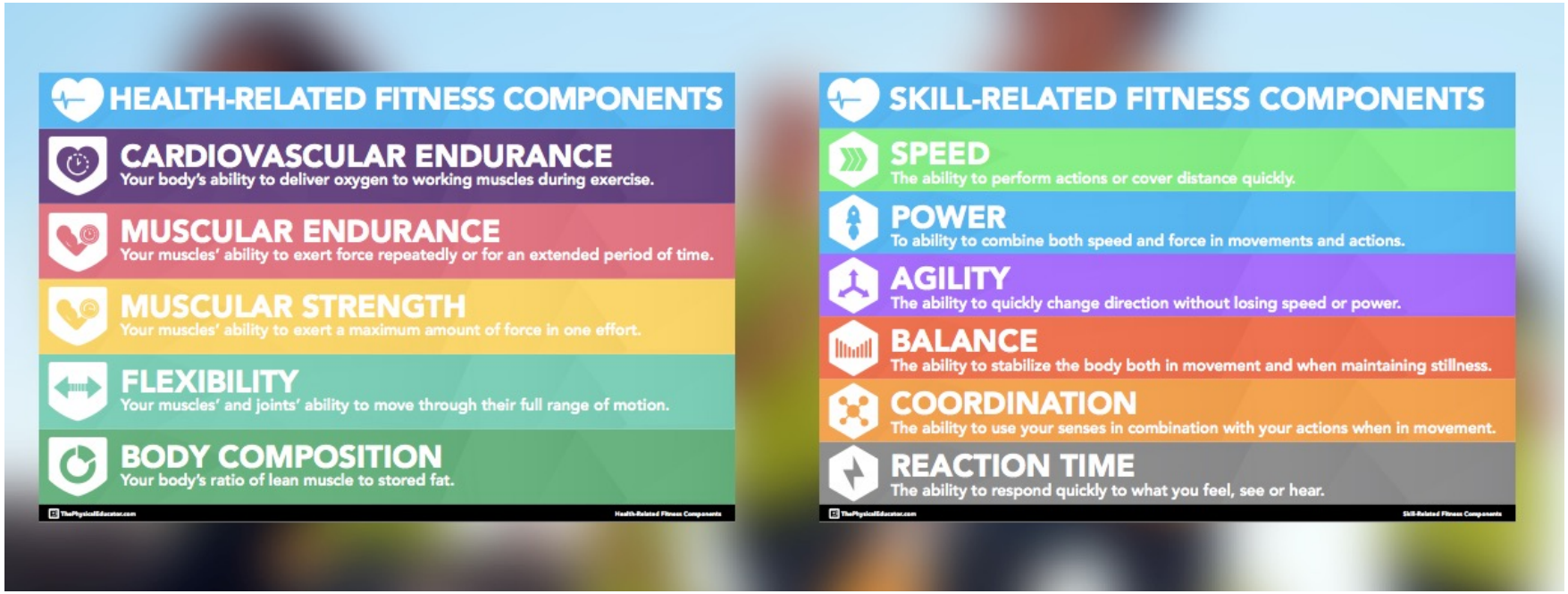
Physical fitness components



Training

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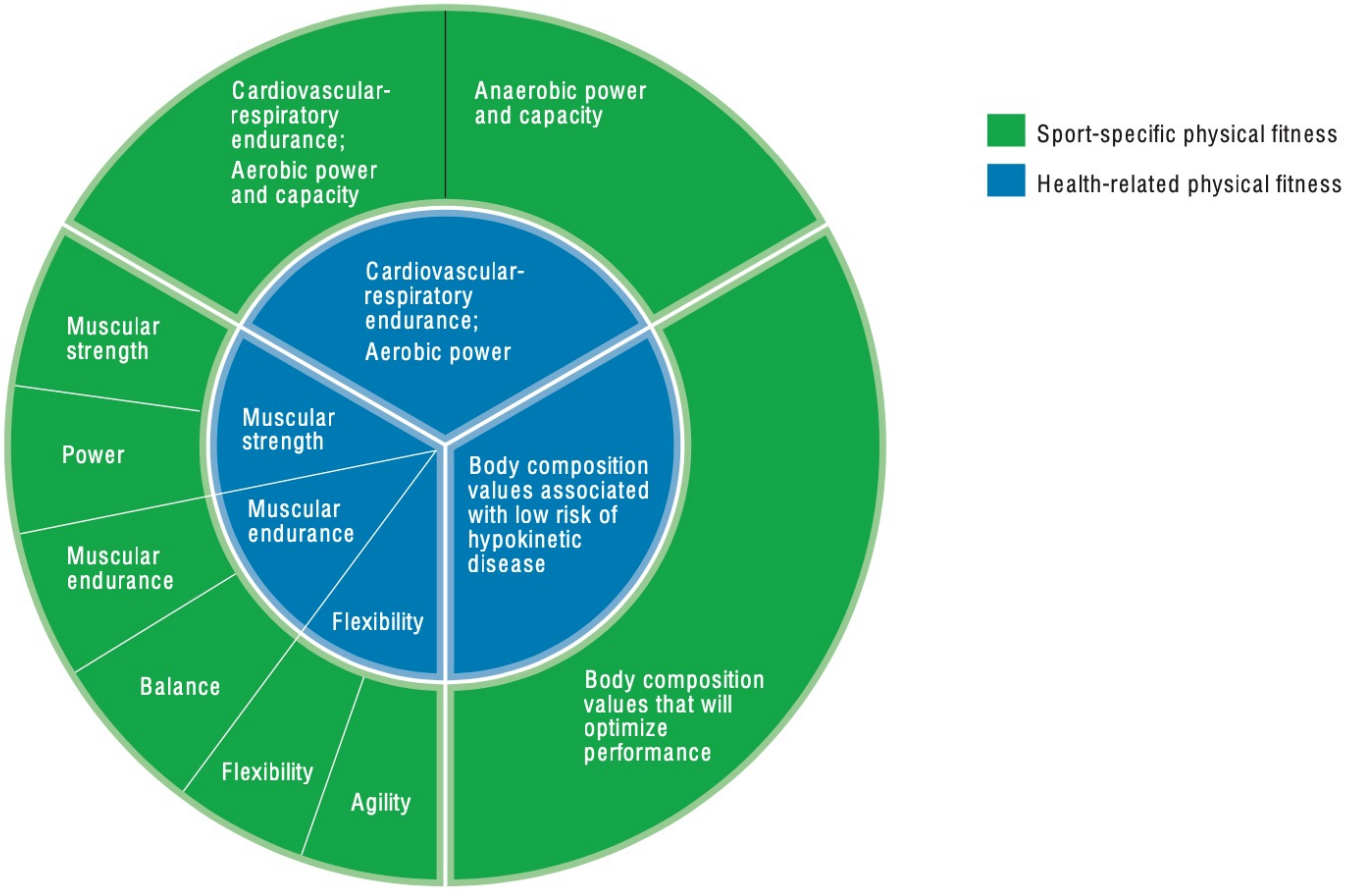
Physical fitness



Training

Dose-Response Relationship

"how much exercise/activity is enough?"

"what is the relationship between specific amounts of exercise/activity or physical fitness levels and the benefits achieved?"

Aerobic Physical Activity Amount	Weight Loss Amount
<150 min per week	No weight loss or minimal weight loss
150–225 min per week	Weight loss of 2 to 3 kg
225–420 min per week	Weight loss of 5 to 7.5 kg
200–300 min per week	Weight maintenance after weight loss

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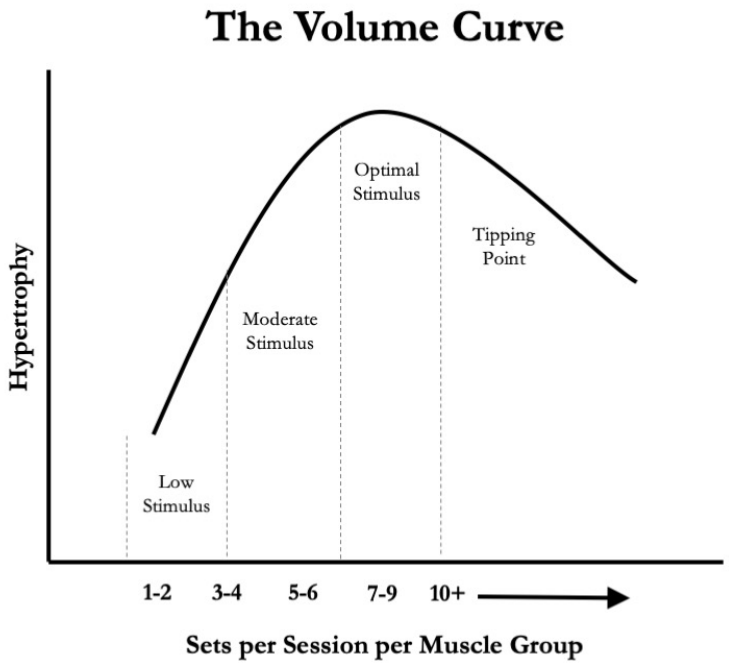
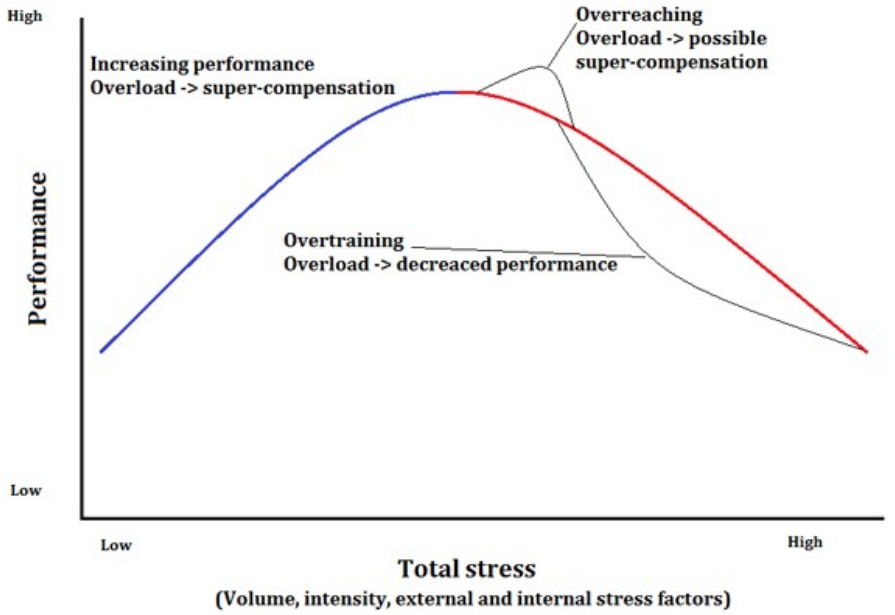
Training

Dose-Response Relationship

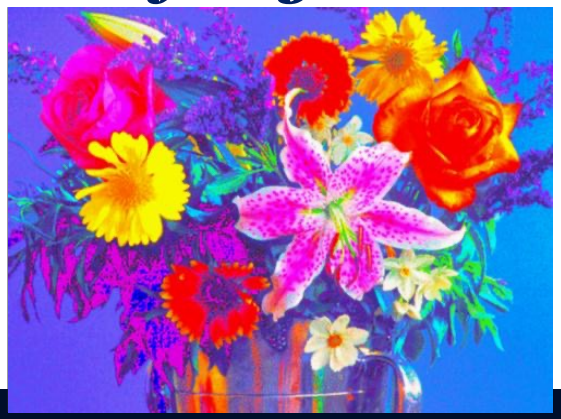




Training

Training Adaptations

Thanks for your attention



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