

**MUNI**  
**SPORT**

# **Basis for training**

Strength Training and Conditioning

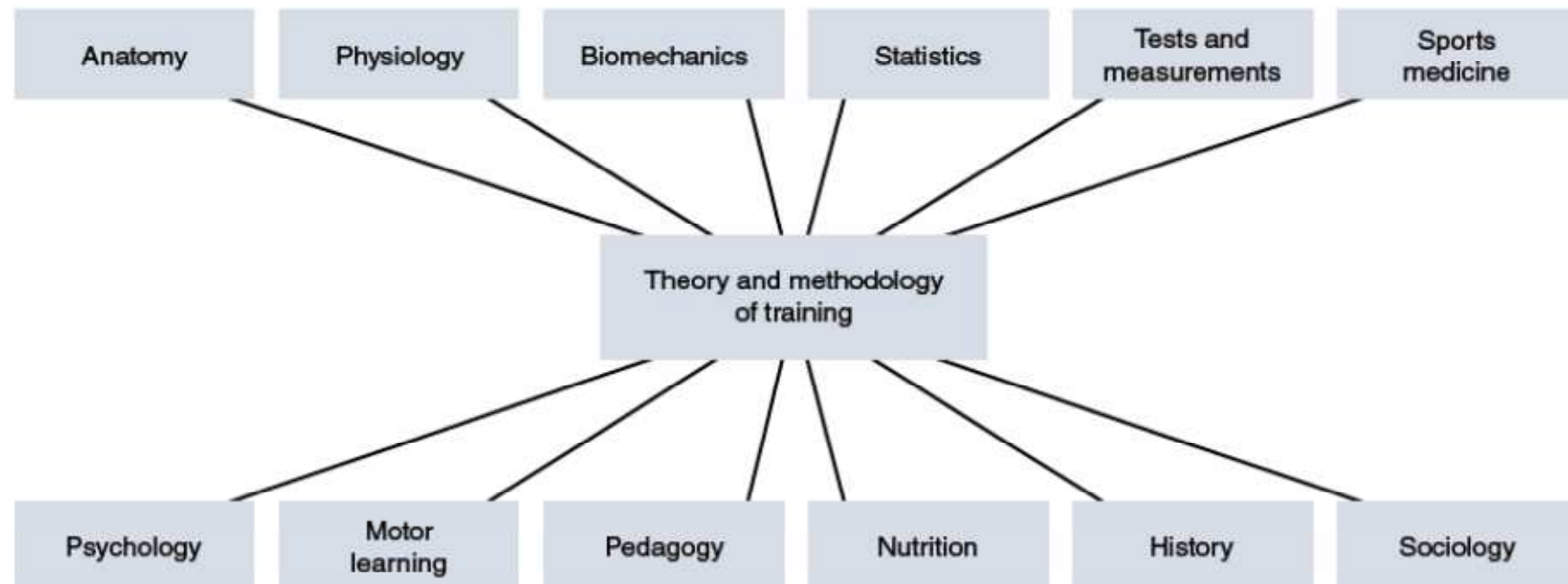
# Scope of training

- Biomotor ability
- (bioenergetics)

# Objectives of Training

- Multilateral physical development
- Sport-specific physical development
  - Blending of key aspects (power, muscle endurance, ...)
- Technical skills
- Tactical abilities
- Psychological factors
- Health maintenance
- Injury resistance
- Theoretical knowlage

# Auxiliary sciences



# Classification of Skill

- Cyclic
  - Rowing
- Acyclic
  - Fencing
- Acyclid combined
  - High jump

# System of Training

Bondarchuck:

1. *Uncovering the system's forming factors*
2. *Determining the system's structure*
3. *Validating the efficacy of the system*

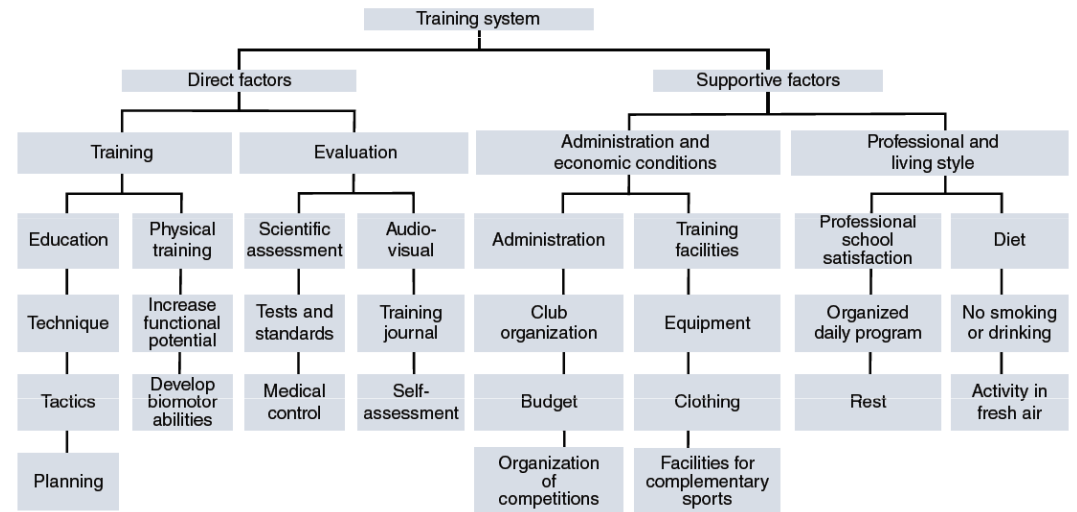
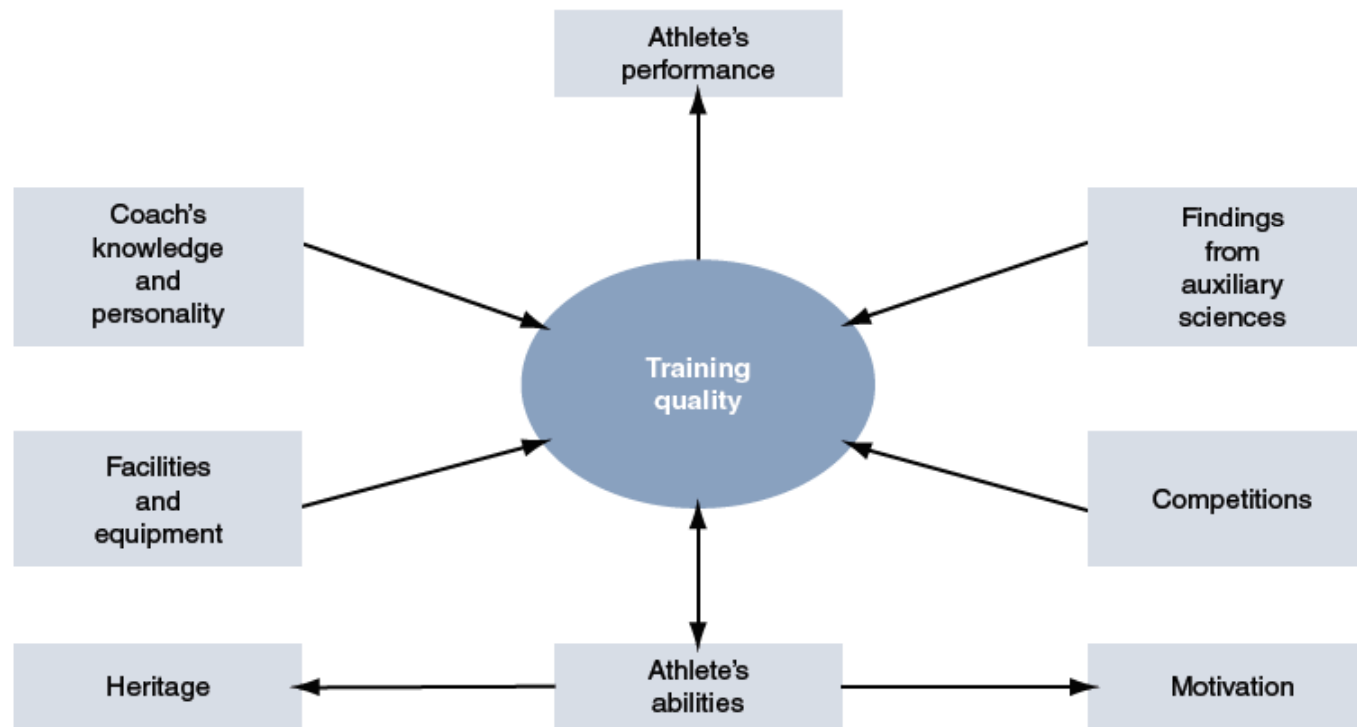


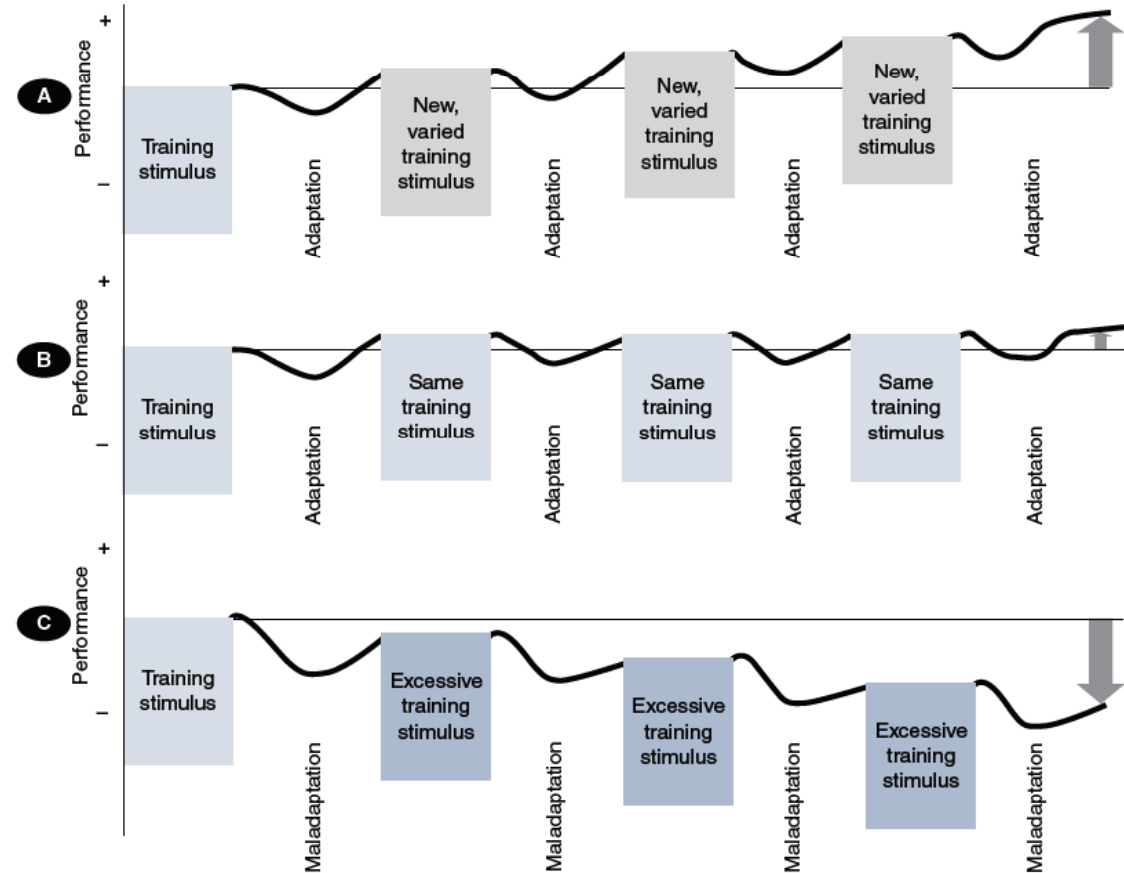
FIGURE 1.2 Components of a training system.

# Factors that affect training quality



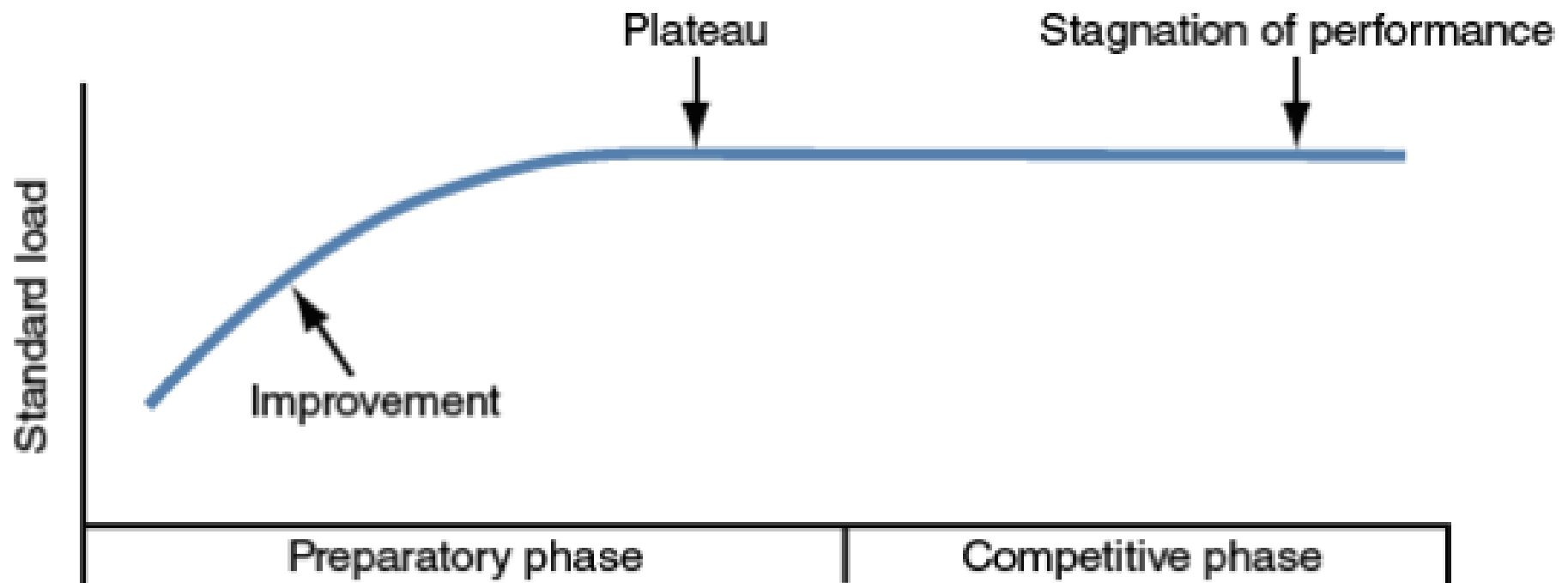
# Adaptation

- A. Fatigue, overreaching, overtraining
- B. Increasing stimulus (load) → Adaptation → Performance improvement
- C. Lack of stimulus → Plateau → Lack of improvement



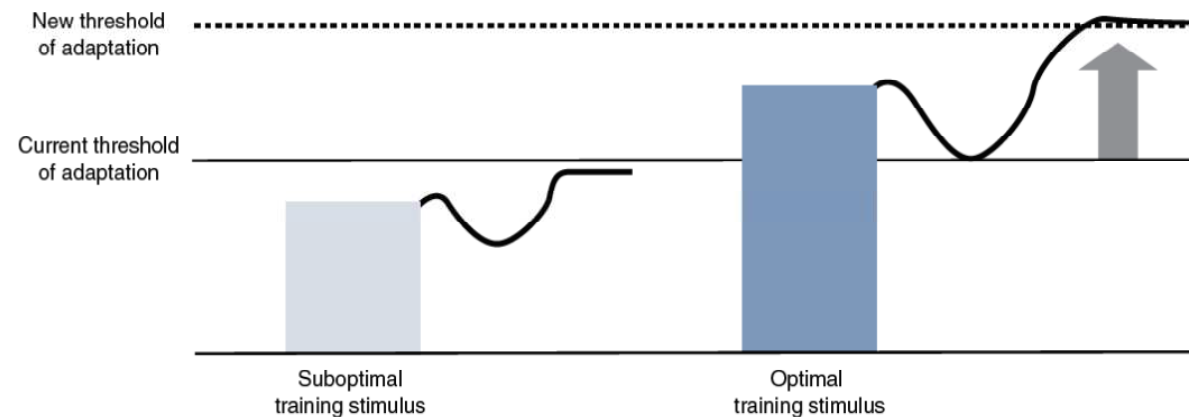


# Standard load results in improvements only during the early phase of the plan



# Specificity of Adaptation

- **Neuromuscular** - motor unit firing rate (rate coding), muscle hypertrophy
- **Metabolic** – ATP+PCr, lactic acid, glycolytic system, oxidative system
- **Cardiorespiratory** – stroke volume,  $\text{VO}_2\text{max}$
- Preadaptation
- Compensation
- Stable or precompetitive adapt.
- State of readiness for competition



**FIGURE 1.6** Breaking the threshold of adaptation should improve performance.

↑ = increase in the threshold of adaptation.

# Training effect

- Immediate TE
- Delayed TE
- Cumulative

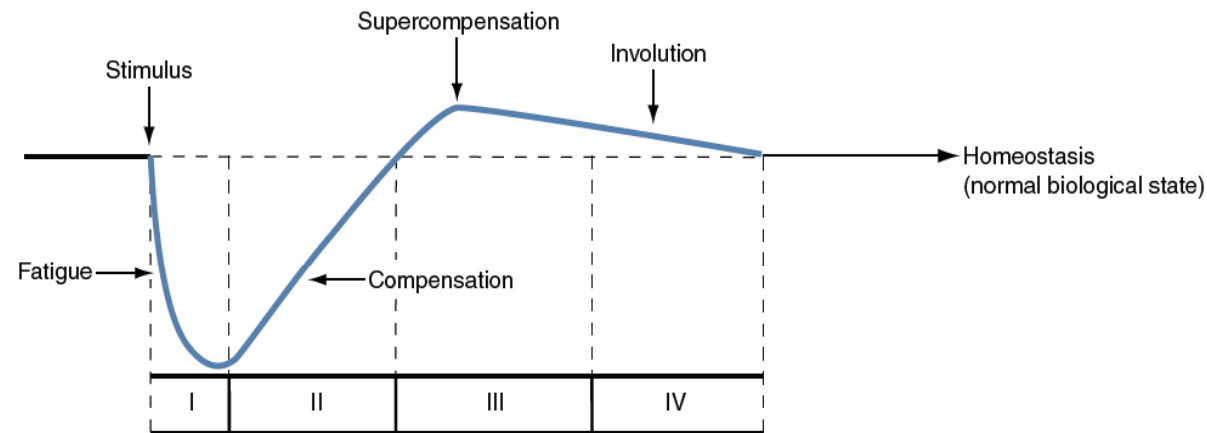
**TABLE 1.1** Cooper's Training Effect Categories

Category	Training effect	Results
1 1.0-1.9	Minor	Develops base endurance. No improvement in maximum performance. Enhances recovery.
2 2.0-2.9	Maintenance	Maintains aerobic fitness. Does little to improve maximum performance.
3 3.0-3.9	Improvement	Improves aerobic fitness if repeated two to four times weekly.
4 4.0-4.9	Rapid improvement	Rapidly improves aerobic fitness if repeated one or two times weekly. Needs few recovery sessions.
5 5.0-up	Overreaching	Dramatically increases aerobic fitness if combined with good recovery.

Adapted from Cooper 1968 (22a).

# Supercompensation Cycle and Adaptation

- Supercompensation
- General adaptation syndrome
- Progressive overloading
- Microcycles, sequenced training, periodization



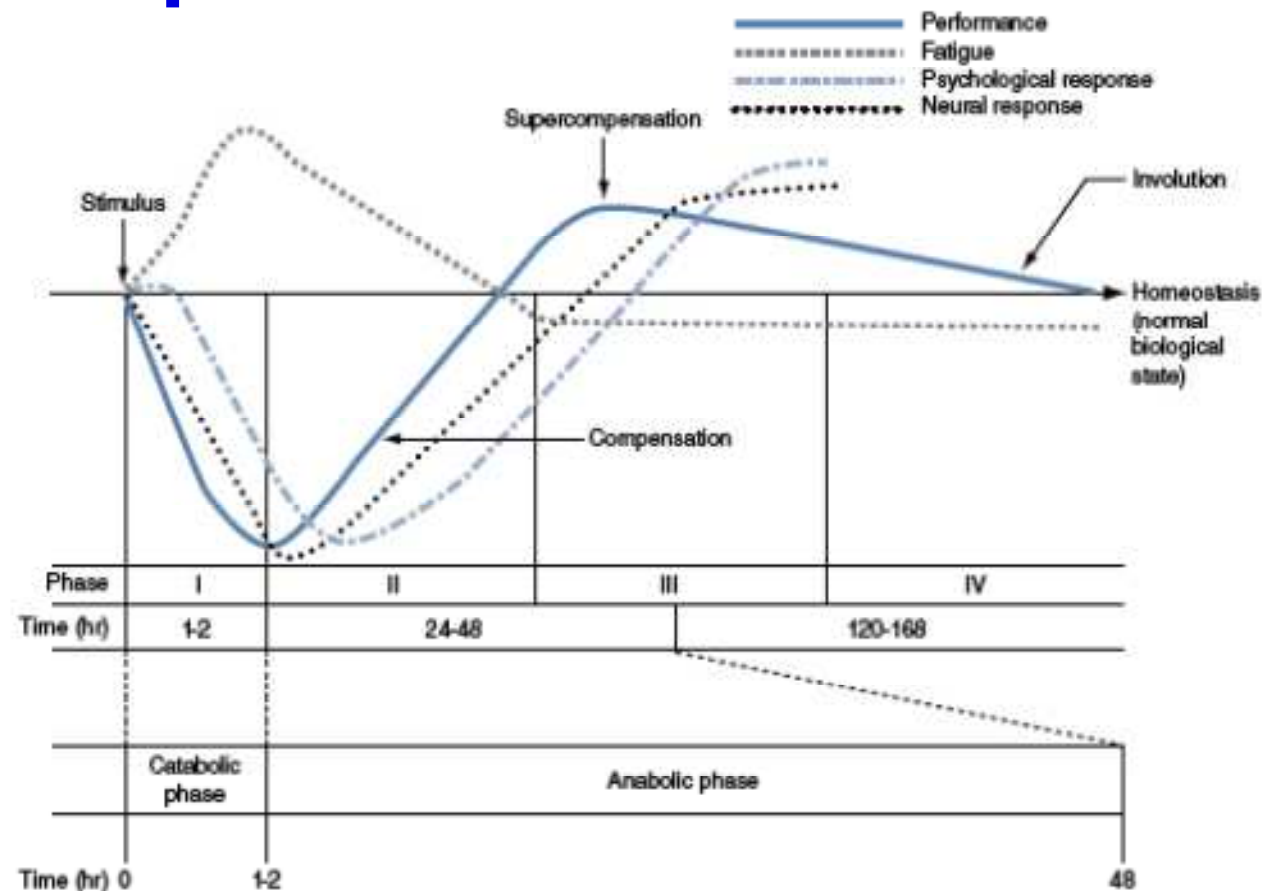
**FIGURE 1.8** Supercompensation cycle of a training session.

Modified from Yakovlev 1967 (116).

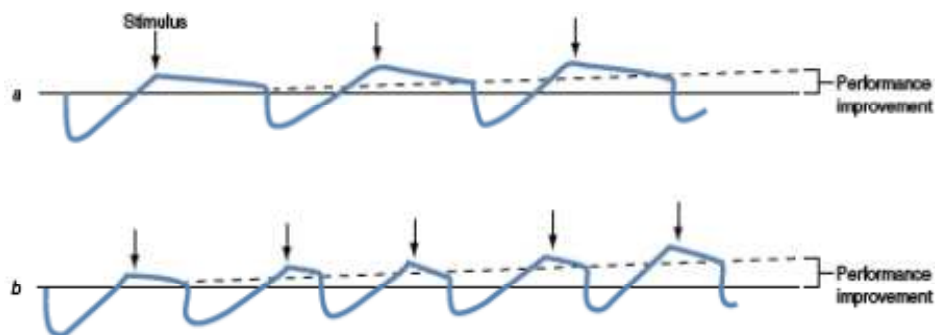
# Phases of Sepercompesantion

Four phases:

- #1: 1 to 2 hours
- #2: 24 to 48 hours
- #3: 36 to 72 hours
- #4: 3 to 7 days

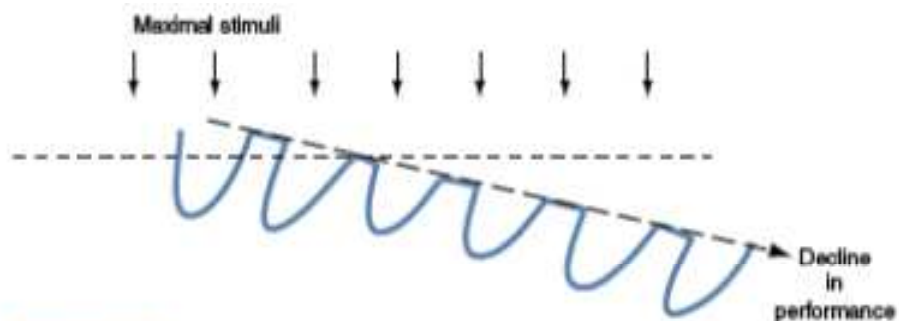


**FIGURE 1.9** Supercompensation cycle response to a training session.

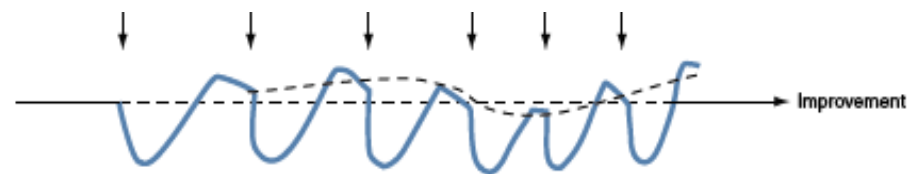


**FIGURE 1.10** The sum of training effect: (a) long intervals between training sessions and (b) short intervals between training sessions.

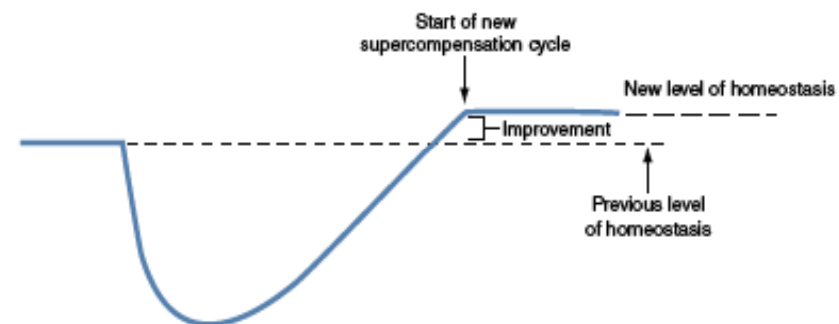
Adapted from Harre 1982 (59).



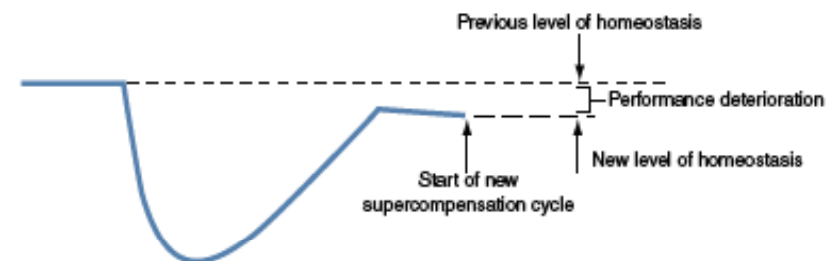
**FIGURE 1.11** Decline in performance from prolonged maximal-intensity stimuli.



**FIGURE 1.12** Alternating maximal- and low-intensity stimuli produces a wavelike improvement curve.



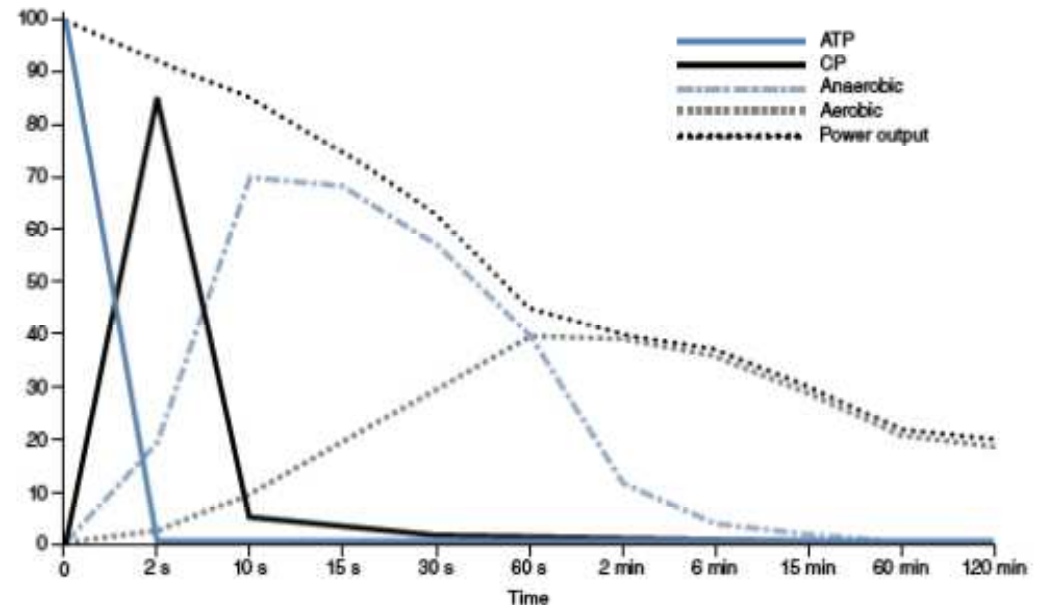
**FIGURE 1.13** A new, higher level of homeostasis means that the next supercompensation cycle starts from that point.



**FIGURE 1.14** A decreased level of homeostasis means that the next supercompensation cycle starts at a point lower than the previous level.

# Sources of Energy

- Anaerobic phosphagen system (ATP-CP)
- Anaerobic glycolytic system (La)
- Aerobic oxidative system ( $O_2$ )

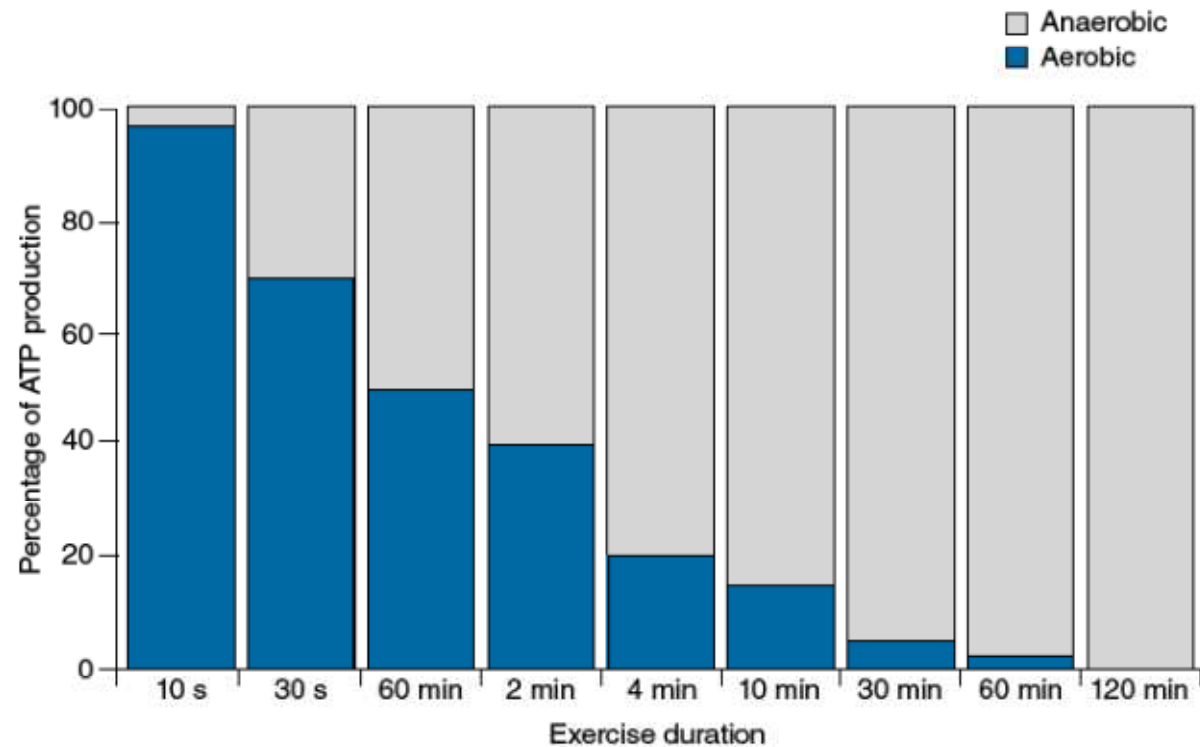


	Anaerobic energy ATP supply predominates			Aerobic energy ATP supply predominates				
	Time (s)			Time (min)				
	10	30	60	2	4	10	30	60
Aerobic ATP supply (%)	3	30	50	60	80	85	95	98
Anaerobic ATP supply (%)	97	73	50	40	20	15	5	2

**FIGURE 1.15** Energy provision of the three energy systems.

Adapted from K.A. van Someren, 2008, *The physiology of anaerobic endurance training*, in *The physiology of training*, edited by G. Whyte (Oxford, UK: Elsevier), 88, and E. Newsholme, A. Leech, and G. Duyster, 1994, *Keep on running: The science of training and performance* (West Sussex, UK: Wiley).

# Relation between time and (an)aerobic energy supply





# Energy sources for competitive sport

Energy pathways	Anaerobic pathways		Aerobic pathways								
	ATP-PC	Glycolytic	ATP produced in the presence of oxygen								
Primary energy sources	ATP produced without the presence of oxygen		ATP produced in the presence of oxygen								
Fuel	Phosphagens: muscular stores of ATP and PCr	Blood glucose Liver glycogen Muscle glycogen	Glycogen completely metabolized in the presence of oxygen						Fat	Protein	
Durations	0 s	10 s	40 s	60 s	2 min	4 min	10 min	30 min	1 hr	2 hr	3 hr
Sports events	Sprinting (<100 m)	Sprinting (200-400 m)	100 m swimming	Middle-distance track, swimming, speed skating	Long distance track, swimming, speed skating, and canoeing						
	Throwing	Speed skating (500 m)	800 m track	1,000 m canoeing	Cross-country skiing						
	Throwing	Most gym events	500 m canoeing	Boxing	Rowing						
	Weightlifting	Track cycling	1,500 m speedskating	Wrestling	Cycling: road racing						
	Ski jumping	50 m swim	Floor exercise in gymnastics	Martial arts	Marathon						
	Golf (swinging)		Alpine skiing	Figure skating	Triathlon						
	Diving		Cycling: track: 1,000 m and pursuit	Synchronized swimming							
	Vaulting in gymnastics			Cycling: pursuit							
Skills	Mostly azytic		Azytic and cyclic						Cyclic		