

# TRAINING COMPLEXES

EXERCISE SEQUENCES, PROGRAMMING AND  
TRAINING CONSIDERATIONS FOR INCREASED  
ATHLETIC PERFORMANCE

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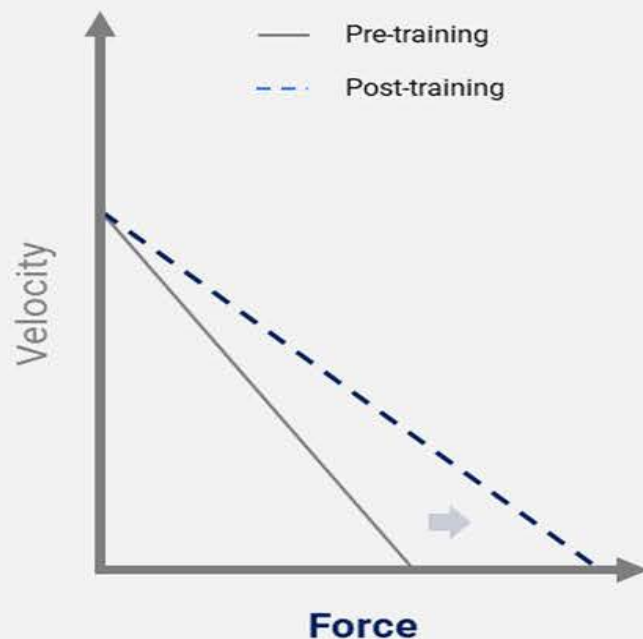
*"Training athletes along the force-velocity curve during the same session can trigger positive neural, muscular, morphological and metabolic adaptations and will most likely have a positive effect on RFD".*



# EXERCISE SEQUENCES

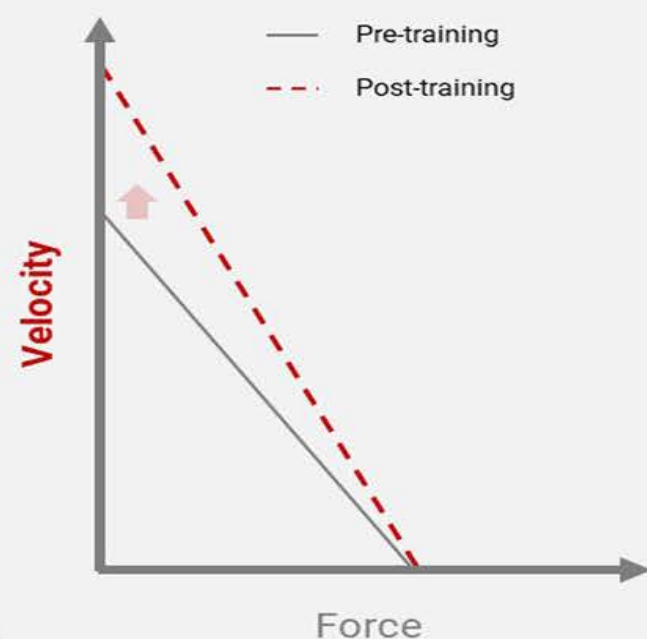
## High-load, low-velocity training

Expected rightward shift in force-velocity relationship



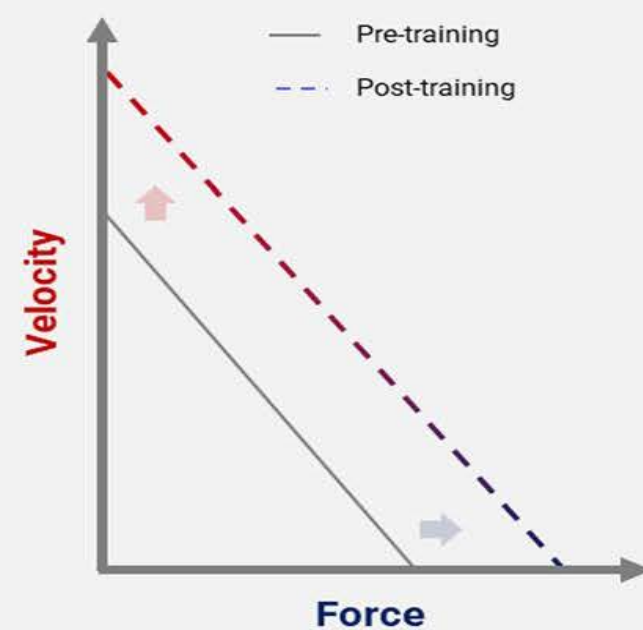
## Low-load, high-velocity training

Expected upward shift in force-velocity relationship



## Mixed-training

Possible upward and rightward shift in force-velocity relationship



1. Several sets of high-load (e.g., back squat) exercises completed before the execution of several sets of lowload, higher-velocity (e.g., vertical jump) exercises within the same session.
2. Several sets of low-load, higher-velocity exercises completed before several sets of high load exercises within the same session.
3. Alternating high-load and low-load (higher-velocity) exercises in a set-by-set fashion within the same session.





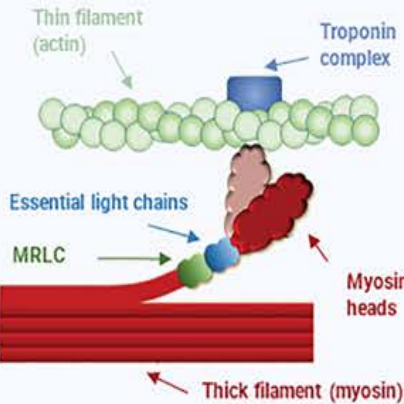





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# ADAPTATION MECHANISMS

"Acute physiological, biomechanical or psychological responses to a set of intense back squat exercise performed using relatively high loads (relatively slow speed) might enhance force and/or velocity in a subsequent lower-load, higher-velocity exercise (e.g., sprint or jump), if sufficient rest is allowed between exercises."

## PAP vs PAPE






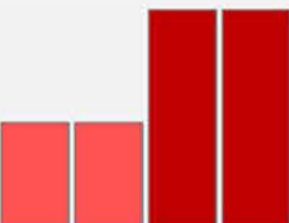

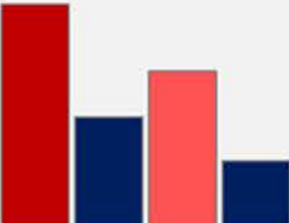
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	PAP	PAPE
	POST-ACTIVATION POTENTIATION	POST-ACTIVATION PERFORMANCE ENHANCEMENT
Performance effects	 Enhancements in muscle twitch properties	 Enhancements in voluntary dynamic force production
Potential time course	 Immediate, transient effects Starts within seconds following conditioning activity and has a short half life (~28 seconds)	 Delayed, long-lasting effects Starts minutes following conditioning activity and lasts 6-10 minutes
Potential mechanism(s)	<div><div><div>Myosin regulatory light chain (MRLC) phosphorylation</div><div>MRLC phosphorylation and subsequent rotation of the myosin head (light color) increases the probability of the head attaching to actin, and thus force production</div></div><div></div></div>	<div><div> <b>Muscle temperature</b> ↑ muscle temperature are associated with ↑ rate of force development and shortening velocity in both fast- and slow-twitch muscles/fibers.</div><div> <b>Muscle &amp; muscle fiber water content</b> ↑ blood flow &amp; intracellular (myocellular) water can enhance muscle force production, and this effect is greater in type II fibers.</div><div> <b>Muscle activation (including motivation)</b> ↑ level of voluntary neural drive from conditioning contractions may improve muscle activation, which can ↑ maximum voluntary rate of force development and maximal muscle force.</div></div>
Inhibition	 Fatigue & motor pattern interference	 Fatigue & motor pattern interference



# COMPLEX TRAINING

## UMBRELLA TERMINOLOGY

Training terminology 	Training description 	Exercise intensity 	Recovery interval 	Examples
<b>Complex</b>	Umbrella term with 4 different implementations, generally used to indicate a method in which movement velocity or load is altered between sets and/or exercises within the same session with the aim of improving slow and fast force expression.			
<b>Contrast</b> 	Exercise sequence with alternating high-load and low-load (higher-velocity) exercises in a set-by-set fashion within the same session (corresponding with 'contrast pairs' and 'intra-contrast rest')	<ul style="list-style-type: none"><li>• <b>Conditioning activity (CA):</b> 0-85% 1-RM</li><li>• <b>Subsequent task:</b> BM to 60% 1-RM</li></ul>	Intra-contrast rest: Strong/trained athletes: 5-7 min (experiment to individualize); Weaker/recreationally trained: ≥ 8 min Inter-set rest: 3-4 min	1. Back squat 85% 1-RM 2. CMJ 3. Back squat 85% 1-RM 4. CMJ
<b>Ascending</b> 	Several sets of low-load, higher-velocity exercises completed before several sets of high-load exercises within the same session	<ul style="list-style-type: none"><li>• <b>Light-load:</b> BM to 60% 1-RM</li><li>• <b>Heavy-load:</b> &gt;85% 1-RM</li></ul>	3-4 min between sets	1. CMJ 2. CMJ 3. Back squat 85% 1-RM 4. Back squat 85% 1-RM
<b>Descending</b> 	Several sets of high-load (e.g., back squat) exercises completed before the execution of several sets of low-load, higher-velocity (e.g., vertical jump) exercises within the same session	<ul style="list-style-type: none"><li>• <b>Heavy-load:</b> &gt;85% 1-RM</li><li>• <b>Light-load:</b> BM to 60% 1-RM</li></ul>	3-4 min between sets	1. Back squat 85% 1-RM 2. Back squat 85% 1-RM 3. CMJ 4. CMJ
<b>French contrast</b> 	Subset of contrast training in which a series of exercises are performed in sequence within a single session: heavy compound exercise, plyometric exercise, light-to-moderate load compound exercise that maximizes movement speed (i.e., external power), and a plyometric exercise (often assisted).	<ul style="list-style-type: none"><li>• <b>Heavy compound:</b> 80-90% 1-RM</li><li>• <b>Plyometric:</b> BM</li><li>• <b>Light-to-moderate compound:</b> 40%</li><li>• <b>Plyometric:</b> assisted</li></ul>	Intra-contrast rest: 20s between exercises; and 4-5 min rest between each series performed	1. Back squat 85% 1-RM 2. CMJ 3. Jump Squat 30% BM 4. Band Assisted CMJ

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# MOVEMENT PATTERNS

" The conditioning activity (CA) needs to be biomechanically similar to the subsequent exercise in order to elicit the optimal potentiation effect and to avoid any motor pattern interferences"

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## 1. *Vertically oriented:*

- *if an athlete completes vertically oriented exercises (e.g., back squat), the similarities in the specificity of force application would result in greater potentiation (or training effects) in vertically oriented activities (e.g., vertical jump).*

## 2. *Horizontally oriented:*

- *exercises with emphasis on antero-posterior force application (e.g., broad jump) would lead to greater acute or chronic improvements in activities in which the hip extensor muscles play a crucial role (DL,RDL,Sled Push, Olympic Weightlifting), such as standing long jumps or short linear sprints.*

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# REST PERIODS AND INTENSITY

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# PROGRAMMING

*With witch athletes should we implement these methods?*

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